Applications and innovative approaches of Nucleic Acid-based Electrochemical Biosensor in Clinical Diagnosis

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Abstract

Biosensors have attracted the attention of scientists as well as end-users because of their advantages of antibodies and their unique qualities such as stability, low cost, and boundless applications. Currently, biosensors are widespread in medical diagnosis, including point-of-care monitoring of treatment, ailment progression, and forensics and biomedical research. The modernized form of the biosensors is an electrochemical nucleic acid biosensor. This electrochemical biosensor combines the sensitivity of electroanalytical methods with the inherent bio-selectivity of Deoxyribonucleic acid (DNA), Ribonucleic acid (RNA), and Peptide nucleic acid (PNA). The biosensors exploit the affinity of single-stranded DNA/RNA for its complementary strands and are used in the detection of specific sequences of nucleic acid or other compounds, aiming to develop portable analytical devices. The nucleic acid component in the sensor recognizes its analyte resulting in a catalytic or binding event that produces an electrical signal in the transducer. The first aptasensor developed in the 1990s was based on optical detection. However, in 2000, extensive interest arose in the development of electrochemical biosensors. Since then, great progress has been made in this field, though; there are still numerous challenges to overcome. This review describes the principles and components of electrochemical biosensors, methods of transducing nucleic acid, ways to enhance conductivity with evidence, progress and innovative tactics in the field of applications, namely clinical diagnostics -- which includes disease biomarkers detection, cancer testing, genetic disease identification, and disease-causing pathogens detection -- as well as future directions for electrochemical nucleic acid biosensors' application and development.

Keywords*: *Application, Biosensor, Clinical, Diagnosis, DNA, Electrochemical