

ALLYL ETHERS OF HETEROCYCLIC ENOLS

Sir:

During research carried out in connection with the preparation of substances allied in structure to the alkaloid coniine, it became necessary to study the preparation and pyrolysis of the allyl ethers of heterocyclic enols. It is well known that α - and γ -N-heterocyclic enols show a marked tautomeric mobility of the enolic hydrogen between oxygen and nitrogen with preferential attachment to the nitrogen. The O-ethers are more difficult to prepare than the N-ethers, the best yields of the former being obtained via the silver salts or chlorine substituted derivatives.

The alkoxy ethers on heating usually undergo a rearrangement of the alkyl group, which wanders invariably to the nitrogen atom in preference to a nuclear carbon atom. One might expect that the allyl group would undergo an analogous migration [*cf.* Hurd, "The Pyrolysis of Carbon Compounds," The Chemical Catalog Company, 1929, pp. 205 and 223]. Tschitschibabin and Jeletsky [*Ber.*, **57**, 1158-61 (1924)] report having pyrolyzed O-allyl-carbostyryl into the N-isomeride.

It has been found in the course of the present work that the migration of the allyl group can occur from oxygen to the adjacent β -unsaturated carbon atom. Thus 4-allyloxyquinaldine pyrolyzes almost quantitatively on heating for a short time, at 200°, to 3-allyl-4-hydroxyquinaldine, the constitution of which has been proved by its synthesis from α -allyl- β -phenylaminocrotonic ester. This is interesting since, in the case of 4-methoxyquinaldine, migration of the methyl group takes place to the nitrogen atom [Conrad and Limpach, *Ber.*, **20**, 956 (1887)].

The significance of these results, and of those obtained with other oxy-N-heterocyclic substances, will be reported shortly in greater detail.

DEPARTMENT OF ORGANIC CHEMISTRY
UNIVERSITY OF SYDNEY
SYDNEY, AUSTRALIA

RECEIVED MAY 25, 1932
PUBLISHED JUNE 6, 1932

BURNETT MANDER-JONES
VICTOR MARTIN TRIKOJUS

NEW BOOKS

Chemistry at the Centenary (1931) Meeting of the British Association for the Advancement of Science. W. Heffer and Sons, Ltd., Cambridge, England, 1932. Price, 7/6, net.

The experience of a century has taught scientists in general and chemists in particular to expect papers of interest and pronouncements of lasting importance at the meetings of the British Association. It is hard for us to say whether the attractively published volume before us, a complete record of the Proceedings of the Chemistry Section, contains any pronouncement of an epoch-making character, but it is easy to discover that every paper is an interesting account of some of the very latest work. A scholarly dis-

course on "Michael Faraday and the Theory of Electrolytic Conduction" by Sir Harold Hartley opens the Proceedings. It contains an excellent historical survey of the development of thought and experiment on solutions of ionized solutes. There follow discussions on "The Influence of the Medium on the Properties of Electrolytes" which in spite of much writing is still far from being a solved problem, "Vitamin-A and the Carotenoids," "The Chemistry of Vitamin-B and Related Problems" and "The Structure of Simple Molecules," and a symposium on "The British Fuel Problem."

In all these discussions the contributors, a truly international array of celebrities, have given consideration to the general scientific reader and as a result the very latest advances are presented most comprehensibly. The fearless and scientific way in which the coal and oil problems of Britain are treated makes the book worth buying for this symposium alone.

While this collection, containing, as it does, contributions not yet published elsewhere from authorities all over the world, will surely be of surpassing interest to those actively pursuing research in the subjects mentioned above, we heartily recommend it to those general readers who wish to keep themselves posted on the latest news from the front of these rapidly advancing lines of investigation.

R. E. GIBSON

Rechnenverfahren und Rechenhilfsmittel mit Anwendungen auf die analytische Chemie. (Methods of Calculation, Aids to Calculation and Applications to Analytical Chemistry.) By Prof. Dr. OTTO LIESCHE, Seelze bei Hannover. Verlag von Ferdinand Enke, Stuttgart, Germany, 1932. viii + 203 pp. 24 figs. 16.5 × 25.5 cm. Price, RM. 20; bound, RM. 22.

There are innumerable manuals devoted to chemical arithmetic and there are many textbooks of higher mathematics particularly designed for the enlightenment of chemists. I am not acquainted with any book covering the important aspects of chemical computation discussed in this volume.

The initial chapter of fifty or more pages is devoted to methods of simple numerical computation, particularly multiplication and division. The author first points out that these subjects are usually taught us so early in our intellectual development that they cannot be presented at that time from the abstract point of view which is necessary both for their thorough comprehension and their most efficient use. Moreover, arithmetic in general and the simpler parts of algebra are neglected in our higher mathematical training so that their application to the most frequent computational requirements of our later work is frequently lost. The author thereupon gives an excellent presentation of the so-called Ferrol methods of multiplication and division, and in a form particularly adapted for self-instruction. Many of these rapid methods should, according to the author, greatly lessen the need of resorting to logarithms, etc.

The second chapter sets forth the utilization of the various aids to multiplication and division—namely, logarithms, slide-rules and calculating machines.

The third chapter discusses at length specifically chemical computations and their algebraic formulation, taking up simple gravimetric analysis, "indirect" analysis (utilizing determinants), analysis of complex mixtures, errors and computations dealing with gases. The final chapter discusses nomography.

This is certainly a most instructive book.

ARTHUR B. LAMB

The Preparation of Pure Inorganic Substances. By E. H. ARCHIBALD, Professor of Analytical Chemistry, University of British Columbia. John Wiley and Sons, Inc., 440 Fourth Ave., New York City, 1932. x + 383 pp. 14.5 × 22.5 cm., 20 figs. Price \$3.75.

The guiding principle followed in the compilation of this work is clearly set forth in the opening paragraph of the Preface:

"The past thirty years have seen a marked advance in the precision and accuracy of physical and chemical, as well as other scientific measurements. In order to take advantage of these improvements, it is frequently necessary for the chemist to supply substances of a much higher degree of purity than corresponds to our "C. P." products. Fortunately, during these thirty years, many methods have been devised, and a great many principles have been set forth, according to which the purification of a large number of chemicals can be effected. What are thought to be the more dependable and simple of these methods are set forth in the following pages."

The author is eminently qualified to speak with authority upon this subject, by reason of his long contact with and his outstanding success in atomic weight determinations, which involve the preparation of materials approaching absolute purity and the careful elimination of errors in the use of such reagents. Many of the methods described have been followed with utmost care by the author and his associates and most of the others are familiar to him by reason of the close parallel in his own work. Such a setting gives the reader a justified confidence in the authority and integrity of the author.

Chapter 1 is devoted to a general discussion of the methods of purification and the refinements which may be employed in each. For example, crystallization is discussed in detail with respect to the effect of inclusion, adsorption, the solid solution of isomorphous substances, the size and form of the crystals, the percentage of the salt crystallizing out, and the efficiency of centrifugal drainage and washing. In addition, attention is paid to the danger of contamination from laboratory utensils of various sorts, and to the adsorption of gases. Each of the remaining sixteen chapters is devoted to a family of the Periodic Table, beginning with the Noble Gases and

concluding with Ruthenium, Palladium and Platinum. A few of the least important elements are not included, but the list includes seventy-three of the elements which are most frequently encountered. There are numerous quotations from original papers and the abundant references will be extremely useful in case additional detail is required. Both a subject index and an author index are included.

This book will be a valuable time saver for all chemists who are concerned with the preparation of pure inorganic compounds.

B. S. HOPKINS

A Course in Quantitative Analysis. By J. SAMUEL GUY, Professor of Chemistry, Emory University, and AUGUSTA SKBEN, Assistant Professor of Chemistry, Agnes Scott College. Ginn and Company, 15 Ashburton Place, Boston, Massachusetts, 1932. xiv + 242 pp. 14.5×21.5 cm. Price, \$2.20.

This little volume covers an elementary course requiring only meager preparation in chemistry (or mathematics). Introducing volumetric studies first, eleven, well-assorted, approximately 0.1 *N* stock solutions are prepared and standardized, $H_2C_2O_4 \cdot 2H_2O$ being preferred as a primary standard because of its availability for titration with both sodium hydroxide and potassium permanganate. The other solutions are standardized directly or indirectly from these. Sixteen volumetric exercises are described, followed by five gravimetric determinations, the latter including water by loss on heating, copper by precipitation as cupric hydroxide and by electrolytic deposition, sulfate by precipitation, and carbon dioxide by loss in weight on dissolving in hydrochloric acid. Details are also given for the use of other primary standards (Fe , Na_2CO_3 , $NaCl$, As_2O_3 , and $Na_2C_2O_4$), for a number of optional gravimetric experiments, and for the colorimetric determination of hydrogen-ion concentration.

For the teacher who feels that the present courses are unwieldy, this book will prove refreshing in its simplicity. Unfortunately, however, in the attempt to simplify, the authors have failed rather frequently in scientific accuracy. The following cases will serve as illustrations: (1) two contradictory procedures are given for determining the resting point of a balance; (2) the need of boiling out carbon dioxide when titrating sodium carbonate with hydrochloric acid (using phenolphthalein as indicator) is discussed in terms of the reaction of carbonic acid with sodium chloride; (3) the electronic description of the reaction between potassium permanganate and ferrous sulfate (pp. 57-58) is obviously unsound.

On the whole, the student who completes a course based solely on this book will have become acquainted with a fair variety of quantitative manipulations, but he may fail to understand the errors of quantitative analyses or the way in which various procedures avoid them.

R. K. McALPINE

The Microscopic Characters of Artificial Inorganic Solid Substances or Artificial Minerals. By ALEXANDER NEWTON WINCHELL, Professor of Mineralogy and Petrology, University of Wisconsin. With a Chapter on the Universal Stage, by Richard Conrad Emmons, Associate Professor of Geology, University of Wisconsin. Second edition. John Wiley and Sons, Inc., 440 Fourth Avenue, New York, 1931. xvii + 403 pp. Illustrated. 15×23.5 cm. Price, \$5.00.

The appearance of this book marks an important step in the education of the chemical fraternity in the application of the methods developed by mineralogists for the description and identification of crystalline compounds. No one who has had an opportunity to make use of these methods can fail to be impressed with their power and convenience, and the rapidly increasing use of the petrographic microscope in research and industrial laboratories shows that they are appreciated. There has long been a need for a book containing optical data for artificial crystalline compounds, and also for a textbook of optical crystallography in English that would teach the fundamental principles and main facts, and the methods by which they are applied in the measurement and observation of crystallographic properties.

Winchell's book represents the most complete set of tables and synoptic data for artificial inorganic compounds thus far published and as such will be found valuable by all who use the polarizing microscope. This assemblage of crystallographic data constitutes Part II, while Part III comprises a well arranged set of determinative tables based thereon. In connection with Parts II and III the reviewers commend plate V as a useful chart classifying artificial inorganic solid substances on the basis of birefringence optic sign, and refringence.

The amount of critical judgment that it is fair to expect of an author of tables is difficult to fix. It should be noted, however, that Winchell himself states in the introduction that "the general rule in this book is to give the values of the indices of refraction of pure substances to the fourth decimal place and in three kinds of light (C, D and F). . . . The indices of refraction of some pure substances have not been measured with accuracy and accurate measures have not always been made on strictly pure material; in such cases the indices of refraction are given only to the second or third decimal place." This implies a critical discrimination that has not been carried out. In some cases inaccurate values have been given instead of accurate values well known in the literature (example: $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$). In other cases more than one set of values of the indices of a compound are given, all expressed to four places of decimals but differing among themselves in the third place (examples: NaNO_3 , KNO_3 , $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$, NH_4Cl). Refractive indices of numerous compounds are quoted to four places of decimals although the measurements were made by means of an indefinite series of wave lengths through colored screens; several of the values thus obtained are inaccurate in the third place owing to the high dispersions of

the compounds and the failure to use monochromatic light (examples: $\text{Nd}_2(\text{MoO}_4)_3$, $\text{Ce}_2(\text{MoO}_4)_3$, CaWO_4 , SrMoO_4). Little or no attention has been given to recorded divergences of measurements, or to irregularities in the curves of dispersion or of optic axial angle, $2V$, such as are indicated in "International Critical Tables," Volume VII. The exercise of critical judgment is of course difficult and laborious and the reviewers do not state that the author of a table is bound to exercise it. They consider it necessary to point out, however, that the claim made by Winchell that he has exercised such judgment is not made good in his tables. Moreover, he has not taken advantage of careful critical work previously done.

Part I entitled "Principles and Methods" "consists in large part of revised selections from the author's 'Elements of Optical Mineralogy,' Part I, 3d Edition." It represents an attempt to give the reader an understanding or working knowledge of the methods whereby the data of Parts II and III have been obtained and are applied. The phenomena observed in crystals in convergent light are not discussed, however; Winchell refers the reader to his "Elements of Optical Mineralogy, Part I" (Chapters XIV and XVIII) for a treatment of this subject, which of course must be understood by all who intend seriously to use microscopic methods for the description and determination of crystalline compounds. The treatment of crystallographic principles and methods in Part I of "The Microscopic Characters of Artificial Minerals" is clearly set forth and well illustrated but contains some erroneous theoretical statements of matters now well established. These are discussed in detail in a forthcoming article in the *American Mineralogist*.

Chapter 2 (of Part I) discusses apparatus and preparation of material, and Chapter 3 (also of Part I) the optical properties of isotropic substances. Winchell uses the symbol N instead of the customary (in all or nearly all countries but France) n ; in later chapters he also uses N_o , N_e and N_g , N_m and N_p for the indices of refraction of uniaxial and biaxial crystals, respectively. The use of the customary symbols n , ω , ϵ , γ , β , α , for refractive indices in the descriptive tables would have segmented the long lines of Roman type and eliminated the small subscripts adopted by the publisher, which are difficult to read.

The phenomena observed under the microscope with central illumination of powdered grains immersed in a liquid, sometimes called the "Becke line," are improperly so-called;¹ the expression, "Becke line," was coined by Salomon² to designate the phenomena associated with total reflection at a vertical interface, which differ in theoretical interpretation from the phenomena obtained with central illumination of irregular grains; the latter are properly known as the central illumination effect.

¹ Cf. F. E. Wright, *J. Wash. Acad. Sci.*, 5, 104 (1915).

² W. Salomon, *Z. Kryst. Min.*, 26, 182 (1896).

The prominence given the "double variation" method of determination of index of refraction, together with the failure to describe the usual methods adequately, is a serious shortcoming. The ease in application of the usual methods, which has already been proved in many places and by many workers, warrants their careful description in a book of this character. The majority of measurements of indices of refraction are made for the purpose of the identification of the substance and the greater speed and convenience of the simplest immersion method make it the unquestionable choice in nearly all determinative work. In measuring refractive indices for record it is desirable to obtain them with an accuracy of ± 0.001 or better, which can be accomplished by the usual methods or by the variation of the wave length in the dispersion method or by the variation of both wave length and temperature in the double variation universal stage method of Emmons. Incidentally, it should be noted that the methods called by Winchell "immersion," "single variation" and "double variation" methods are all immersion methods.

Winchell's statement (p. 65): "The technique of measuring indices of refraction by this [dispersion] method is the same as that involved in using the double variation method with the single exception that all measures are made at room temperature..." is hardly justified by the facts; the reviewers would say that the technique required in the double variation method is more complicated. Although Winchell does not claim that the double variation method is superior in point of accuracy to the dispersion method, he does state that the double variation method is more convenient. On this question there is difference of opinion. Attention should be called to the fact that a very important sacrifice, recognized as a disadvantage by Winchell's collaborator, Emmons, is made in securing the ability to vary the temperature over a range by means of Emmons' apparatus. The variation of temperature is accomplished by means of a water cell between the condenser and the preparation and according to Emmons³ this makes it impossible to obtain interference figures in convergent light from the grains the refractive indices of which are being measured. Without the possibility of using the conoscope (convergent light) to obtain interference figures and unless the universal stage is used, it is impossible to recognize optic normal grains. Now in all cases it is highly desirable to supplement the purely statistical method of determining α and γ (n_p and n_g) by checking the orientations of the grains believed to exhibit α and γ . If the mineral has no cleavage, α and γ can be obtained by the purely statistical method, but one is never sure even in this case that the lowest index, α , and the highest index, γ , have really been obtained unless the orientations of the grains are established. In cases of minerals with good cleavage the statistical method is unreliable and the student or investigator who relies

³ R. C. Emmons, *Am. Min.*, **14**, 425 (1929).

upon it exclusively in such cases will come to grief sooner or later. The orientation of the grain believed to exhibit the minimum or maximum index can be established, either by means of its interference figure in the dispersion method or by the use of the universal stage in the double variation method as described by Emmons. In the dispersion method the establishment of the orientation of the grain by means of its interference figure involves merely the removal of the eyepiece and a glance down the tube, or if the grain is small the use of one of the numerous special eyepieces available for this purpose. It is to be noted that finer grains can be handled accurately by the dispersion method than by the double variation universal stage method of Emmons, an important point in the study of artificial materials, which are so often obtained only in a fine-grained condition. Interference figures can be obtained from grains 0.005 mm. in diameter in many cases and 0.01 mm. in nearly all cases in the dispersion method; in the double variation method Emmons⁴ claims that grains as small as 0.03 mm. in diameter can be handled with the universal stage.

This review may be summarized and concluded with the statement that the book contains a very valuable collection of optical and geometrical crystallographic properties to which has been added a rather unsatisfactory account of selected aspects of optical crystallography.

⁴ R. C. Emmons, *Am. Min.*, **16**, 554 (1931).

GEORGE TUNELL
GEORGE W. MOREY

The Structure and Composition of Foods. Vol. I. Cereals, Starch, Oil Seeds, Nuts, Oils, Forage Plants. By ANDREW L. WINTON, Ph.D., and KATE BARBER WINTON, Ph.D. John Wiley and Sons, Inc., 440 Fourth Ave., New York, 1932. 710 pp. 274 figs. 15.5 × 23.5 cm. Price, \$8.50.

This is a unique and convenient book. It combines a description of the macroscopic and microscopic structure of cereals, nuts, oil seeds and forage plants, with a discussion of their composition. The latter includes not only the results of the conventional proximate analysis, but the products of hydrolysis of the native proteins, physical and chemical constants of the fats and other organic constituents, composition of the ash, and the nature of the enzymes present as well, when such data are available in the literature. In numerous instances the authors have also described manufactures based on these materials and the fractionation of the constituents of the original seed or fruit into the several commercial products. Thus one secures a rather detailed physical and chemical "picture" of these food and forage plants. Of course, the authors cannot trace the chemical technology of the 173 or more materials in as much detail as is attempted in manuals dealing with a limited group or a single fruit or seed. One cannot but be impressed by the volume of useful information recorded on the

seven hundred pages of this book, however, and also by the care and discretion exercised in its selection from the mass of data in the literature.

The structures of the individual forage grasses are not detailed in Part III, although the histology of timothy stems and leaves is shown in three plates. Discussion of the composition of these forage grasses is confined to proximate analyses. The value of the forage plant section might have been enhanced by the inclusion of some reference to cyanogenetic glucosides and the conditions attendant upon their appearance in the forage in lethal concentrations.

Taxonomists may not agree with the Wintons' inclusion of buckwheat, chestnuts, legumes and various weed seeds with the "cereals"; in fact the titles used in this connection are somewhat confusing to the extent that the book contains material which might not be expected to be present. The reviewer feels that the section dealing with the chemical nature of starch would be strengthened by the inclusion of a brief summary of the views of Samec, Haworth and Irvine. The inference that endosperm and pericarp of the cereal grains are essentially devoid of fat, which might be drawn from the first sentence under fats, on page 61, is hardly supported by certain critical studies.

The book cannot fail to be of great service to food chemists and others who desire to learn how these groups of foods are constituted structurally and chemically. The other two volumes in this series are anticipated with interest.

C. H. BAILEY

Glastechnische Tabellen. Physikalische und chemische Konstanten der Gläser. (Glass Tables. The Physical and Chemical Constants of Glasses.) Edited by DR. WILHELM EITEL, DR. MARCELLO PIRANI and DR. KARL SCHEEL. Verlag von Julius Springer, Linkstrasse 23-24, Berlin W 9, Germany, 1932. xii + 714 pp. Illustrated. 20 × 28.5 cm. Price, RM. 145; bound, RM. 149.80.

This vast compendium of technical tables on glass is like the Landolt-Börnstein Physikalisch-chemische Tabellen. It has been made possible through the subsidy of the Deutsche Glastechnische Gesellschaft, the editors named above and their associates.

It is divided into three parts. Section 1 covers equilibria in glass-forming systems, conditions under which they may best function, the proportions of the components and their crystalline phases. It takes up the glass-forming oxides, borate systems, carbonate systems, phosphate systems and silicates. Space is then devoted to two, three and four, or more, component systems as well as to organic substances which may enter a glassy state. This section is replete with phase diagrams which indicate the particular substances possible under various conditions and the point at which eutectic mixtures result. The crystal forms which are obtained are generously illustrated. Section 1 covers the first 88 pages.

Section 2 is devoted to physical and chemical constants such as viscosity, surface tension, internal strain, tensile strength, softening point, specific gravity, coefficient of elasticity, compressibility, cohesion, hardness, refractoriness, porosity to gases, adsorption and evolution of gases, thermal expansion, specific heat, heat conductivity, dielectric constants, electrical capacity, electrical conductivity, sparking point, potential differences, magnetic susceptibility, crushing strength, photo-elasticity, effect of electric fields on refraction, spectral transmission, ultraviolet transmission, infra-red transmission, total light transmission, properties of light filters, dispersion data, chemical susceptibility with methods of testing and results, devitrification. 536 pages are covered by this section, which not only contains numberless tables and diagrams but copious references to the literature covering every item discussed. Here, every glass has a key number which refers to some part of Section 3 of the publication.

Section 3 contains a systematic record of the chemical composition of the glasses covered in Section 2. These are the alkali silicates; the alkali-lime silicates, containing up to 1% of alumina; the alkali-lime-alumina silicates; the alkali silicates with those of calcium, magnesium, strontium, barium, iron, manganese and aluminum; the alkali-alkaline-earth-alumina-lead silicates; the alkali-alkaline-earth-boro silicates; glasses both clear and clouded containing the halogens and phosphorus; silica-free glasses like the borates, phosphates and arsenates; glassy organic substances. With each analysis there is not only a key number but a reference to pages in Sections 1 and 2, where the particular glasses are discussed as to their properties. Section 3 covers 83 pages.

This gigantic undertaking is priceless. The type is clear, the diagrams and illustrations are clean-cut, the cross references are well ordered and the reviewer has thus far not found a single fault in the use of such references. Here is a compilation of data never before available to glass technologists and scientists in other fields who are interested in the properties of glass. It should prove indispensable to serious workers in the field. There is a good table of contents, but the index might be more complete.

The authors and their collaborators are certainly to be congratulated for having made a precious contribution. It is to be hoped that these tables may be translated into English and thus made available for those who are unable to use the German publication.

ALEXANDER SILVERMAN

The Glycosides. By E. F. ARMSTRONG, D.Sc., Ph.D., LL.D., F.R.S., and K. F. ARMSTRONG, B.A., B.Sc. Longmans, Green and Co., 55 Fifth Ave., New York, 1931. vii + 123 pp. 15.5 × 25 cm. Price, \$4.25.

An earlier monograph by E. F. Armstrong in the series of Monographs on Biochemistry edited by R. H. A. Plimmer and F. G. Hopkins bears the

title, "The Simple Carbohydrates and the Glucosides." Since the date of publication of the last edition, the activity of chemists in the field of sugars as well as in the field of glycosides (the newly-accepted term) has been greater than in any other field of organic chemistry, so that the division of the material into two separate monographs is very natural, particularly for the reason that to many workers in the field of glycosides the chief interest lies in the chemistry of the aglucones. Indeed, the work of Willstätter on anthocyanin glycosides, which has been continued by Robinson and his associates, and the investigations of Jacobs and of Windaus on cardiac glycosides—which will remain of outstanding interest to organic chemists—are concerned principally with the structure of the aglucones.

The new monograph on glycosides, which introduces to the chemical world the third generation of Armstrongs, should be regarded as a brief summary of the more recent work on natural and synthetic glycosides rather than as an exhaustive treatise on the subject. The authors emphasize that "no attempt has been made to do more than list the various glycosides and indicate their structure and relationships." In this manner are discussed glycosides containing the following aglucones (should it not be aglycones?)—phenols, hydroxyanthraquinones, hydroxycoumarins, anthoxanthins and anthocyanins, cardiac aglucones, glycosides of mustard oils, cyanophoric glycosides, nucleosides, indican and pentosides. This list of glycosides is a striking illustration of the heterogeneity of the substances capable of coupling with sugars and of the difficulty in correlating all glycosides on a rational genetic basis. Yet the work of recent years has aimed at a chemical correlation of certain groups of glycosides, if not of all, and much success has been attained in this respect in the glycosides of anthoxanthin and anthocyanin groups and perhaps even more so in the group of the cardiac glycosides. The idea of genetic relationship of the components of glycosides, of the sugars and of the aglucones runs through every chapter dealing with the natural glycosides as the basic pattern unifying the heterogeneous material.

In Chapter II of the book, which is the first chapter devoted to natural glycosides, the authors write:

In time the facts available may make it possible to explain the progressive building up of more complicated aglucones and correlate these perhaps with species or plant habitat. With so few primary materials available, with carbon dioxide as its sole source of carbon, it is an unending source of wonder that the plant has created an apparently limitless range of organic compounds, sometimes of fantastic complexity.

In subsequent chapters, again and again the thought is advanced that the anthoxanthin and the anthocyanin, the aglucones and the phenolic aglucones may have their origin in a common hexose (namely, glucose) and in some cases, in hexoses and trioses. The reviewer would hesitate to attribute to Nature this very inefficient way of operating, yet he must admit

that from a literary and didactic viewpoint, the thought serves a useful purpose.

Another expedient used by the authors to unify the heterogeneous material is the frequent reference to the biological aspects of the glycosides. Among them some are important from a practical viewpoint and may be of little familiarity to the organic chemist; for instance, the method of diagnosing sugars by the inhibition method, which is based on the fact that an enzyme specific for a certain glycoside is inhibited in its activity only by the sugar that enters into the structure of the glycoside. Of all natural glycosides those of anthoxanthins and anthocyanins are discussed in greater detail.

Only a few inaccuracies came to the attention of the reviewer. Two may be mentioned. Referring to digitalis glycosides, the authors attribute the activity of the glycoside to the unsaturated lactone group and later in the same chapter, reviewing the properties of the strophanthus glycosides, they state that the activity of the entire molecule is enhanced by the unsaturation of the lactone group. The latter statement is correct and applies to all the cardiac glycosides. The first statement was for a time the generally-accepted one but it has been abandoned. In speaking of nucleosides, the authors state that ribose and desoxyribose nucleosides can be prepared by the identical hydrolytic agents. This is not correct inasmuch as the desoxyribose nucleosides are at present obtainable only through the action of enzymes. The emphasis of the authors on the probability of the formation of *d*-ribose from xylosephosphoric acid seems to the reviewer exaggerated inasmuch as the author of the suggestion, Robinson, viewed it in the light of a mere possibility to be borne in mind—a possibility which thus far has no experimental evidence in its favor.

In addition to the chapters on natural glycosides, the monograph contains an introductory chapter dealing with definitions of the terminology, with the theories of the origin of hexoses, with theories aiming to explain the prevalence of glucose as compared with other hexoses, with speculations on the transformation of hexoses into inositols and into polyhydroxyphenols and with the general properties of glycosides.

The chapters on synthetic glycosides, on uronic acids, on the function of glycosides in plants and on the utilization of carbohydrates in plants, containing a discussion on ripening of fruit, are very brief and rather incomplete.

The monograph will be read with great benefit by all not yet acquainted with the chemistry of natural glycosides.