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Distinguished Professor of Food Science Emeritus
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Dedication

This book is dedicated to two special mentors, one being my Major Professor at the University of California, Davis, Dr. Walter G. Jennings. His concern for students and his enthusiasm for research and teaching continue to inspire. The second is the late Robert S. Shallenberger with whom I was fortunate to work while on sabbatical leave at Cornell University in 1979–1980. His influence on this book should be evident on nearly every page. I would also like to dedicate the book to the many undergraduate and graduate students, who through their suggestions, understanding, and misunderstanding helped me to revise, discard, and improve lecture presentations, homework assignments, demonstrations, and laboratory exercises. All of those items were a platform for this book.


# Contents

Contributors xv
Acknowledgments xvii
Introduction xix

1 Classifying, Identifying, Naming, and Drawing Sugars and Sugar Derivatives 1
   Structure and Nomenclature of Monosaccharides 2
      Aldoses and Ketoses 2
      Configurations of Aldose Sugars 3
      D- vs. L-Sugars 3
   Different Ways of Depicting Sugar Structures 5
      Fischer, Haworth, Mills, and Conformational Structures 5
   Classifying Sugars by Compound Class—Hemiacetals, Hemiketals, Acetals, and Ketals 7
   Structure and Nomenclature of Disaccharides 8
   Structure and Optical Activity 10
   A Systematic Procedure for Determining Conformation (C-1 or 1-C), Chiral Family (D or L), and Anomeric Form (α or β) of Sugar Pyranoid Ring Structures 13
   Structure and Nomenclature of Sugar Derivatives with Relevance to Food Chemistry 14
      Glycols (Alditols) 14
      Glyconic, Glycuronic, and Glycaric Acids 15
      Deoxy Sugars 17
      Amino Sugars and Glycosyl Amines 17
      Glycosides 18
      Sugar Ethers and Sugar Esters 19
   Vocabulary 20
   References 21

2 Sugar Composition of Foods 23
   Introduction 23
   Sugar Content of Foods 24
   Composition of Sweeteners 24
      Cane and Beet Sugar 24
# Contents

Starch Granules 112  
Gelatinization and Pasting: The Cooking of Starch 113  
Retrogradation and Gelation: The Cooling of Cooked Starch 115  
Monitoring Starch Transitions 118  
  Microscopy 118  
  Viscometric Methods 118  
  Differential Scanning Calorimetry 119  
Starch Hydrolytic Enzymes 120  
  α-Amylase 121  
  β-Amylase 122  
Modified Starches 122  
  Physical Modifications 123  
  Chemical Modifications 125  
Resistant Starch 127  
Concluding Remarks 129  
Vocabulary 129  
References 131

## 8 Plant Cell Wall Polysaccharides

Introduction: Why Plant Cell Walls are Important 135  
Cellulose 137  
Hemicelluloses 139  
  Xyloglucans 139  
  Heteroxylans 140  
  (1→3),(1→4)-β-D-Glucans 140  
  Mannans 141  
Pectic Polysaccharides 141  
Interactions Between Polysaccharides and Cellulose 143  
The Plant Cell Wall Structure 144  
Vocabulary 145  
References 145

## 9 Nutritional Roles of Carbohydrates

Introduction 147  
The Digestive Process: From the Buccal Cavity through the Small Intestine 148  
  Absorption of Sugars 149  
  Sugar Metabolism 152  
The Large Intestine and the Digestive Process 153  
  The Colon 153  
  Intestinal Microflora 153
Contents

Fate of Nonabsorbed Monosaccharides, Sugar Derivatives, and Oligosaccharides 155
Dietary Fiber 158
Carbohydrate Nutrition and Human Health 159
Vocabulary 162
References 163

Appendices 165
Unit 1. Laboratory/Homework Exercise—Building Molecular Models of Sugar Molecules 167
Unit 2. Homework Exercise—Recognizing Hemiacetal, Hemiketal, Acetal, and Ketal Functional Groups 171
Unit 3. Laboratory/Homework Exercise—Specification of Conformation (C-1 or 1-C), Chiral Family (D or L), and Anomeric Form (α or β) of Sugar Pyranoid Ring Structures 175
Unit 4. Demonstration of the Existence of Plane-Polarized Light and the Ability of Sugar Solutions to Rotate Plane-Polarized Light 181
Unit 5. Laboratory Exercise—Sugar Polarimetry 183
Unit 6. Laboratory Exercise or Lecture Demonstration—The Fehling’s Test for Reducing Sugars 187
Unit 7. Laboratory Exercise—Student-Designed Maillard Browning Experiments 189
Unit 8. Laboratory Exercise or Lecture Demonstration—Microscopic Examination of Starch 193
Unit 9. Names and Structures of Oligosaccharides 197

Index 211
Contributors

Chapter 7
Andrew S. Ross
Department of Crop and Soil Science/Department of Food Science and Technology
Oregon State University
Corvallis, Oregon

Chapter 8
Bronwen G. Smith and Laurence D. Melton
Food Science Programme
The University of Auckland
Auckland, New Zealand
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Introduction

Carbohydrates are major components of foods, accounting for more than 90% of the dry matter of fruits and vegetables and providing for 70–80% of human caloric intake worldwide (BeMiller and Huber 2008). Thus, from a quantitative perspective alone, carbohydrates warrant the attention of food chemists. From the standpoint of food quality, carbohydrates are multifunctional. Sugars are the major source, as well as our reference point, for sweetness. Although carbohydrates are described as being odorless, the volatile reaction products from the Maillard reaction, Strecker degradation, and carmelization reactions can provide desirable, undesirable, or neutral flavor compounds. And, although carbohydrates are colorless, sugars participate in Maillard and carmelization reactions to produce desirable and undesirable brown colors. Cellulose, hemicellulose, pectin, and starch are the structural components of plants that are largely responsible for the textural characteristics of fruits and vegetables. Starch and starch derivatives and various hydrocolloids isolated from plants, seaweed, and microbial sources are used as thickeners, gelling agents, bodying agents, and stabilizers in foods. When it comes to nutrition, a sizable portion of the lay public view carbohydrates in a bad light. Carbohydrates are often blamed for health issues such as obesity, diabetes, and dental caries. It should be realized that carbohydrates are, or should be, the principal source of energy in our diet. After all, we evolved as a species to efficiently use carbohydrates that can be converted to glucose for our body’s fuel. Good nutrition is based on the consumption of the appropriate carbohydrates in the right amounts in balance with other nutrients. It is widely accepted that consumption of various forms of complex carbohydrate can reduce the risk of diabetes, coronary heart disease, diverticulitis, and colon cancer. For peak athletic performance, the advice of professional nutritionists will emphasize consumption of the appropriate carbohydrates, in the appropriate amounts, at the appropriate time. Although the percentage of carbohydrates contributing to caloric intake in the United States is highly variable, the average is considerably less than 70%. Dietary recommendations call for increased consumption of fruits and vegetables and a greater proportion of complex carbohydrate (Walker and Reamy 2009; WHO 2010).
Introduction

The major thrust of this book is to apply basic carbohydrate chemistry to the quality attributes and functional properties of foods. Structure and nomenclature of sugars and sugar derivatives is covered but limited to those compounds that exist naturally in foods or are used as food additives and food ingredients. Review and presentation of fundamental carbohydrate chemistry is minimized, with the assumption that readers have taken general organic chemistry and general biochemistry and have ready access to those books for reference. Chemical reactions focus on those that have an impact on food quality and occur under processing and storage conditions. How chemical and physical properties of sugars and polysaccharides affect the functional properties of foods is emphasized. Taste properties and nonenzymic browning reactions are covered. The nutritional roles of carbohydrates are covered from a food chemist’s perspective. One chapter describes selected carbohydrate analytical methods, emphasizing the basic principles of the methods and their advantages and limitations. There is an extensive appendix that includes some laboratory and classroom exercises and lecture demonstrations.

References