beginning stands in the relation R or a power of R. Thus we might have a species, a man, a cell, or a gene within a cell, together with all its descendants.

More general is the "*dend*," which allows both many-one and one-many relations, so that there need be neither a unique beginner nor a unique final term. The noun "δένδρον" is of course the source. In particular we have "*zgdend*" and "*cpdend*"—dendra, respectively, of cells (including gametes which, by fusion, yield zygotes) and of cell-parts (in particular such "continuous" or essential parts as chromosomes and genes). Cytology is further developed by a treatment of A-pairs—abstractly defined pairs, exemplified by allelomorphic pairs of genes in the same cell.

Genetics, naturally the next topic, is well outlined—some of the concepts are Mendelian classes of zygotes, A-classes of gene-pairs, a-classes of genes, in each case classes of genetically related objects. The probability calculus of heredity is briefly developed. Woodger points out that Mendelian theory cannot take account of the "discontinuous" components of a cell—those, such as the cytoplasm, which are not certainly transmitted to all descendants of a cell.

Of embryology and taxonomy Woodger does not pretend to give more than a sketch. A requisite in a logical study of the former would seem to be a clear distinction between embryo and adult. The author sets the division at the instant after which no further structural complexity develops. But, as structural complexity is one of the undefined concepts, and is not even furnished with adequate axioms, we gain little. There is, however, a careful description of various phases of the development of an organism. In taxonomy Woodger distinguishes between varieties, species, and larger groups, substantially on the basis of sterility and epochs of differentiation, those distinctive features which fit most readily into his present theory.

Of course this book is but a beginning of the axiomatic treatment of biology. For one thing, it holds to topology, avoiding metric statements of size, duration, spatial separation. Again, it restricts definitions to typical cases, which are by no means universal. Cell division is always taken to be a one-two relation. "A woman who gives birth to identical twins does not stand in the relation of sexual parenthood to either twin in the sense here defined." Likewise, continuous components of zygdendra are forbidden to divide in precisely the second "generation" before a gamete. As this, though typical, is not universal, a mathematician might well prefer to say "precisely the nth generation."

There have been mistakes in biological reasoning in the past. The reviewer would be glad to have cases cited in which the existence of Mr. Woodger's calculus would have prevented errors.* Once mastered by biologists, it may well help them to more rapid, reliable reasoning in the future.

E. S. ALLEN

Introduction to the Theory of Fourier Integrals. By E. C. Titchmarsh. Oxford, Clarendon Press, 1937. 10+390 pp.

The theory of Fourier integrals, although originating as early as that of Fourier series, has not been adequately treated in monograph form until recently, when "introductions" to the subject were published by Bochner, Wiener, and Zygmund (a chapter in his excellent book on trigonometric series). The method of Fourier trans-

* Cf. R. A. Fisher, loc. cit., p. 7: "It is a remarkable fact that had any thinker in the middle of the nineteenth century undertaken, as a piece of abstract and theoretical analysis, the task of constructing a particulate theory of inheritance, he would have been led, on the basis of a few very simple assumptions, to produce a system identical with the modern scheme of Mendelian or factorial inheritance."