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Information Visualization Methods Applied to Nanostructured Biosensors

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Abstract : The control of molecular architecture inherent in some experimental methods to produce nanostructured films has had great impact on devices of various types, including sensors and biosensors. The self-assembly monolayers (SAMs) and the electrostatic layer-by-layer (LbL) techniques, for example, are now routinely used to produce tailored architectures for biosensing where biomolecules are immobilized with long-lasting preserved activity. Enzymes, antigens, antibodies, peptides and many other molecules serve as the molecular recognition elements for detecting an equally wide variety of analytes. The principles of detection are also varied, including electrochemical methods, fluorescence spectroscopy and impedance spectroscopy. In this presentation an overview will be provided of biosensors made with nanostructured films to detect antibodies associated with tropical diseases and HIV, in addition to detection of analytes of medical interest such as cholesterol and triglycerides. Because large amounts of data are generated in the biosensing experiments, use has been made of computational and statistical methods to optimize performance. Multidimensional projection techniques such as Sammon´s mapping have been shown more efficient than traditional multivariate statistical analysis in identifying small concentrations of anti-HIV antibodies and for distinguishing between blood serum samples of animals infected with two tropical diseases, namely Chagas´ disease and Leishmaniasis. Optimization of biosensing may include a combination of another information visualization method, the Parallel Coordinate technique, with artificial intelligence methods in order to identify the most suitable frequencies for reaching higher sensitivity using impedance spectroscopy. Also discussed will be the possible convergence of technologies, through which machine learning and other computational methods may be used to treat data from biosensors within an expert system for clinical diagnosis.

Keywords : clinical diagnosis, information visualization, nanostructured films, layer-by-layer technique
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