With or Without Nervous System, the Living Organisms Are Informational Decision-Making Structures

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While the present level of the understanding of life mechanisms is limited to the biological approach, and consciousness is still considered a mystery, even impossible to be understood, or requiring a revolution in neurosciences, this paper reveals the informational substrate of the structuration and functioning of the living organisms, showing that not only those with nervous system, but also all other living structures are able of a decision-making process. On the basis of a new concept of matter-related information, and multiple interactions/transductions between mobile and fix micro/macro body structures, it is shown that both at the level of eukaryotic cell and human multicellular organism, such processes are operable: the connection with the implicit genetic source allows the body structuration, while the connection with the external/internal informational sources, the adaptation. An explicit relation of Self, as a function of the cognitive centers is given for human, and an equivalent relation for the subhuman organisms too. This is a unique/successful model explaining living and consciousness, opening new and successful applications in other related fields.

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1 Introduction

"What is life" and "What is consciousness" are millenary questions of humanity [1], but still unsolved problems nowadays by the scientific community, approached either from philosophical [2,3] or from neurosciences or biological perspectives [4]. Even recently, it was claimed the necessity of a revolution in neuroscience to understand mind and consciousness [4,5]. The scientific community agrees that the biological, physical/chemical and mathematical laws are not sufficient to describe and understand life and consciousness. Although the concept of information is largely used nowadays in the common mass-media communications [6], in industry and decision-making support and control of any activity field [7], this concept was practically ignored in life science and consciousness studies. A new concept defined as matter-related information was necessary to be introduced recently, deeply involving the understanding of intimate mechanisms which allow both the structuration and communication in the living organisms [8-10]. It was possible in this way to open a new gate to penetrate the mysteries of living, either to scrutinize their self-organization, or behavior [11].

Continuing the investigation of living structures on this line, in this paper it is shown that one of their basic/characteristic property is the decision-making, either they would dispose of a nervous system, or not. Such a problem raised from the fact that the common believe nowadays is that only human and subhuman (mammals) organisms, provided/endowed with such a system are capable of decision-making and adaptation [12]. It is moreover shown that all living creatures dispose of a similar structure of the informational system, which manages both their structuration and functioning, so decision-making is not only a universal property of the living organisms, independently if they dispose or not of a nervous system, but also that this is an informationally assisted complex process. To this end, the paper is organized in two main sections: the first one is dedicated to present the key definitions, concepts and properties of the living organisms as described by the Informational Model

of Human and Living Structures (IMHLS), while the second section approaches, analyzes and describes the decision-making process, from the perspective of IMHLS, in comparison with a model in mammals.

2 The Informational Model of Human and Living Structures: Key Concepts and Informational Components

The Informational Model of Human and Living Structures (IMHLS) shows that information is an essential component of the biologic organisms [9]. In other words, IMHLS explains basically the self-organization and functioning of living organisms on information. Indeed, according to IMHLS, the living organisms, in particular human and the smallest unit of his body – the eukaryotic cell, is connected to the following information sources: (1) the genetic intrinsic Source (iS) of information, integrated/hidden/"embodied" into the genes' structure, formed mainly by molecules of deoxyribonucleic acid (DNA); (2) the explicit external and internal informational sources (eS). The information in this case is received/captured at human and animals (sponges, worms, insects, fish, amphibians, reptiles, birds and mammals) as input information by sensitive elements – sensors, and transmitted along the body through the nervous system components (nervous cells) to the brain, or by biochemical circuits in the eukaryotic cell body (cytoplasm) to the nucleus (genetic system), for the decision process [13], releasing a response as an informational output. In the brain, information is processed by various structures, assuring the memorization, feeling (personal sensations), comparison with the memorized data, and decision. The electrical transmission in the nervous cell follows a YES/NO Bit-type info-mechanism, because the electrical pulse along the axon is of the type "all or nothing" [14], depending on if the initial stimulus can initiate a voltage pulse with a value higher than a "fire threshold". The neurotransmitters crossing the gap between two neighbor nervous cells can stimulate (YES) or inhibit (NO) the transmission [14], according also to a YES/NO – Bit-type mechanism. A special communication between the macro-scale fix (hypothalamus/hypophysis axis) and micro-scale mobile – singular immune cells of the immune system, is assured by direct cell-cell contact and hormonal/small molecule participation at long-range distance, through the specific channels – the lymph/blood vessels and lymphatic operational/storing stations, which are the lymph nodes. Remarkably, this info-communication permits to the fight immune cells to "know" where and when to go to prevent the intruder's invasion and even changing their body shape (macrophage cells), to "eat" them [15,16].

YES (activation)/NO (inhibition) – Bit-type informational process is triggered by an initial input signal/information into the eukaryotic cell in nucleus [17,11], where various sequences of genes are activated/inhibited, according to circumstances. The surface receptors, or internal informational receptors, function also typically by complementarity between structural composition of the signal (a chemical agent) and receptor, in a YES/NO binary style, actuating like a key (info-agent) into a lock (receptor) [18,19]. The info-circuits in the cell cytoplasm are specific for different signals [5], maintained by a species of proteins – scaffold proteins [18,20]. In plants seed, in particular in *Arabidopsis* (or *thale cress*), the info-activity of the informational Bit-type (YES/NO alternatives) induced by temperature, is revealed by two groups of cells: one of them promoting the dormancy – NO activity, another promoting the germination (YES - type activation), and the intra-communication is assured by a hormonal mechanism [21]. Plants – living organisms without nervous system, but disposing of numerous sensorial capabilities for mechanical perception like gravitropic, thigmomorphic, thigmotropic, self-loading, growth strains, turgor pressure, xylem pressure potential, vibrations of sound [22] and light [23], respond/react as a function of circumstances, by auxin hormone modulation, as an info-communication agent, which monitors their plasticity/body shape, germination and flowering [24,25].

Taking into account the specific informational behavior of the living organisms, the IMHLS defines the following components of the Informational System of Human and Living Structures (ISHLS), active/activated when the living organism relates to the external/internal reality.

(I) The Center of Acquirement and Storing of Information (CASI), which captures the informational signals by a network of sensors and stores them in memory, supported by the prefrontal cortex (short-time memory of 1-2 min.) at human, hippocampus, and cerebellum for stereotype mechanic-associated abilities [26]. In the eukaryotic cell, the nucleus with genes contains the full hidden information incorporated/"embodied" into the DNA structure, able not only to structure the body cell, but also to memorize/integrate new repetitive/intensive information by epigenetic mechanisms [14,27].

(II) The Center of Decision and Command (CDC) manages the decision-making process and is supported by the prefrontal cortex (common with the short-time memory), cortex for judgment [26], ventral/dorsal striatum [12], which drives the action-selection processes, and the execution elements EEs (muscles at human). The equivalent decision-making system in the eukaryotic cell is the cell nucleus, which responds to the external stimuli by an informational dynamic YES/NO – Bit-type process, consisting in the genes activation/inhibition (genes expression), according to the local and momentary circumstances [28], for adaptation.

(III) The Info-Emotional System (IES) controls the emotions, and is supported by the limbic system, composed basically by hippocampus and amygdala (alarm component), with contributions of thalamus, hypothalamus (mood states) and basal ganglia (reward processing) [29]. The main organ in the body connected with IES is the heart, pumping additional blood in specific zones, according to the momentary necessities. In the eukaryotic cell, this is represented by the Info-Reactive Sentient System (IRSS) [26,28], controlling the sentient internal reactive response to information, based on the internal sensations processed by the intrinsic network of internal sensors and nucleus reactive activity. Sentience refers to the ability to have/experience feelings and sensations [30] and allows to accept (YES) or reject (NO) a stimulus/information, spontaneously or by awareness control.

(IV) The Info-Connection (IC) is a counselor on the acceptance (YES) or not (NO) of new information, maintaining the right range and type of information, which corresponds to the hereditary and/or acquired experience, taken as a reference. This is supported by the anterior and posterior cingulate cortex, placed between cortex (superior layer of the brain) and medium zone (limbic system and long-time memory) [14]. At human, this advises on preferential social relations and/or on the selection of certain type of information, according to the personal preparation or interest. At cell level, the IC is referred to the maintenance of the inherited/duty tasks, according to the differentiation/belonging to specific organs/tissues and their functions in multicellular composed organisms. In the inferior organisms, IC is manifested for instance by orientation of migrating birds, the detection of the dangerous phenomena, or by the subtle orientation of the roots of plants, avoiding anticipatively the obstacles [11].

The connection with the intrinsic genetic informational source (iS), determines the reproduction and development of the body, according to the age, as presented below.

(V) The Genetic Transmission System (GTS) manages the reproduction and is supported by the activity of hypophysis and hypothalamus, which control the sexual development and response. In cell, the replication is the corresponding process [17]. The key intimate process in the eukaryotic cell, which initiate the replication, can be basically described by the following relation:

$$\text{DNA} \Rightarrow 1/2\ \text{DNA} + 1/2\ \text{DNA} + 2\ (\text{New Strands}) \Rightarrow 2\ \text{DNA} \quad (1)$$

showing that the DNA molecule is split into two halves (strands and associated nucleotides), which are completed by the addition of

new strands, to form two mew identical DNA molecules.

This mechanism is based on the specific behavior of the DNA molecule, structured basically by using only four types of components (nucleotides), organized in a huge number of combinations. These components are adenine (A), thymine (T), guanine (G), and cytosine (C), which can form bonds each other only by complementarity, i.e. the nucleotide A only with T, and G only with C, as in a binary YES/NO – Bit-type informational fashion. Therefore, in informational terms, these act like a four "letters" of a specific "alphabet", forming by combination of sequences of DNA (SeqDNA), various "words" of such a genetic "language".

(VI) The Info-Genetic Generator (IGG), manages the body evolution and development according to the age, and assures also the immunity activities [15,16]. IGG functions are supported by hypophysis and hypothalamus, which regulate fundamental processes like growth, development, metabolism and aging [26]. In cell, IGG is basically represented by the replication-translation process, producing the necessary proteins – the construction "bricks" of the body [28], according to the following schematic relation:

$$\text{Seq(DNA)} \Rightarrow \text{mRNA} \Rightarrow \text{tRNA} + \text{Amino Acids} \Rightarrow \text{Protein} \quad (2)$$

where mRNA is the messenger ribonucleic acid (RNA), which "reads" the necessary DNA sequence (seqDNA) by an enzymatic-assisted process: SeqDNA=>mRNA. This message is transmitted/communicated furthermore to ribosomes organelle of the cell and converted into transport RNA (tRNA), to form together with other various types of amino acids – combined also by Bit-type complementarity, the necessary proteins, according to the necessities.

An indispensable system, acting to assure the necessary energy and substituting material elements from food, is defined below.

(VII) The Maintenance Informational System (MIS) assures the management of the digestion processes and is supported by the brain stem and digestive system in the body. In the eukaryotic cell, similar organelles like human, process the digestion [17].

The functions of the digestive organelles in the eukaryotic cells are similar with that in human: the mitochondria – the energetic plant of the cell work like lung, the Golgi apparatus helped by ribosomes is a "heart"-like/blood/fluid distribution system, involved according to IMHBLS also in IRSS, the endoplasmic reticulum and lysosomes work for lipid/fats and insulin metabolism like the pancreas and spleen in human, and vacuoles like a stomach. The semitransparent membrane is the "skin" of the cell, or epidermis/cuticle of plants, and the skeleton is the "bone" system of human. Chloroplast in plant cells is an additional organelle for the preparation of glucose, by a chlorophyll light-assisted processes [25,31]. The prokaryotic cell (bacterium), although without well-defined organelles, works fulfilling the same functions.

The basic relation for the energy production in cell can be written as follows:

$$ATP + H_2O \Leftrightarrow ADP + Pi + \text{Free Energy (E)} \quad (3)$$

where Pi is inorganic phosphate [5]. The concentration of cellular adenosine triphosphate (ATP) is maintained in the range 1-10 mmol/L (1 mmol = 10^-3 mol), and the concentration ratio of ATP vs. ADP (adenosine diphosphate), of about 1,000 [32]. The ratio of concentration ATP/ADP is a critical value, driving/controlling the forward or reversible reaction, when the value of this ratio becomes less or higher than the critical value. Therefore, the reaction (3) goes toward a production of ATP (YES), or reversely – not (NO), as an informationally driven process [3,28].

3 Decision-Making as an Informational Process of Adaptation

The knowledge of decision-making process is limited to the superior living organisms, because the general belief is that only those are endowed with nervous systems of such a capability. According to a recent study [12], the decision-making at mammals is recognizable

by their action-selection reactivity – action by movement, and selection from multiple possibilities. According to the IMHLS, the selection of a certain solution from various uncertain possibilities, based on own experience accumulated in CASI and used as decision criteria by CDC=>EEs, is an informational process [10], which by repetitive cycles became automatic.

According to the experimental evidence [12], three distinct decision making/action-selection modes have been identified at mammals: Pavlovian, Deliberative, and Habit decisional behavior, managed mainly by the ventral and dorsal striatum, amygdala, and their connections to motor circuits, which would correspond in terms of the IMHLS with CASI, CDC and IES/IRSS.

The Pavlovian decision-making mode is based on a learning process (involving thus CASI), consisting in a associative relation between a stimulus (a bell sound for instance) and an action (delivery of a food), which triggers salivation and movement to the food source – as in the experiments with dogs. Once learned by practice during repetitive cycles, the emission of the stimulus is sufficient to trigger the reactive/stereotype decision-making process (CASI=>CDC=>EEs). This decisional process is fast and low energy consumer, because no extended decisional analysis is necessary.

The Deliberative mode involves own searches among multiple possibilities and expected consequences. Such a process is based on own life experience, acting as decision criteria, by means of a deliberative comparative analysis – typical for humans, applicable also to mammals. In terms of IMHLS, this process is expressed by the informational schematic relation: CDC <=> (CASI/IC/IES)=>CDC=>EEs, where <=> signifies iterative interactions. The Deliberative decisional process is slow and expensive, involving high energy consumption.

The Habit decision-making/action-selection mode is more comfortable than the Deliberative one, because is based on a routine experience. This is based on a previously learned "lesson", but the decision is applied on various distinct situations, even if they are different of the original acquired experience. Such a decisional mode is low consumer, but often erroneous, because of non-concordance with the reality. In terms of IMHLS, such a process could be described schematically by the informational relation: CASI@=>CDC=>EEs), where @ symbolizes stagnant/recycled ideas. Habit decisional process is similar, but more complex than the Pavlovian one.

To really understand the decision-making process [13] and extend it to all living structures, it is necessary to focus on the properties of the Informational System of Human and Living Structures (ISHLS) [11], which can be written as follows:

$$ISHLS = (CASI+CDC+IES+IC) + (GTS+IGG+MIS) = OIS+PIS \quad (4)$$

where OIS=(CASI+CDC+IES+IC) is defined as the Operative Informational System, acting during the connection to the external and internal reality (eS), while PIS is defined as the Programmed Informational System PIS=(GTS+IGG+MIS). Part of PIS, i.e. (GTS+IGG), relates to the implicit informational genetic sources (iS), and another – MIS, assures the connection with matter, processing the incoming foods, responsible to produce the necessary energy and for the materials micro components for the body construction/reconstruction.

To understand the mechanisms of the decision-making process, it is imprescriptible first to understand in detail the intimate mechanisms of the transport of information in the living structures. From the above presentation, it results that the interacting reactions between the micro components of the body are practically characterized in the Carbon-based system, as the living organisms work, by the specific complementary configuration, which therefore plays a fundamental/key role in the body constitution and behavior. Thus, this property could be formally represented by the basic associative/dissociative relation encoding information I, which can be written as:

(A+B)+I<=>(AB)(I) (5)

operating as a YES/NO Bit-type informational unit, where A and B are interacting components, (AB) the obtained compound, and (I) is the hidden/"embodied" information, released as information I by a dissociative/"disembodiment" (<=) reaction. Such a mechanism carries out thus a matter-related information, as defined by IMHLS [28.3].
It can be remarked also that the communication (as informational internal process) between various parts/organs or organelles of a body is done by specific chemical agents of each of such a part, i.e. by a transduction process. Such a consecutive chain process between different constituents, typical in the living bodies [11,18], initiated by an information INFO, can be thus written schematically as follows:

INFO => (A+B)+Info1 => C(Info1) => (D+E)+Info2 => F(Info2) => (G+H)+Info3... => Decision Making => Terminal (6)

Info1/(Info1), Info2/(Info2), Infor3/(Info3), ... in the relation (6) represent information/hidden information respectively in each transduction step, C, F symbolize composing components within a reactive/cascade transduction chain (InfoChain) of interaction series (like in relation (2)), and the Terminal represents the process goal, the final process producing an effective change. In particular, the Terminal in a living eukaryotic cell is the cell nucleus, which can activate/deactivate genes by a Decision-Making, as an irreversible forward process. In human, at a global level, the Terminal is Mind, defined as an informational operator. The activity of ISHLS is therefore operated by Mind (operation represented as M|ISHLS below), and expressed/transduced in virtual/conceptual (language-assisted) information, i.e. in information itself, detectable and recognized by the corresponding cognitive centers, schematically written as:

INFO=> (InfoChain) =>M|(ISHLS)→Iself = Iknow (Ik) + Iwant (Iw) + Ilove (Il) + Iam (Ia) + Icreate (Ic) + Icreated (Icd)+Ibelieve (Ib) (7)

where the symbol → indicates the transduction from the carried information in the human body circuits into information itself, perceived by means of the corresponding cognitive centers, suggestively defined as: Iknow (memory – symbolically written as Ik), Iwant (Ik – decision), Ilove (Il emotions/feelings), Iam (Ia – self status/vivacity/health), Icreate (Ic – biocreation, expressed by sociability/family relations), Icreated (Icd – biogeneration, expressed by inherited talents/predispositions/abilities), Ibelieve (Ib – mentality/decision criteria, duty/task).
The extension to other subhuman organisms is possible introducing the concept of Self as Individual (In) with respect to the rest, allowing to define the following cognitive centers: In_m (memo-experience), In_d (decision), In_s (sentience), In_v (vitality), In_r (reproduction), In_i (instincts/impulses), In_o (info-orientation) [5]. Therefore, the Self (In_self) of an individual of a subhuman organism, can be written as follows:

In_self= In_m+ In_d+ In_s+ In_v+ In_r+In_i+ In_o (8)

This is an original view of consciousness, considered because of the activity of the ISHLS. Thus, according to IMHLS, consciousness is described and expressed by informational concepts, as the projection of the external and internal information in own mind, because of the operability of Mind on the informational system composed by seven components, transduced in seven cognitive centers, able to detect, memorize and decide on own reaction to the input information. Two main fundamental contributions to the understanding of consciousness can be remarked from this model: (a) distinctively compared to other models, which refer to consciousness only in qualitative terms – as subjective perception [33], which never can be understood, consciousness is a consequence of the informational operability of some body material components ("hardware" of the organisms),

acting as an informational system ("software" of the organism); (b) consciousness as informational phenomenon, cannot be limited to human, as long as other subhuman living organisms dispose of informational system composed by similar informational components. However, despite some negativist proposals/opinions cited above, and in accordance with IMHLS stipulations, some recent results [34], show that many animals – all vertebrates, including fishes and reptiles, and even some invertebrate species, have the neurological base for consciousness and neuroanatomical/neurochemical/neurophysiological substrates of conscious states, exhibiting intentional behaviors [35]. Such findings support also the IMHLS.

Iwant and In_d is the decision center at human and subhuman organisms respectively. This is the informational output of ISHLS, expressed by Attitude, which is practically a function of all other cognitive centers [14], and which can be evaluated accordingly [36]. The Operative Informational System (OIS) manages the adaptation, because emotions/sentience (Il/In_s) and orientation (Ib/In_o) determine/influence also the decision by impulsive reactions, or by comparison with accumulated/existing experience (Iknow/In_m). However, MIS (detected as power/health/vivacity by Iam/In_v), GTS (detected as sexual activity by Icreate/In_r) and IGG (inherited predispositions/talents/instincts expressed by Icreated/In_i), can also influence the decision-making process. The performance of each cognitive center depends on the complexity degree of informational tools and informational processing capabilities of each species or individual. From such point of view, the IMHLS is the unique model [37,38] which allows: (1) to distinguish between various informational functions of the organisms, among which CDC operates the decision-making; (2) to reveals the similar informational organization of informational system in seven determinant components, on the entire evolution scale [28]; (3) to describe the complete dependence of Attitude, as an expression of the decision making of the reactive contribution of the living organisms, limited not only to the OIS activity, but also recognizing the detection in mind of the activity of PIS, as the automatic informational system.

The experimental evidence supports the IMHLS. IC is evident by the training of wild and domestic animals and by the compliance with appropriate competences/tasks in their social groups, at insects (bees and ants), at schools of fishes and primate, elephants, dolphins and monkeys, to remark only a few of them, The prokaryotic cell (bacterium), without a nervous system, a "simple" but sufficiently complex organisms, is endowed with cilia (EEs) for mobility in fluids, intentionally commanded by the decision-making system (CDC)|=> Exe). Similar behavior is observed at protozoa – independent eukaryotic unicellular organisms, or at spermatozoa in human and mammals, showing an intentional behavior, even when they are outside of the body [16]. In terms of IMHLS that means that they possess an individual cognitive/decisional operability (CASI/IC/IRSS/CDC)=>EEs), acting as a function of circumstances. At human and mammals, the immune cells demonstrate also cognitive/decision-making and execution (Exe) capabilities under local and time-imposed conditions, determining even their plastic reconfiguration (MIS/IGG), during the macrophage behavior [16].

Plants react for their defense against the attack of the herbivores or pathogens, initiated and driven by a complex signaling network, which involve the communication of the danger signal (IRSS) by chemical agents inside of the whole organism, for a rapid decision-making response (CDC), by toxic emanations [28]. Roots are also decision-making (CDC) structures, showing sensitive capabilities to choose the future trajectory, searching, discovering and selecting (IC) the optimal route of their further development to avoid the obstacles, even before to meet them [25,31]. The carnivore plants demonstrate an evident ability to catch their victims rapidly. A bizarre organism, but demonstrating a high capacity of adaptation, is the *sea squirt larvae*, which posse a small primitive brain, spine and even eye, but when they find a place with sufficient food on the sea floor, these specimens absorb/eat

them, developing instead only their stomach [39].
Human is the more complex organism from the informational point of view, but IMHLS shows that the large variety of living structures demonstrates their high capability of adaptation according to the local conditions, assisted by a decision-making process.

5 Conclusions

The living organisms are informational structures. They dispose of an informational system with seven components, part of them (PIS) assuring the body maintenance (MIS) and its genetic activity, i.e. the genetic transmission (GTS) and the body development and evolution according to the age (IGG). Another component (OIS) supports the info-connection with external/internal reality, especially for food, social communication and defense necessities, assisting the adaptation by a decision-making process. These components operate as OIS, composed by CASI (memory acquirements), IES/IRSS (emotions/sentience), IC (selective connection to information), and CDC system, processing the received information for an adequate adaptation, but the decision is affected also by the activity of PIS.
According to the present level of knowledge, only the organisms with nervous system (typically mammals) are able of decision-making, which can be Pavlovian (distinguished by associative learning process), Deliberative (selective from many alternatives) and Habit (applying the same "lesson" to any situation). The decision-making process is revealed by observing the reactivity, according to the shown/exhibited action-selection behavior. While Deliberative decision-making is a slow and high energy consumption process, the other two are fast and low energy consumers, because the Pavlovian is automatic, and Habit is a routine, so error-prone process. In terms of IMHLS, these correspond respectively with activation of the following informational centers and circuits: CASI=>CDC=>EEs for Pavlovian, CDC <=> (CASI/IC/IES)=>CDC=>EEs for Deliberative model, which includes various cycles of CASI consultation before a final decision, and CASI@=>CDC=>EEs for Habit decisional fashion, where the symbol @ denotes the stagnant/circular thinking mode.
From the perspective of IMHLS, the decision-making process is more complex, manifested by Attitude, which is the informational output of the ISHLS. According to IMHLS, Iself/In_self are functions not only of the components of OIS, but also of the projection of the components of PIS in mind, which are Iam/In_v, expressing the health/vivacity, Icreate/In_r expressing the sexual/reproduction impulses and Icreated/In_i expressing the inherited abilities/instincts. IC is also an important informational center, fixing the range of the info-connection within the limits of the accumulated trust experience, which serves as decision criteria and orientation in life.
The IMHLS is the unique model which is capable to explain the essential characteristics of the living structures and their behavior. In an explicit manner, this offers a clear vision and versatility allowing: (1) to reveal the informational character of the living organisms, connected to two main sources of information – implicit (iS) and explicit (eS) sources; (2) to distinguish the informational components of this informational system and their attributes and tasks; (3) to highlight the common/similar informational organization of the ISHLS in seven specific components on the entire range of evolution/organization scale; (4) to reveal one of the fundamental property of the living structures, independently if they are endowed or not with a nervous system, which is the capacity to decide, by means of the CDC system, allowing the adaptation for survival; (5) to offers a complete dependence of Attitude, as the informational output/reactive response of the living organisms at input information.

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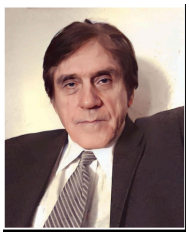

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