

summary of those aspects which have direct application to communication problems. The methods are then used in a study of the influence of periodic and transient signals on various types of circuit, ranging from simple linear networks to multi-stage amplifiers. The band spectra involved in the different types of modulation are then discussed, and the same analytical methods are applied to the study of travelling waves.

The emphasis throughout is on the development of the mathematical methods, and the book is recommended to students wishing to acquire facility with these methods. Brief descriptions of practical techniques, circuits and devices are given, but are no fuller than is necessary to provide the physical background for the mathematical analysis. The problems discussed are those which occur in modern radio practice, and many of them, relating to television, transistors, cavity magnetrons and klystrons, for example, are of recent origin. The presentation is clear and errors few. Each chapter contains exercises for the student, and there are many references, nearly all to American publications.

As radio communication develops, it becomes increasingly necessary for engineers to become familiar with the more advanced mathematical methods. Mr. Cuccia's book is a valuable guide to the use of some powerful analytical tools; but it appears that even these have their limitations, and there are many problems in the solution of which an ounce of experiment is still worth a ton of mathematics.

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THE CESTODES

The Zoology of Tapeworms

By Robert A. Wardle and James Archie McLeod. Pp. xxiv+780. (Minneapolis: University of Minnesota Press; London: Oxford University Press, 1952.) 80s. net.

THIS encyclopædic work on cestodes, comprised within 780 pages, including the index and a bibliography of 105 pages with nearly three thousand references, is a comprehensive study of the tapeworms known throughout the world. It attempts to summarize what is known about their classification, structure, life-histories and ways of life; it discusses theories of origin and evolution; and it provides detailed, systematic descriptions and keys for the identification of all the known families and genera and most of the known species.

Part 1, the first 169 pages, consists of five chapters. The first deals with the general features of cestodes, including information about the 'holdfast organ', a term preferred by the authors to the more conventional 'scolex', the body, skin, parenchyma, musculature, and the osmoregulatory, nervous, and male and female reproductive systems. Chapter 2 discusses the cestode life-cycle. Our knowledge of the development and life-cycle of tapeworms has accumulated more slowly than that of their general anatomy, and few tapeworm life-cycles are known completely. What information, however, is available is presented in a coherent account. Tapeworm biology is discussed in Chapter 3 from two aspects, that concerning the animal as an individual (its growth, activities, alimentation, respiration and so forth) and that concerning the animal as a member of a partnership (its relationships with other parasites and with its

host, and its effects upon the host and those the host may have upon it). In Chapter 4 the various hypotheses, which are purely conjectural, as to the origin and evolution of tapeworms are given, and in Chapter 5 there is an interesting account of the history and classification of cestodes.

Part 2, the bulk of the volume, begins on p. 173 with the classification used by the authors in their book. It is of interest, to systematists at least, to note that the class Cestoda is composed of eleven orders, of which five are new, and the class Cestodaria of three orders, of which one is new. In the ensuing pages these orders are discussed, and for each there is a description, a historical review, the recognition features, and the classification of the order into families, sometimes sub-families, and genera. In the notes on each genus, mention is made of species-groups and of species, and those forms which cannot be fitted within the order or family are dealt with under the heading "Genera Inquirenda". It is difficult, within the compass of a review, to summarize the many interesting and important points raised in this part of the book, and two examples must suffice. Readers will look in vain for *Tænia saginata* and *Tænia taeniiformis*, for they are given respectively as *Tæniarhynchus saginatus* and *Hydatigera taeniiformis*. Regarding the second species, the authors mention that the establishment of genera, indistinguishable as adults, upon features of the larval stages has much to commend it, although there is much to be said against it too. Recognition of the tæniid genera *Echinococcus*, *Hydatigera*, *Multiceps* and *Tænia* on such grounds has long been the practice among American parasitologists; but this very practice opens up the question whether, in the absence of any practicable method of counting chromosomes, the specific and generic units of zoological classification shall be based upon readily recognizable characters of the adult animal, or upon features of the life-cycle and biology, a procedure which, while eminently desirable, is rarely attainable. Without taking sides in the argument, the authors have, in this matter, followed the current American practice.

The authors have undertaken an enormous task, and the result is an important and valuable contribution to zoological literature. They observe that the keys to an understanding of many obscure biological phenomena may be within these animals; but the investigator is baffled by the fragility of his material, by its brief existence when removed from its normal habitat, and by the complexity of its environmental requirements. Nevertheless, a vast literature, polylingual, scattered and fragmentary, has accumulated around them, and the authors' aim has been to present from this literature and from their own observations a coherent story of these helminths and to expose the gaps and imperfections in our knowledge of them; in this they have succeeded remarkably well. The book deserves close and attentive study, for in it are raised problems which provide a challenge and an inspiration to research. It is scarcely a text-book for the undergraduate, but a work of reference for parasitologists, zoologists and workers in various fields of biology. There will be many occasions when it will be consulted by teachers and research workers. The 419 text-illustrations—mostly line-drawings—are well chosen and uniformly good, the text is concise, up to date and lucid, and the printing and binding are all that could be desired.

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