Abstract Submitted
for the TSF11 Meeting of
The American Physical Society

Fundamentals of Charge Transport through DNA JASON SLINKER, The University of Texas at Dallas, NATALIE MUREN, SARA RENFREW, JACKIE BARTON, California Institute of Technology, CHRIS WOHLGAMUTH, MARC MCWILLIAMS, The University of Texas at Dallas — Achieving charge transport (CT) through DNA comlements its inherent biological recognition capabilities and its unmatched capacity to be patterned into precise, nanoscale shapes. We have probed the length and temperature dependence of DNA charge transport with DNA-mediated electrochemistry. Cyclic voltammetry of 100-mer and 17-mer DNA monolayers on gold revealed sizable peaks from distally-bound Nile Blue redox probes for well matched duplexes, but highly attenuated redox peaks from monolayers containing a single base pair mismatch, demonstrating that the charge transfer is DNA-mediated. The similarity in electron transfer rates through 100-mer and 17-mer monolayers is consistent with fast transport through the DNA and rate-limiting tunneling injection. Temperature dependence studies of 17-mer and 34-mer duplexes showed CT is thermally activated and highly sensitive to the integrity of the DNA base pair pi stack. Activation energies are increased by the presence and identity of single base pair mismatches. Furthermore, the yield of DNA CT with temperature argues that this CT is conformationally gated. These results elucidate the mechanism of DNA CT and direct the use of DNA as molecular wires in electronic applications.

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Date submitted: 02 Sep 2011 Electronic form version 1.4