REVIEWS

THE GENETICS OF MICRO-ORGANISMS. By D. G. Catcheside. Pitman & Sons, 1951. Pp. vii+223. 21s.

The rapidly advancing study of microbial genetics is of special importance not only in its theoretical implications but also in its practical consequences. In the first place, the very short generation times involved make microbes ideal material for the experimental investigation of mutation, selection and evolution. The existence of readily accessible haploid stages permits the immediate recognition of genes which might otherwise be masked by dominant partners. A wide variety of mutants are available, including nutritional, enzymatic and serological characters, as well as phage and drug resistance. Further, in some strains at any rate, genetic recombination can be demonstrated and tentative chromosome maps constructed. In the second place, the great progress made in recent years in the chemotherapeutic treatment of disease has given some prominence to the phenomenon of drug resistance. One of the urgent tasks of microbial genetics is to shed further light on drug-resistant mutations with a view to improving the clinical efficiency of antibiotics. We may also expect to develop in due course adequate explanations of microbial evolution which will increase our understanding of the way in which epidemics are caused by the sudden spread of new virulent pathogenic organisms through a community.

The genetics of micro-organisms by Prof. Catcheside is " based on a course of lectures devised for bio-chemists specialising in the microbial aspects of their subject. It attempts to provide an introduction to the general and special aspects of the genetics of micro-organisms." This book can scarcely be regarded as elementary; it presupposes in the reader a fair knowledge of genetics, cytology, biochemistry and microbiology. For those who have the entrée to these subjects a wealth of detailed and painstakingly compiled factual information on a considerable range of fascinating topics is presented and discussed. There are chapters on " Genetic analysis in *Neurospora* and other fungi ", " Mutation and gene action ", " Adaptation and mutation " and " Sexual reproductive systems ", followed by four chapters devoted to yeasts, protozoa, bacteria and viruses, respectively.

In a quickly expanding and developing subject like microbial genetics it is inevitable that any text-book, however well written, will be to some extent out of date in a relatively short time. (It should be noted that the preface to the book under review was written in February 1949.) These consequences will be minimised if the author adopts an historical approach. If he describes when, how and by whom certain researches were undertaken, and how the experimental results were interpreted in relation to the ideas and knowledge of the time, then the treatment may continue to have value long after many of the theories outlined have in fact been proved false. Unfortunately, Catcheside's book does not fulfil these conditions, though it could easily have done so with only slight changes in the method of exposition. Names of individuals and the dates of their work are few and far

between in the text, and it is very rare for both a name and a date to appear together. This is a result of the inconvenient method of documentation adopted. All references are made to a *numbered* entry in the bibliography given at the end of the chapter. Thus in the description of Sonneborn's fundamental work on cytoplasmic inheritance in *Paramecium*, apart from the date (1937) one is given merely a cryptic " 158 ". Sonneborn's name is discovered only by hunting for " 158 " in the bibliography. It would have been much better to have given a textual reference in the form: (Sonneborn, 1937). References of the latter kind coupled with a purely alphabetical bibliography would not only be much easier to use but would make the whole treatment far more readable. Incidentally, as the bibliography contains no page references to the sections of the book where authors' names appear, it is extremely difficult to find where the work of any particular author is discussed.

In a book of this sort one does not, of course, expect any very detailed mathematical discussions, though formulae given should be clear and unambiguous. This desideratum is not always fulfilled. On p. 28 there is a reference to the use of a product formula for the estimation of a recombination fraction allowing for differential viability. Those familiar with such methods will immediately recognise what is intended, but the student would find it far less confusing to be presented with a straightforward formula for the recombination fraction x in terms of the observations, say a, b, c and d, such as

$$x = (ab/cd)^{\frac{1}{2}} / \{1 + ab/cd)^{\frac{1}{2}}\}.$$

Moreover, even if statistical methods are considered beyond the scope of the book, references to the relevant literature should not be omitted. For example, in the chapter on " Genetic analysis in *Neurospora*, etc. ", although there is a detailed discussion of tetrad analysis, no mention is made of the important paper by Mather and Beale (*J. Genetics, 1942*) on the calculation and precision of linkage values from tetrad analysis.

A minor misprint occurs three lines from the bottom of p. 118 where the right hand side of the differential equation should presumably contain an additional factor $1/P$, otherwise the equation will not be satisfied by the solution given in the last line on the page.

Rather more serious confusion arises in some of the mathematical formulae on pp. 159-161, where ambiguities are caused by faulty typography. Thus in line 8 on p. 160, $-\log_e C_o/C$ should read $-\log_e(C_o/C)$. On the other hand, in the following line, $m \log_e 2/N$ should read $m(\log_e 2)/N$. For similar reasons, all the other formulae are liable to misinterpretation by the student seeking to use them, as without prior knowledge it is impossible to guess where the brackets should be inserted.

Throughout the book no very adequate distinction is made between recombination and map distance. Indeed on p. 25, lines 24-28, it is implied that distance *measured as recombination percentage* is additive, which is certainly not true in general though it may be sufficiently accurate for short segments. Similarly, in lines 8-11 on p. 185, 14% recombination is equated to 14 cross-over units, whereas on the assumption of no interference Haldane's formula gives a distance of rather more than 16 cM. Moreover, the 14 is incorporated in the chromosome maps of *Escherichia coli* on p. 186, where the values taken from Lederberg are certainly map distances and not recombinaton fractions. Finally, the estimates of the recombination fractions between the

loci *t* and *l*, and between *b* and *m*, which Catcheside has made on the basis of Lederberg's data, are invalid. As Lederberg himself rightly pointed out, the data only permit the estimation of the recombination fraction between *th* and *m* or *b*. We cannot, for example, use the data to estimate the extent of recombination between *b* and *m* without knowing the order of the loci *th*, *b* and *m*, which is uncertain. Similarly with *t* and *l*.

In spite of the above criticisms of detail, this book is certainly one of the first attempts to provide a broadly based and comprehensive text-book on microbial genetics, and it will no doubt do much to encourage further interest and research.

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GENETICS IN THE 20TH CENTURY. Essays Edited for the Genetics Society of America by L. C. Dunn, The Macmillan Company, New York. 1951.

This volume contains twenty-six essays presented at the " Golden Jubilee of Genetics " meeting of the Genetics Society of America. Most aspects of genetics are covered and a short review can do no justice to such a pleasantly varied collection of essays, none of which is irrelevant. I shall therefore pick a few points which have struck me as unexpected or more important.

In the first place, an impression which I hope to be wrong: in some of the theoretical parts of papers dealing with fundamentals one senses a somewhat defensive attitude; this is reflected in a categorical re-statement of concepts—e.g. unequivocal separation of hereditary and non-hereditary changes; genetic " control " of development; randomness of mutation, etc. —the usefulness of which we know to be the greater the more constantly aware we are of their limited validity and the more eager we are to replace them as soon as a higher synthesis is possible. Mendel's independent assortment was broadened to include linkage; his elements have been replaced by the functions of definite chromosome regions; particulate heredity has been harmonised with Darwinism; the gene-character gap is still there but at least we begin to see clearly the nature of the problem. Are we to believe that concepts as those mentioned above (and even more, that of " self-reproducing " particles) are eternal? If this stiffening attitude were the result of the bitter attacks now raging against genetics, both from the obscurantist biological right and the political extreme left, this would be indeed a victory for the attackers.

Fortunately in other theoretical essays, or theoretical parts of essays, there is no trace of this psychological weakness. Mather, writing on " Progress and Prospect of Biometrical Genetics ", definitely uses the past as a stepping-stone for the future. So do Sonneborn and Ephrussi in their outstanding essays on cell heredity and differentiation. So do Darlington and Lederberg in those parts of their essays where they unify infection and heredity. There is no trace of defensive attitude in the numerous essays which deal with particular fields of experimental genetics or with the application of genetics to agriculture, medicine, and, more generally, human affairs. This is natural because who grapples daily with practical problems of experimental design and analysis in genetics cannot fail to be fascinated by the tremendous predictive value of genetical theory though he realises its limitations. Even Huxley, in his beautiful closing essay, raises well above the stiffening attitude, in which he has recently indulged, when he tries to visualise on the basis of genetical knowledge the novel evolution made