Detection of Anthrax Protective Antigen Using a Nanoporous Impedemetric Biosensors

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Abstract: In response to the 2001 bioterrorist attacks involving anthrax, precautionary methods of containment, such as early detection, have been explored in order to better prepare for similar incidences. This project proposes a highly sensitive and efficient approach in which aspects of cell protein interaction and electrical circuits are combined in nanoporous impedemetric biosensors to detect traces of anthrax toxin through the presence of its protective antigen. The anthrax toxin is comprised of a protective antigen (PA), lethal factor (LF), and edema factor (EF). The presence of both PA and LF is lethal and if left untreated could lead to death 2-3 days after exposure. In order for toxin to enter the cell, PA binds to the toxin receptor capillary morphogenesis protein (CMG2) on cell surfaces. By simulating the specific PA- CMG2 binding on the gold circuit of a printed circuit board chip, detection can be quantitatively measured using Electrochemical Impedance Spectroscopy (EIS) from the capacitance created in the assay. The change in impedance corresponds to the amount of PA bound to CMG2 and thus PA's relative concentration. The biosensors have shown a detection limit at 1ag/ml of PA in phosphate buffer solution and in human serum. Such sensitive detection at low concentrations shows promise for rapid response in a case of potential anthrax toxemia.

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