Chapter 3
Exploring the Potential of Peptides and Peptidomimetics in Biosensing

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ABSTRACT

Biosensors are devices that capture the biological signal and convert it into a detectable electrical signal through transduction. Biological entities like DNA, RNA, and proteins/enzymes can be conjugated onto the biosensor surface to detect and observe certain biological analytes in environment, biomedical, and food industries. Peptides have been efficiently used in the fabrication of peptide-based biosensors due to their attractive properties like established synthesis protocols, diverse structures, and as highly enzyme-selective substrates. However, owing to their labile nature, peptidomimetics are the best alternatives at the bioreceptor interface due to their specificity and stability, relatively low cost and easy modifications, and capability

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to form supramolecular assemblies like nanosheets. Such bioconjugation strategies efficiently convert interaction information into a measurable signal, thus highlighting the importance in the fabrication of next-generation novel robust biosensors desirable for detection and dissemination of pathogens causing infections in the living and non-living worlds.

INTRODUCTION

In the biochemical field, sensors are usually defined as a device which includes both a receptor (bio-recognition element) and a transducer, providing specific quantitative or semi quantitative analytical information. Biosensors are powerful tunable systems capable of switching between an ON/OFF status in response to an external stimulus. In general, *biosensing techniques* can be defined as any of a variety of procedures which use biomolecular probes to measure the presence or concentration of biological molecules, biological structures, microorganisms, etc., by translating a biochemical interaction at the probe surface into a measurable physical signal. The general function of biosensors involves a receptor in the most general sense recognizing an analyte, and then a transducer either triggers a quantifiable signal or catalyzes a reaction related to the analyte concentration to generate a signal (Griffin et al., 2009). In clinical diagnosis, a sensitive, quick, convenient and versatile molecular biosensor has been desired to simplify the testing process, reduce the cost and shorten testing time (Salazar-Salinas et al., 2009). Recent advances in both disciplines allow redesigning the configuration of the sensing elements – either by modifying toggle switches and gene networks, or by producing synthetic entities mimicking the key properties of natural molecules. The primary requirement in the selection of various substances/factors as the components of biosensors includes rapid responding ability, high specificity & sensitivity, reliability, portability, productivity and long-lasting stability. In addition to this, immobilization/fabrication of bioanalyte in its native conformation, high accessibility of the receptor's sites to the species of interest and effective adsorption of the analyte to the employed support (Marx, 2007) are the main crucial factors that should be considered during the engineering of high performance biosensors. These demands need to be ardently addressed when developing the design of biosensors. Peptides and peptide based analogs possess the potential candidature for fulfilling many of these requirements.

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