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Quantum Life: How photosynthetic organisms use quantum coherence to enhance the efficiency of energy transport

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Femtosecond spectroscopy reveals significant quantum coherence in excitonic transport in photosynthetic organisms. How and why are living systems using quantum mechanics? This talk presents a simple theory of how to optimize energy transport in quantum systems that possess noise and disorder. Too much quantum coherence leads to destructive interference and localization, while too little coherence prevents energy from moving at all, via the watchdog or quantum Zeno effect. With just the right amount of quantum coherence, however, energy can move through photosynthetic complexes with almost 100% efficiency. This talk explains how plants and photosynthetic bacteria attain such high efficiencies for energy transport, and discusses how human-made systems could be designed to attain similar efficiencies.