Postgraduate Biophysical Seminars
Institute of Biochemistry and Biophysics, University of Tehran, Iran
1395-96b

Quantum Biology

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"Presented at the Postgraduate Biophysical Seminars, Winter 95 (2017)"

Abstract

Introduction: It seems that since the focus of study in biology is on a different scale from quantum mechanics, there is no room for non-classical physics in biological study. Moreover, living systems like cells are too complex to be investigated by such mechanics in all details, specially with the ever fluctuating and the unstable conditions in living world which is in sharp contrast to fully controlled fundamental physics laboratories. However, recent studies have revealed some exciting processes in living organisms that cannot be explained unless with the help of quantum mechanics. Interestingly, these quantum effects, including quantum coherence in long lasting time scale, are among the abstruse phenomena in quantum description.

Methods: The quantum coherence effect has been shown by measuring the light harvesting efficiency and the coherence time of isolated PSII complexes stimulated by laser pulses. Models based on the resonance effect of singlet-triplet transition suggest a magnetic compass based on a radical-pair are consistence with the experiments; Orientation of avian migration is affected by the angle of an applied exterior oscillating field with respect to the geomagnetic field.

Results and Discussion: Though the unexpected observation of coherence at room temperature is itself remarkable, its not clear weather the small boost in efficiency of light harvesting as a result of coherence can have evolutionary advantageous.

Conclusion: Recent approval of long range effect of quantum concepts like quantum entanglement in distant systems extends the realm of quantum studies into larger worlds. The examples of the most evident of these processes, which are the focus of this paper, are light harvesting in photosynthesis, avian use of magnetoreception in migration and olfactory receptors.

Keywords: Quantum Entanglement, Magnetoreception, Quantum Coherence, Tunneling, Radical Pairs, Light Harvesting

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