stars and galaxies in the second part of the book. It is clear that chapters 3 through 7 were written between 1960 and 1965, and no references to major papers and books published since 1965 are found in the bibliography. Astronomy has moved so fast in recent years that much of Evans's story seems out of date in content and in emphasis. His treatment of the spiral structure of our Galaxy and of galactic rotation are off the beam. Horizontal branch stars are not even mentioned, and the description of stellar evolution and star formation is of early 1960 vintage. The sections on the Star Clouds of Magellan are scanty and incomplete, and some of the presentation is careless: plates 34a and 34b present the Large Magellanic Cloud in two different orientations, one with south at the top, the other with north at the top.

The strength of the Evans book—and its uniqueness—lies in the first chapters, where the author takes the young student step by step into the fascinating world of precision observation of the heavens by optical techniques. Evans is now permanently a professor of astronomy at the University of Texas; the Texas students have a master teacher to introduce them to the field of precision astronomical observations.

BART J. BOK

Steward Observatory,
Tucson, Arizona

Crystal Spectroscopy

Optical Properties and Band Structure of Semiconductors. DAVID L. GREENAWAY and GÜNTHER HARBEKE. Pergamon, New York, 1968. xii + 160 pp., illus. International Series of Monographs in the Science of the Solid State, vol. 1.

Optical spectroscopy and quantum theory have had a particularly close alliance in the development of modern physics, witness the early and productive partnership between atomic and molecular spectroscopy and the emerging quantum theory. The spectroscopy of crystals is a late bloomer in the family of spectroscopy. It suffices to say that it has now come of age, and, not surprisingly, the same close relationship to quantum theory characterizes the new field as well. The key elements in the growth of crystal spectroscopy have been the development of experimental techniques to measure optical constants over a broad range extending from the infrared to the far ultraviolet, the development of tractable theoretical techniques for calculating the band structure of crystals, and the development of the conceptual framework for relating the observed spectra to the calculated band structure. Needless to say, theory and experiment have leaned heavily on one another at various stages of this development.

Solid-state physicists will welcome this short and well-organized monograph as a convenient compendium of the spectroscopic results and analysis in terms of band structure for a large class of crystalline materials. Non-solid-state physicists and those who are entering the field will find this monograph a lucid introduction.

Readers who are familiar with Moss's *Optical Properties of Semiconductors* (Academic Press, 1959) will note a similarity in approach, level, and format. The two books complement one another nicely, since Moss treats mainly the optical effects arising from free carriers and band edges and the current book concentrates on the structure and analysis of the more complicated spectra arising from the higher bands. All of the machinery for producing and interpreting the spectra is described in concise and conceptually clear sections with a minimum of mathematical prolixity. Thus there is a chapter on the optical constants and dispersion relations and another on the experimental techniques for the visible and ultraviolet. There is a very short, in fact too short, chapter on the quantum theory of interband transitions, the classification of critical points, and applications of group theory with a slight reference to the theoretical methods for calculating band structures. The main body of the text, and the part most useful to workers in the field, is a compendium of the experimental results and analysis for a large class of materials including most of the well-known semiconductors and some of the insulators. The effects of deformation are discussed, as well as the contributions of excitons to the spectra. The authors conclude with discussions of other experimental techniques that have been applied to band structure analysis, such as the piezo- and electro-optical modulation techniques, the photoelectric effect, and energy-loss phenomena.

The authors might be criticized for trying to say too little about too much. In the eyes of the reviewer this is no fault. The monograph eminently succeeds in what it attempts: to serve as a compendium of the results scattered through the literature with a skeleton outline of this vital new field. For those who want more detail, ample references to the literature are included.

D. L. MITCHELL

U.S. Naval Research Laboratory,
Washington, D.C.

Festschrift

New Pathways in Inorganic Chemistry. E. A. V. EBSWORTH, A. C. MADDOCK, and A. G. SHARPE, Eds. Cambridge University Press, New York, 1968. xxxiv + 392 pp., illus. $13.

This book has been prepared by a group of former students of H. J. Emeléus in honor of his 65th birthday. After a brief biographical preface and a complete list of Emeléus's scientific publications, each of the 14 authors describes the work he and his students and colleagues have done. The book is a fitting tribute to Emeléus, illustrating as it does the great influence he has had on inorganic chemistry.

One might suppose that since all of the authors were trained in the same school of chemistry, the subject matter of the various chapters would show a strong dependence upon the work done in the Cambridge laboratory. Such dependence, however, is not apparent. Even in the four chapters describing research on compounds of fluorine, it is evident that the authors have departed widely from the work they did as graduate students.

It is difficult to categorize the contents of the various chapters briefly, for some of them cover a fairly wide range of material. Suffice it to say that 4 of the 14 chapters are concerned chiefly with fluorine compounds, three specifically with coordination compounds, two with nonaqueous solvents, one and part of another with silicon compounds, and one each with organometallics, derivatives of gallium hydride, and the solid state. The chemistry of mercury, germanium, tin, lead, and several of the transition metals is the subject of extensive discussion. Aside from that in the chapters on metal-metal interactions in paramagnetic clusters and defect aggregation chemistry, the material discussed is largely descriptive rather than theo-

retical. However, the approach throughout is from the physical chemical point of view, and there are many references to the physical methods that are used in determining the properties and structures of inorganic compounds and the mechanisms of inorganic reactions.

This book was doubtless intended to serve as a reference volume, but because of the breadth of the subject matter included, it can also serve very well as a text in "special topics" or seminar courses. The selection of subject matter in each chapter is excellent and the writing is of uniformly high quality.

JOHN C. BAILAR, JR.
Department of Chemistry and Chemical Engineering, University of Illinois, Urbana

A Fauna and Its Environment

The Zoology of Tropical Africa. J. L. CLOUDSLEY-THOMPSON. Norton, New York, 1969. xvi + 356 pp. + plates. $12.50. World Naturalist Series.

Animal Twilight. Man and Game in Eastern Africa. J. L. CLOUDSLEY-THOMPSON. Dufour, Chester Springs, Pa., 1967. x + 204 pp., illus. $6.95.

In *The Zoology of Tropical Africa* Cloudsley-Thompson endeavors to describe environmental adaptations for a broad spectrum of animals. He provides background information on geology, climate, soils, vegetation, and zoogeography at the outset, and at appropriate places elsewhere, as a basis for relating descriptions of behavioral and physiological adaptations to the environment. In the first half of the book, in which chapters are organized according to major biomes, a general survey at the species level provides a valuable compilation of information for the student and lay reader, as well as the professional zoologist interested in an overview of African animals. General ideas about ecological problems, both human and biological, are included.

Considerable attention is paid to the interesting subject of adaptations, in terms of temperature regulation and water economy, to humid and dry heat. Although descriptions are detailed and specific, this section is also in the nature of a general survey of the subject. Discussions of population regulation, migration, and biological rhythms are brief and limited by the current level of understanding of these phenomena. Here and elsewhere Cloudsley-Thompson tends to oversimplify basic concepts. A final chapter, concerned with the evolution, diseases, and ecological impact of man on African fauna, is also limited in scope and somewhat superficial.

This is not a profound book, but it is the first attempt to present a general zoological account of African animals from the viewpoint of behavioral and physiological adaptations. The information it contains will be useful to the student and general reader, at least as an introduction.

Animal Twilight is a historical account of man's relationship to African animals based on information from nearly 2000 references. Cloudsley-Thompson has selected interesting, although not always relevant, passages from the books and journals of early explorers and hunters. As with most historical information of this type its usefulness in determining population trends is limited greatly by its qualitative nature. Apparently the book was written to put into perspective the threat man presents to the future of African animals, an objective that will require far more attention than this book provides to the present-day impact of man.

HELMUT K. BUECHNER
Office of Ecology, Smithsonian Institution, Washington, D.C.

Cytology

Plant Cells. F. A. L. CLOWES and B. E. JUNIPER. Blackwell Scientific Publications, Oxford, England, 1968 (U.S. distributor, Davis, Philadelphia). xviii + 550 pp., illus. $21. Botanical Monographs, vol. 8.

The modern philosophy of teaching biology tries to do away with such antiquated subjects as botany or zoology and to simplify the biological curriculum by teaching "general biology" or—at the level of the cell—"general cytology." In such a course an idealistic picture of "the cell" is offered, taking into account the nucleus, the mitochondria, the Golgi apparatus, the microtubules, the endoplasmic reticulum, the ribosomes, and other such structures.

These general notions may be satisfactory for biochemists and biophysicists, but for the biologist they give quite an inadequate idea of cellular performance, whose essence, in metabionts, is differentiation, diversification, and histogenesis. Therefore it is gratifying to review a book by two young research fellows who have the courage to deal with "plant cytology." The special features of the plant cell—the controversies concerning its plastids, the formation of its cell wall, the meaning of its pronounced vacuolar system, and the nature of its tonoplast—are given an extensive discussion based on a wide study of the newest literature. A most important chapter is that on specialized cells. Next the meristematic cell, which together with the liver cell is the objective of the "general cytology" mentioned, the differentiation of stomata, tracheids, xylem vessels, sieve tubes, laticifers, secreting cells for resin, for salts, or for slime, and enzymes of insectivorous plants, haustoria of parasites, and bacterial nodule cells are dealt with. This enumeration shows that the biologist has to decide whether he will concentrate on animal cytology (differentiation of muscle fibers, nerve cells, and so on) or on plant cytology. Knowledge of the first is needed in medicine and of the second in agronomy and forestry, and the requirements of these applied fields cannot be met by "general cytology." This fact shows the importance of the monograph under consideration. It includes an outline of the techniques in cell research (light and electron microscopy, autoradiography, chromatography, centrifugation, x-ray diffraction) and the established results of molecular biology (DNA cycle and replication, RNA and DNA in plastids, protein synthesis, and so on) and genetics at the level of the cell (chromosomes, polyploidy, totipotency).

To the reviewer's mind more stress should be laid on the ontogenetic succession of the different objects (for example, proplastids → chloroplasts, or hemicelluloses → cellulose → lignin, instead of the reverse arrangement) so as to emphasize the dynamical character of cytology. Together with the discussions of the function, the inheritance, and the diversity of the cell organelles presented here, a consideration of ontogenetic factors would help to banish the erroneous view that cytology is merely a descriptive science.

A. FREY-WYSSLING
Institut für Allgemeine Botanik, Eidgenössische Technische Hochschule, Zurich, Switzerland