of this collection learn of these implications, both practical and theoretical? Something, but not nearly enough.

Thus the book has three kinds of shortcomings: recent, important developments are omitted; transitions between experiments are not described or are unclear; the significance of some of the work is lost because it is out of context. It could be argued that such shortcomings are inherent in the nature of collections of this kind; or that this is an important book because it reviews the work of an unquestionably important scientist. Each of these arguments has a certain validity. Yet one comes away from the collection feeling that it could have had a wider impact had some of the gaps been filled, if not by Miller then by someone else versed in the various areas in which Miller has made so many important contributions. A few papers not crucial to an adequate coverage of Miller's work could have been deleted to make room for transitional and explanatory material, and the collection could thus have been converted from one that is undoubtedly valuable to the sophisticated professional into one of far wider usefulness and importance, a book that would have been more nearly commensurate with the breadth and significance of Miller's contribution to the daily more important problem of understanding behavior.

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Approaches to Ecology

Analysis of Temperate Forest Ecosystems. A seminar-workshop, Gatlinburg, Tenn., July 1968. DAVID E. REICHLE, Ed. Springer-Verlag, New York, 1970. xii, 304 pp., illus. $14.50. Ecological Studies, vol. 1.

This volume aims to summarize existing data on temperate forest ecosystems and to establish a conceptual framework for ecosystem analysis. It begins with an introduction to systems analysis as it applies to the study of ecosystem structure and function, moves on to consider the roles of primary producers, consumers, and decomposers, and ends with sections devoted to nutrient and hydrologic cycles.

A lucid account of systems modeling is given by F. E. Smith, using a simple hypothetical ecosystem to illustrate the methods. D. W. Goodall points out the conceptual difficulty associated with interpreting the response of an ecosystem to variations in environmental factors when the environment itself is part of the ecosystem, emphasizing further the lack of distinction between dependent and independent variables when, as happens in ecosystems, most variables are interrelated.

The importance of recognizing and accounting for temporal variation in productivity studies is stressed by several authors. An interesting paper by H. A. I. Madgwick points to the value of canopy models in gaining an understanding of photosynthetic processes, a view reinforced by J. S. Olson in relation to carbon exchange in the biosphere. Olson's analysis of available data leads him to suggest that the contribution of terrestrial ecosystems in general, and forests in particular, to the biogeochemical cycle of carbon has previously been underestimated. A stimulating paper by G. M. Woodwell and D. B. Botkin outlines the Brookhaven approach to solving the basic production equations for terrestrial ecosystems. Based on the applications of gas exchange techniques, but still heavily dependent on harvest methods (which are discussed in greater detail by other authors), it illustrates nicely the interdependence of the several approaches to a study of ecosystem productivity.

The degree to which compensatory responses of "dependent" variables stabilize ecosystems is a contentious issue. D. R. McCullough discusses this question, defining stability as the capacity of the system to adjust to modifications. According to this view, the continuing change during community succession does not necessarily involve instability. McCullough comes down on the side of those ecologists who affirm that there is a "balance of nature," a balance which functions mainly by setting limits on deviations.

The section on decomposer populations contains a description of the use of chemical methods in estimating microbial density (L. Steubing) and a comprehensive account of the role of soil invertebrates in the decomposition of organic matter (C. A. Edwards, D. E. Reichle, and D. A. Crossley, Jr.). Lack of knowledge on the part of the reviewer concerning water flux inhibits comment on the papers which deal with this aspect of ecosystem analysis.

Because the book appears only a few years after the English translation of Rodin and Bazilevich's comprehensive summary of production and cycling in terrestrial vegetation, the first of its stated objectives, to summarize existing data, was perhaps the more easily met. Taken overall, it achieves both this and its other aim of providing a conceptual framework for ecosystem studies, though it leaves largely to the reader the task of erecting the framework from the planks scattered among the contributions of various authors. The volume is complementary to (and in my view much more valuable than) the International Biological Programme handbook on primary production in forests.

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Evolutionary Cytogenetics

Chromosomal Evolution in Higher Plants. G. LEDYARD STEBBINS. Addison-Wesley, Reading, Mass., 1971. viii, 216 pp., illus. Cloth, $9; paper, $4.50. Contemporary Biology series.

After its heyday in the 1930's and 1940's, chromosome cytology suffered something of an eclipse with the burgeoning of work on microorganisms and the resulting clarification of so many aspects of the structure and function of the prokaryotic genome. Now fashion is changing again: "chromosome" and "chromatin" are becoming words of common use once more as interest moves back to the higher organism and problems connected with the eukaryotic genome and its expression in development and differentiation. As the new work gathers momentum, there is the distinct possibility that a considerable body of information bearing upon chromosome structure, behavior, and function will be lost or overlaid, necessitating rediscovery at some future date, following a pattern not unfamiliar in the history of biology. This excellent book by Stebbins therefore comes at an opportune time. Aimed at graduate-course level, it brings together in compact form a great deal of chromosome lore which will ultimately have to be integrated into any general account of the function of eukaryotic genomes, and does so in the lucid and readable style that has been a hallmark of the author's work over many years.

One of Stebbins's "basic assumptions" is that "chromosomes are much more than strings of DNA molecules. They are organelles that, in addition to housing genetic information, provide mechanisms for releasing and regulating the transmission of this information during development according to a carefully adjusted programme." The book itself provides ample justification for this assumption—and for its rider, that one of the principal advantages of the chromosomal organization is that through a variety of devices it can "provide for perpetuating and transmitting as units combinations of genes that interact with each other in adaptive fashion," while still offering the capacity for sensitive response to selection and so for evolutionary advance.

The introductory chapters summarize some features of the chromosome as an organelle. The problem in a work of this kind is always to know how far to take the biochemistry; Stebbins is cursory, but his treatment will mostly be sufficient to provide some orientation for the student reader in need. The coverage of chromosome chemistry is perhaps too brief, for the problem of how DNA is organized in the chromosome barely emerges as the pressing one it is. The paragraphs concerned also contain a few erroneous or misleading statements. Chromomeres are described as one form of heterochromatin, and little indication is given of their likely nature as regions of persistent coiling of the chromonema. As for the chromonema itself, one passage seems to imply that the structure seen light-microscopically is the same as the elementary 200- to 300-Å fibril seen with certain preparation procedures electron-microscopically—hardly an acceptable equation without further explanation. And the DNA molecule is certainly not "far below" the resolving power of the electron microscope, as many recent publications illustrate.

The main part of the book is devoted to several of Stebbins's favorite themes —chromosome morphology, chromosome mechanics, and the ecological and evolutionary significance of changes in chromosome structure and number. The versatility of the chromosomal system in plants is illustrated with a wealth of examples in the sections concerned with structural changes and their effects on linkage patterns, recombination, and karyotype morphology. The explanatory diagrams provide a valuable adjunct, although the various errors in figure 4.2 will indeed make it a puzzle for the student reader. In the chapters on polyploidy, hybridization, and plant geography and evolution, Stebbins interweaves evidence and interpretation in a continuously moving panorama in a way which certainly carries the reader along as one plausible hypothesis follows upon another. Yet, although the style is attractive, not always does it allow the presentation of "both sides of the case in question" as the preface promises. Thus the familiar arguments for the restricted evolutionary importance of apomixis appear, without mention of the evidence that at least one major group, the subfamily Panicoideae of the Gramineae, contains so high a proportion of genera with similar forms of facultative apospory as to allow no denial that a balanced sexual-apomictic system is quite compatible with a long and successful evolutionary history.

With a work of so small a compass it is perhaps carping to complain of omissions, but one point should be made. A policy of referring largely to reviews instead of original research papers may be economical of space, but it is not one that can give a proper historical perspective to a reader. Many of the cardinal ideas in this book are paraded without direct reference to their proper parentage—which is a pity, for it means that some of the major names in the development of plant cytogenetics are given no mention.

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Life Strategies

Parasitic Insects. R. R. ASKEW. Elsevier, New York, 1971. xx, 316 pp., illus. $11.50.

In 1968 Askew proposed a mechanism for the rapid speciation of small parasitic wasps (Chalcidoidea) based on a detailed consideration of sperm production, mating behavior, gregarious feeding, synchronous development, and spatial relationships within a population. This detailed ecological approach provided a convincing hypothesis. Therefore when his book was published I expected, and found, fascinating accounts of parasitic insects based on ecological details which enable the reader to gain a broad comprehension of the life system of each taxon treated.

The book was designed for undergraduate and graduate students specializing in entomology, economic entomology, ecology, parasitology, and associated subjects, and it is well suited for these readers. Agriculturalists and veterinarians will also find the book valuable. The applied aspects are allotted only two relatively short chapters, on parasitic insects as vectors of human disease and on biological control, but the fund of biological information in the remainder of the book, supported by an extensive bibliography, makes it an important reference for anybody dealing with parasitic insect control.

The treatment of the insects varies according to the taxonomic diversity within the group to which they belong. For those belonging to large, diverse groups such as the wasps and flies, detail has had to be sacrificed. Therefore the chapters that are most successful in presenting a broad picture of the ecological relationships of organisms are those on such groups as lice and fleas. Taxonomic treatment is nicely adjusted to be informative but inconspicuous, so that the emphasis remains on the major attributes of organisms as parasites—life history, especially adaptations for obtaining food, host specificity, and sexual apparatus and behavior. The exposition is clear, and many detailed and pleasing illustrations, the majority by the author, amplify the text.

Askew points out that no single book has covered parasitic insects before. Though perhaps this is surprising initially, when one considers how different are the two modes of parasitism described it becomes more understandable. Section 1 of Askew's book covers insects that are parasitic as adults: lice, fleas, blood-sucking flies, louse and bat flies, and a few bizarre earwigs, beetles, and moths. These insects are classically the concern of medical entomologists. The larger section 2 involves "protelean parasitic insects," which are parasitic, usually on other insects, only as larvae and are free living as adults. These are the organisms important in the natural control of insect populations and in applied biological control. The word "parasitoid" has been increasingly used over the past ten years for insects of the latter group. Askew avoids the term, for he thinks it embraces too wide a range of phenomena to be useful. From an ecological viewpoint, however, there are some valid differences between the two modes of life which I think should be stressed. Unlike the organisms of the first group, which normally only sap energy from the host, those of the second eventually cause its death. Their effect on a population, therefore, is similar to that of a conventional predator.