DNA-Mediated Charge Transport Chemistry and Biology

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Abstract
A range of photophysical and biochemical experiments have been conducted to establish DNA charge transport, to probe those parameters that influence DNA-mediated charge transport, and to explore the biological applications and consequences. Charge migration through the DNA base stack has been shown to result in oxidative damage 200 Å from the site of the remotely-bound oxidant, but this long-range reaction is exquisitely sensitive to perturbations in the intervening base stack. Spectroscopic measurements provide the timescale for the transfer between bases and highlight the dependence of coupling through the base stack on base dynamics. In exploiting the sensitivity of DNA charge transport to base pair stacking, DNA electrodes have been designed that detect, with high sensitivity, single base mismatches in DNA, as well as protein-dependent changes in DNA stacking. How proteins modulate long-range DNA charge transport has also been examined, and, in exploring charge transport within the biological milieu, oxidative damage to DNA within the cell nucleus is being probed.