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 BOOK REVIEWS
 

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**Heterocyclic Compounds. Volume 3.** Polycyclic Derivatives of Pyrrole; Polycyclic Systems with one Nitrogen Common to Both Rings; Pyrindine and Related Compounds. By ROBERT C. ELDERFIELD (Editor), University of Michigan. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1952. vii + 442 pp. 16 × 23.5 cm. Price, \$12.00.

**Heterocyclic Compounds. Volume 4.** Quinoline, Isoquinoline, and Their Benzo Derivatives. By ROBERT C. ELDERFIELD (Editor), University of Michigan, John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1952. vii + 674 pp. 16 × 23.5 cm. Price, \$17.00.

These two new additions to this valuable series were originally planned as a single volume but, due to the large quantity of material to be presented, a division into two volumes was made with cross references between volumes to avoid undue repetition. The titles of the chapters and their authors are as follows: (Volume 3): Indoles by Julian, Meyer and Printy; Isoindole by Elderfield and Dodd; Carbazole by Freudenberg; Pyrindine and Quinindine by Elderfield and Losin; and Bicyclic Systems with Nitrogen Common to Both Rings by Ing; (Volume 4): Quinoline by Elderfield; Isoquinoline by Gensler; Acridines by Albert; Phenanthridines by Walls; and Benzoquinolines by Walls.

Professor Elderfield and his colleagues are to be congratulated on these excellent summaries of heterocyclic chemistry. I feel that the editor deserves special commendation since, in contrast to common present-day editorial practices, he has made important personal contributions to both volumes. Because the volumes are not encyclopedic in character but are designed to present the general chemistry of the various heterocycles in a readable style, it is regrettable that they need to be priced so high that their sale is virtually restricted to libraries.

To serve their function as a guidepost to the literature the volumes are well supplied with references to the original sources and this coverage appears to extend through 1950. In making the hard decision of what to discuss in the space available, the authors have usually chosen well, although the emphasis of several sections obviously reflects the research interests of the authors. The volumes are relatively free of error of fact. One exception, though, which should be noted since it has also been encountered elsewhere, is the presentation of Diels and Alder's synthesis of pyridocoline without mention of the fact that this claim was later retracted. In many spots, it is refreshing to find a critical appraisal of the literature with new suggestions regarding possible interpretations of earlier results. Probably, the chapters on quinoline and isoquinoline were the most difficult to prepare and are the most rewarding to read.

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**Photosynthesis and Related Processes. Volume II, Part 1.** Spectroscopy and Fluorescence of Photosynthetic Pigments; Kinetics of Photosynthesis. By EUGENE I. RABINOWITZ, Research Professor, Photosynthesis Research Laboratory, Department of Botany, University of Illinois. Formerly Research Associate, Solar Energy Research Project, Massachusetts Institute of Technology. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1951. xi + pp. 603-1208. 16 × 23½ cm. Price, \$15.00.

Because photosynthesis is a field in which physical chemists, biochemists and botanists meet it is difficult for any one scientist to keep up with its developments. In spite of its great theoretical and practical importance there has been until now no authoritative book covering all aspects of photosynthesis. Eugene Rabinowitch has performed this much needed service in an outstanding manner. Dr. Rabinowitch is a physical chemist now working in the De-

partment of Botany at the University of Illinois. With his thorough understanding of physical chemical principles he has given a painstaking résumé of all the literature, covering in the present volume some 1,500 references in different branches of science. No significant publication seems to have been overlooked. The book is critical, fair and clearly written. The results of different workers have been recalculated, put into uniform units and assembled in tables. Most of the graphs and figures have been redrawn and they are uniformly excellent. Perhaps the greatest value of the book is found in the many suggestions which it contains for new research approaches to unexplored and controversial areas.

This monograph on *Photosynthesis and Related Processes* is written in two volumes. The first volume, which appeared in 1945, covered the chemistry and plant mechanism of photosynthesis. The present book is Part 1 of Volume II and it covers the spectroscopy and fluorescence of photosynthetic pigments and the kinetics of photosynthesis. In the last 370 pages of the book the author describes fully the methods by which the rates of photosynthesis and respiration are measured. He discusses next the influence of external and internal factors and particularly the influence of concentration. He then covers in detail the measurements of photosynthetic efficiency and their interpretation.

So rapid has been the progress in this field during the post-war years, particularly in understanding the photochemistry of pigments and in making use of radio-carbon as an isotopic tracer, that the author had to revise his manuscript continuously, and finally ended up by postponing the treatment of these last two subjects to a second section which will be published later.

The author is perhaps a bit optimistic when he states that new developments in photosynthesis have made the older approaches seem "like an attempt to reach a treasure chamber by drilling through steel walls, while keys have been found to unlock the door." The reviewer is of the opinion that a lot of wall-drilling and key-fitting must still be done before we can hope to really understand the mechanism of this fascinating and all-important mechanism of photosynthesis.

Chemists will be interested in the descriptions of analytical methods for carbon dioxide and oxygen and they will be particularly interested in the full historical account of the vigorous controversy over the maximum quantum yield of photosynthesis in algae, which has been going on for several years. "For 16 years the 4 quanta mechanism (of Warburg and Negelein) was the admiration and source of headaches for those who approached the problem of photosynthesis from the point of view of energy conversion." Then several laboratories in the United States found that not 4, but 8 to 10 quanta were required for a molecule of carbon dioxide and water to combine to give carbohydrate. There was general agreement on this energy efficiency of about 10 photons, corresponding to about 25 per cent. conversion of energy in red light, as against Warburg and Negelein's 4 quanta, or 70 per cent. conversion. Then in the post war years Warburg and Burk reported experiments again giving 70 per cent. efficiency and more. Rabinowitch reports critically the play-by-play contributions of the various workers up to 1951. He summarizes the work of Emerson and his associates in which they "were able to reproduce Warburg and Burk's results by strict adherence to the same experimental arrangement and schedule of operations but concluded that these results were affected by a systematic error" and cited nine specific points of criticism. The intricacies of the manometric method and their bearing on photosynthetic measurements are described.

Rabinowitch describes also the chemical, polarographic and calorimetric methods and points out that "the results of the non-manometric measurements of the quantum yield on the whole, agree with the lower efficiencies (10 ± 2 quanta per molecule) found by Emerson and Lewis, Rieke and others by manometric studies rather than with the higher figures (3 to 4 quanta per molecule) claimed by Warburg and Burk."

The reviewer cannot close without expressing both his

appreciation for such a thorough and critical summary of the status of photosynthesis, and his admiration for an author who can, in one decade, fill three important gaps—by writing this authoritative monograph on photosynthesis, by writing (with J. Katz) an equally important and authoritative monograph on the chemistry of uranium, and by founding (with H. Goldsmith) the *Bulletin of Atomic Scientists* and editing it wisely through difficult times.

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**Nuclear Data—A Collection of Experimental Values of Half-lives, Radiation Energies, Relative Isotopic Abundances, Nuclear Moments, and Cross Sections.** Supplement 3 to National Bureau of Standards Circular 499. By KATHERINE WAY, GLADYS FULLER, MARION WOOD, KARIN THEW and ALICE JURGENS. U. S. Government Printing Office, Washington 25, D. C. 1952. ii + 66 pp. 23 × 28.5 cm. Price, Circular 499 + 3 Supplements, \$4.25.

Supplement 3 (June, 1952) brings up to July, 1951, the comprehensive compilation of nuclear data covered in National Bureau of Standards Circular 499 issued November, 1950, and in two succeeding supplements. The format of these issues follows the practice of listing nuclear species according to element with a coded arrangement of data for each. The form of the supplement has been made somewhat different from that of the original circular in the interests of saving space.

The scope of the information given in these compilations is considerably broader than that of the usual isotope table or chart. For the stable nuclides, spins, magnetic moments, quadrupole moments, energy levels, and neutron cross sections (but not masses) are among the properties listed. In the cases of the radioactive nuclides, the means of preparation and detailed data on radioactivity are presented including in many instances decay schemes.

As mentioned, this compilation is comprehensive and includes parallel data by different workers; only old information which has been supplanted by a number of new measurements has been omitted. The inclusion of so many data and references makes this compilation an invaluable source of information for the interested research worker. The intentional omission of selected "best values" may handicap those who have a more casual interest in the data and find it convenient to rely on some standard source to fulfill this function.

With the issue of Supplement 3 the compilers state that National Bureau of Standards Circular 499 is complete but have arranged that collection of data will be continued and put out quarterly in *Nuclear Science Abstracts*, the semi-monthly publication of the Atomic Energy Commission.

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**Molecular Microwave Spectra Tables.** National Bureau of Standards Circular 518. By PAUL KISLIUK and CHARLES H. TOWNES. U. S. Government Printing Office, Washington 25, D. C. 1952. vii + 127 pp. 20 × 26 cm. Price, 65 cents.

In the past few years, microwave spectroscopy has grown from nothing to a subject with a considerable literature. One result of this spectacular growth has been the production of a very considerable volume of measurements on the frequencies of spectral lines for a good many chemical substances in the gas phase. These observations are scattered through the literature. The present work, which is a revision of an earlier publication along the same lines, is an attempt to bring together these measurements in a conveniently usable form. In this aim the authors have been highly successful. They have listed the observed frequencies, the assignment of quantum numbers when these have been worked out, and, in certain cases, the intensities for the microwave lines of about 100 substances. These are arranged first by chemical compound. There then follows an empirical formula index. A separate table is given in which the lines are listed in order of frequency. Finally, an author index, a compound index and a table of certain

quantities useful in interpreting quadrupole hyperfine structure are also included.

Since microwave frequencies can be measured with very great precision, the availability of such a table as this should be an excellent basis on which to erect a technique of using microwave spectroscopy for qualitative chemical analysis. Furthermore, workers in the field will find this compilation invaluable in sorting out cases of residual contamination of their apparatus and impurities in their samples. It also serves to summarize work which was completed up to the effective date of November 15, 1950.

It is hoped that this volume will be revised periodically and that all workers in the field will cooperate by sending in their data to make these revisions possible. However, with the rapid growth which is occurring the question may soon arise as to whether any one volume can contain all of the observations.

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**Fouriersynthese von Kristallen und ihre Anwendung in der Chemie.** By WERNER NOWACKI, Professor der Kristallographie und Strukturlehre an der Universität Bern. Verlag Birkhauser, Basel, Switzerland. 1952. 237 pp. 17.5 × 24.5 cm. Ganzleinen, Fr. 34.80; Broschiert, Fr. 30.15.

The use of Fourier syntheses of electron density or atomic distribution functions, as well as of the interatomic distance distribution functions more recently discovered by Patterson, has grown to great importance in crystal structure work during the thirty-five years since W. H. Bragg first mentioned its possibility. It has become an intricate and fascinating chapter of modern chemical methodology, a chapter which has yet to be given a satisfactorily comprehensive and unifying exposition. In the present book the exposition seems to jump from the excessively detailed to the uncomprehending and excessively brief; aside from a pedestrian treatment of the rudiments, it amounts essentially to only a collection of abstracts. Even so, it is thorough, and would be very useful as a source of references, recent articles in the field being so comparatively numerous, except that the coverage, extending with a few exceptions only through 1948, is seriously out of date.

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## BOOKS RECEIVED

January 10, 1953–February 10, 1953

LUDWIG F. AUDRIETH AND JACOB KLEINBERG. "Non-Aqueous Solvents—Applications as Media for Chemical Reactions." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1953. 284 pp. \$6.75.

S. J. BACH. "The Metabolism of Protein Constituents in the Mammalian Body." Oxford University Press, 114 Fifth Avenue, New York 11, N. Y. 1953. 272 pp. \$9.25.

JAMES G. BECKERLEY (Editor). "Annual Review of Nuclear Science." Volume 2. Annual Reviews, Inc., Stanford, California. 1953. 429 pp. \$6.00.

M. BREZINA AND P. ZUMAN. "Polarography in Medicine, Biochemistry and Pharmacy." Zdravotnicke Nakladatelstvi, Prague, Czechoslovakia. 1952. 528 pp. Kcs. 315.—

ADALBERT FARKAS AND EUGENE P. WIGNER (Editors). "L. Farkas Memorial Volume." Research Council of Israel Special Publication No. 1. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1952. 309 pp. \$6.00.

ARTHUR A. FROST AND RALPH G. PEARSON. "Kinetics and Mechanism—A Study of Homogeneous Chemical Reactions." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1953. 343 pp. \$6.00.

E. T. JAYNES. "Ferroelectricity." Princeton University Press, Princeton, New Jersey. 1953. 137 pp. \$2.00.