

hydrates. The topics deal with the generation of flavour and aroma using enzymes and microorganisms (Chapter 3), the application of biotechnology in the control of the physical properties, stability of fats and oil products, with the production of useful derivatives from their raw materials (Chapter 6) and with three methods (enzymatic, chemical and recombinant DNA method) for the synthesis of aspartame (Chapter 7).

Contributions, all of which are reviews, are well-written, well-illustrated and each has a comprehensive list of references. The book is easily read and is an important source of information for food scientists and food technologists. For other 'non-food' biotechnologists, the topics on fats and oils, flavour and aroma might be found interesting, if not useful. However, the information discussed in the more general topics could be found in other biotechnology books which also contain much more valuable information and which could be bought for the same price.

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Carbohydrate Chemistry. Edited by J. F. Kennedy, Oxford University Press, Oxford, 1988, 678 pp. ISBN 0 19 8551770. Price: £75.00.

The study of carbohydrate chemistry has traditionally fallen into two fields based upon the molecular size of the molecules concerned. Thus monosaccharide chemistry is concerned with the reactions and chemical synthesis of monosaccharides, with a strong emphasis on pure organic chemistry, whilst polysaccharide chemistry is concerned with the primary structure, physical properties and derivatives of polymeric carbohydrates.

Over the past few decades it has become apparent that carbohydrates are heavily involved in other biologically active molecules in that carbohydrates are frequently attached to proteins and lipids. Consequently, interest in carbohydrates has now turned to the possibility that carbohydrates may act as molecular recognition determinants in biological processes and as cell-cell adhesion factors which may be related to health and disease. To this end both fields of carbohydrate chemistry

complement each other in that structural analysis of very small amounts of biological material reveal structures which have been confirmed and reproduced in larger quantities by the methods of synthetic carbohydrate chemistry, often with biomedical applications. *Carbohydrate Chemistry* is thus intended to cover all aspects of carbohydrates regardless of molecular size or function.

To this end the book is divided into three parts: Part 1, 'Chemical identification and chemical properties of carbohydrates'; Part 2, 'Synthesis of carbohydrates'; and Part 3, 'Biotechnology of carbohydrates'. Of the 15 chapters, Part 1 which is by far the largest, contains 9 chapters, whilst Parts 2 and 3 contain 4 and 2 chapters, respectively. At first sight this balance may seem overwhelmingly in favour of structural carbohydrate chemistry but the book has been skillfully edited in that all the chapters are cross-referenced to provide a balanced approach on all aspects of the chemistry of carbohydrates.

Chapter 1 serves as an introduction to carbohydrates and gives a classification and description of all carbohydrate species regardless of molecular size, with a strong emphasis on nomenclature, configuration and conformation of carbohydrates. A very good account of the identification and structural analysis of monomeric and polymeric carbohydrates is given in Chapter 2, which includes traditional methods analysis based upon colorimetric assays, chemical and enzymic degradations and chromatographic techniques, as well as powerful modern methods such as NMR spectroscopy and mass spectrometry. Since many unusual carbohydrates are found as integral parts of antibiotics, Chapter 3 gives an account of the many classes of carbohydrate containing antibiotics, and chemical modifications to the sugar moiety which often enhances the biological activity of antibiotics. Since many new antiviral and anticancer drugs are nucleosides, Chapter 4 gives a review of these molecules with an emphasis on the sugar moiety. Chapters 5–8 give detailed accounts of glycolipids, polysaccharides from various sources, glycoproteins and finally glycoaminoglycans and proteoglycans. Part 1 concludes with a review of the many carbohydrate directed enzymes.

Chapter 10, which begins Part 2 of the book, reviews the synthesis of monosaccharides from non-carbohydrate starting materials and transformations of common sugars by isomerisations, degradations, chain extensions and substitution reactions to give less common sugars, including amino, deoxy-, and branched-chain sugars. An account of monosaccharides as chiral synthons in other areas of organic chemistry is refreshingly included. The synthesis and reactions of monosaccharide derivatives is given in Chapter 11 with particular emphasis placed upon stereochemical considerations and blocking group strategies. Chapter 12,

which is a natural progression from Chapters 10 and 11, gives an account of the synthesis of more complex oligosaccharides for biomedical applications in which the chemical considerations of the previous two chapters are highlighted. The chemical derivatisation of polysaccharides is very well discussed in Chapter 13 which concentrates on the immobilisation of other biologically active molecules (mainly proteins and enzymes) onto polysaccharides.

The final two chapters, which constitute Part 3 of the book, give an account of the numerous and diverse applications of polysaccharides and their derivatives in biotechnology.

Although each chapter is by no means comprehensive in its coverage, each chapter does contain a reference list to many authoritative reviews and original research papers, and a very good subject index is included. The quality of writing and reproduction throughout the entire book was of exceptional standard, and I noticed only a few minor typographical errors. Considering the present very high cost of books, *Carbohydrate Chemistry* is priced very reasonably. All the contributors, who are experts in their own fields, are to be congratulated for producing under one volume a text which covers all aspects of carbohydrate chemistry which I feel will be both authoritative and informative for many years to come.

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