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Biosensors and Biochips

Tuan Vo-Dinh

Center for Advanced Biomedical Photonics, Oak Ridge National Laboratory, Bethel Valley Road; MS-6101, P.O. Box 2008, Oak Ridge, TN 37831-6101, U.S.A.

This chapter provides an overview of the various types of biosensors and biochips that have been developed for biological and medical applications, along with significant advances and over the last several years in these technologies. Various classification schemes that can be used for categorizing the different biosensor and biochip systems are also discussed.

1.1. INTRODUCTION

A biosensor can be generally defined as a device that consists of a biological recognition system, often called a bioreceptor, and a transducer. In general, a biochip consists of an array of individual biosensors that can be individually monitored and generally are used for the analysis of multiple analytes. The interaction of the analyte with the bioreceptor is designed to produce an effect measured by the transducer, which converts the information into a measurable effect, such as an electrical signal. Figure 1.1 illustrates the conceptual principle of the biosensing process. Biosensors that include transducers based on integrated circuit microchips are often referred to as biochips.

There are several classification schemes possible. Biosensors and biochips can be classified either by their bioreceptor or their transducer type (see Figure 1.2). A bioreceptor is a biological molecular species (e.g., an antibody, an enzyme, a protein, or a nucleic acid) or a living biological system (e.g., cells, tissue, or whole organisms) that utilizes a biochemical mechanism for recognition. The sampling component of a biosensor contains a bio-sensitive layer. The layer can either contain bioreceptors or be made of bioreceptors covalently attached to the transducer. The most common forms of bioreceptors used in biosensing are based on 1) antibody/antigen interactions, 2) nucleic acid interactions,
FIGURE 1.1. Conceptual diagram of the biosensing principle.

FIGURE 1.2. Schematic of biosensor/biochip classification schemes.