

Biosensing and Bioelectronics based on organic electrochemical Transistors for Controlling and Monitoring drug processes and Bio-marker detection

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Organic Electrochemical Transistors are becoming more and more an ideally suitable platform for applications in bio-electronics and bio-medicine. In this framework we have been exploring their potential from the point of view of pharmaceutical applications. We have in fact investigated their suitability in studying and monitoring: - drug carriers such as liposomes, micelles and nanosystems; - the active drug chemicals themselves as well as their great potential for studying and monitoring the effects and dynamics of the drugs on living cells in particular for cancer treatments. We report also on an immunosensor based on an OECT biosensor integrated with an immuno-affinity membrane for the label-free detection of cytokine IL-6. Immunosensing shows particular promise for the detection of cytokines in body fluids because they are small soluble proteins (~6-70 kDa) secreted by immune and non-immune cells that act as indicators of the functional status of the body and are strongly associated with inflammation or disease progression. Due to this, they are widely used as biomarkers to characterize the immune function, understand and predict disease, and monitor treatment effects. Among all, Interleukin 6 (IL-6) plays both pro-inflammatory and anti-inflammatory functions that affect processes ranging from immunity to tissue repair and metabolism. We have exploited the gate/electrolyte interface for selectively sensing IL-6 via the immobilization of anti IL-6 antibodies onto the surface of the gate electrode as the recognition reagent, then monitoring antigen-antibody binding events occurring at the functionalized electrode. We demonstrate that our devices could reach the physiological concentration range of cytokines. The results and the perspective of the approach based on OECT as well as a comparison with methods already established in the field will be discussed together with the great potential of these devices and systems in the more general field of bioelectronics.