page 139) should read $\{1+y'+(s-3)yy'\}$. On page 124, a paragraph is duplicated. The item $S\{t(9-1)n_{at}\}$ on page 139 should be $S\{t(a-1)n_{at}\}$. On page 100, the author might profitably have added the remark that maximum precision is attained when the products A_{R_1} A_{R_2} and A_{C_1} A_{C_2} are brought most nearly to equality.

There are some major additions to the text, of which a very useful one is a section on Fisher's scoring method. Here it may be felt that the author has perhaps obscured a particular merit of this method by choosing in his worked example to calculate the information algebraically instead of numerically as score increment divided by difference in parameter values, despite the fact that he has already indicated the possibility of this procedure in an earlier section of Chapter VII. It is perhaps to be regretted as a lost opportunity that the whole of this chapter was not revised in order to make the arithmetical advantages and mental economy of scoring technique more explicit. None the less this chapter still holds its place as one of considerable utility.

The other important addition which the author has made, is a wholly admirable chapter on the estimation of population gene frequencies. Here the author shows very effectively how to exploit partitioned χ^2, and gives a full account of the modern technique of estimation when three alleles are involved.

A. R. G. OWEN.

THE PRINCIPLES OF HEREDITY. By L. H. Snyder. Fourth edition 1951. Boston : D. C. Heath & Co. $4.50.

The principles of heredity arise from the experiments and ideas of Mendel and Weismann, Darwin and Galton, Bateson and Morgan. The growth and nature of these principles are not widely known and the experts have actually been confused about them. Their confusion does not seem to detract from the value of the research work they do. It has, however, certain concealed consequences. It limits their outlook. It prevents genetics from attaining its natural scope and new genetic discoveries from being understood by those who might be expected to understand them.

Professor Snyder's *Principles of Heredity* is intended to introduce " beginning students " to genetics. It derives the principles to which its title refers from Mendel and Morgan. It avoids certain complications by omitting Darwin and Weismann and dismissing Bateson as one of the joint discoverers of linkage.

How Professor Snyder treats the legacy of Mendel and Morgan may be seen from one parenthetical sentence (p. 17). " Mendel did not use the word ' gene ' . . . his hypothetical ' factors ' behaved as today we know genes to behave. We shall, therefore, use ' gene ' in relating Mendel's work." In other words, if Mendel had used the word " factor " he would have meant what Professor Snyder means by the word " gene." Some may think that there is nothing wrong in introducing the word gene into a description of Mendel's experiments. Some may feel also that the word gene is so familiar to all of us that it requires no definition. But in fact Mendel spoke only of " characters," " series," " cells " and " elements " and Bateson spoke of " unit-characters " (without defining them) only later being driven to assume " determiners " and " factors " by the consideration of dominance, presence and absence, and interaction. And surely this is of some importance in understanding the great assumptions of principle

involved in genetics. If the beginning student is given no idea of the difficulties there have been—and still are—in bridging the gap between character and determinant, he can scarcely know what the principles of heredity are about.

Passing now to a later period, in the last thirty years the great advance in the principles of heredity has been in understanding the mechanism of crossing-over, its universality, its relation to the theory and practice of recombination, and to the developing notion of the gene. On all of these things Professor Snyder dithers. He does not seem himself to understand how or when crossing-over takes place. Nor does he make clear how the event of crossing-over and the idea of the gene are connected—or even what he means by a gene, beyond saying that Mendel did not use the word.

On this foundation Professor Snyder builds a theory of human variation and evolution of the most advanced type under the title of " The mutant gene in man." He proceeds with abundant mathematics (taking, let us hope, the beginning student with him) but still without any precise use of words. The conclusion he reaches is therefore emphatic without being exact :—

> " It can be shown, in fact, that in populations numbering a few dozen or score of mating individuals, *the direction of gene-frequency shifts at any locus is in large part independent of the relative selective values of the alleles ; unless the intensity of selection is quite high, fixation or extinction of an allele depends almost exclusively on genetic drift* . . ." (p. 430).

These sentences have, we must suppose, no relevance to man. Neither, however, have they any definite meaning. They convey an aspiration ; and in this respect perhaps they epitomise Professor Snyder's book.

The Principles of Heredity has 155 delightful illustrations. It will no doubt enable the readers of the 250 colleges in which it is used to answer the 505 problem questions set out for them. The text deals with every aspect of the technology of genetics ; a subject to which a great many books have been, and will be, devoted. But it does not introduce the beginner or anyone else to the principles of the subject or to the methods of inquiry on which those principles rest. And in genetics, if he wishes to go far, the beginner will find that principles matter. C. D. DARLINGTON.