

## Introduction

When asked by Liga Kuylenstierna on behalf of Nordforsk (the Nordic cooperative organization for applied research) to organize a meeting on immobilized enzyme and cell systems, I first turned the offer down, this because of a strong feeling that there were already too many meetings in this area. However, since it appeared possible to arrange the meeting within the framework of a minisymposium on "immobilized enzymes/cells in analysis," I felt it worthwhile since the analytical aspect, although of great potential value, has hitherto been covered only in a peripheral way.

The Nordforsk seminar was held during May 13-14, 1980 at the Chemical Center in Lund and at Frostavallen, a conference site outside the city. The principal co-organizer of this meeting in Lund was Dr. Bärbel Hahn-Hägerdal. In addition, Liga Kuylenstierna, representing Nordforsk, actively participated in and supervised the preparations made for the meeting. Also Dr. Kurt Skagius from the Biotechnology Research Foundation took part in the shaping up of the program.

During the first day the sessions given at the Chemical Center, Lund were, mainly posters and demonstrations of (bio)analytical devices and bioreactors. In addition to the Department of Pure and Applied Biochemistry, the Departments of Technical Microbiology and Analytical Chemistry participated in the "open house" venture during the first day.

The second day began with a general survey given by Professor Malcolm D. Lilly (Department of Chemical and Biochemical Engineering, University College London, London, England) on the applications of immobilized enzymes/cells.

Subsequently, representatives of the several Scandinavian countries informed about the "state of the art" in their respective countries. Professor O.B. Jørgensen of Denmark spoke about the various activities going on there; Professor Linko of Finland covered his country, a summary of which is found in this symposium volume. No presentation of the "state of the art" in Norway was given since here the area of immobilized enzyme and cell systems is not yet widely studied. However, the lecture given by Professor Björn Larsen on the "properties of alginate gels" constituted a valuable background for researchers working on immobilization techniques.

In view of the large number of contributions presented by scientists from Sweden, any extensive presentation of this country's activities in the area was not required. I restricted myself in the general overview to mention the work of research groups not well represented at the meeting, notably that of the Uppsala

school, Professor J. Porath and coworkers, on various immobilization techniques and that of Professor S. Gatenbeck of the Royal Institute of Technology, Stockholm, Sweden. I also made some additional comments on the work going on in Lund and wish in this context to add two recent references in the field that were not yet available at the meeting. One relates to the immobilization of animal cells [K. Nilsson and K. Mosbach, "Preparation of Immobilized Animal Cells," *FEBS Lett.* **118**, 145 (1980)], an area of considerable potential. The other reference relates to the production of ethanol from cellobiose using baker's yeast co-immobilized with  $\beta$ -glucosidase (B. Hägerdal and K. Mosbach, in *Food Process Engineering*, vol. 2, P. Linko and J. Larinkari, eds., Applied Science Publishers, London, (1980), pp. 129–132. This latter work, related to that on the bioconversion of whey permeate to ethanol given in this volume (Hägerdal), draws attention to the fact that by co-immobilization to the same support beads, an advantageous proximal arrangement of biocatalysts coming from two different species (yeast cell,  $\beta$ -glucosidase) can be accomplished. This study draws attention to the fact that co-immobilization may, in some instances, achieve what otherwise might only be obtained through advanced cell-fusion or recombinant DNA techniques.

The overviews were followed by a lecture of Professor Martin Ottesen (Carlsberg Laboratories, Copenhagen, Denmark) on "immobilized enzyme crystals" drawing attention to the usefulness of the immobilization technique to answer questions related to fundamental biochemistry. This was followed by the aforementioned lecture of Dr. Larsen. Subsequently, a series of lectures was given on various aspects related to processes in which immobilized enzymes or cells are used. These were:

- A. Muhranta: Production of lactase for use as immobilized enzyme.
- S. Rugh: A comparison on the formation of unwanted byproducts during lactose hydrolysis with free and immobilized thermophilic lactase.
- M. Harju: Problems of immobilized enzyme systems applied on industrial scale.
- S. Martiny: Non-ideal flow in fixed-bed reactors.
- S. Gestrelus: Development of an industrial catalyst: Immobilized penicillin-V acylase.
- K. Mårtensson: Choice of enzyme reactor—theoretical background and consideration as illustrated on a case study.
- T. Björling: Does the use of immobilized cells pay off? Some economic considerations on the use of immobilized cells in technological processes.

The minisymposium on "Immobilized Enzymes/Cells in Analysis" was introduced with a survey on immobilized enzymes and analysis given by Professor George G. Guilbault. This was followed by subsequent lectures.

- G. Johansson: Some analytical applications for reactors containing immobilized enzymes.
- H. Neujahr: Determination of phenol and catechol concentrations using oxygen electrodes coated with immobilized enzymes or immobilized cells.

- S.-O. Enfors: Glucose electrodes for fermentation control.  
B. Mattiasson: Reversible biospecific immobilization applied in analysis.  
J. Ruzicka: Flow injection apparatus.  
B. Danielsson: The enzyme thermistor.  
K. Mosbach: The enzyme transistor.  
H. Sato: Developments in Japan—a survey.

The great majority of the speakers as well as those that participated in the poster and demonstration sessions have kindly submitted manuscripts for this special symposium double issue of *Applied Biochemistry and Biotechnology*. I thank them for their contributions.

December 1981

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