Polymer-Coated Carbon Nanotubes for Enhanced Detection of Biomarkers

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Abstract: The objective of our study is to identify the role in arraying in creating nanostructures with nanospaces that can be leveraged for enhanced detection. The idea behind the experiment is that the nanoweb of polystyrene-coated carbon nanotubes will provide increased surface area for antibody binding. Achieving nano confinement of protein biomolecules leads to designing protein biosensors with enhanced sensing capabilities. Carbon Nanotubes (CNTs) are good conductors and can be polystyrene coated which makes them reactive with antibodies. The more antibody binding that occurs, the more sensitive the detection can be. The purpose of investigating these nanowebs is to enhance detection through providing more places for binding to occur. We are hoping that by making these devices more sensitive that detection of very low concentration antigens, in the femptogram/ml range, will be possible. We are evaluating C-reactive protein, an inflammatory protein as the study protein. We have been using silicon based microchips integrated with the polystyrene-coated carbon nanotube webs as cardiac biosensors for detecting C-reactive protein. These biosensors exhibit binding of biomarker proteins through the impedance changes analyzed through electrical impedance spectroscopy. We see these changes in impedance due to the binding of the antigen to the antibody on the gold electrode located on the silicon microchip of the biosensor. The ultimate goal of this research is to develop a relationship between the properties of polystyrene-coated carbon nanotube webs and the performance metrics of the biosensors.

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