THE BIOCHEMISTRY OF GENETICS. By J. B. S. Haldane. George Allen and Unwin. 1954. Pp. 144. 15s.

The concepts of genetics and of evolutionary theory are of prime importance in the development of biochemistry. In its present state this subject is deeply concerned with the demonstration of impressive similarities in the enzymatic equipment of cells of living organisms of all classes, and it is as yet largely unable to deal with the variations in interaction of these items of equipment which must form the basis of the distinctions in form and function between different cells and species. Despite the sanguine pronouncements of some biochemists, reminiscent of the *fin de siècle* physicists, that all that remains is to tidy up, it is certain that more—and more difficult—biochemistry lies ahead than behind.

This book should be enough to convert any sceptic to such a view. Its author is uniquely qualified to discuss both biochemical and genetic aspects of the interaction between the disciplines, and he brings out very clearly the inadequacy of available biochemical knowledge to the explanation of the genetical complexities which he discusses. It is a pity that so much space has been given to human biochemical genetics, since the possibilities of fundamental analysis of either genetic or biochemical problems are so limited in this field, and since existing knowledge has recently been admirably summarised by Harris. There are occasional obscurities arising out of compression in other parts of the book. In view of the importance of the topic, the discussion on pp. 106-7 of the relation of nucleic acid to genes could profitably have been expanded. The author, as is his wont, treats the mathematical aspect of this problem too concisely for the general reader, and the important suggestion that only a very small fraction of the chromosome nucleic acid can be present in the genes themselves could well have been treated more fully.

R. A. Fisher has defined variance as the attitude of one statistician to another, and it seems probable that variation can be similarly defined in terms of geneticists. A biochemist may therefore be excused from judging the merits of the genetical aspect of this book, whilst being grateful for the introduction which it affords to the conceptual complexities of this subject in a context which is obviously his concern. If, as seems likely, the book also serves to introduce the geneticist to biochemical notions with which he will have increasingly to concern himself, then it should be very widely useful.

R. B. Fisher.

BLOOD GROUPS IN MAN. By R. R. Race and R. Sanger. Blackwell Scientific Publications. (August 1954, 2nd Edition.) 30s.

The second edition of this essential book has been awaited eagerly by all who are interested in serology, and no one will be disappointed in it. The authors are to be congratulated upon a remarkable achievement. They have brought their well-known text book up to date, when to do so required the inclusion of a large proportion of new data, and the consequent minor reorientation of many aspects of the subject. Their undoubted success is due partly to the fact that they are themselves in the front rank of research workers in this field, and that many of the discoveries which they review are their own. Consequently, this is an authoritative work, one which is indispensable alike to geneticists and medical men.

It seems almost ungrateful to criticise a book to which so many students will be indebted, but since further editions are certain to be required, it is possible that constructive suggestions may be of use.

The fundamental drawback to this subject is its defective notation, which makes it difficult to expound, to learn, and to analyse. This is not in accord in accepted genetic usage ; but, far more serious than that, it is inconsistent within itself, and is seriously misleading. The authors are not to be blamed for this, for they are merely adopting the conventions which are in general use. How serious is the situation may be judged from the fact that it is often impossible to determine, both in this and in other works on serology, whether a given symbol refers to a gene or an antigen. A few instances only can be mentioned here to indicate the confusion that exists. Thus the genes of the Duffy and Kell systems are represented respectively as Fy^a, Fy^b, and as K, k. Though the notation used is so dissimilar, the situations involved are the same in that each allelomorph produces an antigen recognisable both in single and in double dose. On the other hand, P and p are used for the genes of the P series, being the same type of notation as K, k, though the serological conditions are different ; for the antigen controlled by p (if it exists) has not yet been detected. One further example out of many must be mentioned : the extraordinary fact that the genes of the MN groups are themselves represented as M and N: an arrangement which gives no indication of their allelomorphism, and so breaks the most fundamental rule of genetic notation.

Turning now to other subjects, the diagrams of crossing-over on page 169 are misleading because chiasma formation is incorrectly represented as occurring in the two strand, instead of in the four strand, stage. On seeing them, those unacquainted with the details of meiosis, and it is surely for such that these figures have been prepared, are bound to conclude that if a single cross-over were to occur between two loci in a hundred per cent. of instances, one hundred per cent. of inter-change chromatids would be formed, instead of the correct value of fifty per cent. This could lead to serious errors in the analysis of linkage.

There are a certain number of subjects which merit rather more extended treatment here than they receive. For instance, those interested in the more recent developments of serology will turn, among others, to the section describing the F locus of the Rhesus system, its genetics and the antigens and antibodies which it controls. Yet the information to be obtained under the heading *The inheritance of f* (p. 160) is confined to the statement, " The inheritance of f is that to be expected of an *Rh* antigen. An example will be given in the next section ". This example proves to be a small family tree in which segregation at the f locus is taking place. It throws no light on its mode of inheritance, and certainly does not indicate the unexpected fact that, contrary to accepted genetic usage, the notation has so been chosen that f is dominant to F.

Finally, I would strongly recommend that the references be listed alphabetically under authors, instead of appearing in the order in which they happen to be quoted in the book. It troubles no one that the first reference one meets in reading the text is not number one, but the corpus of an author's relevant works is a valuable component of a book such as this. Here, the contributions of each author must be searched for among twenty-one distinct bibliographies (at the end of each chapter), a system

which some defend, but I deplore ; but even within each bibliography they appear scattered at random, sometimes among a hundred entries or more, an arrangement which is not easily defensible.

These, however, are minor criticisms. It would be unnecessary to make them, were not the quality of this book a matter of consequence to a wide circle of biologists and medical practitioners. E. B. FORD.

THE DISTRIBUTION OF THE HUMAN BLOOD GROUPS. By A. E. Mourant, M.A., D.Phil., D.M. With a foreword by H. J. Fleure, F.R.S. Oxford : Blackwell Scientific Publications. 1954. Pp. xvii+438, 4 text figures, 9 maps. 42s.

In the second edition of *Genetics and the Origin of Species*, published in 1941, Dobzhansky states : " The geographical distribution of the blood-groups in man has been studied in more detail than any other instance of geographical variability ". Dobzhansky, like many other workers since that time, was able to consult Boyd's invaluable compilation, published as a volume of Tabulæ Biologicæ in 1939, which covered all anthropological blood-group data up to 1938. At that time only three systems were known : ABO, MN and P. Data on MN were somewhat scanty and the P system was, and remains, difficult to work with. During the past sixteen years the accumulation of further data has become enormous. Published ABO groupings run into millions ; six new blood-group systems have been discovered, all of which show large or very large differences of gene frequencies in different parts of the world ; the Rhesus system, with its genetic unit of three (now four) closely linked loci, provides a wide variety of genetic combinations, as also does the now extended MNSs system. Dobzhansky's remark could indeed be repeated to-day with even greater emphasis. The urgency of bringing Boyd's tables up to date has long been apparent, though of course the immense amount of work that would be involved was equally apparent. Boyd had indicated that he had no immediate intention of doing so himself and the task has now been accomplished in Mourant's anxiously awaited monograph. It is hardly necessary to mention Mourant's qualifications for the work. He is himself the discoverer or co-discoverer of two of the blood-group systems, to say nothing of a host of other contributions. His knowledge of every aspect of the serological field is encyclopædic, and he has long been specially interested in anthropological applications, involving detailed knowledge of a very large and scattered literature.

The book, then, must first be judged as a work of reference. We are told that it was originally intended to publish complete tables for the ABO system (after 1938). This proved too great an undertaking. Instead there is the next best thing—a complete bibliography, very conveniently arranged, with titles of papers quoted, and with its own topographical index. It is to be hoped, however, that it will ultimately prove possible to produce a supplementary volume of ABO tables, which would be of great value to many workers. For the MN system after 1938 and for all the other systems complete tables are published. These cover 80 pages. Much thought has been given to form and content and the result is excellent. The basic plan is to give the total number in each sample, with observed and expected percentage phenotypic frequencies and calculated gene frequencies. It must have been a difficult choice whether to show