

DNA-mediated Charge Transport Chemistry and Biology

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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 consequences and applications. 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. DNA-modified electrodes have been constructed that exploit this sensitivity of DNA charge transport to perturbations in base pair stacking. DNA chips have been designed using electrocatalysis that detect with high sensitivity all single base mismatches in DNA. In addition protein-dependent changes in DNA stacking can be monitored electrochemically using DNA films. Hence this chemistry offers a completely new approach to genomic and proteomic analysis. Charge transport is also now being probed in experiments which measure oxidative damage to DNA within the cell nucleus.