

from aldehydes and the factors which determine the course of the reaction are being investigated, in particular the effect of structure on the extent to which paths I and II are followed. That there is a fine balance between these two possibilities is illustrated by the fact that the enamine of cycloheptanone gives no C-alkylation with methyl iodide, while on the other hand it gives 2-cyanoethylcycloheptanone with acrylonitrile. Dr. P. C. Mukharji in this Laboratory has also found that

N-methylation is the principal result with the enamine of testosterone.⁶

(6) Prepared according to reference 2. A number of enamines are known which show simple N-methylation on treatment with methyl iodide, e.g., 1,6-dimethyl-1,2,3,4-tetrahydropyridine: A. Lipp, *Ann.*, **289**, 216 (1896); neostyrychnine, O. Achmatowicz, G. R. Clemons, W. H. Perkin, Jr., and R. Robinson, *J. Chem. Soc.*, 787 (1932).

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BOOK REVIEWS

Low Temperature Physics. By CHARLES F. SQUIRE, Professor of Physics, The Rice Institute, Houston, Texas. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 18, New York, 1953. x + 244 pp. 16 × 23.5 cm. Price \$6.50.

This is a very interesting and well-written book, and is recommended to those interested in learning more about the phenomena of very low temperatures—mostly below 4°K. Some of the phenomena discussed in the book are observable only below 50°K. which makes the book not only interesting but important for those inclined to physical theory. Those interested in the thermodynamics will find many interesting applications of theory to the unusual properties of liquid helium, superconductivity, para- and diamagnetism and the liquefaction of gases. There is a good balance between theory and experiment so that the interested non-mathematical reader will find the purchase of the book justified.

The book begins with a discussion of the liquefaction of gases. Only the liquefaction of helium with a S. C. Collins-type cryostat is discussed in much detail. This may disappoint some but the reviewer approves the author's choice. The book was written to cover low temperature physics not engineering and the Collins-cryostat has been by far the most used liquefier in the U.S.A. for the investigation of the phenomena discussed in this book. The inclusion of such topics as lubrication of the gas compressor, and the draining of oil and water traps will point up for the alert liquefier operator the kind of information needed for the operation of other kinds of liquefaction plants.

There follows a good theoretical discussion of the equation of state of real gases from the point of view of statistical mechanics. The quantum-statistical equations of state for ideal gases at low temperatures are included.

Three chapters on liquid helium follow—really on the strange phenomena of liquid helium below 2.2°K. characterizing a strange state of matter designated Liquid Helium(II). Two chapters are on experimental phenomena—one on thermal and the other on flow phenomena—and the third chapter is on the Theory of Liquid Helium(II). No theory yet proposed really "explains" the strange phenomena of helium(II) beyond showing that they are undoubtedly a consequence of a large accumulation of helium atoms in states of low translational energy.

Superconductivity follows; first there is a discussion of the experimental phenomena and then the pertinent theory. As the author points out there is as yet no adequate theory of superconductivity, though there are a number of equations, some empirical and some derived from classical thermodynamics and electrodynamics, tying together otherwise disjointed properties of superconductors.

There is a chapter on magnetic phenomena with pertinent classical and quantum theory. Besides the regularly included topics the authors discussed the newer phenomena of alignment of nuclear magnetic moments, nuclear magnetic resonance with r.f. fields, anti-ferromagnetism and the production of lowest attained temperatures (0.002°K.) by the adiabatic demagnetization of a paramagnetic salt.

In a chapter on thermal energy of solids at low temperatures, cooperative phenomena and rotation of molecules and radicals are discussed. These are of especial interest to physical chemists.

The final chapter of the book is on dielectric properties at low temperatures. The most interesting phenomena here result from the orientation in the solid state of electric-dipole molecules and radicals. This gives rise to phenomena of electrical polarization of a solid that are analogous to para- and ferromagnetism.

The mathematical parts of the book are at the level of the graduate physics student. A knowledge of elementary statistical mechanics and quantum theory is presupposed. The M.K.S. system of units has been used. This system is not uncommon among physicists, but newton as a unit of force, and $\epsilon_0 = 8.85 \times 10^{-12}$ coulomb²/newton-m² and $\mu_0 = 12.57 \times 10^{-7}$ weber/amp-m for the dielectric constant and magnetic permeability of free space will seem strange to many chemists familiar with $\epsilon_0 = \mu_0 = 1$.

This book is pre-eminent among books covering the whole low temperature field. It is not to be expected however that a book of 250 pages covering so extensive a field could treat a subject like superconductivity in such detail as the specialized monographs on superconductivity by F. London and by D. Shoenberg.

The book is recommended to all who are interested in reading about a comparatively new field of physics that is not only stimulating but is challenging because more remains to be understood than we know about it today.

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Annual Review of Biochemistry. Volume 22. By J. MURRAY LUCK, Stanford University (Editor); HUBERT S. LORING, Stanford University; and GORDON MACKINNEY, University of California (Associate Editors). Annual Reviews, Inc., Stanford, California. 1953. ix + 729 pp. 16.5 × 23 cm. Price \$6.00.

The Prefatory Chapter in this volume is an innovation in the series. In discussing his experiences in the study of foods and nutrition as a student, a teacher and an investigator, Professor E. V. McCollum presents a fascinating account of his early associations in New Haven and Madison with such eminent pioneers in biochemistry as Babcock, Chittenden, Hart, Osborne, Mendel and Underhill. Professor McCollum established (1907) the first rat colony in America for the study of nutrition, obtained (1913) the first evidence that fats contain an indispensable nutrient (vitamin A), and published (1918) the first edition of his outstanding book "The Newer Knowledge of Nutrition." In 1917 he was appointed to take charge of the department of chemistry in the newly established School of Hygiene and Public Health in Johns Hopkins University, a post which he filled with distinction for more than three decades.

Half of the topics surveyed in volume 22—biological oxidations, proteolytic and non-proteolytic enzymes, amino

acids and proteins, water soluble and fat soluble vitamins and nutrition—have been reviewed in all, or nearly all, of the preceding 21 volumes of the series. The remaining subjects—nucleic acids, neoplastic tissue, antibiotics, fungi, photosynthesis, teeth, immunopolysaccharides, vision and ruminant nutrition—have been treated previously from one to ten times. A chapter on Cortisone appears for the first time in volume 22. The reviews have been prepared by eminent biochemists from 13 universities or research institutes in the United States and 9 in foreign countries (Argentina, Denmark, England, France, Israel, Switzerland and Wales).

The work and accomplishments of the editorial committee, the editors, and the reviewers are greatly appreciated generally. During a period of nearly a quarter of a century 75 topics have been discussed in about 550 articles by biochemists in approximately 200 institutions of which nearly half are in 25 foreign countries. About one third of the reviews are contributions from the University of California (40), Cambridge University, England (25), Columbia University (22), the Rockefeller Institute for Medical Research (17) and seven other universities (81).

The policy, stated in the Preface to volume 1, that the reviews should be critical analyses and resumes rather than compendia has been maintained consistently. Although the reviewers have adhered to this policy reasonably well, parts of numerous reviews consist of little more than lists of papers and conclusions. It is probably not possible for any review to be both critical and complete because of the limitations of space if not for other reasons. Since, the approximately 5000 papers cited currently represent only a fraction of those published annually it might be in order for reviewers to limit citations even more drastically thereby releasing space for extension of critical discussion.

All topics of interest are not and cannot (within a reasonable space) be included in each volume of the Review. Approximately 60% of the topics have been discussed in only five or fewer volumes while about 15% of the chapters have been devoted to 10 general subjects, each treated in nearly all of the annual reviews. The Editors have recognized, but only partly solved, this problem by creating new annual review series to which some topics have been transferred.

The underlying difficulty may be that (seemingly) it is virtually impossible to review either critically or completely in one volume the annual publications in a whole field of science such as biochemistry. In this connection one may inquire in vain, I think, concerning a satisfactory definition of biochemistry and thus the boundaries of this discipline. The establishment of annual reviews of *subject* (e.g., proteins, carbohydrates, lipids, vitamins, etc.), rather than *fields* (e.g., biochemistry, physiology, plant physiology, etc.) is suggested as a possible solution of this problem.

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Standard X-Ray Diffraction Powder Patterns. Volume I. National Bureau of Standards Circular 539. By HOWARD E. SWANSON and ELEANOR TATGE. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 1953. ii + 95 pp. 20 × 26 cm. Price, \$0.45.

Standard X-Ray Diffraction Powder Patterns. Volume II. National Bureau of Standards Circular 539. By HOWARD E. SWANSON and RUTH K. FUYAT. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 1953. ii + 65 pp. 20 × 26 cm. Price, \$0.45.

Eighty-four standard X-ray diffraction powder patterns are presented in revision of the corresponding patterns in the ASTM card file employed in the phase identification of crystalline materials. This compilation at the National Bureau of Standards constitutes a major step in the direction of obtaining reliable powder data that are carefully indexed and compared with patterns from the literature. The interplanar spacings of these pure compounds are given with an accuracy of four significant figures. The intensity values, determined by Geiger counter spectrometry, are

reported as peak heights above background and are expressed as percentages of the strongest line. From a theoretical viewpoint, however, integrated intensities are to be preferred. A serious difficulty with the flat sample mounting is the likely distortion of the relative intensities because of preferred orientation of crystallites. By reducing the grain sizes of the samples to less than twenty-five microns the authors have overcome this inherent limitation and achieved quite reproducible intensity measurements.

These two inexpensive circulars are recommended to all diffractionists.

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Infrared Absorption Spectra of Steroids. An Atlas. By KONRAD DOBRINER, E. R. KATZENELLENBOGEN and R. NORMAN JONES, The Sloan-Kettering Institute for Cancer Research and the National Research Council of Canada. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, New York. 1953. xlv + 308 pp. 16.5 × 23.5 cm. Price, \$11.50.

This volume is of general interest as an aid in the identification of organic compounds and in the determination of structures by means of infrared absorption spectra, and of specific usefulness in the facile characterization of steroids by comparison of absorption curves. The collection of curves derives particular value from the fact that all of the spectra have been obtained by the same group of skilled workers, and the accuracy and comparability of the curves cannot be questioned. All of the data—type of prism, cell length, solvent and concentration—have been included which make it feasible to reproduce any curve on a near-quantitative basis.

The spectra are recorded on a linear wave number scale which is identical throughout. The ordinate values, also on an identical scale for all curves, are given in percentage absorption, so that these are true absorption curves. For the form of presentation of the spectra, the authors may have been influenced by the volume on "Ultraviolet Spectra of Aromatic Compounds," by Friedel and Orchin, since the charts in the two books bear close resemblance. The subdivisions of the scales are clearly marked, so that interpolation of the maxima values is easy. The numerical values of the maxima are not given along with the curves, but the alternate blank pages permit the reader to make any notes and jottings he may wish to associate with a particular compound or functional group.

The 3800–2700 cm^{-1} region is recorded for only twelve compounds (supplementary charts). Most of the absorption curves cover the region 1800–650 cm^{-1} , and the 294 charts for this region are arranged in the order of increasing functionality of the compounds: I, C_{18} -steroids; II, C_{19-29} -steroids; hydrocarbons; mono-, di-, tri-, tetra- and pentahydric alcohols; mono-, di- and triketones; hydroxyketones; III, bile acid esters; IV, steroid sapogenins and derivatives; V, cardiac aglycones and derivatives (4); VI steroid alkaloids (2). In general, the curves for stereoisomeric compounds are placed close together in the atlas, so that direct comparison of related spectra is easily achieved. The selection of steroids is representative and also the most complete available at this date. The collection of adrenocortical steroids is remarkable. Nowhere else will one find infrared absorption curves for all these compounds. By contrast, curves for only one halogenated steroid and two *i*-steroids are included in the collection.

While the arrangement of the spectral curves tends to stress the usefulness of the volume in the identification of steroids, there is much general information on infrared spectra of organic compounds to be obtained by a selective study of the curves presented and by referral to the clear and concise introductory section. Finally, the atlas represents a unique testament to the method which has revolutionized structural organic chemistry and a worthy memorial to Dr. Konrad Dobriner, who was a pioneer in the application of this method.

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