

Gene Sensors: Detection of Specific Targeted Sequences on DNA

Alan J. Heeger
Institute for Polymers and Organic Solids
University of California, Santa Barbara
Santa Barbara, CA 93106
U.S.A.

Abstract:

After reviewing the need for high sensitivity methods to detect specific targeted sequences on DNA, I will summarize recent progress in our laboratories on two novel approaches:

- I. DNA Detection using Water Soluble Conjugated Polymers and Peptide Nucleic Acids
- II. Bioelectronic Detection of DNA: The Electrochemical DNA Sensor

Our optical approach (I) employs a PNA-DNA/RNA hybrid formation to control the distance and resonance energy transfer between an acceptor and a highly emissive, water-soluble conjugated polymer. The conjugated polymer acts as a photon-harvesting antenna. The electrochemical approach (II) employs a reagentless electrochemical probe of hybridization in a reusable, miniaturizable, solid-state platform. Initial experiments demonstrate that both scientific approaches are feasible and, after only limited optimization, robustly capable of sequence-specific oligonucleotide detection at target concentrations below 10 pM. Both methods also exhibit greater than million-fold selectivity and are relatively insensitive to false positives arising from non-specific interactions with likely, „real-world contaminants.