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DNA in Nanoscale Electronics JASON SLINKER, MARC MCWILLIAMS, CHRIS WOHLGAMUTH, The University of Texas at Dallas, ALON GORODETSKY, The University of California-Irvine — Functional nanoelectronics are sought for 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 charge transport (CT) under biologically relevant conditions, where the double-helical structure is preserved, is lacking. We measured DNA CT through double-stranded DNA monolayers on gold by assessing 17 base pair bridges at discrete points with redox active probes. This was performed under temperature-controlled and biologically relevant conditions with cyclic and square wave voltammetry, with redox peaks analyzed 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 was 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 CT speed and yield through DNA for device configurations, guiding subsequent application in nanoscale electronics.

Jason Slinker
The University of Texas at Dallas

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