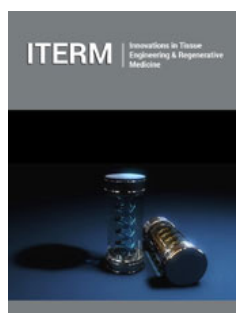


Do Cells of Biosystems Exhibit Intelligence?

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Opinion

“Cell intelligence: The cause of growth, heredity, and instinctive actions, illustrating that the cell is a conscious, intelligent being, and, by reason thereof, plans and builds all plants and animals in the same manner that man constructs houses, railroads, and other structures.” Quevli Nel [1]. In the realm of biology, the term intelligence represents the level of adaptability of a biosystem to the existing environmental conditions and to sustain. This adaptability is in relation to know, understand and sense the cues arising due to the changes in the internal and the environment and deliverance of responses. These stimuli may be physiological, environmental, external and internal, while responses are rational or irrational and appropriate or inappropriate. The process of responding is a cognitive nature and involves identification of stimulus or a cue, think about the related alternative, selection of suitable alternative by weighing the concerned evidence, and evaluation of results prior to deliver the reaction. The higher animals exhibit cognitive behavior.

The term cognition expresses thinking and awareness [2]. This helps the survival and sustenance of a biosystem in a given environment. Thus, live forms need varying degree of cognitive abilities at various levels. Such cognitive abilities relate with intelligence [3,4]. An organism exhibits plastic behavior. This type of behavior develops as a result of experience gained from the sensing stimuli caused due to changed environmental conditions. Quite often, a set behavior shows modifications in short duration. These modifications are internal or external or both, and morphological and physiological in nature. Learning process comprises of collecting, analyzing the information, and comparing with the earlier information. Perception involves reception of information through sense organs and help in delivering the response or results in interaction of the individual with the environment or changes occurring therein. The memory is the collected information or stored information. It also helps in encoding, retrieving the information and is based on the learning, retention, of the previous and current knowledge [2,5].

Commonly, one relates intelligence with brain, at least among higher animals. A vertebrate body has very complicated network comprising of nerves and neuro-hormonal specific pathways. A well set cellular communication pattern and specific set of cellular hormones play essential role and accomplish the intelligence behavior in a biosystem. A cell membrane has the ability to sense, interpret the messages during cellular communication, and deliver response with respect to the cues (zeitgebers). The cells of a biosystem respond to the physicochemical and physiological changes in the internal and ambient environments.

These changes depend on the nutrients from the diet and cues received from the environment. Unicellular organisms and cells of multicellular organisms exhibit cognitive behavior in their physiological niche. This reflects on the existence of some sort of ‘feedback

system' that retains self-control at cellular level. The process of self-regulation with respect to the ambient environment is of common occurrence. This functionality is different than the functionality of brain. The microorganism exhibits intra-neuronal interaction; this may suggest functional moderation in mind. A biosystem models are the molecular devices.

Thus, to a molecular biologist life appears to be complex combination of coded interactions [6]. To a living system, nutrition acts as sources of metabolites like minerals, fats, water. These components provide specific charge, energy, and frequency required for the vital functions at an optimal level to an organism. The living biosystems have ability to utilize the components provided and/or metabolized from the nutrients. In case, a cell fails or become deficient to use these nutrients there is a decline in its degree of wellbeing and it does not show normal interactive tendency or intelligent behavior.

This indicates that healthy cells are intelligent in comparison to the deficient cells. The minerals, water and gases like CO₂ and O₂ are the sources of metabolites while solar radiations and chemical energy provides the required energy needs. A biosystem deficient in nutrition find it difficult to response to the changed conditions. Water provides the specific degree of hydration and helps to maintain appropriate degree of molecular, biochemical, and physiological interactions. It is also maintains optimum turgidity, osmotic pressure, dispersibility, etc. The physicochemical parameters such as charge, energy and the frequency etc., initiate, and regulate the activities in a biological entity [7].

Cells present in multicellular organism along with the extracellular matrix play significant role during the cellular behavior. The components of Extracellular Matrix (ECM) like collagens, elastins, proteoglycans, chondrin sulphate, dermatin sulphate, heparin sulphate, keratin sulphate, fibronectin, laminin etc., are effective participants during repairing, regeneration, physiological processes like homeostasis, and pathological conditions. These regulate the behavior of cell associated with extracellular matrix [8]. Cellular components exhibit an excellent efficiency to sense the changes in their environment and the physical and physiological fluctuations via mechanotransduction. In this process the cell receptors, ion-channels, integrin and other related molecules play an effective functional roles [8,9]. Cellular intelligence is expressed when a cell senses the broken ends of nucleic acid, wrongly folded protein molecules or disassembled biomolecules and then its efforts to repair the broken end of nucleic acids, rectifies disoriented biomolecules. This cellular behavior may be looked like their ability to detect defects, sense them, make decision to rectify these disoriented discrepancies, i.e., ability to make decision and carry out them to retain the normal biomolecular status [10]. This complete process is likely to be a part of allostasis that helps a specific homeostatic level at cellular, organ and system levels. One must note that these phenomena follow time and length scale concept [11,12]. When a cell undergoes stress caused because of the abnormal cue generated in the ambient environment and cell

cope with this stressful situation and quite often it manages to withstand, surmount, and becomes normal. This effort constitutes a part of repairing, regeneration, and/or reviving process; such activities reflect on the cellular intelligence [11,12].

Biological matter is conglomerate of physical matter involving chemical components. This physical aspect exhibits most of the physical features like elasticity, plasticity, thermal, electrical or electrostatic nature and specific structural atomic configuration. The matter exhibits ubiquity of physical continuum in the form of some degree of physical attraction or repulsion and interaction among themselves and others. Some of the fundamentals like quantum mechanism, tunnelling effect, inter and intramolecular bonding, surface area, hydrophobicity, hydrophilicity, net charge, and application of equilibrium affect the behavior of atoms and molecules within biosystems or outside it [13]. Forces like electrostatic forces (Coulomb forces), van der Waal forces (along with their Keesom forces, Debye forces, and London dispersion forces) play major role in the stabilizing covalent bonds, surface chemistry, electron transfer and distribution, atomic and molecular architecture, excitation, quenching, dispersibility, solubility, etc., phenomena which occur during the atomic and molecular interactions [13-18].

These parameters play a basic functional role during their interactive molecular behavior. The molecular behavior seems to be an integral process among cellular intelligence. There exist specific structural and functional characteristics of the molecules and these relate to their typical spatial orientation of specific interacting atoms and molecules. These features help to perpetuate process like allostasis, decay, apoptosis, and cellular communication. These processes function on the bases of the spectral coherence and decoherence frequency bands of such molecules and these are responsible for the quantitative physical resources. The specific arrangement of electromagnetic force frequencies act as the basis of the functional quantum wave equation having specialized distribution of energy that supports quantum participation in the prevailing molecular set-up. Thus, the comprehensive molecular status shows a protocol script that provides the information about the cellular biological set-up in given biosystem [19].

In conclusion, the conformational aspects, types, strength of bonds, of the atoms in biomolecules play major role during their interactions. Their physicochemical behavior is the reflection of these interactivities and it in turn indicates the intelligence of the molecules and that leads to the cellular intelligence. Artificial intelligence is the performance of machines based on the data fed while biological intelligence is an innate ability in an organism. Further related investigations will lead to the understanding of cellular behavior and intelligence during various pathogenesis and stresses.

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