kinds of brachiopods recognized by most paleontologists. It is at the subordinal and superfamily levels that many difficulties appear. Few paleontologists would now insist on a monothetic Beecher-type classification, but some will dispute the revisions made by Williams and Rowell. Despite the apparent finality of this work, major classifications will continue to be advanced on combinations of internal and external characteristics that are considered by various specialists to have phylogenetic and evolutionary significance.

A few examples among the articulates indicate the extent of the difficulties. It has long been recognized that brachiopod shell structures fall into three broad categories: endopunctate, pseudopunctate, and impunctate. The apparently random inclusion of punctate genera in the section on Spirifers is most confusing. Punctate forms, usually with a spondylium in the pedicle valve, are classed as Superfamily Suessiacea, while the punctate syringothyrid forms are included as a family in the Spiriferacea. The Spiriferinacea are predominantly punctate forms which, however, include both the impunctate *Odontospirifer, Spiriferinaella,* and *Spiriferinoides* and the clearly unrelated genus *Dimegelasma.* No argument based on phylogeny or evolutionary change can justify such a hodgepodge. Similar confusion exists among the extremely variable genera included in the superfamily Reticulariacea. Among the strophomenaceans a complete reorganization of families and subfamilies on the basis of internal characters of the brachial valve, coupled with consideration of shell structures, probably would have greater phylogenetic significance than the classification given in the *Treatise.*

Despite these weaknesses in classification and organization, which are largely matters of opinion among specialists, the editor, the authors, and their collaborators have assembled most of the significant biological information on this important animal phylum. These volumes will be a standard reference source for student, teacher, and specialist alike for many years to come.

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Biological Organization: The Case for Evolution

It is no longer a fashionable exercise to prove the "case for evolution." Those textbooks that marshal the evidence from comparative anatomy, embryology, and paleontology in a solid phalanx of Victorian assurance are rapidly becoming extinct. They are being replaced by others that accept the fact of evolution as common knowledge and concern themselves with ways and means.

Bruce Wallace, in **Chromosomes, Giant Molecules, and Evolution** (Norton, New York, 1966. 171 pp., $1.95), contends that we are deluding ourselves. He believes that the recent flurry of antievolutionary sentiment (see *Science,* 11 Feb., p. 632) is the opening gun of a new campaign, and he would like to see his book become the weapon to win the allegiance of intelligent uncommitted laymen, especially teachers in public schools, clergymen, and parents.

The strategy for the demonstration of evolution is familiar, although the illustrations from genetics and molecular biology are a refreshing change from ear bones and aortic arches. Essentially the method is to show (i) that the structures of biological materials (here these are giant chromosomes, amino-acid sequences in proteins, and base sequences in DNA) are complex and precise; (ii) that different species possess very similar structures; (iii) that differences of structure within and between species are of the same kind; and (iv) that it is almost inconceivable that such similar structures could have independent origins.

The case built up by Wallace is a clear, concise, and logically unassailable one. The facts are well presented in a novel format that consists of a short text followed by 39 figures, each with a detailed explanation. My principal reservation concerns the varying standard of depth. The terms mitosis and meiosis are deliberately avoided for the sake of simplicity, but the structural formulas for 20 amino acids appear very early in the argument. Some of the examples, such as the diagram of chromosome changes in *Datura,* are quite complex. They will certainly tax the perseverance of the nonbiologist.

Another audience, however, may well be reached by this book. Undergraduate and beginning graduate students in biology should find that it provides a useful introduction to some very exciting material. It forges connecting links between at least three levels in the hierarchy of biological organization—the biochemical, the cytological, and the populational. Let us hope, therefore, that its principal use will be in the classroom rather than as ammunition in an ideological war.

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Ecological Genetics

In an age when any but the narrowest specialist finds more books published in his field than he can possibly read, the appearance of still another volume of symposium proceedings is likely to engender a feeling of resignation in a prospective reviewer. However, **The Genetics of Colonizing Species: Proceedings of the First International Union of Biological Sciences Symposium on General Biology** (Academic Press, New York, 1965. 458 pp., $24), edited by H. G. Baker and G. L. Stebbins, proved a pleasant exception from run-of-the-mill symposia proceedings, and I read the volume from cover to cover with great interest and considerable profit.

A reading of this volume is well worth the effort for a biologist interested in evolutionary problems. As I see it, the book's particular merits are threefold: (i) Much of the material is new, and it is clearly presented by outstanding authorities in the field. Much credit should go to the editors and to Professor C. H. Waddington, who selected the speakers. (ii) The problems of colonizing species are viewed rather broadly—not only over a wide taxonomic spectrum but also from the viewpoints of the several relevant disciplines, genetics, ecology, cytology, and behavior. (iii) The import of the contributions goes considerably beyond the confines of the symposium title. Much fundamental evolutionary theory is discussed using colonizing species as examples. This aspect of the book makes it of considerable value to evolutionists in general.

The subject matter of the symposium was concerned with the genetical and ecological consequences of the accidental or deliberate introductions of animals or plants into parts of the world

not native to them. Such introductions are in effect evolutionary experiments. The analysis of the interactions among the invading individuals and between them and the native species pertains to a field of evolutionary biology in which genetics and ecology interact closely. This subject of ecological genetics has recently received considerable attention at the hands of both geneticists and ecologists. Persons interested in this field will find this book a mine of factual information with a good many principles and theoretical models discussed as well. The types of colonizers, the genetic and reproductive systems exhibited by them, their ecological tolerances, and their presumed evolutionary strategies are discussed for a wide variety of organisms.

A detailed discussion of the material contained in this book would require an extended review. Merely listing the titles and authors of the 27 contributions in this volume would require a sizable paragraph. I shall therefore exert the reviewer's privilege of singling out those of the many admirable contributions that I found especially thought provoking because of their relevance to problems of interest to me. Waddington's introduction to the symposium, in which he discusses evolutionary strategies of colonizing species, shows his usual masterly touch. Few evolutionists can pack as many important ideas into a few paragraphs as can Waddington. A population genetic survey of self-pollinating species of plants, by R. W. Allard, reveals surprising phenotypic and genetic variability engendered by even a low level of outcrossing. R. G. Lewontin, in a clever manipulation of the equation for the stable age distribution, arrives at some important evolutionary consequences of modifications of biotic parameters. A discussion of genetic differences in various components of growth and nutrition of *Drosophila*, by F. W. Robertson, aids an understanding of competition phenomena observed in several fly species. Fascinating experiments on intraspecific competition and migration in plants and animals are summarized by Kan-ichi Sakai, while J. J. Harper discusses the ecological interactions between weeds and the invaded native species. Frank Fenner presents a good account of the dramatic co-evolution of rabbits and their pathogenic Myxoma virus. A thorough review of chromosomal polymorphism in various species of *Drosophila* is offered by H. L. Carson, who feels that widely distributed species arise from marginal, frequently chromosomally monomorphic populations. Various authors provide interesting accounts of several groups of weeds.

Discussions, apparently transcribed from tape recordings, follow all of the papers. Such discussions often are very valuable in elaborating on the thinking of a given author and in bringing out aspects that he failed to stress. However, not all of the published comments are useful in this manner, and I am more than ever dubious about the wisdom of faithfully reporting discussion verbatim or nearly so. Some of the comments reproduced in the book contribute neither to the clarity of the discussion nor to the reputation of the discussant. However, these are niggling points that do not detract from the substantial value of this book which I am happy to have read and shall continue to find useful.

One additional point must be considered. This volume costs $24, a price that I consider completely out of line for a book of this size and type. If it is in fact true that it is not economically feasible to publish such a symposium volume for less than $24, then serious thought must be given to alternative methods of disseminating this information so that the many research workers and graduate students who could benefit from this material can reasonably obtain it.

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Molecular Biology

Nucleic acids play a central role in the interdiscipline that has come to be known as molecular biology. In recent years, owing to the numerous advances being made in this area, many books have been published, some at the "beginner's" level.

Such a book is **The Biological Role of the Nucleic Acids** (Elsevier, New York, 1966. 112 pp., $3.95) by David Cohen. It is a short work, slightly more than 100 pages; however, since Cohen has elected to write about all of molecular biology, this brevity is its principal weakness. In addition to this difficulty, he never resolves the problem of whether to direct the book toward scientist, student, or layman. As a consequence, the presentation often vacillates stylistically between the type of superficiality encountered in bad newspaper reportage and that which results from insufficient explanation of complicated phenomena. For example, when referring to the action of alkali on RNA, Cohen makes the following statement: "Thus RNA, because of the extra oxygen atom, literally falls to pieces when treated with even the mildest alkali." A few pages further along in the text there is a diagram that depicts in a highly sophisticated manner (that is, by electron displacement) the mechanism for the hydrolysis of RNA by alkali. This is explained in the following way: "The mechanism of this hydrolysis is expressed by the reaction sequence shown in Fig. 38, where the small arrows represent movement of pairs of electrons." No additional explanation is given.

Cohen is inconsistent in other ways. He states in the preface that readers will be warned of "any theories which are of a speculatory nature." However, in discussing the various properties of soluble RNA, this molecule is factually described existing "as a double helix but is looped back on itself so that it is really a single chain," a theory which was never supported by direct evidence and which has now been discarded.

Finally, the lack of references, with only a skimpy bibliography, is self-defeating if the book is to have any value for the scientist or student. Even the general reader would find a selected reading list extremely helpful, and such a list would enable him to maintain and extend any initial interest.

If Davidson's fine monograph *The Biochemistry of Nucleic Acids* is to be thought of as "a child's guide to the nucleic acids," Cohen's book can be considered at best its prenatal counterpart.

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Earth Science

If the reader is a confirmed granitizationist, he will doubtless find much that is comforting in E. Raguin's book, **Geology of Granite** [Interscience (Wiley), New York, 1965. 336 pp., $11], which has been translated from the second French edition by E. H. Kranck, P. R. Eakins, and Jean M. Eakins, for Raguin has followed in the footsteps of H. H. Read in that he believes that there are granites and