The General Theory of Systemicity

"THE GENERAL THEORY OF META-DYNAMICS SYSTEMICITY"

Part three: Biological meta-dynamics systemicity

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The "Cosmo-planetary and terrestrial meta-dynamics systemicity", "Life's meta-dynamics systemicity", and "Biological meta-dynamics systemicity" are the core of a general theory resulting from a "Bioethism's transdisciplinary approach" of the whole set of dynamics that make life to exist throughout the atomic universal cycle systemicity.
Part four, "The biological intra-dynamics systemicity" will be published by 2010. It will develop the systemicity mechanisms that physiologically occur inside a creature's organism particularly referring to biochemical interactions and endogenous fluxes appropriately participating in the milieu metabolism sustainability for survival.

ABSTRACT

Ever since 1996, J.-J. Blanc, the author, made an extensive research on "Systems science" that induced to his developing a new systemic[1] paradigm in terms of a *transdisciplinary* approach to *"Living systems"* that he named "The Bioethism" (see note 1). It is meant to support the acquisition of a large understanding of living systems' origin, of their natural structure and their adaptive behaviors meanings. Their species bonds and evolution trends, while permanently interacting with environmental events for survival, require actions-reactions from ago-antagonistic signals and stimuli. Endogenous within their body milieu and exogenous while confronted with conditions of ecosystemic and sociosystemic environments, living beings are closely linked with and affected by - a) cosmo-planetary and terrestrial meta-dynamic forces, - b) their specific biological individuality and social traits and statuses accounting for the biodiversity of species behavioral and evolutionary trends emerging from the set of the biological metadynamics systemicity. For example the drastic extinction of species, except some bacteria, when the Earth became a "snowball" from a nearly total glaciation (-600 Mo/y) and, on the contrary, an extraordinary explosion of marine species bearing new functions (-545Mo/y)

The survey in the different scientific disciplines concerned with the actual "Science of Systems", shows too many scientists developing the living systems' knowledge of reality in the strict philosophy of human "reason" (logic and metaphysics) under an anthropocentric practice. Excepted are, of course, those works directly concerned with biological disciplines, biochemistry and physicochemical physiology and when individual and societal emotions are taken into consideration so as to support a paramount and pragmatic understanding of survival rules and necessities. An adequate learning for a sustainable development of societies, respecting the required survival diversity needs, is here based on a new general theory the author called "The general theory of meta-dynamics systemicity". A new theory that relies on the whole body of forces and dynamics that made and makes physicochemical and biological moves and objects to exist and sustain at the different dynamics levels of the Universe.

By essence, the dynamics levels are: atomic and cosmic, galactic, stellar, planetary, terrestrial and biological. Though diverse in structure and mechanism, they are all interrelated and provoke intricate moves and fluxes of differential retroactions from

[1] - **Systemic (adj.):** nature of a dynamic and retroactive process pertaining to or affecting an organ or the body of an organism.

which emerge various object "postures" (behaviors). Bound to adapting their behaviors to permanent environmental changes, objects (eg. the planet Earth) and living beings survive within the constraints and effects of dynamics differential retroactivity. These feedbacks, in cycles, induce to the repetition of moves and fluxes, the "meta-dynamics systemicity", a term analogous to "velocity", referring to dynamical behaviors. However, systemicity must be understood as successive and/or parallel retroactive ago-antagonistic, convergent differentials moves making emerge whole bodies of adaptive results while confronted and coevolving with environmental changes.

At Life's level, the set of meta/intra-dynamics systemicity sustains survival at biological, physiological and psychological intricate sublevels. Consubstantial and interrelated with the cosmic[2], galactic, stellar, planetary and terrestrial meta-dynamics, the biological "metadynamics systemicity" is participating in the whole of universal systemic effects feedbacks. Thereby, universal forces and fluxes permanently influence physicochemical reactive dynamics and permanently affect the biological world within its intra-dynamics systemicity moves. A world that is retroactive from emergent results affecting living creatures' survival choices so as to adapt their behaviors supporting their temporal sustainability.

Consequently, an overview upon the entire body of universal interdependent bio-physicochemical mechanisms, moves, processes and streams, interwoven within "3D networks", shows that survival abilities and performances are epigenetically provided with meta-dynamics resulting effects of systemicity. The convergence of cosmo-planetary forces (thermodynamic, magnetic, gravitational…) and terrestrial conditions (geologic, geochemical, geophysical, geo-climatic…) is retroactively sustaining the Earth and the living's own meta-dynamics survival means (biotope equilibrium, local ecosystems biodiversity, food chains,… sustainable behaviors, reproduction , …) thanks to processes that have a "re-seeding" ability.

Furthermore, the biological world of individuals and societal systems (family, group,…) cannot survive but within dynamic equilibriums that are inevitably interdependent. Social groups are subject to chaotic effects of the thermodynamic entropy and by their meta-dynamics, intradynamics and subdynamics drives, which make permanently emerge and temporally sustain differential behaviors.

This work, having required several communications, describes largely here the general systemicity of principles that support living beings survival. A large work that refers to the complexity of cosmo-planetary, terrestrial and (in this part three) *the biological meta-dynamics systemicity, a meta-driver that participated in the origin of Life.* And, for billion of years, participated in the building up of the Earth's and a Life's adaptable sustainability confronted with fluxes and moves of universal forces. The set of meta-drivers with synergetic moves sustaining systemicity cycles, were and are permanently adapting to changing environmental events occurrence, which values have to be viewed in the short and long term.

At the stage of this work process, the communication stands for "The biological meta-dynamics systemicity" and, in the conclusion, assumes the fundamental objectivity and realism of a "General Theory of Systemicity".

Keywords: Systemicity, Bioethism, dynamics, meta-drivers, synergy, cosmic physics, emergence.

INTRODUCTION

The purpose of the author is to bring up to achievement this "General theory of metadynamics Systemicity " based on the systemicity of the entire meta-dynamic forces

[2] - **Cosmic:** the essence of the general relativity is in the space-time that has a dynamic cause and its effect properties,

and moves ruling the universe and "nature on Earth". At subatomic and atomic dynamics levels, cosmic, planetary, terrestrial meta-dynamics and biological microdynamics body levels down to biological intradynamics ones, the moves show:

- the cosmo-planetary "meta-dynamics systemicity" (space and Sun system)
- the terrestrial physicochemical "metadynamics" systemicity (Earth's physics and the Gaïa system)
- the biological meta-dynamics systemicity (exogenous living environment)
- the biological intra-dynamics systemicity (endogenous physiology)
- the atomic dynamics systemicity (physicochemical retroactive differentials)
- the quantum dynamics systemicity (subatomic physics[3])

A whole context of permanent fluxes and moves that was appropriate for the "*Living processes*" to happen, develop and interact so much as to induce to the apparition and survival of primordial living systems (proto-organisms, then cells...) from reproduction of species, their evolution up to the actual species arborescence and their adaptations with environmental changes.

The "General Theory of Metadynamics Systemicity"

The "General Theory of Metadynamics Systemicity" and its components is a set of "meta-drivers", of which systemicity (cycles with differential retroaction specificities) shows the complex imbrications and interrelations of universal forces and fluxes. The circular results issued from feedback are convergent, synergetic and emergent moves, differentiating behavioral postures[4], in one and other physicochemical fields and induce "the drivers" to produce one or another chain of specific effects (stars birth, survival and death, ecosystems' food chains...).

The "General theory of Systemicity" is in no ways meant to be confounded with the different "General systems theories", which have become obsolete approaches of the so many systems' mechanism and intellectual casts of mind. Theories, though expressing large sides of human intelligence and creativity show a large set of anthropomorphisms and living creatures' theoretical traits that are unlikely linked with reality. However, an exceptional work of J.G. Miller (1978) develops a "living systems theory" where each living system contains for 20 biological as well as psychological and sociological "critical subsystems" that participate in species systems' survival.

The Biological World is a Whole Set of Metadynamics

Revealed to science progress, RNA, DNA, genetic processes produced and still produce common survival characters and behavioral abilities for survival adaptations available to all living species including mankind. Survival need principles is a long list of common dynamics and specific capabilities for all species to behave towards feeding, dwelling, communicating, reproducing, escaping, building, reacting, competing, etc. Principles, which methods are specifically appropriate to individuals and groups of which adaptation is submitted to milieu and environmental changes. Biological metadynamics and intradynamics systemic forces and moves mold together with cosmo-planetary, terrestrial and bio-physicochemical meta-dynamics moves at momentary conditions. A notion that is a much precise and innovative overview of our universe and a transdisciplinary approach meant to foster the reality of the differential retroactivity of dynamics emergent results (degree of evolution values...). Environmental pressures over the *systems' survival needs* show how much those interdependent dynamics are fully interrelated with the actual completeness of the Universe ecosystems. Down to atomic and bio-physicochemical structures and processes at the origin of living organisms, their retroactivity participate in developing sustainability, adaptability and endurableness

[3] - **Quantum physics:** Quantum theory is used by physicists to take account of phenomena which happen at the microscopic scale of particles.

[4] - **Posture:** "state or condition at a given time especially with respect to capability in particular circumstances

abilities within cell's body. Their membrane structure, containing filtering reactors of chemical principles, is helping the creature to perdure, reproduce and socially aggregate for the time of the species survival.

By way of consequence, it is postulated in this work that studying the primordial components of the "living processes" origin and their specific evolution do require large transdisciplinary proficiency. Within the "Systemicity of the universal dynamics world", forces and moves retroactions participate in Life to have happened and sustain, and in sciences of the livings to be pragmatically understood. The "Bioethism paradigm" was created and developed at such purpose.

This paper will describe only general aspects of "the metadynamics systemicity" in terms of physics, chemistry and biology principles, given that actual scientific information is to illustrate postulates and realities of cosmo-planetary, terrestrial and biological forces, processes, fluxes and moves.

Living Systems Science and Other Human Creation of Systems and Systemicity

The necessity of a "large clarification of systems science" is principally due to the fact open system permanently changes their status, in other words the livings adapt and reproduce for survival. Therefore, "a general systems science", or a "theory of system science" cannot assume Life's reality so much the "Systemics" actually developed apply to so many concepts not available for application. There is a large amount of morphological and intellectual forms of systems inducing to many works that provoke confusion by using the noun or the adjective "systemic" as assuming theoretical ends.

On Earth, the undisputed contextual situation as related to permanent changes of living events from feedback as "retroaction differential ago-antagonist results" have induced me to adopt research activities centered on "transdisciplinary fundamentals" and on the new paradigm I named "The Bioethism", as pertaining to build up a scientific and realistic development of Life's science of the systemicity of forces, fluxes and dynamics moves.

In order to comfort the specificity of the "Living systems Science ", and thereby explain Life's origin and sustainability of survival principles, methods and means, the study was based on the retroactivity of fundamental metadynamics. I found out that, beyond the sense given to the noun (and adjective) “systemic”, generally qualify most "systems" in about 30 different meanings others than living systems, the notion of “metadynamics systemicity” was an appropriate assumption. It turned out becoming a new theory, based on the forces and moves dynamics that participate in a living system to survive, and is far more suggestive of how life's originated and how it sustains however permanent universal metadynamics changes actually may be. Globally and adequately dynamic, the sense of "systemicity", as we have said, is a good reference to the dynamic sense of “velocity[5]”. However, these two notions are not to be understood as synonymous but yielding to the same connotation in terms of moving forces that participate in cosmos and Life to exist and sustain.

The swaying of the Life's pendulum

The neologism "systemicity" I have *launched* (Monterey CA, 2004), is referring to "Life's driver dynamics" understood and described with "The Bioethism transdisciplinary approach paradigm" (acronym for **Bio**logy-**Eth**ology, ecology - Human**ism**). It fosters universal specificities relative to the complexity of Life's processing, which in form of open systems, appeared on Earth as physicochemical environmental components and survival conditions (see p.14) Dynamic phenomena were physicochemical moves of matter and energy, all of them being, with solar system forces and planet cosmic constraints, progressively sustaining

[5] - **Velocity:** "the rate of change of position along a line and/or throughout a 3D network, with respect to time or the derivative of emerged positions with respect to time. It is also a rate of occurrence or action **:** the differential speed of historical changes.

chemical survival reaction evolutions until forming biological chemistry. Understood as a universal move, the primordial systemic "tick tock" of interdependence, interrelation and interactivity statuses induced to the permanence of intermediation. A phenomenon that, in terms of "in-between" quantitative and qualitative positions and values, provided with ago-antagonistic the circular swings as acting from birth to death of any object (Thermodynamics).

The Life's pendulum is swaying! Throughout the interconnected living systems web and ecosystem networks, it is sustaining determinant survival[6] dynamics in form of dual transactions (predator-prey specific species balance, symbiosis,... as exchanges). Permanently confronted with physicochemical and cosmic periodical forces, move pressures and opposite changes in environments and milieux (body interior) metabolisms, the living systems have to permanently adapt between "hunger and satiety". A predator-prey unavoidable strategy that may end to a crisis and an environmental stress! The fox and rabbits dynamic equilibriums in a predator-prey natural (and mathematical) model of survival interactions between two species in an ecosystem, was developed by Lotka-Volterra (1925), allowing the description of a systemic game within which neither equilibrium point is stable. Instead the predator and prey populations seem to cycle endlessly without momentarily settling down. Birth, hunger, starvation, repletion and death are lying at the door of what I call the survival "in-between" opposing notions such as birth and death or high and low.

The Yin-Yang[7] philosophy, "the principle of duality" between two opposing forces", as being complementary", describes "interactive extremes" that a principle of "irreducible intangibility". Dual permanent games, participating in Cosmic and Life's phenomena and objects to interact and evolve, are where systemicity against irreversible entropy takes its natural place. Thus, mostly being ago-antagonistic, the "in-between behaviors" meet my feelings and assumptions about "Systemicity" and reality. The fuzziness of reality in "what effectively happens" is usually any of a continuum of values in between the opposites until entropy takes over. This is particularly so when related to the role of time in the history of unconscious and conscious natural and cultural differentiated retroactions dedicated to organisms behavioral actions of individuals and societies.

"The everlasting rustle sound of the planet, the "Gaia's clock" tocks, echoes with creatures' behaviors for survival, and together with the permanent change of things, build up their genesis and environments evolution (J.-J Blanc, 2004).

THE NOTION OF "SYSTEMICITY"

The "systemicity phenomenon" is far beyond the sense given to the noun and the adjective "systemic" that is referring to the notion of "systems in general": it is far more suggestive and realistic as understanding "the set of cosmo-planetary-terrestrial and biological dynamics", of which retroactive "meta-drivers" made life to exist and sustain. Illustrating such dynamical sense is simply referring to another notion that has also a dynamic sense: the notion of "velocity" is the rate of change of a moving body position in relation to its speed and direction travel, which is another size of cosmos forces.

The notion of "Systemicity" is related to the whole of primordial and dynamical moves, forces and processes confronted with thermodynamic and physicochemical interactions[8] and reactions[9] between elements, matter and energy moves that drive out

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[6] - **Survival**: "the continuation of life or existence".

[7] - **Yin-Yang:** between those two complementary forces, there are "in-betweens", e.g., there is a certain gap giving some distance in between the two opposites. In fuzzy logic, it means that at a point in between, one can evaluate the value that separate the point to one or the other opposite. It induced to the development of fuzzy-mathematics by Zadeh (note by JJ. Blanc 1997)

[8] - **Interaction:** "action that occurs as two or more objects have an effect upon one another",

[9] - **Reaction: "**resistance or opposition to a force, influence",

systemic momentums[10]. As emerging from interconnected, interrelated and interdependent atomic and physicochemical elements, they are furthermore submitted to permanent pressures, fractures and bifurcations occurring within cosmo-planetary and terrestrial environments (ecosystems). The cosmic space, gas and dust nebula, stars, galaxies, the solar system as well as planetary satellites are as many objects of which interrelated forces have reciprocal effects in consequence of their interconnectivity.

"Systemicity" and the Physicochemical World

The universal physical and chemical forces (magnetism, gravity, strong interaction, weak interaction, gas reactions and contextual changes…) were (and are) together constraining and beneficial (Van Allen belt, magnetism, Moon tidal effect, atmosphere...) to the planet Earth stability, morphological and contextual evolution as well as other cosmic objects have their own survival conditions. Further more, the notion of "systemicity", appreciated in terms of "drivers", is providing impulse and/or motivations that illustrate the dynamics all objects are submitted with. The "cosmic velocity" is one of such dynamics; much consubstantial with other of the universe dynamics (e.g. the relation between the cosmological velocity and gravity fields, kinetics energy and galaxies milieu, Hubble constant referring to the universe expansion…)

"Systemicity" and Life

The "notion of systemicity" is also referring to the retroactivity of biological move dynamics that occurred at the level of molecules in the early primordial chemical ecosystemic "soup", and still occur as inducing to the living processes to form up and sustain. The evolution of molecules towards macromolecular compounds emerged from highly complex physicochemical dynamics made of retro-feeding biochemical matters and energy reactions. They produced endemic capacities for enzymatic reactions and regulations from feedbacks[11] of emergent "differentials" as cascades of positive ago-antagonistic results. Among them, nucleic acids, proteins and enzymes were essential macromolecules to form into physiological processes: they developed a "proto-organism's metabolism" within aqueous ecosystems, engendering the first creatures (unicell, then micro virus, virus and bacteria).

The "metadynamics systemicity" is a general phenomenon

On the whole, "Systemicity" is particularly explicit of the physicochemical processes fields that have ago-antagonistic forces with differential outputs; those promoting dynamical balance statuses, i.e. evolving. The direction induced to retroactive phenomena being irreversible, results from "connectivity", "coevolution" and "synergetic" are sustaining the momentary survival of a phenomenon. In no time, such sustainability is a one way move, since permanent successive outputs and "bifurcations[12]" (ref. Systems complexity, biological open systems) emerge in a synergistic environment from sets of reactions and counteractions[13] though submitted with the permanency of thermodynamic effects, named entropy[14] as balancing with physicochemical systemic moves.

One may observes why "metadynamics systemicity" is a general phenomena issued from the expansion of the universe since it is confronted with the relative speed of thermodynamic processes (process of tempering entropy production from heating and

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[10] - **Momentum:** " force of movement; strength or force gained by motion or through the development of events. Also the product of the mass of a body of matter multiplied by its velocity (Physics, Mechanics)".

[11] - **Feedback:** "the partial reversion of the effects of a process to its source or to a preceding stage. Also the transmission of evaluative or corrective information to the original or controlling source about an action, event, or process and the information so transmitted".

[12] - **Bifurcation:** " a bifurcation occurs when a small smooth change made to the parameter values (the bifurcation parameters) of a system causes a sudden 'qualitative' or topological change in its behaviour".

[13] - **Counteraction:** "to restrain or neutralize the usually ill effects of by means of an opposite force",

[14] - **Entropy: "**the unavailable energy in a closed thermodynamic system, a disorder status that varies directly with any reversible change in heat in the system and inversely with the temperature",

cooling of objects environment called "annealing"). "Velocity" and "gravity" is a dual force that participates in generating cosmic objects that have a transitory survival. Why a survival? Because of the above mentioned effects of ago-antagonist forces like that of gravitation and accretion[15] (apparition of our planet). Two major systems of object survival are those of a galaxy life and of its components as stellar systems submitted to the driving of thermodynamic free energy. The free energy is "a subtraction of the entropy of a system" in terms of temperature giving out a thermodynamic status of "useful energy", in other words the system is in a survival state while "burning" energy. For example, the metadynamic systemicity sustains the momentary survival state of the actual Solar system, which energy depends on the Sun's life thermodynamic evolution, burning its own energy and sustaining from gravitation. The Sun's future will end "shrinking back" giving out a nebula, in about +5bo./years. From the nebula environment will thereafter rise new "baby stars" out of the metadynamics systemicity of the environment.

"Systemicity": a planetary, terrestrial and biological meta-dynamics driver

The whole thermodynamic mechanisms and processes of the universe (cosmic, planetary and terrestrial), because of their interwoven forces, made Life to exist from matter and energy cycles. Within the solar system, natural forces and chemical streams induce to the emergence of energetic surface changes (atmospheric, oceanic and continental): they provide (and provided) circular information and stimuli for the reproduction of vital processes as structuring and sustaining the metabolism of living organisms (micro-organisms, vegetation and animals). Creatures momentary survival came then from biological meta-intra-dynamics systemic fluxes and moves (positive biological feedbacks), which brought and bring up together chains of energetic and biochemical resources (nutriments, food, tools) for their adaptive survival. In body milieux, the processes sustain the metabolism, and from interactions with other species for acquiring survival means, both are propitious to the sustainability of ecosystems' unavoidable diversity.

The Earth primordial context induced physicochemical and organic systems to emerge from apparition of new properties from a new atmosphere composed of oxygen, hydrogen, nitrogen…, and with new terrestrial conditions that considerably changed the environmental and biological structures and the retroactive orientation of chemical reactions. Energetic resources, from numerous feedbacks, enabled more complex molecules to evolve towards cellular organisms. Successive new generations evolved from predator (virus) aggression, as "eukaryote cells" structured with both a nucleus as protection of reproduction abilities. The efficient filtering membrane became capable at regulating endogenous and exogenous resources and information perceived from environmental events, together with expelling wastes as product of the internal chemical treatments of proteins for surviving. The complexity of sub-dynamics that pertain to the cosmo-planetary and terrestrial meta-dynamics conservation, in terms of survival, obviously refer to the systemicity of dynamical physicochemical forces, energy pressure and space-time dimensions.

Environmental conditions in which life originated on Earth, at near -4,6 billion/years ago, have to be remembered here, since "vital conditions" to settle down took around 800 million years (until -3,8 bo./years) for primordial living organisms to emerge out of physicochemical process fluxes within different geographical milieux. This very long period of time for vital processors to mature is difficult to humans' understanding as appreciating such length. However, it is factual that the period promoted the fruits of the permanency of physicochemical metadynamics systemicity, as

[15] **- Accretion: "** a disk, or other object like a planet, of usually gaseous matter surrounding a massive celestial core in which the matter gradually spirals in toward and accretes onto the object as a result of gravitational attraction,

progressively bringing up processed results capable to reproduce, assemble and form biochemical proto-elements able to cooperate and interact until the apparition of entities sufficiently autonomous to track energy and replicate. Thereby, primordial cells, (protocells) emerged, reproduced and evolved from the systemicity of biochemical cooperative reactions and propitious milieux.

Synergy and Emergent Results in Between Ago-Antagonistic Things and moves

Synergistic[16] moves, (as below defined) are links in processing chain development of phenomena. In reference to some specific works on "Synergy", published by H. Hackermann (1994), or P. Corning (2003), one may observe that the notion of pattern is intimately describing linked phenomena within a "model system of synergistic", as, for example, chemical macroscopic reactions in form of outgoing concentric waves, spiral waves, chemical oscillations…Consequently, the notion of physical dynamics is said describing a phenomenon of synergy: e.g. "a water wortex is the effect produced by the combined actions of several different forces like gravity, water pressure, air pressure, rotational forces as centrifugal (or centripetal) forces, even the initial status of a considered object or move. Examples are numerous, but here it is important to stress the fact "synergy" illustrates sets of linked phenomena, indeed combined and cooperative, given that they induce one emergent result. The orientation of a instant-t result is at next instant-t^{+1} one, usually combined with other chain of phenomena, forces and moves; and is, at term, having combined synergistic effects, which are differentiated from retroactive effects. Adding dynamical feedback moves, the systemicity of cycles produce successive changes in the environmental status. Synergistics is then one of the meta-dynamics systemicity"arms" participating in outputs.

In this work part, among many cosmo-planetary and terrestrial dynamics involved in the systemicity of phenomena, we will describe the essential of natural flows and cycling moves resulting from the "universal retroactivity" as the major "meta-driver" between opposed forces, dynamics and differential emergences. Each dynamic has an imprinting[17] mechanism from interactions, at all physicochemical and, or biological character level that produces quantitative and qualitative effects on matter and energy destination. However, as being interrelated with the complex characteristics of other dynamics, the effective emerging result, at instant-t, which is usually the result of combined ago-antagonism moves, induces the environmental ambient metabolism to be permanently modified: each "ecosystem's neighborhood" status evolve by some sort of a "vectorial synergy or momentum". A synergistic move, at short and/or long term in space-time, produces a temporary output effect, which confronted to the permanence of changes, becomes a possible evolutionary factor within the meta-dynamic of the cosmo-planetary and terrestrial systemicity of events (solar vents, tides..., predator fear...)

Changes of status and phase transition

Matter and energy exists in various forms, or phases. If the temperature and, or pressure of matter or energy is adjusted, the phenomenon may undergo a phase transition. Pierre Papon, (2002) describes the change of status together with the dynamic of phase changes as confusing the boundaries with metastability. He wrote about different classes of phase transitions such as: vaporization, (the passage of the liquid to gas), fusion (the passage of the liquid or solid and its reverse that is solidification), the transition between the ferromagnetic status (the material with a permanent magnetization) and the paramagnetic status (without permanent magnetization), the transition supra conducting (the material becomes a perfect electric conductor, etc). These phenomena between opposite statuses usually pass by an intermediary qualification known as the phase transition move that,

[16] - **Synergy**: "combined action of two or more agents which produces a result stronger than their individual efforts".
[17] - **Imprinting:** A process by which a permanent bond is created between an element and others that surround it, within a specific environment (e.g.:chemistry),

through a combination of pressure and temperature, is overpassing a critical point. During the phase transition move, matter shifts between its three statuses: solid, liquid, and gas from which distinction of two phases is "almost non-existent" and fuzzy. "*The statuses of matter are like the countries of a complex geography, separated by borders*" said Pierre Papon, the passage from one status to another as named transition phase corresponds to the crossing of a border. But transition is usually fuzzy; in certain conditions, the substance can pass by a status known as *metastable* before changing course towards a stable status (reference to thermodynamics: the entropic move). The passage of a status to another is not instantaneous and there are "undecided" statuses with particular properties, halfway between liquid and solid, such as the Earth's transformation status at the Early Achaean, or grounds at the status of permafrost.

Metastability scrambles the thermodynamic borders separating the solid, liquid and gas status. Beyond of a certain range of thermodynamic parameters, the phase considered becomes unstable and necessarily passes in another status through a transitory status. The complex history of the Earth has proven successive statuses of an "evolutionary planetary body"; a history that illustrates the results of slow sequences of fuzzy changes of phase within ago-antagonistic dynamics that cosmo-planetary meta-dynamics systemicity engenders. These phenomena, perpetuating themselves throughout the Earth's and Life's actual context, show that Earth's evolutionary living conditions and survival sustainability are "governed" with the systemicity of the cosmo-planetary and terrestrial set of dynamical forces that retroactively sustain moves far from equilibrium unless a major thermonuclear catastrophe should wipe both out.

A change of status, as observed at the passage from one status to another, is called the "threshold effect". Nature is permanently confronted with critical point examples, such as natural selection in terms of a population having adaptive responses; inhibited developments, etc. They show that the threshold effect is typically sensitive to certain characteristics of individual and group behaviors while confronted to environmental changes within specific contextual conditions. Phase transition critical point is an important phenomenon that participated in a major primordial manner to form, for example, part of atmosphere and oceans volcanic and gaseous contextual milieu at the origin of cells apparition (ref. Archaea, Cyanobacteria or blue algae) emerging from the systemicity of meta, intra and subdynamics.

Percolation, Interactivity, Amplification of Disturbance, and Phase Transition

Life has happened through the "dynamic percolation" of physicochemical reactions phenomena, which is a process of communication in an extended environment where quite a number of "sites" (also bifurcation areas) are likely to locally relay information (physical, biological or of a fluid property (J. M. Hamersley, 1957). They communicate by way of links whose effectiveness is most of the time random. According to whether the proportion of active connections is, or not, higher than that of a threshold value, the information to long distance may be transmitted when overpassing a critical point.

These phenomena explain clearly the genetic impact issued from the predator prey game: e.g.: the capacity changes of opposed species as preys while genetically and physiologically adapting to the abilities of predators. Since percolation relies upon the critical point phenomenon, which is constitutive of a phase transition[18], one observes that below the threshold, information remains confined in the spot where it originated; beyond the threshold, "percolated" information (ref.: genetics evolution, ecosystems transformation...) is then found far from its starting point by passing over critical points as it happens with domino or/and butterfly cascading effects initiated from starting conditions. The particular situation of transitions from phase is one out of many physical

[18] - **Transition phase**: "a movement, development, or evolution from one form, stage, or style to another.

or chemical move phenomena occurring to number of cosmic, planetary and biological mechanisms and their metadynamics systemicity.

The appearance of highly sensitive behavioral conditions issued from phase transition is also observed in social life organizations. Disturbances permanently modify living creatures' behaviors and their metabolism while they interact with environmental events and stimuli. Alike the butterfly effect, a small fact can induce to important and perverse cascading effects in proprieties, attitudes and physiological statuses amplitude. Societies of creatures are meta-organizations functioning at the verge of a lethal equilibrium that is a compromise between contradictory constraints not predictable and controllable, but maintaining a timely and temporal survival. However, from feedback effects, the situation might be severely sensed as depending on their weight down on people expectations.

MAJOR COSMO-PLANETARY AND TERRESTRIAL METADYNAMICS

"Systemicity" at the Different Levels of Cosmo-planetary and terrestrial Meta-Dynamics

The "Systemicity" of dynamic phenomena within the Universe is a highly complex set of evolutionary phenomena within permanent interactive environments that occur between physicochemical reactions and cosmic objects dynamics: gas clouds, stars, asteroids, comets planets like Earth, living beings. Attested by cosmic "contextual climates within galactic systems and gas clouds", their dynamic systemicity is permanently influencing the spatial milieu. The solar system, its planets, the Earth and Living creatures' behaviors for existing illustrate how each is confronted with specific dynamics. The sustaining of Life on Earth is a consequence of the set of cosmo-planetary dynamics", of which characteristics are induced to by a general and universal meta-dynamic systemicity. The inventory of the different sets of dynamics that shape up the "cosmic systemicity", requires to overlap quarrels on reductionism, since Life originated out of a complex and long period of heavy and unstoppable chains of atomic and physicochemical events. The Earth was molded from them, becoming the theatre of ever changing ecosystemic components under ever changing geographical structures, atmospheric climates effects and other cycles statuses. By remembering the entire set of long circular and retroactive phenomena occurring in the outer space, one then understands the very slow and progressive thermodynamic recycling of baryonic[19] and other heavy elements within the dark matter. Gas spheres shape up into star embryos from gas and dust nodules, contract, then collapse under the pressure of gravitation within the core of frantic moves of energy (gamma, infrared, ultraviolet and X rays). The interstellar medium is filled with hydrogen gas, some helium and substances like calcium, sodium, water, ammonia, formaldehyde and other dust particles. Such mass is fed back to the interstellar medium, where it mixes with matter that has not yet formed stars.

At a galaxy level, the entire star milieu is not absorbed in by its black hole, since a part of star envelops either rebounds from the temporary formation of a spinning neutron core or misses passing through the very centre of the core and is spun off instead. This circulation of interstellar matter through stars, and the entire retroactive cycle determines the amount of heavy elements throughout cosmic clouds and shows that the constituent elements abundance is a matter of dynamic systemicity. When part of the star, in terms of interstellar matter and gas is passing through the black hole, it is firstly pragmatic to consider that such medium is simply "washed away" into the intergalactic space. Recycling going on with other elements, the "medium", together with the meta-dynamics of space systemicity, participate in the seeding of new stars around or in neighbouring galaxies.

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[19] - **Baryon**: "any of a group of subatomic particles that are subject to the strong force: the atomic nucleus, its atoms, neutrons..."

The General Theory of Systemicity

The universe has reached to a structure, which evokes that of a 3D graph network whose nodes correspond to large gatherings of dark matter in great quantity and super clusters of galaxies, which contain several thousands of galaxies themselves containing each hundred of billion stars and orbiting objects like planets, meteorites... Here is the actual situation since the big-bang, 13,7 billion years ago. Galaxies form galactic clusters due to dynamical forces which are the gravity and the expansion of the universe as well as the intergalactic and interstellar interactions. Galaxies content of stars is largely variable as their number depends on the proportion of stars and their temporal collapse, as well as their capacity re-feeding space with gas and matter "ready" to become new star embryos.

Emerged from thermonuclear reactions in galaxies, the cosmic medium is permanently affected with differential effects that participate in "the cosmos dynamics meta-systemicity" that brings about galaxies, stars, planets and other objects to appear and disappear, giving that gases are "rinsed away" by powerful radiations coming off thermonuclear reactions. The historical succession of a great contextual diversity of galactic happenings and of star planetary systems birth, include that of the Sun thereby induced to the Earth planet to become the "Life's cradle". Complementary "metadynamics systemicity" induced nature to flourish and the humanity species to emerge from "microscopic and light elements" – cells - as contextually constitutive of evolving species structures and behaviors and reproduction selection.

a) Cosmo planetary and terrestrial force of gravity

The terrestrial force of gravity holds back any "object" being on a body surface to be projected out of its "sphere" in rotation (Isaac Newton). The attraction of the Sun prevents planets, revolving around him, to fly away in space. The Moon under the influence of the terrestrial attraction remains in the Earth's orbit. From such action, pressure from gravity becomes the main "sub-meta-driver" that sustains things to happen on Earth. The air that is basic to survival with breathing (nitrogen, N2 and oxygen, O2) is maintained on terrestrial surface by gravity and is a relatively protective shield against meteors, meteorites and dangerous radiations for living species to survive. Air is charged with oxygen, as the paramount molecule to life respiration, which, being an air-water cycle, sustains diverse corpuscles and molecules that structure organisms' diversity. The atmospheric pressure, as a result of gravity, pulls the air downward, giving air molecules enough weight as to exert a force upon the Earth's surface and everything that is on it. Winds of different forces, caused by horizontal variations in air pressure, carrying air particles and rock dusts, participate in building up deserts from benthic sedimentation of oceans depths and by drifting coastal beach sands over as inducing dunes up. Moreover, the pressures of terrestrial tectonic moves, forcing crust surface orogeny, shape up mountains of reworked materials such as benthic sedimentary rocks. So many cycles, that participate in both cosmo-planetary and terrestrial meta-dynamics levels, which at length of human observation, and of planetary ecosystems' evolution, corroborate the notion of dynamics systemicity; therefore, confirm the meta-drivers differential retroactivity thus "systemicity".

b) The Cycle of Rock

Tectonic forces, heat and pressure metamorphose, breaking process of weathering and other surface processes (running waters, glaciers, waves, and winds) are transforming bedrocks down into smaller, moveable pieces that shape the different ecosystems. The rock cycle begins as rocks are lifted up in the magma, pushed up the planet surface and eroded. The particles, or sediment, are travelling by wind or moving water until they are deposited as a material that settles into layers. Additional sediments may bury these layers, and/or change the underlying sediment to metamorphic rocks. Other sediments may also compact the layers into sedimentary rocks. Rocks may be again sunk down into

the lower layers of the earth by plate tectonic processes. Buried and subducted, rocks usually meld and recrystallise into igneous rocks in the magma, ready to be be recycled onto the Earth's surface. Metamorphic, sedimentary, and igneous rocks, then uplifted, start the rock cycle again.

c) The cycle of water and oceans

The geological history of the Earth began in a lapse of time of around 800 million years, while it changed from liquid to solid (True age: -4.6 bo./years old; oldest rocks found: -3.8 bo./years). To day, the origin of water on Earth has *not* been clarified; even so the world's oceans were described to have formed over the past 4.6 billion years. From a systemic point of view (retroactive differential evolution) and under the effect of the "systemicity" of cosmic and terrestrial metadynamics, as contributing factors to the origin of the Earth's oceans, principles are described by the cooling of hot gases. Released substance, "outgassing" or sublimating and evaporating into a gas ("phase transitions results"), were then potentially bringing water to Earth in a probable ocean-continental-atmospheric water cycle. Comets, trans-Neptunian objects or water-rich asteroids (protoplanets) from the outer reaches of the asteroid belt colliding with a pre-historic Earth may have also brought water to the world's *oceans*. Liquid or wapor, water "locked" in the Earth's rocks leaked out over a few million of years. The release is photolysis, the direct process as defining the interaction of one or more photons interacting with one target molecule since radiations can break down chemical bonds separating liquid from a hard mass.

d) The Oxygen Clue

The most primitive organisms existing today include bacteria that live in terrestrial hot springs and in deep-ocean hot water vents native of volcanic activity. The evolutionary significance of these organisms was found from ancient sedimentary rocks much more abundant in iron than in modern marine sediments. The waters that deposited actual sediments (deepsea or weathering) are rich in dissolved oxygen, and iron in the presence of oxygen that quickly turns to rust, in a process called oxidation showing that rust does not dissolve in water. In contrast, non oxidized iron dissolves, moving in waters flowing down rivers into oceans. However, traces of oxygen cause this iron to precipitate out of the water and fall to the ocean bottom, without turning it to rust. The abundance of iron in primordial sedimentary rocks, therefore suggests that there was very little free oxygen on the early earth, either in the atmosphere or dissolved in the oceans.

While it is said that "*more than one of these factors contributed to forming the vast oceans*", it is also likely to postulate that the first living creatures capable to increase the oxygen rate in the atmosphere were algae and some bacteria structuring stromatolites[20] rocks. Algae chloroplasts with chlorophyll use sunlight to assimilate carbon dioxide and produce glucides, while releasing from oxygen. A chemical component of water that, over more than a billion years, was produced in such a volume that it progressively changed the atmosphere composition[21] so as to be breathable but also capable to activate the amount of water vapor that induces to different paleoclimatic changes, precipitation into rains, runoff waters and recycling with evaporation.

e) The cyanobacteria cycle: a major chemical transition phase from metadynamics systemicity

The oxygenic photosynthetic cyanobacteria, are the most primitive bacteria (blue algae), observed from fossils dated as appearing around -2,8 bo./years old, were to evolve into the fossils form actually observed. Cyanobacteria apparition was shown issued from

[20] **- Stromatolite: "**a fossil rock with a structure worked out by a community of microscopic organizations, primarily various types of bacteria and algae" (photosynthesis).

[21] - **Atmosphere:** actual components are nitrogen (78 percent) and oxygen (21 percent). In the remaining 1 percent are argon (0.9 percent), carbon dioxide (0.03 percent), variable water vapor, and trace amounts of hydrogen, ozone, methane, carbon monoxide, helium, neon, krypton, and xenon.

oxidative weathering on land, suggesting a poor oxygen rate in the atmosphere for another 300 million years after the cyanobacteria happened to structure. A sharp rise in atmospheric oxygen between 2.45 and 2.32 bo./years ago let photosynthetic cyanobacteria to be self-sufficient, and growing. These organisms, organised in colonies, live between the low and high water lines where the intertidal soil forms seawater ecosystems (ref.: actual Australian stromatolites).

They are also able to live through the harsh freeze-thaw cycle of seasons (around -20°C), fixing nitrogen and releasing oxygen as they make carbohydrates from water and carbon dioxide. The whole phenomenon is at least induced to rise up from Sun rays, seawater, climatic pressures, the Moon's tidal force and coastal shapes. In the presence of liquid water and carbon dioxide from the surface, the cyanobacteria photosynthesize and produce organic carbon, which the bacteria use to make carbon dioxide for the cyanobacteria to survive, and the cycle repeats itself. Under thaw critical point, this microbial community also appears to generate an antifreeze-like substance that keeps the water pockets liquid long enough for reproduction to take place. Moreover, cyanobacteria have the capability to produce limestone (sediments).

f) The Cycle of Air and Atmosphere

At the time of its completion as a solid body, the Earth's atmosphere was of water vapor, nitrogen (N_2), methane, some hydrogen and small amounts of other gases: some carbon dioxide (CO_2), very little breathable oxygen (O_2)...

J. H. J. Poole, University of Dublin (~1947) postulated that the escape of hydrogen from the earth led to its oxidizing atmosphere. The hydrogen of methane (CH4) and ammonia (NH3) might slowly have escaped ("rinsed out" by the Van Allen belts moves?[22]), leaving nitrogen, carbon dioxide, water and free oxygen. At the Earth's surface, warmth was of a temperature over 49° C (120°F) as a result from volcanic and tectonic activity still going on with less intensity and frequency. The air composition is primarily described in terms of temperature, pressure, wind speed, wind direction, precipitation, and humidity. Cool air sinks and creates high-pressure air flows. It is drawn back to low pressure near the equator, creating a cycle of air winds. Winds converge there and create a zone of dynamic weather, recycling vapour, air and sunlight heat energy up to the troposphere, then moves toward the North and South poles and gradually cool to sink down again. Waters of the oceans have the same kind of cycle, while heated from solar energy. The winds recycle energy, dissipating more of it in the air process than energy dissipated by the combined ocean currents, tides, continental drift and mantle convection.

However, these dynamic cycles, that are permanently interrelated, show how much they participate in the differential of retroactive effects on nature. The long-term fluctuations of the average weather – the climate – together with the fluctuations of ocean waters – currents - make earth historicity an important part of life's dynamic systemicity and evolution of the planet life to sustain.

g) The cycle of seasons

Seasons result from the Earth's annual revolution around the Sun and the axial tilt[23]. They are marked by changes in the intensity of sunlight that reaches the Earth's surface. In temperate and Polar Regions, seasonal variations usually cause some animals to go into hibernation or to migrate, and plants to be dormant. *A metadynamics systemicity drive that has retroactive differentiation results in both the environment and survival terms in the body milieu*. Contrary to common beliefs, the seasons do not result from the varying

[22] - **Relativistic electrons:** "populations of relativistic electrons (relation between energy and velocity) and ions in space form or change in response to changes in solar activity and the solar wind".
[23] - **Axial tilt:** "the axial tilt is the inclination angle of a planet rotational axis in relation to its orbital plane".

distance between the Earth and the Sun. Instead, the tilt of the Earth causes the Sun to be higher in the sky during the summer months which increases the solar flux. *Another metadynamics systemicity drive that has multiple retroactive differentiation results at both terrestrial and biological dynamics systemicity levels.*

h) The Cycle of Climates

Sun's radiation has long-term climatic seasonal effects (temperature and precipitation) on earth atmospheres and surfaces, while it is rotating and orbiting around it. The Earth's rotation deflects winds circulation: tropical and polar winds and two intermediate belts go east in each hemisphere. The atmospheric structure and composition, the heat currents transported by oceans, the latitude and altitude of plateau, mountains and lakes induce to different climate levels. The average ambient temperature grades from tropical above 20°, subtropical, temperate and cold between 10°-20°, polar below 10° C. Precipitations falling down in each hemisphere are differentiated by their frequency (all seasons, summer, winter) and climatic zones (equator, tropics, arid and dry, temperate, polar) are causing erosion cycles and sustain Life development.

For example the zones called the "selva", for equatorial rain-forest with hot tropical rains much of the year; the "savanna", with warm, strong seasonality; and the "tundra", with cold, strong seasonality. Climate effects on life are significant in all bio-physicochemical processes: solar radiation, the chemistry of the atmosphere, clouds and waters, and the biosphere are all affecting Earth's living conditions (cyclonic catastrophes, drastic flooding, desertification, oceans level changes, etc.). Thus, the climate of a region depends on those many factors, including the amount of sunlight it receives: neutrons and protons recombination provokes, from ionization effects (Thermodynamics), all sorts of damaging effects in terms of cell's mutation, burnings, etc. The height of the Sun above sea level, the shape of the land, and how close it is to oceans, are factors influencing living conditions. Since the equator receives more sunlight than the poles, climate varies depending on distance from the equator, much influencing ecosystems components (fauna, flora, soils and kinds of living conditions...). Consequently, the ambient processes that sustain ecosystems at a dynamical balance are under the entire influence of permanent effects of the coevolving and combining metadynamics systemicity, emerging results that converge and mix.

Animals, humans and vegetation acquire their diversities according to the different ecosystems of continents and the type of food chains involved. Humans nowadays alter the Earth's climatic zones, consequently Life's creatures' future (genetics, organic functions, aptitudes for survival..., since pollutants and chemicals on the soils and in waters, and carbon dioxide into the atmosphere become intensely aggressive and damageable for health.

Cosmic, Planetary and Terrestrial Body of Dynamics: cycles of retroactive influence

Largely produced by the Moon's tidal forces, combined with cosmos meta-dynamics (laws of physics e.g.: gravitation), the Earth's spins slowly reduced at one revolution in its axis making days to become longer, a retroactivity that is having an influence over natural terrestrial cycles. In the early of Earth, if abundant volcanic activities emitted off much heat, they diminished, inducing the formation of the first rocks from a crust cooling down. Together the molecules emitted by volcano and atmospheric molecules seeding participated in a great change in the atmosphere composition (more oxygen and nitrogen, but also several of today's atmosphere molecules) that provoked great changes of weathering effects. The oldest rocks (cratons) are known to have been in the mechanical coupling between the outermost layer of the mantle and the crust (asthenosphere and lithosphere), as one of the forces that drive plate tectonic and is dated 3.8 billion years old.

Known as the Archaean[24], this period of time would be 200 million years younger than life's origin also dated at 3,8 billion years, so was raised the problem of its origin at high temperatures. As the Earth's rocky crust slowly formed continental plates (small embryonic surfaces called "cratons" were found) the stable part of continents was "excreted" from the Earth's mantle systemicity (cycle of magma-rocks). The cycle consists in internal moves from the Earth's core up to the surface of the continents and bottom of oceans, in other words the convecting system of the mantle, away from hot mantle zones toward cooler ones. This process known as continental drift, together with the subduction of plates into the mantle is a systemic drift move (Plate tectonics) that produces earthquakes and volcanic eruptions with major changes of continents geography over hundred millions years like the surge of mountain chains and the apparition of crust fractures forming oceans and seas basins or their *disappearance*. Together with the "cycle of rocks", the "cycle of water" participates in the "cycle of air" and the "cycle of climate".

At the same time, as having interrelated effects, the cycles participate in the adaptation of large varieties of physical mechanisms and chemical molecules. They, later, brought up survival abilities to living creatures as to adapt their surviving to environmental conditions (cells' diversity). The sets of terrestrial dynamics permanently participate in "Life's Systemicity" where retroactivity is paramount to the survival of living systems out of synergistic emergent temporary facts and actions. An evolving climate during billion of years prepared conditions propitious to the apparition and development of Life: the terrestrial aqueous context combined to temperatures of relative heat and different weathering cycles participated in the formation of liveable ecosystems. The set of these cycles, as having differential emergent results, at each instant and at different macro-meso-micro levels, permanently changes the interrelated dynamical contexts, which demonstrates the "historicity" character of "systemicity" as the meta-driver of evolution.

THE PLANETARY METADYNAMICS SYSTEMICITY

The Universe gradual evolution is a matter of primordial "neguentropic[25] systemicity" due to the very slow transformation of the Universe. Over -12 bo./years elapsed until the Earth was formed as a planet, and the arrival of Life at an early Archaean period coming around -3.8 billions of years is an authentic illustration of "an evolving historicity". An immense diversity of dynamical phenomena were together involved:

1. High constraints of thermodynamics over cosmic objects, and their practical implementation,
2. Universal force of gravitation that governs the motion of cosmic objects, all forms of matter, and energy,
3. Retroactive effect that induce endogenous and exogenous status changes, while sustaining the formation and evolution of galaxies, star-systems planets and the dynamic effects on Earth's while originating and actualizing its temporal integrity,
4. High benefits of dynamical effects, in terms of an endemic dynamic balance, that maintain planets at distance from an early thermodynamic death,
5. High interrelations of the cosmo-planetary and terrestrial meta-dynamics, and their effect over the Life's intra-dynamic systemicity,

The Historical Metadynamics Systemicity Of Earth Up To The Origin Of Life

The Hadean time (4.5 to 3.8 billion years ago) is not geological. During its history, the Sun formed as the result of neighboring stellar systems gravitation and "baby stars"

[24] - **Archaean: "**pertaining to the earliest known forms of rocks; of or belonging to the earlier of the two divisions of Precambrian time". "The Precambrian is divided into pre-Archean time (from the formation of the earth to 3.8 billion years ago), the Archean Eon (3.8 billion to 2.5 billion years ago), and the Proterozoic Eon (2.5 billion to 570 million years ago).

[25] - **Neguentropy: "**neguentropy is an organization factor in physical, biological and sociological systems that counteract the natural disorganization tendency" of elements, matter and energy.

getting born within the nebula until its thermonuclear activity gave off light and heat in the environment filled with matter, dust and gas. The planet Earth formed from such gas and materials dust mass, including carbon, oxygen, nitrogen, and iron elements (some of the future Life's bricks) that were ejected by ancient stars wherein environment, the Sun has formed. As the Sun's density increased, the surrounding gas and dust slowly condensed, spinning around. The gravitational force of denser areas attracted more gas and elements to the young star disk while it was orbiting. At the same time, gravitation induced to the consolidation of some masses, which growing in size and density, formed the planets of the Sun in a stellar system. The cosmos meta-dynamics systemicity had made emerge planetary objects that have a seeding critical point, an evolving "life" and a "death" trajectory in terms of their matter and energy coherence. The threshold of such events is in an energy collapse from nuclear fusion and gravitational pressure where matter and energy metabolic cycle is re-engineered by phenomena issued from the whole set of metadynamics systemicity drives until entropy would put an end to the process.

In the time of its youth, the Earth's global structure and climates was (and still is) heavily influenced by cosmic forces, additional of solar system nuclear dynamics and of the Moon's formation and gravitational attraction. Since the Earth has a history of successive emergent moves resulting out of interrelated cosmic mechanics and forces that produced its "volume" as originated from the supernova[26] bust, it formed alike many other planets in the universe. As them, it formed from the coalescence of particles by gravity into larger objects *(planetesimals)* that continued to aggregate into rounding planets from matter rotation. The solar system, in this case, has been like a spatial factory within which grew the rocky planets Mercury, Venus, Earth and Mars. "Left-over" material forms asteroids and comets. Earth, at the beginning of its history, and because of collisions between large cosmic bodies releasing a lot of heat, has probably been molten. Its surface progressively cooling down got structured and acquired vital properties from its atmosphere in development. Furthermore, the bombardment of its surface by meteorites, asteroids and comets and the apparition of oceans completed its morphology from fierce pressures of forceful retroaction, fractures and compressions, some because of physical forces, tectonic plates magmatic moves, and from a great quantity of chemical reactions, climate aggressions and water erosion. The Earth, in itself is not a close system but an open cosmic object that has a provisional but sustainable systemic dynamic balance.

Terrestrial pulsations from the metadynamics systemicity

Thereby, under such dynamics systemicity, cosmic and orbiting convergent forces (ref.: celestial mechanics), and the formation of its atmosphere, together played a major role in shaping up its surface. Erosion and transport of sediments, soils and rocks from cosmic and terrestrial winds and volcanism create, in cycles, distinctive land forms and other environmental patterns, which together with water were, and still are, the most important sculptor of the Earth’s landscape.

Furthermore, in a permanent circular cycle, water is continuously evaporating from oceans, transported by winds in form of clouds, and "wash over" lands carving them into coastlines and river valleys. Because of such geological activities, combined with temperatures, water, as an essential habitable milieu, became the "cradle" for living organisms to physicochemically get structured and sustain. Water, winds and volcanism temperatures brought, and are still bringing up anchoring areas to Earth's oceans and ground surfaces: Soils moves and decreasing erosion, while breaking down rock, accumulate matter in one or another place around the World. Erosion and the wind-driven transport of sediments and volcanism materials thus participate in ever changing planet's strata and regional areas of sand and rock formations. Apart from the radioactive fusion of iron trapped in the Earth's core (producing the strong magnetic field), the mineral-rich

[26] - **Supernova:** "extremely bright star that has exploded due to gravitational collapse of the star's core",

mantle is having from temperature differentials, important systemic moves in a constant convection motion of matter from deep under the centre upwards and back. The force of the magnetic field, issued from the flow of liquid iron in the outer core (under the mantle) is shielding the planet Earth from harmful cosmic rays and Sun's solar winds are deviated around from magnetism.

Throughout that immense network of interrelated meta-dynamics producing interactive and emergent results, atomic, physical and chemical events participate in re-structuring the Earth (and other planets) body, by which environmental context in permanent evolution, go confronted with sometimes breathtaking and random changes. In other words, the complex "cosmo-planetary meta-dynamic systemicity" of the phenomena slowly, or harshly, changes the landscape and contextual cosmo-planetary conditions at any single instant.

Most changes are not being usually or mentally perceived at a human mind level. Considering micro or mega sizes and long lapse of time that are to be reckoned in thousands, million and billion of years, they cannot physiologically and mentally be apprehended. The major example, which is a fatal perspective for Life on Earth, is in its programmed end way before our star, the Sun will have consumed its energy away as evaluated around 4 to 5 Bo years ahead. On Earth, one small schedule exception in perceiving day and night light aspects under ever changing climates is however a false impression, given that the orbiting, revolving, contextual conditions are permanently differential[27]. Nonetheless, understanding "systemicity" as the combination, coevolution and cooperation of all dynamical cosmo-planetary, terrestrial forces and moves, particularly in their interaction-retroaction dynamics, is an opening on main formats coupling what makes things permanently moving about from feedbacks and synergistic differential events.

The clue of the universality of emergent differentials seems to present itself as of being close to evidence, simply from referring to the incidence of global warming systemic domino and butterfly effects within the four dimensions of space-time; and because of the weight of cosmologic metadynamics down to the biological levels and of its "horizontal" systemicity (a 4D intrication).

The Habitable Zones for Planet Earth and Formation of Liquid Water

The planet Earth, 4,55 billion/years old, was accreted from dust and embryonic planets that, under the pressure of thermodynamics and gravitation, was structured from a core of heavy elements (iron, nickel) and a coat of lighter elements and volatile molecules (H_2O, H_2, etc), which gradually escaped out. Fifty million years later, a young planet collided with the Earth, at a force that ejected volatile molecules plus oceans and seawaters together with part of its coat, as much at structuring the Moon, in the ambient gravitation. The Earth, at such high thermic forces, was covered with viscous magma, which then after slowly cooled and was constantly restructured under an extraterrestrial rain of material: comets, meteorites and micro meteorites falls. The components of such materials, in particular volatile molecules, participated in the appearance of diverse liquid water areas and flows forming up geological configurations. Thus, about -4,4 bo./years ago, the most important impact of a small planet on Earth, from which the Moon emerged and built up, induced continents and seas to form.

The "zone of habitability" of a planet, where liquid water is stable is limited: it varies according to the luminosity and heat produced by the star, together with its effective distance at a moment-t and the degree of heat makes the vital habitability zone to vary. Since the volume of liquid water is between both the cold and too hot limit, the fragile liquid molecule can be maintained between ice and gas as a perfectly volatile

[27] - **Differential:** "pertaining to the difference of two or more motions"

element. Then, Earth conditions adjust from regulations counteracting the Moon gravity effect with:

- Evolution of the gas composition of space and atmosphere that induced to the apparition of ocean waters ,
- Retroactive moves due to atmospheric conditions that implemented a physicochemical medium and a synergistic context for Life to appear.

The universality of "the general meta-dynamics systemicity" notion, illustrating the number of retroactive processes that produce matter, gas and energy (thermonuclear, thermodynamic, physicochemical, stellar, kinetic, radiant, gravitational, electromagnetic, volcanic, climatic...) is factual. Interrelated cosmo-planetary meta-dynamics effects have influence on stars and planets existence, and are consubstantial with the terrestrial physicochemical metadynamics and biological circular cycles on Earth. As one example of a permanent pressure, let's mention the "climatic recycling" of vapor into water.

The chief part of Albert Einstein's imposing body of work reveals as here quoted, the relativity of universal metadynamics and some systemicity links:

"Albert Einstein, between 1905-1915, developed a theory of relativity: the "electrodynamics of moving bodies" (the speed of light is a physical constant but a cosmic body never rest as continuing to move uniformly) and with the General relativity developed the "geometrical theory of gravitation". An act that unifies special relativity and Sir Isaac Newton's law of universal gravitation with an insight that gravitation is not due to a force but rather is a manifestation of curved space and time, this curvature being produced by the "mass-energy" and momentum content of the "space-time"(unquote).

A first version of the theory of relativity (Albert Einstein, 1905) who did not consider the question of accelerations of a reference frame, nor "gravitational interactions" of the origin, was named "Restricted Relativity**".** However, it presented a coherent explanation of the "electromagnetic interactions" and their transformations by change of reference frame using the transformation of Lorentz[28]. Moreover, it solved paradoxes existing in traditional mechanics relating to the "measurements of the light velocity" without entering the dynamics systemicity.

Introducing the concept of space-time and explaining the phenomena of duration and distance variation was to see it as measured by two observers, each one being located in a different reference frame. Experimentally checked, it made emerge *"results of retroactivity between these dynamic moves"*. The static Universe model developed by Einstein and the cosmological constant, lying at the crossroads of quantum mechanics and gravity is controversial since the Universe volume is found on the move from gravitation attraction as it is assumed by Edmond Hubble (1929). He discovered that galaxies move away from each others at a speed proportional to their distance (Hubble constant) and that cosmology with the physics of astro-particles becomes quantitative.

The particles study becomes differentiated while using other messengers than photons (neutrons, neutrinos, gamma rays and gravitational waves) and the battle about quantum mechanics is particularly sharp observing the factual reality of particles as photons position and their wave duality. At the same time, Paul Dirac (1928), developed a relativistic electron theory and quantized[29] a field theory, called *quantum electrodynamics* that unify relativity and quantum theories in reference with the interaction between electrons, positrons, and electromagnetic radiation. Furthermore, he shows quantum electrodynamics situations in which matter is converted to energy and energy converted to matter (*the particle of light, electricity and magnetism*). Together

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[28] - **Lorentz:** Hendrick A. Lorentz (1853-1928) left his name to the "transformations of Lorentz", which are at the base of the theory of restricted relativity, as the law of change of the Galilean referential frame, without translation neither in space nor in time.

[29] - **Quantize:** restrict a variable to a specific set of values as forming into quanta (Physics)

with such fact, *electromagnetism* is the physics of the electromagnetic field that exerts a force on particles having electric charge properties, *is retroactively affected with the presence and motion of those particles.*

Atomic forces and reactions occurring around the planet are "rinsed out" by "the Van Allen Radiation Belt" that is a protection from solar winds (current of plasma flowing from the Sun) held in place by the Earth's *"magnetic field"*. The solar wind pressure (magnetic storms pressure) on the magnetosphere increases or decreases since depending on the Sun's activity and changes of electric currents in the ionosphere[30] (ions and free electrons).

At this end of a short general analysis of the clear existence of the "cosmo-planetary dynamic systemicity" effects, one assumes the importance of interdependent and interconnected processing and of forces involved. The “primordial meta-dynamic systemicity” from which several cosmo-planetary, terrestrial and biological physicochemical moves operate, participated in the emergence and sustainability of Life on Earth. Within the body of such metadynamic process levels were (and still are) mechanisms of reactions, retroactions, circularity, reproductions, adaptations to physicochemical moves, changes and apparition of new proprieties that, being all interrelated and intricate, seed the metadynamics systemicity in consequence of evolutionary moves. The set of these moves were (and still are) "meta-drivers" making emerge the different bricks of reactive structures, from which, by synergy[31], cosmic objects and living systems' metabolism homeostasis give birth and boost evolutionary capacities to drive dissipative structures, and living creatures to adapt for survival to a perdure.

Chemical interactions, physics of particles, astrophysics and cosmology, matter behavior, vacuum, time ("its arrow") studied by Y. Prigogine (1977) led him to develop the notion of the "dissipative structures". He describes open systems as operating far from a thermodynamic balance in an environment of matter, energy exchange and entropic pressure as well as adapt to "survive" within the momentary limits of a dynamic equilibrium.

Geophysics and Terrestrial Meta-Dynamics Systemicity for Survival

Geophysics studies the Earth existence and its terrestrial moves (or pulsations) applying to physical and chemical principles of the Earth's subsurface and surface motions of tectonic plates. Thus, the internal structure of the Earth and of its metadynamics systemic circular moves (magma convection currents sinking again, rock cycles and shallow deposits) provide for an important inventory for numerous systemic data and geological forms. Many resource basins providing for mineral deposits, groundwater wells, chemical sources…, are well exploited by living systems, some of them at the origin of Life (minerals and water…) promote its sustainability. Petroleum reserves, at the origin of the industrial development of our modern humanity, induce to the surge of new survival consumption means, sometimes in form of their natural status or, for the many, in form of transformations increasing their purpose of utilization. However, transformation of matter is basically current among living beings as also fulfilling survival means. Required from predation strategies among the multiplicity of food chains cycles, the survival means are immensely diverse even though metadynamics systemicity survival principles involved are basically common to all.

Physical phenomena relationships with terrestrial components and moves, during short or extra-long term periods of time, include at least the Earth’s magnetic field, heat flows and the propagation of seismic waves from tectonic plate's moves (earthquake). On

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[30] - **Ionoshpere:** "the part of the Earth's atmosphere in which ionization of atmospheric gases affects the propagation of radio waves, a part close to mesosphere and thermosphere"

[31] - **Synergy:** "also, a mutually advantageous conjunction or compatibility of distinct actors or elements (as resources or efforts).

an outer-space level, other phenomena are conditioning the force of gravity and the effect of solar radiations (Van Allen belt), solar wind inducing to particularly notable climate changes.

The rotation of Earth, in the gravitation fields of the Moon and Sun influence, imposes periodicities changes upon marine tides, solid earth tides (deformations of the crust) and climatic status on continents and oceans. Changes are influenced by temperature, humidity, cloudiness, precipitation, wind, and pressure variations as per physics laws of heat and motion. Their well-defined terrestrial cycles and structural features (monsoons, high and low pressure, thunderstorms and tornadoes, etc.) are systemic drivers making a living Earth' biotope to exist and sustain called "Gaia".

THE TERRESTRIAL META-DYNAMICS SYSTEMICITY AS PRIMORDIAL TO LIFE

Ingredients essential to Life

The ingredients of Life are: *carbon*, a common element in the universe, *liquid water*, an element which is on some rocky planets, *nutrients*, as elements emerging from rocks and minerals, *energy*, produced by solar light, the heat of hydrothermal sources and exergonic chemical reactions produced from interaction between minerals and water. In biology the reactions of catabolism are exergonic (releasing energy in the form of work) while component molecules, present in various forms in the universe, are especially gaseous or solid and provide with carbon and water the unavoidable physiological means for Life to exist and sustain.

Carbon

The tetravalent carbon atom shapes up diversified complex structures. With *hydrogen,* it produces the family of hydrocarbons (more or less long chains, opened or closed, ramified or not) whose connections are simple, double or triple; with additional *oxygen* come up alcohols, sugars, ketenes, and with *nitrogen* amino acids structure emerged. An amino-acid (ref. to esparto, a fiber) was detected in a micrometeorite in the Antarctic. Carbon existing everywhere in the universe, contained in such micrometeorites went heavily bombarding the primitive Earth during 200 million/years, at a rate volume of 25'000 times more than the biological carbon recycled onto the surface of the Earth.

Liquid water

Essential to Life, liquid water is the base of multiple chemical reactions: the water molecule (H_2O) is polar, with the direction where it carries opposite electric charges: the oxygen atom is of weak load (-), the two hydrogen atoms are slightly (+). Thus the dipolarity takes part in the ionization of salts and groups of atoms which increase by as much the molecular solubility that carries them. Moreover, the polarity of water produces weak hydrogen connections between the atom “oxygen” of a molecule and an atom of a close molecule. Then, connections which form the very dense network of liquid waters, as remaining liquid with the atmospheric pressure, sustain its state in spite of a molecular weight weaker than that of gas (e.g. H2S).

PRIMORDIAL ENVIRONMENTAL FORMS AND THE ORIGIN OF LIFE

Plate tectonics and the cycle of rocks

The prebiotic Earth is active, thus dynamic: rigid plates are driven below a more fluid coat, into movements taking part in recycling the rocks of surface. Observed today, the cycle renews nutrients exhausted by marine living creatures present by the surface of oceans: the sediments excreted include in particular organic waste (vegetable and died animals, excrements of all kinds…) and get hidden in the continental coat, where they

mix with fresh elements. Lastly, they go back to surface in various forms: *lava from volcanicity, hydrothermal water fumes, charged gas,* all rich with nutritive elements for living beings food take as to exist. Within such environmental systemicity, the cycle of rocks is regenerating, but is also destroying in the sense movements of tectonic plates participate in the destruction of Earth's primitive crust. Some enclaves dated as rocks -4 to -3,8 billion/years old, called "cratons" were located in the pre-Colombian era (Canadian and Greenlandic anterior to -542 million/years).

a) The proof by zirconium silicate

"Zircons" are zirconium silicate crystals which remained in the core of continents in granitic rocks as old as of -3,6 bo./years. They witness the apparition and existence of tectonic plates as giving out necessary matter and space where formed *oceanic and sea water basins*.

b) Oxygen isotopes, water and systemicity

Oxygen isotopes show that sea water, which circulated at the core of the oceanic crust, is still circulating through hydrothermal sources. Rain water quality, volume and circulation, which had already an influence on the temperature and the composition of oceans and seas, is also depending on the rate of erosion of continental rocks from other forces (climate, volcanism...) Its charging minerals, matter and salts, while its run-off is streaming down marine basins, are the product of interactions on the way down ground surfaces. The primitive grounds have received more acid rains than today, which more strongly eroded emerged grounds at a point of reinforcing the oceans salinity. Thus, the ocean pH influences the probability for prebiotic molecules to assemble and, in the same way, the pH of rainwater, depending on the atmosphere composition, seeding a variable density of matter and gas, influences the biotope organisms diversity at search of energies.

c) The atmospheric air composition

Data on primitive atmosphere are correlative with the history of water: the primitive Earth, set at the thermic limit of Life, was not iced (oceans presence) and the first traces of glaciations are shown much later (around -2,9 billion/years ago), which represents about a "one billion/years" period of time from the threshold of Life's biotic conditions for organisms to evolve along with a favorable atmospheric status.

d) Terrestrial temperature dynamics

Heating planetary surfaces requires a rather dense atmosphere with a high "greenhouse effect", initially made up of methane, and CO_2 of which quantity was not sufficient to maintain water at a liquid state over primitive Earth surface (low temperatures close to -0°).

The isotopes of oxygen and silicon make it possible to describe primitive Earth's ocean surface temperatures as having been between 50° and 80° C. However, in low depth basins, where rocks were formed, hydrothermal waters have certainly took part in the level of oxygen isotopes.

e) Effect of rains

The atmosphere, made up of CO_2, acidifies rains, therefore oceans. However, the prebiotic reactions, subjacent with the creation of Life's bricks (nucleic acid for proteins and purine bases for the ARN/AND) adapt better with an alkaline water than an acid one. Earth's hydrologic cycle is connected with clouds, rain precipitations, groundwater infiltration, water wells, lakes and oceans evaporation, trees transpiration, solar radiation, topography and absorption by the ground, or runoff, glaciers impact and thaw, volcanoes

fumes emission, river flows... all phenomenon that are showing the systemicity of the hydrologic cycle complexity.

f) Effect of hydrothermal water and sea water content

Elements essential to Life are present in hydrothermal water flows: *monoxides and carbon dioxide (carbonaceous molecules), nitrogen, hydrogen, sulfide, metals* and form 80% of the atmosphere content. These elements are constitutive of organic compounds found in all living tissues. Conversely, in hydrothermal sources vent, wherein the pH is higher than in water, is also favorable with the apparition of Life. The energetic interface of catalysis is differentiated: on one side, at low temperature, oxygen and UV rays intervene in the reaction, on the other, at high temperature, carbon, sulfide, nitrogen and metals intervene as well. The first living systems, as chemical entities capable to survive from adaptation and replication were resulting from organic molecules, and still are: each one was to bond atoms of carbon and hydrogen (methane, CH_4) atoms of oxygen (O) and nitrogen (NA) as well as catalytic abilities.

HYDROGEN, OXYGEN, WATER AND ORGANIC MOLECULES

The Hydrogen Bond in Organic Molecules

In the structural chemistry and biochemistry of amino acids, the hydrogen bond is usefully ubiquitous and spanning a wide spectrum of energies, lying between covalent and van der Waals interactions. Permitting hydrogen bonds to associate and dissociate rapidly at ambient temperatures, it brought a vital prerequisite for biological reactions to take place.

Water orders the organic molecules

Organic molecules have at the same time: first, a group of hydrocarbons, not soluble in water since they do not exchange hydrogen bonds with water molecules - they are said "hydrophobic"; second, groups containing oxygen, nitrogen and sulfur - they are said "hydrophilic".

Biological structuring effects

The dynamic of organic molecules is by structuring the development of cellular membranes, proteins, RNA and DNA nucleotides that play a central role in metabolism. Their interactivity with their milieu is one of many subdynamics that jointly participate in the biological body's metadynamics systemicity of the necessary fluxes and moves that sustain a cell's survival (differential retroactivity).

Water, a chemical reactant[32] for survival

The synthesis of A. Strecker shows that amino-acids are, at a rate of two water molecules, allowing the transformation of intermediate components into amino-acids. The Strecker's synthesis of amino acids involves the reaction of potassium cyanide, ammonium chloride, and an aldehyde to make an alpha amino acid. The reaction can also be run with ammonia, hydrogen cyanide, and an aldehyde.

The assembly a+b makes emerge amino-acids, such as glycine specially obtained by hydrolysis of proteins and produce of proteins by hundreds or thousands interacting in between them, interfiled like the pearls of a necklace. The organic groups, containing oxygen, nitrogen and sulfur, separate into ions (ionize) in water and become very reactive.

[32] **- Reactant: "**In organic chemistry, reactants (reagents) are compounds or mixtures, usually composed of inorganic or small organic molecules, that are used to effect a transformation on an organic substrate".

Because of the relative simplicity of the reactants, the Strecker's synthesis has suggested both proto metabolism and meteoritic amino acids were to be considered as origin of Life drivers.

Other elements, their effects as constituent of Life

Sulfur is a nonmetallic element that reacts either free or especially combined in sulfides and sulfates, becoming a constituent of proteins. Parallelly, silicates are any of a large number of mineral compounds, which form over 90 percent of the rock-forming minerals of the Earth's crust. The deterioration of silicates produces clay that is found in great quantities on the primitive Earth. Clays have a great capacity of organic compounds concentration, allowing chemical processes to be essential with Life to originate.

The physicochemistry relates to the interparticle forces of sediments. They result from the physical interaction arising from *gravitational forces and the electrical nature of the particles and the surrounding fluids*. Because of the ubiquitous nature of organic materials, clay-organic interactions are believed to be significant mechanisms in the developmental history of microfabrics[33] and sedimentary deposits (Bennett et al. 1988). Bioorganic processes became important in marine and coastal environments during transport and sedimentation of particles in organic-rich water as areas of high productivity. Processes of burial diagenesis[34] drive microfabric development when overburden or tectonic stress dominate physicochemical and bioorganic bonding energies.

METADYNAMICS SYSTEMIC CYCLES AND APPARITION OF LIFE

The Planet Earth Named "Gaia" as a Living System

The "Systemicity outputs" are illustrated with some of J.E. Lovelock's developments (1979) on planet Earth existence as being a living system he called "Gaia". Lovelock's theoretical approach is based on:

- The "thermodynamics second principle" where matter tends towards an increasing entropy, or disorder, in terms of physicochemical balance, thus its degradation and extinction,
- The "survival principle" opposes itself against disorder since Life constantly renews its molecules from biological retroactivity and adaptation (see later the "molecules of emotion"),

The hydrologic and winds cycles, described as a transdisciplinary approach of contributing dynamics, are in the circulation and conservation of Earth's water that is in a frequent status of change (surface water evaporates, cloud water precipitates, and rainfall infiltrates the ground...). Most probably, the whole volumes of water contained on land, in oceans and the atmosphere was progressively attained to in a dynamic balance with the increasing volume of oxygen in the atmosphere. The formation of the Earth crust under a changing atmosphere, changing land and ocean environments was modifying temperatures, and still is. The hydrologic cycle cannot be considered as a closed system since it is reactive with the planet cosmic behaviors, under the influence of the presently described "cosmo-planetary meta-dynamics systemicity" and other terrestrial dynamics. Participating in, the Sun dynamics, gravitation and orbiting position are some of the components of the set of "the general meta-dynamics Systemicity" of the solar system governing the climate cycle and Earth reactivity.

Winds, one has to consider other dynamics that influence the systemicity of moves: air masses and circulation fronts. Cold fronts and warm fronts and different type of advection collectively form global and local climates according to the status of water or

[33] - **Microfabrics:** Texture or appearance of a geological material.
[34] - **Diagenesis:** "the conversion (as by compaction or chemical reaction) of sediment into rock" refers to the cycle of rocks.

air, temperature, moisture and vortex advection conditions. If global winds result from solar heating of the Earth and the differential heating between the equator and the poles, the rotation of the planet (Coriolis effect) and the magnetic field have major influences on the atmospheric circulation of air and clouds masses. Analogues are the characteristics of the parameters that participate in the formation of oceans currents (natural convection).

The complexity of "cosmo-planetary, terrestrial and life's meta-dynamics systemicity" where interrelated cosmo-planetary and terrestrial forces interact is a well specified phenomenon. The interconnectedness of every physicochemical and biological cycles inside the 3 dimensions of geographical ecosystems, produces differential opportunities for matter, energy and organisms to behave, adapting themselves to temporal conditions and evolving as adapting to environmental reactivity. The "cycle of rocks", the "cycle of water", the cycle of winds and temperature"… as well as the "cycle of cells' individual and social survival", even though physicochemically different in their changing and evolving statuses are formed from a certain number of emerging results. Issued from dynamics differential retroactivity, they reveal the specificity of cycles that participate in cosmo-planetary and terrestrial meta-dynamics systemicity outputs.

The Metadynamics Systemicity Outputs and Apparition of Life

The “primordial systemicity outputs”, within which the body of dynamics were (and still are) mechanisms of reactions, retroactions, circularity, recursive production and reproduction, adaptations to physicochemical moves, changes and apparition of new proprieties, can be considered as evolution seeds (emerging results). The moves were (and still are) “drivers” making emerge the diverse bricks of reactive structures, from which, by synergy[35], proto-metabolisms transformed, living system’s metabolism appeared as the substrate to building up dissipative structures that became (and still become) adaptive individuals and societies, from cell species to actual human societies.

It was early in the Archaean that life first appeared on Earth around -3,8 billion years ago. Oldest bacteria fossils date to roughly 3,55 billion years ago, and consist of early autotrophic bacteria. They probably grew both deep under oceans near volcanic gushes and along ancient seacoasts enduring harsh sunlight as well as episodic wetting and semi-drying from tidal cycles. Environmental conditions like subaquatic volcano emergences with significative temperature and gas effects induced some living most primitive creatures (Archaebacteria) to develop, finding energy and metabolic nutriments from chemical reactions within a rather hot context of water and matter milieu. They constitute a taxon of living organisms characterized by cells without core distinguished from the eubacteria[36], in some biochemical characters. Later, eukaryotes cells (2,5 bo./years) acquired a nucleus organ enclosing the RNA replication mechanism of DNA as expressing proteins and a flexible cellular membrane with specific filtering reactors for endo-exogenous exchanges of vital chemicals and energy.

Feedback Induces to Differential Retroactivity Results (Systemicity)

A "feedback" is the process that enables "loop control" moves participating in the management of systems' regulations processes. In a closed-loop system, a feedback dynamic device has the property permitting to an output (or some other controlled variable of the system) to be compared with an input to the system (or an input to some other internally situated component or subsystem of the system) so that the appropriate control action may be formed as some function of the output and input balance. Most cycles of the cosmo-planetary and terrestrial dynamical materials and energies are retroactively sustained and then evolving, at least within the influence of galaxies gravity on the very long term of their "immense spatial survival". More generally, feedback is

[35] - **Synergy: "**a mutually advantageous conjunction or compatibility of distinct actors or elements (as resources or efforts).
[36] - **Eubacteria:** type of spherical or rod-shaped bacteria.

said to happen in a system when a closed sequence of cause-and-effect relationships exists between the system's survival variables. In parallel, an "open-loop control" function has a distinctive control action since it is independent of the output. (J. Distefano, 1967). The "Sun" and its planets, a star system, has an evaluated life length of another 5 billion years ending into a supernova blow out, which matter, chemicals and energy will seed again the interstellar space and neighboring star-systems, in a cascade of retroactive moves. The seeding is historically and retroactively sustained but confronted with the thermodynamic entropy that end with a thermonuclear matter bust feeding the apparition of new star-systems (ref. to supernovae life). On Earth, organisms are all confronted with entropy and degradation (thermodynamic breaking down) that feed back new elements for survival such as energy, food chain and reproduction chain.

The most important feature a feedback imparts to a living system's integrity and behaviors is in its comparison function that continuously detects differences existing between inputs and outputs effects. Endogenous and exogenous stimuli while emerging provide appropriate signals or information necessary to managing input-output variations. One may name such retroactive moves as the "survival capacity drivers" submitted to the collective meta-dynamics systemicity (meta-drivers) of cosmo-planetary and terrestrial environments. In a biological move, such as reaching an object or reacting to endogenous and exogenous events require some chemical specific reactions that interpret and decide what to reach, positioning a "body", what behavior to have for security or as getting a resource within reach. At different levels of action, variable signals are piloted out the sensitivity of chemical substances, cell's receptor filtering and organ functions (e.g., light chemical vision as conversion of information, like eyes ones) and from their reactivity to "biops" drives. (e.g.: unicell' have a "brain"[37], a chemical memory with enough capacities for an efficient survival management and also bar receptors regulating blood pressure by inhibition drives…). Biological processes might not have an accurate ability to reproduce faithfully an input, then the reducing effect of non-linearity and distortion usually drives to some oscillation or instability. This is why the circularity of moves is primordial for the maintenance of survival dynamics. Life's infinite complexity within its chemical exchanges generates feedback drives (or biological interactive emergent "biops"[38]) of which results affect the object survival streams steadiness (dynamical balance) while confronted to entropy.

The "cycle principle" is the result of retroactive processes like the cycle of water in an ecosystem.

The process of sending status information back for comparison with previous status information called feedback, and the whole processing of inputs, outputs, errors or differences in signals, is called a closed loop; however differences in the status qualification induce the loop to get open the next step. Then , becoming an open system, variations of status qualifications in gains or losses oscillate around a critical point depending upon the type of system and its sensibility to entropy.

The environmental conditions on Earth, at the time Life gradually came out of the limbo, were strongly radioactive under an atmosphere with very little oxygen and no ozone exposing Life with much UV radiations. The pressure of Earth mass and accumulated energy of its radioactive components heated its interior to the point gases and vapor expelled from it, participated in the formation of air and oceans. Among these gases was enough hydrogen for life's elements - organic components – to form and survive: hydrogen presence in the universe is essential to life's components (carbon, nitrogen, oxygen, phosphorus, iron, zinc and calcium. Hydrogen is also the fuel of Sun that provides, together with water, the flux of energy essential to the physiology of

[37] - **Unicell's brain**: biochemical processing information close to more elaborate neural function as the one neurone Aplysia.
[38] - **"Biops"**: the acronym for a bio-physicochemical event.

organisms. The presence of free oxygen induces to the development of oxydo-reduction in diverse environments: oxide components reject oxygen – rust become iron - and "hydrogen +" induces to balance acids and alkaline. If these condition have enough potential, then environmental milieu are prepared for the physicochemical development of the Life's components to develop into organisms. Furthermore, the average temperature of the Earth surface was sufficiently constant so as to participate in organisms to survive and develop.

Here again, at the Earth's cosmo-planetary and terrestrial metadynamics level, the set of cycles having differential emergent results, at each instant, at different macro-meso-micro levels, and permanently changing the interrelated ecosystems dynamical contexts, demonstrates the "historicity" character of "systemicity" with the action oof the meta-drivers of evolution. The history of Earth, a true odyssey, is consubstantial to that of the cosmos, given that the galaxies and stars (matter and energy cycle) have an evolving survival history to perdure in a limited long term: such is the Sun and its system.

The Cycle of Salinity: vitality or liveliness

The oceans get most of their salt from rivers, volcanic gases and hydrothermal vents on the ocean floor. As water is cycling between the oceans, the atmosphere, and lands since over hundreds of millions of years, the salts from rivers remained in the oceans. It explains why seawater is saltier than river water. Ancient salt deposits indicate ocean salinity as having remained relatively constant along 1.5 billion years. Salts are removed from seawater when they bond chemically to clay sediments as they sink to the sea floor in a process called "reverse weathering". Salts are also removed to the profit of marine plants and animals to form body parts and by evaporation forming minerals. They are also blown from waves into the air, leaving a salty aerosol in the air or a salty film on nearby land. The cycle of salinity goes on when uplifted ancient rocky seafloors are weathered releasing ancient sea salts that rivers carry back to the sea. The density of salt participate in the current of the seawaters across the world, together with their temperature, so seeding the systemicity of those dynamics The dynamic is retroactive and participate in Life's to exist: cells, animals, plants, humans, all must retro-regulate their "osmosis" to a certain amount of salts in their tissues in order to provide chemical exchanges within the living organisms for hydration.

The Cycle of Carbon

The cycle of carbon usage by which energy flows through the Earth's ecosystem is basic to cells existence and survival evolution. When photosynthesizing, algae use carbon dioxide (CO_2) found in the atmosphere or dissolved in water. Incorporated in plant tissues as carbohydrates, fats, and protein, the rest of CO_2 is perspired to the atmosphere or water (respiration cycle). Since herbivores eat vegetation, their metabolism uses, rearranges, and degrades the carbon compounds: CO_2 as an aerobic respiration is partially stored in animal tissues and is cycled on to carnivores feeding on herbivores. Wastes and decomposition matters are broken down and their CO_2 is then being used again by plants. Continuously circulating within the Earth’s ecosystems, the carbon dioxide gas from the atmosphere is the energetic mean for plants in photosynthesis process. Animal respiration and photosynthesis balance to keep the amount of atmospheric carbon relatively stable given that a certain amount contributes to underground by-products (petroleum…). However, nowadays, the humans with extra carbon dioxide production from industries and fuel usages perturb climates cycle, ecosystems and milieu metabolism.

As a conclusion in this part of work, the systemicity of terrestrial dynamics, the different levels of their synergy, retroactivity and convergence of emergent results, at instant-t, explain that, from feedback effects, perturbations , so minimal would they be, induce to amplified moves within the different cycles as illustrated by the "butterfly and

domino effects" metaphor. It acknowledges the actual critical situation of the global warming cascade of threats to natural Life.

Primordial and Fractional Process Interactions

The "Science of the Living" has made immense progresses at understanding its mechanisms, particularly since the entire genome of humans and of quite many organisms has been chemically deciphered. From such base and from digitized data, many biological tests in laboratories enable scientists to reproduce and describe some of the Darwin natural selection and evolution mechanisms. The "paleomolecular biology" is a method applicable to genes sequencing, which is the DNA synthesis[39] applied to digitizing some of its models. By sequencing models of gene fragments and test their capabilities to behave, it was obtained simulations of the reproduction of proteins that went silent for billions and, or hundred million years. However these tests cannot be but fractional since it will never be possible to biologically restructure the whole RNA, DNA of past species. since the building up of genes should individually take into account the impact of environmental conditions of the moment, in other words, to reproduce the contextual "dynamical systemicity" of the surroundings they happened to emerge from, live in, reproducing and adaptively evolve.

"Primordial organic functions" have surged along a very slow evolution of positive physicochemical reactions confronted with the entropic world (during ~ a billion years). The interaction between biological processes produced dynamic results that emerged from their being confronted with the permanency of the thermodynamic "work" within specific ecosystems and fluxes. Prior to the apparition of gene segments coding proteins, organic functions have induced to physicochemical combinations from which emerged the "RNA reproduction capacities" of future unicell. Life was in limbo until unicell developed (bacteria, archaebacteria…) and "*cells are the atoms of the living world". A single cell is often a complete organism in itself, such as a bacterium or yeast". However, virus*[40]*types of organism raise the question of the "egg or hen paradox" used as a metaphor, so anyone here may propose questions: "when appeared the predator-prey chain mechanism"? Is the answer within the sole physicochemical milieu that developed this essential function to life? Would energetic results and effects be the clue?* Biochemists, biophysicists and molecular biologists certainly provide important information on the subject, even though anyone has his own arguments to answer to such questions as confronted to biological phenomena. A "food web" is made of *"interconnected dynamic food chains by which energy and materials circulate":* the emergence of primordial chemical reaction in form of biomolecule predating for energy is a dynamic result. The first move that happens is at the level of energetic electrons that absorb and reject energy while transferred from one atom to another during oxydo-reduction reactions[41]. A dynamic that makes biological molecules to exist as they are made of atoms linked with energy, therefore participating in the systemicity of the livings to survive.

"METADYNAMICS SYSTEMICITY" AND EVOLUTIONARY MECHANISMS

Emergence And Effects Of Systemicity Results

Emergence is the "door of evolution", a threshold as being *"the gradual development of something into a more complex or better form"* or pattern that arises out of multiple interactive feedback effects. In other terms, the metadynamics systemicity at any

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[39] - **Polymerase chain reaction (PCR):** a molecular biology technique for enzymatically replicating DNA without using a living organism.

[40] - **Virus:** "microorganism without a cell wall, able to reproduce only by inserting itself into a host cell and hijacking the reproduction mechanism for its own ends".

[41] - **Oxydo-reduction:** transfer of electrons of an atom to another. One calls *oxidizing the* atom which collects the electrons and *reducer* the atom which yields them during the reaction.

environmental level, e.g. here, the terrestrial level induces to emergent new statuses, conditions, properties and behaviors. Being central to a coherent integration of sustainable survival means, a complex dynamic milieu is like that of the metabolism of the Earth or of an organism. The emergence of livable functions to grow and reproduce, maintain structures, and respond to their environments is the keystone of survival. Metabolism is homeostatic and results from catabolism breaking down organic matter, e.g. harvesting energy in cellular respiration. Complementarily, it results in anabolism that is the use of energy to construct components of cells such as proteins and nucleic acids.

The emergent properties, in biology, are the combination of individual atoms to form molecules such as polypeptide chains, which in turn possess behavioral properties folding and refolding to form proteins and reshuffling reactions. Assuming their functional status (eg.: enzymes for survival sustain) from a spatial conformation, these proteins interact together thus achieving higher biological levels of survival functions in form of organelles…, cells…, thereby inducing to sustainable tissues, organs, organ systems, organisms, all holding with behavioral reflexes of protection (fight or fly, habit…) and of survival efficiency. Cascading phenotype reactions, arising from individual genes replication, mutate bringing about biological communities in the world to form the biosphere, where living systems, e.g. ants…, and humans participate in becoming interactive societies, and meta-social systems such as ecosystems (or the global stock-market). As being open systems, "if the condition is left random, the result of conditioning is also random", and the effect of the environmental metadynamics systemicity drives forth evolving and adaptive behaviors inducing endo-exogenous changes.

Evolution is a notion considering the Darwinian natural selection as a driver, and is also, and more broadly, the result of the permanency of change in one or several directions. Among the metadynamics systemicity moves, some of its components are to be mentioned here in the way their asymptotic effects are usually deviant or perversive.

Domino effect

Both effects indicate the multiplying risk constituted with several events and behaviors at risks present on the same site and tending to evolve, spread and settle well beyond the initial condition of its appearance. The expression of “the domino effect” is used as a physical metaphor to represent the propagation by “contagion” (biomedical metaphor) of a local event or of an ideology. It refers to the concept of “coevolution” in ecology where a change at a specific level can promote and facilitates cascading changes at another one. The domino effect suggests that some change, small in itself, will cause a similar change nearby, which then will cause another similar change, and so on, in different sequences, by analogy to a falling row of dominoes standing on end. For example, the food chain networks are very fragile since if one element, predator or prey, matter or water, misses, then the global result becomes hectic and nears the death of at least a species spinneret and at term, that of humans. A rather dangerous thermodynamic effect.

Butterfly effect

Besides differential emergent results, an effect of amplification of a phenomenon may occur well beyond the place of its apparition named a “butterfly effect”. In other words, *"the butterfly effect is a notion of sensitive dependence on initial conditions"* and happens in the course of some chaotic events. The behavior of chaotic systems usually shows such exponential growth of perturbations as of in nature, small variations of initial conditions of a dynamical move may produce large variations in the long term behaviors of the system as for example winds or a population genetic drift or stress.

Coevolution

Coevolution takes the form of different aspects of dualism, often ago-antagonistic between living species that have reciprocal influence from their interactions. For example, the keystone of survival is in the dynamic of predatory-prey, host-parasite, symbiosis between two species, or associations of several species as being systemic phenomena much significative of the "survival principles" mostly common to living species. The biology of evolution makes it possible to observe these dual forms and the importance of coevolution in the history of species and sexual conflicts. Some biologists, as Thierry Lodé and Richard D. Alexander, 1990, describe the effects of these antagonistic interactions, particularly at the sexual level, and the evolutions of characters as leading to an antagonistic coevolution of entities.

Kinetic factors and chemical reactions

As Earth is an open system, it interacts with a part of Cosmos and Sun system forces and moves and from their metadynamics systemicity, it brings down on Earth energy-filled light rays which retroactive effects are differential in climate cycles and in living systems survival potentialities. Cascading, this excess of energy is minored from the dynamic balance of gravity, the Moon effects and atmospheric pressures. However, this resulting energy is adequate to overcome the negative effect of entropy on emergent chemical reactions results as keeping up sustainability requirements and adaptation abilities for living systems to cope with the permanency of environment changes.

Kinetic factors as decisive in multi-step processes

The origin of Life was a matter of convergence and interactions between chemical systems during interrelated processing as adequate with survival moves (e.g.: replication, photosynthesis and autotrophic capacities of cyanobacteria to assemble for). Emergent results build up chemical structures acting like proto-living systems and having a chemical evolution, a molecular self-organization and a biological adaptation reproducing and change.

The chemical environment initiated the assembly of chemicals that formed the first polymers (repeating structural units) able to provide information for others to assemble (proto-nucleic acids?) leading to reproductive polymers and catalytic activities. From then on, the whole environment flourished with properties which dynamic systemicity induced to replication and evolution into more adaptive polymers. Thereby, biological evolving conditions emerged originating different substrates (site of enzyme actions) where the RNA-like molecules formed and later engendered singled-celled organisms, some of them getting differentiated into multicellular systems in a proto-metabolic milieu. Such overview of successive metadynamics systemicity phenomena supporting living systems must be understood having occurred during an immensely long period of time of about 800 million years and plus. While getting more inquisitive about the immensely long period from -4,6 bo./years (the Earth birth) up to + 2'009 years of nowadays, in the history of Life, it becomes highly important to have a transdisciplinary learning as understanding the universal and natural interconnectivity.

TIME AT METADYNAMICS SYSTEMICITY LEVELS

Time At Cosmo-Planetary And Terrestrial Levels

Time is considered as a fundamental quantity, a notion of the period during which an action or event occurs and a dimension representing a succession of such actions or events. The concept of time differs with the cosmo-planetary, terrestrial, biological and intra-biodynamical levels. Its must be considered as referring to dynamics moves and forces duration and that of their retroactive systemicity. It effectively separates cause and effect, particularly within notions of positive emergence or continuity like the domino

and/or the butterfly effect, of which evolving action, much differential, is according to the level it belongs to and the type of the action.

For example, the Universe dynamics refer to a specific understanding of cosmic space represented as being at four dimensions: time, length, width, and depth. In addition, a cosmic object velocity rate is understood in terms of units measuring unimaginable distances: equivalent to the distance that light travels in an average solar year, at a rate of approximately 300,000 km/sec., it represents inconceivable distance in trillions and billions of light years. Conversely at a biological level, a chemical reaction may only last an approximate thousand femtoseconds, or one millionth of a millionth of a second while being provoking sides effects and cascading effects of retroactions with neighboring molecules possibly replicated.

Time is used to define other duration quantities, such as those relative to terrestrial climate cycle evolutions, which notion relate back to the evaluation of a retroactive dynamical move, its systemic cascading effect propriety and its duration length. When referring to natural cycle's retroaction moves, time is the major instrument as evaluating Life's survival phenomena moves, bringing up some biological understandings such as, for example, the billion years it took to a whole set of physicochemical reactions to form protocells in the primordial ocean. A phenomenon that, along with other coevolving metadynamics (Earth's pulsations like volcanism or water currents and tides…), provoked the proto-metabolism of a physicochemical specific milieu propitious to RNA to exist and become the systemic driver of the formation of cells.

Time and The Nature of The Reactants

Time varies along with the type of substances reactions. Acid reactions, the formation of salts, and ion exchange are fast reactions. When covalent bond formation takes place between the molecules and when large molecules are formed, the reactions tend to be very slow.

Survival Dynamics Principles And Time

Survival retroactive dynamics principles that are common to all living species are governed with the "Second law of thermodynamics", which states that entropy increases over time. The cosmological arrow of time, which points away from the Big Bang, and the radiative arrow of time, caused by light only traveling forwards in time, form together a beam of metadynamics moves effects that are slowed down from gravity, retroactive replication, adaptive evolution results that emerge along the course of events. Time is consubstantial with the three dimensions of space and the rate at which time passes, as depending on the velocity of cosmic objects. It is relative to both the speed of light and the intensity of the gravitational field between neighboring objects that slow the passage of time, allowing "slots" as propitious with the livings to sustain however they are aging from entropy.

Biological Clock And Terrestrial Metadynamics Systemicity

Life exists from periodic physicochemical and physiological phenomena thanks to living organisms' adaptation to the Sun and the Moon as having sub and intra-biodynamical effects on creatures' metabolism sustaining survival capacities. These cycles, named "biological rhythms" (ref.: chronobiology) are molecular mechanisms. In memoriam, a molecule is a group of at least two atoms arranged and held by strong chemical bonds. (ref.: covalent bonds). Genetics, molecular biology and the behavior of organisms within biological rhythms mechanics, reproduction, ecology and evolution as different Life's dynamic moves, are science fields that will be shortly described during the development of this "General Systemicity" work.

Circadian Rhythm And The Biological Retroactivity Differentials

A circadian rhythm is a roughly-24-hour cycle in the biochemical, physiological or behavioural processes of living entities, including plants, animals, fungi and cyanobacteria (ref.: bacterial circadian rhythms). The formal study of *biological temporal rhythms such as daily, tidal, weekly, seasonal, and annual rhythms is called chronobiology* and was described before. Circadian rhythms occur within the creature's body physicochemical milieu and interact with external events like, for example, daylight. These rhythms allow organisms to anticipate and prepare survival acts made of individual behaviors and adaptation to environmental changes.

Bacteria, Circadian Rhythms And Survival Aptitudes

Bacterial circadian rhythms, like other circadian rhythms, are internal "biological clocks" that are submitted with (a) conditions of temperature, constant light or constant darkness, (b) oscillations with a period close to 24 hours in duration, (c) the 'free-running' compensation rhythm of temperature, and (d) a rhythm appropriate with environmental cycles types and force.

Cyanobacteria (a phylum of photosynthetic eubacteria) have quite similar circadian rhythms than eukaryotic cells' circadian rhythms. Three key proteins form molecular clockwork that generates survival behaviors substrates, which induce to the fitness of cyanobacteria in rhythmic environments.

CHEMICAL REACTIONS AND METADYNAMICS SYSTEMICITY

Chemical Kinetics And Transition State

Chemical kinetics, as the rearrangement of atoms or ions accompanying energy change, or reaction kinetics shows the reaction rates of chemical processes, e.g.: the oxidation of iron under the atmosphere is a slow reaction which can take quite many years. Chemical kinetics conditions influence the speed of a chemical reaction, the type of reaction mechanism and transition states involved. In 1864, Peter Waage and Cato Guldberg developed "the law of mass action", by which a reaction states the speed of a chemical reaction as proportional to the quantity of the reacting substances. At the level of a cell's membrane, its filtering function of "energy" and production of proteins are both managed with reactors.

Reactants And Proto-Metabolic Changes As Primordial To Life

The physical state (solid, liquid, or gas) of a reactant is also an important factor of the rate of change. When reactants are in the same phase, as in aqueous solution, thermal motion brings them into contact. However, when they are in different phases, a reaction, at area of contact, is limited to the interface between the reactants where it only occurs. In the case of a liquid and a gas, the reaction takes place at the surface of the liquid. Shaking and stirring moves, as in an ocean, induce the reaction to completion so that finer is a solid or a liquid reactant, the greater is the surface area per unit volume, and the more contact it induces the other substances to be reactant, thus the faster the reaction (see exceptions in biochemistry).

Organic Chemistry And Life's Metadynamics Systemicity

The organic chemistry is referring to the structure, properties, composition, reactions and preparation (by synthesis or by other means) of chemical compounds that contain carbon and other elements such hydrogen, nitrogen, oxygen that are parts of Life's primordial chemical bricks. However, Life also depends on inorganic chemistry such as enzymes that rely on metals (iron...) and shells, teeth and bones are partly organic and inorganic in composition. Biochemistry deals mainly with the natural chemistry of biomolecule such as proteins, nucleic acids, and sugars. The reactions as then originate those syntheses that

participate in metadynamics systemicity moves of the molecules that form propitious replication feedbacks for survival dynamics to sustain.

Biopolymers, As Proteines Role In Dynamic Biological Processes

A polymer is a large molecule (macromolecule) composed of repeating structural units typically connected by covalent chemical bonds. The term actually refers to a large class of natural (and synthetic) materials with a variety of properties. Well-known examples of polymers include *proteins*. However, polymers are not just limited to having predominantly carbon backbones. The backbone of DNA is in fact based on a *phosphodiester bond*. Biopolymers such as proteins and nucleic acids play crucial roles in biological processes and are basic inductors for survival characters in genetics.

Biopolymers And Evolution

Evolutionary steps from instructional polymers of nucleic acids to have formed came as carrying information along a linear sequence of chemical bases. The nucleic acids replication products are then submitted with environmental changes. Thereby, they play a dominant role (a sociality fundamental role) in their population. Such behaviors induce to natural selection and "survival motivated reflexes" proprieties to form. These latter are fit for a "chemical population" to prepare, step by step, the building up of the differentiated elements of the prebiotic organisms. Historically, that was the age for RNA to happen from metadynamic systemicity moves, particularly forming the biopolymer metabolic environment, and that was around -3,6 bo./years ago.

Catalysis Is A Propitious Dynamic For Life To Happen

Catalysis is the process in which the rate of a chemical reaction is either increased or decreased by means of a chemical substance known as a "catalyst". Catalysts have the ability to speed up a chemical reaction, however is not consumed by the reaction itself and then participate in multiple chemical transformations. They are positive catalysts when speeding the reaction. Otherwise, negative catalysts or inhibitors slow down the reaction. Chemical interactions make permanently emerge differential conditions favorable or not with survival environments at rate-limiting free energy change to a transition state. In nature, enzymes are biocatalysts in metabolism and catbolism and are protein-based.

Several factors affect the activity of enzymes (and other catalysts) including temperature, pH and concentration of enzyme, substrate and products. A particularly important reagent in enzymatic reactions is water, which is the product of many bond-forming reactions and a reactant in many bond-breaking processes. Again here, these factors and interrelated dynamic moves participate in differential retroactions that make Life to sustain.

Autocatalysis As A Basic Sustainability Move For Biological Survival

A single chemical reaction is said to have undergone autocatalysis, or be autocatalytic, if the reaction product is itself the catalyst for that reaction. A set of chemical reactions may be "collectively autocatalytic" if reactions produce catalysts for enough of the other reactions; it becomes self sustaining given that an input of energy and food molecules is participating in the whole reactions (see autocatalytic set).

Autocatalytic chemical reactions are producing reactants with a fundamentally non-linear rate (biological open systems). Two researchers, Robert Ulanowicz and Stuart Kauffman have suggested that autocatalytic reactions played a central role in the evolution of life, participating in the constitution of a basic element in life architecture named the "emergence of order" out of chaotic dynamics. This phenomenon refers to the second law of thermodynamics and to the systemicity of an emergent result.

Autotrophs and Photosynthesis: A Survival Form of "Blue Algae"

Chemoautotrophs generally only use inorganic energy sources. Most are bacteria or archaea with a type of nutrition in which organisms synthesize the organic materials they require from inorganic sources. It was observed that expandable clay is not only protecting methanol, but promotes reactions *that formed even more complex organic compounds* (Lynda Williams, 2005). Here again one cross another dynamic systemicity move.

Chief sources of carbon and nitrogen are carbon dioxide and nitrates, respectively. Autotroph microorganisms independently produce the compounds necessary for their survival. Their specific cell's reactors act as molecular signals that allow their communicating with each others. Proteins receptors are found all over organic and neuronal cells and which function are to receive signals from other cells and environmental events. These signals are *transduced* and passed in a different form into the cell that reacts. For example, a hormone binding to a receptor allows calcium ions to flow into the cell. Other proteins on the surface of the cell membrane serve as "markers" that identify a cell to other cells. The interaction of these markers with their respective receptors forms the basis of cell-cell interaction in the immune system. Nor then, some reactors serves identifying the molecules of emotion induced to from the brain amygdale in form of "opioïdes", an endorphins type emitted by the pituitary gland.

OTHER PHENOMENA AS APPROPRIATE TO LIFE'S EMERGENCE

Structure And Metabolism For Survival In A Contextual Milieu

In order to describe a "systemic process", the specifications and configuration of the system's components must be put into a form compatible to analysis, design, and evaluation of its structure and behaviors, giving that systemic dynamics as possibly "self-managing" the individual metabolism and morphology of creatures. Many of them learned how to extract oxygen from water or how to produce it. Furthermore, a unicell has a neural-like chemical function with proper centres (memory chemical basins) for survival information treatment or a jellyfish that is the simplest organisms having neuronal functions in form of a one neuron brain to retroactively manage its survival.

Phytoplankton (algae as autotrophic[42]) and zooplankton (protozoa as eukaryotic[43]), usually single-celled, are micro-organisms that became the primordial apparition of food chains constitutive of all extinct or actual species. In that respect, the major "survival dynamic principle" is a consequence of the "predator-prey process at quest of energy", a chemical process that emerged while the RNA structured. In perspective of a molecular phylogenesis approach of primordial biological matters as corresponding to genes producing ancestral proteins, Joseph Thornton, (2006) developed and tested primordial proteins as big molecules intervening in most functions of organisms: primordial proteins that had not participated to organisms' metabolism for billions or hundred million years.

The physicochemical biological world, in terms of Life's sustainability, cannot be described to the sole universal laws as Evelyn Fox Keller, MIT, wrote in *Nature* 2007: "*Biological phenomena are permanently contingent upon evolution".* Which evolution? Planet Earth, the "Gaia" ecosystem, is also subject to evolutionary metadynamics, in the context of its body milieu homeostasis within a framework of long term structural changes. They are contingent to cosmo-planetary and terrestrial cycles and confronted to biological ecosystems' environmental changes.

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[42] - **Autotrophic:** light (photosynthesis) or of chemical links (chimiosynthesis).
[43] - **Eukaryotic:** having cell organelles and nuclei with chromosomes.

Molecules Of Emotion Physiolgy And Unthinkable Theorization

These general phenomena and events cannot be theorized but may be considered as relying upon provisional "rules or generalizations" described as probabilistic data. Submitted to cosmo-planetary and terrestrial physicochemical mechanisms in terms of universal laws (for how long?) and geophysical cycles, the biological organisms and their physiological cycles, fluxes and behaviors are ever changing and adapting for survival. Their capabilities usually fit differently according to environmental world areas conditions, climates and seasons, given that orbiting and magnetic forces are implicated together with solar system winds and the gravity effects.

"Living beings behaviors" are reducible to the dynamics of physicochemical reactions, as well as to their "e-psop" cycle fluxes (see chapter 5: "environmental-psychosomatopsychism", its acronym "e-psop"). Cells all possess membrane chemical reactors that behave according to the world of opiates, as molecular emotion participating in managing survival; this is a major discovery made by Dr. Candace Pert, on a biomedical research on emotions opiate receptors, endorphin and peptide that explain how feelings, emotions are connected through our mind with the body. In other terms, how the body-mind functions are set in a single psychosomatic network of information and interrelated molecules that participate in the intra-systemicity of survival dynamics controlling health and physiological statuses.

In biology, hypothesis have but "an intrinsic value of given explanations" and will never become more than a tentative to develop "theoretical principles", since "Life survival replication data" permanently emerge from ever changing phenomena on an orbiting planet submitted to the cosmo-planetary and terrestrial meta-dynamics changing effects. Some mechanisms, like the Darwin biological evolution work describing principle, method and mean of species adaptation to environment, are sometimes considered as a theory. However, since a theory implies large data evidence that is a world of "variables", Life's moves are not invariable under the same condition.

Moreover, primordial life appeared within specific combinations of those dynamics effects where water and temperature encountered specific physicochemical statuses and values that have much different oscillations today. As a matter of fact, in terms of evolution, one is now able to describe the massive quantity of information contained within nucleotides emergent results considering their permanent interactions, in an ago-antagonistic manner, within a world of ago-antagonistic events of the milieu. It is observed that biological values oscillate at a constant evolution rhythm from which one is only capable to bring about one or another fragment of Life's complexity. Furthermore, biological phenomena cannot be reduced to specific molecules: DNA segments are "associated" to genes in ways that also evolve while confronted with an ever changing body milieu metabolism and contextual events. A pressure that much weighs upon organisms behavior, retroactively affecting genes expression during the renewal of proteins and enzymes sets.

Life's Chemical Element Interactions And Origin Of Life

The abundance of organic chemicals together with side waters and solar energy provoked reactions in favor of the production of Life's components (acids, reactors…) that were progressively interacting and reproducing while they were tossed around within bubbles in shallow and tidal waters.

Alexander I. Oparin (1895) described the formation of cells' membrane from "coacervates" as tiny spherical droplets of assorted organic molecules (specifically, lipid molecules) which are held together by hydrophobic forces from a surrounding liquid. In order to observe the living's origin phenomenon, in seawater, it is assumed here that backwash created naturally by rebounding off a beach, the bubbles that "captured the

propitious assembly of molecules everlastingly replicating along a very long period of time became viable sytems.

We arrive at the point of this "systemic description of dynamics", where bacteria and viruses appear in seawater as single cells, which explains that DNA had completed their assembly capacities (nucleotides, genes, chromosomes) and that survival metabolic functions were at the origin of cells to exist: the filtering membrane as integrating physicochemical information, energy, expelling wastes, protecting their integrity and capacity to manage a reproduction cycle, coding proteins, producing molecules. At the time probably emerged the predator-prey dynamics from a specific chemical survival consciousness capable to memorize defenses information learnt from the milieu. In ecosystems' metabolism, the ecological dynamics such as cell's circulation and survival communication with the neighborhood are first found in the field of oscillations, within which predator-prey populations occupy a resource, or several as well as managing a balanced sociality.

Without going further into James Lovelock work, the back office of his description is again understandable in terms of "systemicity" and dynamics that were and still are participating in the dynamic of moves, particularly the function of *feedback positive and ago-antagonistic biochemical reactions.* Furthermore, it comprises a large set of other functions such as autocatalytic chemical reactions, reaction diffusion, morphogenesis, instability dynamics and pattern surge, activator-inhibitor drivers, self-replication...

"SURVIVAL PRINCIPLES", MAJOR TO INTRA-BIODYNAMICS SYSTEMICITY

At the Asilomar ISSS 48th conference (2004), J.-J. Blanc, the author described "Living systems' survival" as a circular and regulating set of dynamic moves ("biops") permanently fed along with matters, energy and information from feedback results emerging from survival necessary interactions with bio-physicochemical endo-external milieu. The retroactivity of phenomena, which I call "Meta-dynamics Systemicity" as fundamental to survival, suggests another and complementary approach in form of a psycho-physiological new paradigm. As central to Life's dynamics systemicity, the nervous circular system is a network of interactions and retroactions with stimuli in environmental areas of life: ecosystems, brains, internal milieu, bodies". This phenomenon I named: the "environmental-psycho-somatopsychic" cycle, (a neologism and its abbreviation: "e-psop") because survival is a matter of circularities between organs in organisms, species individuals and groups in ecosystems. The whole body of interdependent bio-physicochemical mechanisms, processes and streams, interwoven in a 3D milieu, within interdependent networks shows that systemic abilities and performances for any individual creature to survive come from a set of dynamical forces. Because of permanent changes in behavioral statuses, one understands then "survival principle" as the result of many forces and moves as its constitutive forms and are common processes for the whole of species survival, like for example:, feeding, reproducing, fear and self-defending, competing, sheltering from atmospheric elements dangers, dodging predators attack issues, engineering habitat, ..,. Evolution dynamics, from genetic inheritance to apprenticeship, adaptiveness and education participate in building up and managing the different survival dynamics. The necessary biodiversity of species and matter in interaction in ecosystems and within food chains is keystone to dynamic equilibriums so as life to reproduce and matter to recycle for a survival sustainability, adaptability and endurableness.

PROVISIONAL CONCLUSION

"Systemicity" and its dynamics as "Life's drivers" are consubstantial (of the same essence) to the cosmic origin of planet Earth's drivers, showing that the "ticktock" of the

biological clock that sustains life against entropy are phenomena tuned with glocal planetary and terrestrial pulsatory tick-tocks of our Planet. Maxwell predicted with metaphors that dynamics are inducing to the production of the "compost" for theories to emerge, which suggested to me the development of the "Theory of general dynamics systemicity ". Since my research was entirely devoted to a transdisciplinary approach of living systems, as the *"bricks of all human systems",* I postulated that a large and further development of a new theory would require a transdisciplinary structure, "The Bioethism paradigm" (J.-J. Blanc, 1996) sustaining transdisciplinary specific fields corresponding with the different metadynamics systemicity levels, is complementing different communication papers and future issues. The whole transdisciplinary description of the "Theory of General Meta-dynamics Systemicity" requires to have made a large investigation, integrating actual science knowledge, particularly that of biology and its "drivers", physics, general chemistry and living systems structure and behaviors.

Life's intra-biodynamics Systemicity" is mentioned in last paragraph as introducing an "abridged description of some of Life's mechanisms and of some phenomena historicity". These phenomena show the presence of sets of dynamics that have, level after level of the physicochemical cosmic evolving world, structured up the emergence of "Life's meta-drivers", their development and the elements, forces and sub-dynamics that compose adequate chemical kinetic systemicity for Life to happen.

Furthermore, this work strongly suggests that any species and its societal organization being scrutinized brings up a better understanding and description of the principle of "meta-systemicity drivers" sustaining survival behaviors as retroactive emerging results. It is particularly assumed here that interrelated and interconnected factors or functions have indisputable intricate cascading and collateral effects. A large approach about "surroundings", and actual dynamic variations confronted to entropy status would enlarge the quality of any expertise of direct and collateral effects. Permanently emerging from the world of physicochemical and biological processes, vital survival behaviors usually result from sustainable, adaptable and endurable Life's principles within the context and today require an important effort for humanity to better update and govern new survival strategies. The survival of the livings is in danger because mankind produces aggravating degradations. A danger that is implicating the global society, its intelligence, actual human cultures, socioeconomic fulfilling attitudes and human systems as to protect the fruits of thinking, creativity, survival competition and a set oof political attitudes, understanding the irreversibility of the obverse side of entropy as per the second law of thermodynamics lessons.

My intimate conviction here is that a "general system(s) theory" cannot be assumed since Ludwig von Bertalanffy biologist's theory is superseded, as I expressed it since 2000, and is here proven. Since I have inventoried and linked most of the physicochemical events issued from "cosmo-planetary and terrestrial meta-dynamic mechanisms, drivers and processes systemicity, I found them to bring up strong evidence of "Systemicity, as a general universal set of moves" converging the natural moves from the reality of differential emerging result seeding dynamic retroactions.

Since the apparition of Life, every individual living organism and communities, from unicell to the actual living creatures (humans included) is submitted to a universal contextual "meta-dynamic systemicity" that shows cosmic objects and living beings having a diversity of specific and common survival behavior dynamics while submitted to the evolutionary effect of the cosmo-planetary and terrestrial forces. Microgravity at the subatomic level is probably getting behind a general subatomic and atomic systemicity.

These processes are all constitutive of the "cosmo-planetary and terrestrial meta-dynamics systemicity" drives. In this work, dynamics interrelations are usually described

in general, in other terms, the whole development of the theory is supported with an up-to-date science approached about a transdisciplinary point of view.

In conclusion, it is here assumed and postulated that "Systemicity" is the general propriety of meta-dynamic moves and forces retroactivity, inducing to a general evolution from feedback, which result emerges in particular forms within coevolution, synergistic and collateral effects. "The general systemicity" of cosmic objects environments is part of the entire physical universe metabolism, its dynamics equilibrium since it includes gravitational effects and retro-feeding capacities. It is therefore assumed that "Systemicity" is naturally concerned with abstractions and theories.

The next field as "The Life's intra-biodynamics Systemicity" is to be developed, step by step, later in 2010, the result bringing up the 4th part of my work, and assume will not be the last. The theory of "A primordial general systemicity" (5th stage of my works), is a last clue and the keystone at considering the "General Metadynamics Systemicity" as a universal phenomena issued from the thermo-dynamicity of matter and energy as confronted to the gravitation effects that slow down space-time.

PARTICIPATION REFERENCES AND BIBLIOGRAPHY

Allman, J.M. (1999): Evolving brains, Scientific American Library, HPHL div., New York.

Auger, P. (1986): Dynamics in Hierarchically Organized Systems: a General Modeling Adapted to Ecology, Biology and Economics, Systems Res. 3. Paris.

Berger P., Pomeau Y. & Vidal (1997): *Espaces chaotiques*, Hermann, Paris.

Bernard-Weil, Elie (1992): Role played by vasopressin (and of an adrenal-postpituitary imbalance) in the develop-ment of cancerous diseases, *Med. Hypotheses*, 37, 127-136

Blanc, J.-J. (Sept. 1996): Systems Science for a Sustainable Planet, for the *14th Wacra Congress*, Madrid, Spain

Blanc, J.-J. (Sept. 1997): "The Bioethism" as a systemic transdisciplinary paradigm", *14th Wacra Congress*, Madrid, Spain

Blanc, J.-J. (July 1998): "The Bioethism" as a transdisciplinary approach towards fundamental survival values, ISA, *14th World Congress of Sociology*, Montreal, Canada

Blanc, J.-J. (Sept. 1999): "The Bioethism" as a transdisciplinary approach of Living Systems science, *4th European Congress of Systems Science*, Valencia, Spain

Blanc, J.-J. (Jul. 2000): The Bioethism paradigm with collective and consciousness of local sociosystems, Millenium World Congress of Systems Science, Toronto, Canada,

Blanc, J.-J. (Oct. 2002): 5th Congress of Systems Science and "The Bioethism" approach on "Environmental-psycho-somatopsychism" phenomena, 5th Europ-ean Congress of Systems Science, Hersonissos, Crete

Blanc, J.-J. (July 2004): ISSS 48th Conference of Systems Science and "The Bioethism" approach on "Environmental-psycho-somatopsychic" phenomena and the "Systemicity of life". Asilomar Center, Monterey, CA, USA.

Corning, Peter (2003): Nature's Magic, Synergy in Evolution, Cambridge University Press, UK

Deléage, J.-P. (1994): *Une histoire de l'écologie,*Ed. Seuil, Paris.

Distefano, Joseph J. (1967): Feedback & Control Systems, Schaum Publ., New York.

Frontier, S., and Viale, D. (1991): *Ecosystèmes, structures, fonctionnement, évolution,* Ed. Masson, Paris.

Georgescu-Roegen, N. (1995): *La Décroissance, l'Entropie, l'Ecologie et l'Economie,* Edition Sang de la Terre, Paris.

Golmann, D. (1995): Emotional Intelligence, Bloomsbury Publishing Plc, London.

Griffin, D. (1984): Animal Thinking*,* Harvard University Press, Harvard.

Hinde, R., and Stevenson J. (1979): *Survival motivations of animals and man,* La Recherche en Ethologie, Ed. Seuil, Sciences, Paris.

Haken, H. (1996): *Synergetic in Systems Theory, 3rd European Congress of Systems Science*, and (1983) *Synergetic, an introduction,* Ed. Springer, Berlin

Lesourne, J. (1978): *Les Systèmes du Destin,* Edition Dalloz Economie, Paris.

Levy, P. (1994): *L'intelligence collective,* Ed. La Découverte. Paris

Novak, M., and May R. (1992): Evolutionary game and spatial chaos, Ed. Nature, New York.

Pert, C. (1998): *Molecules of emotions*, Simon & Schuster ltd., London.

Raven, Johson, Losos, Singer: Biology, De Boeck & Larcier Brussels, 2007 (transl. from McGraw-Hill),

Reicholf, J. (1996): *L'Emancipation de la Vie,* Editions Flammarion, Paris.

Ruelle D. (1991): *Hasard et chaos*, Odile Jacob, Paris.

Ruffie, J. (1983): *De la Biologie à la Culture,* Edition Flammarion, Paris.

Systems Theories: Le Moigne J.-L., Miller J., Rapoport A., von Bertalanffy L.,

Thornton, Joseph (2006): Mixed model phylogenetic methods for evolutionarily heterogeneous data, DEB-0516530, October 1, 2005

Thom R. (1980): *Modèles mathématiques de la morphogenèse*, Bourgeois, 2è. éd., Paris, (1977) Stabilité structurelle et morphogenèse, Inter Editions, Paris.

Vallée, R. (1995): *Cognition et Systèmes,* L'Interdisciplinaire, Limonest, France

Watson James D. with Alberts, B. Bray D., Lewis J., Raff M. and Roberts K., (1983): Molecular Biology of the Cell, Garland Publishing Inc., New York.

Zubay, G. (2000): Origins of Life on the Earth and in Cosmos, Harcourt Academic Press, San Diego, CA,

Zwang, G. (1992): *Ethologie humaine*, Ed. Simep, Paris.

A much abridged list of references.