The Penrose-Hameroff Orchestrated Objective-Reduction Proposal for Human Consciousness is Not Biologically Feasible

JEFFREY REIMERS, LAURA MCKEMMISH, NOEL HUSH, The University of Sydney, ROSS MCKENZIE, ALAN MARK, The University of Queensland — Penrose and Hameroff have argued that conventional models of brain function based solely on neural linear-computational elements cannot account for human consciousness, claiming instead that quantum-computation elements are required. Specifically, in their Orchestrated Objective Reduction (Orch OR) model it is postulated that microtubules act as quantum processing units, with individual tubulin dimers forming the computational elements. This model requires that tubulin is able to switch between alternative conformational states in a coherent manner, and that this process be rapid on the physiological time scale. Here the biological feasibility of the Orch OR proposal is examined in light of recent experimental studies on microtubule assembly and dynamics. It is shown that tubulins do not possess essential properties required for the Orch OR proposal, as originally proposed, to hold. Further, we extensively consider the likelihood of Fröhlich condensates producing coherent motions in biological systems, a feature critical to Orch OR, and show that no biologically feasible reformation of the proposal could lead to the production of a quantum processor. Hence the Orch OR model is not a feasible explanation of the origin of consciousness.