DNA Electrochemistry as a Probe of Base Pair Stacking in A-, B-, and Z-Form DNA

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Abstract:

DNA-mediated charge transport (CT) chemistry is sensitive to DNA structure and base pair stacking. In an electrochemical assay based upon DNA CT, DNA-modified electrode surfaces are used to examine the electrochemical reduction of methylene blue (MB), a small molecule that binds to the DNA film by intercalation. Here electrochemically we probe CT in the three primary conformations of double-stranded nucleic acids, A-, B-, and Z-form DNA. The A-form is examined in the context of a DNA/RNA hybrid duplex and Z-DNA, in duplexes containing $d(^{m}CG)_8$ sequences at high Mg^{2+} concentrations. We find that both A- and B-DNA support efficient DNA CT as measured by MB reduction in the DNA film; a lower level of reduction is evident with the Z-form film. Furthermore, mismatches incorporated into A-form duplexes, as in B-form duplexes, disrupt MB reduction, thus providing a strategy for mutation detection through testing of RNA transcripts at DNA electrodes.