

The last and shortest part of the book, "Current Topics in Materials Research", reports on facilities and instrumentation, and may therefore be important for people interested in funding practices and politics.

In spite of its inhomogeneous character, with detailed articles describing dislocation theories of metals or the reptation model of polymer diffusion on the one hand, and articles which only give keywords without further explanation on the other hand, the book serves its purpose: It gives a rather complete summary over the first funding period of a gigantic and successful program and it sketches important challenges. Maybe the international competitiveness of today's research in materials science is respon-

sible for the fact that extremely topical research areas such as impact-resistant ceramics, quantum wells, and new aspects of semiconductor research, are only touched upon briefly.

There is no equivalent European or Japanese book on the same topic. The book reflects a good American tradition of formulating and reviewing national goals. I hope that some European programs are stimulating and powerful enough to be the basis for a rewarding book 25 years from now.

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Biosensors

Biosensors International Workshop 1987 (GBF Monographs, Vol. 10). Edited by *R. D. Schmid*. VCH Verlagsgesellschaft, Weinheim 1987, XIV, 346 pp, paperback, DM 128.00, ISBN 3-527-26801-4

In June 1987 the "Gesellschaft für Biotechnologische Forschung (GBF)" invited a representative circle of speakers to a workshop on biosensors in Braunschweig (FRG). The conference proceedings, published late in 1987, offer a good survey of the great variety of lectures held at the GBF. These topical proceedings illustrate, with a well suited mixture of reviews and reports, the broad range of biosensor research as well as the innovative power and the state of the art of this technology.

One of the purposes of this workshop was to define the position of the West German biosensor research in comparison with international activities in the field. In the preface the editor comments on the current situation and describes the position of the FRG by way of analyzing statistical data about biosensor publications and patents. Based on data from 1985, the West German biosensor research has to be placed in the sixth rank, far behind the dominating Japan and even behind the GDR.

Brilliant examples of new biosensors that make use of all important transducer technologies (potentiometric, amperometric, fiber optic and piezoelectric) were presented and their enormous potential, especially in medicine, was illustrated with ion-, enzyme-, and immunosensors. In addition, possible applications of biosensors in process engineering and environmental protection were discussed.

The performance of biosensors is already impressive. Gas sensors for organophosphorus compounds with ppb sensitivities and immunosensors with detection limits beyond the picomolar range were reported. The large number of lectures about glucose sensors gives an impression of the topicality and importance of this subject. The long-term goal is an implantable glucose sensor which, combined with an insulin pump, would improve the life of many diabetics. In general, most of the biosensors are developed as diagnostic tools. Because of their excellent performance and cost effectiveness they have already become serious competitors to established methods. Remarkable success in this field is reported from the GDR.

There are many different approaches to reach the long-term goals, i.e., the combination of small size (mm scale),

cheapness (less than 50 cents), high sensitivity (nM- μ M) and selectivity (10^5 or better), longevity (years), and high reliability (margin of error less than 1%) in one biosensor. The capabilities of living systems serve as a model. The detection sensitivities of sea animals to minimal water contaminations (down to 10^{-13} M) that are used, for example, to control the quality of drinking-water are still unrivalled. Biosensors with natural receptors are the way to imitate nature in this respect.

The efficient interdisciplinary cooperation of different fields like biology, chemistry, electronics, physics, and medicine is an important key to success and characterizes the internationally leading groups. It should be mentioned that there were also a few interesting contributions from West German researchers, and they demonstrated that a variety of innovations in this field are awaiting a breakthrough. The question remains why biosensor research, which will be an important economic factor in the next decades, has been so long neglected in the FRG. It is estimated that the nineties will see the commercial breakthrough of biosensors. For the year 2000 a study predicts an American biosensor market of \$ 200 million for medical applications alone. Biosensors are also important for biotechnology, environmental technology, and the food industry. However, the proceedings of this workshop leave no doubt that medical applications predominate. The current situation in biosensor research in West Germany bears some similarities to the status of microelectronics and gene technology research a few years ago; in both fields, the FRG is now having to undertake enormous efforts to reach international standards. Will biosensor research have a similar fate? Immediate strong support for this interdisciplinary field could help prevent this.

A final word on the workshop proceedings: The editor should have insisted on a better elaboration of some of the abstracts. In a few cases a half-page summary of a lecture is all that is provided. However, the book enables one to rapidly obtain a comprehensive overview of the state of the art in biosensor research. Also, the book gives an impression of the innovative power of this technology.

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