



BIOECONOMICS

Economic Aspects of Biotechnology. By Andrew J. Hacking. Pp. 306. ISBN 0-521-25893-6. \$59.50. (Cambridge University Press, New York: 1986).

Economic Aspects of Biotechnology details what every corporate scientist had best learn rather quickly: How will my project make money? Many industrial scientists are forced to garner such knowledge through on-the-job training; others, particularly those in the engineering disciplines, may have obtained the information as part of their academic preparation. A third group of scientists are normally not exposed to the economics of industrial science, and this book is a good primer for them.

Economic Aspects is organized into chapters on raw materials, fermentation technology, and downstream processing. It examines four programs: enzyme catalysis, energy, waste treatment, and corn wet milling. Also included is a chapter entitled "Innovation and economic analysis of projects," and a unique and informative section on raising money

(which includes a discussion of venture capital). The chapter on economy of scale is "must" reading for the industrial microbiologist, although I wish Dr. Hacking had expanded it with case analyses.

One of the perpetual questions asked by the industrial microbiologist is whether to do a process by batch or continuous fermentation. The productivity ratios of each can be calculated, but this manipulation is not to be found in *Economic Aspects of Biotechnology*. While the book does discuss the pros and cons of continuous culture—outlining, incidentally, more cons than pros—this subject might have been presented in greater detail and should have included a mathematical analysis.

Raw materials are discussed as to their price and availability, and there is a short treatment of renewable resources like cellulose and lignocellulose. The reader, however, could have benefited from an analysis of the sensitivity of the feedstock source on the product's economics. A low-priced commodity selling for, say, \$1.00 per pound or less, is more dependent on source price than a specialty product, such as an antibiot-

ic, which may sell for several hundred dollars per pound. Such a relationship may seem obvious, but it is surprising how elusive it is to some corporate managers of biotechnology.

The discussion of finance—a topic of interest to those who want to start a business—could also have been expanded. For example, although the venture capital section states that "95% of [business] proposals are rejected," it would have been informative to analyze why the rejection rate is so high, emphasizing the importance of style in the presentation. Venture capitalists by and large are not scientists, and frequently proposals are full of scientific jargon not understandable to the layperson.

All in all, the book should be of use to scientists just becoming acquainted with the economic implications of their work. *Economic Aspects* should become increasingly valuable as more and more university-based biotechnology projects are being funded by corporate capital.

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A SIMPLISTIC VIEW OF PLANT AGRICULTURE

Plant Agriculture—Federal Biotechnology Activities. By Carolyn Bloch. Pp. 210. ISBN 0-8155-1058-6. \$39.00. (Noyes Publications, Park Ridge, NJ: 1986).

Plant Agriculture presents an overview of U.S. policies, issues, and research in plant biotechnology.

The book is divided into two parts. The first section covers federal policies and issues, including source of funds for plant biotechnology, university/industry relationships, plant patent law, technology transfer, and regulatory options. The second section outlines the actual activities of government agencies and departments in plant biotechnology.

Out of 203 pages of text, about 30 percent are dedicated to a list of government agencies and companies involved in plant biotechnology—a sort of telephone book listing. An additional 45 percent of the text describes, in short paragraphs, the research of individual investigators supported by federal funds. These brief descriptions are presumably drawn

from the abstracts of grants awarded. The remaining 25 percent of the text is a series of brief précis of otherwise meaty issues.

This book—an assemblage of information drawn from public documents—is of use only to the uninitiated. *Plant Agriculture* would have been of substantial use if published in 1980. However, in 1986 it understates and oversimplifies areas that have grown to be fast-moving and very complex.

For instance, the book's eight-page (double-spaced) treatment of intellectual property law and patents inadequately describes key features of the 1930 Plant Patent Act and the 1970 Plant Variety Protection Act. Omitted, in particular, is a discussion of the Appeals Court decision in favor of Hibberd *et. al.*, which argues that plants, plant parts, and tissue cultures can be protected under general patent law. Even the usual protection afforded seed companies by selling hybrid seed, while maintaining parental lines as trade secrets, is not discussed.

In another instance, the short

chapter on methods used for international biotechnology transfer questions the reader's intelligence: licensing agreements and joint ventures, the book explains, are one method used. In addition, the reader is informed that bilateral trade or research agreements are another mechanism for dissemination of technology abroad. Such writing does not challenge the intellect of a sophisticated audience.

In several chapters, the author has summarized statistics on expenditures for plant biotechnology research by the federal government. However, there is no reference made to the published or trade literature. Assuming these statistics are valid, what are the author's sources?

Finally, who is Carolyn Bloch? The reader is denied a simple biographical sketch. The reader cannot understand the point-of-view because the author is unknown.

Ceres is a long-time observer, analyst, and enthusiast of agricultural biotechnology.