

国外大学生物学优秀教材（影印版）

# Nutrition

concepts and  
controversies

(Eighth Edition)

Frances Sizer  
Eleanor Whitney

营养学

概念与争论（第八版）



清华大学出版社



美国汤姆森学习出版集团





# Nutrition

Eighth Edition


*Concepts and Controversies*

营养学：概念与争论

Frances Sienkiewicz Sizer

Eleanor Noss Whitney

 **Wadsworth**  
Thomson Learning.

 清华大学出版社

(京)新登字 158 号

**Nutrition concept and controversies (Eighth Edition)**

Frances Sizer, Eleanor Whitney

Copyright © 2000. Wadsworth, a division of Thomson Learning Inc.

All rights reserved.

First published by Wadsworth, an imprint of Thomson Learning, United States of America. Reprinted for the People's Republic of China by Thomson Learning Asia and Tsinghua University Press under the authorization of Thomson Learning. No Part of this book may be reproduced in any form without the express written permission of Thomson Learning Asia and Tsinghua University Press.

本书影印版由 Thomson Learning Inc 授权清华大学出版社独家出版。

未经出版者书面许可,不得用任何方式复制或抄袭本书的任何部分。

版权所有,侵权必究。

本书封面贴有清华大学出版社激光防伪标签,无标签者不得销售。

北京市版权局著作权合同登记号:图字 01-2001-4064

书 名: 营养学: 概念与争论(第 8 版)

作 者: Frances Sizer, Eleanor Whitney

出版者: 清华大学出版社(北京清华大学学研大厦,邮编 100084)

<http://www.tup.tsinghua.edu.cn>

印刷者: 清华大学印刷厂

发行者: 新华书店总店北京发行所

开 本: 850×1168 1/16 印张: 47.25 彩插: 22

版 次: 2001 年 10 月第 1 版 2001 年 10 月第 1 次印刷

书 号: ISBN 7-302-04820-7/Q·6

印 数: 0001~3000

定 价: 68.00 元

## 出版前言

为了使生物学教学适应 21 世纪生命科学发展的需要,同时也为了提高学生阅读专业文献和获取信息的能力,结合当前生物学在高等院校中教学的实际情况,我们精选了一些国外优秀的生物教材,组织专家进行了评阅和审核,组成国外大学生物学优秀教材系列(影印版)。该系列反映了国外大学生物学教材的最新内容和编写特色,多数教材经过教学实践,被国外很多大学广泛采用,并获得好评,因而不断再版。本书即是其中的一册。


希望这套教材能对高等院校师生和广大科技人员有所帮助,同时对我国的生命科学赶超世界先进水平起到一定的推动作用。

欢迎广大读者将使用本系列教材后的意见反馈给我们,更欢迎国内外专家、教授积极向我社推荐国外的优秀生物学教材,以便我们将国外大学生物学优秀教材系列做得更好。

清华大学出版社

2001 年 8 月

## About the Authors



*To my husband Philip Webb  
and our four "little fish,"  
Caroline, Amanda, David  
and Spencer, and the smallest  
fry, David Warren.*

Fran

*To all of my grandchildren  
and stepgrandchildren: Max,  
Zoey, Emily, Rebecca, Sarah,  
Will, TootToot, and Jacob.*

Ellie


**F**RANCES SIENKIEWICZ SIZER, M.S., R.D., F.A.D.A., attended Florida State University where, in 1980, she received her B.S., and in 1982, her M.S. in nutrition. She is certified as a charter Fellow of the American Dietetic Association. She is a founding member and vice president of Nutrition and Health Associates, an information and resource center in Tallahassee, Florida, that maintains an ongoing bibliographic database tracking research in more than 1,000 topic areas of nutrition. Her textbooks include *Life Choices: Health Concepts and Strategies*; *Making Life Choices*; *The Fitness Triad: Motivation, Training, and Nutrition*; and others. She is a primary author of *Nutrition Interactive*, an instructional college-level nutrition CD-ROM. In addition to writing, she lectures at universities and at national and regional conferences, and co-coordinates a local hunger relief effort in her community.

**E**LEANOR NOSS WHITNEY, Ph.D., RECEIVED HER B.A. in Biology from Radcliffe College in 1960 and her Ph.D. in Biology from Washington University, St. Louis, in 1970. Formerly on the faculty at the Florida State University, and a dietitian registered with the American Dietetic Association, she now devotes full time to research, writing, and consulting in nutrition, health, and environmental issues. Her earlier publications include articles in *Science*, *Genetics*, and other journals. Her textbooks include *Understanding Nutrition*, *Understanding Normal and Clinical Nutrition*, *Nutrition and Diet Therapy*, and *Essential Life Choices* for college students and *Making Life Choices* for high-school students. Her most intense interests presently include energy conservation, solar energy uses, alternatively fueled vehicles, and ecosystem restoration.

## Preface

FOR MORE than 20 years and in seven previous editions, *Nutrition: Concepts and Controversies* has been serving the needs of students and professors in classrooms across North America. In this, our millennium edition, we apply what we have learned from our past readers, changing the book to meet changing times. As the 21st century is born, the World Health Organization predicts a healthier future for people living in developed nations, with longer life spans, fewer deaths in infancy and childhood, and declining disabilities due to heart and artery disease in old age. Such improvements spring from advances in the science of nutrition, from progress in medical treatment of diseases, and from improved education concerning the effects of daily life choices on people's well being. This book provides the key understandings in the science of nutrition and guides its readers toward making wise choices amidst almost unlimited options.

In this edition, we have explored many of the new frontiers in nutrition, confronting new mysteries while acknowledging their grounding in science. We have heightened our sense of personal connection with instructors and learners alike, writing to them in the informal, clear style that has become our trademark. For both verbal and visual learners, our logical presentation and our clear, colorful figures keep interest high and understanding at a peak. New photos also adorn many of our pages, adding pleasure to reading.

In this edition, you will encounter two new features. The first of these tickles the reader's interest by posing some "Frequently Asked Questions" on the opening page of each chapter. The answers are found sprinkled throughout the chapter text, in sections marked with the FAQ symbol:  The second new feature, called *Fitness for Life*, draws connections among physical activity, nutrition, and health and is intended to motivate readers by addressing fitness topics as they arise in each chapter. The *Fitness for Life* section of Chapter 1 identifies the health benefits that one can expect from regular physical activity, echoing the chapter's emphasis on nutrition and disease risks. That of Chapter 2 provides guidelines for physical activity; those for Chapters 4 through 8, the nutrient chapters, emphasize the roles of the nutrients in supporting physical performance. The remaining sections spell out advantages of physical activity for weight-conscious readers, athletes, healthy adults, pregnant women, and older people.

The practical interactive activities, called *Do It!*, have been retained in this edition to invite students to apply the chapter contents in their everyday encounters with nutrition. The popular *Self Check* features provide review questions at the end of each chapter. The answers to the *Self Check* questions are in Appendix G to provide immediate feedback to the learner.

By popular demand, we have retained our *Snapshots* of vitamins and minerals, but have given them an updated look. These capsules of information depict food sources and reinforce concepts concerning the Food Guide Pyramid and the Daily Values found on food labels. In this edition, the food label format appears often in figures to familiarize readers with the process of comparing the nutrients in foods that bear labels.

We hope that you will enjoy the eighth edition of our text. Chapter 1 begins with a personal challenge to nutrition students. It asks the question so many people ask of nutrition educators: "What kinds of nutritious foods can help to prevent diseases?" We answer with a lesson in diseases on a continuum, from those almost totally preventable by nutrition to those caused by inherited genes. We then introduce the nutrients and explore their roles in the body. Finally, a discussion of the importance of scientific research lends perspective on the context in which study results may be rightly viewed. Chapter 2 brings together the concepts of diet planning through nutrient allowances, such as the new *Dietary Reference Intakes*, and food grouping systems featuring the *Daily Food Guide* with its pyramid of food choices. Chapter 3 presents a thorough, but brief, introduction to the workings of the human body with major emphasis on the digestive system. Chapters 4 through 6 are devoted to the energy-yielding nutrients—carbohydrates, lipids, and proteins. Chapters 7 and 8 present the vitamins, minerals, and water, with special emphasis on the emerging importance of the antioxidant nutrients. Chapter 9 relates energy balance to body composition, obesity, and underweight and presents weight maintenance as a lifelong effort. Chapter 10 presents details about relationships between fitness, physical activity, and nutrition to follow up on concepts introduced in the *Fitness for Life* features of other chapters. Chapter 11 applies the essence of the first ten chapters to two broad and rapidly changing areas within nutrition: immunity and disease prevention. Chapters 12 and 13 point out the importance of nutrition throughout the life span, from gestation through old age. Chapter 14

considers the problems and advantages of food technology, with emphasis on food safety. Chapter 15 touches on the vast problems of the global food supply—world hunger, pollution, overpopulation—and shows how everyday food choices link each person with the meaningful whole.

The *Controversies* of this book's title invite you to explore beyond the safe boundaries of established nutrition knowledge. These optional readings, which appear at the end of each chapter and are printed with colored borders, delve into current scientific topics and emerging controversies. Some are new to this edition and the others have been updated. Controversy 7 sets up a lively competition between food and supplements as vitamin sources, exploring the research to date on the antioxidant vitamins. Controversy 9 tackles some pressing questions surrounding the safety and effectiveness of weight-loss diets, diet profiteers, and attitudes toward overweight people in this country. Controversy 10 presents current thinking about eating disorders. Of special current interest is Controversy 11, which presents the struggle between scientific exploration of the phytochemicals in foods and consumers' need for guidance concerning their consumption of phytochemicals. Controversy 14 evaluates new food technologies and invites the reader to look forward to and evaluate future innovations. Controversy 15 explores ways in which agriculture can ensure a high-quality food supply throughout this century and beyond.

The *Food Feature* sections that appear in most chapters act as bridges between theory and practice; they are practical applications of the chapter concepts that help readers to choose foods according to nutrition principles. *Consumer Corners* present information on olestra and other fat replacers, amino acid supplements, vitamin C and the common cold, bottled water, marketing of infant formula, organic foods, and other nutrition-related marketplace issues to empower students to make informed decisions.

New or major terms in chapters are defined in the margins of the pages where they are introduced and also in the Glossary at the end of the book. Terms in Controversy sections are grouped together and defined in tables within the

sections and in the Glossary. The reader who wishes to locate any term can do so by consulting the index, which lists the page numbers of definitions in boldface type.

The appendixes have been updated. Appendix A now presents the most complete and accurate listings ever of the nutrient contents of more than 2,200 foods. Appendix B, *Canadiana*, supplies the RNI, the Guidelines, the Food Guide, Food Labels, and the Choice System for our Canadian readers. Appendix C demonstrates nutrition calculations, with special emphasis on finding the percentage of calories from fat in a diet and percentages of the Daily Values. Appendix D provides full coverage with applications of the U.S. Exchange System. Appendix E offers an invaluable list of current addresses, telephone numbers, and Internet websites for those interested in additional information. We have collected all chapter and Controversy references in Appendix F. Older source notes have been removed but are easily available by consulting older editions of this book or by contacting the publisher.

As always, our purpose in writing this text is to enhance our readers' understanding of nutrition science and motivation to apply it. We hope the information on this book's pages will reach beyond the classroom into our readers' lives. Take the information you find inside this book home with you. Use it in your life: nourish yourself, educate your loved ones, and nurture others to be a part of our healthy new future. Stay up with the news, too. For despite all the conflicting messages, inflated claims, and even quackery that abound in news reports, true nutrition knowledge progresses with a genuine scientific spirit, and important new truths are constantly unfolding.

## Acknowledgments

OUR THANKS to Linda Kelly DeBruyne for the newly updated Chapter 10 and Chapter 12 of this edition. Thanks to Kellie Harder Hatcher for her careful revision of Chapter 14 and her competent and

willing assistance at each stage of this writing. Thanks also to Sharon Rady Rolfes for her helpful ideas throughout this work. Thanks to Sally Lorch Mayo for office tasks and for extra help when time ran short (and congratulations on graduating). Thanks, too, to our associate Lori Turner for much of the *Instructor's Manual*; thanks to Margaret Hedley, University of Guelph, who prepared the Canadian material for the manual and reviewed the Canadian resources listed in the text. For the special Instructor's Edition of the text, we thank Lori Turner, University of Arkansas–Fayetteville (lecture outlines); and Judy Kaufman, Monroe Community College (margin references to overheads, *Nutrition Interactive* CD-ROM, and *NutriLink* CD-ROM). Thanks also to Judy Kaufman who developed the *Self Check* questions for the seventh edition, most of which are still serving students in the current text, and who reviewed the acetate package for the eighth edition. Thank you, Myrna Engler, Dorothy Reinhardt, Polara Studios, David Ruppe and Sandra McMahon and Associates for bringing our figures and photos to their full potential. For his work in creating this edition's lively new design, we thank Norman Baugher.

Special thanks to our publisher, Peter Marshall, and to our editors Laura Graham, Dusty Friedman, and Sandra Craig, and to their staff, for their unflagging efforts to ensure the highest quality of all facets of this book. Our applause and gratitude goes to Becky Tollerson for her efforts in marketing our book. Special thanks to our librarians: Linda Patton, Jackie Hannick, and Lonnie Walsh, for their competent and exacting bibliographic help. Thanks also to Jana Kicklighter of Georgia State University for preparing the *Student Study Guide* and the *Test Bank*. As always, we are grateful to Bob Geltz and Betty Hands and their staff at ESHA research for Appendix A and for the computerized diet analysis program that accompanies this book. To our reviewers, many heartfelt thanks for your many thoughtful ideas and suggestions:

Jenna Anding	University of Houston
Raga M. Bakhit	Virginia Polytechnic Institute
Linda C. Barnes	Tidewater Community College
Ethan A. Bergman	Central Washington University
Debra Boardley	University of Toledo
Mallory Boylan	Texas Technical University
Pat Brown	Cuesta College
N. Joanne Caid	California State University–Fresno
Marjorie Caldwell	University of Rhode Island

Leah Carter	Bakersfield College
Thomas W. Castonguay	University of Maryland
Stacy Coseio	University of Houston
Leslie Edwards Cummings	University of Nevada
Earlene Davis	Bakersfield College
Allan Davison	Simon Fraser University
Robert DiSilvestro	Ohio State University
Carol Friesen	Ball State University
Sherrie Frye	University of Northern Colorado
Cindy J. Fuller	University of North Carolina
Leonard Gerber	University of Rhode Island
Jan Goodwin	University of North Dakota
Cynthia Gossage	Prince George's Community College
Deborah Gustafson	Utah State University
Deloy G. Hendricks	Utah State University
Ann A. Hertzler	Virginia Polytechnic Institute
Wendy T. Hunt	American River College
Kendra K. Kattelmann	South Dakota State University
Judy Kaufman	Monroe Community College
Margaret Kessel	Ohio State University
Jeanne W. Lawless	Bloomsburg University
Dalia Lima	Houston Community College
Cleo Long	Shelby State Community College
Teresa T. Marcus	Chattanooga State Technical Community College
Sharon L. McWhinney	Prairie View A & M University
Janis Mena	Santa Fe Community College (Univ of FL)
Stella Miller	Mt. San Antonio College
Ryna Levy Milne	University of British Columbia
Cherie L. Moore	Cuesta College
Mary Etta Moorachian	Johnson & Wales University
Sharon K. Morcos	Kansas State University
Leonard A. Piche	Brescia College
Clay Robinson	Lewis Clark State College
Samuel C. Smith	University of New Hampshire
Wendy Stuhldreher	Slippery Rock University
Joan Thompson	Weber State University
Dellman Walker	Middle Tennessee State University
Hope Weiler	University of Manitoba
Julian H. Williford, Jr.	Bowling Green State University
Fred H. Wolfe	University of Arizona
Cynthia Wright	Southern Utah University
Lisa Young	New York University



# Contents in Brief

- Chapter 1* Food Choices and Human Health 1  
Controversy 1 *Who Speaks On Nutrition?* 22
- Chapter 2* Nutrition Tools—Standards and Guidelines 27  
Controversy 2 *The Mediterranean Diet: Does It Hold the Secret for a Healthy Heart?* 60
- Chapter 3* The Remarkable Body 65  
Controversy 3 *Should We Be Eating the “Natural” Foods of Ancient Diets?* 88
- Chapter 4* The Carbohydrates: Sugar, Starch, Glycogen, and Fiber 93  
Controversy 4 *Sugar and Alternative Sweeteners: Are They “Bad” for You?* 124
- Chapter 5* The Lipids: Fats, Oils, Phospholipids, and Sterols 133  
Controversy 5 *Alcohol and Nutrition* 167
- Chapter 6* The Proteins and Amino Acids 175  
Controversy 6 *Vegetarians versus Meat Eaters: Whose Diet Is Best?* 203
- Chapter 7* The Vitamins 209  
Controversy 7 *Antioxidant Nutrients: Magic Bullets?* 256
- Chapter 8* Water and Minerals 263  
Controversy 8 *Osteoporosis and Calcium* 304
- Chapter 9* Energy Balance and Healthy Body Weight 313  
Controversy 9 *The Diet Debate: Who Chooses, Who Profits, and What Are the Risks?* 350
- Chapter 10* Nutrients, Physical Activity, and the Body’s Responses 355  
Controversy 10 *What Causes Eating Disorders?* 384
- Chapter 11* Diet and Health 391  
Controversy 11 *Phytochemicals: Can They Prevent Chronic Diseases?* 424
- Chapter 12* Life Cycle Nutrition: Mother and Infant 431  
Controversy 12 *Medicines, Other Drugs, and Nutrition* 463
- Chapter 13* Child, Teen, and Older Adult 469  
Controversy 13 *Food, Mind, and Memory* 501
- Chapter 14* Food Safety and Food Technology 507  
Controversy 14 *Future Foods: Are the New Food Technologies Safe?* 539
- Chapter 15* Hunger and the Global Environment 547  
Controversy 15 *Agribusiness and Sustainable Food Production: How to Go Forward?* 562
- Appendixes A-1*  
*Glossary G2-1*

# Table of Contents

## Chapter 1

### FOOD CHOICES AND HUMAN HEALTH 1

#### A Lifetime of Nourishment 2

*How Powerful Is a Nutritious Diet  
in Preventing Diseases?* 2

*Genetics and Individuality* 3

*Lifestyle Choices* 4

#### ■ FITNESS FOR LIFE • Why Bother to Be Active? 4

#### The Human Body and Its Food 4

*The Nutrients in Foods* 5

*Can I Forgo Food and Live Just on Supplements?* 6

*What Are the Nonnutrients and Phytochemicals  
That I Hear about in the News?* 8

#### The Science of Nutrition 8

*If the Scientists Don't Know, How Can I?  
Scientific Challenge* 9

*Can I Trust the Media to Deliver Nutrition News?* 10

#### Cultural and Social Meanings Attached to Food 11

#### ■ CONSUMER CORNER • Nutrition in the News 12

#### Nutrition Goals for the Nation 14

#### The Challenge of Choosing Foods 15

*The Variety of Foods to Choose From* 15

*What Exactly Is a Nutritious Diet?* 17

#### ■ FOOD FEATURE • How Can I Get Enough Nutrients without Consuming Too Many Calories? 18

#### ■ DO IT • Analyze Nutrition News 20

#### ■ SELF CHECK 21

#### ■ NUTRITION ON THE NET 21

#### ☒ CONTROVERSY 1 • Who Speaks on Nutrition? 22

## Chapter 2

### NUTRITION TOOLS—STANDARDS AND GUIDELINES 27

#### Nutrient Recommendations 28

*The DRI Nutrient Intake Recommendations* 28

*Why Can't Nutrient Advice Be Kept Simple?* 29

*Understanding the DRI Recommended*

*Intakes for Individuals* 30

*How the Committee Establishes DRI Values—  
An RDA Example* 31

*How Much of a Nutrient Is Too Much?* 32

*Daily Values* 33

*Other Nutrient Standards* 33

#### Dietary Guidelines 34

#### ■ FITNESS FOR LIFE •

*How Much Activity Is Enough?* 36

#### Diet Planning with the Daily Food Guide and the Food Guide Pyramid 37

*The Daily Food Guide* 37

*How Can the Food Guide Pyramid  
Help Me to Eat Well?* 38

*A Note about Exchange Systems* 44

*How Many Servings Do I Need Each Day?* 44

*Serving Sizes versus Helpings* 45

#### ■ CONSUMER CORNER •

*Checking Out Food Labels* 47

*The Nutrition Facts Panel* 47

#### Which Packaged Foods and Restaurant Choices Are Best for My Health? 49

#### ■ FOOD FEATURE •

*Getting a Feel for the Nutrients in Foods* 52

#### ■ DO IT •

*Score Your Diet with the Food Guide Pyramid* 55

#### ■ SELF CHECK 59

#### ■ NUTRITION ON THE NET 59

#### ☒ CONTROVERSY 2 • The Mediterranean Diet: Does It Hold the Secret for a Healthy Heart? 60

## Chapter 3

### THE REMARKABLE BODY 65

#### The Body's Cells 66

#### The Body Fluids and the Cardiovascular System 67

#### The Hormonal and Nervous Systems 70

*What Do Hormones Have to Do with Nutrition?* 70

*How Does the Nervous System Interact with Nutrition?* 71

#### The Immune System 73



## The Digestive System 73

- Why Do People Like Sugar, Fat, and Salt? 74
- The Digestive Tract 74
- The Mechanical Aspect of Digestion 75
- The Chemical Aspect of Digestion 78
- How Do "Digestive Juices" Work? 78
- Are Some Food Combinations More Easily Digested Than Others? 78
- If "I Am What I Eat," Then How Does a Sandwich Become "Me"? 79
- Absorption and Transportation of Nutrients 81
- A Letter from Your Digestive Tract 83

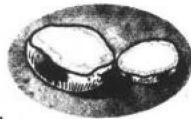
## The Excretory System 85

### Storage Systems 85

- When I Eat More Than My Body Needs, What Happens to the Extra Nutrients? 85
- Variations in Nutrient Stores 86

### Other Systems 86

- SELF CHECK 87
- NUTRITION ON THE NET 87
- ✚ CONTROVERSY 3 • Should We Be Eating the "Natural" Foods of Ancient Diets? 88



## Chapter 4

### THE CARBOHYDRATES: SUGAR, STARCH, GLYCOGEN, AND FIBER 93

#### A Close Look at Carbohydrates 94

- Sugars 95
- Starch 95
- Glycogen 96
- Fiber 96

#### The Need for Carbohydrates 98

- If I Want to Lose Weight, Should I Avoid Carbohydrates? 98
- How Does Fiber in Food Affect My Health, and How Much Do I Need to Stay Healthy? 98
- Can My Diet Have Too Much Fiber? 101

- CONSUMER CORNER • Refined, Enriched, and Whole-Grain Bread 102

#### From Carbohydrates to Glucose 105

- Digestion and Absorption of Carbohydrates 105
- Why Do Some People Have Trouble Digesting Milk? 107

#### The Body's Use of Glucose 108

- Splitting Glucose for Energy 108
- Storing Glucose as Glycogen 109
- Returning Glucose to the Blood 109
- Converting Glucose to Fat 110



- FITNESS FOR LIFE • What Can I Eat to Make Workouts Easier? 111

#### Diabetes and Hypoglycemia 112

- What Is Diabetes? 112
- If I Feel Dizzy Between Meals, Do I Have Hypoglycemia? 114

- FOOD FEATURE • Meeting Carbohydrate Needs 116
- DO IT • Investigate Your Fiber Intake 120
- SELF CHECK 123
- NUTRITION ON THE NET 123
- ✚ CONTROVERSY 4 • Sugar and Alternative Sweeteners: Are They "Bad" for You? 124

## Chapter 5

### THE LIPIDS: FATS, OILS, PHOSPHOLIPIDS, AND STEROLS 133

#### Introducing the Lipids 134

- Usefulness of Fats in the Body 134
- Usefulness of Fats in Food 135

#### A Close Look at Fats 136

- Triglycerides: Fatty Acids and Glycerol 136
- Saturated versus Unsaturated Fatty Acids 137
- Other Members of the Lipid Family 139



#### Lipids in the Body 140

- Digestion of Fats 140
- If Fat Floats, How Does It Travel around the Body in the Watery Blood? 141
- How Can I Use My Stored Fat for Energy? 143
- How, Exactly, Do Fat and Cholesterol Affect People's Health? 144
- What Is the Significance of LDL and HDL in Blood? 146
- Essential Polyunsaturated Fatty Acids 147

- FITNESS FOR LIFE • Why Exercise the Body for the Health of the Heart? 148

#### The Effects of Processing on Unsaturated Fats 150

- What Is "Hydrogenated Vegetable Oil," and What's It Doing in My Peanut Butter? 150
- What Are Trans-Fatty Acids, and Are They Harmful? 151

#### Fat in the Diet 152

- Added Fats 152
- CONSUMER CORNER • Fat Replacers 153
- Meat, Poultry, Fish, Dry Beans, Eggs, and Nuts 156
- Milk, Yogurt, and Cheese 157
- Bread, Cereal, Rice, and Pasta 157

- FOOD FEATURE • Defensive Dining 160
- DO IT • Read about Fats on Food Labels 163
- SELF CHECK 166
- NUTRITION ON THE NET 166
- ☒ CONTROVERSY 5 • Alcohol and Nutrition 167

## Chapter 6 THE PROTEINS AND AMINO ACIDS 175

### The Structure of Proteins 176

- Amino Acids 176
- How Do Amino Acids Build Proteins? 177
- The Variety of Proteins 178
- Denaturation of Proteins 179

- FITNESS FOR LIFE • Can Eating Extra Protein Make Muscles Grow Larger? 181

### Digestion and Absorption of Protein 181

- Protein Digestion 182
- After Protein Is Digested, What Happens to the Amino Acids? 182



### The Roles of Proteins in the Body 182

- Supporting Growth and Maintenance 183
- Building Enzymes, Hormones, and Other Compounds 184
- Building Antibodies 184
- Maintaining Fluid and Electrolyte Balance 185
- Maintaining Acid-Base Balance 185
- Providing Energy 186
- The Fate of an Amino Acid 187

### Food Proteins: Quality, Use, and Need 188

- Which Kinds of Protein-Rich Foods are Easiest to Digest and Use? 188

### ■ CONSUMER CORNER •

- Protein and Amino Acid Supplements 189
- Protein Quality 190
- Measuring Protein Quality 192
- How Much Protein Do People Really Need? 193

### Protein Deficiency and Excess 194

- What Happens When People Consume Too Little Protein? 195
- Is it Possible to Consume Too Much Protein? 197

- FOOD FEATURE • Getting Enough, But Not Too Much Protein 198

- DO IT • Add Up the Protein in a Day's Meals 200

- SELF CHECK 202

- NUTRITION ON THE NET 202

- ☒ CONTROVERSY 6 • Vegetarians versus Meat Eaters: Whose Diet Is Best? 203

## Chapter 7 THE VITAMINS 209

### Definition and Classification of Vitamins 210

### The Fat-Soluble Vitamins 211

- Vitamin A 211
- Vitamin D 216
- Vitamin E 218
- Vitamin K 220



### The Water-Soluble Vitamins 222

- The B Vitamins and Their Relatives 223
- B Vitamin Roles in Metabolism 223
- B Vitamin Deficiencies and Toxicities 224
- Vitamin C 234

- FITNESS FOR LIFE • The Power of Vitamins 223

### Vitamin Supplements 235

### ■ CONSUMER CORNER •

- Vitamin C and the Common Cold 236
- Do I Need to Take a Vitamin Supplement? 237
- Which Supplements Are Helpful, and Which Should I Avoid? 238
- Supplements Must Be Safe, or the Government Would Not Allow Their Sales, Right? 240
- Selection of a Multinutrient Supplement 241

### ■ FOOD FEATURE •

- Choosing Foods Rich in Vitamins 248

- DO IT • Find the Vitamins on a Menu 252

- SELF CHECK 255

- NUTRITION ON THE NET 255

### ☒ CONTROVERSY 7 •

- Antioxidant Nutrients: Magic Bullets? 256

## Chapter 8 WATER AND MINERALS 263

### Water 264

- What Does Water Do for My Body? 264
- The Body's Water Balance 266
- Quenching Thirst and Balancing Losses 267
- Water Recommendations and Sources 267

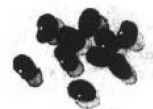
### Body Fluids and Minerals 268

### ■ CONSUMER CORNER •

- Which Type of Water Is Safest? 269

### The Major Minerals 273

- Calcium 273
- Phosphorus 275
- Magnesium 276
- Sodium 277
- Potassium 281
- Chloride and Sulfur 282



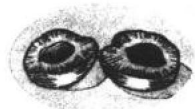
The Trace Minerals 283

- Iodine 283
- Iron 284
- Zinc 288

■ **FITNESS FOR LIFE • Iron or Exercise for More Energy?** 289

- Selenium 290
- Fluoride 291
- Chromium 292
- Copper 293

*Other Trace Minerals and Some Candidates* 294



■ **FOOD FEATURE • Meeting the Need for Calcium** 295

■ **DO IT • Find the Minerals in Snack Foods** 300

■ **SELF CHECK** 303

■ **NUTRITION ON THE NET** 303

■ **CONTROVERSY 8 • Osteoporosis and Calcium** 304

## Chapter 9

### ENERGY BALANCE AND HEALTHY BODY WEIGHT 313

Energy Balance 314

- Energy In 314
- Energy Out 315
- How Many Calories Do I Need Each Day? 316

The Problems of Too Little or Too Much Body Fat 317

- What Are the Risks from Underweight? 317
- How Fat Is Too Fat? 318

Body Weight versus Body Fatness 319

- Body Mass Index 320
- Estimating Body Fatness 321
- Defining Priorities 321

The Mystery of Obesity 322

- Why Did I Eat That? 323
- Genetics and Obesity 325
- Do People's Behaviors Cause Obesity? 328

■ **FITNESS FOR LIFE • Physical Activity for Building Up and Trimming Down** 330

How the Body Loses and Gains Weight 332

- Moderate Weight Loss versus Rapid Weight Loss 332
- Weight Gain 335

Achieving and Maintaining a Healthy Body Weight 336

- What Strategies Are Best for a Healthy Body Weight? 336

■ **CONSUMER CORNER •**

Surgery and Drugs for Weight Loss 338

What Diet Strategies Can Help Me to Gain Weight? 342  
 Once I've Changed My Weight, How Can I Stay Changed? 343

■ **FOOD FEATURE •**

Behavior Modification for Weight Control 344

■ **DO IT • Control the Calories in a Day's Meals** 346

■ **SELF CHECK** 349

■ **NUTRITION ON THE NET** 349

■ **CONTROVERSY 9 • The Diet Debate: Who Chooses, Who Profits, and What Are the Risks?** 350

## Chapter 10

### NUTRIENTS, PHYSICAL ACTIVITY, AND THE BODY'S RESPONSES 355

The Essentials of Fitness and Training 356

- How Do My Muscles Become Physically Fit? 357
- Can I Expect Any Health Benefits from Weight Training? 357
- How, Exactly, Does Cardiorespiratory Training Benefit the Heart? 358

The Active Body's Use of Fuels 359

- Glucose Use and Storage 360
- Activity Intensity, Glucose Use, and Glycogen Stores 361
- Activity Duration and Glucose Use 362
- Degree of Training Affects Glycogen Use 364
- To Burn More Fat during Activity, Should Athletes Eat More Fat? 364

■ **FITNESS FOR LIFE • Can Physical Training Speed Up an Athlete's Metabolism?** 366

- Using Protein and Amino Acids for Building Muscles and to Fuel Activity 366
- How Much Protein Should an Athlete Consume? 367

Vitamins and Minerals—Keys to Performance 368

- Do Nutrient Supplements Benefit Athletic Performance? 368
- Physical Activity and Bone Loss 369
- Iron and Performance 370
- Other Minerals 370

Fluids and Temperature Regulation in Physical Activity 371

Temperature Regulation 371

■ **CONSUMER CORNER •**

- Steroids and "Ergogenic" Aids 372
- Fluid Needs during Physical Activity 375
- What Do Sports Drinks Have to Offer? 376
- Other Beverage Choices 377





- FOOD FEATURE • Choosing a Performance Diet 378
- DO IT • Detect Fitness Deception 382
- SELF CHECK 383
- NUTRITION ON THE NET 383
- ✂ CONTROVERSY 10 • What Causes Eating Disorders? 384



*Chapter 11*  
DIET AND HEALTH 391

- Nutrition and Immunity 392
- Lifestyle Choices and Risks of Degenerative Disease 394
- Nutrition and Atherosclerosis 396
  - How Atherosclerosis Develops 397
  - Risk Factors for CVD 399
  - What Else, Besides Controlling Diet, Can I Do to Reduce My Risk of CVD? 402
- FITNESS FOR LIFE • Ways to Include Physical Activity in a Day 403
- Nutrition and Hypertension 404
  - How Does Blood Pressure Work in the Body, and What Makes It Too High? 405
  - How Does Nutrition Affect Hypertension? 406
- Nutrition and Cancer 408
  - How Does Cancer Develop? 408
  - How Powerful Is Diet in Reducing a Person's Risk of Developing Cancer? 410
- CONSUMER CORNER • Complementary, Alternative, and Herbal Medicine 414
- FOOD FEATURE • Diet As Preventive Medicine 417
- DO IT • Practice Eyeballing a Meal 419
- SELF CHECK 423
- NUTRITION ON THE NET 423
- ✂ CONTROVERSY 11 • Phytochemicals: Can They Prevent Chronic Diseases? 424

*Chapter 12*  
LIFE CYCLE NUTRITION: MOTHER AND INFANT 431

- Pregnancy: The Impact of Nutrition on the Future 432
  - Preparing for Pregnancy 432
  - The Events of Pregnancy 434
  - Increased Need for Nutrition 435
  - How Much Weight Should a Woman Expect to Gain during Pregnancy? 440

- FITNESS FOR LIFE • Should Pregnant Women Be Physically Active? 440
  - Teen Pregnancy 442
  - Why Do Some Women Crave Pickles and Ice Cream While Others Can't Keep Anything Down? 442
  - What Behaviors or Substances Should Pregnant Women Avoid? 443



- Drinking during Pregnancy 445
  - Alcohol's Effects 445
  - Fetal Alcohol Syndrome 445
  - Experts' Advice 447

Troubleshooting 447

- Breastfeeding 448
  - Why Is Breast Milk So Good for Babies? 448
  - Concerns for the Breastfeeding Mother 450

- CONSUMER CORNER • Formula's Advertising Advantage 451
  - Are There Any Situations in Which a Woman Should Not Breastfeed? 453

- Feeding the Infant 454
  - Nutrient Needs 454
  - Formula Feeding and Weaning to Milk 455
  - An Infant's First Foods 457
  - Looking Ahead 460

- FOOD FEATURE • Mealtimes with Infants 461
- SELF CHECK 462
- NUTRITION ON THE NET 462
- ✂ CONTROVERSY 12 • Medicines, Other Drugs, and Nutrition 463

*Chapter 13*  
CHILD, TEEN, AND OLDER ADULT 469

- Early and Middle Childhood 470
  - Growth and Nutrient Needs of Young Children 470
  - Mealtimes and Snacking 472
  - Can Nutrient Deficiencies Impair a Child's Thinking or Cause Misbehavior? 473
  - The Problem of Lead 474
  - Food Allergy, Intolerance, and Aversion 476
  - Does Diet Affect Hyperactivity? 477
  - Television and Children's Nutrition 478
  - Childhood Obesity and Disease in Later Life 479
  - Is Breakfast Really the Most Important Meal of the Day for Children? 480
  - How Nourishing Are the Lunches Served at School? 480
  - Nutrition Education 481

- The Teen Years 482
  - Growth and Nutrient Needs of Teenagers 482

- CONSUMER CORNER • Nutrition and PMS 484
  - Eating Patterns and Food Choices 485
  - Acne 486

## The Later Years 487

### Nutrition in the Later Years 487

Energy and Activity 488

- FITNESS FOR LIFE • Fitness in the Later Years 489

Carbohydrates and Fiber 489

Fats and Arthritis 490

Protein 490

Vitamins 491

Water and the Minerals 492

Can Nutrition Help People to Live Longer? 493

Can Supplements Affect the Course of  
Alzheimer's Disease? 494

Food Choices of Older Adults 495

- FOOD FEATURE • Single Survival  
and Nutrition on the Run 497

- SELF CHECK 500

- NUTRITION ON THE NET 500

- ☒ CONTROVERSY 13 • Food, Mind, and Memory 501

## Chapter 14

### FOOD SAFETY AND FOOD TECHNOLOGY 507

#### Microbes and Food Safety 509

How Do Microorganisms in Food Cause  
Illness in the Body? 509

Food Safety in the Marketplace 510

Food Safety in the Kitchen 512

Are Some Foods More Likely Than Others  
to Make People Sick? 514

Food Safety while Traveling 517

#### Natural Toxins in Foods 518

#### Environmental Contaminants 519

#### Pesticides 520

#### Food Processing and the Nutrients in Foods 524

- CONSUMER CORNER • Is Organic the Answer? 525

Modified Atmosphere Packaging 526

Do Canned Foods Contain Any Nutrients? 526

Freezing 527

Drying 527

Extrusion 528

#### Food Additives 528

Regulations Governing Additives 528

Antimicrobial Agents 530

How Do Antioxidants Protect Food? 531

Artificial Colors 532



- Are Artificial Flavors and the Flavor Enhancer  
MSG Safe to Consume? 532
- Incidental Food Additives 533
- Nutrient Additives 534

#### Growth Hormone in Meat and Milk 534

- FOOD FEATURE • Making Wise Food Choices  
and Cooking to Preserve Nutrients 535

- SELF CHECK 538

- NUTRITION ON THE NET 538

- ☒ CONTROVERSY 14 • Future Foods: Are  
the New Food Technologies Safe? 539

## Chapter 15

### HUNGER AND THE GLOBAL ENVIRONMENT 547

#### The Need For Change 548

#### Hunger 549

What U.S. Food Programs Are Directed  
at Stopping Domestic Hunger? 550

What Is the State of World Hunger? 552

#### Environmental Degradation and Hunger 553

#### Poverty and Overpopulation 554

#### Moving toward Solutions 556

What Are the Impacts of Sustainable  
Development Worldwide? 556

How Can People Engage in Activism and  
Simpler Lifestyles at Home? 557

- CONSUMER CORNER •  
Saving Money and Protecting the Environment 558

- SELF CHECK 561

- NUTRITION ON THE NET 561

- ☒ CONTROVERSY 15 • Agribusiness and Sustainable  
Food Production: How to Go Forward? 562

Appendix A Table of Food Composition A-1

Appendix B Canadiana: Recommendations,  
Choice System, and Labels B-1

Appendix C Aids to Calculations C-1

Appendix D U.S. Food Exchange System D-1

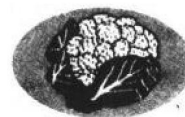
Appendix E Nutrition Resources E-1

Appendix F Reference Notes F-1

Appendix G Answers to Self Check  
Questions G-1

Glossary G2-1

Index I-1



# 1

# Food Choices and Human Health

Henry Church, *Still Life*  
Date Unknown



## Contents

A Lifetime of Nourishment

### FITNESS FOR LIFE

Why Bother to Be Active?

The Human Body and Its Food

The Science of Nutrition

Cultural and Social Meanings  
Attached to Food

### CONSUMER CORNER

Nutrition in the News

Nutrition Goals for the Nation

The Challenge of Choosing Foods

### FOOD FEATURE

How Can I Get Enough Nutrients  
without Consuming Too Many Calories?

### DO IT!

Analyze Nutrition News

### SELF CHECK

### NUTRITION ON THE NET

### CONTROVERSY

Who Speaks on Nutrition?



## Frequently Asked Questions

FAQ: How powerful is a nutritious diet in preventing diseases? p. 2

FAQ: Can I forgo food and live just on supplements? p. 6

FAQ: What are the nonnutrients and phytochemicals that I hear about in the news? p. 8

FAQ: If the scientists don't know, how can I? p. 8

FAQ: Can I trust the media to deliver nutrition news? p. 10

FAQ: What exactly is a nutritious diet? p. 16

**food** medically, any substance that the body can take in and assimilate that will enable it to stay alive and to grow; the carrier of nourishment; socially, a more limited number of such substances defined as acceptable by each culture.

**nutrition** the study of the nutrients in foods and in the body; sometimes also the study of human behaviors related to food.

**diet** the foods (including beverages) a person usually eats and drinks.

**nutrients** components of food that are indispensable to the body's functioning. They provide energy, serve as building material, help maintain or repair body parts, and support growth. The nutrients include water, carbohydrate, fat, protein, vitamins, and minerals.

**malnutrition** any condition caused by excess or deficient food energy or nutrient intake or by an imbalance of nutrients. Nutrient or energy deficiencies are classed as forms of undernutrition; nutrient or energy excesses are classed as forms of overnutrition.



**IF YOU CARE** about your body, and if you have strong feelings about **food**, then you have much to gain from learning about **nutrition**—the study of how food nourishes the body. Nutrition is a fascinating, much talked-about subject. Everyone wants to know how food affects health—naturally, because we love food and we care about our health. Each day, newspapers, **radio**, and television present stories of new findings on nutrition and heart health or nutrition and cancer prevention. Magazine advertisements and television commercials constantly bombard us with multicolored pictures of tempting foods—pizza, burgers, cakes, chips, sweet drinks, alcoholic beverages, and many more.<sup>1</sup> Several times a day, you get hungry and turn from your other activities to eat a meal. And if you are like most people, you wonder, “Is this food good for me?” or you berate yourself, “I probably shouldn’t be eating this.”

When you study nutrition, you learn which foods serve you best, and you can work out ways of choosing foods, planning meals, and designing your **diet** wisely. Knowing the facts can enhance your health and your enjoyment of eating while relieving you of feeling guilty or worried that you aren’t eating well.

This book devotes many chapters to the science of nutrition. This chapter provides a starting point by offering answers to the following questions:

1. What connections exist between the diets people consume and physical health?
2. What does food do for the body and its owner?
3. How can consumers judge whether to believe nutrition news from the media?
4. What constitutes a nutritious diet?

## *A Lifetime of Nourishment*

If you live for 65 years or longer, you will have consumed more than 70,000 meals, and your remarkable body will have disposed of 50 tons of food. The foods you choose have cumulative effects on your body. At 65 years of age, you will see and feel those effects, if you know what to look for.

Your body renews its structures continuously, and each day it builds a little muscle, bone, skin, and blood, replacing old tissues with new. It may also add a little fat, if you consume excess food energy (calories), or subtract a little, should you consume less than you require. In this way some of the food you eat today becomes part of “you” tomorrow. The best food for you, then, is the kind that supports the growth and maintenance of strong muscles, sound bones, healthy skin, and sufficient blood to cleanse and nourish all parts of your body. This means you need food that provides not only energy but also sufficient ‘**nutrients**,’ that is, enough water, carbohydrates, fat, protein, vitamins, and minerals. If the foods you eat provide too little or too much of any nutrient today, your health may suffer just a little. If the foods you eat provide too little or too much of one or more nutrients every day for years, then, by the time you are old, you may well suffer severe disease effects.

The point is that a well-chosen array of foods supplies enough energy and enough of each nutrient to prevent **malnutrition**. Malnutrition includes deficiencies of nutrients, imbalances, and excesses, any of which can take a toll on health over time.

**KEY POINT** \* The nutrients in food support growth, maintenance, and repair of the body. Deficiencies, excesses, and imbalances of nutrients bring on the diseases of malnutrition.

### **How Powerful Is a Nutritious Diet in Preventing Diseases?**

Your choice of diet profoundly influences your long-term health prospects. Only two common lifestyle habits are more influential: smoking and other tobacco use, and excessive drinking of alcohol.<sup>2</sup> Many older people suffer from debilitating conditions that could have been largely prevented had they known the nutrition principles that we know today and applied those principles throughout their lives.

