THE CARBOHYDRATES

Chemistry and Biochemistry

SECOND EDITION

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VOLUME IA

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We dedicate this work to the persons most responsible for our professional development

HORACE S. ISBELL AND THE LATE MELVILLE L. WOLFROM

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PREFACE

This edition of "The Carbohydrates" is a complete revision of the 1957 work which was based on "The Chemistry of the Carbohydrates" (1948). Because of its size, it is divided into two volumes, each in two separate parts. The considerably greater length of this edition is a reflection of the rapid growth of research in the field.

In retrospect, the previous edition has very little that needs correction, but new fields of knowledge have developed. Thus, conformational analysis has made spectacular advances with the development of nuclear magnetic resonance methods. Amino sugars and uronic acids have attained great importance because of their widespread occurrence in important biological substances. Unsaturated sugars and dicarbonyl sugars have become especially important with the development of newer methods of synthesis and structural characterization. A chapter has been added on the effects of ionizing radiations and of autoxidation reactions. Recently developed physical methods and methods of separation are described in additional chapters. The literature on nucleosides and antibiotics has expanded to the extent that these subjects have necessitated full chapters. With the discovery of transglycosylation reactions, the number of known oligosaccharides and enzymes acting on carbohydrates has greatly increased. A new chapter on the biosynthesis of sugars and complex saccharides was required to cover this rapidly growing field.

In the previous edition, the discussion of polysaccharides was reduced to two chapters because of the prior appearance of "The Polysaccharides" by Whistler and Smart. In the present edition, the original practice of having separate chapters for the main types of polysaccharides has been restored. Chapters on the rapidly growing fields of glycolipids and glycoproteins have been introduced.

The two final chapters cover the official nomenclature rules for carbohydrates and for enzymes having carbohydrates as substrates. The latter were extracted from the official report, but the names have been modified to conform as much as possible to official carbohydrate nomenclature. In the other chapters, official carbohydrate nomenclature has been used, but both old and new enzyme names are given.

As in the previous edition, the chapter authors were encouraged to be selective rather than exhaustive in their citation of the literature. The objective has been to achieve a proper balance, in correct historical perspective, between the important early papers and the more recent developments. Even in a work the size of this one, it is possible to cite only a small fraction of the total published literature on the subject, and the material selected reflects the collective judgment of the chapter authors and the editors.

For the chapters in Volume I, selective coverage of articles published through

1971 has been made. For more detailed treatment of individual subject areas, the reader is referred especially to the annual series *Advances in Carbohydrate Chemistry and Biochemistry* for authoritative, in-depth articles. For detailed listing of all articles and patents published in the carbohydrate field, both before and since the date of publication of this book, the reader should consult the Carbohydrates section of *Chemical Abstracts* (currently Section 33) and also the Cellulose and Industrial Carbohydrates sections (currently Sections 43 and 44). For new research articles on the carbohydrates, the international journal *Carbohydrate Research*, inaugurated in 1965, provides a prime source. The series of *Specialist Periodical Reports on Carbohydrate Chemistry* (Chemical Society, London) serves to catalogue, on an annual basis starting in 1967, a major proportion of the work published on the carbohydrates during each year. The *Advances*, *Carbohydrate Research*, the Carbohydrates section of *Chemical Abstracts*, and the *Specialist Periodical Reports on Carbohydrate Chemistry* serve to complement this treatise and with it provide a complete bibliographic core on the subject, including detailed foundations in the past literature, and continuing developments subsequent to the publication of this edition.

For extracting from the literature new articles on carbohydrates as they appear, a most valuable tool is the computer-assisted search of current-awareness journals (such as *Chemical Titles* produced by Chemical Abstracts Service) that are available on magnetic tape. Titles and literature citations are printed out automatically in response to a given search-profile. Search profiles for selecting titles dealing with carbohydrates have been devised [see, for example, G. G. S. Dutton and K. B. Gibney, *Carbohyd. Res.* **19**, 393 (1971)] and can be modified appropriately to reflect individual interests and emphasis.

This book is an international collaborative effort, and sixty-four authors were involved in the writing of the various chapters. They reside in Australia, the British Isles, Canada, France, Germany, Japan, and the United States. Most of the chapters were read by other workers in the field. We thank especially the following for their assistance in this way: Drs. I. Danishefsky, H. El Khadem, J. J. Fox, S. Hanessian, M. J. Harris, R. Hems, M. I. Horowitz, K. L. Loening, R. H. McCluer, D. J. Manners, F. Parrish, N. K. Richtmyer, R. Schaffer, C. Szymanski, R. Stuart Tipson, and the late M. L. Wolfrom.

We owe special appreciation for the help of Drs. Anthony Herp, Hewitt Fletcher, Jr., and Leonard T. Capell. Dr. Herp acted as a co-editor in Volume II and translated or rewrote several chapters, Dr. Fletcher read all of the galley proofs, and Dr. Capell was responsible for the indexes, both important and onerous tasks.

Our own institutions, New York Medical College and The Ohio State University, gave important support and encouragement to us in the preparation of these volumes. Academic Press gave the expected hearty cooperation.

CONTENTS OF OTHER VOLUMES

VOLUME IIA

VOLUME IIB

ERRATA FOR VOLUME IIB

Page 697, *below heading*, *IX. BIOSYNTHESIS.* Insert (This section was written by W. Pigman)

Page 708, *reference* 362. This reference should read: Michael Weiss, "An Investigation of the Primary Structure of the Protein Core of Bovine Submaxillary Mucin," New York Medical College, 1970 (Advisor, Ward Pigman), *Diss. Abstr. Intern.* B (Ann Arbor) **32**, No. 7 72–305 (1972).

CONTENTS

1. Introduction: Structure and Stereochemistry of the Monosaccharides

Ward Pigman and Derek Horton

2. Occurrence, Properties, and Preparation of Naturally Occurring Monosaccharides (Including 6-Deoxy Sugars)

Robert Schaffer

3. Synthesis of Monosaccharides

L. Hough and A. C. Richardson

4. Mutarotations and Actions of Acids and Bases

Ward Pigman and E. F. L. J. Anet

5. Conformations of Sugars

S. J. Angyal

6. Esters

Melville L. Wolfrom and Walter A. Szarek

7. Halogen Derivatives

Melville L. Wolfrom and Walter A. Szarek