would constitute the first step toward a more extensive study of this class of sugar derivatives. We believe that we have found such a method. It represents a modification of a previous general procedure of one of us [Pacsu, *ibid.*, **58**, 509 (1925); Pacsu and Ticharich, *ibid.*, **62**, 3008 (1929)] by which the α-alkylpyranosides were prepared from the sugar mercaptals and mercuric chloride in the *boiling* solutions of the different alcohols. Taking, *e. g.*, galactosediethylmercaptal and ethanol, the reaction can be expressed by the following summary equation

$$C_6H_{12}O_5 \cdot (SC_2H_5)_2 + 2HgCl_2 + C_2H_5OH = 2HCl + 2C_2H_5S \cdot HgCl + C_6H_{11}O_5 \cdot OC_2H_5$$

This method was shown to yield almost pure (up to 92%) α-alkylpyranosides accompanied only by a slight quantity of the β-isomers. Now we have found that if the same reaction be carried out *at low temperature*, and the hydrochloric acid formed be neutralized at the moment of its development, an excellent yield of crystalline β-ethylgalactofuranoside can be obtained. The substance had m. p. 84.5–86° and $[\alpha]^{25}\text{D} -100.1°$ in water solution. Schlubach and Meisenheimer [*ibid.*, **67**, 429 (1934)] reported m. p. 86° (corr.) and $[\alpha]^{20}\text{D} -97.2°$ for the same compound obtained by a lengthy synthesis from the β-pentaacetate of galactofuranose of Hudson and Johnson. So far it has not been possible to find any isomer in the mother liquor. The same furanoside was obtained when dibenzylmercaptal had been used as starting material. For the instantaneous neutralization of the hydrochloric acid we have found the use of an excess of yellow mercuric oxide to be most excellent. It keeps the reaction mixture neutral during the whole process, and it provides for a desirable excess of the mercuric chloride up to the end of the reaction. For the removal of the mercuric chloride from the solution we have found that pyridine can be used most successfully. It seems very likely that these modifications can also be used with advantage in the procedures developed for the preparation of the open-chain methylated (Levene, 1926) and acetylated (Wolfrom, 1929) aldoses.

Since the formation of glycopyranosides by the original method has proved to be of general validity, we believe that by this modified procedure it will be possible to prepare the hitherto unknown or only difficultly available furanosides of the carbohydrates. It is our purpose to prepare by this method the alkylfuranosides and -thiofuranosides of the aldoses and ketoses from their mercaptals and acetonylated mercaptals. In the forthcoming first paper of this series of investigations conducted in this Laboratory, a detailed description of the procedure will be given.

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EUGENE PACSU
JOHN W. GREEN

RECEIVED AUGUST 14, 1936

NEW BOOKS

Colorimetric Methods of Analysis, Including Some Turbidimetric and Nephelometric Methods. Vol. I. Inorganic. By FOSTER DEE SNELL and CORNELIA T. SNELL. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y., 1936. 766 pp. Illustrated.

In this second edition of Dr. Snell's treatise a much more comprehensive treatment of the field of colorimetry has been made. The book has been divided. This first volume covers general colorimetry and inorganic determinations; a second will deal with organic, biological and miscellaneous methods.

In its general plan and scope the book closely resembles Yoe's "Photometric Analysis." It differs in that nephelometric methods are treated with the colorimetric ones instead of in a separate volume and in that the bibliography occurs in footnotes instead of as a separate section at the end of the book. It contains, of course, methods and references which have appeared in the seven years since the publication of Yoe's book.

In the first nine chapters the general methods of colorimetry are discussed and the multitudinous forms of apparatus which have been devised for the measurement of color and of turbidity are illustrated and explained. Fifty-four chapters are then devoted to different methods for the determination of seventy-four elements or simple inorganic compounds. The last four chapters deal with the colorimetric determination of hydrogen ions. As many as ten or twelve methods are given for some elements. The treatment is well balanced in that the more important methods are given more space while other methods of less value are dismissed with a reference and a brief description.

The book, however, is by no means simply a reference list but rather an excellent working text. In general, after an introductory discussion of each method, the preparation of samples is detailed. This should be one of the most attractive features of the book to the practical worker. Next directions for making up reagents are given and then details of the analytical procedure. Finally there are directions for preparing standards suitable for the method.

Although the treatment is comprehensive rather than critical, this text represents a distinct contribution to the literature of analytical chemistry. It is a reference book which should be on the shelves of every chemist who has occasion to take advantage of the ease and rapidity of colorimetric methods.

CHARLES H. GREENE

Protoplasm. By WILLIAM SEIFRIZ, Ph.D., Professor of Botany, University of Pennsylvania. McGraw-Hill Book Co., Inc., 330 West 42d Street, New York, N. Y., 1936. x + 584 pp. 179 figs. 15.5 × 23.5 cm. Price, $6.00.

This is a delightful volume, a storehouse of information, and should be on the desk of every biologist, biochemist and biophysicist. If only all chemists teaching general chemistry, organic chemistry and especially physical chemistry would read this book they would gain a clear insight into the role which chemistry plays in the phenomena of life.

The author is Professor of Botany in the University of Pennsylvania but the book reads almost as though it were written by a physical chemist. It is a far cry from the "plant physiology" of a generation ago to this discussion of "protoplasm," the ultimate living matter of all cells. The author is to be congratulated on his accomplishment in bringing together in a unified whole so many interesting and diverse series of information.

Of the twenty-seven chapters only five may be said to be primarily biological and even these contain much chemistry and physics. The first chapter deals with "The Living Substance." This is followed with "The Cell"; "Model Making," "Micrurgy" (micromanipulation within living cells) and "Tissue Culture." The last chapter "The Origin of Living Matter" sums up the volume and presents a philosophical consideration of how life possibly came to be.

The other 22 chapters are fundamentally chemical and deal with "The Colloidal State," "Emulsions," "Hydrophilic Sols and Gels," "Surface Tension," "Adsorption," "Osmosis," "Imbibition," "Viscosity." "Elasticity," "The Structure of Protoplasm and Organic Colloidal Matter," "Permeability," "Acidity," "Electrophysiology," "Electrokinetics," "Radiant Energy," "The Role of Water," "Salts," "Carbohydrates," "Fats," "Proteins," and "Regulatory Substances," but into the chemistry and physics of these chapters is woven the experience of years of reading and teaching biological principles so that they are a mine of information uniting abstract chemical and physical laws with cell behavior.

As is to be expected in the first edition of a volume of this size there are some unfortunate typographical errors, some omissions and some inaccuracies. Furthermore, it is perhaps too much to hope that everyone will agree with the author in his interpretation of certain biological processes, certainly the reviewer does not agree in all points, but any and all shortcomings of the book are easily condoned in the light of the magnificent accomplishment which the author has achieved.

A few of the more serious errors are here noted, not as criticisms but to assist prospective purchasers: p. 56, "microvolts" is incorrectly used for millivolts; p. 82, glutathione is stated to be a dipeptide, it is a tripeptide, glutamyl-cysteinyl-glycine; p. 82, amino acids are not the "hydration" products of proteins, rather the products of hydrolysis; pp. 92, 94 and 118, the Tyndall phenomenon is discussed and statements made that it is perhaps the most characteristic property of colloids. Since the Tyndall phenomenon depends upon the refraction of light from an interface it is evident that a solid immersed in a liquid, both having the same index of refraction, will show no Tyndall phenomenon. The absence of "optical properties" in certain protein sols is well known and does not mitigate against their being truly colloidally dispersed. On p. 93 the author states that the word peptization is derived from "peptone, itself a peptizing agent." This is incorrect. Graham coined the word "peptization" and states that it "may be looked upon as analogous to the solution of insoluble organic colloids witnessed in animal digestion. . . . Liquid silicic acid may be represented as the 'peptone' of gelatinous silicic acid—etc." Accordingly "peptization" is derived from pepsin and the process is likened to enzymatic action. On p. 144 there is an erroneous statement as to the osmotic pressure developed by an 0.1 molar sucrose solution. On p. 153 the reference in the text to Fig. 91 should be to Fig. 92. On p. 174 Traube's rule is stated with no indication that it depends upon the nature of the interface and that it is reversed for a polar substance, *e. g.*, SiO_2, in water. On p. 175 there is an unfortunate error in the formula of the Freundlich adsorption isotherm. On p. 199 in the discussion of the osmotic pressure of the blood and body fluids, no mention is made of colloid osmotic pressure and the role it plays in urine secretion. On p. 287 the unfortunate statement is made that a low surface tension means a "loose arrangement of surface molecules and therefore a more permeable membrane." On p. 361 the apparatus figured is that of Freundlich and Rona, not that of Kruyt. On p. 418 metabolic water is stated to arise in part from the "polymerization" of compounds. On p. 429 is given a list of the elements found in protoplasm and the statement that the first 10 are essential. In the first ten sodium is included and iron is omitted! On p. 431 the term "phosphoproteins" is used for the correct "nucleoproteins." On p. 431 in a discussion of the being an integral part of the chlorophyll molecule. That it is present in chlorophyll is noted in another connection on a later page. This type of "omission" occurs in a number of places in the book, thus in discussing vitamin C on p. 514 no mention is made of ascorbic acid although ascorbic acid comes in later in another connection on p. 519. On p. 432 a typographical error gives the sulfhydryl group the formula, SH_2 and on the same page the unfortunate statement occurs that the sulfur bacteria "use sulfur instead of carbon in the synthesis of higher foods"; of course what the author meant was that elemental sulfur was used by the sulfur bacteria as an *energy* source and that by the oxidation of the sulfur they secured energy for the synthesis of carbon compounds. Likewise on p. 432 the cystine discussion is ambiguous. On p. 451 pernicious anemia is confused with nutritional anemia. On p. 477 Sørensen is stated to have found the molecular weight of egg albumin by the freezing point method to be 14,000. This is incorrect. By direct osmotic pressure measurements he found (*Compt. rend. trav. Lab. Carlsberg*, Vol. 12) a mol. function of magnesium in plants no mention is made of its wt. for egg albumin of 34,000. On p. 514 "night blindness," an hereditary affliction, is confused with lack of Vitamin A. On. p. 508 Northrup instead of Sumner is credited with the crystalline enzyme urease.

Apparently the author (in common with most biologists and chemists) is confused (p. 478) with Svedberg's use of the term "molecular weight" as it applies to proteins. It is unfortunate that Svedberg has used this term instead of the more exact (from the chemists' viewpoint) term of "particle weight." Svedberg's "molecular weights" are used in the physical sense and defines "a molecule as a unit which will acquire from thermal vibrations an average of $^1/_2\ kT$ ergs of energy for each of three translational degrees of freedom, neglecting quantum restrictions. The size and weights of these molecules may change with temperature, rate of sheer, and other factors" (personal communication from Prof. J. W. Williams).

Svedberg's use of the term does not necessarily connote that the "molecule" is the smallest unit of that primary substance that can be obtained. Consequently he speaks of the "decomposition" of molecules and later the reversal of the "decomposition" process so that the original "molecular weight" was regained. Obviously this cannot be accomplished if the term "molecular" were used in the older chemical sense.

Again I recommend this volume to all biologists, physicists and chemists who are interested in the phenomena of life in its manifold manifestations.

ROSS AIKEN GORTNER

Handbuch der biologischen Arbeitsmethoden. Edited by EMIL ABDERHALDEN. Abt. IV, Angewandte chemische und physikalische Methoden, Teil 1, Heft 9. (**Handbook of Biological Methods.** Section IV. Applied Chemical and Physical Methods. Part I, Vol. 9.) Fermentforschung. Urban and Schwarzenberg, Friedrichstrasse 105 B, Berlin N 24, Germany, 1935. 245 pp. 17.5 × 25.5 cm. Price, RM. 13.50.

This volume is of interest to those devoted to research in enzyme chemistry and related fields. It gives a comprehensive review of the following subjects:

In the first two articles the method of carrying out the Abderhalden reaction with immersion refractometer according to the method described by Pregl–de Crinis, is given. The estimation of protective enzymes by the use of the interferometer is described by Paul Hirsch.

The preparation of crystalline pepsin, trypsin and chymotrypsin is presented by John H. Northrop and M. Kunitz. The crystalline pepsin is prepared from the amorphous commercial product and is obtained (after recrystallization) in colorless microscopic crystals. The trypsin is obtained from pancreas and finally the chymotrypsin from the pancreas of cattle through the intermediate preparation of crystalline chymotrypsinogen.

The ketonaldehydmutase, an enzyme having the property of converting the alpha-keto aldehydes into alpha-hydroxy acids, is described by Carl Neuberg and E. Simon. This enzyme is widely distributed in nature and functions in the metabolism of living organisms. The most important reaction of this kind is the conversion of methyl glyoxal into lactic acid. The various derivatives of methyl glyoxal such as phenyl glyoxal and methyl glyoxal acetic acid react similarly. The article gives a comprehensive treatment of these reactions.

Emulsin is described by Karl Tauböck. The enzyme preparation consists mainly of β-*d*-glucosidase. It cleaves the β-*d*-glucosides both natural and synthetic, but not the *l*-glucosides. It has been observed that some preparations also cleave various galactosides or mannosides, but the question as to whether this is due to some other enzyme such as alpha-*d*-galactosidase or alpha-*d*-mannosidase, or the β-glucosidase alone has not been determined. This subject is under investigation at the present time.

The method of studying dehydrogenases is presented by Torsten Thunberg in great detail. A complete bibliography is given with each article.

G. BRAUN
C. N. FREY

Die Allotropie der chemischen Elemente und die Ergebnisse der Röntgenographie. (The Allotropy of the Chemical Elements and the Results of X-Ray Analysis.) By M. C. NEUBURGER. Verlag von Ferdinand Enke, Stuttgart W, Germany, 1936. 106 pp. 32 figs. 16 × 24 cm. Price, RM. 9.30; RM. 8.20, for subscribers.

This is Number 30 of a series of monographs on chemistry and chemical technology. The author has written a number of works on crystal chemistry and x-ray diffraction. Each year he writes the annual summary of lattice constants for the *Zeitschrift für Kristallographie.*

The possible allotropic forms and crystal structures of 69 elements, 23 of which actually have several modifications, are discussed. In addition, there is an introduction in which the criteria for distinguishing allotropic forms are discussed. There are chapters on the influence of foreign atoms on allotropy; the relations between allotropy, crystal structure and atomic properties; and transformation mechanisms and the kinetics of allotropic changes.

Crystal structure is chosen as the most unambiguous criterion of allotropic change and x-ray data as the most direct evidence. Although the author is in a position to write authoritatively and his judgment is generally good, a number of criticisms must be made.

In a book of this nature we should expect to find a short review of the literature for each element, giving all important ideas which have been put forth with references. The author should weigh these facts critically and sum up his conclusions distinguishing between what is thoroughly established and what is merely probable and mention possibilities which have not been verified. Neuburger's book falls below this standard. He ignores considerable data, good and bad, and often gives only his conclusions without specifically indicating their source or their relative probability. To get a good idea of the status of work on a given element it is still necessary to consult the original literature.

The author fails completely to mention the fact that cobalt is hexagonal at high temperatures, which has been verified by a number of authors and never disputed. On phosphorus, he ignores the fact that a number of contradictory x-ray patterns have been reported. He mentions the work of Frost [*J. Russ. Phys.-Chem. Soc.*, **62**, 2235 (1930)] which shows that red and violet phosphorus have different structures without giving credit or listing the reference. The best work on the transformation point of iron [by Wells, Ackley and Mehl (1935)] is not mentioned; perhaps it is too recent for inclusion.

The references, instead of being conveniently listed under each element, are placed at the end of the volume. The first 920 of them are alphabetically arranged according to author, but 82 more follow (not the most recent ones) in irregular order. The reference numbers are hard to find since they are not conspicuously printed and separate lines are not given to each reference. A great deal of space could have been saved by omitting data such as lattice constants which are conveniently found elsewhere. A few good tables would advantageously take the place of much of the discussion.

On the whole, the book bears evidence of hasty preparation. However, it is the first book on this subject and provides a summary, usually well chosen, of data to be found only by a search of the literature. It should be a useful reference work.

RALPH HULTGREN
ALDEN B. GRENINGER

Organic Chemistry. By ROBIN CHARLES BURRELL, Ph.D., Associate Professor of Agricultural Chemistry, The Ohio State University. McGraw-Hill Book Company, Inc., 330 West 42d Street, New York, N. Y., 1936. xii + 336 pp. 34 figs. 14 × 20.5 cm. Price, $2.75.

A more specific title for this textbook would be more appropriate in view of its rather extensive discussion of the biologically important substances and its more restricted treatment of some of the other subjects, such as methods of synthesis which are less pertinent to its purpose. The text is especially designed for a semester course in organic chemistry for students of home economics, agriculture and biological sciences. The choice of subject matter was largely based upon the consensus of the opinions of a number of authorities on nutrition.

The fundamental concepts and the most important types of compounds are adequately discussed. The aliphatic and the aromatic hydrocarbons are presented in the same chapter. About one-half of the book is devoted to the treatment of substances of direct biochemical importance—lipides, carbohydrates, proteins and their components, and miscellaneous natural substances. A concise account of the digestion and assimilation of each of the three important classes of food substances is also included.

The book is quite accurate and up-to-date; however, the following errors ought to be noted: "ethyl nitrile" for C_2H_5CN (p. 115); the boiling point of lactic acid is given as 122°C. (p. 154); the consideration of alcoholic fermentation as "a type of biological oxidation" (p. 176); and the formulas for hydroxyproline (p. 216) and nicotine (p. 281). The classification of the types of isomers that is given (p. 45) and the likening of esters to salts (p. 111) are not in accord with modern concepts.

The book is well organized and written in a clear and concise manner. It is well suited for the purpose for which it was intended.

EDWARD A. PRILL

BOOKS RECEIVED

July 15, 1936–August 15, 1936

ÉTIENNE AUDIBERT. "Les Carburants. I. L'Essence." Gauthier-Villars, Éditeur, 55 Quai des Grands-Augustins, Paris, France. 181 pp. Fr. 45.

F. R. BICHOWSKY AND F. D. ROSSINI. "The Thermochemistry of the Chemical Substances." Reinhold Publishing Corporation, 330 West 42nd St., New York, N. Y. 460 pp. $7.00.

G. DUPONT. "Cours de Chimie Industrielle. Vol. III. Métallurgie." Gauthier-Villars et Cie., Éditeur, 55 Quai des Grands-Augustins, Paris, France. 357 pp. Fr. 65.

HEINRICH FINCKE. "Handbuch der Kakaoerzeugnisse." Verlag von Julius Springer, Linkstrasse 23–24, Berlin W 9, Germany. 568 pp. RM. 55.

O. A. HOUGEN AND K. M. WATSON. "Industrial Chemical Calculations. The Application of Physico-Chemical Principles and Data to Problems of Industry." Second edition. John Wiley and Sons, Inc., 440 Fourth Ave., New York, N. Y. 487 pp. $4.50.

KATHLEEN LONSDALE. "Simplified Structure Factor and Electron Density Formulae for the 230 Space Groups of Mathematical Crystallography." Published for the Royal Institution by G. Bell and Sons, Ltd., York House, Portugal St., London W. C. 2, England. 181 pp. 10s./- net.

S. SABETAY. "Progrès Récents dans la Chimie des Parfums et des Huiles Essentielles." Gauthier-Villars, Éditeur, 55 Quai des Grands-Augustins, Paris, France. 77 pp.

KARL SCHULTZE. "Das Ausblühen der Salze." Verlag von Theodor Steinkopff, Residenzstrasse 32, Dresden-Blasewitz, Germany. 99 pp. RM. 4.