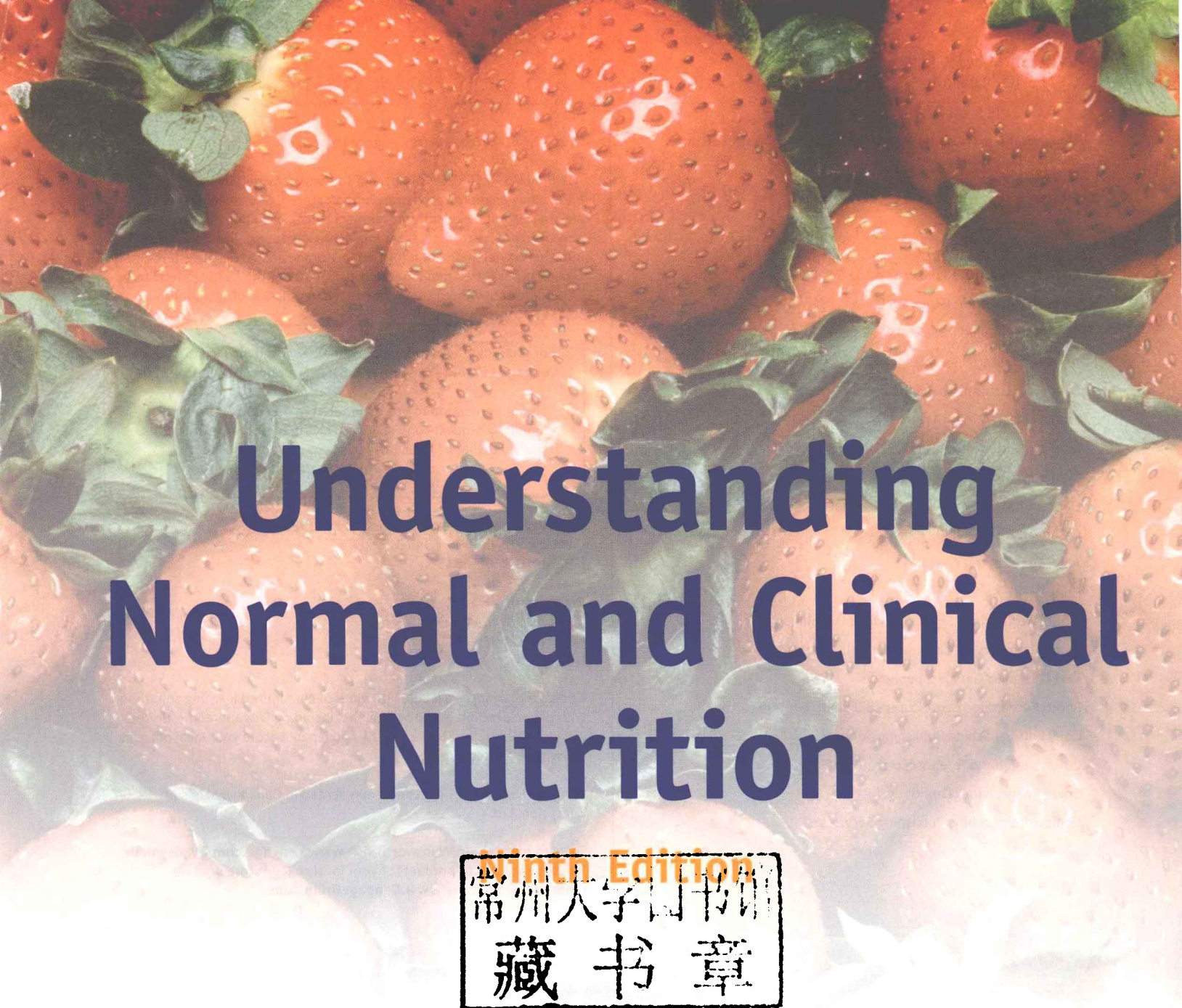
UNDERSTANDING

normal and clinical nutrition

9e

ROLFES | PINNA | WHITNEY



Understanding Normal and Clinical Nutrition

Ninth Edition

Sharon Rady Rolfes
Kathryn Pinna
Ellie Whitney

WADSWORTH
CENGAGE Learning

Australia • Brazil • Japan • Korea • Mexico • Singapore
Spain • United Kingdom • United States

WADSWORTH
CENGAGE Learning

***Understanding Normal and Clinical Nutrition*, Ninth Edition**
Sharon Rady Rolfes
Kathryn Pinna
Ellie Whitney

Publisher/Executive Editor: Yolanda Cossio
Acquisitions Editor: Peggy Williams
Developmental Editor: Elesha Feldman
Assistant Editor: Elesha Feldman
Editorial Assistant: Shana Baldassari
Media Editor: Miriam Myers
Marketing Manager: Laura McGinn
Marketing Communications Manager: Linda Yip
Content Project Manager: Carol Samet
Creative Director: Rob Hugel
Art Director: John Walker
Print Buyer: Karen Hunt
Rights Acquisitions Specialist: Dean Dauphinais
Production Service: Lachina Publishing Services
Text Designer: Gary Hespenheide
Photo Researcher: Scott Rosen, Bill Smith Group
Copy Editor: Lachina Publishing Services
Cover Designer: Riezebos Holzbaur/Brie Hattey
Cover Image: istock©mbbirdy
Compositor: Lachina Publishing Services

Library of Congress Control Number: 2011920459
ISBN-13: 978-0-8400-6845-3
ISBN-10: 0-8400-6845-X

Wadsworth
20 Davis Drive
Belmont, CA 94002-3098
USA

Cengage Learning is a leading provider of customized learning solutions with office locations around the globe, including Singapore, the United Kingdom, Australia, Mexico, Brazil, and Japan. Locate your local office at **www.cengage.com/global**.

Cengage Learning products are represented in Canada by Nelson Education, Ltd.

To learn more about Wadsworth visit **www.cengage.com/Wadsworth**
Purchase any of our products at your local college store or at our preferred online store **www.CengageBrain.com**.

Printed in Canada
1 2 3 4 5 6 7 15 14 13 12 11

To Ellie Whitney, my mentor, partner, and friend, with much appreciation for believing in me, sharing your wisdom, and giving me the opportunity to pursue a career more challenging and rewarding than any I could have imagined.

Sharon

To my mother, Tina Pinna, for her many years of love and support.

Kathryn

To the memory of Gary Woodruff, the editor who first encouraged me to write.

Ellie

About the Authors

Sharon Rady Rolfes received her M.S. in nutrition and food science from Florida State University. She is a founding member of Nutrition and Health Associates, an information resource center that maintains a research database on over 1000 nutrition-related topics. Her other publications include the college textbooks *Understanding Nutrition* and *Nutrition for Health and Health Care* and a multimedia CD-ROM called *Nutrition Interactive*. In addition to writing, she occasionally teaches at Florida State University and serves as a consultant for various educational projects. Her volunteer work includes serving on the board of Working Well, a community initiative dedicated to creating a healthy workforce. She maintains her registration as a dietitian and membership in the American Dietetic Association.

Kathryn Pinna received her M.S. and Ph.D. degrees in nutrition from the University of California at Berkeley. She has taught nutrition, food science, and human biology courses in the San Francisco Bay area for over 20 years and currently teaches nutrition classes at City College of San Francisco. She has also worked as an outpatient dietitian, Internet consultant, and freelance writer. Her other publications include the textbooks *Nutrition for Health and Health Care* and *Nutrition and Diet Therapy*. She is a registered dietitian and a member of the American Society for Nutrition and the American Dietetic Association.

Ellie Whitney, Ph.D., grew up in New York City and received her B.A. and Ph.D. degrees in English and biology at Radcliffe/Harvard University and Washington University, respectively. She has taught at both Florida State University and Florida A&M University, has written newspaper columns on environmental matters for the *Tallahassee Democrat*, and has authored almost a dozen college textbooks on nutrition, health, and related topics, many of which have been revised multiple times over the years. In addition to teaching and writing, she has spent the past three-plus decades exploring outdoor Florida and studying its ecology. Her latest book is *Priceless Florida: The Natural Ecosystems* (Pineapple Press, 2004).

Preface

As we launch this ninth edition of *Understanding Normal and Clinical Nutrition*, nutrition research continues to uncover the many complex relationships between nutrition and health. Together with other lifestyle practices, sound nutrition remains a cornerstone of good health status and disease prevention and treatment. Our goals for this edition are therefore to incorporate current research findings into these pages while retaining the core information necessary for a beginning course in nutrition. As with previous editions, each chapter has been substantially revised and updated. New topics, such as functional foods, nutritional genomics, probiotics, and bariatric surgery, are introduced and some existing topics more fully explored. The chapters include practical information and valuable resources to help readers apply nutrition knowledge and skills to their daily lives and the clinical setting.

A main objective in writing this book has always been to share our enthusiasm about nutrition in a manner that motivates students to study and learn. Moreover, we seek to provide accurate information that is meaningful to the student or health professional. Students of nutrition often find the subject to be both fascinating and overwhelming; there are so many "details" to learn—new terms, new chemical structures, and new biological concepts. Taken one step at a time, however, the science of nutrition may seem less daunting and the "facts" more memorable. We hope that this book serves you well.

A Book Tour of This Edition

Understanding Normal and Clinical Nutrition presents updated, comprehensive coverage of the fundamentals of nutrition and nutrition therapy for an introductory nutrition course. The early chapters introduce the nutrients and their work in the body as well as recommendations about nutrition that are essential for maintaining health and preventing disease. The later chapters provide instruction in clinical nutrition—the pathophysiology and nutrition care for a wide range of medical conditions.

The Chapters Chapter 1 begins by exploring why we eat the foods we do and continues with a brief overview of the nutrients, the science of nutrition, recommended nutrient intakes, and important relationships between nutrition and health. Chapter 2 describes the menu-planning principles and food guides used to create diets that support good health and includes instructions on how to read a food label. In Chapter 3, readers follow the journey of digestion and absorption as the body breaks down foods into absorbable nutrients. Chapters 4 through 6 describe carbohydrates, fats, and proteins—their chemistry, roles in the body, and places in the diet. Chapter 7 shows how the body derives energy from these three nutrients. Chapters 8 and 9 continue the story with a look at energy balance, the factors associated with overweight and underweight, and the benefits and risks of weight loss and weight gain. Chapters 10 through 13 describe the vitamins, the minerals, and water—their roles in the body, deficiency and toxicity symptoms, and food sources. Chapters 14 through 16 complete the "normal" chapters by presenting the special nutrient needs of people through the life cycle—pregnancy and lactation, infancy, childhood, adolescence, and adulthood and the later years.

The remaining "clinical" chapters of the book focus on the nutrition care of individuals with health problems. Chapter 17 explains how illnesses and their treatments influence nutrient needs and describes the process of nutrition assessment. Chapter 18 discusses how nutrition care is implemented and introduces the different types of therapeutic diets used in patient care. Chapter 19 explores the potential interactions between nutrients and medications and examines the benefits and risks associated with herbal products. Chapters 20 and 21 describe special ways of feeding people who cannot eat conventional foods. Chapter 22 explains the inflammatory process and shows how metabolic and respiratory stress influence nutrient needs. Chapters 23 through 29 explore the pathology, medical treatment, and nutrition therapy for specific diseases, including gastrointestinal disorders, liver disease, diabetes mellitus, cardiovascular diseases, renal diseases, cancer, and HIV infection.

The Highlights Each chapter is followed by a highlight that provides readers with an in-depth look at a current, and often controversial, topic that may relate to its companion chapter. New to this edition is a highlight that examines the scientific evidence behind some of the current controversies surrounding carbohydrates and their role in weight gain and weight loss.

Special Features The art and layout in this edition have been carefully designed to be inviting while enhancing student learning. In addition, special features help readers identify key concepts and apply nutrition knowledge. For example, when a new term is introduced, it is printed in bold type, and a **definition** is provided. These definitions often include pronunciations and derivations to facilitate understanding. The glossary at the end of the text includes all defined terms.

definition (DEF-eh-NISH-en): the meaning of a word.
- **de** = from
- **finis** = boundary

Nutrition in Your Life/ Nutrition in the Clinical Setting

Chapters 1 through 16 begin with Nutrition in Your Life sections that introduce the essence of the chapter with a friendly and familiar scenario. Similarly, Chapters 17 through 29 begin with Nutrition in the Clinical Setting sections, which introduce real-life concerns associated with diseases or their treatments.

Nutrition Portfolio / Clinical Portfolio

At the end of Chapters 1 through 16, a Nutrition Portfolio section revisits the messages introduced in the chapter and prompts readers to consider whether their personal choices meet the dietary goals discussed. Chapters 17 through 29 finish with a Clinical Portfolio section, which enables readers to practice their clinical skills by addressing hypothetical clinical situations. New to this edition are instructions for using the Diet Analysis Plus computer program to complete this assignment.

IN SUMMARY **Each major section within a chapter concludes with a summary paragraph that reviews key concepts. Similarly, summary tables organize information in an easy-to-read format.**

Also featured in this edition are the *Dietary Guidelines for Americans*, which are introduced in Chapter 2 and presented throughout the text whenever their subjects are discussed. Look for the following design.

Dietary Guidelines for Americans 2010

These guidelines provide science-based advice to promote health and to reduce the risk of chronic disease through diet and physical activity.

HOW TO Many of the chapters include "How To" sections that guide readers through problem-solving tasks. For example, the "How To" in Chapter 1 takes students through the steps of calculating energy intake from the grams of carbohydrate, fat, and protein in a food; another "How To" in Chapter 18 describes how to estimate the energy requirements of a hospital patient.

TRY IT New to this edition are "Try It" activities that help readers practice the "How To" lessons. Additional activities can be found in CourseMate, the online student study tool that accompanies this text.

CASE STUDY The clinical chapters include case studies that present problems and pose questions that allow readers to apply chapter material to hypothetical situations. Readers who successfully master these exercises will be better prepared to face real-life challenges that arise in the clinical setting.

Nutrition Assessment Checklist

The clinical chapters close with Nutrition Assessment Checklists that help readers evaluate how various disorders impair nutrition status. These sections highlight the medical, dietary, anthropometric, biochemical, and physical findings most relevant to patients with specific diseases. Most of the clinical chapters also include a section on Diet-Drug Interactions that presents the nutrition-related concerns associated with the medications commonly used to treat the disorders described in the chapter.

Nutrition on the Net

Each chapter and many highlights conclude with Nutrition on the Net—a list of websites for further study of topics covered in the accompanying text. These lists do not imply an endorsement of the organizations or their programs. We have tried to provide reputable sources but cannot be responsible for the content of these sites. Read Highlight 1 to learn how to find reliable nutrition information on the Internet.

Study and Reference Cards New to this edition are study cards located at the back of the text—one for each chapter. Each study card presents a review list of the chapter's core concepts, and perhaps a table or figure to remind readers of key points. The backside of the study card provides essay and multiple-choice questions to help prepare students for exams. Following the study cards are a series of handy reference cards featuring the current nutrient recommendations; the Daily Values used on food labels and a glossary of nutrient measures; and aids to calculations and conversions.

The Appendixes The appendixes are valuable references for a number of purposes. Appendix A summarizes background information on the hormonal and nervous systems, complementing Appendixes B and C on basic chemistry, the chemical structures of nutrients, and major metabolic pathways. Appendix D describes measures of protein quality. Appendix E provides supplemental coverage of nutrition assessment, and Appendix F presents the estimated energy requirements for men and women at various levels of physical activity. Appendix G presents the 2008 *Choose Your Foods: Exchange List for Diabetes*. Appendix H is a 2000-item food composition table. Appendix I presents recommendations from the World Health Organization (WHO) and information for Canadians—the 2005 *Beyond the Basics* meal-planning system and guidelines to healthy eating and

physical activities. Appendix J presents the Healthy People 2020 nutrition-related objectives. Appendix K provides examples of commercial enteral formulas commonly used in tube feedings or to supplement oral diets.

The Inside Covers The inside covers put commonly used information at your fingertips. The front covers (pp. A–C) present the current nutrient recommendations; and the inside back cover (p. Z on the right) shows the suggested weight ranges for various heights.

Notable Changes in This Edition

Much has changed in the world of nutrition and in our daily lives since the first edition. The connections between diet and disease have become more apparent—and consumer interest in making smart health choices has followed. More people are living longer and healthier lives. The science of nutrition has grown rapidly, with new "facts" emerging daily. In this edition, as with all previous editions, every chapter has been revised to enhance learning by presenting current information accurately and attractively.

For all chapters and highlights we have:

- Reviewed and updated content throughout the text, including the 2010 *Dietary Guidelines for Americans,* Healthy People 2020, and the 2011 Dietary Reference Intakes for calcium and vitamin D
- Created several new figures and tables and revised old ones to enhance learning
- Added activities to "How To" features
- Moved all Nutrition Calculation activities from the end of the chapters to the website
- Added *Diet Analysis Plus* activities to Nutrition Portfolios at the end of the chapters

Chapter 1

- Added a table describing the parts of a typical research article
- Updated the text and table for Healthy People 2020

Chapter 2

- Updated all text, tables, and figures to reflect the 2010 *Dietary Guidelines for Americans*
- Introduced the concept of nutrient profiling
- Created a new section that introduces the Healthy Eating Index and evaluates the current American diet against dietary guidelines
- Created a new figure comparing recommendations with actual intakes
- Created a new figure comparing low-fat milk and soy milk
- Created a new table listing good vegetarian sources of key nutrients

Chapter 3

- Created a new figure using gastrin as an example of a negative feedback loop (created similar figures for other GI hormones that are provided in the Instructor's Manual)
- Described how heart disease can damage the digestive tract (intestinal ischemia)

Chapter 4

- Added new photos to reinforce the concept that glucose is the primary fuel of the brain and to illustrate how consumers can read food labels to find whole-grain products
- Refocused organization on the monosaccharides, disaccharides, and polysaccharides (instead of "simple carbohydrates" and "complex carbohydrates")
- Added a little more on resistant starch; deleted a little from glycemic index
- Moved an introduction of alternative sweeteners from the highlight into the chapter; created a new table of alternative sweeteners; moved discussion on alternative sweeteners and weight control to Chapter 9
- Moved controversies surrounding sugars to the highlight and other chapters as appropriate
- Created a new highlight that explores the roles of carbohydrates in weight gain and in weight loss

Chapter 5

- Created a new figure diagramming how saturated fatty acids tend to "stack" and unsaturated fatty acids do not, helping explain why saturated fats tend to be solid in foods at room temperature and to clog arteries in the body
- Created a new figure summarizing lipid transport via lipoproteins
- Added discussion on endocrine role of adipose tissue and introduced adipokines

Chapter 6

- Introduced the terms *primary, secondary, tertiary,* and *quaternary* to the discussion on protein structure
- Simplified the discussion on fluid balance and added a photo of edema
- Moved the discussions on deamination, transamination, ammonia production, and urea excretion from Chapter 7 (metabolism) to here
- Created a new figure describing nutritional genomics
- Created a new figure illustrating nutrient regulation of gene expression

Chapter 7

- Moved the mitochondrion blowout from the figure of a typical cell to a new figure later in the chapter
- Revised the ATP figure illustrating the capture and release of energy
- Simplified the figure illustrating the glucose-to-energy pathway

- Moved the discussions on deamination, transamination, ammonia production, and urea excretion from here to Chapter 6 (proteins)
- Moved the discussions on low-carbohydrate diets from Highlight 9 to here
- Revised the table of alcoholic beverages to include grams of alcohol and additional drinks

Chapter 8

- Replaced the BMI figure with a BMI table of weights
- Created a new "How To" feature on using the BMI table to determine current BMI and a desired BMI
- Moved "How to Determine Body Weight Based on BMI" based on mathematical equations from the last edition to the Instructor's Manual

Chapter 9

- Introduced the term *nonexercise activity thermogenesis (NEAT)*
- Added discussion on adiponectin
- Created a table of proteins involved in the regulation of food intake and energy homeostasis
- Added discussion on phentermine and diethylpropion to section on drug treatments
- Added discussion on cognitive skills to support weight loss
- Revised Highlight 9 to examine fad diets in general (no longer tightly focused on low-carbohydrate diets)

Chapter 10

- Added discussion differentiating between "wet" and "dry" beriberi
- Rewrote section on folate and cancer
- Rewrote section on vitamin C and the common cold
- Created a figure illustrating dose levels and effects
- Moved the discussion on distinguishing symptoms and causes into the text

Chapter 11

- Created a new "How To" feature on converting IU to weight measurements
- Clarified vitamin A's roles in gene regulation, vision, and bone development
- Provided descriptions of vitamin D's many forms
- Added details on vitamin D's roles in gene regulation and disease development, including discussions on insufficiency, deficiency, and new recommendations
- Added details on vitamin K and osteocalcin

Chapter 12

- Clarified the details of the rennin-angiotensin-aldosterone pathway in the text and created a new figure

Chapter 13

- Simplified discussion of iron and zinc absorption and transport
- Revised the figure showing the fluoride map to reflect recent data
- Revised the table of phytochemicals

Chapter 14

- Elaborated on weight issues, including new weight-gain recommendations, weight gains compared with recommendations, pregnancy after gastric bypass, weight loss during pregnancy, and weight gains after pregnancy
- Added short discussion on maternal PKU and aspartame use

Chapter 15

- Created a new figure that includes MyPyramid for Preschoolers and MyPyramid for Kids
- Expanded discussion in the childhood obesity section
- Created a table of recommended eating and physical activity behaviors to prevent obesity
- Included the new *Physical Activity Guidelines for Americans, 2008* (specific to children)
- Created a table of foods and beverages that meet recommended school food standards
- Created a new figure of age-appropriate physical activities

Chapter 16

- Expanded discussion on immunity and inflammation in the aging process
- Added a figure illustrating a modified pyramid for older adults
- Added discussion on folate and zinc needs of older adults
- Created new figure illustrating the hunger-obesity paradox

Chapter 17

- Replaced the Mini Nutritional Assessment table with a figure
- Revised the table about historical information used in nutrition assessment
- Reorganized the discussions about anthropometric assessment in adults and physical examinations for nutrition assessment

Chapter 18

- Simplified the table of equations for estimating resting metabolic rate
- Incorporated the Mifflin–St. Jeor equation into the "How To" about estimating energy requirements in a hospital patient
- Reorganized the section about implementing nutrition care

Chapter 19

- Revised the introductory section about medications in disease treatment

- Simplified the table on terms prohibited in clinical documentation
- Added specific examples of drugs and drug names throughout the chapter
- Revised the tables listing grapefruit juice–drug interactions and foods high in tyramine
- Moved the section about herbal products to the end of the chapter; simplified the table on herb-drug interactions
- Moved the highlight about complementary and alternative medicine to here

Chapter 20

- Moved the discussion of formula selection to the section introducing enteral formulas
- Moved the discussion about meeting water needs to the section about tube feeding administration
- Revised and reorganized the table about the causes and management of tube feeding complications
- Added a new table to the highlight showing examples of nutrition-related inborn errors of metabolism

Chapter 21

- Revised the "How To" about expressing the osmolar concentration of a solution

Chapter 22

- Modified the discussions about the nutrient needs of patients undergoing acute stress and approaches to nutrition care
- Modified the "How To" about estimating energy needs in critical care patients by including the information in a table listing both the Ireton-Jones and Penn State equations
- Revised and reorganized the overall discussion about respiratory failure, including the description of acute respiratory distress syndrome and the nutrition therapy for acute respiratory failure

Chapter 23

- Revised the listings of foods to avoid in the various dysphagia diets
- Revised and expanded the section on bariatric surgery, including a revision of the "How To" about dietary habits after bariatric surgery

Chapter 24

- Revised or reorganized the tables describing laxatives and bulk-forming agents, foods that cause intestinal gas, foods that affect diarrhea, foods to include or restrict in a fat-controlled diet, and foods to include or restrict in a gluten-free diet
- Added sample menus for a fat-controlled diet and a gluten-free diet
- Revised or modified the sections on pancreatitis, cystic fibrosis, and short bowel syndrome

Chapter 25

- Expanded the descriptions of the different types of hepatitis viruses
- Revised the sections on ascites and the medical treatment and nutrition therapy for cirrhosis
- Revised several paragraphs about risk factors for gallstones
- Moved the highlight about anemia in illness to here

Chapter 26

- Added the glycated hemoglobin measure to the section about diagnosis of diabetes
- Revised the discussion about type 2 diabetes in children and adolescents
- Added a new figure outlining the acute effects of insulin insufficiency
- Revised some discussions related to the complications of diabetes
- Revised the section about physical activity and diabetes management

Chapter 27

- Reorganized and revised the sections on the causes of atherosclerosis
- Modified several sections related to therapeutic lifestyle changes for coronary heart disease (CHD)
- Reorganized the "How To" on the evaluation and treatment of high blood cholesterol levels; moved the discussion about drug therapies for CHD prevention from the text to the "How To"
- Expanded the section on stroke management and moved the sections about stroke to follow the discussion of CHD
- In the section on the treatment of hypertension, revised the paragraph about weight reduction and added a paragraph about physical activity
- Revised the discussion about the consequences of heart failure

Chapter 28

- Revised the discussions about the nephrotic syndrome and its consequences; revised the table describing a sodium-controlled diet
- Modified several paragraphs related to the consequences and treatment of acute kidney injury
- In the section on chronic kidney disease, revised discussions about the uremic syndrome and various aspects of nutrition therapy
- Added new tables showing the approximate potassium content of common fruits and vegetables, foods high in phosphorus, and an appropriate menu for a person with chronic kidney disease
- Revised the section on the nutrition therapy following a kidney transplant; eliminated the table on dietary guidelines following a transplant

- In the section on kidney stones, added a paragraph about calcium phosphate stones, revised the table on foods high in oxalate, and eliminated the table on foods high in purines
- In the section on the prevention and treatment of kidney stones, revised the discussion about calcium oxalate stones and added a paragraph about the medical treatment of kidney stones

Chapter 29

- Modified the discussion about nutrition and cancer risk and the table about recommendations for reducing risk
- Modified the section about hematopoietic stem cell transplantation; added a section about biological therapies for cancer
- Expanded the "How To" about increasing kcalories and protein in meals
- Added a section about the low-microbial diet for individuals with suppressed immunity
- Reorganized and revised the section on nutrition therapy for HIV infection, including a discussion about weight management and overweight/obesity
- Moved the highlight about food allergies to here

Student and Instructor Resources

- **CourseMate:** An intelligent, Web-based study system, CourseMate provides a completely integrated package of quizzes, personalized study, animations, videos, case studies, and more—along with the capability for instructors to track student progress. New to this edition is a set of 11 videos covering more difficult concepts. Videos are available as pop-up tutors in the e-book and can be downloaded to an iPod or other portable device.
- **Power Lecture DVD-ROM:** This one-stop course preparation and presentation resource makes it easy for you to assemble, edit, publish, and present custom lectures for your course, using PowerPoint®. The PowerLecture includes PowerPoint®, animations, BBC video clips, the instructor's manual, the test bank, "clicker" content, and ExamView computerized testing.
- **Test Bank:** The test bank features a large assortment of multiple-choice questions (categorized by knowledge or application), essay questions, and matching exercises, now organized by chapter section title for easier item selection.
- **Instructor's Manual:** New to this edition are assignable case studies, critical-thinking questions, and Internet exercises, all with grading rubrics. This comprehensive manual also includes chapter objectives, chapter outlines, answer keys for the new "How To" exercises from the text, assignment worksheets, handouts, and classroom activity suggestions. (For Canadian adopters, the manual contains a Canadian information section with equivalencies, nutrient recommendations, and more.)

Closing Comments

We have taken great care to provide accurate information and have included many references at the end of each chapter and highlight. However, to keep the number of references manageable, many statements that appeared in previous editions with references now appear without them. All statements reflect current nutrition knowledge and the authors will supply references upon request. In addition to supporting text statements, the end-of-chapter references provide readers with resources for finding a good overview or more details on the subject. Nutrition is a fascinating subject, and we hope our enthusiasm for it comes through on every page.

Sharon Rady Rolfes
Kathryn Pinna
Ellie Whitney
June 2011

Acknowledgments

To produce a book requires the coordinated effort of a team of people—and, no doubt, each team member has another team of support people as well. We salute, with a big round of applause, everyone who has worked so diligently to ensure the quality of this book.

We thank our partners and friends, Linda DeBruyne and Fran Webb, for their valuable consultations and contributions; working together over the past 25-plus years has been a most wonderful experience. We especially appreciate Linda's research assistance on several chapters. Special thanks to Elesha Feldman, whose critical eye, numerous suggestions, and unceasing support were especially helpful in revising the clinical chapters. Additional thank yous to our colleagues Gail Hammond for her Canadian perspective, and David Stone for his help in critiquing various sections in the clinical chapters. Thanks also to Alex Rodriguez for her work on manuscript preparation and to James Gegenheimer for his assistance in creating informative tables and descriptive figures.

We also thank the many professors who prepared the ancillaries that accompany this text: Harry Sitren and Ileana Trautwein for writing and enhancing the test bank; and Connie Goff, Jorunn Gran-Henriksen, Gail Hammond, Mandy Graves Hillstrom, Melissa Langone, Barbara Quinn, Kathleen Rourke, and Daryle Wane for contributing to the Instructor's Manual. Thanks also to Lauren Tarson, Shelly Ryan, Elesha Feldman, and the folks at Axxya Systems for their assistance in creating the food composition appendix and developing the computerized *Diet Analysis Plus* program that accompanies this book.

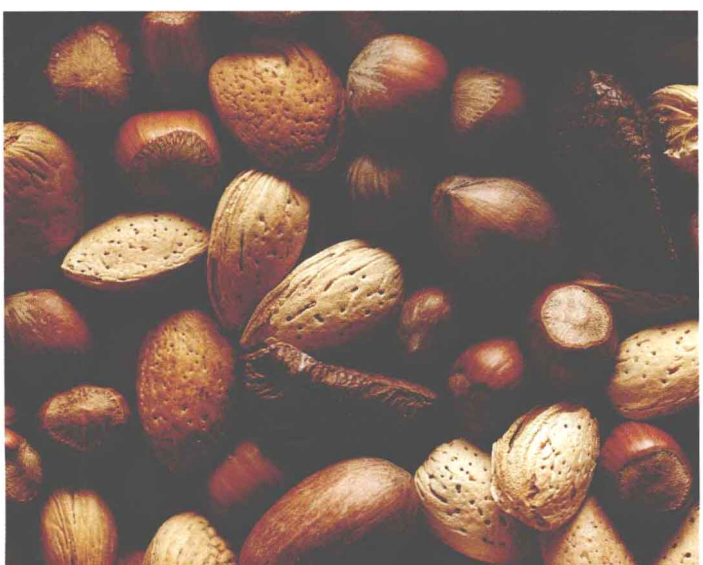
Our heartfelt thanks to our editorial team for their efforts in creating an outstanding nutrition textbook—Peggy Williams for her leadership and support; Nedah Rose for her thoughtful suggestions and efficient analysis of reviews; Carol Samet for her management of this project; Laura McGinn for her energetic efforts in marketing; Miriam Myers and Lauren Tarson for their dedication in developing online animations and study tools; Dean Dauphinais, Bill Jentzen, and Karyn Morrison for their assistance in obtaining permissions; and Elesha Feldman for her masterminding of ancillaries.

We also thank Gary Hespenheide for creatively designing these pages; Josh Garvin/Bill Smith Group for selecting photographs that deliver nutrition messages attractively; Susan Gall for copyediting more than 2000 manuscript pages; and Pat Lewis for proofreading close to 1000 final text pages. We would also like to extend our gratitude to the talented team at Lachina Publishing Services for their assistance with layout, production, proofreading, copyediting, and indexing. To the hundreds of others involved in production and sales, we tip our hats in appreciation.

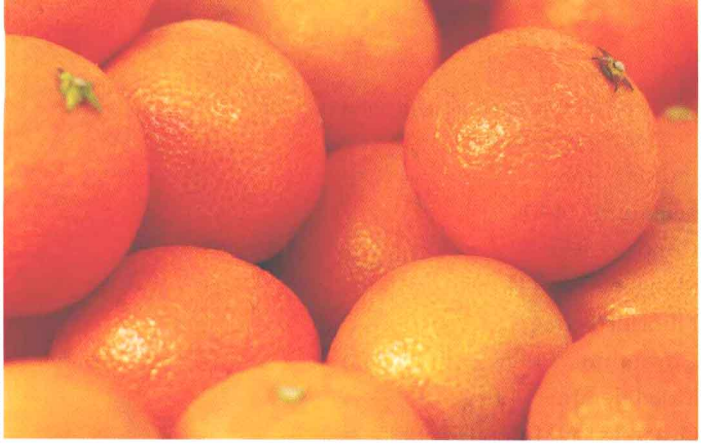
We are especially grateful to our friends and families for their continued encouragement and support. We also thank our many reviewers for their comments and contributions.

Brief Contents

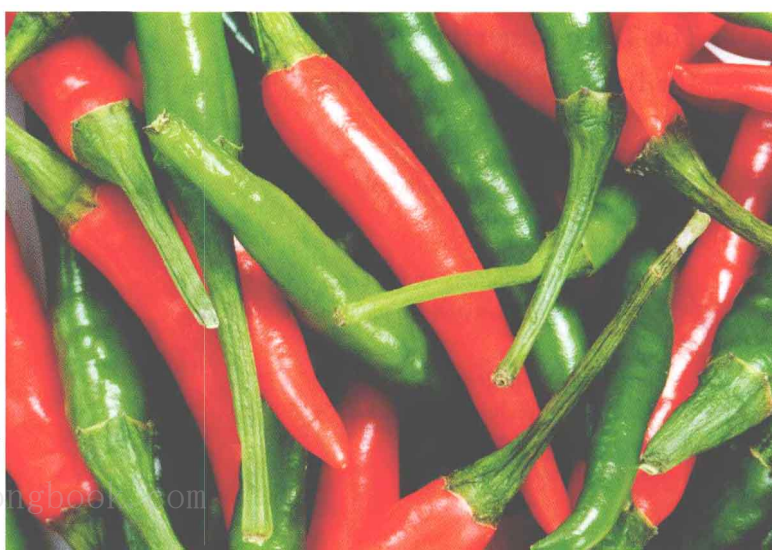
Contents



J. Helgason/Shutterstock.com



HGalina/Shutterstock.com



Elnur/Shutterstock.com