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It is a pleasure to introduce this special edition of Cell and Development Biology dedicated to the field and application of Biosensors. This edition comprises seven reviews covering the most active research areas where we believe some of the most prominent advances in the field are likely to emerge in the near to medium term. In line with scope of this journal, some emphasis is given towards techniques applicable to Cell Biology.

The authors have been selected from some of the most active research groups around the world in the field of Biosensors and since all of the articles are reviews, the coverage of material is extremely broad reaching.

The field of Biosensors has continued to grow from the early 1960s when Clark and Lyons [1] along with other pioneers such as Updike and Hicks [2] reported the first devices that could be described as being true 'Biosensors'. For those new to the field, there are a number of definitions, although one of the most widely accepted defines a Biosensor as being: 'a device that comprises a biological recognition entity coupled in close proximity to a transducer'. In this context an enzyme, antibody, nucleic acid or other biological molecule may be coupled to a transducer such as an electrode, thermistor or optical detector.

Over the four decades of Biosensor research, there have been a number of drivers, which have steered much of the development of the field. Much of the early work was focussed towards the development of blood glucose sensors to allow the determination of blood glucose levels—firstly for hospital-based analyses and later via disposable blood test strips for use by diabetics. Many reviews of blood glucose sensing for diabetes have already been published and the reader is referred, for example to [3] and [4]. While it is hard to precisely quantify the sizes of specific market sectors, it has been estimated that in excess of $130 billion is spent annually on direct and indirect costs relating to diabetes with an increasing percentage being devoted to testing via the use of blood glucose biosensors [5]. Research over the last two decades has increasingly diversified into many differing fields such as DNA analysis, the use of antibodies for simplified diagnostics and homeland security, as well as the exploitation of nanotechnology and the potential this offers.

This edition commences with: 'A review of the use of genetically engineered enzymes in electrochemical biosensors', by Jean-Louis and co-workers, since enzyme-based biosensors still represent the largest class of biosensors that have been successfully commercialised. Much of the ongoing research effort using enzymes has recently been focused towards the exploitation of genetically modified enzymes since the exploitation of all of the main classes of enzymes within biosensors have been extensively researched. The reader is referred to [6] and [7] for coverage of this area.

The next review: 'Antibody production, design and use in biosensor-based applications', by Richard O'Kennedy and co-workers, is focussed towards the exploitation of antibodies within biosensors as the next largest grouping of biomolecules used to date; this review illustrates how a biosensor can be produced towards almost any analyte so long as an antibody can be raised towards an antigen.

Nucleic acids represents another major class of bio-molecule extensively exploited within biosensors, however since this field has been extensively reviewed elsewhere, the reader is referred to [8] and [9].

The next three reviews in this edition are focussed towards transducers, the first of which: 'Optical biosensors for probing at the cellular level: A review of recent and future perspectives', by Maria Velasco-Garcia, considers the most recent advances in the use of optically based biosensors since these represent the largest class of transducer exploited to date after electrochemical devices. This is followed by a contribution by Paul Millner and co-workers entitled: 'Nanostructured transducer surfaces for electrochemical biosensor construction – interfacing the sensing component with the electrode', which covers the use of nanotechnology – an area which will unquestionably play a major role in future developments within the biosensor field.

The role of modern electronics is emphasised within the review by Michael Schöning and co-workers of: 'Field effect devices for detecting cellular signals', while also demonstrating some practical applications to the field of cellular biology.

This special edition ends with two reviews dedicated to two further areas of practical applications for contemporary biosensors. Ashok Murchandani firstly considers: 'Real-time molecular methods to detect infectious viruses', while Ibtisam Tothill concludes with a review of the use of: 'Biosensors for Cancer Markers Diagnosis'.

References

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