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Advances and Biosensors Contribution in Next-Generation Medicines

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Commentary

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ABOUT THE STUDY

Biosensors contribute to advances in next-generation medicines such as individualized medicine and ultrasensitive point-of-care detection of disease markers, biosensor research and development is becoming the most widely studied discipline due to its easy, rapid, low-cost, highly sensitive, and highly selective. From the perspective of smart biomaterials, this survey mentioned about traditional biosensors and bio sensing techniques and emphasized current breakthroughs in essential biosensors such as SPR-based biosensors, FET-based biosensors, and AuNPs-based biosensors. Biosensor research is really interdisciplinary. Surface chemistry developments have opened up a slew of new possibilities for producing target molecule identification systems. Furthermore, improvements in nanofabrication technologies promise not only the development of novel transducers, but also the shrinking and integration of high-throughput biosensors. For the production of new biosensors, interdisciplinary efforts beyond traditional specialties are necessary. Biosensor development will be accelerated and biomedical areas will be revolutionized as a result of the merging of considerable interdisciplinary expertise.

The mode of physicochemical transduction or the type of bio recognition element can be used to classify biosensors. Biosensors

are categorized as electrochemical, optical, thermal, or piezoelectric biosensors based on the transducer. Amperometric biosensors, potentiometric biosensors (which assess the potential of the biosensor electrode in relation to a reference electrode), and conduct metric biosensors are all types of electrochemical biosensors (that measure the change in conductance arising due to the biochemical reaction). Electrochemical biosensors have been the most extensively studied biosensors due to their low detection limit, specificity, ease of manufacture, and ease of operation. These biosensors can be downsized as lab-on-chip devices for *in vivo* monitoring or as handheld devices for on-site monitoring thanks to recent improvements in electronic instrumentation.

Optical biosensors work by measuring how much light is absorbed or released as a result of a biological activity. Optical biosensors use absorption, fluorescence, luminescence, Surface Plasmon Resonance (SPR), and other optical techniques. Colorimetric biosensors are among the most studied, owing to the ease with which the visible color shift produced by these biosensors may be detected. SPR-based biosensors make use of the plasmonic characteristics of noble metal films. The development of diverse optical biosensors has accelerated since the introduction of fibre optics technology.

Thermal biosensors work by measuring the temperature changes that occur during biochemical recognition. The majority of biological reactions result in a change in enthalpy, which can be detected with sensitive thermistors.

The mass change caused by bimolecular contact is measured using piezoelectric biosensors. The mass change is measured using piezoelectric crystals by comparing the change in oscillation frequency of the piezo crystal.

Biosensors are categorized as enzymatic, nucleic acid–based, aptamer–based, antibody–based, or whole cell–based biosensors based on the type of bio recognition unit used.

Biosensors are divided into three generations based on how well the individual components are integrated. The process by which the bio recognition or bio receptor molecule is attached to the transducer's base element.

The bio receptor is physically imprisoned in the region of the base sensor behind a discriminating membrane, such as a dialysis membrane, in the first generation. Immobilization is done in successive generations either through covalent bonding at a properly adapted transducer interface or through incorporation into a polymer matrix at the transduction surface. Individual components are fundamentally different in the second generation, whereas the bio receptor molecule becomes an intrinsic part of the base sensing element in the third generation. While these classifications were most likely meant for enzyme electrode systems, they can be used to biosensors in general. The significant development effort can now be seen in the second and third generations of these families.