

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 We all hope that this will last for a long time, and so there is a good chance that the present volume will become superseded by a more up-to-date account of his work.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 stepchildren 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 experi-

mental 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 relevance 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

obvious. There is also lacking a discussion of the variety of organelles (ribosomes, mitochondria, etc.) in which distinct types of biochemical reactions take place in the living cell. How much is known about the extent to which the architecture of these organelles has varied in the course of biological evolution?

Despite this criticism, the charm for the biologist of Professor Baldwin's book cannot be denied. It is still a worthwhile *entrée* to comparative biochemistry, if for no other reason than its emphasis on the biological importance of phenomena studied at the molecular level. All too often, both in research and in teaching, biochemistry becomes an end in itself, with the result that the biological problems originally stimulating biochemical analysis are forgotten. One cannot accuse Professor Baldwin of such oversight of the biologically significant. Indeed, much of what is contained in this book often passes as physiology (the regulation of osmotic pressure, the conservation of water, digestion), and the morphological aspects of adaptation (pigmentation, type of eggs produced, food-gathering mechanisms) have the prominent position they should in a book on comparative biochemistry. The theme running through this book is evolution and adaptation to different ecological niches. The conclusion finally reached is that "... there exists a common, fundamental chemical ground-plan of composition and metabolism to which all animals, and very probably other living organisms also, conform, and that, superimposed on these foundations, there are numerous secondary, specific and adaptational variations, some of addition and others of omission." This is a lesson worthy of deep consideration by the beginning student of biochemistry.

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Theorie und Praxis der Gravimetrischen Analyse. Band II. Bestimmung der Metalle. By LÁSZLÓ ERDEY, Professor an der Technischen Universität Budapest, Mitglied der Ungarischen Akademie der Wissenschaften. Akadémiai Kiadó, Alkotmány U. 21, Budapest V, Hungary. 1964. 802 pp. 18 × 24 cm. Price, \$18.00.

The literature of analytical chemistry is a well-tilled field. In fact, some of its areas are beginning to show signs of overcultivation. Gravimetric analysis is not one of these, however. In some quarters, resort to precipitation processes is looked upon as something reprehensible, especially if the precipitate is finally weighed. Be that as it may, we have here, in the second volume of the German translation of Professor Erdey's three-volume treatise on the theory and practice of gravimetric analysis, a good account of such methods for the determination of the metallic elements. Adequately detailed directions are given for important procedures, and separation methods are included. A commendable feature is the inclusion of many thermoanalytical curves and tables showing the accuracy and precision of determinations, both from work in the author's laboratory.

If any fault is to be found, it is that some omissions of determination methods, or modifications of value, occur. More extensive bibliographies dealing with the determination of each metal would be helpful. Perhaps a full treatment of separations cannot reasonably be asked for—the field is too large. In a work of this size, errors are bound to be made, but not many were noticed (p. 396, the solubility of dimethylglyoxime in water at 25° is 63 mg. per 100 ml., not 0.4 mg.).

The last volume in the series will cover the anions.

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Gas Analysis by Gas Chromatography. By P. G. JEFFERY, Principal Scientific Officer, and P. J. KIPPING, Senior Experimental Officer, Warren Spring Laboratory, D.S.I.R. The Macmillan Co., 60 Fifth Ave., New York 11, N. Y. 1964. xi + 216 pp. 15 × 22 cm. Price, \$10.00.

This book is Volume 17 of the International Series of Monographs on Analytical Chemistry, edited by R. Belcher and L. Gordon. The analyses considered are those performed by the gas, mining, petroleum, iron and steel, and related industries. There is only one reference to gas analysis of a biological sample. Therefore this book will be of little interest to those in the biochemical and medical fields.

The introductory chapter and, indeed, all theoretical material is so briefly treated that the book cannot be compared to other books on gas chromatography which may be used as texts. The sections on sample transfer systems, detectors, and gas sampling should prove useful to gas analysts.

Although there are a number of recent references in this volume, certain significant recent developments are not included. For example, the section on detectors might have included some information on the recent advances in micro thermal conductivity cells, and in microcoulometric methods of detection. The tables listing separating columns and retention times for various gases provide a handy source of useful data.

The price of this volume is rather high for a brief book printed on inexpensive paper. Almost all of the information presented, with the exception of the unpublished references of the authors and their associates, is available in other more comprehensive volumes such as those written by Purnell, Littlewood, Dal Nogare and Juvet, and Keulemans. However, the practicing analyst in the industries cited above may wish to have a copy for use in the laboratory.

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Porphyryns and Metalloporphyryns. Their General, Physical and Coordination Chemistry, and Laboratory Methods. By J. E. FALK, Division of Plant Industry, Commonwealth Scientific and Industrial Research Organization, Canberra, A.C.T. (Australia). American Elsevier Publishing Co., Inc., 52 Vanderbilt Ave., New York 17, N. Y. 1964. xii + 266 pp. 17 × 24.5 cm. Price, \$13.50.

This excellent monograph may be characterized briefly as "poly-functional." One function intended by the author is to bring up to date the review of the porphyrin and metalloporphyrin portion of the book published by Lemberg and Legge fifteen years ago. In particular, the attempt has been made to correlate experimental observations with newly developed basic concepts in the field. A real effort has been made, however, to provide enough background material to permit the book to stand alone. This will make it valuable to organic, inorganic, and physical chemists, biologists, and medical students. Both experts and beginners in the field will find this a useful compilation of the literature.

The monograph is divided into two sections, a general and theoretical section and one on laboratory methods. The section on laboratory methods will give other laboratories the benefit of the long experience of the Australian investigators in the manipulations involved in porphyrin chemistry and will be a great time saver for investigators in the chemical and biological aspects of porphyrin studies.

The work also serves the useful purpose of providing an up-to-date insight into the theoretical and experimental advances in the field of porphyrin chemistry made in the Australian laboratories. In particular, the extensive work on the properties of porphyrin derivatives in detergent solutions is presented in several sections. It is stated (p. 117) that detergent solutions of porphyrins are essentially aqueous, yet arguments are presented and observations recorded (pp. 29, 37, 46) showing the strong contrast in the environment of the porphyrins in detergent micelles from that in truly aqueous media. While the detergent technique is one of great value, Falk's own observations raise objections which must temper interpretations of its ultimate significance.

A brief section appears (pp. 24 and 25) which mentions clinical use of porphyrins. Since this may well be used as an introduction by medical men, it is unfortunate that the author did not draw upon his extensive experience to sound a warning about the hazards involved in clinical use from undesired photosensitization of patients.

The position is taken (p. 59) that both the visible and ultraviolet bands of metalloporphyrins are shifted by a change from low-spin to high-spin bonding. Examination of the spectra shows, however, that the change in the ultraviolet is due to a change in ligandcy, not in spin-state. The figure of 300 m μ should read 30 m μ .

The section on hemoglobin (pp. 106–108) relies on the X-ray evidence from the ferric series for structural conclusions regarding the ferrous series. As more chemical and X-ray evidence has accumulated, it is apparent that this conclusion is not tenable and will have to be revised.

The value of the well-selected bibliography at the end is limited by the lack of an author index. Whatever the cause of this deficiency,