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The Informational Model of the Human Body and Living Structures: from Micro to Macro Structuration and Functions

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Posted Date: 7 April 2023

doi: 10.20944/preprints202304.0110.v1

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The Informational Model of the Human Body and Living Structures: from Micro to Macro Structuration and Functions

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Abstract: This paper is referred to a top frontline research in life science, showing that in spite of the large variation of the physiological architecture and behavioral forms of the living systems, the fundamental structure of their informational system is basically the same, allowing the body growth/development by micro to macro-structuration processes, maintaining the same informational configuration and functions like the basic unit of life–the eukaryotic cell. Starting and based on the determination of the special/specific info-operability in living structures and the role of information in structuration and their functionality, there are discussed the informational functions of the eukaryotic/prokaryotic cells, the simplest units of life and is elaborated and presented the Informational Model of the Living Structures, showing that these structures operate on the basis of two main informational systems: one of them defined as the Programmed Informational System, composed by three components, assuring respectively the info-generation, maintenance and the proliferation/reproduction, and another one defined as the Operative Informational System, necessary for the continuous communication with the environment for adaptation, consisting in four main components referred to memory, decision, sentience and info-connection/info-selection. The revealed properties are compared with the Informational System of the Human Body, as a prototype of a living system on the top of the evolutionary scale, showing/demonstrating the compatibility of structuration and functions on the entire scale, from prokaryotic/eukaryotic unit cells to multicellular organisms–plants, animals and human, by means of a continuous adaptation process, which always follows the same line of micro to macro-structuration process based on the same Info-organization and functionality. These models are new and revolutionary in the information and life sciences.

Keywords: information; matter-related information; micro/macro structuration/destructuration; non-living/living structures; informational model of the human body and living structures; informational model of consciousness

1. Introduction

In this informational century [1], when many facilities–phone terminals, leptops, computers, radio, television and especially internet, are current and common media of communication, or associated with operational management data [2,3], a consequence of the spectacular development of the microelectronic devices, which definitely changed and continue to change the modern life [1,4], the information concept is largely used in various fields of activities in industry, healthcare and education. In spite of this extraordinary development of the informational tools and communication [5,6], little is known about the role of information in the structuration/destructuration of matter, and even much less about the role of information in the structuration and functionality of the living organisms. There were many open issues in philosophy, psychology, neuroscience/psychiatry or life science concerning the relation between mind and body [7], the balance between the nature (inherited predispositions/abilities) and nurture (training/learning) performances [8], mental aggressiveness [9], mood dysfunctions [10] and psychic equilibrium [11], to name only a few of them, in which information and communication show a relevant role. Looking to the structural microscopic composition of matter, it can be not easily or even at all distinguished the inter-relation between the composing components, but this can be described however in terms of information, an "invisible"

but effective participant to the macro-structuration and properties of the macro systems [12]. Even a much relevant effect play information in the living structures, where information demonstrate an observable behavior under normal/current conditions [13]. The relation between micro-components and the macro structures is therefore an issue of great interest and importance, which was not taken into account sufficiently, and even less concerning the implication of information in such a relational circuit. This paper is dedicated just to this goal, deeply entering the micro-structural properties and especially functions, to show that information is deeply involved in structuration/functionality processes, and that these are fundamentally the same with the macro structure of the multicellular global organism, acting as an entire system in continuous inter-communication between its components and with the environment.

For this, the present paper is organized in the following sections: the first section is dedicated to a clarification of information concept used for info-structuration; in the second section is presented the informational system of the human body and living structures, revealing the components and functions of the eukaryotic cell and of the human body as prototype extremes of living structuration, i.e., that of the life unit of the plants and animals–the eukaryotic cell and that of the most complex structure–the human; the experimental evidences are presented in the third chapter, highlighting the common properties on the organization/evolution scale, from cells as micro composing structures, to multicellular organisms.

2. Information and Info-Structuration

In a most general sense, information should be understood as a result of an operation [1], which is a process of changing the configuration inside of a micro or macro-scale system, or using operational/abstract concepts to obtain some new data. Therefore, such a process is not actually either matter neither energy, is something distinct of each of them [14]. Such a distinction was not at all easily to be understood [14], and remained even during our informational century a confusing problem, elucidated recently [1]. This problem was suggestively highlighted in science in the 19th century (although not clarified during that time) by the physicist James Clark Maxwell, who proposed an experiment, which seems to violate the second thermodynamic law [15]: if a "demon" (intelligent, informed "demon"–it should be remarked today) would open a door between two containers with ideal gas molecules, when he "observes" some molecules with higher velocity, then in the second container the pressure and temperature should increase, i.e., acrually heat would pass from smaller to higher temperature! Such a problem was and is still debated, showing the difficulty to understand that nothing can be created if "something" is not spend, although even since 1929 the physicist Leo Szilard has been shown [16], that this "demon" should spend "knowledge" to perform such a process. In other words, by using in this older description the adequate concepts and suitable terminology used nowadays [1], such an imaginary "intelligent demon" should operate with "information" [7,13,14], as it was recently demonstrated experimentally [17]. In a more general sense, concerning matter as an object of observation, Draganescu proposed a philosophic model, in which a "deep" matter would be an inert layer of reality, if an "informater" agent do not activate it, both in non-living and especially in living structures [18]. Extending the implication and consequences of the above imaginary experiment, it is to understand therefore actually that this "something" (so information, according to nowadays concepts) is necessary to be taken into account to explain correctly the world and the world inter-correlating mechanisms. If such a concept is not included in our view of reality, we cannot really understand it, either concerning the non-living [12] or living matter structures [13]. As it was shown recently, besides matter, considered in the philosophic Aristotle's view the fundamental component of the word, or energy (expressed in mass-matter terms by Einstein's well known relation), information is also a fundamental component of the word (corresponding in the Plato's philosophic view with "ideas", "forms" concepts), constituting actually the Universal Triangle of Reality [12].

Information is a result of an operation, in which the physics, chemistry, biologic or mathematics laws act as operators, producing a new event, a change, a message for an observer, able to decode the significance of such a message. This new and synthetic definition of information leads to a deep

 doi:10.20944/preprints202304.0110.v1

consequence in the understanding of the life functioning, based actually by the interaction between micro-components of the living structures, with consequences both on macro-structuration and functionality of micro and macro components within the entire living system. One major consequence is that the continuous structuration/destructuration microprocesses in the living organisms absorb and release actually information. In other words, such operations are informationally assisted/driven processes.

The participation of information to the matter structuration and to the revers (destructuration) process, can be better understood considering for instance a system of two interacting components A and B, and taking into account that such an interaction is assisted by information I, which participates as an active operational agent, manifested by a law or a rule of such an interaction/operation/interactivity, so this process can be represented by the following general/fundamental relation:

$$(A + B) + I \Leftrightarrow AB(I) \quad (1)$$

where (I) represents actually an intrinsic (incorporated) "embodied" information, as it was defined earlier in one recent publication [19], just to reflect the hidden, but still present/active operability of information within the new (AB(I)) structure. Relation (1), although seems to be simple, and maybe without importance, is really determinant for the understanding of the structuration in nature, just because reveals the role of information, otherwise not "visible" at micro-structural level. It is also important to note that this is a general form of reactions/interactions in nature, operated by physics/chemistry/biologic/mathematics laws, which otherwise would follow the simpler relation A+B<=>AB, as they are usually described till now, but which exclude unfortunately the fundamental role of information, operating both at elemental microscopic and macroscopic level. Such operability is not so evident in the lifeless solid bodies like silicon for instance, the basic material for the fabrication of the microelectronic circuits, although the lattice atoms there move at high temperatures between the vacancy and interstitial sites, interchanging positions also with doping impurities, which generate the necessary informational carriers, electrons and holes (lack of electrons in the valence band) [20,21]. However, such a situation is common especially in the living structures, where millions of reactions/min (understanding by this information-assisted, operations, as revealed by rel. (1)) operate in the human body, taken as a reference. The following main factors promote this situation: (i) the ability of the cell/multicellular organism to create itself the necessary proteins, the bricks of the body and its micro/macro circuits and specific micro/macro "devices" (organelles/organs), according to own necessities, as it is presented in details below; (ii) the ability of the living organisms (in particular human) to maintain nearly the same temperature of the body, assuring the optimal conditions for the involved chemical reactions, the excess of heat created by metabolism being eliminated in the external ambient, like a thermostatic/refrigerator thermodynamic "machine"; (iii) the intervention of the enzymes, a species of proteins, which determine the lowering of the reaction barrier when and where it is the case, at the body normal temperature. The chemistry in the living organisms is actually an info-related operational activity, as discussed in this paper and as it is stated/revealed by the rel. (1).

The intrinsic information, manifested as a specific event, distinct of the rest, can become (non-hidden) released/observable "free/virtual" information if a revers dissociating process could occur. Information in this case could be described by the configuration change of the (A,B) system, toward the left side sense in relation (1) composed by two separated (micro)components, or to the right side sense (toward the mixt (composed)/growth) configuration, when information is incorporated into the structure. In rel. (1), (I) can be defined as matter-related information, participating to further processes by the "disembodiment" mechanism, described by the revers realtion [1,22]. From the above discussion, we have to distinguish therefore two main forms of information: (A) manifested ("free", virtual, "working", "disembodied") form; (B) matter-related (intrinsic, "embodied") info-structuration form, which can be manifested by a destructuration ("disembodiment", releasing) process. In the biologic system, the so called dogma of the molecular biology stipulates that the reactions to form proteins starting from the deoxyribonucleic (DNA) sequencing follows always in the unique sense, only from nucleus to proteins in the cytoplasm of the cell, and never reversely [23].

 doi:10.20944/preprints202304.0110.v1

A variant form of information would be the reactive one, as a consequence of the interaction between the components A and B, not necessary forming a new (composed) structure (AB): if a component A of a system acts for instance mechanically or by vibrations/light or any other form of the contributing/action operability, the second component will react to such a stimulating action. The second component B will "feel" a "sentient" experience as a "shock", an impulse, an induced vibration or a "visible" light field, or any other event interpretable like signal, as a reaction to such an informational stimulus. Such types of interactions induce therefore an info-reactive "response" of the exposed element B, as a "sentient" reactive reaction. The component A of the interaction will also have a reactive "sentience" experience, expressed/"felt" as own reactivity.

The theory of information applied at its origin to electronic systems, was actually initiated by Claude Shannon, referring to the communication within an electronic equipment, composed by a source and a codifier, a transmission channel and a receiver and a decoder system, interpreting the message [24]. The problem in this case is the accuracy of the received signal, affected by noise on the transmission line between the information sorce/info-coder and the receiver/info-decoder, expressed in terms of the balance between actual information and the initial one. Such a model could be applied to a large variety of communication phenomena, specifically to microscale biological processes, like the living structures [25,26].

Our world is therefore composed not only by matter and energy, but also by information. A fundamental contributor to the structuration/destructuration of matter is information, so matter, energy and information form actually the fundamental triangle of the universe, as it represented in Figure 1 left upper side, where the larger triangle would suggestively show the world of matter and the smaller triangle the living world. At the fundamental level, information is actually the structuring matrix of the world, composed by operability laws and rules of the engaged matter-related (energy) constituents. This invisible agent arranges/structures matter and matter systems, configuring them as these are perceived at the macroscopic level. Living is an advanced/complex form of structuration, manifested as a continuously dynamic system, both concerning the entire assembly and the composing constituting microelements.

According to these definitions, it is possible therefore to discuss coherently the structuration and functionality of the living organisms, treated as informational systems in terms of information, independently on the nature of the informational signals or carrying agents, or on the structure/architectural/physiologic form/shape of the living systems and their informational detection/decisional/sentient tools. One of the great merit of such an approach is that this permits for the first time to describe unitarily and coherently the living systems, and reveals their common informational structure and features on the entire evolution/organizational scale, and their ability to inter-communicate from micro to macro components and reversely, as it will be presented in detail below.

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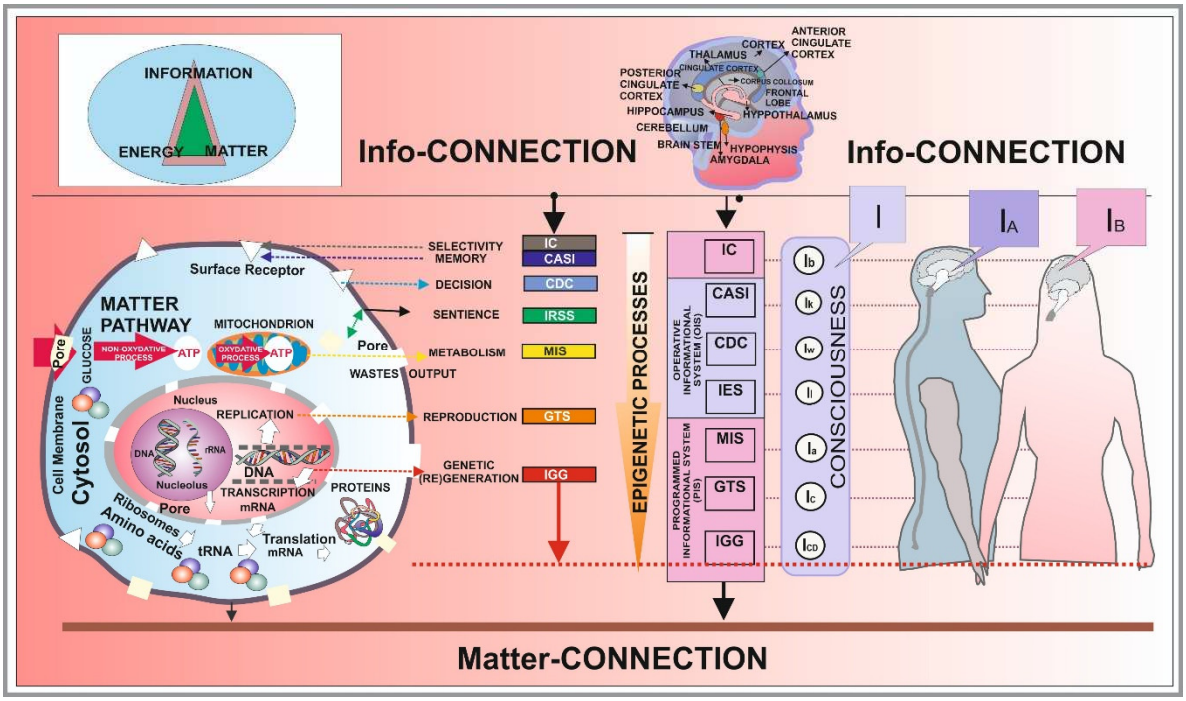

Figure 1. Schematic representation of the info/matter connection and informational system of the living structures, from eukaryotic cell to the informational system of the human body and consciousness.

3. The Informational Model of the Human Body and Living Structures

The structuration and functionality of the living structures can be discussed in terms of information and matter-related information, as this was defined above. The living structures are able to work themselves as structured/self-maintained/self-multiplicative/organized systems, but with distinct functions. From the analysis of the necessary functions of the living systems, the following characteristic features can be outlined:

(1)the living structures need to consume organic and non-organic matter structures from the external neighborhoods and to convert them in suitable components to maintain their structure and operability;

(2)the operability refers actually to an informational process/(process chain), which assures in a standard and typical mode (automatically and always the same), the functionality of the entire structures and/or of their parts;

(3)the living structures should dispose of a central stationary warehouse/pattern of information, which would contain the necessary information for the suitable reproduction/(re)structuration, either of the entire structure and of each parts of it;

(4)as the existence of living structures depends on the interaction with the surrounding reality, changing under various conditions, such structures should dispose of an informational system of communication/detection/decision, because: (i) they should adapt (so react and decide) their functions and even their structure (plasticity), according to the detected changes; (ii) the reaction of such a system should be selective (decisional, preferential–between at least two YES/NO Bit-type alternatives), according to the survival tasks.

3.1. The information Model of the Living Structures

A most simple living cell, either a prokaryotic (non distinguished specialized components inside) and eukaryotic cell, is the unit of living structures. This living unit works under the conditions stipulated by the items (1)–(4) described above. Differently from the living systems, the trivial (non-living) matter is not differentiable in general in informational functions like that described above. In the artificial informational (like microelectronic) systems, the information is carried by the electrical

 doi:10.20944/preprints202304.0110.v1

species, i.e., electrons and holes (lack of valence electrons of some atoms in the foreigner atoms-diffused silicon lattice) [20,21], as YES/NO dual/bipolar opposite-type mobile elements. The basic operators in such systems are switching components, operating with YES/NO type elements/signals.

According to item (1), the maintenance of the cell existence is assured by the metabolic processes [27], providing both the cell energy and the primary components of structuration/restructuration of the cell, which mainly are the organic components. The energy supplier is the adenosine triphosphate (ATP) synthetized during the catabolic/metabolic processes, which is broken down into adenosine diphosphate (ADP) and inorganic phosphate, in cytoplasm and mitochondrion (in eukaryotic cell), an organelle working similarly with the lung in human and sub-human organisms on the basis of oxygen-assisted reactions [22,28] (Figure 1 left side). The concentration of ADP is determinant for a signal transmission (YES) concerning a lack of energetic material or NOT in the case when the concentration is sufficiently high. Therefore, such a balancing relation between the concentration of ATP and ADP is a suggestive example, showing how some sequential metabolic processes are informationally/automatically managed inside of the cells, in agreement with relation (1). The informational automatic/autonomic ("programmed") system, managing the metabolic (matter-related) processes, can be therefore defined as the Maintenance Informational System (MIS), and the corresponding cell pathways of the associated reactions as metabolic circuits. The inflow of the metabolic circuit is represented by matter (foods, air, water) and the outflow by wastes and uric acid. The reproduction system assures the formation of a new cell, fulfilling the requirement (3) in the list discussed above. Such a process is defined as replication and starts by the split of a molecule of deoxyribonucleic acid (DNA) into the two strands by specialized enzymes and the reconstruction of two DNA molecules, so a new cell (daughter) from the original one (mother) is obtained. Such a process is represented schematically in Figure 1, showing the replication starting with DNA split in the nucleus of an eukaryotic cell, working as a Genetic Transmission System (GTS), referred in this case to the elemental micro-structural cell level.

The informational system defined as Info-Genetic Generation (IGG), refers to the management of body development, according to the age or necessities of matter (re)generation/(re)structuration, and is represented by the activity of RNA (ribonucleic acid)/enzymes assisting the transcription/translation process of some DNA informational sequences to yield the proteins, which are the building blocks of the organism [27], from cell to multicellular bodies (Figure 1 left side). The eukaryotic cells compose the major range of the living structures, from plants to animals and human, while the prokaryotic cells, as ones of the most rudimentary organisms, are typical for bacteria. The transcription process is actually an info-communication between the nucleous DNA and RNA messenger (mRNA), allowing together with some amino acids molecules from the externally foods (9 types) and/or fabricated by the organism itself (11 types in human) to prepare a suitable sort of (differentiated) proteins according to the local needs, with the informational contribution/communication of the transfer RNA (tRNA) from ribosomes/nucleolus components of the cell [22,28].

From the physics/chemistry point of view, DNA is a very large molecule contained by chromosomes, which are composed by DNA (30-40%), RNA (ribonucleic acid, 1-10%) and histones (50-60%), some proteins which anchor the double helix type DNA structure to avoid its physical damage. The largest human chromosome with approximately 220 million base pairs (bp) measures 85 mm long if straightened [29–31]. The proportion of these components is different by species, various tissues of the same organism, and even in the same cell, depending on the evolution stages of the cell life cycle and its specific functions/tasks. From informational point of view (rel. (1)), the informational ability/capability of the DNA molecule at micro-structural nucleic level, is revealed by the info-operability of its structure, which consists in two strands of carbon, bonded by bases (nucleotides), which are four distinct units, acting as informational "letters": Adenine (A), Thymine (T), Cytosine (C) and Guanine (G), which accomplish the rule that A may bind only the complementary T base and C only the complementary base G, as a YES/NO informational (binary Bit-type) operator. The human DNA can contain hundreds of millions of pairs. The enormous number of possible combinations/permutations of such structural units ("letters"), allows the

formation of a specific DNA informational "language", and the certain sequences express/transmit actually to mRNA and finally to proteins the specific encoded information of a certain corresponding structuration. As DNA/RNA/proteins are specific structures for each type of organism, the estimation of the quantity of information in various eukaryotic cells [32] exhibits the evolution and organism info-development on the evolutionary scale as follows: 5.07×10^{6} Bits (Staphylococcus aureus (bacterium)); 1.08×10^{8} Bits (Aegypti (mosquito)); 4.13×10^{8} Bits (Gallus (chicken)); 5.28×10^{8} Bits (Bos Taurus (cow)); 8.38×10^{8} Bits (Homo sapiens (human)).

As it can be observed from the above presentation, the info-structuration process is carried by mRNA/tRNA from the (DNA) memory–the informational master/library of the cell, with the contributions of enzymes, working for the decrease of the activation energy of reactions and construction/reconstructions of the info-components of the cells. The GTS and IGG refer specifically to such matter-related information-associated processes, while MIS to the actual maintenance of the body structure. IGG and GTS work therefore for the further structuration and reproduction, while MIS for the present structuration and the energy provision. The system MIS+GTS+IGG can be defined as the Programmed Informational System, working automatically for any cell structure, assuring its existence, from its creation to its death.

The item (4) presented above stipulates however the necessity of communication/(inter)reaction with the external environment, depending on the momentary conditions, specially concerning the food (useful/necessary matter recourse) availability and the structure defense/sociability for survival and adaptation. Therefore, a primary condition consists in the capability of the elementary cell to perceive the concerned (selective) informational signals. This condition is fulfilled by means of info-receptors, situated on the cell membrane [28]. These are structured by means of proteins, which recognize/bind only the complementary (YES/NO) type structures (ligands), so the reception is selective and memorized, because a certain type of information, according only to a certain type of structure, the same always, can be received (Figure 1 left side).

A decisional YES/NO selection is operated as a function of the informational category. Therefore, a proto-knowledge of the external informational interaction is detected and selectively accepted or not, according to the momentary needs, so a Center of Acquirement and Storing of Information (CASI) and a Center of Decision and Command (CDC) could be defined, as a sum of the operative contributing components detecting and operating with momentary information. As the communication of the cell with the external environment is mutual, the cell itself transmits to the external neighborhood its own signals by means of specific output pores channels of the cell membrane. From this point of view, the cell membrane plays an essential role for the cell communication with the external environment, just because of the selective semi-transparency of such a membrane. In the multicellular organisms [28], the external communication is accomplished by direct contact, junction gap (like in the nervous system) or by means of hormones, which support a long-range communication [27]. As it was shown earlier [22,28], the eukaryotic cells (particularly a cell of a plant) uses a tubular wire-type structure (believed till recently to only support passively the cell), able to transport moreover the external environmental information from membrane to the cell nucleus, involving for this ionic and charge free electron/proton gradients near membrane and transmembrane proteins [33], describable in terms of information theory [23,34].

IC in Figure 1 is defined as the Info-Connection system, allowing the automatic selection of information according to the survival/inherited and acquired/"learned" requirements, which is manifested for instance in bacteria by the synchronized organization in colonies [22,28], at the migratory birds to recognize the flight trajectory at large distances, and for each particular species/cell to select from environment the specific signal and to decode/interpret its significance according to the inherited/acquired life experience/tasks and endowed informational tools.

According to the discussion on the reactivity of interacting components of a system, it is necessary to define an Info-Reactive Sentient System (IRSS), managing the sensitive reactive information in own body to an initial received signal, equivalent with the reaction interpreted in the human organism as "emotion". The sum of CASI+CDC+IRSS, together with IC selective center compose the Operative Informational System, necessary for the momentary adaptive process.

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A longer process of adaptation, attaining even the stable informational system (PIS), but without to change the genetic characteristics of species, is operated by epigenetic mechanisms, suggestively indicated by the vertical arrow in the central side of Figure 1. The epigenetic mechanisms represent a pattern "patented" by nature to absorb information from environment and to integrate it into the living structures, as it is actually demonstrated by the informational relation (1). These play an efficient and proactive role to gain in organization/information on the evolutionary scale of the living structures. In terms of information, the epigenetic mechanisms could be discussed taking into account three main categories of signals [29–31] and internal cell cascade-type reactions, named as: (i) "epigenetor", which initiates the info-interaction with the environment, inducing a molecular reaction chain of interaction with the body cell; (ii) the "initiator" signal is triggered by epigenetor into the body cell, which have to be sufficiently intensive or insistent to induce the epigenetic process itself; (iii) the "maintainer" is the informational signal which conserves the epigenetic changes (represented mainly by DNA methylation, histone modifications and variants of nucleosome positioning, chromosome coating with (long) noncoding RNAs and others), transgenerationally transmitted. According to the informational model described here, such mechanisms could act on the informational system of the cell, even if an epigenetic final process is not actually attained, emphasizing the dynamics of info-operability of the cell, as a response of the informational stimulus.

The structuration of the solid bodies is based on the repetitive bonding-type association between atoms or molecules, the smallest microstructural elements which still maintain the properties of the entire material, resulting a repetitive lattice in the crystalline materials like silicon, the basic material in the microelectronic/microsystems devices. In the living organisms, the eukaryotic cell is the basic elementary unit of the multicellular organisms, much more complex than the simple molecules, composed by organelles inside of the eukaryotic cell bulk, protected by the external semitransparent membrane, which allows the inter-change with the external environment of matter and information by means of pores and surface receptors, specialized to receive only a specific information on the basis of complementarity with info-chemical agents (ligands) [27], with a binary YES/NO type of communication. Surprisingly, but coherently, the eukaryotic cell shows similar functional properties, supported by organelles, like the human's organs [28,35]. Indeed, the metabolic processes are managed by MIS, automatically running specific chemical reactions on the corresponding internal pathways in the cytoplasm body: vacuoles, which work like the stomach, the mitochondria organelles (containing their own DNA as process info-manager [27] like the "lung" to produce energy from glucose in interaction with oxygen, the Golgi apparatus like a "heart" and blood vessels distributer of fluids in the cell body, the endoplasmic reticulum and lysosomes for lipid (fats) and insulin metabolism like the pancreas and spleen, for degradation of obsolete products in human and animals. The role of GTS and IGG is evidently played by multiplication–replication mechanism and by transcription-translation processes respectively. The plant cells have an additional organelle–chloroplast, for the preparation of glucose components directly, within a light-assisted processes involving chlorophyll participation [34]. The functionality of the prokaryotic cells (bacterium), the most inferior organisms, is similar with that of the eukaryotic cell, but without distinctive organelles.

According to the above discussion, an Informational System of the Living Structures (ISLS) can be defined therefore by the following relation:

$$ISLS = (CASI + CDC + IRSS + MIS + GTS + IGG + IC)_{ISLS} \quad (2)$$

The revolutionary findings presented above, shows that the living organisms are bipolar structures, working with matter and information (Figure 1), organized in seven informational systems, allowing the operation of matter for maintenance, reproduction and self-development by PIS, and assuring the momentary adaptation to the environmental conditions by means of OIS. This model is defined as the Informational Model of the Living Structures (IMLS).

As described above, the living structures are able to assure the long-time adaptation by means of epigenetic/"learning" processes, allowing the gradual integration of information in the self-core (DNA) structure and transgenerational transmission to the next generation. The living structures works like an informational "device" to assure the existence of the species by means of the info-genetic input (IGG) and output (GTS), and for momentary life adaptation by means of the info-input

 doi:10.20944/preprints202304.0110.v1

(CASI) and info-output (CDC). According to the above discussion, it is reasonable/justifiable to admit that the functions of the organism are the result of the intimate informational processes in the body, the "hardware" support of the beings' behavior, while the informational system acts as an associated "software" for maintenance/species proliferation and adaptation, coherently/reactively communicating with the external environment.

3.2. The Informational Model of the Human Body

While the solid lifeless bodies are structured by the bonds between the atoms of the same chemical elements or by a few elements, the living bodies are structured by living cells as unit basic components, built basically with organic elements composed by atoms of carbon (the fundamental element of the living matter), hydrogen, oxygen, nitrogen and phosphorus, interconnecting between them in an aqueous fluid which transports the nutrients and information to the cells. In opposition with the solid bodies, in particular that of silicon–the basic material in the microelectronic technology [20,21], with stable bonding structure at normal temperature, the organic components of the living organisms can be stable, forming the rigid structure of the organism, but also consisting in various unstable mobile agents under a dynamic inter-changing state, carrying information between various macro-components of the body [28,35]. Following such a line of structuration, the compartmentalization process (specialization in organs by functions) is a "patented" strategy of nature, in order to decrease the entropy (assimilated with matter disorganization) in the living structures, by absorption and integration of information (increasing the organizing degree) on the evolutionary scale [35–37]. Within the multicellular organisms, which are associative collectivities of elementary eukaryotic cells, these cells remain the main basic micro-structural components acting themselves as active organisms–living their own life, able to sustain themselves their own organization and functionality, but in the same time supporting the functionality of the entire body by differentiation in organs, according to the body requirements and necessities, as distinct entity, which must face as a whole the interface with environment and with own organization/functional problems. At human and subhuman organisms (animals), the brain centralizes the informational management of the body. As it can be seen from Figure 1, the Informational System of the Human Body (ISHB) can be defined according to the above discussion, managed by the brain and connected to the body organs (transducers) which works as execution (but sensitive) elements (EE) (informed matter).

Besides some basic non-organic minerals, like Ca (useful to structure the rigid skeleton at human and animals, and electric conduction channels in plants [33,34]), Na and K (essential for the operability of the neurons at human and animals [38]) and other elements, the organic eukaryotic cells form actually the body and tissues strucure of the multicellular organisms. In human, the informational circuits composed essentially by neurons are marked in Figure 1 right side by dotted lines, connecting the specific brain areas responsible for the corresponding activity (CASI, CDC, IES, MIS, GTS, IGG, IC) with the body itself [36,37]. Distinctly from other organisms (although not really necessary), the human interprets the informational reactive sentient signals as emotions, so in this case we can redefine IRSS as Info-Emotional System (IES), such that it is schematically represented in Figure 1 (central side) as a component IES of ISHB. The ISHB can be therefore defined by the following relation:

$$ISHB = (CASI + CDC + IES + MIS + GTS + IGG + IC) \quad (3)$$

administrating the information in the entire organism.

The info-circuits corresponding to the informational systems defined above can be described as follows (Figure 1 central and right side).

CASI is connected with the external and internal informational sensors and is supported by the sum of all brain areas where the internal and external information is received and stored, basically represented by short-term (1min.) memory connected to the prefrontal cortex, and by long-term memory connected to the hippocampus and cerebellum, the last one responsible for learned behaviors and acquired skills (like playing an instrument, driving a car), to thalamus–with the

 doi:10.20944/preprints202304.0110.v1

function of a relay for sensory impulses, and cerebral cortex for interpreting the main sensorial signals like touch, vision and hearing.

CDC is responsible for the main dynamic/operational abilities of the mind like thought, language/communication, comprehension, arithmetic and writing activites (especially supported by the left hemisphere), creativity, spatial ability, artistic and musical skills (especially supported by the right hemisphere), intelligence, motivation, judgement, planning, voluntary control/command of muscles (EE), operated by the cerebral hemispheres, frontal and prefrontal lobes of the cerebrum for the acquired skills.

IES manages the emotions and sensorial impulses by means of the limbic system, composed by thalamus, hypothalamus, hippocampus, midbrain and amygdala (info-alarm component) and is connected especially to the hearth, which administrates the blood distribution to the action involved regions as motor-impulsive reaction to the input information.

MIS operates automatically the metabolic circuit, to manage by means of the brain stem as a relay between cerebrum, cerebellum and spinal cord and medulla the operational processes related to the digestion and the distribution in the organism of the necessary nutrients (breathing, heart rate, body temperature, wake and sleep cycles and digestion, reflex functions like cardiac activity–the rate and force of heartbeat, vasomotor regulation, variation of diameter of the blood vessels and the blood pressure), so is connected to the digestive and the cardio-respiratory system/organs of the body, while the hypothalamus controls and integrates the activities of the autonomic nervous system as part also of MIS.

GTS is correlated mainly with hypophysis and hypothalamus, responsible for the sexual activity. This system assures the output matter-related (genetic) information of the body, including the epigenetically acquired traits.

IGG is the informational genetic generator of the body, transferring the information from the parents to the offspring, managing the development of the body according to the age, especially by means of hypophysis and hypothalamus to regulate the body growth and its development. The basal ganglia are also involved in the personality features. The immune system, a complex organization of mobile cells, fighting against the local micro-organisms investors, and stable organs (thymus, spleen, lymph vessels and nodes), is managed also by the hypophysis/hypothalamus axis, involving an intensive and precise micro/macro informational activity between cells spread in the entire human/mammals' body themselves and brain, exhibiting a relevant example of info-coordination/info-communication on the tridimensional (3D) map of the organism [39,40].

IC is the info-connection system supported by the anterior cingulate cortex, which is a brain structure between cortex and the other inferior structures, automatically acting as a hub for the selective (criterial) transmission of information to the prefrontal lobes (conscious, judgment area), as it was recently discussed [12,35,37].

IC is center/system scrutinizing/detecting the certainty vs. uncertainty during the exploration of reality, advertising on a non-right (NO) vs. right (YES) interpretation of information on the connected range of information among the entire spectrum, comparing automatically the new information with the GOOD/trust/verified/FIABLE inherited/acquired information, which represent the life experience. For understanding better the IC role, a special attention should be paid to the studies on anterior cingulate cortex (ACC) at human and animals [41], showing that ACC lies/complies in/with a special and unique position/task between the limbic system, which manages/interprets/selects information including info-emotions (IES), to be transmitted to the prefrontal cortex (CASI) and judgment (CDC), and which signalizes a "wrong" info-interpretation with respect to the info-references from memory (CASI). The electroencephalographic (EEG) studies have been showing that ACC produces ''distress signals'' upon the detection of errors, conflict, and expectancy violation, called the error-related negativity (ERN). ACC plays actually not only a role of a hub of info-distribution from the inferior zones of the brain to the decisional prefrontal cortex, but also that of an interpreter of information with respect to a reference value (criterion), and let pass normally the non-error/certainty information, in agreement with the correct functionality of the body and its interaction with reality, so with the individual/species "norms"/tasks, really checked/verified/accepted as

 doi:10.20944/preprints202304.0110.v1

"GOOD"/right, while the "BAD"/uncertain information is selected as a "distress" signal for life and survival. By "norms", this should be understand both as the inherited and adopted/acquired decision criteria included/represented by mentality, as a complex set of rules/"instructions" set, learned in family/school/society. ACC is therefore an YES/NO administrator of (GOOD/BAD) information before to enter in the judgement (CASI/CDC) circuit, with the participation of IES/CASI (limbic system), serving for the correct/right orientation/"navigation" in the life. These findings were demonstrated recently in rats, showing that ACC sustains attention to a goal with accuracy and performance of the judgement [43].

At human, IC is involved in trustworthy-related states, in any forms of scrutinizing the future events and situations, developing/(expressed by) premonition and other extra-sensorial phenomena [44], in particular the extra-corporal detection of reality during NDEs experiences [45] and even in extra-consciousness after the body death, clinically proved [45], as well as in certainty/trustworthy states emulated by the Religious and Mystic Experiences (RMEs) [46]. The activity of the posterior cingulate cortex was recently clarified [47], and consists in the automatic disconnection from the external reality and connection (by means of the mind "eyes"–the prefrontal cortex) to the internal world, for analysis according to own criteria and projections to an imaginary reality and personal dreaming plans for the future. This is also associated with the need of certainty and reliable "navigation" between the uncertain events of the life, so PCC is also a supporting part of IC.

Such a description allows to define the Informational System of the Human Body (IMHB) in terms of information, as presented above. The great importance of ISHB and ISLS is that they practically show the similar informational structuration of the living organisms, from micro to macro organization scale, and the compatible association and communication in the colonies and multicellular bodies. Therefore, an Informational System of the Human Body and Living Structures (ISHBLS) can be defined, as following:

$$ISHBLS = (CASI + CDC + IES/IRSS + MIS + GTS + IGG + IC) \quad (4)$$

Relation (4) reveals the basic common informational composition of the living structures, as a fundamental property demonstrated by the Informational Model of the Human Body and Living Structures (IMHBLS) discussed here, on the entire biologic scale of organization, from micro to macro multicellular structuration.

As a living body is structured by the intervention of information within the biologic/physics/chemistry rules (deoxyribonucleic acid (DNA)-assisted processes and info-communication by electrical (nervous) and chemical (neurotransmitters, hormones, ligands) agents [27], such processes are manifested finally as a direct "media-like" info-integrated product of mind, consisting in a conscious detection composing actually consciousness, on the "screen/display" of prefrontal cortex. The mind is therefore a tooling "device" of the body, resulted from own informational activity, outlining the informational panorama itself as a "mirror" reflection/projection of the detected/interpreted reality, recomposed by the informational system of the body, and expressed by the capacity of every individual to have access to the integral data "field" of his/her own life experience, where the thought acts as an informational operator, which can activate in every moment the required information from internal/external reality panorama. Consciousness is the resulted info-representation of the explored reality, acquired by the momentary connection and compared/combined with the life experience and interpreted ("decoded") conformingly, serving as judgment reference/criteria. There are various forms and capacity of knowledge ("consciousness") for exploration of reality in the living world, specific to each species, depending on the sensorial and info-processing "tools" which each species/exemplar is endowed with, and on the complexity degree on the evolution/organization scale, even some of them do not dispose of a nervous system, like plants and bacteria, as it is presented in the next section in more details. In other words, the integral physical (matter-related) panorama of reality, received/perceived through the (limited) informational "window" as an informational input in the living structures, in particular at human and subhuman organisms, is finally "objectified"/converted/transduced/"reduced" by the body informational system and associated tools/micro-macro devices, to a pure (non-physical) informational impressing/"imprinted" result, as an informational internal projected panorama, submitted to

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analysis/interpretation (decoding), judgment and decision, which becomes own virtual informational "reality".

Consciousness in human, defined within the Informational Model of Consciousness (IMC), as a part of IMHBLS, more complex and distinguished from other subhuman categories, and improved by language as a communication tool [48], is therefore a result of the projection of the informational activities of the ISHB on mind, as follows: CASI => Iknow (memory), CDC => Iwant (decision), IES => Ilove (emotions–expressed by love, this representative driving force of life), MIS => Iam (self-detection/self-existence, power/health), GTS => Icreate (genetic transmission, self-creativity, associativity), IGG => Icreated (inherited features/traits/predispositions), IC => Ibelieve (beliefs, decision criteria), which are the cognitive centers of consciousness. Therefore, the own personality (I–the Ego), can be expressed as the following sum contributions:

$$I = Iknow + Iwant + Ilove + Iam + Icreate + Icreated + Ibelieve \quad (5)$$

Within the Informational Model of Consciousness (IMC), as described above, "I' represents a personal reflection of reality, according not only to the personal capabilities and accuracy of reality detection by means of own sensors, but also to the personal ability/intelligence to operate with the received information on the basis of the accumulated life experience, mentality and decision criteria. Therefore, consciousness is always different not only from one person to another ($I_A \neq I_B$ in Figure 1 right side), but also from a period of life to another at the same person. The contribution of each component to a decision Iwant, which is actually the informational output with respect to an objective analysis, i.e., the attitude, can be also different, depending on the proposed/analyzed/perceived object/objective [49,50].

In terms of information, the human body (like that of all the other living structures), can be regarded as an informational decisional "device", allowing to receive and codify the information detected from reality, to transmit it by the body channels and to decoding it in the mind by consciousness. In philosophic terms, compared with ancient concepts and views, this informational model unifies the eastern and western concepts/models on the world and mind, explaining the energetic Yung/Yin Chinese contrarians by YES/NO–informational Bit type behavior, the Plato's ideas/"forms" by "information" concept as participating components of reality, Aristotle's materialist view with matter structuration, but assisted by information, and the archaic model of the seven "chakras" at human, as vital centers [14].

4. Experimental Evidences Supporting the Informational Model of Human Body and Living Structures

The informational model is supported by experimental evidences and results reported in specific studies dedicated to the behavior of animals, plants and living prokaryotic (bacteria) [51]/eukaryotic (plants, animals, human) cells [52], which highlight the decisional/behavioral reactivity of them on the entire living scale, not only in human [53,54], from virus (parasitic sub-living structures in hosts), bacteria, yeast, lower metazoans–to mammals, as an a universal characteristic of the biological organisms [55]. The decisional reaction is a consequence of the intervention of an input information received by the sensorial network in CASI, as defined by IMHBLS, and the reactivity by the output behavior/attitude. The selective process of information from the huge quantity, according to species experience and operational capacity, is operated by IC, specialized to grant the preferences in the decisional process, already verified/experienced as GOOD (pro-living info) for life and survival, from micro to macro living scale, and according to the functionality tasks of each cell in the multicellular organisms within an organ structure or part of it. At mammals, in particular at rats, it was demonstrated that ACC sustains attention to a goal, with accurate performance of judgement, as mentioned above [43] . Ib at human represents the a guaranty/need of certainty as a basic reference in life, and is not restrained to religious concepts, although this could include them. In terms of information, IC corresponds/represents the native/preferential selection of certainty (producing wellbeing with respect to the organism requirements) vs. uncertainty [5,6] (inducing discomfort/indecision/anxiety/distress [42,56] at human. At other species, IC operates according to the individual/species experience/info-acquirement, monitoring the selection of the favorable

verified information, from the other ones. Such a behavior is evidenced also by empathy–the preferential choice in the social interactions [57]. IC is therefore a driving selective seeker. which operates comparatively to select from the permitted info-connected "window" of each living structure (including a singular/independent cell, or a cell as a part of a multicellular organism), the safe/right "navigation"/orientation (certainty) information of individual/species, among the high diversity/quantity of external information (uncertainty), which is/should be taken into account for a correct decisional process, within the frame of the individual/species tasks/goals, according to the life acquired/inherited experience/behavior. In terms of information, IC acts actually as an informational decoder, selecting and interpreting the suitable information/message for every individual/species, for a right functioning [1].

Wherever examined, the specific components of the informational system described above, could be discovered even at the smallest "simple" prokaryotic living cells (typically bacteria–with non-sharply delineated organelles like the prokaryotic cells) [28]. These display sophisticated regulatory networks for appropriate adaptations to stress conditions, that maximize the probability of survival, by using remarkable capabilities for intercellular/intracellular signaling coordination, allowing the observation that all living cells are cognitive [52]. This means [52], that cells are able to perceive changing (information) of their internal/external environment (CASI–according to IMHBLS), and undertake responses (CDC/IRSS) directed to survival, growth (IGG), and reproduction (GTS) of themselves or their clonal relatives. Since it is not possible to document comprehensively this feature for every kind of cell, but can be demonstrated for the simplest (prokaryotic) organism, and for the derived one (eukaryotic cell–formed about two millions of years ago by the fusion between a bacterial cell with an archaeal cell to generate the initial mitochondrion, bearing ancestor of all eukaryotic cells [58], which work in the same way till nowadays, it can be admitted that this is a basic characteristic of life for all living organisms, as a guaranty for the adaptation of their physiology and behavior to novel circumstances [52], as actually is demonstrated by IMHBLS. So, studies on bacteria, stimulated by the need to improve vaccines and antibiotic pharmaceutical products in microbiology, show that bacterial signal transduction systems (OIS–according to IMHBLS) are responsible for sensing (CASI/ISRR) environmental cues (information) and for adjusting (CDC) the cellular behavior and/or metabolism (MIS), in response to these cues, monitoring intracellular/cytoplasm/membrane conditions to counteract adverse changes [59]. The sensorial info-connection for the surveillance of the external/internal status (CASI–according to IMHBLS) is based on the activity of a protein network, encoded in genome, which could be even characterized by a "bacterial IQ" (intelligence quotient) [60], a factor introduced just to express/reflect the abundance/complexity of signal transduction components encoded in a given organism, even at the most primitive bacterial cells, and their adaptation capabilities as compared with others with similar genome [59]. Each of these sensor types involves a specific kind of signal transduction machinery in the regulatory panorama, but on the complexity scale, despite of certain mechanistic differences, the sensory "logics" of humans' cells, which encode more than 600 protein kinases (enzymes acting as a YES (active) vs. NO (inactive) switch, according. to IMHBLS), and about 800 G-protein-coupled receptors–while bacteria have far fewer signaling proteins–show relevant parallels [52].

The greatest stress (CASI/IRSS/CDC) of bacteria, like that of all other biologic organisms, is the reduction of the food resources (MIS), or the lack thereof [59] [~~61~~]. Many categories of bacteria are endowed and capable to cognitively-guide/monitor their motility in liquid/viscosity environment by means of membrane-embedded "motors" ("microdevices" according to IMHBLS), powered by proton gradients to move flagella–an external helicoid appendix structure allowing to swim [52]–execution elements (EE) according to IMHBLS, present also in many unicellular organisms (like protozoa) and in some cells of multicellular organisms (like spermatozoa). Such complex systems are formed by sensors/"tunable" receptors (with adjustable sensitivity) for specific nutrients, involving the membrane structure [52] (CASI), coupled with decision-making components (CDC) in cytoplasm by means of enzymatic/protein-assisted response regulation, which monitors the motors/flagella (EE) during the searching of foods [52]: they guide the movement toward the detected nutrients, or they

change the running trajectory, when the nutrient concentration falls, showing a high/rapid adaptation response. This selective YES/NO-type behavior/property during the exploration of the environmental neighborhood, expresses the info-connecting selective predilection of IC, on the chain (CASI/IRSS)|IC=>CDC=>EE [1]. The variety of sensing/selective detection/orientation tools of such a category is really remarkable, as regards the various species of bacteria, living in various media, which were studied up to date: some bacteria are guided by their sensitive/selective system (CASI/IRSS/IC) to rapidly move toward more oxygenated zones [61], others in water according to the orientation of the magnetic field of Earth [62], or toward, or against the light sources [63]. This preferred/selective orientation, points out the specific activity of IC, different for various species and categories of living structures, as a function of the endowed/inherited tools/habits, necessary to comply with individual necessities, as defined by IMHBLS.

The intercommunication between cells in multicellular organisms is performed by endocrine/paracrine/direct-contact/autocrine signaling, necessary to make them "aware" of the neighboring cells, and they work/act according to these signalization [64] (so as cognitive systems/components: (i) endocrine is a long-distance communication supported by hormones, circulating in the blood/fluids circuits of the multicellular organisms; (ii) paracrine is a short-distance communication by diffusion of info-agents (in particular neurotransmitters) between neighbor cells (like in the nervous synapses); (iii) direct-contact communication is performed through gap junctions (intercellular micro-bridges/channels between neighbor cell membrane in animals) or plasmodesmata (microscopic channels in plants for the transit only of small molecules and ions); (iv) distinctively, autocrine is the communication with the cell itself (the cell secrets an info-chemical agent which is received by its own surface membrane receptors, as a self-communication forward-feedback loop response/circuit). Such type of communication works both in unicellular (quorum sensing) and multicellular organisms (engaged in cardiac remodeling/heart failure), self-sustaining growth of cancer cells (by dysfunctional activity of cells' IC [39,40]) and inflammations by grow factor (small polypeptides that stimulate and promote cell differentiation/division), in macrophage mechanisms of white molecules (for elimination of cellular debris and foreign particles) in the immune system. The quorum sensing is a special intercommunication of bacteria in various "languages" [65] with themselves and others, which induces a population with a critical density level, requiring a regulatory process for making a "consensual" decision on the chain CASI/IRSS/IC/CDC. When this threshold/critical value, based on meta stable reactions ('Go on/Go off'–YES/NO reactions [52] is exceeded, influencing thus MIS/IGG/GTS (metabolism/growth/reproduction) this determines the (re)configuration/(re)organization of bacteria colony [51] by the intervention of EEs. This behavior corresponds therefore with a pre-decisional YES/NO-type regulation mechanism, typical for IC activity, as this is defined within the IMHBLS. As it was shown previously, the empathy at human [65] is a sensitive/reactive response (individual/"quorum" sensing) involving a pre-selective IC driving support–according to IMHBLS, within the mutual interactions and relation with the society. IC is not therefore limited to spatial orientation, although this is included, and manifested for instance at some species of insects and birds (the "feats" of navigation performed by bees and pigeons, precision of the tool-using crows), fish and bats for spatial/migratory orientation [66], at plants by light/sun orientation or by anticipative ability of roots to avoid the obstacles even with anticiparion [34,67,68], and at some species of animals of the danger anticipation, in particular the detection of the weather change and natural perilous phenomena [69]. Such info-selective sensitivity comprise thus solutions to various problems in confrontation/interaction with reality. IC is therefore relevant as an informational signalization system, at prokaryotic/eukaryotic cells and unicellular/multicellular organisms to select/maintain the "right way" to a target/completion of a goal, manifested by solutions/corrections/adjustments, according to the species characteristics, tasks/goals, "navigation" project/tools and power/complexity of the informational system. At human, the acceptance/rejection during/after a first "flashing" view of someone or something (the first impression), intuition, inspiration and revelation within a creative act, would be a consequence of the IC selective intervention in such a subtle informational process, at the certainty/uncertainty border/balance [5] for exploration of reality. In science, as also in art, the creative searching of an unknown yet

 doi:10.20944/preprints202304.0110.v1

information/solution is a magnificent act involving IC, needing a solid/great previous accumulated experience/information and preparation in the approached domain (CASI/IRSS), necessary to build/find (CASI/IRSS/CDC) the right YES/NO IC-assisted selective/algorithmic chain-steps, toward a decisive (CDC) final solution [5]. As the surface receptors of information are also selective, receiving only a suitable information based on chemical (YES/NO) complementarity, but which can be changed by adaptation (new receptors are formed by repetitive/insistent type of information, like in epigenetic processes), IC of cell is also subjected to formation/adaptation/"education" [10], within the IC network , responsible for such a selective activity.

The sentience-reactive response of cells to information is actually part of a regulatory process of the decision and adaptation to the external cues [70,71]. It is to be expected that the great events like growth and especially the cell division to be "felt" as special important sentience situations. Such reactions are a consequence of the body "resonance"/response as a reactive tool/"resonant" instrument at perceived input information. Within a direct interaction scene between two bodies, each of them "feels" such an interaction. In living systems, equipped with sensorial tools, the interactions with the environmental cues are transmitted to the body, which processes them in its own manner for decision making, so the body itself "feels" them within the regulatory process for adaptation. Some living natural processes (like missing of food, danger, reproduction event) should be also felt in specific manner at any species, like an info-reactive sentient response (IRSS). Just like in humans, in which emotion mobilizes the organism for action readiness [9,19], in animals (sponges, worms, insects, fish, amphibians, reptiles, birds, and mammals), the IRSS is reflected by preparation to movement and action [72]. It is justifiable therefore to correlate the IRSS defined here, with cognition and behavior on the evolutionary scale [66] , demonstrating the cognitive capacities/abilities of animals and bacteria, lived in their own specific conditions and physical systems.

Within this approaching, we have to undertake therefore that cognition, feeling and behavior according to IMHBLS, should be not necessarily understood as identical with those in human, but as an extension of such concepts to comprise all specific characteristics includable in each of such categories, independently on the input cues/signals and their origin (coming from nature or social interaction) and the reactive form of expression (info-output), which depends on the informational limited window through each living individual/species perceives the reality, on own available/complexity tools of info-processing and on the available/adaptation tools of expression/behavior [73]. It is inappropriate therefore to appreciate if some species are more smart like others [34], as long as specific physical and social environmental conditions creates a selection pressure, determining a preferential evolution of a certain cognitive adaptation and skill [74], because each of them actuates in own specific ecosystem conditions [75], needing to affront/confront with specific adversities and adapt to them for survival [73].

5. Conclusions

The structuration process from micro to macro organization, was approached by the demonstration of the inexorable role of information, intervening in any form of interaction between the components of a system. Information can be therefore defined in a large sense as a result of an operation, in which the physics, chemistry, biology and mathematics laws act as operators. It was shown thus that the micro/macro structuration is an information-assisted process absorbing information, while the macro/micro destructuration is an information-releasing process, demonstrating the participation of information, besides matter and energy, in all the building/(re)configuration processes in nature, describable by the Universal Triangle of Reality. While the informational processes are evident in the non-living artificial structures like the artificial information devices, "animated" by the flowing of various electronic currents of opposite nature (electrons and holes) in the semiconductors (in particular in the silicon) microcircuits and microsystems), in the living structures this should be taken into consideration just by the info-"embodiment" structuration and "info-disembodiment" destructuration, which are processes of

integration/incorporation and releasing/decorporation of information, suggestively demonstrated by the rel. (1).

The operability of information in the simple micro-structure–the eukaryotic cell, the life unit of animals and plants, similar in functions with the prokaryotic simplest, independent structure of bacteria, was emphasized to be related with the activity of seven informational systems, which compose the basic Informational System of the Living Structures. Analyzing the informational System of the Human Body, there were observed and emphasized the common structural (organs) and functional/informational characteristics with that of the elementary eukaryotic cell (organelles), allowing to define the Informational System of the Human Body and Living Structures and the associated explanatory model.

The informational model discussed above allowed to define accurately, from informational perspective the mind and consciousness concepts, still under debate since ancient times. The mind is the result of the capability to access the knowledge (life experience), where the though is an informational operator, activating momentarily (in real time) the necessary information from the info-creational (cumulative) field of data in memory, and consciousness is the associated state, the result of the activity of the Informational components of the informational system, which are projected, as a "media"-like integrated information, on the mental "display", the prefrontal lobe of the short-term memory/judgement.

The experimental data strongly support the informational model on the entire biological scale of micro/macro organization, emphasizing the activity of each informational component of the informational system, as a function of the specific access and info-processing performances of each individual/species and of the corresponding endowed informational tools, according to the specific local conditions of life.

Acknowledgments: The author addresses his grateful thanks to Acad. Florin Gheorghe Filip for his continuous and valuable incentivizing support to this new line of research and investigation, related with Information in the living structures. To Romanian Academy of Sciences and Scientists. To all specialists willing to recognize the role of information in the living structures and the priority of the Romanian contributions on this field, and to all others from everywhere in the world, which still do not do it. To this Journal, for the kind invitation and professional publication. To Adrian Gaiseanu and Ana Gaiseanu, with love. In the memory of my loved parents, Emeritus Professors Emanoil and Florica Gaiseanu, of my brother Prof. Constantin Gaiseanu and for all my family members.

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