



2014 Fall Physics Colloquium Series

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DNA in Nanoscale Electronics

Functional nanowires and nanoelectronics are sought for their use in next generation integrated circuits, but several challenges limit the use of most nanoscale devices on large scales. DNA has great potential for use as a molecular wire due to high yield synthesis, near-unity purification, and nanoscale self-organization. Nonetheless, a thorough understanding of ground state DNA CT in electronic configurations under biologically relevant conditions, where the fully base-paired, double-helical structure is preserved, is lacking. We explored the fundamentals of charge transport (CT) through double-stranded DNA monolayers on gold by assessing 17 base pair bridges at discrete points with a redox active probe conjugated to a modified thymine. This assessment was performed under temperature-controlled and biologically relevant conditions with cyclic and square wave voltammetry, analyzing the redox peaks to assess transfer rate and yield. We demonstrated that the yield of transport is strongly tied to the stability of the duplex, linearly correlating with the melting temperature. Transfer rate is found to be temperature-activated and to follow inverse distance dependence, consistent with a hopping mechanism of transport. These results establish the governing factors of charge transfer speed and throughput in DNA molecular wires for device configurations, guiding subsequent application for nanoscale electronics.

Wednesday, September 10, 2014

4:00 p.m.

Baylor Sciences Building E.125

Reception at 3:40 p.m. in BSB D.311

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