

Opinion Article

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Underlying Humanities in a Molecular Cell

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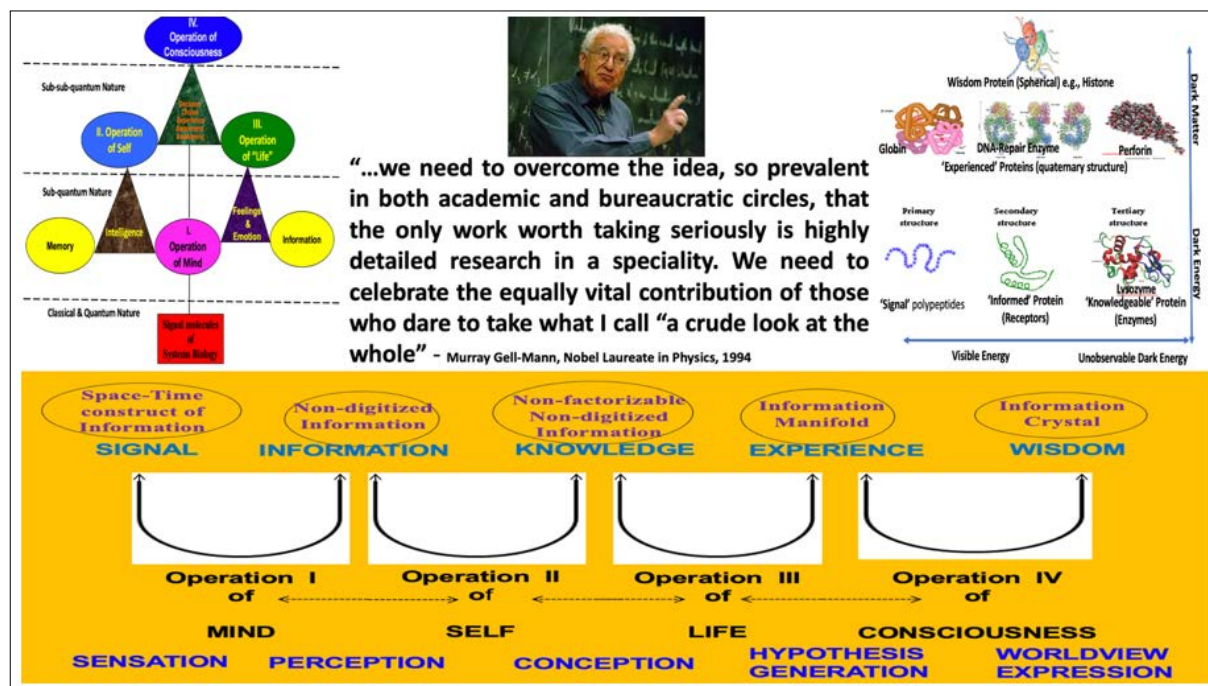
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While science is mandated for discovering “life”, we are engaged in the ‘chemistry-as-life’ or ‘physics-as-life’ paradigm with machine-metaphor everywhere! The whole explanation of photosynthesis by plants and quorum sensing in the bacterial colony is based on chemistry and physics. The focus is on signal-based automated molecular robots directed by the molecular clock and molecular memory ignoring the obvious, the autonomous behavior of a cell. Machine learning is preferred to the way a cell learns! Synthetic biology and artificial life are diamond points in cell science!

The evidence that a single cell is conscious, has free will, can learn, takes decision, and communicates and exchanges with its colleagues comes from the recently published seven papers. Beckman and Latty [1] report *Physarum polycephalum* finding the shortest path through a maze, constructing networks like humans, solving computationally difficult puzzles, making multi-objective foraging decisions, balancing nutrient intake, and often behaving irrationally. Tang and Marshall [2] highlight the behavior of bacteria or protists, free-living single-celled organisms coping with varying environments, locating prey and potential mates, and escaping from predators similar to any free-living animal. Dexter et al [3] communicate the hierarchy of complex avoidance behavior by unicellular *Stentor roeseli*. Schenz et al [4] communicate the ability of slime moulds and ciliates to integrate complex spatial information. Chaehwan et al [5] publish how the senescent cell’s extracellular vesicles (EVs) promote the senescence of other cells. Nonsenescent cells’ EVs are seen to rejuvenate senescent cells. Lanna et al [6] report gifting of telomeres by APC to T cells to keep T cells young! Could all such complex cognitive activities and behavior be explained by the molecular assembly, automation, and robotic intelligence? To solve these problems there are attempts to rely on AI e.g., producing a computational model of multilevel development of cognitive abilities in an artificial neural network [7]. The author, however, prefers a different track to explain such behaviors accepting the view that attributes of the human psyche such as mind, information, self, life, and consciousness are already present in a single cell, and each of them has molecular correlates.

Communication in robotic intelligence is signal-based, automated, and can be expressed by an algorithm. Communication in cellular intelligence is based on information, that is autonomous. Information's flowchart demands not an algorithm but an organogram. What converts a signal into a piece of information is what in popular language has been called the mind. A cell is a self-organizing system with a reversal of the second law of thermodynamics. The underlying logic and the ethics a cell follows in behavior supposedly originate from this self-sense. Its ion pumps maintain the cell's ionic self-identity! On the difference between self-pattern and damage-associated molecular pattern or pathogen-associated molecular pattern, the immune system is initiated to act. HLA molecules found in the cells bring a specific kind of self-identity. The characteristic of "Life" is homeostasis, not merely confined to the metabolism. An entity that can maintain homeostasis in the context of uncertainty-certainty, symmetry-breaking, and symmetry-making, and consumption of non-observable (dark) and visible energy is considered alive. Cells could withstand uncertainty produced by oxidative stress, metabolic stress, and endoplasmic reticular stress. A cell could retain symmetry in mitotic catastrophe and apoptotic crisis. Emotion, another characteristic of 'life', is exhibited by the macrophage, during 'frustrated phagocytosis', a pathogenetic mechanism for occupational lung disease especially asbestosis. A lively cell is nonviolent, takes care of itself by self-defense. When a cell becomes violent, it is a disease state such as hemophagocytic syndrome. The interconvertibility of visible energy and non-observable energy helps protein structurization. The brain constitutes 2% of body weight but consumes nearly 20% of cardiac output. Where is this visible energy consumed? Most likely in the thinking process, to extract information from a signal, to build up knowledge from information, to develop experience from the accumulated knowledge, to crystalize wisdom from life-experiences! A neuron consumes more observable energy than a non-thinking cell like an astrocyte that produces ATPs for neurons. Information, mind, self, and life are the faculties of systems psyche depicting the underlying humanities in cell science. Cellular consciousness (the popular name of which is protoplasm) coordinates their operations. Three attributes of human consciousness namely cognition, will, and feeling/emotion, are also observed in the behavior of a cell. We have cited evidence on this line. Cells have a will. It makes decisions on cell division or apoptosis. Cells can learn. Cell expresses emotion. The author has published this hierarchically structured labyrinth of cell psychology and suggested their representations at the biochemical/molecular level in several papers of which three [8,9,10] are referred to at the end.

The presentation is concluded with a research hypothesis that the molecular robots within a cell carry out their perfected mechanical behavior under the guidance of proactive elements such as information, 'life', mind, self, and consciousness.

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