interpretation of their own work. Most aspects of nutrition do indeed find inclusion—the use of mutants in nutritional research, measurement and interpretation of food utilization, isolation of nutritional requirements, symbiotes, nutrition at the cellular or metabolic level, artificial diets, and some case histories where nutrition might possibly become involved in pest control. The problem for the reader is to find guidance for assessing the various authors' differing interpretations and approaches; he may also be left with the wrong impression that insect nutrition can play little practical part in pest control on crops. For example, the final chapter, with the all-embracing title of "Insect control strategies based on nutritional principles: a prospectus," concentrates almost entirely on the possibilities of pest control in manufactured foodstuffs. Even Maxwell ("Host plant resistance to insects—nutritional and pest management relationships") emphasizes the contribution plant resistance can make to our knowledge of insect nutrition at the expense of possible contributions in the other direction.

The book could well have been more argumentative and cohesive and is no substitute for a textbook to a worker seeking an interpreted summary of the literature. For example, the mites in "Food utilization by acarid mites" are *Caloglyphus berlesei*, "Chemical feeding requirements of oligophagous insects" refer to those of the Colorado beetle, and the "Neuroendocrine regulation of insect metabolism and the influence of nutrition" is about *Blaberus discoidalis*. In spite of this, each chapter (in an isolated way) is an entry point into a particular field for the worker changing the orientation of his research or for the graduate student starting a nutrition-based project. I therefore do recommend that workers have this book ordered for their libraries, but it is not a reference book necessary for their own bookshelves.

Most chapters carry an adequately up-to-date bibliography, but, as in so many books published in English, one is left with the impression that the non-English literature has contributed remarkably little to the subject. The book is attractively presented and printed with rather few typographical errors which are likely to mislead (except possibly "phospholysid" for "phospholipid"). It is annoying that legends to tables and figures are hardly distinguishable as such from the adjacent text and that the subject index is rather arbitrary. For example, the phrase "dietary imbalance" may occur only once as such, in a table heading, but the subject is mentioned frequently elsewhere and surely warrants keying out to where it is discussed in the text. The book bears many marks of hasty copy editing: joint authors are variably linked by "and" or "&," lists of authors in the text may be found in both alphabetical and chronological order, species are cited with and without their authors, and an "unpubl. obs." is equally likely to turn up as just "unpublished" or even "unpublished obs."

H. F. VAN EMDEN
Department of Agriculture and Horticulture, University of Reading, Reading, England

Biochemistry of Metal Ions

The Inorganic Chemistry of Biological Processes. M. N. HUGHES. Wiley-Interscience, New York, 1973. viii, 304 pp., illus. $12.95.

This book is an outgrowth of a course designed to introduce advanced inorganic chemistry students to problems in biology germane to their expertise. A more apt title might be "The Role of Metals in Biological Processes," since the text is restricted to a treatment of metal ions and, specifically, those involved in life functions. The metabolic transformations of inorganic forms of elements such as nitrogen and sulfur are discussed only to the extent that metalloproteins are involved. However, to focus criticism on its ambiguous title would be unfair because this book serves a useful purpose within its intended scope.

A second scientific audience will also find this book of value, namely, biologists who are interested in the occurrence of metal ions in biological systems and the functions they fulfill there. To provide sufficient background for both chemists and biologists, Hughes presents fundamental biological information regarding proteins and their mediation of metabolic reactions on the one hand and a general introduction to the chemistry of metal ions on the other. However, in general, biologists would be well advised to have an advanced inorganic chemistry text at hand when they undertake this book. Chemists may require a biology text in order fully to appreciate processes such as oxidative phosphorylation.

This book is properly focused on the nature of metalloproteins and considers the respective contributions of the biochemical properties of the protein and the inorganic chemistry of the particular metal moiety to the mechanism of action of the conjugated complex. Methods of study which yield information concerning these complexes by exploiting either protein or metal properties are reviewed and typical results are noted. Deviations of one component from expected behavior are rationalized in light of contributions or perturbations by the other. Within this framework, examples from the various classes of metal-containing proteins are considered in detail with respect to their mechanism of action, and the strong relation between the specific metal ion involved and the function of the metalloprotein is emphasized. For instance, the properties of zinc which render it a strong Lewis acid are correlated with its role in hydrolytic enzymes; and the presence of the transition elements, copper, iron, and molybdenum, in oxidoreductases is justified through the electron transfer capabilities they possess by virtue of their characteristic unfilled *d* orbitals.

The book is short considering the breadth of the topic and the depth of the treatment. Obviously, then, the material is condensed and selected. However, it is concisely presented, organized, and objective. Each chapter includes a statement of purpose. Also, the book is well referenced (through 1971), thereby providing the reader with ample opportunity to explore interests or gain further explanations.

REGINALD H. GARRETT
Department of Biology, University of Virginia, Charlottesville

Holography

An Introduction to Acoustical Holography. B. P. HILDEBRAND and B. B. BRENDEN. Plenum, New York, 1972. xii, 224 pp., illus. $14.50.

Optical and Acoustical Holography. Proceedings of a NATO Advanced Study Institute, Milan, May 1971. EZIO CAMATINI, Ed. Plenum, New York, 1972. xii, 436 pp., illus. $26.

These two books take up some recent developments in holography that have applications in fields as diverse as medicine, geology, and information storage. The book by Hildebrand and Brenden is a monograph on the theory and applications of holographic technique

using acoustic waves. The book is an "introduction" to the use of acoustics in holography, not to holography itself. The book edited by Camatini ranges over a wide variety of subjects. The acoustical part of it was prepared by one of the authors of the monograph, Brenden, and its entire subject matter is also contained in the monograph. Thus my comments on acoustical holography relate primarily to the monograph and I will limit remarks about Camatini's book to the optical portion.

Acoustical holography is interesting, not only because the interaction of acoustic waves with matter is different from that of light, but also because the wavelengths that can be used are much longer. While this reduces the theoretically allowed resolution, the longer wavelengths provide so many advantages that one feels that the ultimate versatility of holography can be achieved only with acoustic waves. For one thing, simultaneous amplitudes and phase detection are possible, and the holographic reference beam can thus be introduced electronically and tailored to optimize the type of imaging that is desired. Furthermore, to generate the hologram one must often resort to scanning with point detectors. This would appear on the first thought to be a disadvantage, but Hildebrand and Brenden show that, by using circular scans, the multiple-order imaging that limits the field of view of conventional holograms can be largely eliminated.

The monograph starts with an introduction to optical holography which, while required for a consistent mathematical exposition, is probably too abbreviated for a beginner in the field. The chapter on acoustic wave propagation, on the other hand, is quite basic and adequately prepares the reader for the following discussions on scanning and liquid-surface holography. There is a highly mathematical chapter on sampling theory as it applies to acoustical holography, much of which is applicable to optical holography as well. Liquid-surface holography refers to the use of the surface to convert acoustic wave pressure to phase variations in an optical wave, so that the hologram can be reconstructed visually in real time. Chapters on other detection methods and on applications in medicine, geology, and industrial testing, among others, round out the book.

The monograph is well illustrated by photographs of holographic effects, all of which were produced acoustically. Unfortunately, the long wavelengths of acoustical holography result in a gross "laser speckle" which is painfully evident in the photographs. It is to be hoped that acoustic analogs of methods used in optical holography to reduce speckle will be available in the future.

Camatini's book contains, besides the chapters on acoustic holography, one on microwave holography by E. N. Leith that is a reprint of an earlier journal paper. Among the papers on optical holography, those that I found most interesting were the highly readable introduction by Gabor, papers on interferometric techniques by Ennos, Abramson, and Kersch, and a paper on information storage by Kiemle. There are also papers on materials and techniques, and several on image sharpening by holography. For the latter application, holography must compete with digital computation techniques that, in my opinion, are inherently more versatile.

For the person interested primarily in acoustical holography, the monograph by Hildebrand and Brenden is definitely the better choice, not only because of a more complete and detailed exposition, but also because it has the benefit of professional editing and preparation sadly lacking in the symposium proceedings.

ARNOLD L. BLOOM
Department of Physics, Stanford University, Stanford, California

Cosmological Theory

L'Univers Relativiste. STAMATIA MAVRIDÈS. Masson, Paris, 1973. xx, 384 pp., illus. Paper, 198 F.

To quote out of context can be a cardinal sin when important and serious questions are under consideration. Let us nevertheless invoke a remark in G. C. McVittie's introduction to *L'Univers Relativiste*: "Fashion plays as great a role in science as it does in dressmaking." In science, unlike dressmaking, fashionable trends are based on data accumulated over decades of painstaking endeavor. In science, unlike dressmaking, the expenditure of concentrated effort by a group of talented researchers often produces a dramatic increase in our understanding of a given problem; and fashion deserves also to be commended for its catalytic role in providing such a stimulus.

There is, however, a tendency for recent books to highlight the more dramatic discoveries, often at the expense of somewhat less exotic achievements. Fashion, of course, is largely irrelevant to the quality of research accomplishments, and one should be grateful to Stamatia Mavridès in *L'Univers Relativiste* for reminding us of this basic scientific fact of life by avoiding the trend to science à la mode. Here is an exposition of general relativity and cosmology theory that is decidedly unfashionable in its selection of contents. The five chapters on cosmology constitute an admirably lucid discussion of the observational and theoretical foundations of this subject. There is even a chapter devoted to various unconventional cosmological theories, and indeed throughout the book the current orthodoxy is largely deemphasized. The author's objectivity is noteworthy, to the extent, for example, that four pages are devoted to cosmic blackbody radiation and its ramifications, whereas equal space is given to steady state theory and twice as much is spent expounding the tired light theories of Bogorodski, Finlay-Freundlich, Zwicky, *et al.*

Mavridès is a member of the mathematically oriented relativity group at the Institut Henri Poincaré, and the success of this book is a tribute to her facility in handling complex mathematical topics in a straightforward and precise manner. The first two chapters include a discussion of the observations of stars, galaxies, and radio sources that remains intelligible to the nonastronomer and yet is not devoid of detail. There follows a clear, concise introduction to the fundamentals of general relativity, and the observable predictions of Einstein's theory are discussed in detail. The book closes with a straightforward account of the equilibrium and collapse of self-gravitating systems.

This sober and solid book will appeal to the reader who enjoys his relativity free of vivid or passionate writing and unencumbered by the distracting stimulus of a heavy dosage of recent discoveries. The book's strength lies in the fair and unbiased discussion of various cosmological theories, which are developed in a compact and self-consistent manner. If one were to cite a weakness, it would lie in the brevity of the attention paid to such "fashionable" topics as the cosmic blackbody radiation and its cosmological progenitor, the primordial fireball. A more extensive discussion of this subject would enhance the diversity of the presentation of cosmological theory. I