

genetics, at present the most rapidly advancing frontier in microbiology, and already crowned by Nobel prizes, practically did not exist before 1940. In twenty years it has leaped by a series of major steps: the techniques for the isolation and use of nutritional mutants in 1940; the identification of deoxyribonucleic acid as the substance responsible for transformation in *Pneumococcus* in 1944; gene recombination in bacteria and in bacterial viruses in 1946; bacteriophage-mediated transduction in 1952; 'parasexuality' in fungi in 1953; unidirectional and partial transfer of genetic material in bacteria in 1953, and many others later.

All these advances have made it clear that micro-organisms present such a variety of processes of genetic recombination that higher organisms seem dull in comparison.

While making possible this spectacular progress in the knowledge of micro-organisms themselves, microbial genetics has opened, and contributed decisively to, the general field of molecular genetics, that is, the description of the processes of heredity and variation at the molecular level. This was the consequence of two main reasons: the enormously increased resolving power of genetic analysis when in one experiment millions, rather than hundreds, of individuals can be handled, and the ease with which chemical techniques can be used with micro-organisms.

This volume, for which the Society and the editors, Drs. Hayes and Clowes, should be congratulated, is the collection of thirteen papers and an introduction presented at the symposium. The standard is very high almost throughout and most of the papers are also presented in an intelligible form. The contributors include some of the best people in the various sections of the subject. It is a volume that no microbiologist can ignore and that all geneticists—especially those without direct acquaintance with microbial genetics—will profit by reading.

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THE FATHER OF MICROSCOPY

Measuring the Invisible World

The Life and Works of Antoni van Leeuwenhoek, F.R.S. By Dr. A. Schierbeek. With a biographical chapter by Dr. Maria Rooseboom. (The Life of Science Library, Vol. 37.) Pp. 223 (28 plates). (London and New York: Abelard-Schuman, Ltd., 1959.) 25s. net.

ANTONY VAN LEEUWENHOEK is the most astonishing figure in the history of biology. Unaided, he discovered bacteria, described spermatozoa, and observed a nucleus in a blood-corpusele. Not for more than 150 years was progress in microscopy resumed at the resolution which Leeuwenhoek could command with his home-made lenses. His discoveries extended over fifty years and were described in a series of some 165 letters to the Royal Society. The last, in 1723, was dictated from his death-bed.

Yet our knowledge of this amazing man has remained strangely incomplete until the present time. Some thirty years ago, a committee of Dutch scientists began the task of assembling a series of volumes in which each of Leeuwenhoek's letters is followed by a detailed description of the objects concerned. Since

1942, Dr. A. Schierbeek has been editor-in-chief of this undertaking. In 1950, he published in Dutch a two-volume work on Leeuwenhoek, to which he has now added the present book in the English language. It opens with a valuable biographical chapter by Dr. Maria Rooseboom, who tells us much about the social history of the Netherlands in Leeuwenhoek's day. She makes the point that Leeuwenhoek was first introduced to the Royal Society of London at a time when the two countries were at war.

We are here given a view of the father of microscopy in the round. It would be hard to over-estimate the importance of the service to science which these authors have rendered. Here is a book which all biologists must read, and which every student of the history of the sciences will need to study. One of the most interesting topics which are discussed is Leeuwenhoek's relations with the Royal Society. Though he never met them, these men were his colleagues. Their confirmation in 1677, after repeated trials, of the presence of animalcules in 'pepper water' is a vivid chapter in the history of science. Only fourteen years later, however, Robert Hooke lamented that Leeuwenhoek already stood alone in the use of the microscope. Yet for a further thirty years the Society continued to receive the letters from Delft.

Dr. Schierbeek's book is accompanied by a number of plates reproduced mainly from the original publications of Leeuwenhoek. I would suggest that in further editions the references should be given to the year and page in the *Philosophical Transactions*.

ARTHUR HUGHES

APPLIED MICROBIOLOGY

Advances in Applied Microbiology

Vol. 2. Edited by Wayne W. Umbreit. Pp. xii + 384. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London), Ltd., 1960.) 12 dollars.

ON the whole, the second volume in this series fulfils the promise of the first. The book contains eight fairly comprehensive reviews and eight short articles that were presented during a symposium on "Engineering Advances in Fermentation Practice" before the Division of Agricultural and Food Chemistry at the American Chemical Society meetings in September 1959. Five of the reviews are concerned with the use of micro-organisms in fermentation processes: recent work on the oxidative fermentation of industrial wastes, with particular reference to the disposal of dairy waste, is discussed in a posthumous article by N. Porges; G. J. Haas points out the importance of microbial control during brewing, and details the methods used during the brewing of lager beer; R. J. Allgeier and F. M. Hildebrandt describe the development of the use of deep-fermentation equipment for the manufacture of vinegar; T. H. Soudt contributes an account of the transformations of steroids that can be accomplished with micro-organisms—such interconversions are important adjuncts to chemical synthesis; and W. J. Oswald and C. G. Coluoko give an interesting, though at present somewhat hypothetical, discussion of the possibility of biologically transforming solar energy into electrical power. Two reviews deal with the collection and counting of micro-organisms: H. W. Batehlor considers the techniques available for