

Book review

Advanced Sugar Chemistry, Principles of Sugar Stereochemistry, by R. S. SHALLENBERGER, Avi Publishing Company, Westport, Conn., 1982, xx + 323 pages, \$49.50 (in the U.S., \$45.00).

This book elaborates upon the role of asymmetry and dissymmetry as the source of the stereoisomerism and optical activity displayed by the sugars. It presents some of the tenets of general stereochemistry, with numerous illustrations portraying stereochemical relationships.

Chapter 1, "Preliminary Stereochemical Materials", begins with a brief résumé of the classification of the simple sugars. This is followed by quotation, with some modification, of the A.C.S. and British Rules of Carbohydrate Nomenclature. In transcribing and modifying the rules, several editorial and factual errors were introduced. Thus, in the structures for α -D-glucopyranose and α -D-glucopyranosides (pp. 11 and 13), the hydroxyl group at carbon 4 is shown above the ring rather than below. Essentially the same error is found at other places in the text. The rules of nomenclature are followed by a review of various methods for depicting the structural features of sugars.

Chapter 2, "Chiral Nature of the Sugars", includes discussion of the following topics: definition of chirality, symmetry principles, transposition from symmetry to chirality, elements of chirality in the structure of sugars, the tetrahedral carbon atom as the chirality, sugar ring-structures as planes of chirality, chirality and stereoisomerism, and chirality and optical rotation. The presentation is not well organized, and there is considerable repetition.

Chapter 3, "The Pseudosugars and First Simple Sugars", presents a short discussion of the dimeric modifications of glycolaldehyde, D-glyceraldehyde, and dihydroxyacetone. Statements concerning the optical activity of the dimers of glycolaldehyde and dihydroxyacetone are questionable, because these compounds are ordinarily racemic. The discussion of the Cahn–Ingold–Prelog (*R*) and (*S*) system for representing chirality is inadequate. The system depends on the clockwise or counterclockwise sequence of the atoms or groups attached to a chiral center, but the text does not present the rule for assigning priority to the groups.

Chapter 4, "The Acyclic Structures of the Sugars", deals with elucidation of the configurations of the sugars by application of chiral principles. The sections entitled "Uncertainty in the Fischer Proof" and "The Second Fischer Convention" seem superfluous in view of the clear description of the present concept.

Chapter 5, "Ring Forms of the Sugars", presents a historical development of our knowledge of ring structures of the sugars. The derivation of the Haworth perspective formulas from the Fischer projection formulas is particularly noteworthy.

Unfortunately, an error appears in the formula of α -D-glucopyranose on page 101, but the correct structure is given in a Figure describing the alpha- and beta-pyranose and -furanose structures for the aldo-hexoses and -pentoses and the keto-hexoses.

Chapter 6, "The Conformational Structures of the Sugars", traces the evolving principles of conformational analysis and elaborates upon the role of asymmetry as the source of stereoisomerism and optical activity. Structures are given for the chair and boat forms of the aldohexopyranoses and twist forms of the aldopenopyranoses. The text is excellent, except for the section entitled "Calculation and Specification of Multiple Chirality". The reviewer considers this section superfluous, because the structure of any sugar can be formulated from the systematic name, and conversely, the name can be assigned from a depicted structure, without recourse to an alphabetic scheme.

Chapter 7, "Optical Rotatory Power, A Stereochemical Property", covers the theory of optical rotation, including a historical review of early work on the relationship between configuration and optical rotation. Ring formation and the effect of conformation on optical rotation are discussed, and interpreted by consideration of modern concepts of optical activity. The procedures of Whiffen and Brewster, of Lemieux, and of others are presented in detail. The presentation is clear and quite complete.

Chapter 8, "Stereochemical Transformation", treats the subjects of mutarotation, enolization, hydride formation, and reversion. The treatment is concise, but entirely adequate for a text on the stereochemistry of sugars.

Chapter 9, "Oligosaccharides", gives structural formulas and optical rotations for numerous reducing and nonreducing disaccharides. Workers will find the data useful for demonstrating relationships between structure and optical rotatory power. Usefulness of the chapter would have been enhanced by inclusion of references to the optical rotations cited. Calculations of the optical rotatory power of numerous oligosaccharides are presented. The ideas expressed are stimulating, and worthy of further investigation. Discussions of the structure of sucrose and of β -D-fructofuranose are especially noteworthy.

Chapter 10, "Sweetness, A Stereochemical Attribute", relates the diverse sweetness of the sugars to their stereochemistry and structure. This leads to an understanding of the initial chemistry of the sweetness response. It is pointed out that sweet taste arises from intermolecular hydrogen-bonding of a glycol group with the taste-bud receptor-site in an AHB system. The effect is greatest when the hydroxyl group of the glycol possesses the *gauche* orientation, with an AHB distance parameter of ~ 300 pm. This interesting chapter illustrates the importance of stereochemistry for understanding biological phenomena.

This book covers one phase of carbohydrate chemistry (stereoisomerism) very well, but, because of its limited scope, it is questionable whether it would be useful as a text in either a beginning or an advanced course in carbohydrate chemis-

try. Unfortunately, the book is *replete* with errors—some trivial, some serious. The reviewer has made no attempt to list corrections, but advises the reader to approach the text with a modicum of scepticism.

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