Special Issue on Biosensing Materials and Engineering for Electrobiology

Preface

With the rapid increase of knowledge in medicine and biology, micro- and nanotechnologies in electronics have been applied in these fields for parallel processing of information, miniaturization of analysis systems, and exploring molecular mechanisms of life. A biosensor is one of the typical examples of fusion between biotechnology and microelectronics, which consists of transducers and membranes on which biologically active substances are immobilized. Physical and chemical changes at the membrane as a result of biochemical reaction are transduced to electrical signals in the transducer. Electrochemical electrodes such as ion-selective electrodes and oxygen electrodes are commonly used as the transducer in conventional biosensors.

Such biosensing technologies are required for biological analyses and clinical diagnosis throughout the world. Basically, biosensing devices are composed of three functional elements such as a detection device, signal translational interface, and targeted biological phenomenon. In fact, electrical devices are developed as one type of detection devices for bioanalytical tools, because the targeted biological signals, which often originate from ionic behaviors of ions and biomolecules, can be directly detected as electrical signals using semiconductor devices such as a field-effect transistor (FET). On the other hand, for selectively and specifically detecting biosamples, it is more urgent to design and develop a well-defined bio/device interface (as the signal translational interface). Such a novel electrical biosensing device is expected to uncover a new aspect of biology, “electrobiology”, in the future. This special issue focuses on the state-of-the-art biosensing technologies that are leading toward “electrobiology”, such as electrical devices and chemical/bio-interface materials.

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Toshiya Sakata
The University of Tokyo
Japan