

Electrochemical impedance detection of hCG β : Preliminary results and analysis in the development of 'lab on a chip' technology.

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Introduction - From a systems analysis stand point, all (automated) immunoassay systems are based on three distinct components: the immunological reaction (1), chemically tailored to match an optics detection/measuring device (2), that gives rise to an electrical signal that is data processed (3). Sensitive optics-based immunomethods for antigen detection such as the enzyme-linked immunosorbent assay (ELISA), have been widely employed in clinical laboratories over the past few decades. Their operation is multistage and complex and time consuming since their analysis time is a distinct entity separate from the capture detection system. Thus, real-time "lab on a chip" monitoring is often not possible in immunoassay measurement systems.

Aims - Currently the major obstacle to true miniaturization (and even implantable) immunoassay monitoring systems is the optics components. In order to remove the optics component, a direct electrical component must arise from the biophysical event of the Ab:Ag immunological reaction. One such approach is the measurement of the change of electrical impedance, which can results from the build up of a bio-film.

Methodology - We have constructed a NON-optical assay biosensor system based on the change in electrical impedance as a result of hCG β being bound by immobilized anti-hCG β antibodies. The biosensor is based on the formation of stable antibody-antigen complexes on commercially available golden microband electrodes covered with a layer of a self-assembled monolayer (SAM). We present the preliminary results obtained from the analysis of the hCG β biosensor: -

Results - A step by step analysis of each layer of the sensor was employed using impedance spectroscopy, illustrating the difference between and hence, the detection of each layer. The preliminary results and analysis relate the interfacial processes and physical structure of the sensor to its electrical behaviour. However, significantly the sensor shows a dramatic shift in impedance spectra corresponding to specific binding of the antigen - hCG β

Conclusion - The magnitude of the electrical "detection" signal clearly illustrates that real-time "lab on the chip" assay/monitoring system (for hCG) are feasible based on electrical impedance measurements.