The treatment is so good that there is only one serious criticism, which, however, must be given some weight lest the student feel that quantitative genetics is better tied up than it really is. This criticism concerns the question of linkage, which is treated as if of negligible relevance. It is true that the author points out this is a matter of controversy and that the last chapter's contents are " to a large extent matters of personal opinion ". Nevertheless the reader is likely to be misled.

The attitude to linkage is based on the conclusion, derived from Wright's mathematical treatment, that for linkage phase to be non-random " coefficients of the same order of magnitude as the recombination frequency would be required. . . . Loci with more than about 1 per cent. recombination between them would not be expected to depart significantly from a random arrangement, unless they carried major genes with large effects on the character ". Is this not to fall into the error of assuming that such selection coefficients as Fisher, for example, postulated in order to demonstrate that small selection coefficients would be sufficient to keep relatively deleterious genes rare despite recurrent mutation, are normal selection coefficients? Are say 5 per cent. selection coefficients very unusual? If not then loci 5 map units apart may well be found in non-random linkage arrangement. Synthetic lethals occur and involve larger selection coefficients. It is to be hoped that some additional treatment of linkage will be added when the second edition of this book is called for.

Despite this criticism, however, this is an excellent book. Dr Falconer is to be congratulated on having produced just what was needed. It will have to be one of the standard textbooks for all students of genetics.

J. M. THODAY.

PRINCIPLES OF GENETICS. By Eldon J. Gardner. New York and London: John Wiley and Sons. 1960. Pp. 366, 192 figures. 60s.

The purpose of this book, according to the author, is to emphasise basic genetic principles and present a well-rounded view of modern genetics to the college student taking his first course in the subject. The words " basic " and " modern " should be noted. How far has he succeeded in his aims?

In his first chapter accounts are given of what the subject entails, why it is classified as a biological science, what organisms are commonly used in its study, and why; and lastly, the main contributions of the early pioneers of the subject are given. We can excuse the verbosity of this first chapter—no doubt it is meant to get the student interested. But, unfortunately, it continues at the expense of emphasising the fundamental principles of the subject and their relationship to one another. Perhaps the author is of the opinion that the more words he uses the simpler the subject is to understand.

Let us take the way that Mendelism is described. Independent assortment is illustrated by ample diagrams and chequerboards, and the actual numbers of progeny obtained by Mendel in his experiments are given. But any reference to the physical basis of inheritance must first await a chapter on probability which is introduced without a clue being given as to where chance operates in the process: not a word yet about fertilisation or meiosis. Eventually the author introduces us to chromosomes and

attempts to illustrate how the genes they carry undergo independent assortment. He does this without considering chiasma formation and its meaning. Does he realise that before one can show the real relationship between independent assortment and meiosis one has to account for the overall ratio of *gametes* from each parent; that this ratio results from pooling the four products of each of many cells which have gone through meiosis; that, therefore, the relationship can be shown effectively only by considering how each kind of different combination of four products arises; that the frequency and type of each combination depend on chiasma formation between the genes and centromeres as well as on independent orientation of chromosomes on both the first and second metaphase plates? If so, why has the student got to remain ignorant of this? It is odd that one has to read chapters on gene interaction, multiple gene inheritance, and sex-linkage before even being introduced to the word chiasma at the end of the chapter on gene linkage. Further, if almost as much space must be given to copy-choice as that given to chiasma formation as a mechanism to account for crossing-over, why isn't the student entitled to know what evidence exists for copy-choice?

The chapter on multiple inheritance gives a good account of the classical work of Nilsson-Ehle. Are we then brought up to date with what is known about polygenes? They are mentioned. Of the mechanism of quantitative inheritance we are told "The classical study of kernel colour in wheat on which the multiple gene hypothesis was established may not represent multiple genic or polygenic action in the sense in which Kenneth Mather and others have recently framed it". No more. Isn't the way in which Mather has framed it fundamental enough for the student to know about?

An account of gene product interaction given in a separate chapter from that in which physiological genetics is considered would have been justified ten years ago. But to describe modified ratios arising as a result of gene product interaction while omitting such examples as the inheritance of cyanide production in white clover, eye pigments in *Drosophila*, and the cases of epistasis demonstrated in fungi, the biochemical basis of which is known, is not justified in a modern textbook. Must the ratio always be a modified 9 : 3 : 3 : 1? Must tradition be followed?

Work in the field of microbial genetics has contributed substantially to our knowledge of gene structure and action, and confirmed many basic principles already elucidated in higher organisms. In addition it has revealed novel genetic systems in these organisms. Yet the author is happy to limit his account of recombination in bacteria and bacteriophages to ten fragments. One of these appears before linkage in higher organisms is considered; the other when he describes what is known of the chemical nature of genes. The work of Jacob and Wollman is not mentioned. Accounts of genetic systems such as heterocaryosis, parasexuality, and somatic recombination in fungi are also omitted.

The Watson-Crick model of the structure of DNA is described, but it is disappointing to see that the author has not thought it desirable to include the pioneer contributions of Chargaff and other workers who made the formulation of the model possible. Aside from the structure of DNA much of the modern work contributing to our knowledge of gene structure and action does not appear. Surely, such complementation studies as those of Catcheside and Giles on *Neuroposra* deserve mention. And where

is such work as that of Taylor's on radioactive labelling of chromosomes, and Freese's work on mutations induced by base-analogues ?

A general account is given of " chromosomal aberrations ". By these are meant the origins of new types of chromosome in evolution by structural change. Here the emphasis is on how meiosis takes place in organisms heterozygous for these " aberrations ". Little idea is given to the student of the significance of structural changes in the evolution of a species. Similarly, in dealing with polyploidy later in the book, the following statement appears : " In general it is the presence of genes and their interactions with each other and the environment, rather than the number of chromosomes among which they are divided, that determines the variation that has real meaning in evolution." Does the author realise that the rate of evolution depends on the amount of variation released ? And what happens when genes are not present ?

It is indeed surprising to see a text of this type giving an account of polyploids without illustrating the way in which their chromosomes behave at meiosis. Aside from allowing the students to understand the genetics of polyploids, such illustrations would give a better understanding of the mechanism of meiosis in diploids. Also surprising is the omission of certain references given at the end of the chapter on chromosome numbers. Standard works giving the chromosome numbers of organisms are published together with classical cytology texts, but for some reason neither they nor any of the fundamental contributions of their authors deserve mention.

A chapter devoted to a description of mating systems ignores completely the various systems found in plants. The only time in the whole book that one of these is mentioned is as an illustration of multiple allelomorphic inheritance. Is it wrong to think that a better understanding of population genetics is gained by studying a range of such systems ? When discussing the effects of outbreeding and inbreeding the author seems to be obsessed with the deleterious nature of recessive mutations. Nowhere does he point out that mutations which may be deleterious when they arise may contribute to the adaptation and evolution of the species following a change of their environment—including that of background genotype by recombination.

In general this book consists of a series of accounts on which the author has made little attempt to correlate or integrate the information in each. He has failed to present genetics as a " whole ", and to convey the excitement of modern studies to the would-be geneticist. E. A. BEVAN.

THE CONTROL OF GROWTH AND FORM. By V. B. Wigglesworth. Ithaca: Cornell University Press and London: Oxford University Press. 1958. Pp.vi+140. 21s.

The book is based on six Messenger Lectures delivered at Cornell University at the end of 1958. The author assumes that the physiological control of growth and form is based on principles that are common to all animals. He then chooses growth and differentiation of the insect epidermal cell and more precisely the epidermal cell of *Rhodnius* in order to discuss and illustrate these principles.

The nature of the epidermal cell and its capacity to differentiate are discussed as well as the control of growth and form by hormones. The last two chapters are entitled Polymorphism and Integration of Growth respectively.