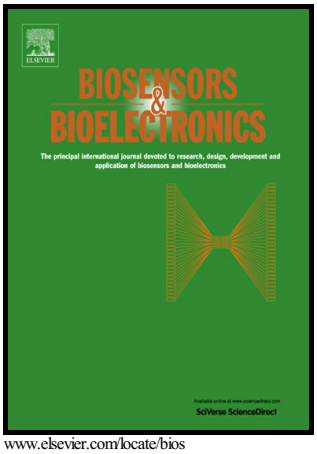

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Immunosensor for the ultrasensitive and quantitative detection of bladder cancer in point of care testing

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Abstract

An ultrasensitive and real-time impedance based immunosensor has been fabricated for the quantitative detection of Galectin-1 (Gal-1) protein, a biomarker for the onset of multiple oncological conditions, especially bladder cancer. The chip consists of a gold annular interdigitated microelectrode array (3x3 format with a sensing area of 200 μm) patterned using standard microfabrication processes, with the ability to electrically address each electrode individually. To improve sensitivity and immobilization efficiency, we have utilized nanoprobes (Gal-1 antibodies conjugated to alumina nanoparticles through silane modification) that are trapped on the microelectrode surface using programmable dielectrophoretic manipulations. The limit of detection of the immunosensor for Gal-1 protein is 0.0078mg/ml of T24 (Grade III) cell lysate in phosphate buffered saline, artificial urine and human urine samples. The normalized impedance variations show a linear dependence on the concentration of cell lysate present while specificity is demonstrated by comparing the immunosensor response for two different grades of bladder cancer cell lysates. We have also designed a portable impedance analyzing device to connect the immunosensor for regular checkup in point of care testing with the ability to transfer data over the internet using a personal computer. We believe that this diagnostic system would allow for improved public health monitoring and aid in early cancer diagnosis.

Keywords: Immunosensor; Impedance; Microelectrodes; Dielectrophoresis; Point of Care