Final Report

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Theory of Electron Transfer in Complex systems

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This research grant is the most recent of a continuous series of grants from the Department of Energy supporting our theoretical efforts to understand various electron transfer processes. In part, my research on this topic has focused on distributions of electric fields [4, 5, 6], as it is these fields that drive electron transfer. Additional focus has been concerned with kinetics [1-3, 8, 11], as the rates of electron transfer are central to the utility of electron transfer. Finally, we have found that the theoretical tools we originally developed to treat electron transfer can be suitably applied to understand the workings of molecular motors [7, 9, 10].

I believe the most promising work supported with this grant is our collection of papers on disordered systems [4, 5, 8, 11]. The first two of these were concerned with static aspects of disorder, namely the effects on reorganization energies and capacitance due to frozen inhomogeneities. The last two of these are concerned with the slow dynamics by which long-lived inhomogeneities age. Inhomogeneities of appropriate size and spatial composition can be exploited to make energy efficient devices, but the useful lifetime of these devices can be limited by rates of disassembly. As such, our research on this topic may be of use in designing advanced materials for the future.

Papers published reporting research supported by this grant

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9. Sun, S., A. Dinner, D. Chandler and G. Oster. Elastic energy storage in beta-sheets with application to F1 ATPase. *Eur. Biophys. J.*, **32**, 676-683 (2003).
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