topic naturally includes a review of diffusion and other mechanisms by which molecules, macromolecular complexes, organelles, and even cells may be transported; of organismal and cellular polarization; and of the adhesive properties of animal cells. This section is enriched by analogies between differentiation of castes within societies of insects such as termites, differentiation of cells and hyphae in fungi, the truly anomalous situations in cellular slime molds and elaborate uninucleate algae such as *Acetabularia*, and pattern development in unicellular eukaroytes as well as Metazoa such as hydroid coelenterates. Great attention is paid to the complexity and diversity of control mechanisms at the level of cells and of the synthesis and activation of enzymes.

Bonner's approach to these complex subjects is well balanced and reasonably comprehensive. He refers frequently to biological classics such as the work of H. Spemann, H. Driesch, C. M. Child, and T. H. Morgan; but he rightly pays more attention to discoveries made during the past decade as a consequence of the molecular revolution in biology. He does not have any pet theories and refrains from both laudatory and derogatory comments on the work of others. He lets the results speak for themselves. Nevertheless, from time to time the philosophy of a mature and perceptive biologist appears in the form of editorial comments: for instance, "We apparently like mystery; we like to think that what we are doing is just a bit more complicated than the work of others, and we seem to take some pride in this; we gloat over the fact that some aspects of our problems have so far defied explanation."

This book will be useful to young investigators, including beginning graduate students, who are seeking to orient themselves with respect to the complex problems of development at the molecular and cellular level. Teachers of general biology will enjoy a new approach to the subject of development and will undoubtedly find new ways of presenting it to their students, whether or not they agree with Bonner's approach in its entirety. Specialists in the field are likely to find the book disappointingly superficial, but obviously it was not written for them.

There are, unfortunately, some glaring omissions and some topics that are not covered thoroughly enough that their application to problems of development can be fully appreciated. The geneticist will be particularly disappointed at the comparatively slight attention that is given to differential gene action during development. For instance, both puffing in giant chromosomes of Diptera and the action of lampbrush chromosomes during oocyte development of Amphibia are ignored. In view of the dramatic presentation of puffing sequences in a recent (1972) volume edited by W. Beermann, which provides us with the best information we have on the number of genes that must cooperate to produce a single complex cell, and of the extensive research by H. Callan, J. Gall, and E. H. Davidson on lampbrush chromosomes, these omissions are most unfortunate. Another subject omitted is the effects of cellular tensions and pressures in determining patterns of supramolecular organization. This is a key topic for understanding differentiation in plants, as has been demonstrated by Paul Green and others. The properties of membranes are given less attention than they deserve. Perhaps the severest criticism that can be made of the book is that while it orients the reader well with respect to biochemistry and cell biology as applied to development, it neglects to an unfortunate degree the actual and potential contributions of genetics and biophysics.

Recognizing these imperfections, and regarding the book more as a source of ideas and stimulation than of factual knowledge, this reviewer nevertheless feels that Bonner has made a substantial and valuable contribution to the subject of organismal development.

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## Selenium

**Organic Selenium Compounds. Their Chemistry and Biology.** DANIEL L. KLAYMAN and WOLFGANG H. H. GÜNTHER, Eds. **Wiley-Interscience, New York, 1973. xviii, 1188 pp., illus. $55. Chemistry of Organometallic Compounds.**

Interest in the biology of selenium is likely to remain with us for many years. Compounds of selenium can be very toxic. Selenium is present in the soil in varying amounts and gets into plants, some of which concentrate selenium in their seeds to dangerous levels. Selenium has been suspected of being a carcinogen under certain circumstances, yet it is also an essential trace element. When the selenium content of the soil is low, there may not be enough in the plants produced for the adequate nutrition of farm animals. We have soils in the United States that contain too much selenium and more that don't contain enough. Both situations also exist in the rest of the world. Attempts to understand selenium deficiency were beclouded for many years by the fact that selenium and vitamin E sometimes cure the same deficiency symptoms. But now it is clear that animals need some selenium even when the amounts of vitamin E in the diet are large. It is highly probable that man, also, needs it in his diet. Yet what it actually does in the animal body is still far from being fully understood, and the selenium problem continues to be attractive to investigators.

The volume edited by Klayman and Günther is the latest and largest in a series on the Chemistry of Organo-Metallic Compounds and follows monographs on lead, tin, germanium, iron-group metallocenes, and arsenic, antimony, and bismuth. The new compilation promises to be at least as useful as any of its predecessors. Certainly it is timely. As the authors point out in the foreword, the organic chemistry of selenium has undergone major expansion during the past two decades, after a century of relative neglect during which compounds of selenium were prepared or studied more or less as incidental variants of the corresponding compounds of sulfur.

The chemical chapters make it abundantly clear that chemists have finally been giving the organoselenium compounds the attention they deserve in their own right, and the extensive detail as well as the large number of references cited promises to make this "Handbuch" useful for many years to anyone who has occasion to seek information on organically bound selenium. Incidentally, the 41 contributors to this volume are truly an international group; a great many European authors from both sides of the Iron Curtain are represented.

Although the subtitle might suggest roughly equal emphasis on chemistry and biology, the volume is heavily weighted toward chemistry. The first 12 chapters deal with selenium itself or its organic derivatives, and chapters 14 through 17 deal with physicochemical properties of organoselenium molecules or with analytical methods. Only 186 pages deal specifically with

the biology of selenium, but these are loaded with information and are well documented. They encompass nutrition, assimilation, metabolism, toxicity, human biology, and therapeutic applications. The chapters are readable and could well serve as a short course in the biology of selenium as well as a convenient guide to the original papers and to older reviews.

Since the chapters in the volume were written, selenium has been identified as an integral part of the enzyme glutathione peroxidase (J. T. Rotruck, A. L. Pope, H. E. Ganther, A. B. Swanson, D. G. Hafeman, W. G. Hoekstra, *Science* **179**, 588 [1973]). This finding has already given research on selenium a new direction, as well as new intensity. Present and future researchers will need to know as much basic chemistry of organoselenium compounds as possible, and that is what this volume is all about.

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## Saline Ecosystems

**Ecology of Halophytes.** Papers from a symposium, Minneapolis, Minn., Aug. 1972. ROBERT J. REIMOLD and WILLIAM H. QUEEN, Eds. Academic Press, New York, 1974. xiv, 606 pp., illus. $19.50.

Most of the potentially arable soil remaining unfarmed in the world is saline to some degree, and water available for its irrigation is also saline. Consequently it has become increasingly important that the ecology and physiology of plants able to tolerate soils containing extraneous salts be better understood and that procedures for better utilization of saline waters for irrigation be devised. Moreover, the difficulties encountered in the utilization of coastal salt marshes have been of sufficient magnitude that many of these areas have not been significantly altered and constitute some of the few remaining pristine ecosystems, inviting the attention of many ecologists. Thus it is timely that the proceedings of this symposium be published.

The book is not offered as a compendium of research from all the diverse fields encompassed by the title, but is rather a collection of papers presented by authors concerned with various aspects of halophyte ecosystems. Many of the papers are comprehensive reviews, and some are reports of current research, but there is little attempt to evaluate current knowledge, generalize, or formulate new concepts. There are, however, numerous instances where need for intensive research is pointed out. The emphasis is mostly on the halophytes of the United States, with only one of the authors being from outside of the country.

This book will be a good introduction to newcomers in halophyte research and a good review for scientists already in the field. There are over 2000 references, and much of the information on halophytes in the United States is brought together for the first time. The topics considered are diverse, and although most of the important disciplines are represented the representation is uneven. Eighty percent of the book is about coastal marshes and mangroves, with only 20 percent dedicated to desert halophytes, perhaps because most of the authors are from the eastern seaboard or gulf coast states.

The book is divided into four parts as follows:

1) A brief introductory overview by V. J. Chapman summarizing ecological literature on halophytes over the past ten years.

2) Halophytes of the United States: Distribution, Ecology, Anatomy and Physiology. The chapters on distribution are primarily extensive reviews of the literature with only brief consideration of community relationships or factors influencing distribution. An exception is the chapter on mangroves (Gerald E. Walsh), which is an excellent and comprehensive ecological survey comparing the mangroves of the world. The two chapters on the physiology of halophytes are also excellent reviews, including some evaluation of available information.

3) Habitat Associations of Halophytes. This portion of the book consists of several brief research reports followed by reviews on the roles of animals in salt marsh ecosystems. These reviews add considerably to the book, broadening the ecological scope to include both vertebrates and invertebrates and their role in the ecosystem.

4) Applied Research Related to Halophytes. What man has done and might do to salt marsh vegetation is considered in chapters on the effects of herbicides, fertilizer, and reclamation of disturbed areas. P. J. Mudie, in an excellent summary, reviews the extent of halophyte habitats, discusses their potential economic value, and proposes several important avenues of research. The final chapter, by E. P. Odum, emphasizes the unique energy relationships of coastal marshes, wherein halophytes expend considerable energy to survive under salt stress but take advantage of tidal irrigation to balance the energy demand.

This book is a valuable reference. Typographical errors, misspelling of simple words and author's names, and the omission of references from bibliographies are too abundant and will be detractive to many readers. An introduction or epilogue summarizing the major problems and principles would have added considerably to the book.

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## Cytogenetics

**Somatic Cell Hybridization.** Proceedings of a conference, Winter Park, Fla., Mar. 1973. RICHARD L. DAVIDSON and FELIX F. DE LA CRUZ, Eds. Raven, New York, 1974. xviii, 296 pp., illus. $19.75.

Of the 33 contributions to this volume 27 are short papers of the sort given at large meetings, two (by Krooth and Ephrussi) are brief commentaries, and four are reviews of moderate length. The reviews deal with the uses of somatic cell hybrids in human gene mapping (Ruddle); in studies of virus-cell interactions, immune functions, and antigenic determinants (Koprowski and Knowles); in studies of the expression of differentiated functions (Davidson); and in the analysis of gene expression and nuclear function in binucleated heterokaryons (Ringertz).

Taken together, the reviews and the experimental papers present practically every type of experiment that has been attempted with somatic cell hybrids. Such experiments fall into two categories: those performed directly on heterokaryons within the first few hours after fusion has occurred, and those performed on the synkaryon hybrids which grow out as clones following the rare event of nuclear fusion. The former type of experiment, which requires direct cytochemical observation, can produce dramatic and unequivocal results —as exemplified by the beautiful experiments on nuclear-cytoplasmic interactions reviewed in this volume by Ringertz. The latter type, in which clones can be grown to any size for genetic and biochemical experimentation, suffers from considerable uncertainties concerning, among other things, the