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Challenge and Prospect of Label Free Impedimetric Biosensors for Point of Care Diagnostics

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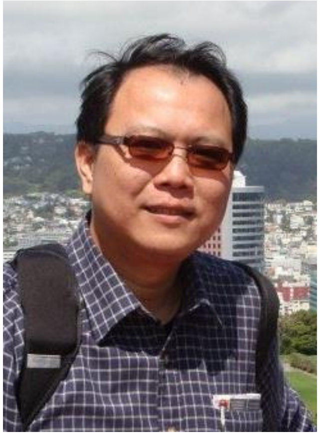
Venue: 31A, 3F Faculty of Engineering Bldg. 2



Abstract:

An increasing trend towards the development of impedance biosensors is currently being observed due to the viability of this method for direct and label free detection of affinity biorecognition events and suitability for point of care diagnostics. Impedance based biosensors normally utilize the formation of a recognition complex between a bioreceptor (e.g. antibody) and its corresponding specific analyte (e.g. antigen) in a thin film configuration on the electrode surface. They can sensitively monitor changes in resistance and capacitance at the electrochemical interface and are powerful analytical devices when electrode surfaces are controllably modified with biomaterials. In our lab, we have developed novel impedimetric immunosensors for the point of care detection of two diseases, namely bladder cancer and chronic kidney disease.

The immunosensor for bladder cancer detection utilizes a gold interdigitated microelectrode array and dielectrophoretically trapped nanoprobes (antibody-conjugated nanoparticles) with an achievable limit of detection in the pg/ml range. Owing to the microelectrode design and modification scheme utilized, the immunosensor can successfully overcome Debye screening length limitations and successfully perform immunosensing directly in high ionic strength clinical human urine samples obtained from Chi-Mei Hospital, Tainan, with high accuracy and sensitivity. We have also developed a novel, inexpensive and disposable screen-printed immunosensor for the early detection of CKD, which is urgently needed as Taiwan has the highest incidence and prevalence rates of end stage renal disease in the world. To improve sensitivity, stability and antibody immobilization, the carbon working electrode surface is sequentially modified with polyaniline and gold nanocrystals, and shows a linear dependence on microalbuminuria concentration in the clinically relevant range. Furthermore, we have also designed a portable impedance analyzer that can analyze the data from these immunosensors and transfer it wirelessly for cloud computing, thus enabling real time improved public health monitoring.

主催:　東京大学大学院工学系研究科専攻間横断型教育プログラム 機械システム・イノベーション（GMSI）
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