Anal. Calcd. for $C_{18}H_{24}O_3$: C, 75.0; H, 8.39. Found: C, 75.1; H, 8.29.

Hydrolysis and demethylation of V gave an unsaturated phenolic acid (VI), m. p. 217–219, which produced the full estrus response at levels of 0.33 gamma.

A detailed description of this work will be reported later.

RESEARCH LABORATORIES
THE UPJOHN COMPANY JAMES H. HUNTER
KALAMAZOO 99, MICHIGAN JOHN A. HOGG

RECEIVED JUNE 28, 1946

NEW BOOKS

Rocks and Rivers. By ELLIS W. SHULER, Southern Methodist University, Dallas, Texas. The Jaques Cattell Press, Lancaster, Pennsylvania, 1945. xx + 300 pp. 16 × 24 cm. Price, $4.00.

Time was, a century or more ago, when a scientist might aspire to a fair acquaintance with all of what was then called Natural Science, but now in this Atom Age a chemist's own special field usually is too large for him to master. However, nearly every chemist has a side interest elsewhere in the field of science; for some years the reviewer has enjoyed reading, studying, working and looking at geology and geography; hence this new book by Dr. Shuler has for him an eloquent and fascinating message.

In the Preface the author says: ". . . Geologists, as most scientists, have been afraid to show any feeling for the larger scope, the cultural interest, the wonder of their science. . . . so that the whole modern science of geology is now entombed in highly technical fact-telling records. . . . An attempt is made to glorify the common phenomena rather than the odd or unusual. . . . The method of presentation is by story and illustration. . . . The topics selected are those of everyday observation. . . ." and the author has succeeded very well in his task ". . . of making the landscape understandable to every traveler" and observer, both by words and a fine selection of less-often-seen illustrations.

The 300-odd pages of the book are divided among sixteen chapters, which in simple words carry the reader all over the earth's surface, but principally in the United States, and introduce him to crystals, gems, dirt, sedimentary rocks, the earth's surface, earth movements, landscape changes, weathering effects of wind, frost, water both running and ocean, landslides, erosion, glaciation, windblown earth, soil and its formation, loss and conservation methods, rock and its sculpturing, mesas and bad lands, small and large springs, water table, plain and artesian wells, hot springs and geysers, underground waters and their work, caves, sinkholes, natural bridges, the ocean as an engineer, beaches and their activity, volcanic activity, both modern and ancient and the building of mountains, the ice age theory and its evidence, glaciation and its remains, rivers, their work and ceaseless attack on mountains, Major Powell, lakes both past and present (Lake Bonneville), Niagara River and Falls, the Arkansas River and its Royal Gorge, the Colorado, the Merced, the Yellowstone, the Snake and Columbia, individual mountains and their history, useful ores and minerals with their locations and availability, and the age of the earth. This is an imposing list of topics, subjects and objects which any traveler may see and not appreciate; "Rocks and Rivers" is an illustrated lecture to assist him in seeing, believing and understanding.

ALLEN D. BLISS

Physical Chemistry of Cells and Tissues. By RUDOLF HÖBER, University of Pennsylvania School of Medicine, Philadelphia, Pa. With the Collaboration of David I. Hitchcock, J. B. Bateman, David R. Goddard and Wallace O. Fenn. The Blakiston Company, 1012 Walnut Street, Philadelphia 5, Pa. (Toronto), 1945. xiii + 676 pp. 70 illustrations. 16 × 24 cm. Price, $9.00.

This is a book of remarkable interest and value in many respects. Its character may be indicated by a brief discussion of the eight sections into which it is divided.

Section I, by Hitchcock, presents some selected principles of physical chemistry, including diffusion in liquids, reaction velocity and enzyme action, the elements of thermodynamics, electromotive force measurements and some of the osmotic and electrical properties of aqueous solutions. The treatment is definitely not on an elementary level; some knowledge of the calculus, and some previous acquaintance with the fundamentals of physical chemistry, are assumed. For students so equipped, the discussion given here should be of great value. Many relevant subjects were, of necessity, omitted; one may regret that the treatment of oxidation–reduction potentials is so brief.

Section II, by Bateman, deals with interatomic and intermolecular forces, and with the properties of large molecules in solution, in the solid state and in the form of films and membranes. To a reader with some previous background in this field, the discussion may be recommended as most illuminating and suggestive throughout. Those without some previous knowledge in this area may find the treatment highly condensed in places. There are frequent allusions to matters which the reader is expected to know and which may not always be well known, even to many with a good knowledge of general physical chemistry. In the discussion of dielectric measurements, for instance, it would have been useful to give a more explicit discussion of the relation between the dielectric constant and the dipole moment, in polar liquids and solutions; and some additional figures and diagrams would have been helpful. Nevertheless, this is a remarkably interesting and thoughtful discussion of the field it covers.

The following three sections—Introductory Remarks Concerning the Architecture of Protoplasm; The Surface of the Protoplast, Its Properties and Its Architecture; Influence of Some Extracellular Factors on Cellular Activity—are written by Dr. Höber himself. In the general character of their subject matter they follow closely the pattern of the author's earlier "Physikalische Chemie der Zelle und der Gewebe." The entire discussion, however, has been rewritten throughout, and takes account of all the more recent developments in this area. From the point of view of the physical chemist, the systems discussed are extremely complex; although from the point of view of the biologist, they may be relatively simple. The answers suggested are necessarily tentative, with frequent gaps and

uncertainties in our knowledge. Many of the important principles contained in Sections I and II can be little utilized in this discussion, although this is certainly not the fault of Dr. Höber, but is due to the inherent complexities of the subject.

Section VI, by Goddard, deals with the respiration of cells and tissues. Again one could wish that, either here or in Section I, a fuller formulation had been given of oxidation–reduction potentials, particularly with respect to the acid dissociation constants of oxidant and reductant, and to the details of the equilibria involved in semiquinone formation—a subject of great and increasing biological importance, so beautifully formulated by Michaelis in recent years. It may also be noted that, in the thermodynamic discussion on page 386, some of the terms employed should be more precisely defined, and two or three of the sentences on this page are incorrect as they stand. Nevertheless, this Section, taken as a whole, is one of the clearest and most comprehensive presentations of the chemistry of respiratory enzymes, and the intermediate steps in biological oxidation and reduction, that I have seen. It should be of great value to students.

Section VII, by Fenn, deals with contractile tissues, in particular with muscles; primarily with the nature of muscle regarded as a physical machine. The interrelations of these physical studies with recent chemical work on myosin are very well presented in the final pages of this section. An added note indicates that this section was completed in 1942; therefore, of necessity, it contains no discussion of the recent exciting developments in the laboratories of Szent-Györgi, of C. F. and G. T. Cori, and of F. O. Schmitt. It admirably brings together, however, the background of the problems in this whole area, and forms an excellent introduction to more recent developments.

The final Section, VIII, by Höber, deals with passive penetration and active transfer in animal and plant tissues, treating specifically of intestinal absorption, urine formation, permeability of the body surface and the elaboration of digestive juices. There is a final discussion about the energetics involved in the active transfer of ions and molecules against activity gradients.

Dr. Höber speaks, in his preface, of the wounds inflicted upon the forms of this book by the war; and considers it, in its present form, only an imperfect manifestation of the plan as originally conceived. It is true that some relevant topics of great importance are omitted; for example, there is practically no discussion of the physical chemistry of the respiratory exchanges in blood—perhaps the most complete example at present of the application of physical chemistry to a biological system. Nevertheless, this book remains a remarkable achievement. For advanced students in this area and for many investigators, it will be almost indispensable.

The price is perhaps not unduly high, in view of general price levels today. One may fear, however, that it is high enough to diminish somewhat the wide circulation which the book deserves.

JOHN T. EDSALL

Encyclopedia of Chemical Reactions. Compiled and Edited by C. A. JACOBSON, Professor of Chemistry, West Virginia University. Volume I. Reinhold Publishing Corporation, 330 West 42nd Street, New York 18, N. Y., 1946. 804 pp. 16 × 24 cm. Price, $10.00.

Originally planned in 1933, this encyclopedia aims to include "all, or practically all, the published chemical reactions, described briefly and expressed in equation form," omitting carbon and oxygen only. It combines "the convenience of an index with a considerable portion of the informational content of abstract and reference works." Volume I covers aluminum, antimony, arsenic, barium, beryllium, bismuth, boron and bromine—over three thousand reactions in all. Data subsequently published or abstracted are to be issued as Supplement Volume I.

The enthusiasm of the Editor was so infectious that over a hundred collaborators devoted unlimited time and energy to the project without financial compensation. By June, 1942, nearly sixteen thousand reactions had been submitted. Only those believed to have a solid experimental basis are included. The nomenclature follows the recommendations of a committee of the International Union of Chemistry (1940). Each equation is supported by a reference to an original article—occasionally to an abstract. Reactions involving a given element or compound as a reactant are grouped together, but one index groups them again according to reagents employed and still another according to products obtained. Equations not actually given by an author, but sufficiently justified by his data, are supplied by the abstractors in parentheses. Substantial reversibility is indicated by the double arrow, though no effort is made to cover the effects of widely varied temperatures. Conscientious efforts have been made to exclude dubious "compounds," but a few, such as arsenic pentachloride, have somehow managed to run the gauntlet. The inclusion of the more complicated organic reagents and products is a valuable feature.

The use of this work will not eliminate the obligation to read widely and critically whenever the whole truth must be ascertained. It does, however, contain a large amount of material which would probably be overlooked in any ordinary literature search. In addition, it is highly suggestive of unsolved problems in inorganic chemistry. If a conservative attitude is maintained, its use will be profitabler.

GEORGE S. FORBES

Electron Optics and the Electron Microscope. By V. K. ZWORYKIN, G. A. MORTON, E. G. RAMBERG, J. HILLIER and A. W. VANCE, RCA Laboratories, Princeton, N. J. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., 1945. xi + 766 pp. Illustrated. 14.5 × 22 cm. Price, $10.00.

This is the first really satisfactory book in English on electron optics, with particular emphasis on the electron microscope. Readers who looked forward to a thoroughgoing treatment of the subject—as would be expected from these authors—will not be disappointed. The book is divided into two parts.

Part I, entitled Practical Electron Optics and Electron Microscopy, comprises about 350 pages in nine chapters. It covers in a descriptive way the motion of electrons in electric and magnetic fields, electron lenses and mirrors, electron guns, the application of electron optics to the design of electron tubes and similar topics. This leads to the possibility of an electron microscope. There follows a description of some of the early microscopes, after which the magnetic electron microscope of high magnification is treated in considerable detail. This includes such topics as the design of magnetic electron lenses and a study of their properties, including aberrations, power supply and high voltage requirements, specimen preparation, alignment and focusing of the microscope, stereo-electron microscopy, surface studies and electron diffraction. Considerable attention is naturally devoted to the RCA Type B electron microscope and indeed every user of this instrument would do well to be thoroughly familiar with Part I of this book. The last chapter of this section is devoted to the results that have been obtained with the electron microscope. Typical illustrations are given, largely from the field of biology, but including also chemistry and metallurgy. This chapter can be read without reference to the rest of the book and might be recommended as first reading to those unfamiliar with the possibilities opened up by the electron microscope.

Part II contains ten chapters and about 400 pages. Its title is Theoretical Basis of Electron Optics and the Electron Microscope. This section of the book is largely mathematical in character. After a brief introductory chapter on the wave properties of electrons, and the electron optics of electric and magnetic fields there follows a

section on the analytical determination of the potential distribution (solution of Laplace's equation for a number of representative cases), potential mapping by means of the electrolytic plotting tank, and electron trajectory tracing (both analytical, and by means of rubber sheet models where applicable). The Gaussian dioptrics of the axially symmetrical electrostatic field is then developed and applied to electron lenses of the types ordinarily encountered in practice. A section on the properties of magnetic fields in the presence or absence of iron is followed by a treatment of magnetic electron lenses; *i. e.*, the motion of electrons in an axially symmetrical magnetic field. Consideration is also given to the case of two-dimensional fields as well as combined electric and magnetic fields, applicable to such devices as the mass spectrograph, electron multiplier tubes and television pickup tubes of certain types. A detailed consideration of the third order aberrations of electron lenses and mirrors is followed by a chapter devoted to methods of minimizing these image defects. A short chapter is devoted to high voltage electron optics and ion optics and the book concludes with a chapter on the subject of image formation in the electron microscope. The effects of scattering and absorption are considered in some detail as are also diffraction effects, resolution and dark field operation.

This brief outline is not intended to be exhaustive but merely to point out the type of material covered. The division of the book into two parts is a particularly good feature. Every user of an electron microscope, regardless of his own field or training, can read with profit the first part of the book while no serious student of electron optics will fail to become thoroughly familiar with the entire book.

G. G. HARVEY

Röntgenographischen-analytische Chemie. By DR. E. BRANDENBERGER, Professor an der Eidg. Techn. Hochschule in Zürich. Verlag Birkhäuser, AG, Basel, Switzerland, 1945. 287 pp. 121 figs. 17 × 24.5 cm. Price, Swiss Fr. 24.50; bound, Swiss Fr. 28.50.

The subject as given in the title is not adequately developed, attention rather being diverted to classification of the diverse results of X-ray diffraction work on solids. Treatment of powder diffraction methods is very cursory and the applications follow what might be called the "Bertillon system." About one fourth of the space is devoted to applications of X-ray diffraction methods to phase identification without use of the phase rule in the treatment. X-Ray diffraction gives little direct information about amorphous materials, but still one of the earliest chapters is devoted to the subject and that without touching on the only successful methods and their limited returns. A major part of the book is used for a descriptive treatment of what is now known as "Crystal Chemistry" which does not bear too directly on the intended subject.

Unravelling of phase relationships in crystalline solids is still a very tricky subject and the fine points which are generally deeply significant are too often overlooked as is the case here. Thus in Fig. 32, which deals with identification of long chain hydrocarbons, and the accompanying text no attention is paid to the entirely different conditions produced by the mixtures generally found in actual samples. The extent and significance of transitions of the second kind is missed.

Development and systematic use of tabulated powder diffraction data, which are at the core of X-ray analytical chemistry, are not mentioned. The many excellent applications to intermetallic systems are practically ignored. The actual classification schemes and treatments which are the main theme do not appear to be needed for the presentation of the subject or for development of X-ray diffraction research.

The Reviewer, with regret, cannot recommend the book to your attention. The regret chiefly comes from the fact that the press, Birkhäuser, Basel, have done a beautiful job of printing a volume of a new scientific series that might fill the great gap left by the loss of series published by German firms.

STERLING B. HENDRICKS

Atomic and Free Radical Reactions. The Kinetics of Gas-Phase Reactions Involving Atoms and Organic Radicals. By E. W. R. STEACIE, National Research Laboratories, Ottawa. Reinhold Publishing Corp. 330 W. 42nd St., New York, N. Y., 1946. vii + 548 pp. 26 figures. 15 × 23 cm. Price, $8.00.

Within the limitation on its scope imposed by the subtitle, this book offers a very comprehensive survey of experimental information in the field. The book consists of fourteen chapters and a very useful table of radical and atomic reactions with their activation energies. By the nature of their contents the chapters fall into three distinct groups. Chapter II is a brief survey of experimental methods for the production and the detection of free atoms and radicals in gas phase. Chapters I, III, IV and V are devoted to the discussion of the over-all mechanisms of organic gas-phase reactions, in which atoms and free radicals are either known or are suspected to be involved. Chapters VI to XV inclusive contain a systematic survey of proven or suggested elementary reactions of atoms and all those organic free radicals whose existence has been made at least plausible by some experimental investigation. In the discussion of the mechanism of complex organic reactions the author impartially presents the frequently conflicting ideas of all investigators having contributed to the subject. He then proceeds to point out various weaknesses and inconsistencies of the mechanisms proposed and correlates information available from the study of various reactions supposedly involving the same radicals. Pretty much the same treatment is offered in the chapters devoted to the systematic survey of individual reactions. The book contains a large number of references to the literature and the reviewer cannot think of any contributions which have not been mentioned. Unfortunately this book is not always interesting reading because of the manner in which it has been written. The division of its contents into three sections has resulted in a very repetitious form of presentation, most of the subject matter being referred to and discussed more than once in the text, with very little change of emphasis from one occasion to the next. Too many literature sources are cited repeatedly and not enough use has been made of cross references in the text. Their judicious use would have reduced the length of the book very materially and made it a more stimulating reading without doing any harm to the completeness of the presentation. In fact, most of the contents of Chapters VI to XIV inclusive could have been presented in the form of a comprehensive table with cross references to the text of earlier chapters. Even the less detailed table which is appended makes superfluous a considerable portion of this part of the text.

Notwithstanding these defects the book can be recommended as a very useful aid to those who wish to obtain up to date and exhaustive information in the field covered by the book. It should be particularly valuable as a reference source to those who are engaged in research involving free radicals.

The book is well printed and the reviewer has noticed no misprints or erroneous statements.

G. B. KISTIAKOWSKY

Raw Materials from the Sea. By E. FRANKLAND ARMSTRONG, D.Sc., F.R.S., and L. MACKENZIE MIALL, B.A. Constructive Publications, Limited, 213 London Road, Leicester, England, 1945. xi + 164 pp. 21 illustrations. 14 × 22 cm. Price, 15/- net.

Winning the wealth of the sea has always had a great fascination. Unfortunately, although the quantity of valuable materials entrapped in the ocean is vast, the concentrations of most constituents is so small that little

progress has been made until recently in extracting its wealth. The most abundant constituent of the water, sodium chloride, has of course been obtained by the simple process of solar evaporation since the beginning of history, and continues to be the most important raw material obtained from the sea. Other salts of sodium, potassium and magnesium are useful by-products of this process. Recent industrial needs and modern physical chemical methods have now made the extraction of magnesium and bromine profitable on a large scale. It is noteworthy that these are elements present in relatively high concentration in the water, magnesium ranking fifth and bromine ninth in order of abundance among the forty-odd elements which have been identified in amounts great enough to measure. Of the scarcer elements only iodine, the nineteenth in order of abundance, appears to be obtained in commercially important quantity, and this element which is present in a concentration of only five-millionths of a per cent. is harvested after it has been concentrated in growing seaweeds.

Dr. Armstrong's book contains an informative account of the industries at present concerned with harvesting the raw materials of the sea. By raw materials is meant those chemical elements which can be obtained from sea water. Salt deposits resulting from the evaporation of ancient seas are included, with sea water, as the sources of such raw materials, since the technological processes of extraction are essentially the same. The book does not attempt to include the important foodstuffs, vitamins, fertilizers, industrial fats and other biological products which are secured directly by the fishing and whaling industries. A timely chapter reviews recent methods for obtaining potable water from sea water, which have been developed for the benefit of those cast away in life boats, but fails to mention the use of distillation as a normal shipboard source of fresh water.

The book contains an unpretentious chapter of general information about the ocean and a summary of our knowledge of the chemicals in the sea and the biochemical processes of ocean waters. One of its most useful features is an appendix in which the more useful analytical methods of sea water chemistry are briefly reviewed.

ALFRED C. REDFIELD

BOOKS RECEIVED

June 10, 1946–July 10, 1946

EMIL ABDERHALDEN, "Lehrbuch der physiologischen Chemie." Benno Schwabe and Co., Verlag, Basel, Switzerland. 417 pp. Fr. 26 (bound).

J. ANSEL ANDERSON, Editor. "Enzymes and their Role in Wheat Technology." Interscience Publishers, Inc., 215 Fourth Avenue, New York (3), N. Y. 371 pp. $4.50.

E. J. BOWEN. "The Chemical Aspects of Light." Second edition. Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. 300 pp. $5.00.

WALTER B. CANNON AND RICHARD M. FIELD. "International Relations in Science." Chronica Botanica, Vol. 9, No. 4. The Chronica Botanica Co., Waltham, Mass. 43 pp.

SAMUEL GLASSTONE. "Textbook of Physical Chemistry." Second Edition. D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York, N. Y. 1320 pp. $12.00.

DAVID E. GREEN, Editor. "Currents in Biochemical Research." Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 486 pp. $5.00.

MARTIN GROSS. "Acetanilid. A Critical Bibliographic Review." Hillhouse Press, Publishers, 432 Temple St., New Haven, Conn. 155 pp. $3.00.

JOSEPH J. MATTIELLO, Editor. "Protective and Decorative Coatings." Vol. V. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 662 pp. $7.00.

FRANK SCHNEIDER. "Organic Qualitative Microanalysis." John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y. 218 pp. $3.50.

"Transactions of the Faraday Society." No. 286. Vol. XLII. Parts 3 and 4. March–April, 1946. "A General Discussion on Oxidation." Gurney and Jackson, 98 Great Russell Street, London, England. 398 pp. 20s.