The systematic principles used in preparing compounds of the various types discussed are not sufficiently well defined for the reviewer to recommend that every scientist should buy a copy of this book. On the other hand, every chemist who wants to improve preparative inorganic chemistry will find this book useful; and some noninorganic chemists may even be surprised at the organization which can be found in these areas.

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**Inorganic Reaction Mechanisms.** By JOHN O. EDWARDS, Department of Chemistry, Brown University, Providence, R. I. W. A. Benjamin, Inc., 2465 Broadway, New York, N. Y. 1964. xii + 190 pp. 15 × 22.5 cm. Price, $7.00.

This book is part of the W. A. Benjamin, Inc., series on Physical–Inorganic Chemistry. According to the author's preface, it has been designed to fit the needs of undergraduate seniors and beginning graduate students who seek an introduction to the topic of inorganic reaction mechanisms. After three fine chapters devoted to definitions of terms and descriptions of concepts such as reaction order, molecularity, reaction coordinate, symmetry number, Brønsted theory of acids, general and specific acid catalysis, etc., the author presents separate chapters covering nucleophilic displacements, nonradical mechanisms for peroxide reactions, replacements in octahedral complexes, electron-transfer reactions of complexes, reactions of oxyanions, and free radical reactions.

The author is clearly aware of almost all of the pertinent literature in the fields covered, and has indicated in very brief form the existence of much of the pertinent work on the topics considered. Concepts are covered very briefly. For the worker beginning a research problem in inorganic reaction mechanisms, this book will provide a valuable entry into the literature. On the other hand, this reviewer found the book so terse that logical development suffers; many highly significant points were made as assertions with little attempt at real development. Even a few definitions such as that of symmetry number on page 20 were passed over so lightly that many students will not comprehend the significance of the points raised. On pages 57 and 58 the author has arranged nucleophiles on the basis of their rate of attack on boron compounds, sulfur compounds, carbon compounds, etc. Little reference to the literature or basis for the order is given. Such information seems pertinent.

In short this is a valuable book for all inorganic chemists, but this reviewer hopes that in any revision Dr. Edwards will take time and space to give his readers a little more help in the development of a detailed view of the transition from experimental observation to mechanistic conclusion. This reviewer is only sorry that the book isn't longer.

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**Mechanism of Oxidation of Organic Compounds.** By W. A. WATERS, Fellow of Balliol College, Oxford Reader in Physical Organic Chemistry, Oxford University. John Wiley and Sons, Inc., 605 Third Ave., New York 16, N. Y. 1964. 152 pp. 14.5 × 22.5 cm. Price, $5.00.

As usual in this series, this monograph treats its subject in a very concise manner. Correspondingly, many of the references are made to review articles, rather than to original papers. Nevertheless, the subject itself is defined rather broadly to include, *e.g.*, electrophilic substitutions such as halogenation, sulfonation, nitration, etc. On the other hand, only liquid phase oxidations are included. The book is organized according to the type of compounds to be oxidized: peroxides (Chapter 3), alcohols (Chapter 4), 1,2-glycols (Chapter 5), aldehydes (Chapter 7), ketones and carboxylic acids (Chapter 7), unsaturated compounds and aromatic hydrocarbons (Chapter 8), and phenols and aromatic amines (Chapter 9). Besides molecular oxygen, ions of various transition metals are discussed as oxidants in considerable detail. References are often made to biological oxidations, which may correspond to the particular *in vitro* oxidations discussed. The book is a useful short introduction to the mechanisms of oxidation, in general.

There are minor inconsistencies, mistakes, and repetitions in the chapter on peroxides with regard to the chemistry of hydroperoxides (pp. 34 and 45). The organization of the book is not consistent. The order of discussing homolytic and heterolytic oxidations changes from chapter to chapter. This reviewer feels that a separate chapter should have been included on the oxidation of saturated hydrocarbons. It is also felt that the mechanism of oxidations by molecular oxygen, in general—which is of great industrial significance—has not been given enough attention in this otherwise excellent book.

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**Amino Acids and Serum Proteins. Advances in Chemistry Series, No. 44.** Based on the Richard J. Block Memorial Symposium Sponsored by the Division of Biological Chemistry at the 142nd National Meeting of the American Chemical Society, Atlantic City, N. J., Sept. 11, 1962. JACOB A. STEKOL, Symposium Chairman. Edited by ROBERT F. GOULD. Special Issues Sales, American Chemical Society, 1155 Sixteenth Street, N.W., Washington, D. C. 1964. xxiii + 154 pp. 16 × 23.5 cm. Price, $5.50.

The papers in this volume were for the most part presented at a Symposium at the Atlantic City meeting of the American Chemical Society in September 1962, arranged by the Division of Biological Chemistry to honor the memory of Richard J. Block who met death tragically in February of that year.

The slim volume contains ten contributions in addition to a very brief biography and a complete bibliography (151 contributions) of his scientific work. The papers presented at the symposium do have a tenuous relationship to Dr. Block's consuming passion for the amino acids. No doubt owing to the wide scope of his interest in amino acids and proteins, he would have been fascinated by every one of these contributions. Unquestionably, those in attendance at the symposium found many if not all of the papers interesting. However, the published work presents neither a systematic survey nor the summation of the current stage of our knowledge in a special area of interest but rather a collection of papers bearing but an extremely remote, if any, relationship one to another. The general biochemist would consider them diverse indeed despite the recurring protein and amino acid theme. Such being the case, it is essentially impossible to review the volume and avoid "refereeing" the individual contributions.

Apart from the significance of the individual papers, and for the most part they are well worth studying, this volume must be considered primarily as a tribute by his colleagues to a dedicated biochemist who contributed significantly to the field of amino acid and protein biochemistry.

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**Molecular Orbitals in Chemistry, Physics, and Biology. A Tribute to R. S. Mulliken.** Edited by PER-OLOV LÖWDIN, Department of Quantum Chemistry, Uppsala University, Uppsala, Sweden, and Quantum Theory Project, University of Florida, Gainesville, Fla., and BERNARD PULLMAN, Institut de Biologie Physico-Chimique, Université de Paris, Paris, France. Academic Press, Inc., 111 Fifth Ave., New York 3, N. Y. 1964. xiii + 578 pp. 16 × 24 cm. Price, $22.00.

As the title indicates, this collection of papers forms a tribute to R. S. Mulliken. The individual papers range from delightful personal reminiscences to highly technical discussions of almost every phase of quantum chemistry, molecular structure, theoretical chemistry, or whatever one prefers to call this subject. To say that these papers reflect Mulliken's interests is to say simply that he is interested in everything related to molecules.

The first paper by C. A. Coulson gives an excellent general summary of Mulliken's work and discusses in particular its significance in the development of molecular orbital theories and in methods of interpretation of molecular spectra. The results of Mulliken's work have become so much a part of our way of thinking that we may tend to believe that the ideas were *always* there. It is well to

see the development of these ideas in historical perspective. This paper and the one following by J. C. Slater tell us something about the man, and *how* he worked, which is all related in an interesting, instructive, and amusing way

Evaluation of the scientific content of the technical papers which follow is not the purpose of this review. It is sufficient to say, apart from their scientific value, that the individual papers help us to see more clearly the profound influence of Mulliken's ideas on modern research in theoretical chemistry. Geographical locations of the authors show the international character of this influence.

Finally, it is most gratifying to have this book published while Professor Mulliken is working actively on further developments. We all hope that this will last for a long time, and so there is a good chance that the present volume will become superseded by a more up-to-date account of his work. This event certainly can be anticipated with considerable pleasure.

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**Inorganic Ion Exchangers.** By C. B. AMPHLETT, Chemistry Division, Atomic Energy Research Establishment, Harwell, Berks (Great Britain). American Elsevier Publishing Co., Inc., 52 Vanderbilt Ave., New York 17, N. Y. 1964. x + 141 pp. 14 × 22 cm. Price, $6.50.

Inorganic ion-exchange materials have been treated like step-children in the past twenty years Yet the earliest observation of the ion-exchange phenomenon over a hundred years ago stems from the work of agricultural specialists concerned with the properties of soils. It is therefore a most welcome event that Dr. Amphlett has put together pertinent information on inorganic ion exchangers in a small handy booklet.

The topics covered after a historical introduction are: the clay minerals, the zeolites, the heteropolyacids, and the hydrous oxides. There is no attempt for complete treatment nor is there a need for it as ample (and recent, including 1963) references are given at the end of each chapter.

The renewed interest in inorganics is occasioned by the fact that while organic materials were designed to overcome the poor stability of inorganic exchangers at low pH, the shortcomings of the organic types became apparent with the advent of ionizing radiation and high temperatures encountered in some atomic reactors.

It is perhaps because of our preoccupation with studying organic resins that the author has a hard time to break away from this captivity. The explanation of the exchange phenomena (introduction) could have been made without resorting to resins and certainly without the use of proprietary trademarks. The English spelling for Al and S does not need to jar the American reader, and the easy essay-like style will delight him. Dr. Amphlett's booklet will gain him many readers and friends.

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**Water and Solute–Water Interactions.** By J. LEE KAVANAU, University of California, Los Angeles, Calif. Holden-Day, Inc., 728 Montgomery St., San Francisco, Calif. 1964. 101 pp. 17.5 × 25.5 cm. Price, $5.50.

The author of this volume is a zoologist who tells us in its preface that the volume itself is one of the products of studies he made "to lay (for another monograph) the groundwork for the development of theories on the structure and functions of biological membranes." Intended as "a comprehensive review and discussion of the current theories and status of research in the fields of water structure and water-solute interactions," it is reprinted here without modification, "because of the general interest of this material for researchers and students in many areas of the physical and chemical sciences."

That this was a heroic undertaking is attested to by the more than 370 items in its list of references, and by the acknowledgment in the preface to 14 workers in the field with whom the author corresponded for the purpose of receiving suggestions and comments and/or to make sure that he gave a fair presentation of their points of view. The job was not simplified by the fact that it necessitated excursions into a variety of highly specialized fields, including proton resonance chemical shifts, spin–lattice relaxation times, and cold neutron scattering, in many of which the interpretation of experimental data is still often controversial, not to mention the fact that new data are still coming in which sometimes call older inferences in question. An even more severe handicap is the fact that, in spite of all the work that has been, and is being, done on it, our present understanding of water is still in a very preliminary stage, so that widely divergent theories about it can still be stated and defended.

Under the circumstances it was inevitable that this book would have to present diverse viewpoints, which in some cases are in flat contradiction to each other. The author meets this problem head-on and has wisely "not sought to smooth over the complexities of the problems nor the tangle of the many existing discrepancies." Some selectivity was of course exercised in deciding which models and treatments to discuss in detail (and how much detail to attempt) and which to mention by name only. In a case of this sort, probably no two people would have made identical choices, but those made here seem appropriate for the author's purposes, particularly that of singling out items which would be of direct relevence to interpretation of biological phenomena.

All things considered, therefore, it is the opinion of this reviewer that the author has done a good job. The dissatisfaction which one cannot help feeling on putting the book down is principally dissatisfaction with the present state of the water problem, in which explicit answers to even the simplest questions can still not be given without qualifications and reservations. If he had waited ten years, the author would have been able to write a better book on this subject.

In the meantime, however, with the growing realization that the properties of water must be taken into account if almost any process is to be understood which takes place in an aqueous medium, increasing numbers of people are finding it necessary, as the author did, to orient themselves in this field now. For these the present book performs an important service, and even a person who has been interested in water for a long time is likely to find items in its bibliography which he had missed and/or discussions which remind him of unfinished business. Also in our debt are the National Science Foundation and the National Institute of Mental Health, to both of which the author makes acknowledgment of research-grant support.

This is a good book to have, and, at the comparatively modest price of $5.50, it is a bargain, of which many workers in many branches of science will want to take advantage.

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**An Introduction to Comparative Biochemistry.** By ERNEST BALDWIN, Professor of Biochemistry at University College in the University of London, Formerly Fellow of St. John's College, Cambridge, Fellow of the New York Academy of Sciences. Cambridge University Press, 32 East 57th St., New York, N. Y. 1964. xix + 179 pp. 13 × 19 cm. Price, $2.75.

First published in 1937, this little book has undergone three revisions in the intervening years, culminating in this fourth edition. Comparison of the original with the latest edition reveals that only a few new sections have been added and a little revision of outdated information has taken place. All in all, the book retains the essential substance and form of the original work, as the author frankly intended. Yet the field of comparative biochemistry has progressed further than one would suppose from a reading of this book. While it is true, as Professor Baldwin complains at various points, that certain groups of animals have been neglected by the biochemist and that certain biochemical studies, carried out a long time ago in the absence of important relevant information acquired more recently, badly need to be re-examined, a great deal of interest to the comparative biochemist has been learned that does not find a place in this book. A few examples must suffice. Missing from the book are a treatment of the heterogeneity in composition of deoxyribonucleic acids, a comparison of these heterogeneities in different taxonomic groups, and the significance of these findings to our ideas of biochemical and biological evolution. Missing also are the determinations of the primary structures of proteins performing similar functions in widely disparate taxonomic groups. Such recent analyses have thrown much light on the extent to which biological evolution is mirrored in the macromolecular structure of proteins having functions that are widespread among living things. Nor is the problem of the universality of the genetic code discussed in this book, although its relevance to comparative biochemistry is