



# A Non-Linear Approach to Life Sciences

Theories, Models and Applications

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## **Author Contributions**

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## **Note on edition**

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## **1 Introduction**

Any method of analysis, any technique for assessing the quality of a product depends on the level of knowledge at a given moment, on the paradigm with which said methods and techniques had been created. This observation highlights the direct relationship between the level of knowledge, and the concrete ways of applying and verifying this knowledge. When scientific development generates new paradigms, and technology makes it possible to put into practice the associated conceptual frameworks, substantial changes are expected to occur in the way that knowledge is capitalized on, due to the emergence of novel materials, evaluation techniques and equipment. One such promising new paradigm is the non-linear approach to life sciences, which is set to reshape the way we approach the quality of food, health and life.

This paradigm leap was made possible by the following developments from the past few decades:

- The emergence and development of Complexity science (which made it possible to study nonlinear systems with hierarchical structures and thermodynamic evolution far from equilibrium);
- The new vision of the universe based on the information-energy-matter triad (which

defines the existence of information-based interactions that ensure the morphogenesis and homeostasis of biostructures interacting with the inorganic medium, characterized by the continuous increase of entropy);

- The development of computational science (which made the modelling and simulation of complex phenomena possible, along with the extraction of information from large and heterogeneous data bases: data mining, artificial intelligence, deep learning).

This work aims to present a synthesis of these directions, which characterize the new scientific vision on the phenomena and processes that take place in the Universe, in order to stimulate creativity and innovation in the university environment.

## 2 A general overview

Describing planet Earth as a *Living Planet* [1] [2] emphasizes its hierarchical structure, consisting of systems and subsystems at varying levels of organization and complexity. Information, matter and energy are exchanged within and across the systems and levels, ultimately achieving a state of dynamic stability known as geostasis<sup>1</sup>.

Within this ecosystem, regulated as a whole by its own set of laws, man has emerged as a particular being, especially due to his ability to create exosomatic extensions, or artefacts. These extensions lead to an accelerated consumption of free energy and production of associated entropy. With the emergence of humans, a new layer formed on the planet: the *noosphere*<sup>2</sup>, representing the third stage of Earth's development, following the geosphere (inanimate, inorganic matter) and the biosphere (biological life).

Just as the emergence of life had transformed the geosphere, so too the emergence of humanity has fundamentally transformed the biosphere. Consequently, the study of planet Earth as a whole requires incorporating concepts, models and theories specific to cognition and consciousness (a science of the Mind) into an integrative, holistic approach, along with the body of knowledge gained from the study of astro-geophysical phenomena (governed by physical-chemical laws) and from cybernetics (used in modelling living structures and automated systems).

One of the primary characteristics of the aggregate of constructions that constitute the infrastructure of our current civilization is its global nature, Transportation networks for electricity, highways, rail-roads, and various transportation vehicles connect all parts of the planet. At the same time, the lifestyle specific to a consumer society entails an exponential

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<sup>1</sup>Geostasis refers to the dynamic equilibrium created by interactions between the geosphere and the biosphere, which, on a planetary scale, maintains the stability of physical and chemical parameters within the boundaries compatible with life. This concept is analogous to homeostasis in the human organism.

<sup>2</sup>In the Romanian explanatory dictionary, the Noosphere is defined as: the aggregate of information, knowledge, and value systems that are unique to human beings; the spiritual layer of Earth, represented by humankind.

growth in demand for energy, water, food and raw materials. This suggests that the ongoing socio-economic evolution, characterized by the widespread *diffusion* of artefacts across the Earth, is forming a qualitatively different set of elements on the planet, defined by its subtle natural-artificial conglomerations. This combination carries a distinct dynamic capable of generating unforeseen fluctuations within the entire system, at all levels (geosphere, biosphere, noosphere). These fluctuations would have unpredictable consequences for the evolution of life in general and for the human species specifically.

The emergence and evolution of computer science and information technology, spanning from rudimentary computers to artificial intelligence, have enabled theoretical and experimental approaches to nonlinear processes. This has given rise to new theories such as the Theory of Dissipative Systems [3], Chaos Theory [4], Bifurcation Theory [5], Synergetics [6], Fractal Geometry [7], Cellular Automata Theory [8], and Neural Networks Theory [9]. Together, these theories have coalesced into a unified perspective known as the Science of Complexity. The development of a conceptual framework and specific evaluation techniques for studying complex systems has spurred new areas of scientific inquiry, including the study of biocomplexity and geocomplexity.

The term *biocomplexity* was first introduced by Rita Colwell in 1998 [10]. It refers to the study of structures and complex behaviours originating from nonlinear active biological agents (molecules, cells, organs, organisms, groups and societies) and their environment. This interdisciplinary field of study integrates various disciplines, including biology, biochemistry, engineering, geosciences, genetics, and ecology, and it extensively employs techniques and methods specific to computational science.

The advent of chaos theory and fractal geometry made it possible to interpret the phenomena responsible for generating earthquakes through the lens of nonlinear dynamic systems. Per Bak's model of self-organized criticality [11] has become the leading model for understanding earthquake production, and has had a defining impact on the field of geocomplexity. As Goltz points out,

”the existence in active geodynamic areas of some periods of time in the course of which we can identify a periodicity of earthquakes followed by periods when the frequency of earthquakes is irregular means that the predictability degree itself changes with time.” [12]

Earthquakes can thus be seen as a manifestation of geocomplexity [13].

Advancements in quantum physics, paralleled by the emergence and growth of nanotechnology, have introduced a pivotal element into our understanding and formal modelling of the interactions among the geosphere, biosphere, and noosphere. Namely, the recognition of information as an ontological dimension alongside matter and energy. In this context, we can no longer ignore either the role of the Observer in our reality. Nor can we ignore the interaction of the Quantum World, the Energetic or Material Universe, and Consciousness in our studies

concerning Earth's geostasis, humanity's socio-economic evolution, or in the development of sustainable development policies.

To conclude, it is essential that we shift the scientific paradigm, elevate our conceptual understanding, and structure a multi- and transdisciplinary vision concerning Reality. We must refine our concepts, theories, models and evaluation methods in alignment with the new vision. In other words, it is essential for us to evolve our Minds to Nature's level of Complexity, and not to simplify Nature within our minds to the level of fragmented, linear, Newtonian thinking. In the words of Constantin Brâncuși:

"Simplicity (in the sense of essence of reality, a.n.) is a resolved Complexity." [14].

### 3 Information as an ontological dimension

The true significance of history in any  
Universe is the birth and development of  
Consciousness

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*Mihai Drăgănescu*  
*The Depths of the Material World*

While astro-bio-geophysical phenomena have been studied intensively from the perspective of Complexity science, the questions of information as an ontological dimension, of Consciousness, of the Observer - Universe relationship have predominantly been approached from a philosophical perspective.

In the last few decades, however, numerous researchers have concentrated their efforts on defining information as a profound reality, responsible for generating the laws of energy and matter identified by science. This transition in the way that science looks at information was formulated by Mihai Drăgănescu in the following manner:

"If we look at information beyond a technical standpoint, that is information treated statistically, such as information within the statistical theory of information or information within automated data-processing systems, then we must take into consideration genetic information from biology as well as information developed in relation to the human being. [...] To understand information we probably have to take into consideration the whole material world, starting with the physical world and concluding with the psychological activity of the human mind. From all we know, information appears to be first and foremost a certain structure. It may be objective if it is inscribed in the most profound levels of matter, passing from here under a certain form into the quantum world, further into the genetic elements of the live cell and further still into the *wiring* of the human nervous system." [15]

An initial step towards defining information in this manner can be found in Victor Săhleanu's *Essay of Informational Biology* (1973) [16]. In this work, he introduces the concept of the *informational link* (I.L.), a type of interaction specific to cybernetic systems that initiates, commands, regulates and controls processes aimed at maintaining the homeostasis of the organism. This interaction differs from what he refers to as the *causal link* (C.L.) both in terms of its nature and intensity. While the C.L. ensures the flux of energy and matter that underpin the processes of the organism from the perspective of these dimensions, I.L. is more closely related to our understanding of information as codes and messages. The flows of information in feedback loops, although still 'dressed up' as energy and/or matter, have a distinct structure and role in the organism's dynamic stability. Their purpose is to adjust the functioning of the organism in response to changes in the external environment, thereby ensuring its survival. Three aspects can be highlighted:

- There exist interactions in the functioning of the organism that produce nonlinear effects, indicating that the fluxes within the regulating loops are orders of magnitude smaller in intensity than those that determine the actual functioning of the organism, yet they condition the latter.
- There exists a fundamental qualitative distinction between I.L. and C.L. Specifically, I.L. is determined by the structure of a *message*, coded in a flux of energy/matter that serves merely as a carrier (the order relation is that which matters, and implicitly cannot be identified using statistical methods).
- The message (code, syntax) is an expression of the organism's structure (architecture), in the sense that it carries significance and triggers actions solely within that context.

From these insights, we can draw several general observations:

- Small fluctuations, often disregarded as 'noise' due to their perceived insignificance, are actually important as they can carry essential messages for the functioning of the organism.
- Analytical methods applicable to the study of C.L. such as statistics, deconvolutions, etc., cannot be applied in the study of I.L. As such, it becomes essential to develop techniques like pattern recognition (neural networks with and without supervision, clustering techniques, etc.).
- Identifying the structure of messages and the codes being used constitutes an initial stage in the study of I.L., with the aim to create a semiotics specific to communication within the structure/architecture of the organism [17].
- If the aforementioned points relate to artifacts, or to some man-made automated or intelligent systems, then the problem is simple, since we know the purpose of the system and the specific *language* used in feedback or feedforward loops from the design stage

itself. This is not the case, however, when studying a living organism, an ecosystem, or the planet's geostasis as a whole (the *Gaia* model). Although the necessity of a cybernetic approach is evident, and there have been modelling attempts in this respect [18] [19], experimental validation methods are only now taking shape. Identifying captors/sensors specific to I.L. becomes crucial, as does their context placement so as to maximise the signal-to-noise ratio - by 'signal' we mean specific messages with initiation, command, regulation and control roles that ensure the dynamic stability and evolution of the organism.

What we have described above can be considered a preliminary interpretation of information as a concept. Cybernetic systems theory, having been successfully applied in the modelling of automated systems, was then extended into biology, medicine and ecology.

A more subtle understanding of information, as an ontological dimension alongside matter and energy was formally structured starting in the '70s with the *orthophysical* model elaborated by Mihai Drăgănescu [15]. The model postulates the existence of a profound reality, termed *orthoexistence*, which is both the source and substrate of universes. At this level of existence *orthoenergy*<sup>3</sup> and *informatter* coexist. Orthoenergy refers to profound potential matter, while informatter refers to an informational matter wherein the information manifests itself primarily phenomenologically. The pairing between these two substrates gives birth to the matter of the Universe which, through life, acquires specific properties: the phenomenological properties of meaning, and psychological continuity - the process of rendering spatio-temporal reality continuous.

Life, when endowed with Consciousness, is referred to as *archem*<sup>4</sup>, an architecture encompassing non-formal functions around a nucleus of functions pertaining to a system. Archems can access informatter through a specific interaction called *intro-opening*, which phenomenologically connects the living organism to the profound layers of reality. Thus the *Ring of Existence* is formed: Orthoexistence  $\rightarrow$  Quantum Reality  $\rightarrow$  Macroscopic World  $\rightarrow$  Mental Reality  $\rightarrow$  Orthoexistence.

To clarify, in Drăgănescu's model of the *Ring of Existence* [21]:

- All living organisms may be described as intro-open systems, *i.e.* systems that are not only open to the immediate environment of their material existence, but are also intro-open to

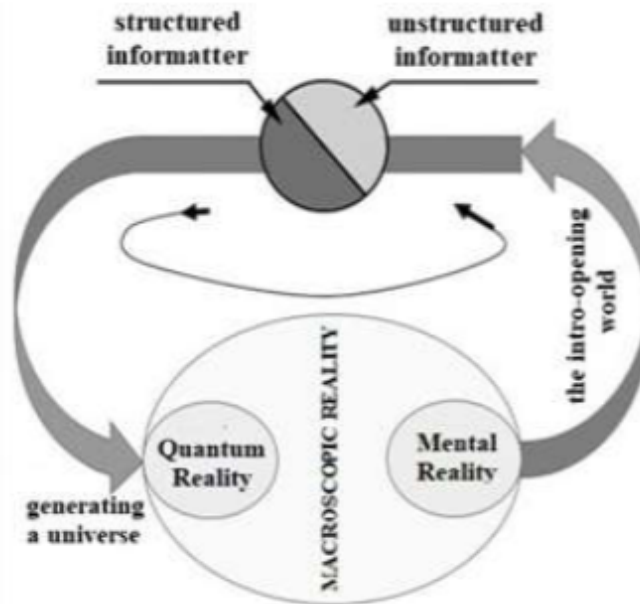
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<sup>3</sup>In the original publication, the author used the term *lumatia* instead of *orthoenergy*. We use here the term *orthoenergy* as it became the author's preferred term in later publications.

<sup>4</sup>Archem - First introduced by Mihai Drăgănescu in *Science and Civilization* [20]. From the author's glossary in *The Ring of the Material world* [21]: "Quasi-system formed from structural and phenomenological elements, endowed with the property of consciousness. It is part of the larger class of intro-open systems. The reality with an architecture that cannot be reduced to a system - hence the name *archem* (indentations from original text - a.n.)."

In the same glossary, architecture is defined as "the ensemble of functions of a system, archem or intro-open system that are observable by a natural or artificial observer, or by any other system or living organism... Formal, non-formal and mixed functions are combined in more or less harmonious architectures."

Figure 1



orthoexistence through informatter.

- All living organisms are characterized by *beingness* - a physical phenomenon, but of a different class compared to all other material phenomena described before. Beingness occurs in the informatter that is coupled with any living organism through intro-opening. It is not thought, it is unconsciousness, though it may become the source for the phenomena of consciousness and meaning.
- Living organisms with a sufficient degree of complexity in their architecture are endowed with awareness. Awareness is always both structural and phenomenological.
- Awareness does not imply consciousness, though conscious organisms also have awareness. Consciousness, as the highest form of psychic reflection, is a characteristic of archems. Any system which can be described externally through completely structural means is not an archem - this includes any living organisms whose set of behaviours can be described mechanistically. By definition, an archem necessitates the possibility of generating/creating/inventing novelty.<sup>5</sup>

From this perspective, humans are seen as structural-phenomenological entities, fundamentally distinct from other entities in the plant or animal kingdoms. Moreover, humans become participatory observers because the act of observation, under certain circumstances, 'gives meaning' and stability to reality. Drăgănescu's orthophysical model aligns with J. A. Wheeler's

<sup>5</sup>In this context, intro-open systems without consciousness are also referred to as *subarchems*.

vision of the Universe as a self-excited circuit. According to Wheeler, a participatory universe is a self-excited circuit in that it involves observers in perceptual, ontological feedback. It is a “logic loop” in which “physics gives rise to observer participancy; observer participancy gives rise to information; and information gives rise to physics” [22].

The intro-opening process is carried out in orthoexistence, a profound reality that does not adhere to our typical understanding of time and space. The intro-opening process can be likened to an act of global perception, invariably presenting itself as a subjective experience (*qualia*), which can sometimes be distilled to a structural (formal) level and labelled (through semiotic and semantic processing). This process of subjective experience, thus far less explored from this perspective, could serve as a foundation for scientific explanations for phenomena such as biodetection, biolocation, clairvoyance, teleperception, telepathy, psychokinesis, etc. It could also offer a means for the scientific exploration of the profound, unseen part of the Universe, responsible for the genesis and geostasis of planet Earth itself .

In informatter, Man is able to conceive of abstract forms without dimensions. In other words, our capacity for mathematical thought has its roots in orthoexistence. The limits of formal languages expressed by Gödel’s theorem [23] are overcome through intuition.

”Gödel’s argument does not argue in favour of there being inaccessible mathematical truths. What it does argue for, on the other hand, is that human insight lies beyond formal argument and beyond computable procedures.” (Sir Roger Penrose) [24]

Moreover, the model postulates that, at a certain level of Consciousness, man may be able to locally modulate the laws of physics and even generate matter by:

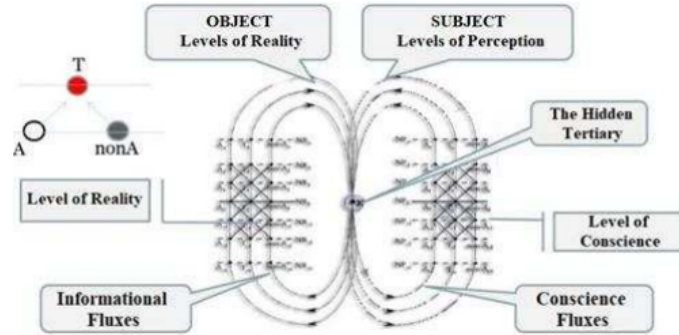
”creating a device in *active* relation with the informatter from orthoexistence through which structures may be fixed that could produce an effect in the universe [...] We refer to such a device as an *orthotronic device* or *orthotron*.” (highlights from original text - a.n.) [15]

The notion of *information flux* also shows up in Basarab Nicolescu’s model described in his book *Ce este Realitatea? (What is Reality)* [25]. In addition to separating reality into a hierarchy of layers, and to integrating Lupaşcu’s logic of *the included third* [26] as an engine for transitioning between levels, Basarab Nicolescu postulates the existence of a flux of consciousness. The Observer and the Observed Reality are traversed by fluxes of different natures - an informational one, specific to the material world , and one specific to the Conscious Observer.

Thus one defines that subtle mental process of understanding called *the hidden third*. In other words, the decoding of reality and the insight into meaning entail a subtle resonance between the various levels of reality and of consciousness (Figure 2). In the words of the author:

”To the information flux that coherently traverses the different levels of reality of the object corresponds a consciousness flux that coherently traverses the different

Figure 2



levels of reality of the subject. The two fluxes are in an isomorphic relation thanks to a single common area of non-resistance. The area of non-resistance plays the part of the *hidden third*, which allows for the unification, in their difference, of the transdisciplinary subject and the transdisciplinary object. It allows for and demands the *interaction* between subject and object.” (highlights from original text - a.n.) [25]

#### 4 Several useful elements in the experimental approach to the issue of information as an ontological dimension

In the spirit of an approach specific to exploratory research, we propose several foundational statements for the investigation of information as an ontological dimension. We then present a series of experiments that, while known, lack comprehensive explanations, and reframe them in a way that connects them to the present problematic.

1. **Information as Cause:** Information as an ontological dimension is responsible for the construction of the structure/architecture of all living and non-living entities. It ensures the internal coherence in relation to the information/energy/matter flux that animates and gives sense/stability<sup>6</sup> to any given entity;
2. **Quantitative Evaluation:** Beyond properties like information *density* or *quantity* that complement energy/matter approaches, we must elaborate methods for the quantitative evaluation of the *degree of organization* of living and non-living entities.
3. **Origin of Morphogenesis:** The morphogenesis process initiates in orthoexistence through the structuring of a *germ* (informational matrix) that defines the entity structurally and functionally, responsible for the finality and the stability of the entity through-

<sup>6</sup>*Sense* and *stability* are two sides of the same coin, *sense* being a meaningful term in relation to the transcendent, while *stability* is a meaningful term in relation to the immanent.

out its material manifestations of growth, development and evolution<sup>7</sup>.

4. **Quantitative vs. Qualitative Growth:** Throughout an entity's evolution we define periods of homothetic growth that ensure the development of the entity without affecting the external shape or internal architecture of the entity, on the one hand, and periods of architectural reconfiguration, characterized by major informational influences. The first we characterize as quantitative growth, while the second we characterize as qualitative growth, *i.e.* growth in terms of the information that is manifested.
5. **Patterns:** The study of patterns can generate a new semiotics, and lead to the decoding of the sense and finality of the studied entities; such a semiotics would lie at the intersection of the study of information as an ontological dimension, and of the study of the composition, concatenation and interaction of informational matrices.
6. **Gradient Structuring of Inorganic Entities:** The morphogenesis of inorganic entities may be viewed as a gradient structuring, where the patterns are obtained through forces and fields that exert themselves upon the constituent material elements driving towards equilibrium.<sup>8</sup>
7. **Living Entities as Subarchems:** Living structures are intro-open systems; they are fundamentally different from inorganic entities which can be modelled through theories of energy and mass; Man as an entity with consciousness is archem and implicitly has access to informatter through intro-opening;
8. **Growing Levels of Complexity:** There is a growing level of informational complexity required to ensure the dynamics and evolution of living structures within the context of their respective environments. The living structures may be differentiated into *kingdoms* - plants, fungi, animals, man - while their respective environments are, in turn, hierarchical and characterized by differing level of complexity.
9. **Hierarchies:** By viewing reality as a hierarchical structure controlled through feedback and feedforward loops, one can distinguish informational specificities (structures, 'languages') associated with each level of hierarchy, and observe that successive levels of complexity control and informationally modulate the level below them.

From the above points it follows that:

There is a fundamental difference between the morphogenesis of inorganic structures and that of living structures. The living structures are intro-open and consequently related to/determined by phenomena that are specific to orthoexistence. One possibly fruitful area of experimentation which could emphasize this fundamental difference could be the investigation of interferences between processes that form inorganic matter (crystallization, agglutination, clustering) and processes that ensure the homeostasis of living organisms (life implies a permanent restructuring, a pairing in orthoexistence).

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<sup>7</sup>We differentiate between these three terms as follows: we use the word *growth* in the generic sense, referring to the process of increasing in size; we use the word *development* to refer to those material manifestations which lead to new functions and capabilities; finally, the term *evolution* implicates both the transformations of the entity as well as its context.

<sup>8</sup>Examples of such phenomena include Diffusion-Limited Aggregation processes and Bénard cells.

Man as archem, as a participatory observer, is characterized by access to informatter through intro-opening. This characteristic determines a subtle pairing between the observer and the experiment. Depending upon one's intentionality, upon the capacity of transmitting/mentally modulating the act of living (intro-opening), one can induce small fluctuations in informatter, which lead to modifications in the material plane of some behaviours/structures. With this in mind, the capacity of chaotic processes to undergo abrupt transitions to order could be used as a favourable environment for experimentation so as to bring intro-opening into objectivity. The same environment can highlight the fact that certain processes can be dependent on the one carrying out the experiment, the observer; this fact raises a matter of principle - whether this direction of study qualifies as what is understood today as a scientific approach. The scientific approach demands reproducibility and independence from the subject (objectivity). However, in an orthophysical context we are dealing with subject-dependant processes and reduced reproducibility, likely insufficient to ensure statistical validation.

Modern theories on the dynamics and evolution of complex systems are also a valuable source for statements that attempt to address processes with a low degree of reproducibility in a rational, experimental manner:

1. Complex systems, living ones in particular, evolve far from thermodynamic equilibrium - their study therefore requires a specific approach. [27]
2. The inherent nonlinearity of complex systems determines their susceptibility to initial conditions, while their chaotic behaviour manifests universality (the constants of chaos), chaotic resonance, and abrupt transitions between periodic and non-periodic states.
3. Self-similarity, the defining characteristic of fractal structures, enables the objective, quantitative evaluation of some qualitative properties associated with the shape, structure and texture in both living and non-living entities.
4. The bifurcation and catastrophe theories provide the foundation for carrying out experiments in the proximity of critical points where environmental fluctuations trigger exponential increases in sensitivity, leading to abrupt restructurings - *mutations* - of the system's internal structure/architecture; the environmental fluctuations (or "noise") [28] [29] play a crucial role in the dynamics of chemical, biochemical and metabolic reactions, with the resulting restructuring interpretable as jumps in entropy/negative entropy - essentially, in information.
5. Complex systems cannot be analysed through fragmentation into their constituent parts; the system's properties manifest themselves as a result of the interaction between the component subsystems, and with the environment in which it is immersed.

These few observations derived from the study of complex systems are useful in designing a sensor for the purpose of observing processes of an informational nature, such as those suggested by the orthophysical model of the Universe.

## 5 Tesigraphy (sensitive crystallization) - a technique which emphasizes phenomena of a potentially informational nature

Rudolf Steiner postulates within his interpretative framework concerning biodynamic agriculture that the development of a structure entails two opposite forces: a centrifugal one, having at its origin the seed (the crystallization germ), and a centripetal one, generated by the properties of the spatio-temporal context within which the structure develops and grows [30]. The interaction of the centrifugal and centripetal forces give birth to and modulate the growth rhythms of the entity, ultimately shaping its structure/architecture. This same idea is more broadly expressed in terms of modern physics by John Archibald Wheeler [31]:

“Matter tells spacetime how to curve; spacetime tells matter how to move.”

This entails a fundamental relationship between the forces of germination and growth, and the spacetime conditions in which the entity develops - their interplay being essential in defining the entity's structure. The interaction between interior and exterior, entity and environment calls for a new approach that requires careful examination, adequate formalization and subsequently experimental validation.

The concept of a *biological quality* appears necessary to express the capacity of integrating the parts of a bio-structured system as a functional whole while preserving the properties of a living organism. The biological quality can constitute the maximum expression of the specific information that a subsystem provides within the context of the information that it embodies and the natural tendency of integrating it in the cosmic environment [32]. In the aforementioned context, the biological quality becomes dynamic, defined both by the internal rhythm/vibration of the analysed system and by the cosmic rhythm/vibration.

Starting from these premises, Ehrenfried Pfeiffer [33] had imagined an experiment called the method of sensitive crystallization - or *tesigraphy*. This method was later picked up by several other researchers, including Oleg and Alla Sellawry, and Frida Bessenich. The modern technology of pattern recognition and the use of artificial intelligence has brought back into the spotlight this method that seems to emphasize the existence of an informational *field*, of an informational matrix, of a code more fundamental than the genetic one.

The experiment is based on the analysis of a pattern obtained through a crystallization process in the presence of a substance taken from living organisms: blood, saliva, plant extracts, and so on. The obtained patterns are considered an indicator of the qualities and characteristics associated with the analysed mixture, which is why tesigraphy is known also as an evaluation method for food quality [34].

The growth of the crystals from a thin layer of solution in the presence of biological substances can be formally described through concepts and theories from complexity studies (fractal theory, chaos theory, bifurcation theory, cellular automata). We hope that this nonlinear approach can lead to an explanation for the sensitivity of tesigraphy to the global qualities

of biological substances, and ultimately to defining a methodology that is able to highlight a so-far hypothetical morphogenetic field [35]. The reaction of the sensitive crystallization hereby becomes a research method, an objective test by means of we may investigate the qualitative properties of organisms, such as their vitality or health.

Concretely, the technique that Pfeiffer proposes is as follows: In a Petri dish with a diameter of 10 cm, 10 ml of copper chloride solution with a concentration of 5-20% is poured uniformly. As a result, the dish is covered with a solution of 0.5 - 1 mm thickness. The dish is placed in an enclosure where temperature is maintained at 28 degrees Celsius, while humidity is maintained at 30-50%. The mechanical vibrations generated by the environment are also attenuated. Due to the gradual evaporation of the solvent (water), crystallization occurs, generating a certain spatial distribution of the crystals. Using a solution of copper chloride, the aspect of the crystallized structure is acicular, with rectilinear growth directions.

If a few drops from a living entity (saliva, urine, blood, extracts from tissue, etc.) are added to the copper chloride solution, the shape and arrangement of the crystals are significantly altered. The change consists in the curving of the previously rectilinear crystallization directions, and the emergence of a chiral tendency. Specific patterns are generated through the *modulation* of the curves. The patterns themselves can be correlated with the qualitative properties of the organisms from which the test solution was sampled.

If the extract is added to the solution a few days after being collected from the living organism, the crystals' distribution becomes indistinguishable from the one that is specific to the crystallization of the copper chloride solution - acicular and rectilinear. We can thus state that the presence of some bio-structured fragments in the inorganic environment subjected to crystallization has the capacity of significantly modifying the spatial distribution of the crystals, so long as the fragments are added immediately after sampling. The obtained *patterns* can be seen as the result of the interference between the gradient structuring of the inorganic substratum and a process specific to the living. This latter process we associate with an informational interaction.

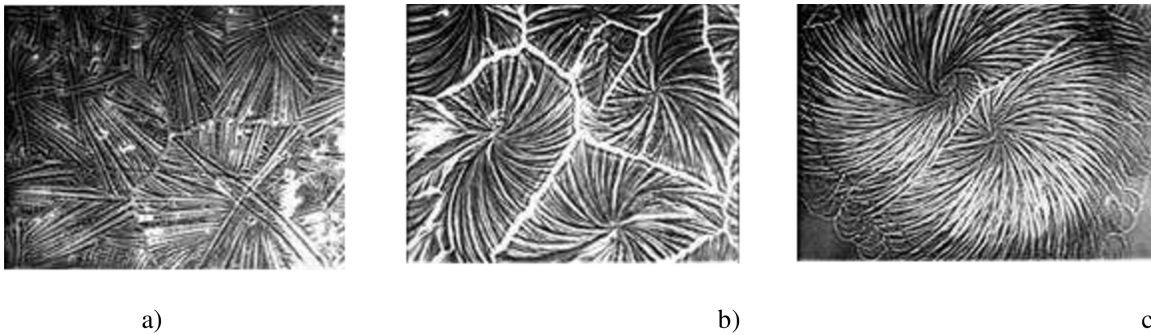
This hypothesis is also justified by the hundreds of thousands of sensitive crystallizations carried out in the early '30s, with the biological components being fluids sampled from healthy individuals, as well as from patients suffering from certain illnesses. The comparative study lead to the differentiated diagnosis of the illnesses based on the differences in patterns of the crystallized structure - by adding only a few drops of blood we can modify the crystallization process of the copper chloride in a specific manner, correlatable with the patient's state of health, as well as with the anatomic location of the disease [33]. This fact suggests the existence of some informationally coordinated morphogenetic processes.

In the absence of a theory that could explain this process, and especially in the absence of an automated technique for the objective evaluation of the tesigram, the method has not been generalized in clinical practice. However, renewed interest for this non-invasive and inexpensive

diagnostic method can be observed as early as 1990. This renewed interest is justified by the development of techniques for the complex analysis of imagery (e.g. neural networks, artificial intelligence, fractal analysis).

In our studies, we reduced the crystallization period by allowing the crystals to develop within very thin layers - a few tenths of a millimetre. We considered that the crystallization period plays an important role in the pattern's morphology, given the different purpose of our research: to create a sensor for the objective detection of the postulated morphogenetic/informational field. The goal was to obtain some *snapshots* of the dynamic interaction between the crystallization process and the informational flux of the location in which the experiment takes place, modulated by the informational field brought on by the living (the substance for analysis).

Figure 3: Experimental results - thin layer tesigraphy



The results have confirmed the geometric difference of the crystallization patterns under the influence of some biological components sampled from living organisms. See **fig-resigraphy** for the patterns without (a) and with (b) the addition of biological samples. The remarkable pattern obtained in (c) suggests some correlation between the sensitive crystallization process in the presence of life with information carrying processes defined in vortex [36] and scalar wave theories [37] [38].

The future research activity will be centred on refining this method with the aim of an experimental validation of the models that define information as an ontological dimension, alongside energy and matter.

## 6 Conclusions

Developing a formal model necessitates the existence of a set of prerequisites, of a previous formalization experience, and of corresponding tools generally supplied by mathematics. It is to be noted that the entire body of utilized notions, concepts and tools have their roots in the currently prevailing paradigm.

Validating a theoretical model requires the conception of an experimental setup, the use of

adequate measuring instruments and, obviously, a specific protocol. The degree of reproducibility and prediction capacity of the model is verified through quantitative evaluation. The design of the experimental context, the basis for the functioning of the measuring instruments and even the nature of the experimental protocol are themselves dependent on the paradigm prevailing among the scientific community at that time. There are inherent challenges, therefore, in the experimental validation of some models that go beyond said paradigm.

We draw the following conclusions based on the conducted studies:

- The environment is neither homogeneous and isotropic, nor inert, but informationally participatory to the germination, the dynamics and evolution of the living and non-living entities.
- The study of living organisms and of the planet's geostasis cannot be performed outside of an orthophysical vision that includes the ontological triad information-energy-matter.
- The use of artificial intelligence in the discrimination and classification of forms that emerge from nonlinear growth processes (crystallization, agglutination) allows for the elaboration of semiotics specific to informational processes.
- The theoretical and experimental study of scalar waves is necessary for the validation of the statements according to which these waves are information carriers.
- The framework of the ontological triad information-energy-matter is useful redefining the meaning of food quality, the concept of health, and the geostasis process of planet Earth, seen as a living planet.

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