

anhydrous pyridine had shown the relative ease of N-acylation, particularly in the case of the N<sup>6</sup>-amino group of the cytosine ring.<sup>7a,8</sup> In the present work, acetylation of the amino groups in the pyrimidine and purine rings was carefully looked for but none was detected. The most significant aspect of the aqueous acetylation technique described is its selectivity in acetylation of the terminal hydroxyl groups. Further, although most of the experiments so far have been

(8) H. Schaller, G. Weimann, B. Lerch, and H. G. Khorana, *J. Am. Chem. Soc.*, in press.

carried out with oligonucleotides bearing 3'-hydroxyl (sec.) groups, preliminary work shows that the technique is promising also for the substitution of the terminal 5'-hydroxyl groups in polynucleotides.

Currently, we are investigating the use of C<sup>14</sup>-labeled acetic anhydride in this technique.

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## BOOK REVIEWS

**Progress in the Chemistry of Organic Natural Products. Volume XX.** Edited by L. ZECHMEISTER, California Institute of Technology. Springer-Verlag, Molkerbastei 5, Wien, Austria. 1962. xiii + 509 pp. 16 × 23.5 cm. Price, \$23.00; leatherbound, \$24.00.

"Zechmeister's Fortschritte" appeared first in 1938 and ever since has held a very prominent position among reports of progress in organic chemistry. All the succeeding volumes contain valuable reviews on novel classes of natural products, modern experimental techniques and articles of general biochemical interest. The present twentieth volume reaches the same high quality as its forerunners.

The recent, hectic development of the chemistry of the ubiquinones and plastoquinone is reviewed by Schindler. These lipophilic compounds, which are structurally related to the vitamins of the E- and K-groups, play an important role in biological electron transport systems, but, like acyclic oligoterpenes such as solanesol, they are also very intriguing from a purely chemical point of view. Careful investigations of other "unattractive" lipid fractions so often discarded in phytochemical studies are bound to be rewarding.

Mors, Taveira Magalhães and Gottlieb discuss styryl- and phenyl- $\alpha$ -pyrones from the unrelated genera *Piper* (Piperaceae) and *Aniba* (Lauraceae). The biosynthesis of the benzene ring of these compounds poses an interesting problem. A related substance, hispidin, has recently been isolated from a fungus, and a  $\beta$ -pyridyl analog, anibine, from an *Aniba* species.

Harborn contributes a chapter on anthocyanins and their glycosides. Recently the presence of these pigments in mosses (*Bryum*) has been definitely established. Hence anthocyanins have now been shown to occur in all "higher" plant divisions. Their absence in the angiosperm order Centrospermae, where they are replaced by betanidin and similar substances, is a matter of great systematic interest.

The at first weird-looking *Lycopodium* alkaloids now form a homogeneous, albeit isolated group of alkaloids confined to the ancient pteridophyte order Lycopodiales. The elucidation of their structures is largely due to Canadian chemists including Wiesner, the author of a chapter on these alkaloids. Conroy's hypothesis on the acetate origin of these alkaloids is also interesting in view of the occurrence of nicotine in some *Lycopodium* species. Narayanan has written an ambitious review on the steroidal alkaloids first isolated from *Veratrum* species, which are characteristic of a few related genera of the chemotaxonomically interesting family Liliaceae, renowned for its large variety of steroidal constituents.

The numerous nitrogen-containing metabolites of fungal origin are amply reviewed by Birkinshaw and Stickings. An outstanding contribution on aminosugars has been written by Baschang. Much of our knowledge in this field is the result of recent studies on antibiotics. The brilliant work of R. Kuhn and his collaborators in Heidelberg on milk oligosaccharides and brain gangliosides is well summarized, and the chapter on aminosugars from polysaccharides and glycoproteids provides a vision of what is to be expected from future investigations in this immensely important field. There are no less than 430 references. Various uses of the ultracentrifuge technique in the study of macromolecules and viruses are discussed in an important contribution by Vinograd and Hearst.

A paper by Freudenberg on the structure of the lignins mainly deals with the views presently held in Heidelberg but is clearly influenced by current ideas in other centers of lignin research. A comparison with the article by the same author in Volume 11 of "Zechmeister" is recommended. Less emphasis is now laid upon coniferin and syringin which are rare natural compounds, and the insinuating *Araucaria* cross section is omitted. One

must admire the interminable patience with which Freudenberg has struggled with the lignin problem for about forty years, and the great experimental skill with which the Heidelberg school has developed the reviewer's dehydrogenation hypothesis of 1933. (Discussed in more detail in "Research" 1950, a paper which is seldom referred to in lignin literature). The author, unfortunately does not strictly differentiate between "biosynthesis" and "biogenetic" theories, and the presumptuous statement on page 63 "Erst durch die Auffindung der oligomeren Zwischenprodukte der Biosynthese . . . wurde es möglich definierte Angaben über die Struktur grosser Teile des Naturstoffs zu machen" contains an overstatement obvious to every critical reader.

Still more speculative, but probably more universally enjoyable, is Horowitz and Miller's article on Current Theories on the Origin of Life, which ends with a chapter on "Space Research and the Origin of Life." May time be granted to Professor Zechmeister to include an article on extraterrestrial natural products in a future volume of this excellent series.

Talking about space research, I have found that out of the 459 text pages of the present volume no less than about 70 are devoted to literature references containing the full titles of the relevant papers. Much space could be saved omitting the titles as well as by using Arabic instead of Roman numerals. Moreover, at least this reviewer finds it much easier to apprehend 88 than LXXXVIII.

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### Ionization Constants of Acids and Bases. A Laboratory Manual.

By ADRIEN ALBERT, D.Sc. (London), F.R.I.C., F.A.A. Professor of Medical Chemistry in the Australian National University, Canberra, and E. P. SERJEANT, University of New South Wales, Sydney. John Wiley and Sons, Inc., 440 Park Avenue South, New York 16, N. Y. 1962. xxi + 179 pp. 14 × 20 cm. Price, \$3.75.

The authors of this book state that "it is intended for those, who without previous experience, wish to determine an ionization constant." Judging the book in the framework of this stated aim, I believe the authors have been partially successful in writing a book which will accomplish this goal. The authors present extensive experimental details and numerical examples to illustrate the calculation of dissociation constants by potentiometric, spectrophotometric, and conductometric methods, and also touch upon the use of solubility techniques. Seven pages are devoted to a description of zwitterions, and a concise description of the effect of structure on the ionization constants of organic and inorganic acids and bases is presented in Chapter 8, along with a well documented compilation of 400 dissociation constants. The last chapter is a clear treatment of the application of the potentiometric pH method for the determination of stability constants of metal chelates.

In an introductory book it is obvious that compromises must be made in the interest of brevity. In this book, since it is a laboratory manual, considerably heavier emphasis has been placed upon the details of obtaining the experimental data than on the theory underlying the treatment of these data. In nearly all cases, however, enough literature references are given so that the interested student can expand on the theoretical background. There are several glaring omissions, e.g., in the last chapter the discussion of other methods of determining complex ion stability constants is completely inadequate. Only seventy words are devoted to the mention of ligand and metal ion exchange, spectrophotometric, indicator, polarographic, and metal ion indicator electrode methods, giving only one literature refer-

ence for each of these techniques. Also, the description of the use of mixed nonaqueous solvents for the determination of relative acid-base strength is extremely short and reaches overly pessimistic conclusions as to the value of nonaqueous methods.

It is apparent that this book is intended for persons with an almost negligible training in chemistry. For example, detailed instructions are given for calculating the activity of hydrogen ion and of hydroxyl ion from pH, p. 168, and for calculating  $pK$  from the equilibrium constant  $K$ , p. 8. Numerous minor experimental details which are described could be new only to someone with extremely limited chemical laboratory experience. The equipment described is of British manufacture, and it is apparent that the American novice would be unable to benefit from much of the practical advice given concerning the relative merits of the equipment which is described.

The authors state erroneously on p. 71 that hydrochloric acid and sodium and potassium hydroxide solutions lack buffering capacity. In a similar vein the reader is given to believe on p. 106 that buffering action in sulfuric acid solutions at pH 2 is caused only by the weak acid nature of bisulfate ion.

This book has many good features. The calculations are carried out in detail and are easily followed; the problem of treating the case of closely spaced dissociation constants is not slighted, and the fact that it is possible to obtain a mirage (false constant) if activity coefficients are neglected, as described on p. 41 and 42, is well worth noting. However, I believe that a novice using this laboratory manual would still need to supplement it by considerable outside reading.

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STANLEY BRUCKENSTEIN

**The Nature of Biochemistry.** By ERNEST BALDWIN, B.A., Ph.D., Professor of Biochemistry, University College London, Sometime Fellow of St. John's College, Cambridge. Cambridge University Press, 32 East 57th Street, New York 22, N. Y. 1962. xiii + 111 pp. 14.5 × 22 cm. Price, cloth \$2.75; paper, \$1.45.

This little book, according to a statement in the preface by the author, is meant to be read, not studied. The author attempts to present the essentials of Biochemistry in outline form, chiefly for the benefit of those students who, knowing nothing of Biochemistry, are contemplating a serious study of the subject in a formal course in a university.

The book certainly would be found easily readable by anyone who had some knowledge of chemistry. The topics, which are concerned to a large extent with animal biochemistry, include the importance of a constant internal environment, the respiratory function of blood, the nature and behavior of proteins and enzymes, a glimpse at the metabolism of proteins, carbohydrates, and fats, a little about the generation of energy by the cell and finally a brief outline of recent work on nucleic acid function and protein synthesis.

In writing a book of this sort, it must be difficult to decide how much chemistry should be considered as already known by the reader and what basic chemistry should be included to furnish sufficient background to make the story comprehensible. It would seem that this problem has not been solved in an entirely satisfactory manner in this book since, for example, there is a short section explaining the concept of pH in a chapter which seems to assume prior knowledge of terms such as *normality*, *titration*, and *buffer*. One would be inclined to think that either all or none of these terms should be explained. Similarly, in another section the term *osazone* is apparently assumed as known to the reader, whereas the ring structures of the commoner sugars are taken up in some detail.

The book also contains some errors, such as the erroneous statement that a typical biuret test is given by substances containing two or more peptide linkages. Actually a tripeptide with two peptide linkages does not usually give a typical biuret test, a tetrapeptide with three peptide linkages being the smallest polypeptide in the cases of most of the amino acids that do give a typical biuret test. Another apparent error is the statement that the number of possible proteins would be roughly equal to the number of visible stars in the sky, assuming 500 amino acids in each protein with complete freedom of choice in regard to proportion and sequence arrangement of these amino acids. Actually there are only about 5 or 6 thousand stars visible to the unaided eye in the whole celestial sphere, whereas the number of theoretically possible proteins is superastronomical, probably far greater even than the total number of stars in our galaxy (including those not visible or photographable with the largest telescopes).

There are also some dubious statements. For instance, on page 39 it is stated that enzymes are well on the way towards being infinitesimal in concentration in cells. Actually, important enzymes may occur in concentrations of 0.01 to 0.1% or higher, which would not appear to the reviewer as approaching infinitesimal concentrations. On page 47 it is stated that the deaminated residues (of amino acids) have been put away on one side to await metabolism for energy production when the time comes. This statement certainly is not true without considerable qualification.

Occasionally there is obscurity of style, as in the statement on page 88 that "one molecule of ATP can be formed by a reaction in the direct chain," and on page 98 where there appears to be considerable confusion between RNA-type and DNA-type polynucleotides.

In some areas, more explanation would appear to the reviewer to be needed. For instance, on page 68 the compounds ATP and UTP are introduced in the discussion very casually and with much less explanation than they would seem to deserve.

In spite of the above criticisms Baldwin's book should be of interest and benefit not only to students but also to other persons who have some scientific background and wish to become acquainted with Biochemistry. It can be read easily in a few evenings and to the reviewer would appear to be well worth the modest price.

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June 1, 1963–July 1, 1963

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