host plant, through the agency of a volatile sex pheromone, or plant odor, does not necessarily mate or feed. Further stimuli, presented in the correct sequence and in the right context, may be necessary before these end results are achieved. Just as aphrodisiacs and courtship behavior may be essential preliminaries to mating, so the texture of a leaf of a food plant and, perhaps, its degree of turgidity may determine whether an insect will feed.

The temptation to exaggerate the practical possibilities of controlling populations of insect pests by manipulating their systems of chemical communication has, by and large, been resisted by those contributing to these volumes. The results obtained so far, often at great expense, have been useful in making surveys but apparently not, with a few possible exceptions, in directly controlling pest insects. The potentialities are so great, however, that work on pheromones, plant attractants, arrestants, repellents, and other such substances should be intensified.

In the immediate future, insecticides will certainly continue to be our mainstay in combatting insect pests, but highly selective insect attractants and repellents will probably have important parts to play in the long-term goal of controlling insect populations effectively, economically, and without harming man or his environment. However, much more detailed information is required, and, as is indicated in these volumes, this can only be obtained by close cooperation between chemists and insect ethologists and physiologists.

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Calcium in Living Systems

Biological Calcification. Cellular and Molecular Aspects. HARALD SCHRAER, Ed. Appleton-Century-Crofts, New York, 1970. x, 462 pp., illus. $24.

Recent contributions to the understanding of biological calcification have come from several disciplines. The diversity of experimental approach and the variety of the material studied have often, and quite naturally, meant that information in one sector is not common knowledge in the field as a whole. The present volume will provide a welcome and useful extension of the lines of communication by bringing together viewpoints of several disciplines and findings on calcification in mammals, invertebrates, plants, and microorganisms. The focus, appropriately specific rather than broad, is on cellular and molecular mechanisms. Since the volume is less than 500 pages in length, some aspects of calcification inevitably receive only brief statement or are omitted altogether. This is apparently by design, for the objective is to provide perspective rather than a compendium. Even so, some will wish for a more complete discussion of such topics as mechanisms of invertebrate calcium deposition, bone formation, and hormonal factors in calcification. Those who are interested in plants and unicellular organisms will appreciate the substantial coverage of calcification in these groups.

The 13 investigators contributing to the volume have provided excellent summaries of research and current thinking on various aspects of calcification. These include the crystallography of bone, the composition and ultrastructure of skeletal structures, calcification of organic matrices, and the physiology of calcium movement. A valuable aspect of the discussions is the attention given to problems that require experimental study. The illustrations in the volume are of uniformly high quality and include a hundred pages of electron micrographs and photographs. The sections on unicellular organisms and plants by F. G. E. Pautard and H. J. Arnott are comprehensive in the inclusion of various aspects of mineral metabolism. I found the style and appreciation of historical perspective of these chapters delightful. R. and H. Schraer give an interesting account, with new data, of the remarkable system of calcification by the hen's shell gland. Nearly one-fourth of the volume is devoted to a chapter on representatives of four invertebrate phyla and bovine enamel, presenting in detail the ultrastructure studies of D. F. Travis and her associates.

It is evident from reading the various presentations that the study of calcification now requires an assessment. A comparison of the differences among various calcification systems as well as of the characteristics they have in common would be most valuable in increasing our understanding of calcification mechanisms.

The bibliographies in the volume are extensive, totaling some 1100 references. Unfortunately, few studies are cited for the two years preceding publication, a circumstance that undoubtedly rests not with the authors but with the extended period in bringing the volume to conclusion.

This book will be helpful as an introduction to specific phases of calcification, and its review of several areas of research provides a breadth of view of this diversified field of study.

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Cyclic Structures

The Chemistry of Inorganic Ring Systems. IONEL HAIDUC. Wiley-Interscience, New York, 1970. Part 1, viii pp. + pp. 1–622, illus.; part 2, vi pp. + pp. 623–1198, illus. Each part, $34.50. Monographs on Chemistry: Inorganic Chemistry Section.

The significant development of research on cyclic inorganic systems that has taken place in the last decade or two has been prompted by both theory and practice—by theory to the extent that the bonding and geometry originally restricted to carbon systems are now recognized as broadly applicable and capable of yielding substances with properties unlike those characteristic of carbon compounds, and by practice to the extent that the demand for new materials with specific properties has intensified investigation of new polymeric systems. Haiduc summarizes this development in an encyclopedic but readable and understandable fashion. His inclusion of an abundance of references to the original literature, many tabulations of numerical data, and thorough indexes provides the reader with a single, invaluable source for most of the information he may need.

The introductory chapter in volume 1 gives the necessary details of classification, nomenclature, molecular structure, bonding, and equilibria essential both to an understanding of inorganic ring systems and to a systematization among the several elements. The ring index in the latter part of volume 2 illustrates a continuity in nomenclature and a correlation with designations used in organic chemistry to describe heterocycles containing carbon atoms. The detailed treatment of particular inorganic ring systems is divided among an all-inclusive chapter on homocyclic systems, a series of extensive chapters treating heterocyclic systems by periodic group of the major element, and a chapter on metal-containing coordination