

tellurium, phosphorus, barium, arsenic, antimony, boron, mercury, and metals in metallo-organic compounds. The material on the carbon and hydrogen determination includes the manual method of Pregl, as well as the automatic modifications. For the latter, emphasis is placed on the method of Zimmermann. The determination of oxygen is by the volumetric procedure of Unterzaucher. The determination of nitrogen is divided into three parts, the first describing the Dumas, the second, the Kjeldahl, and the third, the Lacourt hydrogenation methods. The first part emphasizes the Zimmermann modification of the Dumas-Pregl method. The Kjeldahl description includes a hydriodic acid pretreatment, either at atmospheric pressure or in a Carius tube, followed by kjeldahlization with sulfuric acid. For the determination of the halogens, a number of methods are described. For chlorine and bromine, these include catalytic combustion, Carius-Pregl, Kirsten and Schöniger procedures, as well as the Moser and Miksch simultaneous determination of the two elements. For iodine, the methods include the Leipter modification of the catalytic combustion and the Kainz potassium decomposition. For the determination of fluorine, decomposition with calcium hydroxide, perchloric acid distillation, and subsequent titration with thorium nitrate is described. In view of recent literature on the determination of fluorine, the method described by the author might not be expected to give reliable results with certain compounds, particularly the perfluoro ones. The material on the determination of sulfur includes both oxidation and reduction methods. Of the former, there are the Pregl and Zinneke catalytic, Carius and Schöniger combustions. The latter is a volumetric procedure based on the methods of Bürger and of Zimmermann. The determination of selenium is accomplished by an iodimetric procedure, based on that of Kainz, involving combustion in a bomb with sodium peroxide. Two procedures are given for phosphorus, the first being gravimetric, in which the element is determined as ammonium phosphomolybdate, and the second being colorimetric, the method of Roth, using the molybdenum blue reaction. Also included are the simultaneous determinations of barium, phosphorus and nitrogen. For arsenic, the Wintersteiner iodimetric procedure is described, for antimony, a bromide-bromate titration and for boron, a sodium hydroxide titration. Mercury is determined (a) by a Carius combustion, followed by titration with sodium diethyldithiocarbamate; (b) by decomposition in a carbon-hydrogen type combustion tube, followed by collection of the mercury as gold amalgam; and (c) by the electrolytic process. The determination of metals, in general, by the ashing technique is included as well as the electrolytic method for copper.

The third section of the book is devoted to the determination of various groups: C-methyl, isopropylidene, unsaturation, hydroxyl, active hydrogen, acetyl, benzoyl, alkoxyl, S-alkyl, carbonyl, peroxide, carboxyl, acid anhydride, lactone, saponification number, acid amide, amino acids, alkimide, primary amino groups, mercapto, disulfide and dialkyl sulfide, isocyanate and isothiocyanate, and dithiocarbamate and thiuram disulfide. The determinations of C-methyl and isopropylidene are according to the respective acidimetric and iodimetric methods of Kuhn and Roth. Both volumetric and manometric procedures are described for the determination of double bonds by means of hydrogenation. Triple bonds are determined by reaction with silver nitrate, followed by titration of the resulting acid. Hydroxyl groups are determined by means of either acetylation or the Karl Fischer reagent. Active hydrogen is determined by the Zerewitinoff (Grignard) method with reference to that which uses lithium aluminum hydride. Distillation in the apparatuses of either Schöniger, Lieb, and El Din Ibrahim or Roth is recommended for the acetyl (benzoyl) determinations. Alkoxyl (S-methyl) is analyzed in the classic Pregl apparatus, except for very volatile substances for which the Furter set-up is recommended. The simultaneous determination of methoxyl and ethoxyl is still performed by the method of Küster and Maag. The literature reference number 3 on page 254 in connection with the above is incorrect. The reference should read "Z. physiol. Chem., 127, 190 (1923)." Propoxyl and butoxyl determinations are carried out using the Shaw apparatus. The basis for the vinyl ether determination is the Siggia and Edsberg iodine addition method. Carbonyl is determined by reaction with 2,4-dinitrophenylhydrazine, reduction of the dinitrophenylhydrazone to the diamino compound with

an excess of titanium trichloride and subsequent titration of the excess with standard ferric ammonium sulfate. Peroxide is determined iodimetrically by the method of Roth and Schuster. Various procedures of titration with alkali are used for carboxyl (neutralization equivalent), acid anhydrides and lactones. The acid anhydrides are also determined indirectly after reacting with 2,4-dichloroaniline. The sodium salt of triphenyl-*p*-rosanilinesulfonic acid is used as indicator for the determination of saponification number, while methyl red is used for acid amides. Four methods are described for α -aminoacids: (a) titration with alkali, using thymolphthalein as indicator; (b) by the ninhydrin (triketohydrindene hydrate) reaction; (c) by the perinaphthidan-2,3,4-trione hydrate reaction, and (d) by the Van Slyke volumetric procedure. Besides the Van Slyke apparatus, that of Kainz is used for amino groups. It is attached to a regulation microtitrometer. Two procedures are described for alkimide groups, namely, the gravimetric and the volumetric (iodimetric). The apparatus employed is that described by Sirotenko. Mercapto (sulfhydryl) groups are determined by oxidation with iodine or by reaction with cupric salts. Disulfides and dialkyl sulfides (thioethers) are determined iodimetrically. Isocyanates and isothiocyanates are treated with amines to give alkyl derivatives of urea and thiourea, respectively. Dithiocarbamates and thiuram disulfides are determined iodimetrically by the method of Roth and Beck.

The fourth section of the book is devoted to the determination of physical constants. Included are determination of melting point, boiling point, molecular weight, optical rotation and molecular refraction. Considerable space is devoted to the determination of melting points by means of the Kofler micro hot-stage. The boiling point determination is a modification of the method of Schleiermacher which gives the value at 760 mm. pressure. Two methods for molecular weight are described, namely, the Rast melting point lowering and the Barger osmotic (isothermal distillation). In connection with the former, 27 compounds are listed which are suitable as solvents. Optical rotation is done by the method of Fischer. A special precision weighing pipet is used for the molecular refraction determination. The last eight pages of the section are devoted to calculations and tables of factors. Included is a table of factors for the Dumas nitrogen determination, covering the ranges of temperatures from 10 to 30° and pressures from 700 to 760 mm.

In general, the illustrations are the same type that Dr. Roth (and Pregl) used in previous editions. In the opinion of the reviewer, it would have been far more preferable to have used fully dimensioned drawings (of the type published by the Committee on Microchemical Apparatus of the Division of Analytical Chemistry of the American Chemical Society or by the British Standards Institution) which would have made it possible for anyone to correctly manufacture the various pieces of apparatus. With this exception, Dr. Roth's book is an extremely valuable contribution to the literature of the field.

MICROCHEMICAL DEPARTMENT
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Growth and Perfection of Crystals. Proceedings of an International Conference on Crystal Growth held at Coopers-town, New York, on August 27-29, 1958. Sponsored by Air Force Office of Scientific Research, Air Research and Development Command and The General Electric Research Laboratory. Edited by R. H. DOREMUS, B. W. ROBERTS and DAVID TURNBULL. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1958. xviii + 609 pp. 22 x 28.5 cm. Price, \$12.50.

In less than ten years, three conferences (two of which were international) have been held on current research in the general field of crystal growth: in 1949, sponsored by the Faraday Society; in 1956, sponsored by the USSR Academy of Sciences; in 1958, sponsored by the United States Air Force and the General Electric Company. Full reports of these conferences have been made available; the last is the subject of this review. In addition, the comprehensive book by H. E. Buckley appeared in 1951.

Following an introductory lecture, the conference report

is divided into five sections covering the following subjects; The Growth of Whiskers, *i.e.*, filamentary single crystals (five papers); The Properties of Whiskers and Crystal Imperfections (eleven papers); The Growth of Crystals of the Solvent Phase (nine papers); The Growth of Crystals of the Solute Phase (seven papers); The Crystallization of Polymers (eight papers). In each section, the first paper is a review of the work to date; separate reviews are included on the kinetics of polymer crystallization and on the morphology of polymer crystals. The review covering crystal whiskers is particularly noteworthy and includes some two hundred fifty references in one hundred pages. The discussions which followed the presentation of the papers are included; some contributions to the discussions were written in considerable detail after the conference and add to the value of the report.

The principal distinguishing features of the conference report are the attention given to whisker phenomena which represents half of the written record, the effort to associate the problem of liquid structure with studies of crystal growth from melts and the comparison of the characteristics of polymer crystals with those of ordinary crystals.

The report was printed by the photo-offset process after typing. The use of large type resulted in a large, heavy volume but the clarity and general effect are pleasant. The nearly three hundred photographs and the more than two hundred line drawings are excellent. The papers are uniformly well written.

Thirteen of the participating scientists were from other countries; I. N. Stranski from Berlin was present and the delegation from Bristol University was headed by F. C. Frank. Six of the scientists taking part also had been present at the Faraday Society conference. The conference and its carefully prepared report represent a most useful contribution to an important and rapidly growing field of research.

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Symposium on Protein Structure. Sponsored by the Protein Commission of the Section of Biological Chemistry of I.U.P.A.C. and held at the College de France, Paris, 25-29 July, 1957. Edited by ALBERT NEUBERGER, Professor of Chemical Pathology, St. Mary's Hospital Medical School, London. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1958. 351 pp. 16 X 24 cm. Price, \$7.75.

This symposium and the volume that reports its proceedings may well be considered a sequel to the Ciba Foundation symposium in 1952 that resulted in the volume entitled "Chemical Structure of Proteins" (reviewed in THIS JOURNAL, 76, 6212 (1954)). The speakers in both symposia are well known for their investigations of the structure of proteins. Some participated in both.

About a third of the volume is taken up with a discussion of general problems and methods in protein chemistry. The remainder is devoted to specific information about the structure of hemoglobin, myoglobin, proteolytic enzymes, ribonuclease, tobacco mosaic virus, and other proteins.

This book dramatically illustrates the progress that has been made in elucidating the structures of proteins during the five years between the symposia. Much of the earlier symposium was devoted to a discussion of methods. The now commonplace usage of these methods has led to the specific and detailed information about many proteins and peptides that was so ably presented in the second symposium and is recorded in this volume.

The subject matter of this book is too detailed to be read with profit unless the reader has a good grounding in the fundamentals of protein chemistry. On the other hand, workers in the field and teachers whose course work deals with protein chemistry will find it a valuable addition to their library.

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BOOKS RECEIVED

May 10, 1959-June 10, 1959

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HOWARD K. SCHACHMAN. "Ultracentrifugation in Biochemistry." Academic Press, Inc., 111 Fifth Avenue, New York 3, N. Y. 1959. 272 pp. \$8.80.

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N. N. SEMENOV. "Some Problems in Chemical Kinetics and Reactivity." Volume 2. Translated by MICHEL BOUDART. Princeton University Press, Princeton, New Jersey. 1959. 330 pp. \$4.50.

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