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Perspective of Wireless Biological Electronic Sensors

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Perspective

The development of wireless biological electronic sensors could pave the way for significant advances in fundamental studies and practical applications in various fields, including medical diagnostics, environmental monitoring and defense applications. One of the main challenges in the development of wireless bio-electronic sensors is the successful integration of bio-detection units and wireless signal transducers. In recent years, certain types of wireless communication systems have been integrated with bio-detection systems to construct wireless bio-electronic sensors. Electronic biological sensors have gained increasing interest due to the advantages of being miniaturized, portable, specific and sensitive, and can be used for a variety of applications, such as medical diagnosis / prognosis, drug detection, defense / war and food contamination. Here, a biological electronic sensor on which the examination focuses is an integrated electronic device based on the immobilization of biological molecules on a detection electrode for the detection of a target analyte. Although there are several studies for the development of wireless electronic devices without immobilization of biological molecules for biological applications, this review does not focus on these detection systems The target analyte interacts with the bio receptors immobilized on the surfaces of the l A sensing electrode which further induces a change in an electrical signal, such as conductance, current, potential, frequency, phase, amplitude, impedance and / or capacitance. The signal response can be monitored and correlated to the concentration of the target analyte via a standard curve. Therefore, when there is a signal response of an unknown concentration of an analyte, the concentration can be determined from the calibration curve. Most sensors generally require a connection between the sensors and external instruments via cables. In the presence of an analyte, the interaction between the target analyte and the bio receptor on the detection electrode induces a modification of an electrical signal and, via the connection cable, the signal can be transmitted to the external instrument. . These sensors offer excellent sensitivity and fast responses. However, the connection cables limit the applications. Therefore, it is highly desirable to develop wireless biological electronic sensors. Wireless sensors can offer the benefits of being portable, real-time, continuous, in-vivo, or long-distance. Radio frequency identification technology is being used to power a new sensor platform. The energy harvesting system used by the individual sensors allows the radio frequency field to be darkened for a defined period, providing the sensor electronics with a very stable voltage. This ensures full reference-free operation of electronic circuits during measurements. The implementation of this principle is demonstrated for a state-of-the-art sensor system based on a micro plate insert. Each insert carries electronic circuits and a system of inter digitated electrodes which acts as a sensor to record alterations in cell metabolism. A biosensor capable of wireless data transfer has been designed, manufactured and tested. The sensor uses aptamers immobilized on a pair of electrodes to detect Staphylococcus Enterotoxin B (SEB). We have designed a solvent-free method to fabricate sensor chips composed of inter digitated gold electrodes (150 nm thick) evaporated on a silicon substrate. The electrodes are functionalized with thiol-modified aptamers which have been chosen on the basis of their bio-affinity for the target analyte. On contact with SEB, a discriminant binding occurs between SEB and the aptamers bound to the electrodes, thus producing an observable change in the electrical properties of the electrodes. A minimal two-fold increase in capacity resulted from exposure of the sensor to SEB compared to exposure to non-specific proteins, thus demonstrating the sensitivity and selectivity of the device for the target analyte. Ultimately, we expect this device to be used for the remote detection of biological agents, thereby limiting human exposure to potential biological threats.

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