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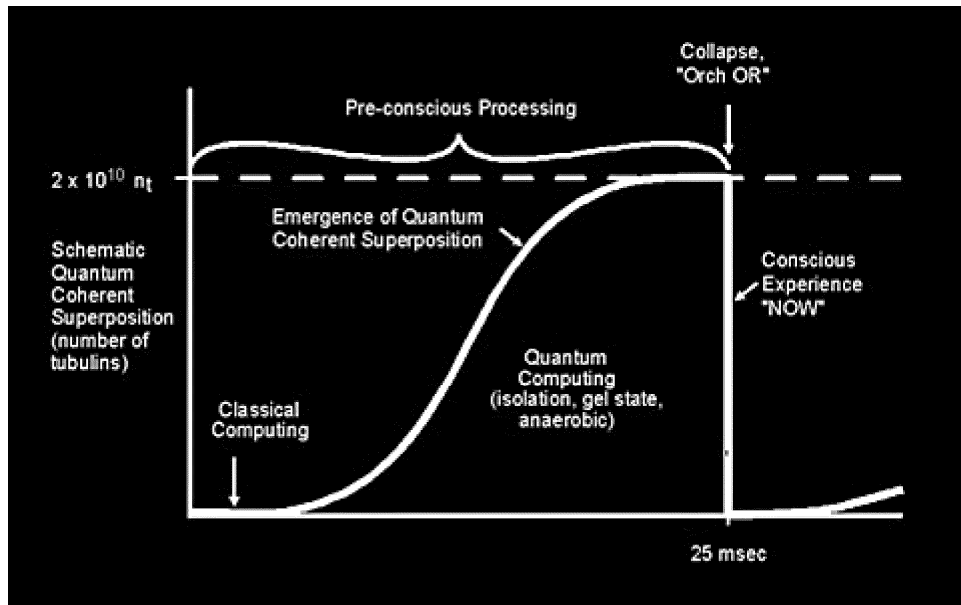
Summer 2004, Volume 3, Number 5

A Critique of the Hameroff and Penrose Theory of Consciousness

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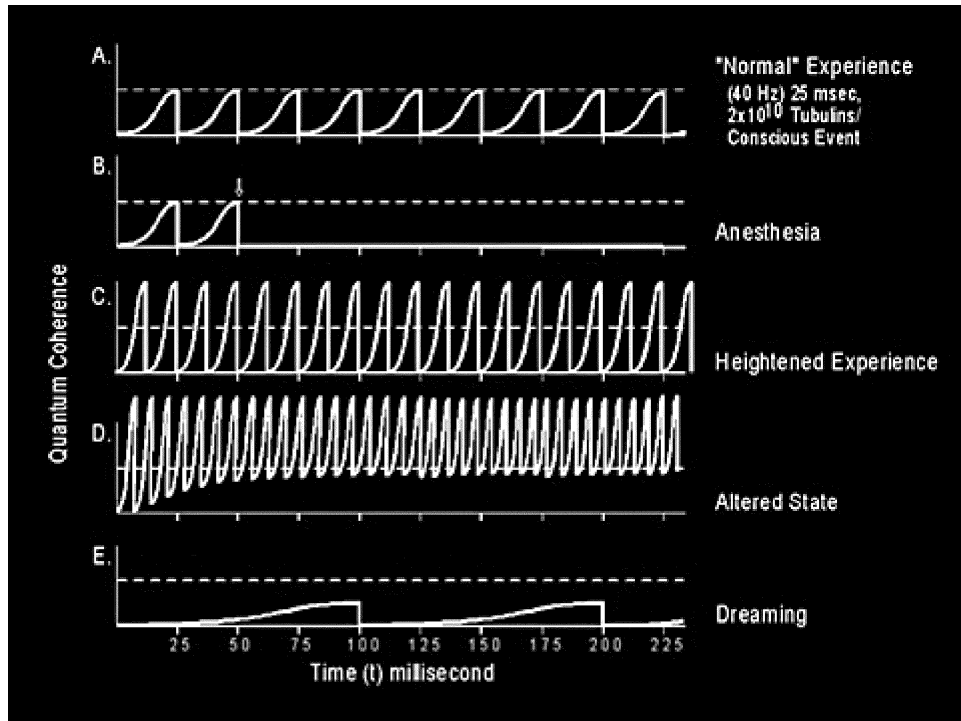
The quantum theory of consciousness as presented by Penrose and Hameroff, otherwise known as "orchestrated objective reduction" or Orch OR, suggests that consciousness is a series of quantum phenomena observable at the microtubule level of neuron structure. The microtubule, Hameroff contends, is the locale for quantum superposition/collapse. While conventional explanations portray consciousness as an emergent property of classical computer-like activities in the brain's neural networks, the quantum theory of consciousness attempts to apply the findings of quantum physics to the 'hard problems' of awareness, namely, issues pertaining to free-will, subjective conscious experience, and binding unity. Hameroff argues that reductionistic and emergent theories of consciousness fail to adequately account and explain these difficult problems of mental phenomena. Orch OR attempts to tackle the elusive conundrums of conscious experience with the use of ideas related to space/time geometry, quantum electrodynamics, and quantum field theory. However, Orch OR may not adequately apply quantum dynamics to the electrical, biological, and chemical construct of the brain as a whole. While quantum processes may indeed occur at the level of microtubules, theorists who apply quantum physics to the brain need to consider the potential ramifications of quantum events occurring at each and every level of neural communication. Quantum applications to brain theory need not be isolated to the microtubules. Instead, each structure of the brain's anatomy can be viewed as a quantum event.

As the graph below shows, there is a brief moment of pre-conscious processing where superposition of various possibilities occurs. During this brief moment of pre-conscious activity, the brain considers several options simultaneously. Hameroff uses the recognition of faces as an example to depict the nature of this pre-conscious processing. As we gaze upon the face of a person, our minds begin to quickly search the internal memory of known faces. Perhaps ever so briefly, our minds are presented with names and faces of three persons simultaneously. Then, quantum collapse occurs and we now clearly recognize the face in our field of vision. Hameroff appears to suggest that this mental process is prior to the conscious experience of 'NOW.' Yet, most of us seem to be quite aware of this so-called 'pre-conscious processing.' We vividly experience the mental pictures of Amy, Betty and Carol as options in present conscious awareness. Our minds may quickly process these possibilities, but they seem to be quite clearly a part of present consciousness nevertheless.



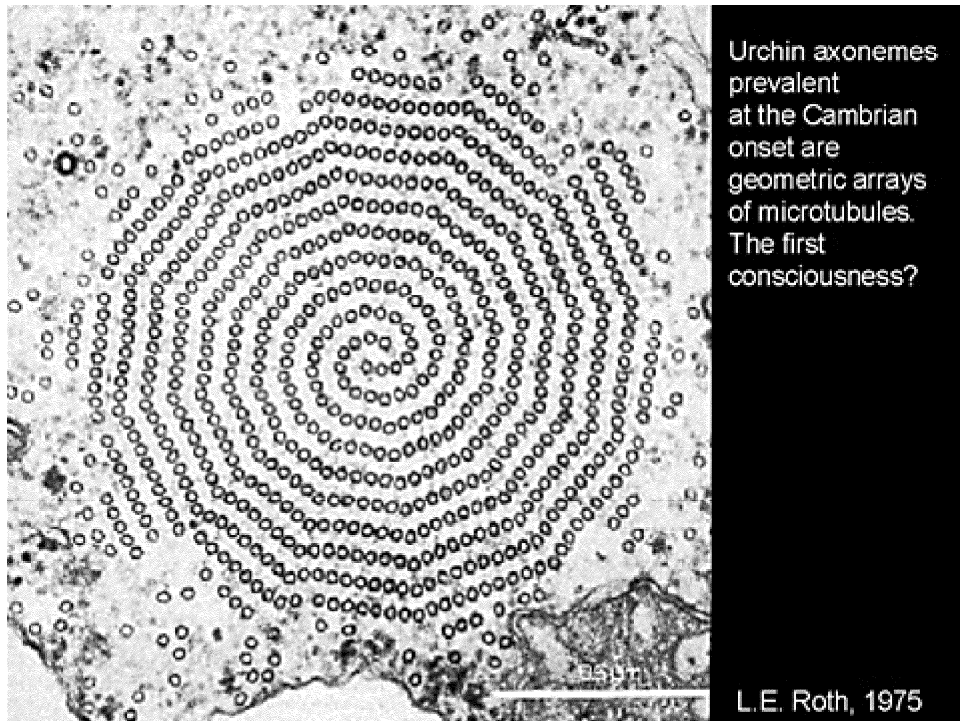
source: http://www.consciousness.arizona.edu/hameroff/slide%20show/slideshow_7.htm

Hameroff proceeds in his depiction of Orch OR by attempting to show its application to the problem of free-will. Instead of using faces, Hameroff uses the example of a person who is choosing between three different dishes, namely, sushi, shrimp, and pasta. During pre-conscious processing, the three dishes are presented apparently unconsciously. Then, quantum collapse occurs and the choice of sushi is finally made. Once again however, the survey of choices appears to occur in present conscious experience rather than as a pre-conscious activity. We seem to know that we are considering whether we want sushi or pasta- we are fully aware of this decision-making process. If this is indeed the case, where does the quantum collapse occur? Sometime during pre-conscious processing? Before? After? And perhaps more importantly, if we are not entirely aware of our pre-conscious activity prior to present consciousness, have we freely made a decision? Can free-will be maintained when we are not fully aware of all of our options? While a quantum collapse may occur at this level of mental functioning, it must happen more frequently and during so-called 'pre-conscious processing.'



source: http://www.consciousness.arizona.edu/hameroff/slide%20show/slideshow_7.htm

In the graph above, Hameroff applies the Orch OR theory of consciousness to five separate modes of conscious experience. He suggests that while under anesthesia, the superposition and subsequent collapse is interrupted at the level of the microtubules where the individual becomes no longer aware of their surroundings, feelings of pain, etc. During heightened experience, quantum collapse occurs more frequently as the mind processes larger and more complex packets of information. With the onset of altered states of consciousness induced by psychedelics and/or meditation, superposition occurs at its swiftest rate. And finally, in the dream state, superposition is extended over a relatively long period of time and quantum collapse occurs more slowly. Unfortunately, the connection between chemical and quantum processes in these instances appear to be poorly linked. Does the introduction of chemicals into the brain alter the quantum process? According to Hameroff, apparently so, but is it in terms of speed only? The conscious experience of time is a strange and interesting anomaly. During sleep, time seems to fly by and while in altered states, time appears to cease altogether. Is it fair and accurate to suppose that these inner conscious experiences of time correlate to the rate of quantum superpositions? How do we adequately account for the relativity of time in conscious experience?



source: http://www.consciousness.arizona.edu/hameroff/slide%20show/slideshow_9.htm

Hameroff also uses the Orch OR theory to speculate upon the origins of consciousness in evolutionary history. Consistent with his idea that consciousness is in a direct relationship and correlation to microtubules, Hameroff contends that the explosion of Cambrian life, which occurred approximately 540 million years ago, is the point at which consciousness first appeared in the known universe. Prior to this time, microtubules had not evolved sufficiently to procure conscious awareness of any significant magnitude. Although eukaryotes, sponges, algae and other simple celled-organisms existed prior to this time, Hameroff suggests that these forms of life did not possess consciousness in any discernable sense. Yet, the principles of quantum physics are equally present in the human brain as they are in the tape worm or single celled organism. If the universe is holographic in the sense that each particle of space/matter contains within it information about the whole, there is arguably a continuity of consciousness throughout all of space/time and throughout the vast history of the evolving universe. In such a perspective, consciousness is latent in all forms of life and matter rather than being an endowment of post-cambrian life exclusively. While there may have been a rather miraculous shift in the embodiment of consciousness during the Cambrian explosion, the precursors to small worms and urchins may have had their own forms of consciousness not accounted for by microtubule structure. Furthermore, we are left with the perplexing question about the manner in which consciousness could have evolved out of the unconscious. If consciousness was not present at the beginning of the universe, how did it come to be?

Application of quantum physics to theories of consciousness is an exciting and potentially paradigm shifting mode of inquiry. Our understanding of quantum phenomena continues to be in its infancy. As our knowledge of quantum physics deepens and extends in the years to come, we will be better equipped to use such insights in our passion to comprehend the mysteries of the mind and human consciousness. Hameroff and Penrose's theory of orchestrated objective reduction is one such attempt to use our knowledge of the physical world to peer into the nature and mechanisms of the mind. Yet, we must become more fully aware of the quantum complexity and totality that supports all levels of biological being. The human brain is perhaps the most complex material form in the visible universe. Our knowledge of biology, physics, and chemistry must integrate to form a seamless coherent whole to understand the dynamics of consciousness. As we plumb the depths of our increasing knowledge as a

species about ourselves and the world around us, we may catch a brief glimpse into the ultimate origins of consciousness and the evolutionary drama that continues to bring consciousness to fruition. Or perhaps we must transcend human knowledge altogether and enter supra-rational consciousness to fully comprehend the majesty of being aware.

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