Micro-biosensor Devices for Biochemical Analysis Applications

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Full Abstract

A biosensor is generally defined as analytical device that convert biological response into a quantifiable and measurable signal via a transducer. Every year, billions of US dollars have been funded to support biosensor-related studies. There is an urgent need in the diagnostics laboratories for accurate, inexpensive and fast response devices. This doctoral dissertation research mainly focuses on design and development of microscale optical and electronic biosensor devices for biochemical analysis applications. The dissertation research would propose five major technical chapters: first chapter describes an MgF₂ based microfluidic device for nature cell fingerprint collection. The second chapter introduces an inkjet printed paper-based device for urine glucose testing. The third chapter demonstrates SERS detection of the response of HEK-GPR120 cell to fatty acid under microfluidic environment. The fourth chapter proposes a PET/PI based device for electrochemical detection of pathogenic organism DNA, and the fifth chapter is the application of Raman spectroscopy to characterize extracellular vesicles. Some ongoing and future experiments are also highlighted in this proposal. Since the considerable advantages such as smaller size faster response, high specificity and relatively low cost, biosensor devices are considered to provide feasible solutions to overcome the challenges faced in current healthcare communities.