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The control of electron transfer pathways in biomolecular systems: the role of fluctuations

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Electron transfer reactions are ubiquitous in biology. They are observed in both protein and DNA systems. Biological electron transfer mechanisms range from tunnelling to thermally activated hopping. Due to the floppiness of biomolecules, molecular motion is an important determinant of the electron transfer rate. The electronic couplings that enable electron transfer in biomolecular systems can be understood in terms of competing and interfering electron transfer pathways that are controlled by structure, dynamics, and initial state preparation. We review recent theoretical progress on the effects of conformational distributions, excited-state polarization, and electron-nuclear dynamics on tunneling electron transfer reactions in different biomolecular systems. We discuss how electron-transfer-rate control can be achieved in the presence of a highly fluctuating environment.

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- [2] I. A. Balabin, D.N. Beratan, and S. S. Skourtis. The persistence of structure over fluctuations in biological electron transfer reactions. *Phys. Rev. Lett.* 101, 158102 (2008).