BOOK REVIEWS

Comprehensive Biotechnology

MURRAY MOO-YOUNG

Pergamon Press, Oxford, 1985, 4 volumes,
ISBN 0-08-026204-X, 3764 p., $995. for 4 vol. set

If you ask 10 persons having expertise in different areas of science or engineering to give a definition of biotechnology, you will likely receive answers that differ considerably in the breadth or narrowness attributed to this branch of technology. This new book series views biotechnology as a combination of the biological, chemical, and engineering sciences and defines biotechnology as "the evaluation and use of biological agents and materials in the production of goods and services for industry, trade, and commerce." The thrust of the series is toward industrial processing, which is certainly a key component of present biotechnology. Topics such as biomedical instrumentation, molecular-based drug design, food engineering, and agricultural crop or herbicide development, which some people include under the biotechnology umbrella, are given little to no coverage. This limitation of coverage is actually an advantage because it leaves the series with a focus on an aspect of biotechnology that has not been adequately addressed in the past.

The four volumes are divided between principles (volumes 1 and 2) and practice (volumes 3 and 4). Volume 1 (688 pages) covers genetic and biochemical principles particularly relevant to microbial processes. Volume 2 (632) pages) deals with the principles of bioreactor design, including fermentation, and with the many problems and processing steps required to prepare materials for feed to a reactor and to isolate and purify the products that emerge from the reaction step. Volume 3 (1136 pages) is focused on commodity products currently produced by biotechnological means, i.e., mainly by fermentation. The Volume is divided about equally into health care products (mainly antibiotics), food and beverage products, and industrial chemicals and fuels. The final volume (4) (1308 pages) contains two large sections on special applications (in medicine, agriculture, chemical processing, and analytical chemistry)

and on waste treatment. A smaller section in volume 4 covers government regulations in regard to biotechnology. The four volumes give the present state of industrial process biotechnology. Research topics and newer products just entering the pilot scale production level are left to be covered elsewhere.

The preparation of the four volumes for publication all at the same time was a major undertaking, for which the 10 editors are to be congratulated. The high cost of the four volume set precludes purchase by many individuals. However, the wide variety of coverage of principles, as well as current practices, makes the set a very valuable addition for reference libraries and for large research groups in which new persons are continually being introduced to the processing aspects of biotechnology. Separate reviews are planned for each of the four volumes.

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Enzymes in Organic Synthesis. CIBA Foundation Symposium 111

R. PORTER AND S. CLARK, EDS.

Pitman Press, London, 1985, ISBN 0272797855, 248 p., $35.00

Most pharmaceutical products are produced on a scale of several tons per year, either by chemical synthesis or by industrial fermentation. The two different procedures have traditionally been regarded as distinct, and the discovery and development of industrial scale processes have been thought to require contributions from organic chemists or biological scientists, but not both. Even when the finished product is obtained by a combined effort (e.g., chemical transformation of a fermentation product), the two stages of the process are often developed separately, without close contact among the researchers.

Apparently, in most organizations, synthetic organic chemists play the leading role in the development of industrial scale processes and in decision-making concerning which kinds of processes will be pursued. However, organic chemists are usually unfamiliar with the experimental techniques associated with biological processes, and it is not surprising that, if a nonbiological route to the target can be found, this will probably be used, even if it is more expensive.

This attitude is readily rationalized by repetition of the widely held (by organic chemists) opinions that biological methodology is inappropriate for transformations of the water-insoluble substances that are the targets of much of organic synthesis, and that scale-up of laboratory syntheses involving enzymes or cell-free extracts is impractical, because of the cost of the natural or synthetic cofactors of these enzymes. Thus, whenever the opinions of organic chemists prevail, it is argued that chemists should concentrate on chemical solutions to synthetic problems.

Organic chemists holding these views who take the time to read *Enzymes in Organic Synthesis* will be greatly surprised and, hopefully, encouraged to reevaluate their thinking. This 248 page book, including a detailed subject index, is a record of the lectures, and of the discussion following each lecture, at the 111th Ciba Foundation Symposium, May 15–17, 1984. The Symposium brought together authorities from governmental, industrial, and academic laboratories of nine countries for a

wide-ranging examination of the art and science of organic synthesis using enzymes. The skeptical organic chemist will find here exhortations, questions, comments, and leading references on how to obtain, purify, genetically engineer, and immobilize enzymes, how to carry out experiments on both water-soluble and water-insoluble substrates, how to recycle certain of the more common cofactors, and how to scale up a laboratory synthesis and estimate its cost.

The lecturers were knowledgeable and pedagogically skilled. Throughout the book there is an obvious awareness of the need to reeducate and stimulate the wider community of organic chemists to the view that enzymes are valid reagents for both laboratory scale and industrial scale organic synthesis. The book should be required reading for every synthetic organic chemist.

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