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What is Life: A Large Variety of Informational Structures, but Self- Structuring and Functioning on the Same Basic Principles

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ABSTRACT

To find an adequate response to the millenary question 'What is life', still present on the research table of the scientific community, in this paper there are synthesized seven basic/fundamental principle which assure the self-structuration and functioning of all living organisms, on the entire scale of their organization and evolution. These principles refer to:

(1) All the living organisms are bipolar structures, connected to matter (foods, air, watter) and implicit (genetic) and explicit external/internal informational sources.

(2) Every living organism is protected by a semitransparent membrane, which assures the integrity and functioning of the internal components, permitting the interchange of matter and information with the external environment.

(3) The connection with the implicit genetic source assures the self-structuration/self-organization and development of the body ("hardware" support) according to the age, and also the reactive response to information in the cell, by corresponding activation/inhibition of the activity of various genes.

(4) The structuration and communication processes are based on absorption/release of information by association/dissociation mechanisms and transduction between the micro/macro components of the body.

(5) The typical reactions in the living organisms consist in the interactions between the reactive complementary components, acting as informational YES/NO Bit-type units.

(6) All living organisms dispose of an information ("software") system, defined as Informational System of Human and Living Structures (ISHLS), composed by seven components.

(7) Human and living organisms dispose of seven cognitive centers for contact with the external and internal reality.

Keywords: What Is Life; Information and Matter-Related Information; Key/Fundamental Principles; Self-Structuration/Self-Organization and Functioning; Informational System of Human and Living Structures; Consciousness and Cognitive Centers; Detection of Self at Human and Other Living Structures

Introduction

'What is life' is a millenary question [1], but an actual problem still not solved on the worktable of the scientific community [2]. Although in the present informational era [3] of modern and imprescriptible/ impressive tools of communication/investigation, developed by the microelectronics and microsystems contributions [4] able to facilitate the knowledge [5], practically in the entire range of human private and professional activities, in medicine [6,7], industry, biotechnology [8], in research [9] and managing [10] and decision making fields [3-11], this question did not received yet a decisive and coherent response, although famous personalities [12] approached from various perspectives this issue [13,14]. Based on an informational perspective, not really used up to date systematically for the examination/ exploration of this "mysterious", but so exciting/challenging field, in this paper there are presented the key/fundamental characteristics of life, pointing out so large variety of manifestations, which sometimes obstructs the capturing their essential properties, but which ultimately reveals the essential core of life, just by the introduction of some adequate terms of information.

Informational Key Principles of Life

The variety of forms and species of the living organisms is impressive: from the small independent prokaryotic and eukaryotic cells to multicellular organisms of elemental eukaryotic cells, composing the body of plants, animals and human [8]. Such a variety demonstrates the large biodiversity on the Earth, which seems to be really difficult to be approached systematically in some common terms. However, as it was recently shown in a series of publications [15-17], this is possible by introducing the new concept of matter-related information. To understand thus life and its working principles, it is necessary to observe first of all its dynamic characteristics and the role of information both in the structuration/organization of the living organisms and their behavior.

Synthesizing the results achieved recently by the investigation of the living structures from informational perspectives, the main key principles of life can be deduced, as presented below

1) All living organisms are connected to matter (foods, water, air) and two kinds of informational sources [18].

(a) An implicit Informational Source (iIS), referred to the genetic system, dissipated in the prokaryotic cell (bacterium) or concentrated firmly in the nucleus of the eukaryotic cell – an independent structure, or living as a smallest composing unit of all the animals, plants and human;

(b) An explicit Informational Source (eIS), composed especially by the multitude sources of information from external/environmental and internal sources, informing on the momentary external/internal state reported to the body necessities. Although has not well defined organelles [19], the prokaryotic cell (bacterium), is considered to be the "simplest" living structure, but in reality this is however a very sophisticate system, living independently or in colonies [20], The eukaryotic cell is a more evolved organism, containing well defined organelles, specialized to produce energy (mitochondrion), to manage the genetic inheritance (nucleus), to distribute the nutrient fluids (Golgi's apparatus), and to work as "stomach" (vacuoles) or endoplasmic reticulum (pancreas-like) for insulin and fats control [21]. The eukaryotic cell of plants contains an additional organelle for the chlorophyll-based glucose-type preparation as a basic nutrient during a light-assisted process [19], but this works according to the same basic principles [22] The living organisms are therefore bipolar structures, connected to matter and information [23].

2) Every living organism is an individual structure, protected by a semitransparent membrane, which allows the development of chemical/physical/biological processes inside of this covering organic skin, but at the same time allows the exchange of information (by eIS) and necessary foods (air, water, nutrients) from the external environment and the elimination of the waste outside [21-24].

3) The connection with the implicit (genetic) informational source (iIS), assures the self- structuration/self-organization and development and evolution of the body (the "hardware" of the living structure) – according to the age and functions by means of the replication and transcription/translation processes in cell, and also the reactive response by activation/inhibition of some genes during the adaptation process, triggered by the connection with the external/internal explicit s) ources (eISs) [25,26].

4) The informational processes for structuration and communication are based on the successive transducing absorption/release of information, schematically represented by the elemental reaction between two components A and B of a living organism with participation of information I, absorbed as a hidden information (I) in the obtained compound: (A+B) +I <=> (AB)(I). This relation allows actually to defines I as matter-related information, showing in the same time that the living bodies are composed by informed matter [27], i.e. by sensitive matter, containing information. The reverse reaction is prohibited in the reactions generated by the connection with (iIS), according to the biological dogma, stating that genetic information flows only in one direction, from DNA to RNA and to protein during the transcription-translation or equivalent process [19]. Derived from the above relation, the general extended relation of transduction between various micro/macro components of the body, with various forms/agents of inter-communication, can be written as follows:

$$INFO => (A+B)+(Info1) => C(Info1) => (D+E)+(Info2) => F(Info2) => ...DecisionMaking => Ter\min alOperationExe => \{Organic(bio\log ical), Mechanical(Physical), Mental(\mathrm{I}nformation)\Pr ocess\} \quad (1)$$

where INFO represents the input information, Info1, Info2 , intermediary transduced information till the Decision Making and Terminal Operation (Exe), where this can be converted/processed in/as organic (biological), mechanical (physical), or mental information [3].

5) The typical reactions in biological organisms are based on the complementarity between the reactive components, acting actually as informational YES/NO Bit-type units, both during the connection with implicit and explicit sources. The connection with elSs by the surface or bulk sensor receptors, generates a consecutive cascade of reactions reaching out the nucleus, for further decisional process of adequate response [11], common for all living structures, independently if they dispose or not of a nervous system. The competitive interaction between the activator and inhibitory action of the neurotransmitters in the nervous system cells follows also a typical YES/NO Bit-type informational process.

6) All living organisms dispose of an information ("software") system defined as Informational System of Human and Living Structures (ISHLS), composed by the following components [28]: CASI – the Center of Acquisition and Storing of Information, accumulating the info-experience during the connection with eISs; CDC – the Center of Decision and Command, responsible for the decisional reactivity; IES/IRSS, which represents the Info-Emotional System at human and mammals, and Info- Reactive Sentient System at other subhuman organisms respectively, referring to the internal reaction at an information; MIS – the Maintenance Informational System, which refers to the management of the body metabolism to provide energy/vivacity and adequate nutrients; GTS – the Genetic Transmission System, managing the reproduction; IGG – the Info-Genetic Generator, connected with iIS, for the management of the growth/development/evolution of the body; IC – the Info-Connection, expressing the range of the permitted info-connectivity, according to the inherited/attributed tasks and functionality of the organism [16,15]. According to the Informational Model of Human and Living Structures recently discussed [15], the ISHLS can be therefore expressed as:

$$ISHLS = (CASI + CDC + IES / IRSS + IC) + (MIS + GTS + IGG) \quad (2)$$

where the sum in the first parenthesis is defined as the Operative Informational Systems (OIS), acting for adaptation, and the second sum is defined as the Programmed Informational System (PIS), acting for the body maintenance and genetic support.

7) In a large sense, information can be defined within the Informational Model of Human and Living Structures (IMHLS) as a result of an operation, be this physical, chemical, mathematical or biological one [16,26,32]. The application of a set of physics/chemistry/mathematic/biologic laws on a system, acting as an informational operator, produces thus an information [3-11]. Mind at human and mammals, or any other operational equivalent system at the subhuman organisms [31] applied to ISHLS, gives rise to a detectable "Self": at human and mammals this is expressed as consciousness, and at other organisms as Individual (In) distinct from the rest. Therefore, the Self at human (Iself) can be expressed by the application of the operator Mind to ISHLS, giving rise to the following result:

$$Iself = Iknow + Idecide + Ilove + Ibelieve + Iam + Icreate + Icreated \quad (3)$$

where the components of Iself are the cognitive centers of consciousness, which refer respectively to: memory, decision, feelings/emotions, mentality/orientation, vivacity/health/personal status, social/sexual relations, inherited/acquired predispositions/talents/abilities [29]. At the inferior organisms, the Self of the living structures is based on the detection of the Self Individual (In self) with respect to the rest, so a similar general relation could be expressed as following:

$$In\_self = In\_m + In\_d + In\_s + In\_v + In\_r = In\_i + In\_o \quad (4)$$

where In_m is memo-experience, In_d is the decision, In_s is sentience, In_v vitality, In_r reproduction, In_i instincts/impulses and In_o info-orientation [11].

Such an approach and results represent an innovative, novel view on life, based on informational activity of human and living organisms, which is a real revolution in life and consciousness sciences [26,18,30], invoked and intensively searched by the scientific community [2].

Conclusion

'What is life', this millenary question, still present in the investigation worktable of the scientific community, was treated in informational terms. The analysis of the self-structuration/self-organization and functioning of the living organisms allowed to extract/synthesize seven key principles applied to all living organisms, explaining their structuration and functioning. Such an analysis and results were possible by the distinct/novel definition of information in the living systems as matter-related information, where the interaction between the micro/macro components are based on associative/dissociative mechanisms and transduction processes with absorption and release of information.

The connection to the genetic implicit informational sources permits the self-structuration/self-organization of the living info-related body – the "hardware" of the living structures, and also a reactive response by the implication of the activation/inhibition YES/NO Bit-

type informational unit, during the connection with the explicit sources, for adaptation. The typical complementary kind of interactions which trigger successive cascade of reactions follow similar YES/NO Bit-type informational processes in cells and multicellular organisms (plants, animals, human), where the eukaryotic cells – disposing of well defined organelles, is the unit component. All living organisms dispose of an informational system with seven components. The Self is manifested at human and mammals by consciousness, composed by corresponding seven cognitive centers, as a result of the informational operability of Mind, defined as informational operator. At other living organisms, the Self is a result of the detection of own individual, with respect to the rest. This Informational Model of Human and Living Structures discussed here, is a revolutionary/novel remarkable contribution to the life science and consciousness science, long awaited by the scientific community, clarifying still not understood fundamental problems in these scientific fields, with benefic implications in various other branches like neurosciences and medicine.

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