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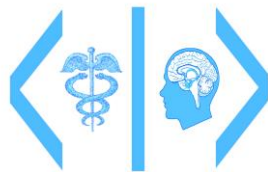
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quantum paradigms of psychopathology

The Palermo Declaration

On this day of April 27, 2013 a core international group of investigators (Aramini, Bernroider, Cocchi, Gabrielli, Globus, Malik, Mender, Mullis, Pessa, Pregmolato, Pylkkänen, Rasenick, Tonello, Tuszynski, Vitiello, Werneke, Zizzi), with expertise in the fields of psychiatry, biochemistry, physics, computational neuroscience, mathematics, philosophy and theology, gathered in Palermo, Sicily, to assess the potential relevance of quantum physics and quantum chemistry in augmenting the assumptions of non-quantum biophysics and biochemistry aimed toward understanding mind-brain relations in normal and abnormal states of consciousness applicable to humans and non-human animals. It can be stated that

Recent progress of a restricted kind in mainstream consciousness research has proceeded rapidly due to dramatic technical improvements in relevant empirical research tools. Classical biophysics, which provides the paradigmatic foundation of mainstream consciousness research, has offered bountiful correlations between subjective reports of qualitative human experience and quantitative measurements of objective physical processes. However, these merely correlative advances have not at all addressed what David Chalmers has termed the “Hard Problem” of mind-brain relations by bridging what Joseph Levine has called the “Explanatory Gap” between qualitatively subjective phenomenal experience and quantifiable objective physical events. So far no explanatory bridge between consciousness and corporeal neural tissue has issued from the classical biophysics of mind and brain in homo sapiens, and, in research on non-human subjects precluding self-reports via human language abilities, even correlations have remained substantially elusive. Quantum approaches may offer greater latitude in addressing these classical deficiencies, to the extent that at least some latent links formally exist between the qualitative dimensionality and quantitative measurability of canonically conjugate quantum observables, whereas no such formal links are required with reference to the possessed observables of classical physics. Moreover, at least one interpretation of quantum measurement as formulated by John Von Neumann casts the measuring agency itself as subjectively conscious per se, in contrast to an absence of any such classical notion.

Quantum generalization of classical biophysics opens up the possibility that relevant brain processes may reach both beneath the scale and beyond the boundaries of discrete neurons and the synaptic connections among those classically cellular “nodes.” Quantum-germane structures and dynamics within the brain may include superposed dimeric tubulin conformations in the microtubular cytoskeleton spanning both intraneuronal and interneuronal spaces, ordered water in relation to cytoskeletal proteins, membrane channels and lipids along with their second messenger pipe lines to neuronal interstices, and solitons communicating along cytoskeletal routes between classical and quantum aspects of brain function. Max Tegmark’s objections to the thermodynamic feasibility of such quantum structures and processes surviving thermal decoherence at biological temperatures entailing orders of magnitude comparable to those within the human skull have been thrown into doubt by the recent work of Gregory Engel’s group, which demonstrated non-trivial quantum computation in photosynthesis. The ubiquity of water, cytoskeletal tubulin, membrane lipids, and second messengers in non-human life suggests that a new biophysics accounting for quantum-generalized processes in living tissue may lead to future predictions about consciousness not only in human beings but also in organisms lacking any semblance of human brain architecture at the level of organized neuronal networks or “higher.”

Emmanuel Pothos and Jerome Busemeyer have presented abundant empirical evidence that properties of normal mental life may be more parsimoniously modeled by abstract quantum formalisms than by classical computational algorithms. The quantum wetware outlined above is more compatible with these formalistic findings than is any classical model of neural biophysics. Both quantum-logical and quantum-physical approaches to mind and brain also promise to generate avenues for better comprehension of neurophysics in psychopathology. Explanatory and even psychotherapeutic opportunities may emerge from considerations of superpositional logic and malattunement in the primary process thinking of schizophrenia, Everett’s quantum ontology in the “alternate worlds” of psychotic perception, and membrane and second-messenger interfaces between serotonin biochemistry and quantum-microtubular nanowire dysfunction in mood disorders. Aberrations of scale emergence in quantum thermofield phase transitions and problematic barriers to Bohmian holism may be important in multiple forms of mental illness.

We declare the following: “The absence of neurons and their synaptic connections does not preclude the presence of at least rudimentary phenomenal experience in organisms endowed with superposed microtubular dimers, ordered water, membrane ion channels, and/or crucial lipid raft assemblies connected to selected second messenger systems. In addition, quantum-biophysical aspects of these and/or other yet undiscovered structures and related processes may prove to be potent factors in the deeper etiologies and improved treatments of psychiatric disorders.”