GAODENG XUEXIAO ZHUANYE JIAOCAI

· 高等学校专业教材 ·

食品科学导论

（影印版）

INTRODUCTION TO FOOD SCIENCE

Rick Parker

中国轻工业出版社

高等学校专业教材

食品科学导论

（影印版）

INTRODUCTION TO FOOD SCIENCE

Rick Parker

中国轻工业出版社

图书在版编目（CIP）数据

食品科学导论/（美）帕克（Parker，R.）著 .—影印本 .—北京：中国轻工业出版社，2005.7
高等学校专业教材
ISBN 7-5019-4976-X

Ⅰ.食 … Ⅱ.帕 … Ⅲ.食品工业—基础科学—高等学校—教材—英文 Ⅳ.TS201

中国版本图书馆 CIP 数据核字（2005）第 072222 号

责任编辑：李亦兵　　责任终审：劳国强　　封面设计：王佳芃
版式设计：丁　夕　马金路　　责任监印：胡　兵

出版发行：中国轻工业出版社（北京东长安街 6 号，邮编：100740）
印　　刷：北京公大印刷厂
经　　销：各地新华书店
版　　次：2005 年 7 月第 1 版　　2005 年 7 月第 1 次印刷
开　　本：787 × 1092　1/16　　印张：41
字　　数：922 千字
书　　号：ISBN 7-5019-4976-X/TS·2876　定价：43.00 元
著作权合同登记　图字：01—2005—2050
读者服务部邮购热线电话：010—65241695　85111729　传真：85111730
发行电话：010—65141375　65128898
网　　址：http：//www.chlip.com.cn
Email：club@chlip.com.cn
如发现图书残缺请直接与我社读者服务部联系调换
50130J4X101ZYW

内容简介

任何人若有兴趣想对食品的科学作全面了解，《食品科学导论》是一本理想的参考书。该书将食品科学有机组合为四部分二十八章，内容涉及基本的化学和营养到食品组成和保藏，直至环境意识和世界食品需求。该书以通俗易懂的方式阐述食品的科学性及相关主题，并为有志于从事于食品科学和工业者提供就业指导。

主要特点

每章起始的学习目标明确了该章的重要概念，并可作为阅读指南

每章列出的关键词表构建了词汇表和书后的名词解释表

图文并茂的风格使学习科学知识轻松快捷

每章后的“学生课外活动”部分为学生直接运用食品原料提供了机会

内容全面丰富的附录提供了重要的转换因子、指南、工业界联系方法、食品组成和包括因特网址的附加资源列表

Preface

As the title of the book suggests, science is an important component of the book. Food science as understood by humans represents a specific body of knowledge that approaches and solves problems by the scientific method–a continuous cycle of observation, hypothesis, predictions, experiments, and results. The *science* of food science is emphasized throughout the book.

Introduction to Food Science makes teaching easy. The chapters are based on a thorough, easy-to-follow outline. Developing a lesson plan is simple. Each chapter in this book starts with a list of learning objectives. These help the student identify what concepts are really important from all the information in the chapter. The beginning of each chapter also features a list of key terms. Knowing the meaning of these key terms is essential to reading and understanding the chapter. Many of the words are defined within the text, and all are defined in the extensive Glossary.

Throughout the book, numerous tables, charts, graphs, photographs, and illustrations provide quick and understandable access to information without wading through excess words. Students will quickly learn how to read these and grasp the information they contain. To help maintain interest, each chapter contains short, informative sidebars, and the book contains a series of photographs that feature the many aspects of food science.

Knowledge and information alone are useless unless they can be applied. In the Student Activities section at the end of each chapter, students and instructors will find opportunities for learning by doing. For more information the student can go to the list of Resources, including URLs for Internet sites. Also, at the end of each chapter students can test their understanding by answering the Review Questions.

The 28 chapters of *Introduction to Food Science* are divided into four sections. Section I, Introduction and Background, provides the necessary introductory and background information for understanding the science of foods. This includes chapters on a review of basic chemistry, nutrition and digestion, food composition and quality, unit operations, and food deterioration. These chapters are the foundation.

Section II, Preservation, groups the chapters that relate to the methods of food preservation including heat, cold, drying, radiant and electrical energy, fermentation, microorganisms, biotechnology, chemicals, and packaging. These chapters are the basics of food science.

Section III, Foods and Food Products, includes chapters on milk, meat, poultry and eggs, fish and shellfish, cereal grains, legumes and oilseeds, fruits and vegetables, fats and oils, candies and sweets, and beverages. These chapters are the application of food science.

Finally, Section IV, Related Issues, includes five chapters covering environmental concerns, food safety, regulations and labeling, world food needs, and career opportunities. These chapters represent the challenges of food science.

The Appendix contains helpful tables with information for converting units of measure, and for making contact with the industry and agencies. Most important, the Appendix contains a food composition table that students can learn to read and use. Also, the Appendix lists the Web addresses (URLs) for agencies and other food science-related Internet sites.

ACKNOWLEDGMENTS

Without the support of my wife Marilyn, this book would still be a dream or idea. As I have discovered, writing each textbook required the goodwill of 10 years of marriage. Since we have been married a little over 30 years and this is the fourth book for Delmar, this book was completed on "borrowed time!" She is a friend who critiques ideas, types parts of the manuscript, writes questions and answers, organizes artwork, takes photographs, and checks format. She is a partner in the production of a textbook and in all other aspects of my life.

Four young sons at home were patient and helpful during the time required for all the steps in the production of this book. My two teenage sons, Cole and Morgan, even proved helpful with some of the checking, searching, and revising. All four tolerated my distractions as long as we found frequent time together.

Unless otherwise noted, Marilyn or I took the photographs in the book.

Finally, I appreciate the support, understanding, help, and encouragement of Judith Boyd Nelson and Andrea Edwards Myers, and the rest of the Delmar team.

The author and Delmar wish to express their since appreciation to the following reviewers:

Daniel Andrews
Wauneta-Palisade High School
Wauneta, Nebraska

Roy Crawford
Lancaster High School
Lancaster, Texas

Diane Ryberg
Eau Claire North High School
Eau Claire, Wisconsin

Dr. Janelle Walter
Baylor University
Waco, Texas

ABOUT THE AUTHOR

R. O. (Rick) Parker grew up on an irrigated farm in southern Idaho. His love of agriculture guided his education. Starting at Brigham Young University, he received his bachelor's degree and then moved to Ames, Iowa, where he finished his Ph.D. in animal physiology at Iowa State University. After completing his Ph.D., he and his wife Marilyn and their children moved to Edmonton, Alberta, Canada, where he completed a postdoctorate at the University of Alberta. The next move was to Laramie, Wyoming, where he was a research and teaching associate at the University of Wyoming.

The author currently works as a division director at the College of Southern Idaho in Twin Falls. As director, he works with faculty in agriculture, information technology, and business management. He serves on the governor's Idaho Food Quality Assurance Commission, and he serves as Chair of the College-wide Curriculum Committee. Occasionally, he teaches a computer class, agriculture class, or a writing class.

He is also the author of three other Delmar texts–*Aquaculture Science, 2nd Edition, Introduction to Plant Science,* and *Equine Science.*

目　录

前言 …… XVII
第 1 部分　引言和背景 …… 1
第 1 章　食品科学概述 …… 3
第 2 章　化学回顾 …… 20
第 3 章　食品的化学 …… 33
第 4 章　营养与消化 …… 63
第 5 章　食品成分 …… 82
第 6 章　食品的质量要素 …… 90
第 7 章　食品加工的单元操作 …… 109
第 8 章　食品劣变 …… 124
第 2 部分　保藏 …… 139
第 9 章　热 …… 141
第 10 章　冷藏 …… 156
第 11 章　干燥和脱水 …… 172
第 12 章　辐照和电能 …… 189
第 13 章　发酵，微生物和生物技术 …… 199
第 14 章　化学品 …… 214
第 15 章　包装 …… 230
第 3 部分　食物和食品 …… 243
第 16 章　乳 …… 245
第 17 章　肉、禽和蛋 …… 270
第 18 章　鱼和贝类 …… 306
第 19 章　谷物、豆类和油料种子 …… 322
第 20 章　水果和蔬菜 …… 355
第 21 章　油脂 …… 386
第 22 章　糖制品 …… 400
第 23 章　饮料 …… 415
第 4 部分　相关信息 …… 437
第 24 章　环境意识和加工 …… 439
第 25 章　食品安全 …… 451
第 26 章　法规与标签管理制度 …… 477
第 27 章　世界食品需求 …… 499
第 28 章　食品科学的职业 …… 518
附录 …… 555
名词解释表 …… 611
索引 …… 639

Contents

Preface xvii

Acknowledgments / xviii
About the Author / xix

SECTION *One* **Introduction and Background** 1

Chapter 1 Overview of Food Science 3

Objectives / 3
Key Terms / 3
Parts of the Food Industry / 4
Trends / 5
Allied Industries / 11
International Activities / 13
Responsiveness to Change / 17
Interrelated Operations / 17
Summary / 18
Review Questions / 18
Student Activities / 19
Resources / 19
Internet / 19

Chapter 2 Review of Chemistry 20

Objectives / 20
Key Terms / 20
Elements / 21
Chemical Bonds / 22
Molecules / 26
Reactions / 26
Metabolism / 28
Organic Chemistry / 29
Summary / 29
Review Questions / 31
Student Activities / 31

Resources / 32
Internet / 32

Chapter 3 Chemistry of Foods **33**

Objectives / 33
Key Terms / 33
Carbohydrates / 34
Proteins / 44
Lipids / 48
Vitamins / 53
Minerals / 54
Water / 58
Biotin / 59
Choline / 59
Phytochemicals / 59
Summary / 61
Review Questions / 61
Student Activities / 62
Resources / 62
Internet / 62

Chapter 4 Nutrition and Digestion **63**

Objectives / 63
Key Terms / 63
Nutrient Needs / 64
Water / 65
Food Pyramid / 72
Digestive Processes / 73
Vegetarian Diets / 77
Bioavailability of Nutrients / 78
Stability of Nutrients / 78
Diet and Chronic Disease / 79
Summary / 79
Review Questions / 79
Student Activities / 80
Resources / 80
Internet / 81

Chapter 5 Food Composition **82**

Objectives / 82
Key Terms / 82

Determining the Composition of Foods / 83
Energy in Food / 84
Food Composition Tables / 85
Summary / 86
Review Questions / 87
Student Activities / 87
Resources / 88
Internet / 89

Chapter 6 Quality Factors in Foods 90

Objectives / 90
Key Terms / 90
Appearance Factors / 91
Textural Factors / 92
Flavor Factors / 94
Additional Quality Factors / 97
Quality Standards / 99
Quality Control / 105
Summary / 106
Review Questions / 107
Student Activities / 107
Resources / 108
Internet / 108

Chapter 7 Unit Operations in Food Processing 109

Objectives / 109
Key Terms / 109
Materials Handling / 110
Cleaning / 111
Separating / 111
Size Reduction / 113
Pumping (Fluid Flow) / 114
Mixing / 114
Heat Exchanging / 114
Concentration / 117
Drying / 119
Forming / 119
Packaging / 120
Controlling / 120
Overlapping Operations / 121
Conserving Energy / 121
New Processes / 122

Summary / 122
Review Questions / 122
Student Activities / 123
Resources / 123
Internet / 123

Chapter 8 Food Deterioration **124**

Objectives / 124
Key Terms / 124
Types of Food Deterioration / 125
Shelf Life and Dating of Foods / 125
Causes of Food Deterioration / 125
Post-Harvest Biochemical Changes / 128
Post-Slaughter Biochemical Changes / 132
Principles of Food Preservation / 132
Summary / 136
Review Questions / 136
Student Activities / 136
Resources / 137
Internet / 137

SECTION *Two* Preservation **139**

Chapter 9 Heat **141**

Objectives / 141
Key Terms / 141
Heat / 142
Degrees of Preservation / 142
Selecting Heat Treatments / 143
Heat Resistance of Microorganisms / 144
Heat Transfer / 144
Protective Effects of Food Constituents / 147
Different Temperature-Time Combinations / 147
Heating Before or After Packaging / 148
Home Canning / 150
Summary / 153
Review Questions / 154
Student Activities / 154
Resources / 155
Internet / 155

Chapter 10 Cold 156

Objectives / 156
Key Terms / 156
Refrigeration versus Freezing / 157
Refrigeration and Cool Storage / 157
Freezing and Frozen Storage / 159
New Developments / 165
Home Freezing / 165
Summary / 169
Review Questions / 169
Student Activities / 170
Resources / 170
Internet / 171

Chapter 11 Drying and Dehydration 172

Objectives / 172
Key Terms / 172
Dehydration / 173
Food Concentration / 179
Home Drying / 183
Summary / 186
Review Questions / 187
Student Activities / 187
Resources / 188
Internet / 188

Chapter 12 Radiant and Electrical Energy 189

Objectives / 189
Key Terms / 189
Food Irradiation / 190
Microwave Heating / 193
Ohmic (Electrical) Heating / 196
Summary / 196
Review Questions / 197
Student Activities / 197
Resources / 198
Internet / 198

Chapter 13 Fermentation, Microorganisms, and Biotechnology 199

Objectives / 199
Key Terms / 199

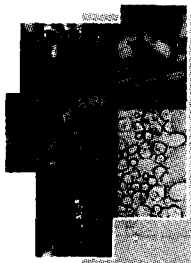
Fermentations / 200
Uses of Fermentation / 202
Microorganisms as Foods / 207
Genetic Engineering and Biotechnology / 208
Summary / 211
Review Questions / 212
Student Activities / 212
Resources / 212
Internet / 213

Chapter 14 Chemicals **214**

Objectives / 214
Key Terms / 214
Reasons for Use / 215
Preservatives / 220
Nutritional Additives / 220
Color Modifiers / 221
Flavoring Agents / 224
Texturing Agents / 225
Acidulants / 225
Fat Replacers / 226
Irradiation / 226
Hazards / 226
Summary / 227
Review Questions / 228
Student Activities / 228
Resources / 229
Internet / 229

Chapter 15 Packaging **230**

Objectives / 230
Key Terms / 230
Types of Containers / 231
Food-Packaging Materials and Forms / 231
Package Testing / 236
Packages with Special Features / 238
Environmental Considerations / 238
Innovations in Packaging / 239
Summary / 240
Review Questions / 241
Student Activities / 241
Resources / 242
Internet / 242



SECTION *Three* Foods and Food Products 243

Chapter 16 Milk 245

Objectives / 245
Key Terms / 245
Fluid Milk / 246
Milk Products and By-products / 251
Quality Products / 265
Milk Substitutes / 266
Reduced Fat Products / 266
Summary / 266
Review Questions / 267
Student Activities / 268
Resources / 268
Internet / 268

Chapter 17 Meat, Poultry, and Eggs 270

Objectives / 270
Key Terms / 270
Meat and Meat Products / 271
Meat Substitutes / 284
Poultry / 285
Eggs / 295
Summary / 302
Review Questions / 303
Student Activities / 303
Resources / 304
Internet / 305

Chapter 18 Fish and Shellfish 306

Objectives / 306
Key Terms / 306
Fish, Shellfish, Salt- and Freshwater / 307
Fishing versus Culture / 307
Composition, Flavor, and Texture / 309
Spoilage / 309
Processing / 311
Preservation / 316
Shellfish / 317
Fish By-products / 317
Storage / 317

New Products / 318
Summary / 319
Review Questions / 320
Student Activities / 320
Resources / 320
Internet / 321

Chapter 19 Cereal Grains, Legumes, and Oilseeds 322

Objectives / 322
Key Terms / 323
Cereal Grains / 323
Starch / 324
Milling of Grains / 328
Corn Refining / 335
Breakfast Cereals / 338
Principles of Baking / 339
Legumes / 341
Soybeans / 344
Summary / 352
Review Questions / 352
Student Activities / 353
Resources / 353
Internet / 354

Chapter 20 Fruits and Vegetables 355

Objectives / 355
Key Terms / 355
General Properties and Structural Features / 356
General Composition / 357
Activities of Living Systems / 358
Harvesting / 361
Post-Harvest / 371
Processing of Fruits / 372
Processing of Vegetables / 377
By-products / 382
Biotechnology / 383
Summary / 383
Review Questions / 384
Student Activities / 384
Resources / 385
Internet / 385

Chapter 21 Fats and Oils **386**

Objectives / 386
Key Terms / 386
Effects of Composition on Fat Properties / 387
Sources of Fats and Oils / 388
Functional Properties of Fats / 389
Production and Processing Methods / 390
Products Made from Fats and Oils / 394
Monoglycerides and Diglycerides / 394
Fat Substitutes / 395
Tests on Fats and Oils / 396
Summary / 397
Review Questions / 398
Student Activities / 398
Resources / 399
Internet / 399

Chapter 22 Candy and Confectionery **400**

Objectives / 400
Key Terms / 400
Sugar-Based Confectionery / 401
Chocolate and Cocoa Products / 407
Confectionery Manufacturing Practices / 410
Sugar Substitutes / 411
Labeling / 412
Summary / 412
Review Questions / 413
Student Activities / 413
Resources / 414
Internet / 414

Chapter 23 Beverages **415**

Objectives / 415
Key Terms / 415
Carbonated Nonalcoholic Beverages / 416
Noncarbonated Herbal and Healthful Bevrages / 419
Bottled Water / 422
Alcoholic Beverages / 424
Coffee / 428
Coffee Substitutes / 429
Tea / 430
Herbal Tea / 431