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Book review

In Vivo Glucose Sensing, D.D. Cunningham, J.A. Stenken (Eds.). Wiley (2010). 450 pp. GBP 73.50

Though there are opportunities for the in vivo monitoring of many analytes in clinical medicine, by far the most attention has been placed on continuous glucose monitoring (CGM) in diabetes. The clinical importance and financial costs of diabetes to the community are immense, but there are real prospects that diabetes control can be improved and healthcare costs reduced by the use of CGM. Implantable glucose sensors have already entered clinical practice in the last decade and research into non-invasive glucose sensing though complex and troublesome is extremely active. This book of in vivo glucose sensing is therefore most timely.

The volume is part of a series of monographs on analytical chemistry. The 15 chapters are authored by more than 30 contributors, from industry and academia. All of the authors are from the United States, and though many are established experts in their field, it is perhaps a pity that some contributors from Europe and Asia were not included (particularly since researchers from these continents have made notable and pioneering advances in glucose sensing over the years).

The book begins with a general overview of the glucose sensing problem, with a focus on subcutaneously implanted enzyme electrodes, which is the technology used in present clinical practice. Highlighting the issues of suboptimal accuracy and reliability, it is appropriate that three excellent chapters then follow in which the authors discuss how the biology of the wound response, and the problems of 'biocompatibility' contribute to poor sensor performance, and how responses might be improved.

The present commercially available glucose sensors which are used in clinical practice are the subject of chapters on implanted electrochemical sensors and microdialysis probes. Here, the emphasis is on the different types of technology and assessing performance, which are covered in some detail. Notwithstanding that this is a book mainly on analytical science, it would have been valuable also to discuss several recent randomized controlled trials which show the clinical effectiveness of continuous glucose monitoring at reducing glycaemia. The biggest problems for clinicians using CGM in recent years have been the lack of an evidence base for glucose sensing (and therefore re-imbursement) and poor guidelines for best clinical use.

Most of the other technologies for in vivo glucose sensing which have been researched over the years are mentioned in a series of chapters which include methods such as reverse iontophoresis, microneedles, ultrasound for permeabilizing the skin, and fluorescence approaches. The latter is a particularly active field of biosensor research since fluorescence promises several advantages over electrochemistry, and this chapter is especially comprehensive and informative.

Non-invasive methods such near-infrared (NIR) spectroscopy, and Raman and surface-enhanced Raman spectroscopy are the subjects of four final chapters, one of which also include a good review of multivariate calibration models and their problems. However, as far as I can see, there is no detailed mention of impedance spectroscopy for non-invasive in vivo glucose sensing, a technology that in fact briefly reached the market. The chapter on NIR-based methods, their difficulties and potential is excellent.

This book is well illustrated and most of the chapters are detailed and up-to-date. Perhaps the chapters would have been even better if all had included a summary. The book will be of more value to the researcher than the clinician interested in CGM.

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