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Electrical percolation based biosensors

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Electrical percolation which is the formation of long-range connectivity in random systems is a new biosensor which enables to measure biological interactions directly and electronically. It is based on biological semiconductor (BSC) which is a multi-layer 3-D carbon nanotube-antibody network, in BSC the passage of current through the conductive network is dependent upon the continuity of the network. Molecular interactions, such as binding of antigens to the antibodies, disrupt the network continuity causing increased resistance of the network. BSC can be fabricated by immobilizing a pre-functionalized single-walled carbon nanotubes (SWNTs)-antibody complex directly on a Poly(methyl methacrylate) (PMMA) surface (also known as plexi-glass or Acrylic). BSC was demonstrated for direct (label-free) electronic measurements of antibody-antigen binding, at slightly above the electrical percolation threshold of the network, binding of a specific antigen dramatically increases the electrical resistance. Using anti-Staphylococcal enterotoxin B (SEB) IgG as a "gate" and SEB as an "actuator", we demonstrated that the BSC was able to detect SEB at concentrations of 1 ng/ml. The new BSCs may permit assembly of multiple sensors on the same chip to create "Biological Central Processing Units (CPUs)" with multiple biological elements, capable of processing and sorting out information on multiple analytes simultaneously.

Biography

Avraham Rasooly, Ph.D. is serving as Special Assistant for Cancer Technologies and Translational Research at the Division of Cancer Biology, National Cancer Institute. Dr. Rasooly laboratory at the Division of Biological Science at the FDA's Center for Devices and Radiological Health (CDRH) is studying biosensor technologies for rapid biodetection and diagnostics. Dr. Rasooly has published over 90 scientific publications and he edited five volume books on biodetection technologies the most recent one is on biosensors for cancer detection and diagnosis.

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