ISSN: 2687-8100

DOI: 10.33552/ABEB.2019.01.000525

Archives in Biomedical Engineering & Biotechnology

Iris Publishers

Research Article

Informational Mode of the Brain Operation and Consciousness as an Informational Related System

Florin Gaiseanu*

PhD, Principal senior Researcher (Professor), Science of Information and Technology Bucharest (Romania) and Barcelona, Spain

***Corresponding author:** Florin Gaiseanu, PhD, Principal senior Researcher (Professor), Science of Information and Technology Bucharest (Romania) and Barcelona, Spain.

Received Date: May 30, 2019

Published Date: June 07, 2019

Abstract

Introduction: The objective of the investigation is to analyse the informational operating-mode of the brain and to extract conclusions on the structure of the informational system of the human body and consciousness.

Analysis: The mechanisms and processes of the transmission of information in the body both by electrical and non-electrical ways are analysed in order to unify the informational concepts and to identify the specific essential requirements supporting the life. It is shown that the electrical transmission can be described by typical YES/NO (all or nothing) binary units as defined by the information science, while the inter and intra cell communication, including within the synaptic junction, by mechanisms of embodiment/disembodiment of information. The virtual received or operated information can be integrated in the cells as matter-related information, with a maximum level of integration as genetically codified info. Therefore, in terms of information, the human appears as a reactive system changing information with the environment and between inner informational subsystems which are: the centre of acquisition and storing of information (acquired data), the centre of decision and command (decision), the info-emotional system (emotions), the maintenance informational system (matter absorption/desorption/distribution), the genetic transmission system (reproduction) and info-genetic generator (genetically assisted body evolution). The dedicated areas and components of the brain are correlated with such systems and their functions are specified.

Result: The corresponding cognitive centres projected into consciousness are defined and described according to their specific functions. The cognitive centres, suggestively named to appropriately include their main characteristics are detected at the conscious level respectively as: memory, decisional operation (attitude), emotional state, power/energy status and health, associativity and offspring formation, inherited predispositions, skills and mentality. The near-death and religious experiences can be explained by an Info-Connection pole.

Conclusion: Consciousness could be fully described and understood in informational terms.

Keywords: Brain; Informational operation; Virtual and matter-related information; Info-input and output; Genetic and Epigenetic; Informational subsystems; Cognitive centres; Extra-sensorial experiences

Introduction

Although when we refer to brain and its running mode, we often relate it to information, little it is really known about information itself and how the brain operates with it. Information concepts are largely used day by day in our informational age, the microelectronic intelligent systems assure us a comfortable communication at distance and unify our knowledge around the earth. We speak about Bits, internet and television and benefit of telecommunication and computer systems to be informed, but little data we know actually on how our brain acts, as an interface with our internal and external world and on consciousness, this knowledge spectrum which illuminates our life, even less. The advances in information science and technology, starting with the statement concepts on information and its evaluation [1] and continuing with operating mode of microcircuits and microprocessors in the intelligent systems today, and with the specific terminology and investigation/evaluation tools allow to initiate the approach of the brain operation mode by analogy with microprocessors, complex units of informational processing in computers [2,3]. Artificial intelligence was also a stimulating way to approach also consciousness from the artificial neuronal networks point of view [4]. However, while from the philosophical point view the logic operation and information interchange between various systems would be understandable

somehow, the "hard" problem which arises when we refer to the brain operation is how to explain the senses and sensations [5]. Physics is implied also more and more on this field, bringing into the discussion the intimate mechanisms of the matter-support of mind and consciousness [6], offering responses to the "mind-body" problem on the basis of quantum [7] or epigenetic processes [8]. As concerns the near-death experiences (NDEs) and other extra-properties of the mind [9,10], it was necessary to imply a deep understanding of matter-related information both at the micro and macro scale [11]. In this paper it is presented especially the informational mode of brain operation correlated with its anatomic structure and functions to extract conclusions on the structure of the informational system of the human body and consciousness.

Analysis of the Informational Structure of the Brain and Associated Functions

Mechanisms of the transmission of information and consequences

As it was shown above, little attention was paid to the deep implication of information, as a physical parameter, when the working functions of brain were approached. The term of information was and still is used in a general way, as a news or intercommunication support [12,13]. However, when we apply this concept to matter, particularly to biological processes, we have to take into account not only the basic meaning, coming from our fundamental senses (sight, hearing, smell, taste, touching), but also the implicit, incorporated information into the matter components.

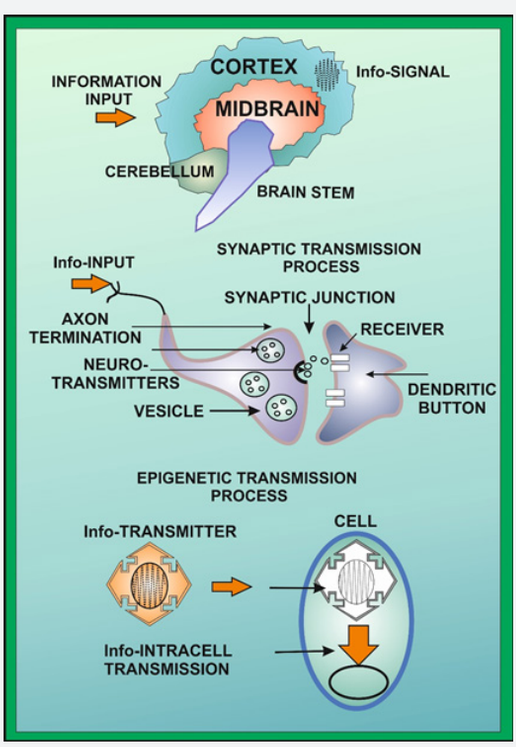

Figure 1: Mechanisms of the transmission of information in the organism: the virtual information received by sensors and operated by the brain (superior side), electrically-assisted info-transmission by the axons of the nervous cells and neurotransmitters between the nervous cells, and the epigenetic transmission (bottom side).

In Fig. 1 there are represented the transmission processes of information in the human body, starting with info-recorded signal in the brain and continued by electric and non-electric signals to the cells. Specifically, the transmission of information by the nervous system is part of it assured by electrical signals along the nervous axon, on the basis of YES/NO type conduction, like in the computer systems. YES/NO decisional operation unit is an informational basic way to approach and evaluate the information, as it was defined by Shannon [5] by means of functions of probability in a binary system. In the brain, specifically consisting in a highly packaged neural mass, this is a main type of informational transmission. As an electrical transmission, this is associated with the electro-magnetic field specific for the electric and electronic circuits and processes, which allow applications concerning especially motor-type commands by mind to various helping body-added mechanisms or to wifi-assisted external electro-mechanic devices [14]. The recent non-invasive and non-destructive functional Magnetic Resonance Imaging (fMRI) is a high technological method to investigate the local activity of the brain as a function of the investigation goals and to correlate various areas of the brain with a specific task. This is based on a differentiated visualisation of the predominantly irrigated regions with blood flow due to the nervous specific activation.

Although the electrical transmission by neural axons is an essential way of communication, allowing the understanding/analysis of the brain activity by similarity with that in the logic/intelligent microelectronic systems, a next signal differentiating, but non-electrical transmission way is assured within the synaptic junctions between the neurons by physico-chemical mechanisms assisted by neurotransmitters, as info-transmission agents, as it can be seen in Fig. 1. Vesicles with neurotransmitter molecules are transported within the dendritic button, which expel the neurotransmitters to the next dendritic button of a neighbourhood neuron, to be trapped by specific receivers from its surface. This is a selective mechanism of the transmission of information, because only certain type of neurotransmitter is accepted by a corresponding receiver, if each other have complementary structures, allowing to fit together like a key in a lock. When the fiting process is attained, information signal is transmitted from the informational agent (in this case the neurotransmitter) by a "disembodiment" of information to the receptors, which receive the transmitted information by an info-"embodiment" process, that meaning that the information is on this way "incorporated" into this new agent of info-transmission. After multi-repetitive steps of the transmission of the same type of information, converted in a typical stereotype, this could be transmitted into the cells by an intra-cellular communication, and incorporated as a new trait in the genetic system, without affecting the genetic structure of the species, as it can be seen in the bottom side of Fig. 1. This is an epigenetic-type mechanism, proposed to explain not only the traits transmission, by also memory and some forms of mental disorders [8].

All these mechanisms show, besides the possibility to describe them in terms of information, independently if they are electrically or non-electrically supported, that the information automatically and insistently experimented by the brain as a acquired information, could be included in the genetic system as a new acquired trait and transmitted to the offspring. Therefore, the informational processes managed by the brain are not referred only to the virtual (mentally activated) information, but also to the matter-related (not conscious) information, as "embodied" into the cells, with the maximum expression in the genetic final form, ready to be transmitted to the offspring. It is to be concluded thus that viewed from the informational perspective, the activity of the brain and of its circuits could be globally described as referring to an informational system of the human body, able to manage the information resulted from the interaction with the environment for adaptation, to receive, operate and to transmit the decisions to the execution elements as a motor-type response, and/or to incorporate it by repetitive processes until this informational sequence to become part of the cell itself, by epigenetic mechanisms, responsible for the transmission of the acquired traits as a genetic information, as discussed above.

Informational structure of the brain

Starting from the stimulating results of such an informational analysis, the next step would be the identification of the specific essential/vital functions of the organism from the informational point of view and of the associated areas of the brain, which manage such functions. The main components of the brain which we refer to [3] are schematically presented in Figure 2.

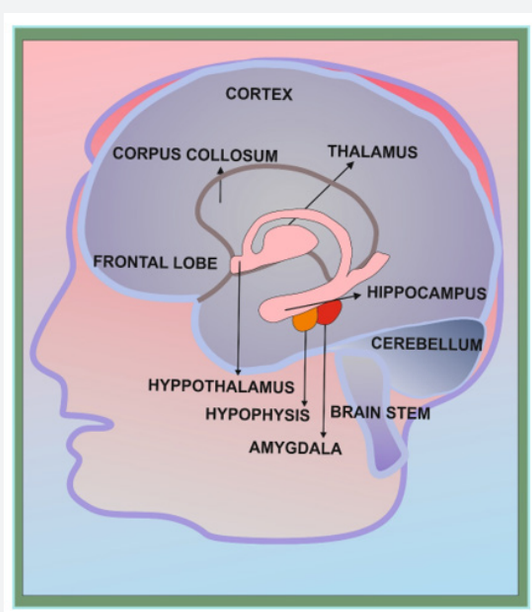

Figure 2: Schematic representation of the anatomic structure of the brain, which defines the main areas managing the components of the informational system of the human body.

Taking into account both the informational activity to operate with the virtual information (received from the external and internal sensors), and with the matter-related information (particularly with the genetic information), the following operational subsystems could be distinguished, as described below and referring to the Figure 1,2&3.

1. Centre of Acquisition and Storing of Information (CASI, Fig. 3), which is represented by the sum of all areas where the internal and external information is received and stoked. This centre is basically represented by short- and long-term memory, but also by the areas connected to the sensors of the virtual information. The main associated physical areas of the brain are (Fig. 2): the prefrontal cortex, the area of the short-term memory (about 1 min. duration), hippocampus – corresponding to the long-term memory, cerebellum, responsible of the memory of the learned behaviours and skills, thalamus-complying the function of a relay for sensory impulses, cerebral cortex with areas for interpreting the main sensorial signals (touch, vision, hearing). CASI is connected to the external and internal sensors, which transmit to it the input information into the informational system Figure 3.

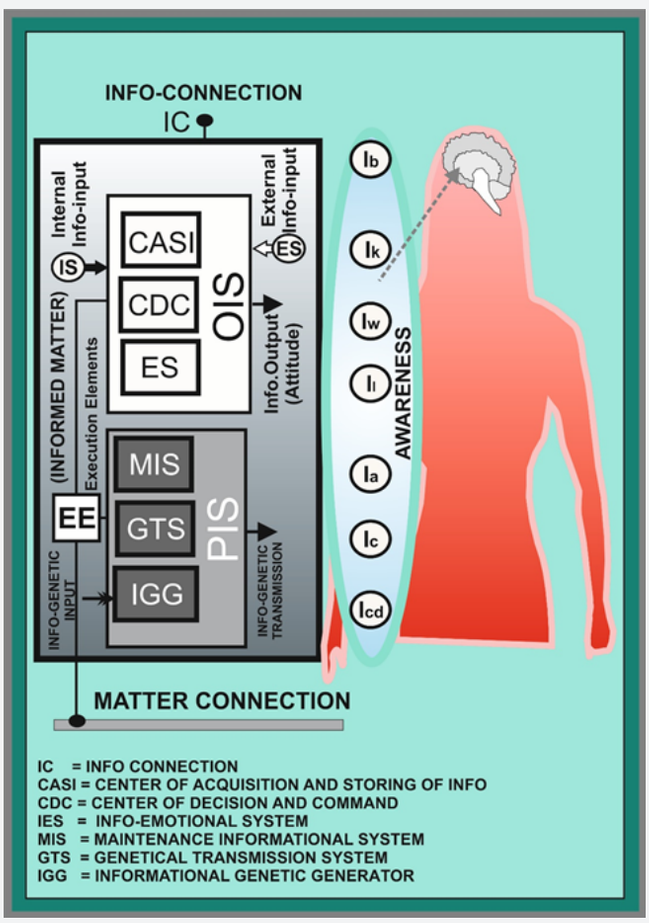

Figure 3: Schematic representation of the informational structure of the human body and the corresponding cognitive centres of consciousness.

2. Centre of the Decision and Command (CDC), responsible of the main dynamic abilities of the mind like thought, creativity, communication, intelligence, motivation, judgement, planning, voluntary control of muscles, voluntary movement operated by the cerebral hemispheres, frontal and prefrontal lobes of the cerebrum. Cerebellum has also a helping role in the muscle's

coordination, including learning and storing motor skills. The left hemisphere is typically responsible for language and speech, comprehension, arithmetic, and writing, while the right hemisphere manages especially the creativity, spatial ability, artistic and musical skills. CDC provides to the body and to external environment a decisional information, which is the attitude, as an information output of the informational system (Fig. 3). The motor decisions are addressed to the execution elements (EE), as shown in Fig. 3.

3. Info-Emotional System (IES, Fig. 3) is managed by the limbic system, composed by thalamus, hypothalamus, hippocampus, midbrain and amygdala (Fig, 1 and Fig. 2). This is also an informational system because is responsible of emotions a sensorial impulse.

4. Maintenance Informational System (MIS) operates automatically to manage basically the operational processes related to the digestion and the distribution in the organism of the necessary nutrients. This system is therefore related with the processing of the material components necessary for the continuous maintenance of the body (nourishment, water, air) (Fig. 3). The brain stem area of brain acts as a relay centre between the cerebrum and cerebellum to the spinal cord, and manages many automatic functions such as breathing, heart rate, body temperature, wake and sleep cycles and digestion, while the hypothalamus controls and integrates the activities of the autonomic nervous system. Medulla – the last part of the brain stem controls the vital autonomic reflex functions like cardiac activity (rate and force of heartbeat, vasomotor regulation, variation of diameter of the blood vessels, the blood distribution to specific organs, the blood pressure and the respiratory rate and depth of breathing (Figure 2).

5. Genetic Transmission System (GTS, Fig. 3) 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 species characteristics and the acquired traits.

6. Info-Genetic Generator (IGG, Fig. 3) manages the development of the body according to the age, especially by means of hypophysis and hypothalamus (Fig. 2). These brain components regulate the body growth and its development, metabolism and even the aging [15]. Basal ganglia seem to have also a role in the personality features. This system is based on the genetic input information inherited from parents.

According to the above analysis, the human body is managed by an informational system, basically provided with: (i) inputs for the reception of the virtual information and for genetic (matter-related) information from the parents; (ii) an informational output which is actually the attitude, as a reactive, decisional response to the information input, and a genetic information output for the species survival (Fig. 3). The human body appears therefore as an informational structure connected to matter, able to process it for the survival.

Results

Consciousness as an Informational System

Cognitive centres of consciousness

The informational components described above are projected into the consciousness as discussed below (Fig. 3).

- CASI is actually the memory, accumulating the data of the life experience [8,16] and therefore could be suggestively named I-know (Ik in Fig. 3), where the personal character of the life experience is highlighted as related to come from the first-person perspective. The information stoked in CASI is provided from external and internal sources, and the data contribution of all other cognitive centres is also retrieved in CASI as remembrances. CASI stores the acquired information under a passive, "stand-by" form.

- CDC activates actually the necessary information from CASI, bringing it in the operational cycle of the brain activity to make a decision. Therefore, this centre is suggestively called I-want (Iw – Fig. 3). The informational operator of such a process is the thought. To obtain a decision, CDC needs both information but also decision criteria, which are provided actually by other cognitive centres via CASI. Among them, the emotions could have an important role in the decision making [16-18]. The decision composes actually the attitude. The motor type decisions are directed to the EE components, basically to the muscles and to the vocal system to express the attitude.

- IES is projected in consciousness as the centre I-love (Il in Fig. 3), dedicated to emotions. The emotional states represent the reaction of the body to the received information [16,18]. The name of this centre suggests the large spectrum of emotions represented by love, which is the central emotional state of the life, as a favourable force.

- MIS assures the power of the body and of the life, supporting the energetic processes and the body health, and it is projected in consciousness as the cognitive centre I-am (Ia-Fig. 3). This centre manages the characteristic information concerning the self-status.

- GTS is perceived in consciousness as the cognitive centre I-create (Ic -Fig. 3). This centre is responsible for the associativity and the formation of the next generation, in close relation with the centre Il.

- IGG is projected in consciousness as the centre I-created (Icd- Fig.3) and is perceived in the conscious mind by the inherited skills, predispositions and talents, and also by mentality, which is acquired especially during the first years of the life. Therefore, this centre provides strong decision criteria for the decisional centre [16,18] (Figure 3).

According to the above description, the human body appears as an informed matter structure, a combination between matter and information, permanently under a dynamic regime of communications between its own components and with the

environment, as it can be observed in Fig. 3. The graduated change of the background colour from lighter to the darker suggests the degree of conscious level. The conscious system, allowing the reaction for adaptation is defined as the Operative Informational System (OIS), while the defined Programmed Informational System (PIS) manages specifically the matter-related information. The virtual information, specific to OIS can be integrated into PIS by repetition, converting it in skills or epigenetically integrated info. Therefore, the graduated change of the background colour from lighter to the darker suggests also the integration/conversion by a repetition process of a virtual information to a deeply matter-integrated info.

The cognitive extra-sensorial experiences

The centres discussed above relate the current proprieties of the mind as a system for exploration of the reality [10,12,19]. However, in order to explain also the extra-sensorial properties of the mind, like that associated with near-death experiences (NDEs) [9], it is necessary to include in the informational system of the human body the Info-Connection (IC) pole. This connection refers to the possibility of the mind to access information on the informational field of matter, as it was defined earlier by Gaiseanu [10,20-22]. The concept of the informational field of matter is based on some recent discoveries of quantum mechanics, which shown that the physical properties of the particle, even that of atoms of a collectivity of atoms, could be separated from their body [23], and it was for the first time defined and introduced by Gaiseanu [20].

Another recent discovery, this time at a cosmic scale, shows that the dark matter, this mysterious matter of our universe, undetectable but present by the specific effects and field (even in our solar system), referred mainly to the contribution to the galaxies build, is actually anti-matter [24], with anti-symmetrical properties with respect to matter. The pair particles of matter/anti-matter are permanently generated in the vacuum, giving rise to a gravitational polarization of such pairs induced by the earth and sun gravitational field. This is a similar process like in the tetravalent semiconductor materials (particularly in silicon), were pairs of electron/hole (positive charges) in the depleted regions of the junctions [25] or of atom/vacancy (a lack of an atom in the semiconductor lattice) [26,27] are generated statistically for a certain temperature. The activity of our universe could be therefore compared with that of an informational field, composed by YES/NO specific alternatives – the basic informational binary unit (Bit), defined within the science of information and technology [6,20].

The mind connection to such a field by IC pole allows to explain the associated phenomena to NDEs as follows. The regression to the childhood is a consequence of the mind connection to the anti-gravitational and anti-entropic field of anti-matter, where the time arrow is inversely oriented, from the future to the past [11]. The same physical process can explain the premonition phenomena [10]. The extra-corporal view is based on the direct scanning of the informational field of matter by the internal "eye" [6]. These concepts and mechanisms could seem to be "strange". However, "strange" could seems also the quantum proprieties of the elemental particles, which quantum physics increasingly more reveals in various experiments, like entanglement (instantaneous communication at distance) and retro-causal phenomena (the future influence the present events) [11]. Therefore, the quantum phenomena are more and more invoked to explain some intimate biologic processes [28].

Immortality is also an example which could be discussed in relation with the exposed properties of the Info-Connection pole. As during the NDEs consciousness seems to separate from the physical body, and on the other hand the information should be conserved in nature, the question which arises is if consciousness could conserve its properties coherently and independently of the physical body and for what time period [22]. Recently, there were reported new data on this field in a study of case, showing the persistence of the cerebral delta waves following the cessation of both the cardiac rhythm and arterial blood pressure [29].

The Info-Connection can explain also the religious and mysticalexperiences (RMEs) due to the protection feelings induced by the anti-entropic field, favorable to living structures, against the destructive (entropic) field of matter [8]. IC is also favorable for the meditation process, serving for stress relaxation, as a hypnotic-based palliative therapy [8,30,31]. Therefore, the associated cognitive centre was defined as I-believe (Ib), such as it is represented in Fig. 3. Recently, it was shown that a cerebral correspondent area could be identified specifically in the anterior cingulate cortex [32]. On the basis of the cognitive structure of consciousness a music-based palliative therapy procedure could be also applied [17].

Conclusions

Starting from the analysis of the specific processes implied in the transmission of information in the nervous system and by cellular inter and intra communication, there were identified two main mechanisms of transmission: electrical, along the axons of the nervous cells and non-electrical mechanism, by means of embodiment/disembodiment of information. The possibility to express in terms of information the transmission processes, starting from the virtual acquired information to the matter-related information within the frame of the epigenetic processes, there were analysed and determined the main informational components of the informational system of the human body and the corresponding functional areas in the brain.

In such way there were defined the following informational subsystems: CASI as a centre of acquiring and storing of information, with a corresponding cognitive centre Ik in consciousness, CDC – the centre of decision and command, with correspondence in consciousness by the cognitive centre Iw, IES as Info-Emotional system, correlated with the cognitive centre Il, MIS – the maintenance info-system, corresponding with the cognitive centre Ia, GTS representing the genetic transmission system, which corresponds with the cognitive centre Ic, and IGG – the info-genetic generator, corresponding with the cognitive centre Icd. The

informational structure of the informational system is completed by IC – the info-connection to the informational field of universe, explaining the religious and mystical properties and NDEs by means of the cognitive centre Ib.

The obtained results support from physiological and functional point of view the informational relations between the informational subsystems as components of the informational system of the human body, centered on the main directives of the living structures: reactivity for adaptation and survival. It was shown that these directives are fulfilled by info-connection to the environment and body itself by means of information inputs and outputs, both virtual and matter-related (genetic) information, assuring the individual adaptation and survival of the species.

Acknowledgment

In the memory of my exemplar and loved parents, the distinguished (Magna cum Laude) Professor Emanoil Gaiseanu and the distinguished (Emeritus) Professor Florica Gaiseanu, to my Brother and to All Other Members of my Family, who were part of my life.

Conflict of interests

No any.

References

1. Shannon C (1948) The Mathematical Theory of Communication. Bell Syst Tech J 27: 379-423.
2. Baars BJ (1988) A Cognitive Theory of Consciousness. Cambridge, MA: Cambridge University Press.
3. Baars BJ, Gage N (2013) Cognition, Brain and Consciousness, 2nd (ED) USA, Academic Press (Elsevier Sequoia).
4. Perlovski L (2001) Neural Networks and Intellect: Using Model Based Concepts. Oxford: University Press.
5. Chalmers D (1995) Facing up to the problem of consciousness. Journal of Consciousness Studies 2(3): 200-219.
6. Gaiseanu F (2018) Information: from Philosophic to Physics Concepts for Informational Modeling of Consciousness, Philosophy Study 8(8): 368-382.
7. Hameroff S (1998) Quantum Computation in Brain Microtubules? The Pennrose-Hameroff. 'Orch OR' Model of Consciousness. Philos. Trans. Royal Society London, Ser A Math Phys Sci 356: 1869-1898.
8. Gaiseanu F (2019) The Informational Model of Consciousness: Mechanisms of Embodiment/Disembodiment of Information. Neuro Quantology 17(4): 1-17.
9. Gaiseanu F (2017) Quantum-Assisted Process of Disembody Under Near-Death Conditions: An Informational-Field Support Model." Neuro Quantology 15(1): 4-9.
10. Gaiseanu F (2017) An Information Based Model of Consciousness Fully Explaining the Mind Normal/Paranormal Properties. Neuro Quantology 15(2): 132-140.
11. Gaiseanu F (2019) Human/Humanity, Consciousness and Universe: Informational Relation, Neuro Quantology 17(5): 60-70.
12. Gaiseanu F (2019) Language Patterns and Cognitive-Sentient Reality: Certainty/Uncertainty in Cognitive-Sentient Exploration of Reality, Chapter in Media Models to Foster Collective Human Coherence in the psychecology, (Ed) Stephen Brock Schafer, USA, IGI Global.
13. Meijer D (2013) Information: What Do You Mean? On the Formative Element of Our Universe. Syntropy 3: 1-49.
14. Kaku M (2014) The Future of the Mind, The Scientific Quest to Understand Enhance and Empowered the Mind, NY, London, Toronto, Sidney Aukland: Doubleday, Division of Random9 House Canada, Toronto, Penguin Random Hose Companies, Twin Revolution.
15. Zhang Y, Kim MS, Jia B, Yan J, Zuniga-Hertz PJ, et al. (2017) Hypothalamic stem cells control ageing speed partly through exosomal miRNAs. Nature 548: 52-57.
16. Gaiseanu F (2018) Destiny or Free Will Decision? A Life Overview from the Perspective of an Informational Modeling of Consciousness Part II: Attitude and Decision Criteria, Free Will and Destiny. Gerontology & Geriatric Studies 4(1): 1-7.
17. Gaiseanu F, Graur A (2018) Cognitive Centers Related Attitude: Application for an Iterative Evaluation Method in Music-Based Therapy Process. Abstract Book of the Conference on Science of Consciousness (Co-Chair Prof. Stuart Hameroff, The University of Arizona-Center for Consciousness Studies, Tucson, Arizona). Consciousness and Education-Cognitive Development, Concurrent Session C27, 165: 2-7.
18. Gaiseanu F (2019) Destiny or Free Will Decision? A Life Overview from the Perspective of an Informational Modeling of Consciousness Part I: Information, Consciousness and Life Cycle. Gerontology & Geriatric Studies 4(1): 1-7.
19. Gaiseanu F (2018) An Informational Modeling of Consciousness and Cognitive Centers. Proc. of the Human Project Brain (HPB) International Conference: Understanding Consciousness, a Scientific Quest for the 21st Century. 04-Models, simulation and emulation of consciousness, Barcelona: 21-22.
20. Gaiseanu F (2016) Consciousness as Informational System of the Human Body. Consciousness and Life Physics, Cosmology and Astrophysics Journal 16(1): 14-25.
21. Gaiseanu F (2016) Informational Subsystems of the Consciousness. The Science of Consciousness, Abstract Book, TSC 2016 TUCSON. Ed. The University of Arizona Center for Consciousness Studies and University of Michigan Center for Consciousness Science, by Stuart Hameroff (The University of Arizona) and George Mashour (University of Michigan).
22. Gaiseanu F (2018) Near-Death Experiences and Immortality from the Perspective of an Informational Modeling of Consciousness. Gerontology & Geriatric Studies 2(3): 1-4.
23. Aharonov Y, Popescu S, Rohrlich D, Skrzypczyk P (2013) Quantum Cheshire Cat. New Journal of Volume Physics 15: 1-5.
24. Hajdukovic D (2013) Can Observations Inside the Solar System Reveal the Gravitational Properties of the Quantum Vacuum? Astrophys Space Sci. 343: 505-509.
25. Gaiseanu F, Sachelarie M, Sachelarie D, Esteve J (1997) Analytical Modeling of the Gold Diffusion Induced Modification of the Forward Current Density Through the p-n Junctions. Solid State Phenomena 37-38: 525-530.
26. Gaiseanu F (2013) Contributions to the Modelling and Simulation of the Atomic Transport Processes in Silicon and Polysilicon and Applications. Proceedings of the Romanian Academy, Series A 4(4): 376-384.
27. Gaiseanu F (2017) Modeling and Simulation of the Impurity Diffusion and Related Phenomena in Silicon and Polysilicon Systems in Microfabrication and Micromachining Technologies. Annals of the Academy of Romanian Scientists, Series on Science and Technology of Information 10(1): 41-78.
28. Tarlaci S (2011) Quantum physics in living matter: from quantum biology to quantum neurobiology. Neuro Quantology 9(4): 692-701.
29. Norton L, Gibson R, Gofton T, Benson C, Dhanani S, et al. (2017) Electroencephalographic Recordings During Withdrawal of Life-Sustaining Therapy Until 30 Minutes After Declaration of Death. The Canadian Journal of Neurological Sciences Inc (Can J Neurol Sci) 44: 139-145.
30. Satsangi AK, Brugnoli MP (2018) Anxiety and psychosomatic symptoms in palliative care: from neuro-psychobiological response to stress, to symptoms' management with clinical hypnosis and meditative states. Annals of Palliative Medicine 7(1):75-111.

31. Brugnoli MP, Pesce G, Pasin E, Basile MF, Tamburin S, et al. (2015) The role of clinical hypnosis and self-hypnosis to relief pain and anxiety in severe chronic diseases in palliative care: a 2-year long-term follow-up of treatment in a nonrandomized clinical trial, Ann Palliat Med 1-17.

32. Inzlicht M, Tullett A, Good M (2011) The need to believe: a neuroscience account of religion as a motivated process, Religion, Brain & Behavior 1(3): 192-251.