Microbes Used by Man

Genetics of Industrial Microorganisms. Edited by Z. Vaněk, Z. Hošťálek and J. Cudlín. Volume 1: *Bacteria.* Pp. 496. Volume 2: *Actinomycetes and Fungi.* Pp. 511. (Elsevier: Amsterdam, London and New York, 1973.) Dfl. 225; $70.25.

THE chemical activities of microbes for centuries have been exploited to produce commercially useful chemicals and microbial cell material. From the beginning, improvements and developments were pragmatic, which is not surprising in view of the lack of any understanding of the biochemical activities of living cells, and the genetic control of these activities, until around the turn of the present century. The realization that conceivably just a minute part of the corporate microbial genome had been exploited for industrial purposes came only in the late 1940s and early 1950s with the discovery of a range of commercially useful antibiotics, and later the use of microbes in production of valuable steroid drugs. With the accompanying explosion in the growth of information about the biochemical and genetic activities of microbes, even the less imaginative among industrial microbiologists began to believe that microbes might, by appropriate biochemical and genetical manipulation, be made to yield an almost limitless number of commercially valuable chemicals. These in many ways were the sentiments which prompted some 600 scientists to convene in Prague in August 1970 at the First International Symposium on the Genetics of Industrial Microorganisms. The keynote of the symposium was eloquently expressed in the title which Professor A. L. Demain gave to his address: "Marriage of Genetics and Industrial Microbiology—After a Long Engagement a Bright Future".

The proceedings of the symposium, in two volumes, have just been published—almost three years later. Such a long delay in publication must surely mean that at least some of the contributions are hopelessly out of date, especially since many of the participants to the symposium research in very active areas of molecular biology. The first volume deals with bacteria and the second with actinomycetes and fungi. Both volumes are well produced, which they should be with the swingeing price being charged for them. The first volume includes eight sections, dealing with genetics, mutagenesis, regulation of metabolism, and sporulation in bacteria. It also contains a most valuable section of four contributions on legal protection of strains, mutants, and genetic procedures, which includes accounts of problems which arise from litigation covering industrial microorganisms in Western (by W. L. Hayhurst) and Eastern Europe (A. Stoy), the importance of accurately describing producing organisms (H. B. Woodruff and his colleagues), and the problems of novelty in relation to litigation in industrial microbiology (Z. Řeháček). These contributions bring together information which is not readily accessible elsewhere, especially to the microbiologist, and is a most useful feature of the volume. The second volume of the proceedings is concerned principally with the genetics and metabolic regulation of streptomycetes and fungi, especially with the production of secondary metabolites such as antibiotics and alkaloids.

Nevertheless, the plain truth is that, over the past two decades, most of the major advances in industrial microbiology have still come from purely pragmatic approaches to problems of strain improvement, mainly through mutagenesis, and the refinement of cultural conditions. The contribution of genetics—the purposeful breeding of strains of industrial microorganisms with better performance characteristics—has been minimal indeed. This fact is reiterated, often with not a little coyness, in several of the contributions to these proceedings. Professor J. A. Roper, in an article on mitotic recombination and mitotic non-conformity in fungi, goes as far as to accuse the industrial microbiologist of a certain naïveté in believing that genetical manipulation could make a significant contribution to industrial microbiology. There have, undoubtedly, been technical barriers to the use of genetics in the microbiological industries, as well as biological barriers such as the possible existence of chromosome aberrations in highly mutated strains. Parasexual genetics has made some impact, especially in improving the quality of penicillin-producing fungi, but the contribution has been small, as Boyd Woodruff points out in his article in the second volume. Strangely, although the proceedings include a number of articles on metabolic control in yeast, there is no account of the role which genetical and biochemical research could make in improving brewing and baking strains of yeast. Here, surely, is an industrial microorganism which could be exploited genetically and biochemically; perhaps the brewers and the bakers are just not interested.

The contributions to these two volumes of proceedings contain a great deal of useful information on microbial genetics and biochemistry. Although they have been published far too late, these data are not to be found brought together elsewhere, and this in itself is sufficient recommendation to libraries to purchase the volumes. A second symposium on the Genetics of Industrial Microorganisms is to be held in Britain in 1974. Frankly, one cannot yet believe that the marriage to which Professor Demain referred has been consummated. Even now, might it not be possible for the organizers of the 1974 symposium to call it "Genetics and Industrial Microorganisms" rather than "Genetics of Industrial Microorganisms"?

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Biological Control

Principles of Biological Regulation: An Introduction to Feedback Systems. By Richard W. Jones. Pp. xiii+359. (Academic: New York and London, March 1973.) $16.

RICHARD JONES is no stranger to the problem of writing definitively about biological control systems. His earlier work in this field has largely been directed towards the reader with a firm grounding in engineering or physics. In this new book he has undertaken the much more difficult task of writing a book on the mathematical analysis of biological regulation, which is designed primarily for the life scientist.

The mathematical description of the principles of biological regulation is largely a question of organization. Historically, the understanding of homeostasis has progressed with each new insight into the organization of the organism from Bernard to Weiner and later workers. The continuation of this process inevitably leads to the use of mathematics.

The initial step in describing any biological system quantitatively is to organize the known facts in a block diagram or signal flow graph. In this book the author restricts himself primarily to the use of the block diagram with the simultaneous introduction of differential equations. The technique of developing each new mathematical idea in terms of a well known biological example is particularly useful, for it enables the reader, who is no doubt familiar with the qualitative description of the problem, to move more easily to a quantitative understanding.

Having introduced such concepts as transient response, and interacting and non-interacting processes, the author begins his discussion of feedback, which is the central principle of regulation. It is clear from block diagram algebra that any system which is to be analysed can be reduced to its canonical form, that is it can be reduced to one block in the forward pathway (efferent) and one block in the feedback pathway (afferent). In any discussion of regulation it is therefore logical to start from the canonical form.

This approach lends itself to the development of the open and closed loop gain equations and the concept of error. Within the book the under-