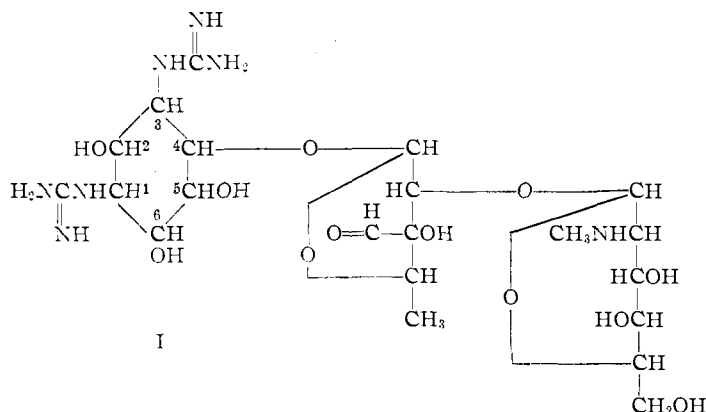


STREPTOMYCES ANTIBIOTICS. XIV. THE POSITION OF THE LINKAGE OF STREPTOBIOSAMINE TO STREPTIDINE IN STREPTOMYCIN

Sir:

A degradative series of reactions has now yielded information on the linkage of streptobiosamine to streptidine in streptomycin.



Reaction of streptomycin with benzoyl chloride and pyridine yielded benzoylated streptomycin (mol. wt., calcd., 1727. Found, 1625 \pm 10%), which was cleaved to heptabenzoylstreptidine, m. p. 256–258°, (calcd., C, 69.15; H, 4.77; N, 8.49. Found, C, 69.28; H, 4.96; N, 8.77). Stepwise treatment of heptabenzoylstreptidine gave mesylheptabenzoylstreptidine, m. p. 241–242° (S, calcd., 2.99. Found, 2.46), iodohepta-

benzoylstreptidine, m. p. 153–154° (I, calcd., 11.54. Found, 11.83), heptabenzoyldeoxystreptidine (m. p. 198–199°), pentabenzoyldeoxystreptomycin (m. p. 298–299°), and N,N'-dibenzoyldeoxystreptomycin, m. p. 287–289° (calcd., C, 64.85; H, 5.99. Found, C, 64.72; H, 6.21).

Treatment of N,N'-dibenzoyldeoxystreptomycin and N,N'-dibenzoylstreptomycin under comparable conditions with periodate led to the consumption of one and two moles of periodate, respectively. Work on the characterization of the oxidation product from the deoxy compound is in progress.

These data are in agreement with the attachment of streptobiosamine only at carbon atom 4 of streptidine as shown in formula I for streptomycin.

Other workers¹ have recovered streptidine after treatment of streptomycin with excess periodate. This they interpreted as strongly indicating that streptobiosamine is attached to streptidine at carbon 5, although carbon 4 could not be entirely disregarded.

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RECEIVED APRIL 29, 1947

(1) Carter, Loo and Skell, *J. Biol. Chem.*, **168**, 402 (1947).

NEW BOOKS

Modern Chemistry. By A. J. BERRY, M.A. The Macmillan Company (Cambridge University Press), 60 Fifth Avenue, New York 11, N. Y., 1946. 240 pp. 14.5 \times 22 cm. Price, \$2.50.

In the preface to this book the author points out that since most works on the history of chemistry deal with the subject as a whole, the treatment of the more recent discoveries tends, of necessity, to be somewhat abbreviated. The purpose of the present book is, therefore, "to focus attention on the development of some of the newer branches of chemical science." In order to achieve this end the purely chronological method of approach has been avoided and a number of aspects of chemistry, in which progress has been rapid during the past fifty years, are chosen for detailed consideration. A separate chapter, "nearly self-contained and independent of the others," is then devoted to an essay on the history of each of these subjects. The choice of topics has been determined by the author's teaching experience, and the titles of the chapters are as follows: Classical Atomic Theory; Electrochemistry; Stereochemistry; Radioactivity; Elements, Isotopes and Atomic Numbers; Some Experimental Studies of Gases; Some Problems of Solutions; Some Essential Features of Chemical Change; and A Retrospect.

It should be stated at the outset that the title "Modern

Chemistry" is something of a misnomer, but the subtitle, "Some Sketches of Its Historical Development," gives a much better idea of the content of the book. Nevertheless, it is the opinion of the reviewer that there are few chemists who could not read this book with profit and even pleasure. It is true that there are certain matters, chiefly of opinion, which are open to argument. This is especially the case in the assignment of credit for particular discoveries or advances; for example, Kohler is not mentioned in connection with the resolution of allene derivatives, neither is there any reference to Compton or to Eldridge in the account of the experimental verification of Maxwell's law of the distribution of velocities, nor to Müller in the section on the passivity of metals. But these points are relatively minor and should not affect the essential value of the book. In the view of the present writer, the chief weakness of this work lies in the fact that it so frequently fails to state the most recent point of view, as, for example, in connection with the theory of solutions, reaction rates, the mechanism of the Kolbe reaction, strengths of acids, steric hindrance, the starch-iodine complex, acids and bases, as well as in several minor respects.

The author claims that the material has been "treated in a manner so as to be acceptable to anyone who is endowed with a moderate stock of chemical knowledge." However, to appreciate this book adequately, it is desir-

able for the reader to have a fairly thorough acquaintance with inorganic, organic and physical chemistry; not only because of the very large number of topics to which reference is made, but also because a reader with insufficient knowledge might be misled concerning the present status of many of these matters.

The book is written in a clear, concise and highly readable style. The paragraphs are perhaps overlong, but this is a matter of individual taste, for the material is so well presented that the reader's interest is held throughout. Although it could probably not be used as a class text, this book can be recommended for additional reading by graduate students in chemistry and by others who wish to know how some of the ideas of modern chemistry were developed.

S. GLASSSTONE

Advances in Carbohydrate Chemistry, Vol. I. Edited by W. W. PIGMAN, Corn Products Refining Co., Argo, Illinois, formerly with the National Bureau of Standards, and M. L. WOLFROM, The Ohio State University, Columbus, Ohio. Academic Press, Inc. Publishers, New York, N. Y., 1945. xii + 374 pp. 15 × 23 cm. Price, \$6.00.

It is generally conceded that the scientific and technical literature is becoming an increasingly difficult problem if only because of its bulk. Individual scientific papers are so compressed in extent and so lacking in detail, on account of inescapable editorial policies on the part of the various journals, that they are barely comprehensible except to specialists. The problem of the beginner and likewise of the non-specialist who aspires to some information outside his most immediate field of interest is to attain the orientation and perspective necessary for comprehension of these individual contributions, or at least of the patterns of knowledge ultimately built from them.

At the same time, text-books in the usual sense are no longer able to fulfill wholly their traditional function of providing orientation and perspective, because of the ever-growing gap between the elementary levels of the various sciences and the fast moving frontiers where the most rapid progress is currently being recorded. This is particularly true among the older sciences such as chemistry.

There was a period in the last century which might well be designated the Golden Age of Text-books, when one mind could encompass nearly the whole of a science, and if likewise gifted in organization and presentation lead the novice, in a single monumental volume, all the way from his first introduction to chemistry into the front-line trenches of the subject. This age has departed.

It was followed by the Era of the Monograph, the volume designed to present the whole of contemporary knowledge in some smaller section of a major science and thus to fill the growing gap between elementary textbooks and the zone of current progress. The monograph will persist, but its functions will change. It will and already has become a more advanced textbook, fulfilling the traditional functions of orientation and perspective-building, in ever more advanced and narrower subdivisions of science.

The monograph, however, if it performs the necessary function of providing a super-textbook, will inevitably and progressively fail in any effort to bring the reader up to the minute. The creation of perspective is incompatible with over much detail, and then unfortunately, there are also the limitations of the human mind. No one person could now follow minutely all the papers published within the one field of carbohydrate chemistry and do anything else whatever, even if it were desirable that any one person should do so or that the rest of us should depend upon the synopses of such a person for a judgment as to what is more important.

Altogether the best conceivable solution of these several difficulties has been adopted in the several annual volumes now being published to report the Advances in various subjects. By cutting the topics to small size, the possibility of obtaining *critical* reviews by genuine specialists,

and of getting them published before they become too obsolete, has been revived at a time when it was sorely needed. If the various library budgets and their shelf space are able to absorb these volumes and make them available generally to scholars and research workers, they promise to go a long way in meeting the demands of this researching world. (The problem of the personal book budget is worthy of consideration that cannot be given here.)

An inherent weakness, naturally, is that reviews are no better than the reviewers. As we come to depend more and more upon compilations, the tragedy of omission or misjudgment of important work will be enhanced. The fact that most reviews are at least partially obsolete at the time of publication is not important, if every review carries a *precise statement of the date to which the literature search has been carried*. It may then be expected that each properly constructed article will stand as a permanent contribution to the subject, gaining historical value as it loses currency. Presumably important subjects will eventually be reviewed again at intervals, by new experts and from somewhat different viewpoints. The present volume has not observed specifically this practice of noting the last date to which literature coverage is carried.

The "Advances in Carbohydrate Chemistry" has made an auspicious beginning. Paper and typography are excellent, especially when judged in the light of wartime shortage of material and labor. Errors are very few.

As may be expected in a volume of composite authorship, the articles vary considerably in design, content and construction. This is not, of course, a defect.

The review of "The Fischer Cyanhydrin Synthesis and the Configurations of Higher-Carbon Sugars and Alcohols" by Claude S. Hudson, is a complete and scholarly monograph on the subject, with history, experimental details, a full account of the reasoning involved in assigning configurations to all the substances in these groups and tabulation of the compounds with physical constants. One might very nearly throw away all previously existing literature on the subject since it appears unlikely that anyone but the very exceptional scholar will ever again have occasion to consult it.

"The Altrose Group of Substances" by Nelson K. Richtmyer is similar in plan and treatment, as are also the articles on "Thio- and Seleno-Sugars" by Albert L. Raymond, the "Carbohydrate Components of the Cardiac Glycosides," by Robert C. Elderfield and on "The Chemistry of the Nucleic Acids" by R. Stuart Tipson. One wishes that an account of the synthesis of cymarose and other more recent advances might have been included in Prof. Elderfield's article before it went to press.

"Carbohydrate Orthoesters" by Eugene Pacsu is more than an historical account. It contains much that is interpretive and includes an account of many substances not yet fully characterized but which will probably be found to contain the ortho-ester structure. In this way it is well calculated to stimulate investigation.

"Metabolism of the Sugar Alcohols and their Derivatives" by C. Jelleff Carr and John C. Krantz, Jr., is the most frankly biochemical contribution. Its effect is slightly marred by inclusion of a number of substances whose structures had not been rigidly proven or were uncertain at the time of its writing. Articles in later volumes will, however, set all this straight.

"The Fractionation of Starch" is actually the first complete account of the work described, of which a notable proportion was achieved by its author Thomas John Schoch. In this sense it is close to being a primary contribution as well as a review, and fills a very distinct need.

Another marked gap is filled by Roy L. Whistler's review of the "Preparation and Properties of Starch Esters" which brings together material never before easily available.

Much more, particularly of a technical nature, has been published on cellulose esters. The very mass and indigestibility of this tremendous body of data, lends value and point to the concise and readable account of "Cellulose Esters of Organic Acids" by Charles R. Fordyce. The

reading of this account should henceforth be regarded as a prerequisite to any attack on recorded technological material, especially since much of the latter was accumulated before the development of modern concepts of cellulose structure.

The only article concerned directly with methodology is that by Ernest Anderson and Lila Sands entitled "A Discussion of Methods of Value in Research on Plant Polyuronides." Nevertheless this review presents the "rationale" of the experimental attack rather than the details. Despite the enormous amount of work that has been carried out on polyuronides, a novice entering the field has heretofore been compelled to *sense* the logic of existing methods by ploughing through an extensive mass of experimental data. The present article will prove enormously valuable in orienting either the prospective investigator or the student who wishes to prepare himself for intelligent reading of the literature. It will, moreover, guide the new investigator in finding articles containing the detailed experimental procedures that he needs.

Vol. I of *Advances in Carbohydrate Chemistry* excellently fulfills the avowed objectives of the editors to present *critical*, integrating reviews. It has also preserved a good balance, always at a scholarly level, between subjects of immediately practical implication and those which, at least for the present, are mainly of theoretical interest.

If the quality of the series can be maintained, these volumes will soon achieve the status of an encyclopedia of carbohydrate chemistry and easily become the outstanding source of reliable and accessible information on the subject.

ROBERT C. HOCKETT

Trace Elements in Plants and Animals. By WALTER STILES, M.A., Sc.D., F.L.S., F.R.S., Mason Professor of Botany in the University of Birmingham. The Macmillan Company, 60 Fifth Avenue, New York, N. Y., 1946. xi + 189 pp. 12 figs. 13.5 × 21 cm. Price, \$2.75.

The chemical elements essential for life are an unending topic of interest for all. With them the protoplasm of organisms forms the multitude of complex compounds necessary to its existence. Of these elements the macronutrients include C, H, O, N, K, P, Mg, S, and Ca. All other elements, many of them frequently present as minute impurities in compounds of the macronutrients, are termed trace elements. The micronutrients are those trace elements that have been identified as biologically essential. They suffice for the needs of organisms even in micro quantities, *i.e.*, 0.02–1.0 p. p. m. Though other terms have been suggested and used to a minor extent, Professor Stiles in his book on trace elements has also adopted this terminology, which is in most frequent use in biology, including medicine.

This little volume contains a very careful summary of the results obtained in studies of the rather elusive trace-elements needed by plants and animals. A total of about 400 citations is covered. The elements discussed at length are Zn, Cu, Mn, Mo, Co, B, I, Al, and Se. Iron is grouped by the author with the macronutrients and therefore omitted as are Na and Cl. Included in the subject matter are historical development, purification of materials for dietary experiments, an evaluation of methods of estimation, the diagnosis of diseases caused by deficiencies and excesses, and the functions of micronutrients. A lengthy list of the green plants and fungi benefited by each of the micronutrients, together with the authorities for their inclusions, should be very useful to investigators. Another attractive feature in arrangement is the presentation of results under the heading of each of the known deficiency and toxicity diseases, including a careful description of symptoms.

It is to be regretted that Professor Stiles fails to make clear that Raulin, under the tutelage of Pasteur, was the first to discover the essentiality of a trace-element, namely, zinc for the fungus, *Aspergillus niger*, in 1869. Inclusion of additional data on purification of organic dietary com-

pounds would have been desirable. Presumably because of unintentional ambiguity by the reviewer, he is cited as suggesting the non-essentiality of silicon. The intention, rather, was to emphasize that an arrangement of the chemical elements on the basis of atomic structures indicated that biological essentiality was a property of atomic structure. Further, that the necessity for still other chemical elements also appeared to be indicated: Sc, Ga, one of the Ti-Th series, one of the V-Ta series, and either Ni or Pd. No reference is made by Professor Stiles to the description by Bertrand of deficiency symptoms in rats on elimination of zinc from the diet, nor the very recent reports on crop deficiencies in molybdenum from Australia and Tasmania.

These, however, are minor faults that detract little from the potential value of this digest to all those dealing with any phase of nutrition. The reviewer can recommend it as a thorough and well-balanced treatment of the subject. The book is quite attractive in appearance, very free of errors and adequately indexed.

ROBERT A. STEINBERG

BOOKS RECEIVED

March 10, 1947–April 10, 1947

C. G. ANDERSON. "An Introduction to Bacteriological Chemistry." Second Edition. The Williams and Wilkins Company, Baltimore, Md. 500 pp. \$5.00.

W. T. ASTBURY, A. BRAUNSTEIN, C. F. CORI, CL. FROMAGEOT, K. LINDERSTRÖM-LANG, H. G. K. WESTENBRINK and R. W. G. WYCKOFF. "*Biochimica et Biophysica Acta*. International Journal of Biochemistry and Biophysics." Vol. I, Part 1. Elsevier Publishing Company, Inc., 215 Fourth Avenue, New York 3, N. Y. 100 pp. \$9.00 per annum.

H. BENNETT. "Concise Chemical and Technical Dictionary." Chemical Publishing Company, Inc., 26 Court Street, Brooklyn 2, N. Y. 1120 pp. \$10.00.

LUDMILLA IGNATIEV CALLAHAM. "Russian-English Technical and Chemical Dictionary." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 794 pp. \$10.00.

NANCY CROSS, *et al.* "Questions in the Physical Sciences." Published for The College by the University of Chicago; Commercial Printing Company, Lexington, Ky. 332 pp. \$2.50 postpaid.

CLÉMENT DUVAL. "Notions fondamentales de Biochimie à l'Usage des Candidats aux Facultés et Écoles de Médecine." Messieurs Gauthier-Villars, Imprimeur-Éditeur, 55 Quai des Grands-Augustins, Paris VI^e, France. 399 pp.

GREGORY PINCUS, Editor. "Recent Progress in Hormone Research." Academic Press, Inc., 125 East 23rd Street, New York, N. Y. 399 pp. \$7.50.

PAUL S. PITTENGER. "Sugars and Sugar Derivatives in Pharmacy." Scientific Report Series No. 5, Sugar Research Foundation, Inc., 52 Wall Street, New York 5, N. Y. 51 pp.

ERNESTO PRADO-TAGLA, ENRIQUE EGAÑA and FERNANDO UGALDE, Editors. "Tiamina y Metabolismo de la Acetilcolina en el Sistema nervioso central." (Publicaciones del Laboratorio de Medicina experimental.) Vol. I, 1946. Published by the University of Chile, Santiago, Chile. 127 pp.

A. SOMMER. "Photoelectric Cells." Chemical Publishing Company, Inc., Brooklyn 2, New York. 104 pp. \$2.75.

FRANK J. WELCHER. "Organic Analytical Reagents." Volume I. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York. 442 pp. \$7.00. (Set price of Volume I, \$7.00. Single-volume price of Volume I, \$8.00.)