



Advanced Perspectives in Biological Researches: Info-Operability of the Cell and Human/Multicellular Organisms

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Information is a largely used concept nowadays in our professional and private activities, but not well understood when the biological organisms are concerned. However, this concept was recently proved as effective in the modeling of the Informational System of the Human Body (ISHB) [1], able to coherently describe the informational functions of the brain and their correlation with the body [2,3]. According to this model, the human is connected to matter (foods, water, air) as basic nutrients and with information, necessary for the food detection, protection and reactive adaptation to the momentary changes of the neighborhood environment, as it is shown in Figure 1, upper side. Human is therefore an adaptable bipolar structure, connected to matter and information [4]. This really seems to be a surprising result, considering that the large scientific and public opinion is that our reality, including the biological structures, is structured only with matter and energy. It was moreover shown that information is part not only of the living [5], but also of the non-living structures [6], so our reality is composed by three fundamental components, i.e., matter, energy and information, suggestively represented as a Universal Triangle of Reality [5].

In the common sense, the information concept is practically perceived as news, specific to the communication through internet and telephony, as a benefit of the unprecedented development of

the microelectronic systems and equipment. But this subtle concept is not understood when is referred to the matter structuration, in particular the structuration of the living systems. However, as it was recently explained, although unnoticeable, information is a discrete, but active agent, an effective participant to the configuration/reconfiguration of matter, or structuration/destructuration processes. This can be better understood if we refer to the accumulation of information in the deoxyribonucleic acid (DNA) very large molecules, containing 4 distinct nucleotides, i.e. Adenine (A), thymine (T), guanine (G) and cytosine (C), which constitutes the basic "letters" forming various possible combinations/configurations/sequences in the DNA structures, transcribed/translated as "words" by the intervention of enzymes and the participation of mRNA (ribonucleic acid messenger), tRNA (transfer RNA) and amino acids into specific proteins in the cell, as it is represented schematically in the bottom side of the Figure 1. In terms of information, this is equivalent to say that the information stocked/"absorbed" into the DNA structures (hidden there by a structuration/"embodiment" process)-the main informational source of the cell, is released by a deconstruction/"disembodiment" process and "communicated" (\Rightarrow) successively to a receiver (receptor), under the form: DNA \Rightarrow mRNA \Rightarrow Protein. The structural and functional protein properties is specific for an appropriate application, according to the body (re)construction needs [7-9].

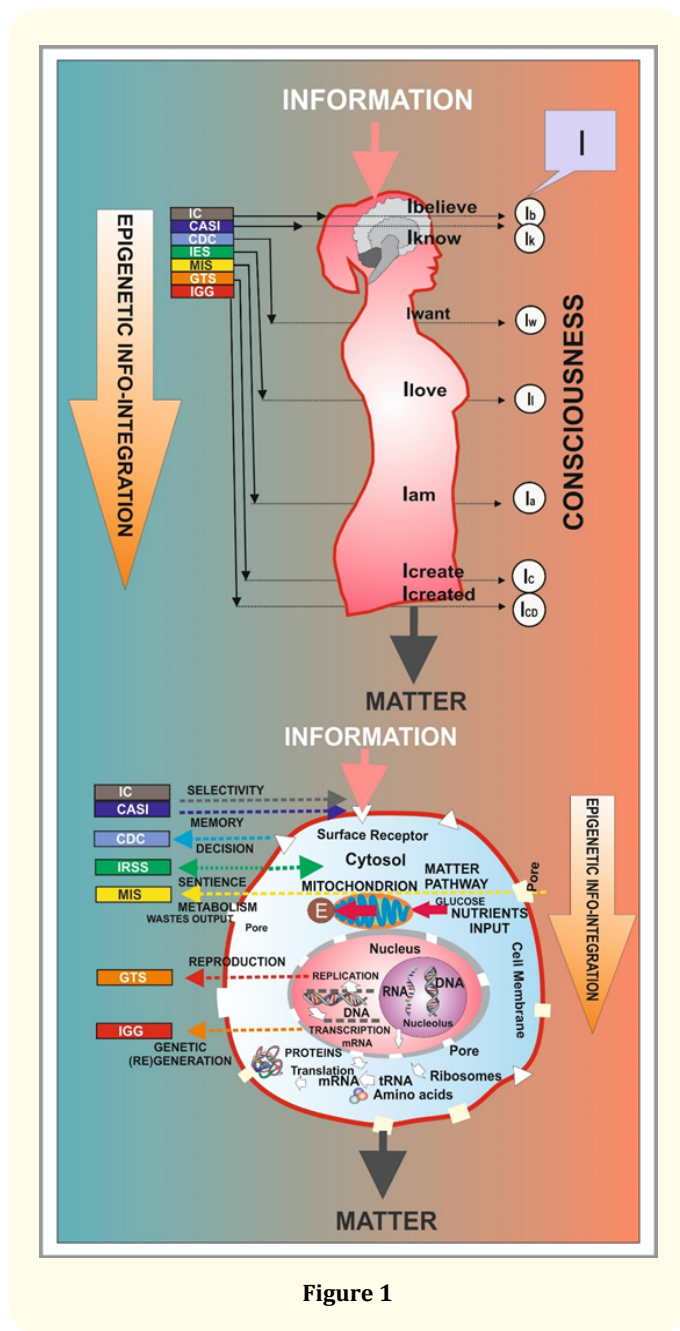


Figure 1

(Figure 1) Schematic representation of the informational system of the human body and living structures, with reference to the eukaryotic cell (bottom side), specific for plants, animals and human. In the prokaryotic cell the organelles are not distinguishable or separated by the semitransparent membrane like in eukaryotic cell, but the informational functions are the same.

In a different way is perceived and interpreted the information received by the communication with the environment. In human, this is transduced in electrical (K^+/Na^+ firing waves) and chemical (neurotransmitters) signals within the nervous system, processed and transduced/interpreted in the brain as visual, auditory, gustatory, smelling and touching sensations/perceptions. Each kind of information is processed in distinct circuits but integrated in thalamus and projected on the mental prefrontal “screen”/” display” as integrated conscious perception. The language is the info-communication tool to express/distinguish the large variety of the information received from the external and internal reality [10]. Information induces reactive effects in the body: a category is interpreted/felt as impression/emotion/affectivity, a sentience informational reaction to the received information, and another is referred to the analysis/judgment and interpretation of this information, according to own decision criteria, allowing the processing and emission/manifestation of a reactive decision/attitude. The information achieved by means of the language is a virtual information, expressible by words, symbols, and the specific scientific or artistic tools/concepts. In the animal multicellular organisms, information is processed/centralized by the brain, supporting not only the metabolic and info-reactive processing, but also the management of the mobility and movement/displacement for food seek and defense, which need complex decisional acts. In plants, the info-communication is achieved by a species of hormones and direct cell-cell contact, but there is recent evidence of specific nervous-like pathways, which allow the communication by electrical channels [11, 12], like a “neurobiological” system [13].

According to the specificity of the brain functions and the above defined mechanisms of operation with information, the following informational components of the ISHB can be defined: (1) the Center of the Acquiring and Storing of Information (CASI), as a sum of all informational networks in cell and zones of the brain (centralized info-processor at human and subhuman organisms); (2) the Center of Decision and Command (CDC), operating the virtual information in human and momentary received information from environment in cell (consisting in reactive info-decisional chains of YES/NO steps); (3) the Info-Emotional System (IES) in human and Info-Reactive Sentience System (IRSS) in inferior organisms, in particular in cell; (4) the Maintenance Informational System (IMS), managing the metabolic processes for conversion of nutrients in energy (E) and substituting micro-constituents; (5) the Ge-

netic Transmission System (GTS), responsible for the info-genetic (matter-related) information to the next generation, represented in cell by the replication process; (6) the Info-Genetic Generator (IGG), responsible for the body growth and development/evolution, according to the age; (7) the Info-Connection (IC) pole, which manages the binary YES/NO Bit-type (acceptance/rejection) selection of information, according to the survival inherited/acquired/learned ("navigation") criteria and life experience.

In the subhuman organisms, this pole engages "navigation" mechanisms according to the life experience and evolution of the species, depending on the environment nature (air, water, earth) and particular/local conditions (luminosity, humidity, temperature, nutrients level and composition). In the inferior organisms like bacteria, the informational activity of IC is manifested by the synchronized geometrical disposition in colonies, at plants by light/sun orientation, and at some species of fish, birds, snakes and animals by the spatial/migratory orientation and the danger anticipation, in particular the detection of the weather change and natural perilous phenomena. At human, this activity is manifested by mental spatial-temporal exploration/"navigation"/body inside/outside "travels", daydreaming, anticipative phenomena, near-death, mystic and religious experiences, supported by the anterior/posterior cingulate cortex [14-16] and the afferent sensorial spatial-temporal zone (temporo-parietal junction) of the brain [17].

The general informational functions, even their structural support and behavior, are basically the same on the entire evolution scale, sustained by the unit of life-prokaryotic/eukaryotic cell. Indeed, although not evident at a first glance, an attentive observation shows (as it is represented in Figure 1 bottom side), that the informational system of the human body (Figure 1 upper side), is reproduced in a similar way in the eukaryotic cell, where the organelles' functions/structure are similar with that of the human, and with the multi-cellular/animal organisms in general. First of all, the semitransparent membrane at cell (skin at human and the other multi-cellular organisms) is essential to protect the intimate internal "laboratory" processes, sensitive to small changes of the physical-chemical parameters, but which permits (through pores and surface specialized (YES/NO acceptance/rejection) receptors, the filtered/selective interchange of matter and information with the environment. The mechanism involved in this type of commu-

nication is based on the complementarity between the chemical info-agent and the corresponding receptor, operating like a key into a lock, allowing only a selective YES/NO binary (Bit-type) operability. The semitransparent membrane/skin isolates/protects/and maintains the corporal temperature, which is a fundamental parameter for the internal equilibrium between YES/NO opposite chemical reactions [18], and for the normal functionality of the body [19]. In fact, temperature is proving to be a key parameter for the initiation of the development and growth of a plant from its seed-the "zip"-type compressed matter-related informational egg, and of the inflorescence period, when a temperature threshold value is exceeded, operating as a YES/NO type of parameter [1]. In the eukaryotic cell, the Golgi's apparatus is equivalent with the heart and distribution system of the nutrients by blood, the mitochondria correspond with bowels and lungs because they produce proteins by an oxygen assisted process to achieve energy, the activity of the endoplasmic reticulum is equivalent to the pancreas/blood vessels functions, active also in the reproductive system [9], the vacuoles are equivalent with the stomach, useful for food and water storing for further use, lysosomes with spleen and liver-kidney, cytoplasm supporting role is equivalent with that of the muscles, and cytoskeleton-useful for the static resistance, is equivalent with the bones in the animal bodies. The chloroplast in plants fulfills the role of mitochondrion in animal cells, by means of a light-assisted process. The master role in cell is played by nucleus and DNA/RNA molecules as genetic structures, managing the development/growth of the body and reproduction.

The biological organisms are self-organized learning systems, able to adjust their structure and behavior by epigenetic mechanisms (schematically represented by the vertical arrows in Figure 1), according to the modifications of the environmental conditions (if these acts intensively/repetitively for sufficient long time), explaining the evolution and the huge variety of the species [20]. According to above analysis, information is proved therefore to be a powerful constituent/player for the structuration/functionality of the biological organisms, from the elementary, basic units of life-the prokaryotic/eukaryotic cells to multicellular organisms and human.

The informational activity of the ISHB components is detected into the mind as cognitive centers, the basic manifestation of (individual) consciousness (I), suggestively defined as Iknow (Ik)-memory, Iwant (Iw)-decision, Ilove (Il) (the driving force of

life)-emotions, Iam (Ia)-self-status/health/power/vitality, Icreate (Ic)-genetic/biological creation, Icreated (Icd)-genetic inheritance, Ibelieve (Ib) (trust, beliefs, confidence), projected from CASI, CDC, IES, MIS, GTS, IGG, IC systems respectively. This informational model, extended to the living structures on the entire evolution scale, shows that even the inferior organisms (prokaryotic and eukaryotic cells), dispose of a proto-cognition form of connection with the surrounding reality-a basic/primitive/rudimentary "proto-consciousness", and the degree of connection/operability/reactivity/interpretation of this reality by the multicellular organisms depend on the development degree of their informational system. This revolutionary model allows the understanding of the mind-body relation [2], with successful applications in neurology [2,16,21,22], neuroscience/psychology/psychiatry [19, 23-25], geriatrics [26], biotechnology and biomedicine [27,28], biostatistics and biometric field [29].

Conflict of Interest

No financial or conflict of interests.

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