„Advanced Electrochemical Biosensors for Low-Molecular Weight Analytes: Integrated Tailorable Strategies for Sensitive and Selective Detection”

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Abstract

The current environmental and health concerns associated with chemical, or pathogen exposure have led to an increasing demand for novel, sensitive detection technologies which can be readily adapted to point-of-care devices. Biosensing, in particular, has gained attention from the scientific community for its remarkable adaptability and increased analytical performance. Within this category, electrochemical-based biosensors have shown great potential for field applications where low analyte limits of detection are required. Moreover, the combination between this transduction method and short biological or synthetic receptors (like aptamers or biomimetic molecules) has delivered great analytical results with high sensitivity and specificity towards low molecular-weight analytes.

In this thesis we explore the development of highly tailorable electrochemical biosensors, utilizing oligonucleotide aptamers as capture probes for small molecules and we propose the rational development of novel biomimetic molecules with great potential for sensing applications. The main goal of the work (i.e. the design, preparation and evaluation of the analytical response of biosensing platforms for low-molecular-weight analytes) has been achieved though sequential analysis of favorable development strategies that would tackle the main challenges of sensor fabrication.

The current thesis has provided great contributions for biosensing technologies, highlighting an integrated approach for device fabrication. The results obtained not only advance the current scientific knowledge of this field but also provide concrete strategies to tackle controllable sensor design and real sample analysis that can be further expanded to applications in point-of-care detection devices for small molecules.