research on genetic mechanisms, from the molecular to chromosomal level, and from lower to higher forms, in order to present a picture of current activities and ideas in this field of biology." The contents of the book are indeed described by this statement, and the use of the word "evolution" in the title is warranted because in nearly every case the authors emphasize the evolutionary implications of their data and ideas.

The 21 papers published in these proceedings treat a rather wide range of topics, from recombination (H. L. K. Whitehouse) to chromosome structure (E. J. Dupraw) to the metaphysics of evolution at the molecular level (C. R. Woese). However, a central theme is evident, which is the nature of repetitious versus unique DNA in the eukaryotes and the question why there is so much redundancy in the higher eukaryotes. Papers by B. J. McCarthy and M. N. Farquhar and by N. R. Rice deal with this question directly. McCarthy issues a warning about interpretation of data by pointing out that redundant and unique DNA are to a great extent defined by the experimental conditions and are not two distinct classes. Rice points out that there are at least several classes of repeated sequences of DNA. She has found that 10 to 20 percent of rodent species studied (some as closely related as rat and mouse) have genomes with repeated elements that are unique to the species. Thus it would appear that 20 percent of the total mouse DNA, which shows high thermal stability, has no measurable counterpart in rat DNA. This is indeed an important, though puzzling, observation.

The currently popular subject of "neutral" mutations is discussed in two papers, one by W. M. Fitch and the other by R. Milkman. As expected they leave the answer in the air, but their discussions and the remarks from the floor are of great interest for an understanding of this important question.

Probably the part of the volume which will have the longest half-life is a series of four papers giving quantitative data about DNA per genome in organisms ranging from prokaryotes to higher plants and vertebrates. All four of these papers contain detailed data, and will serve as a ready source of reference. In particular the papers by Sparrow *et al.* and H. Rees have valuable charts which will be of considerable usefulness in teaching.

The last paper in the volume, by A. Campbell, is a speculative one about the role of episomes in bacterial evolution. It has a considerable number of thought-provoking ideas in it; but so do the other papers, for the participants are all experts in their areas.

Evolutionists of all varieties will do well to consult this volume.

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## The History of Mapping

**Maps and Man.** An Examination of Cartography in Relation to Culture and Civilization. NORMAN J. W. THROWER. Prentice-Hall, Englewood Cliffs, N.J., 1972. viii, 184 pp., illus. Cloth, $5.95; paper, $2.95.

This book is a concise and summary account of the development of cartography from earliest times to the present day. More precisely, it seeks to trace the interplay of cartography with cultural and scientific history, to identify a development process not so much in its own right as in relation to the changing total environments in which it was set. For example, in a chapter entitled "Cartography in the scientific revolution and the enlightenment," the author is concerned to select from across the spectrum of scientific advancement those aspects which related to progress in contemporary cartography. Thus he draws attention to improvements in survey instruments and techniques as well as astronomical discovery. But it was not just a matter of new methods of making maps giving rise to cartographic progress. Scientific discovery was in some instances of a nature which required cartographic portrayal, and thus an unprecedented amount of new subject matter was available for cartography. The rapid advance in thematic mapping was necessary to portray such diverse and newfound information as the patterns of prevailing winds across the earth's surface or the nature of the earth's magnetic field, and new techniques (for example isopleths) were developed to handle such subject matter. Moreover, not only was improvement in cartographic technique stimulated by scientific discovery; the dissemination of knowledge by cartographic means was in turn a stimulus to scientific discovery.

In dealing with the period prior to the 17th century, the author is covering well-trodden ground. He takes full account of recent work, however, and thus his treatment of early developments is a useful summary despite overlap with the work of previous writers. Among other things, he gives more credit to both Roman and Oriental cartographers than has been customary in much previous writing. But it is the last three centuries which provide a field for greater originality in textbook writing, and over half of the book is usefully devoted to this period. In particular the succinct treatment of the complex innovations in 19th-century cartography is welcome. For example, considerable sophistication came about in the field of cadastral mapping, in part as a consequence of the development of precision techniques, but once again not to be seen out of the larger historical context. It was a wide range of factors which gave the impetus to substantial improvements in both technique and the volume of work achieved, factors such as contemporary exploration, the political and administrative necessity of locating boundaries, the military need for precise survey work, the legal necessity of accurate measurement and allocation of newly settled agricultural land, and, conversely, rapid urban growth.

The book concludes with a review of modern cartography, in which a range of topics are dealt with, such as the state of the International Map of the World, the extent of large-scale topographic mapping of the earth's surface (which is very much more restricted than is generally appreciated), the concept of the national or regional atlas, lunar mapping, and publicity or propaganda maps. Inevitably, this last section is highly abbreviated, but in the context of a slim and summary volume which encompasses the entire time span of cartography, such abbreviation is appropriate. This is a book not for those who seek detailed information about modern maps, but rather for those who look for an introduction to a prolonged evolutionary process in which our modern map is just one more phase.

It is unfortunate that in a few instances the black-and-white reproductions are so reduced in size to fit the modest format that they verge on the illegible.

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