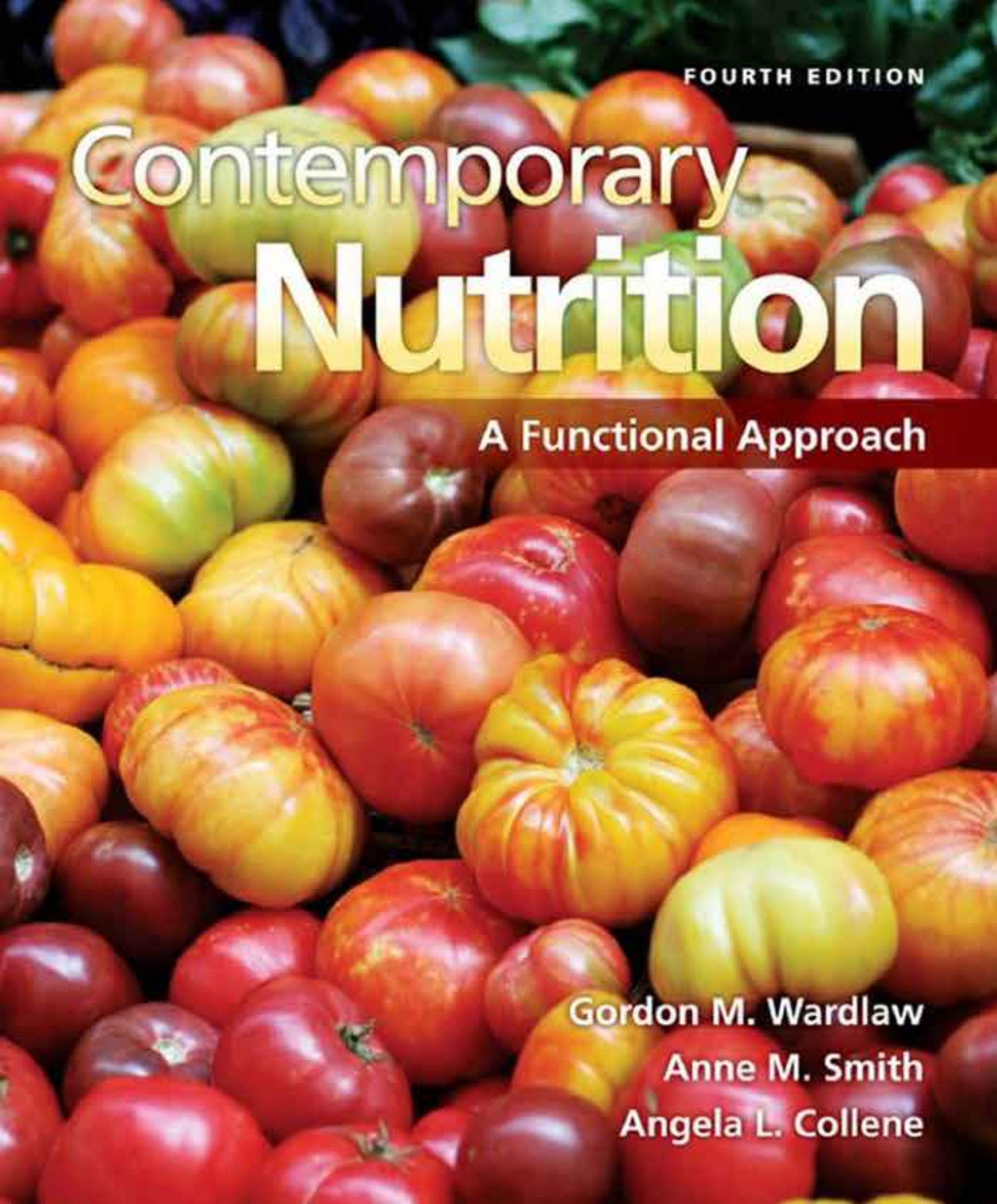
FOURTH EDITION
Contemporary
Nutrition
A Functional Approach
Gordon M. Wardlaw
Anne M. Smith
Angela L. Collene

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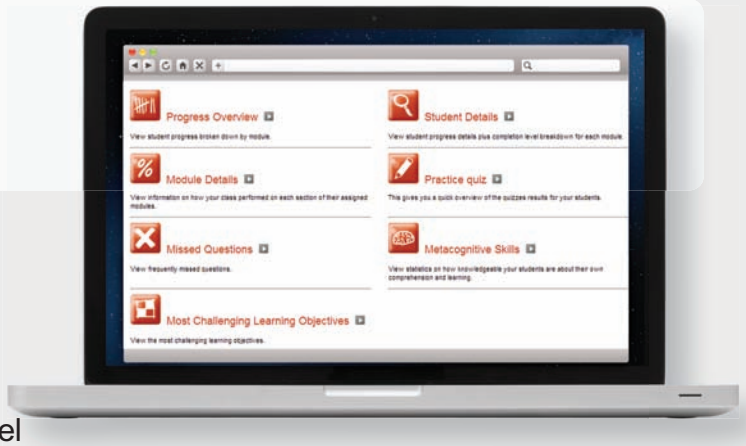

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CONTEMPORARY NUTRITION: A FUNCTIONAL APPROACH, FOURTH EDITION

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Brief Contents





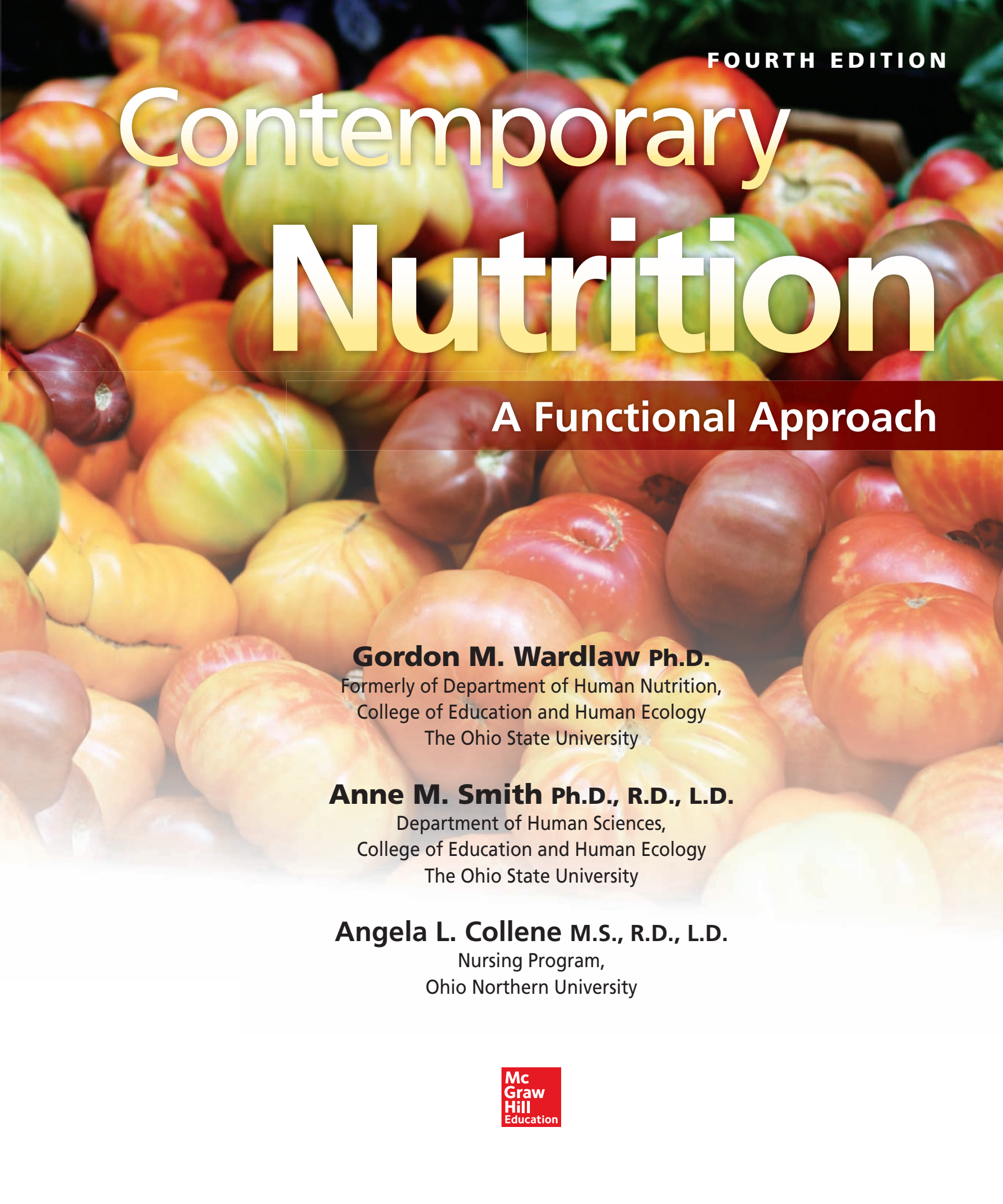
Dear Students,

Welcome to the fascinating world of nutrition! We are all nutrition experts, in a sense, because we all eat—several times a day. At the same time, though, nutrition can seem a bit confusing. One reason for all the confusion is that it seems like "good nutrition" is a moving target: different authorities have different ideas of how we should eat and nutrition recommendations are subject to change! Are eggs good for us or not? Should we eat foods that contain gluten or not? Second, there are so many choices. Did you know that the average supermarket carries about 40,000 food and beverage products? Food manufacturers and grocery chains have one purpose–to make a profit. Typically, the most aggressively marketed items are not the healthiest. This has made shopping very complicated. In addition, as a nation, we eat out a lot. When we eat foods that someone else has prepared for us, we surrender control over how much salt and fat is in our food, where the food came from, and how much of it goes on our plates. There is a lot yet to learn, and you are undoubtedly interested in what you should be eating and how the food you eat affects you.

Contemporary Nutrition: A Functional Approach *is designed to accurately convey changing and seemingly conflicting messages to all kinds of students. Our students commonly have misconceptions about nutrition, and many have a limited background in biology or chemistry. We teach complex scientific concepts at a level that will enable you to apply the material to your own life.*

We have written Contemporary Nutrition: A Functional Approach *to help you make informed choices about the food you eat. We will take you through explanations of the nutrients in food and their relationship to health, but will also make you aware of the multitude of other factors that drive food choices. To guide you, we refer to many reputable research studies, books, policies, and websites throughout the book. With this information at your fingertips, you will be well equipped to make your own informed choices about what and how much to eat. There is much to learn, so let's get started!*

Anne Smith
Angela Collene



FOURTH EDITION

Contemporary Nutrition

A Functional Approach

Gordon M. Wardlaw Ph.D.
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Mc Graw Hill Education

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GORDON M. WARDLAW, Ph.D., has taught introductory nutrition courses to students in the Department of Human Nutrition at The Ohio State University and at other colleges and universities. Dr. Wardlaw is the author of many articles that have appeared in prominent nutrition, biology, physiology, and biochemistry journals and was the 1985 recipient of the American Dietetic Association's Mary P. Huddleson Award. Dr. Wardlaw is a member of the American Society for Nutrition and is certified as a Specialist in Human Nutrition by the American Board of Nutrition. Dr. Wardlaw is currently retired from academia.

ANNE M. SMITH, Ph.D., R.D., L.D., is an associate professor and currently teaches nutrition at The Ohio State University. She was the recipient of the 1995 Outstanding Teacher Award from the College of Human Ecology, the 2008 Outstanding Dietetic Educator Award from the Ohio Dietetic Association, and the 1998 Emerging Dietetic Leader Award from the American Dietetic Association. She also was awarded the 2006 Outstanding Faculty Member Award from the Department of Human Nutrition and the 2011 Distinguished Service Award from the College of Education and Human Ecology for her commitment to undergraduate education in nutrition. Dr. Smith has conducted research in the area of vitamin and mineral metabolism and was awarded the 1996 Departmental Research Award from the Ohio Agricultural Research and Development Center. Dr. Smith's research articles have appeared in prominent nutrition journals. She is a member of the American Society for Nutrition and the Academy of Nutrition and Dietetics.

ANGELA L. COLLENE, M.S., R.D., L.D., currently teaches nutrition to nursing students at Ohio Northern University in Ada, Ohio. During her graduate studies at The Ohio State University, where she received the Graduate Student Award in 2003, she had the privilege of learning from both Dr. Wardlaw and Dr. Smith. Her career began in clinical human nutrition research at Ohio State, where she served as a Registered Dietitian and Clinical Studies Coordinator for research studies related to diabetes and aging. Other professional experiences include community nutrition lecturing and counseling, owner of a personal chef business, and many diverse and rewarding science writing and editing projects. Her interests include novel approaches to glycemic control, weight management, and—quite predictably for the mother of three little girls—maternal and child nutrition. Mrs. Collene is a member of the Academy of Nutrition and Dietetics.

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It takes a cooperative and dedicated team to produce a successful textbook. We are privileged to work with many talented people that have made contributions to this latest edition of *Contemporary Nutrition: A Functional Approach.* We are indebted to the energetic staff at McGraw-Hill Education for their commitment to this textbook. We are grateful to Amy Reed, our Brand Manager, for her leadership and support of the *Contemporary Nutrition* team. Our biggest *"thank you"* goes to our Product Developer, Angela FitzPatrick. Angie enthusiastically coordinated the editorial team and guided us through every phase of this revision of the textbook. We are grateful for her analysis of reviews, meticulous editing skills, and day to day encouragement and patience while we wrote the manuscript. We are grateful to our Content Project Manager, Tammy Juran, and her staff for the careful coordination of the numerous production efforts needed to create the very appealing and accurate fourth edition. We appreciate the thorough work and attention to detail of our copy editor, Marilynn Taylor; proofreader, Debbie Budde-Bandy; and photo editors, John Leland and Mary Reeg. We thank our designer, Tara McDermott, who not only guided the visual appeal of this edition, but worked to ensure each page was where it needed to be. Finally, we thank our colleagues, friends, and families for their continued support, encouragement, and genuine interest in nutrition.

Thank you to reviewers

Our goal is to provide students and educators with the most accurate, up-to-date, and useful textbook possible. As with earlier editions, the quality of the fourth edition of *Contemporary Nutrition*: *A Functional Approach* is largely dependent on the thorough, professional assistance of nutrition educators from academic institutions across the nation. We are indebted to these colleagues who reviewed the third edition, evaluated new material for the fourth edition, participated in instructional symposia, and responded to surveys. The advice and suggestions from these colleagues have been used in every chapter and have resulted in a textbook that is current and inviting.

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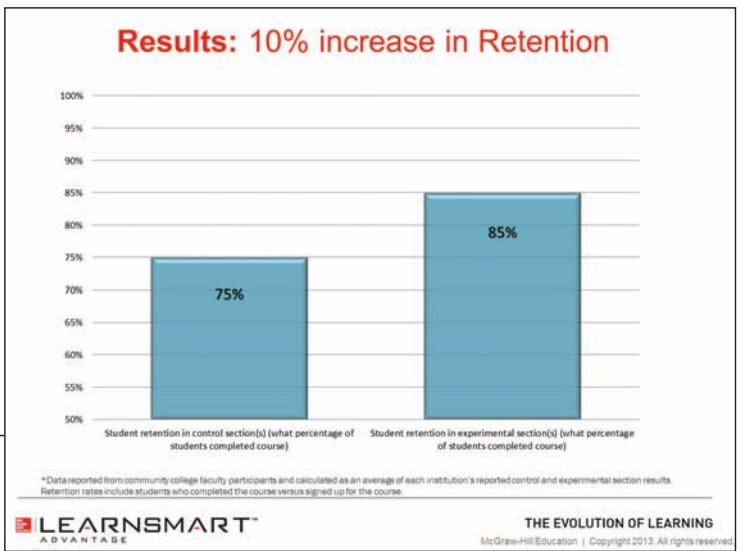
- Retention rates increased an average of **10%** across the schools and by a weighted average of **8%** across all students.

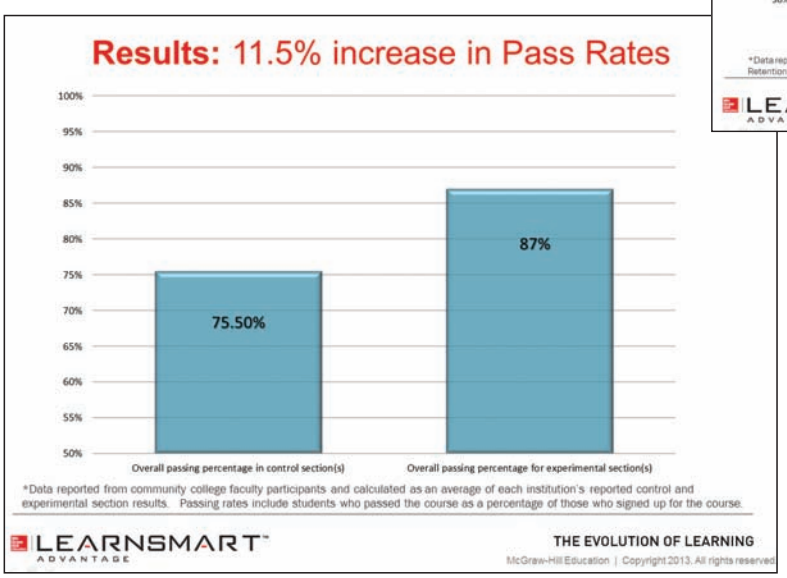
Study details:

- Included two state universities and four community colleges
- Control sections assigned chapter assignments consisting of testbank questions and the experimental sections assigned LearnSmart, both through McGraw-Hill Connect®.
- Both types of assignments were counted as a portion of the grade, and all other course materials and assessments were consistent.
- 358 students opted into the LearnSmart sections and 332 into the sections where testbank questions were assigned.

"After collecting data for five semesters, including two 8-week intensive courses, the trend was very clear: students who used LearnSmart scored higher on exams and tended to achieve a letter grade higher than those who did not."

Gabriel Guzman
Triton College





"LearnSmart has helped me to understand exactly what concepts I do not yet understand. I feel like after I complete a module I have a deeper understanding of the material and a stronger base to then build on to apply the material to more challenging concepts."

Student

Connect Improves Performance

Easily assign key features from the book to increase engagement and learning.

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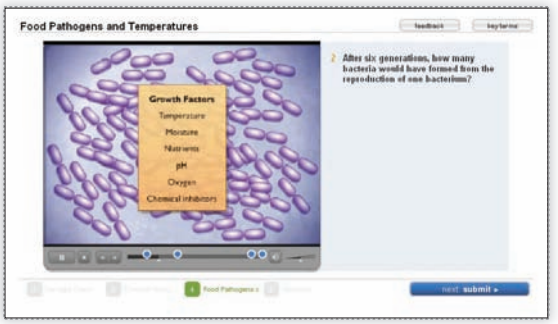
McGraw-Hill ConnectPlus Nutrition is a digital teaching and learning environment that saves students and instructors time while improving performance over a variety of critical outcomes. From in-site tutorials, to tips and best practices, to live help from colleagues and specialists—you're never left alone to maximize Connect's potential.

- **Auto-graded assessments and tutorials**

You can easily create customized assessments that will be automatically graded. All Connect content is created by the authors so it is pedagogical, instructional, and at the appropriate level. Interactive questions using high-quality art from the textbook and animations and videos from a variety of sources take you way beyond multiple choice. Assignable features from the book, such as Newsworthy Nutrition, What Would You Choose, and Rate Your Plate, increase student engagement and understanding.

- **Gather assessment information**

All Connect questions are tagged to a learning outcome, specific section and topic, and Bloom's level so you can easily track assessment data!



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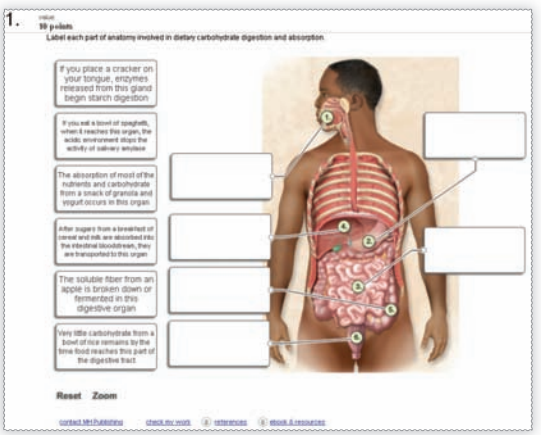
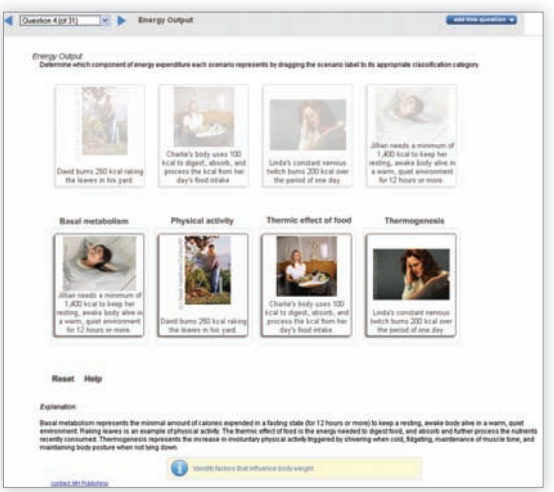
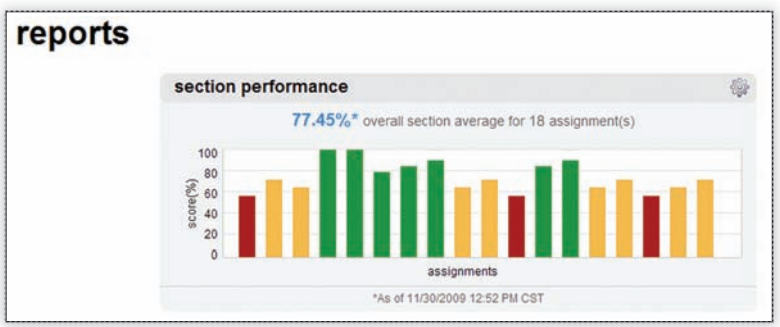


▲ Connect Assessment: Labeling Interactive



▲ Connect Assessment: Classification Interactive



- **Access content anywhere, anytime**

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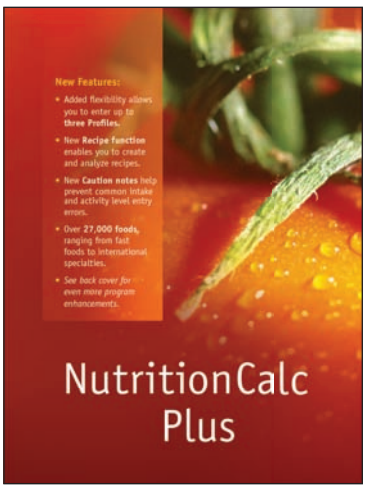
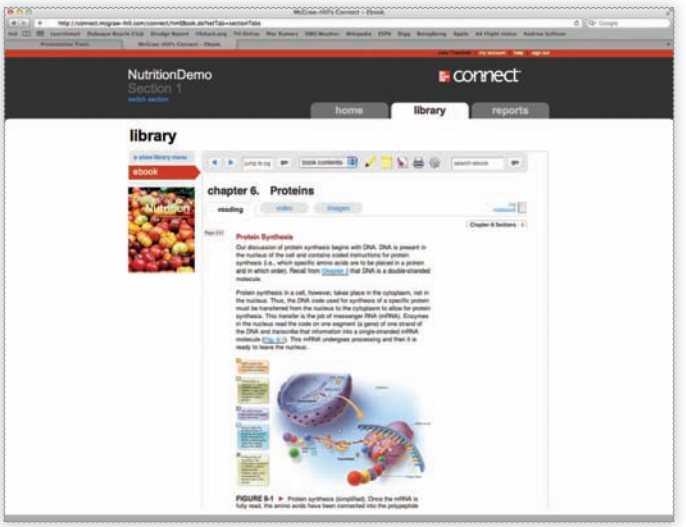
- **Streamline lecture creation**

Presentation tools, such as PowerPoint® lecture outlines, including art, photos, tables, and animations, allow you to customize your lectures.

- **Inspire behavior change**

NutritionCalc Plus dietary analysis software helps students track their food and activity and analyze their choices with a robust selection of reports.





- **Explore additional resources**

Instructors and students can access a variety of additional resources coordinated with the book at **www.mhhe.com/nutrition.**

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Connecting Students to Today's Nutrition

Why the Functional Approach?

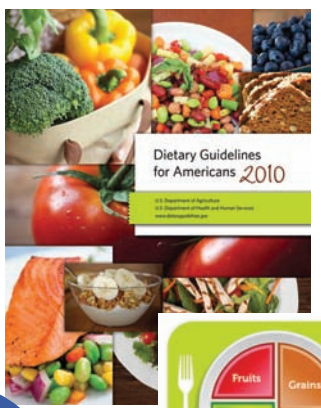
Contemporary Nutrition: A Functional Approach is organized somewhat differently than the traditional nutrition textbook in that Part Three presents information on vitamins, minerals, and water using "a functional approach." Instead of describing these nutrients in their traditional categories (e.g., water soluble vitamins), we discuss them in groups based on their functions as antioxidants or in either fluid and electrolyte balance, bone health, energy metabolism, or blood and immunity. This format will enable students to understand how these nutrients interact in food and in our bodies and how they work together to support key functions that sustain our health.

Understanding Our Audience

We have written *Contemporary Nutrition: A Functional Approach* assuming that our students have a limited background in college-level biology, chemistry, or physiology. We have been careful to include the essential science foundation needed to adequately comprehend certain topics in nutrition, such as protein synthesis in Chapter 6. The science in this text has been presented in a simple, straightforward manner so that undergraduate students can master the material and apply it to their own lives. The Concept Maps that provide a visual depiction of macronutrient functions and characteristics are an additional aid to help students grasp nutrition science.

Featuring the Latest Guidelines and Research

The vast amount of published research is constantly reshaping our knowledge of nutritional science. The fourth edition has been carefully updated to reflect current scientific understanding, as well as the latest health and nutrition guidelines. Students will learn about the Dietary Guidelines for Americans 2010, MyPlate, and Healthy People 2020.



Healthy People 2020

Newsworthy Nutrition, a feature in each chapter, highlights the use of the scientific method in recently published research studies that relate to the chapter topics. In addition, assignable questions in Connect take learning a step farther by asking students to read primary literature and apply what they have learned.

Newsworthy Nutrition

Calcium supplements decrease risk of hip fracture in women

The Women's Health Initiative (WHI) clinical trial randomly assigned 36,282 postmenopausal women in the United States to a placebo or 1000 milligram supplement of calcium carbonate plus 400 IU of vitamin D daily for 7.0 years. The hypothesis of this study was that calcium plus vitamin D supplementation would reduce hip fracture. This study also examined the health benefits and risks of calcium and vitamin D supplementation on total fractures, cardiovascular disease, cancer, and total mortality. Women in both groups were also allowed to take personal calcium and vitamin D supplements during the study, which was accounted for during the analysis of the data. Regarding bone health, the women who took the assigned calcium and vitamin D supplement but took no personal calcium supplements had a 75 percent lower risk of hip fracture than women who got the placebo and took no personal calcium supplements. The results also showed that women assigned to take calcium and vitamin D had no higher risk of heart disease, heart attacks, stroke, colorectal cancer, or total mortality. The supplement group did have a 17 percent increase risk of kidney stones. The authors concluded that long-term use of calcium and vitamin D appears to confer a substantial reduction in the risk of hip fracture among postmenopausal women. Because the risk reduction was significant only in women not taking any additional calcium supplements, it is recommended that women strive to consume the RDA for calcium (1200 milligrams per day) and vitamin D (600 IU/per day up to age 70 and 800 IU per day over 70) from food and supplements combined.

Source: Prentice RL and others: Health risks and benefits from calcium and vitamin D supplementation: Women's Health Initiative clinical trial and cohort study. *Osteoporosis International* 24(2):567, 2013.

connect NUTRITION Check out Connect at **www.mcgrawhillconnect.com** to further explore calcium and vitamin D supplements.

In the new margin feature, *Medicine Cabinet*, we present information on common medications used to treat diseases that have a nutrition connection. A description of the medication is provided along with potential effects on nutritional status.

Medicine Cabinet

Some people take **diuretics** to lower their blood pressure. Diuretics cause the kidneys to excrete more urine but at the same time may increase urinary excretion of minerals. This is nutritionally relevant for regulation of blood levels of potassium, magnesium (see Chapter 11), and zinc (see Chapter 13). People who take potassium-wasting diuretics need to carefully monitor their dietary intake of this mineral. Increased intake of fruits and vegetables or potassium chloride supplements are prescribed by physicians.

Examples:

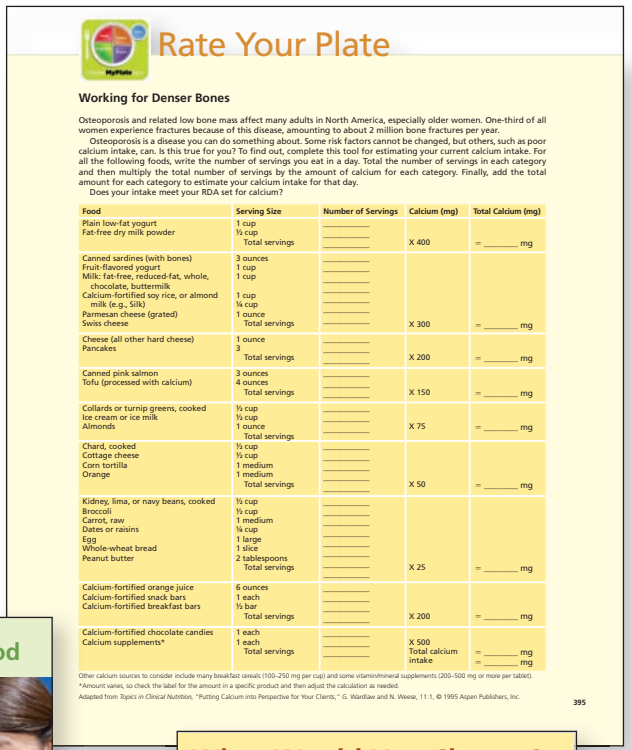
Hydrochlorothiazide (Microzide)

Furosemide (Lasix)

Connecting with a Personal Focus

Applying Nutrition on a Personal Level

Throughout the fourth edition we reinforce the fact that each person responds differently to nutrients. To further convey the importance of applying nutrition to their personal lives, we include many examples of people and situations that resonate with college students. We also stress the importance of learning to intelligently sort through the seemingly endless range of nutrition messages to recognize reliable information and to sensibly apply it to their own lives. Our goal is to provide students the tools they need to eat healthy and make informed nutrition decisions after they leave this course. These features can be assigned and graded through Connect Nutrition to help students learn and apply the information and engage with the text.



Rate Your Plate

Working for Denser Bones

Osteoporosis and related low bone mass affect many adults in North America, especially older women. One-third of all women experience fractures because of this disease, amounting to about 2 million bone fractures per year.

Osteoporosis is a disease you can do something about. Some risk factors cannot be changed, but others, such as poor calcium intake, can. Is this true for you? To find out, complete this tool for estimating your current calcium intake. For all the following foods, write the number of servings you eat in a day. Total the number of servings in each category and then multiply the total number of servings by the amount of calcium for each category. Finally, add the total amount for each category to estimate your calcium intake for that day.

Does your intake meet your RDA set for calcium?

Food	Serving Size	Number of Servings	Calcium (mg)	Total Calcium (mg)
Plain low-fat yogurt Fat-free dry milk powder	1 cup ½ cup Total servings	_____ _____ _____	X 400	= _____ mg
Canned sardines (with bones) Fruit-flavored yogurt Milk: fat-free, reduced-fat, whole, chocolate, buttermilk Calcium-fortified soy rice, or almond milk (e.g., Silk) Parmesan cheese (grated) Swiss cheese	3 ounces 1 cup 1 cup 1 cup ¼ cup 1 ounce Total servings	_____ _____ _____ _____ _____ _____ _____	X 300	= _____ mg
Cheese (all other hard cheese) Pancakes	1 ounce 3 Total servings	_____ _____ _____	X 200	= _____ mg
Canned pink salmon Tofu (processed with calcium)	3 ounces 4 ounces Total servings	_____ _____ _____	X 150	= _____ mg
Collards or turnip greens, cooked Ice cream or ice milk Almonds	½ cup ½ cup 1 ounce Total servings	_____ _____ _____ _____	X 75	= _____ mg
Chard, cooked Cottage cheese Corn tortilla Orange	½ cup ½ cup 1 medium 1 medium Total servings	_____ _____ _____ _____ _____	X 50	= _____ mg
Kidney, lima, or navy beans, cooked Broccoli Carrot, raw Dates or raisins Egg Whole-wheat bread Peanut butter	½ cup ½ cup 1 medium ¼ cup 1 large 1 slice 2 tablespoons Total servings	_____ _____ _____ _____ _____ _____ _____ _____	X 25	= _____ mg
Calcium-fortified orange juice Calcium-fortified snack bars Calcium-fortified breakfast bars	6 ounces 1 each ½ bar Total servings	_____ _____ _____ _____	X 200	= _____ mg
Calcium-fortified chocolate candies Calcium supplements*	1 each 1 each Total servings	_____ _____ _____	X 500 Total calcium intake	= _____ mg = _____ mg

Other calcium sources to consider include many breakfast cereals (100–250 mg per cup) and some vitamin/mineral supplements (200–500 mg or more per tablet).
*Amount varies, so check the label for the amount in a specific product and then adjust the calculation as needed.
Adapted from *Topics in Clinical Nutrition*, "Putting Calcium into Perspective for Your Clients," © Wardlaw and N. Weese, 11:1, © 1995 Aspen Publishers, Inc.

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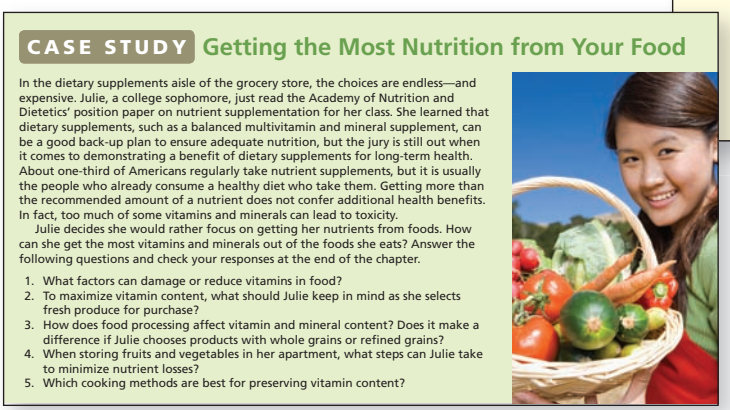


CASE STUDY Getting the Most Nutrition from Your Food

In the dietary supplements aisle of the grocery store, the choices are endless—and expensive. Julie, a college sophomore, just read the Academy of Nutrition and Dietetics' position paper on nutrient supplementation for her class. She learned that dietary supplements, such as a balanced multivitamin and mineral supplement, can be a good back-up plan to ensure adequate nutrition, but the jury is still out when it comes to demonstrating a benefit of dietary supplements for long-term health. About one-third of Americans regularly take nutrient supplements, but it is usually the people who already consume a healthy diet who take them. Getting more than the recommended amount of a nutrient does not confer additional health benefits. In fact, too much of some vitamins and minerals can lead to toxicity.

Julie decides she would rather focus on getting her nutrients from foods. How can she get the most vitamins and minerals out of the foods she eats? Answer the following questions and check your responses at the end of the chapter.

1. What factors can damage or reduce vitamins in food?
2. To maximize vitamin content, what should Julie keep in mind as she selects fresh produce for purchase?
3. How does food processing affect vitamin and mineral content? Does it make a difference if Julie chooses products with whole grains or refined grains?
4. When storing fruits and vegetables in her apartment, what steps can Julie take to minimize nutrient losses?
5. Which cooking methods are best for preserving vitamin content?

What Would You Choose?

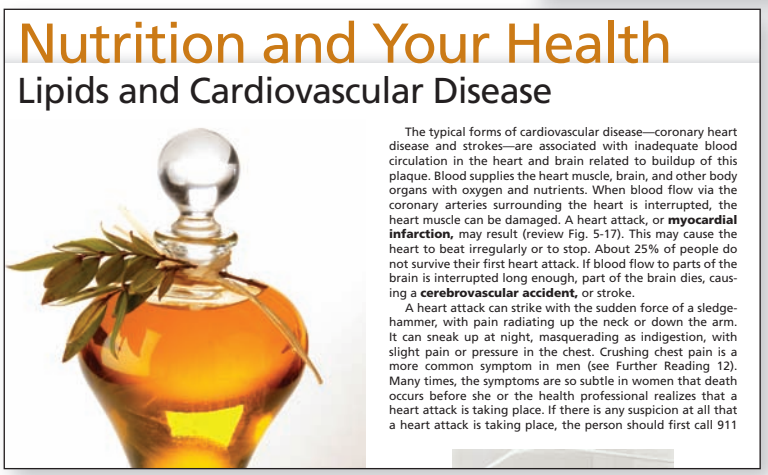
With a class schedule that begins at 8 every morning, you are searching for a beverage that will jump-start your day as well as provide antioxidants that will boost your body's defense against stress. You know that coffee is the most common morning pick-me-up, but lately you have been hearing a lot about the health benefits of tea, especially green tea. Which of the following would you choose as the first drink of the day to make you alert while also decreasing your risk of oxidative stress and other health concerns?

- **a** Tall 12-ounce cup of Starbucks Pike Place® Roast coffee
- **b** 8-ounce cup of fresh-brewed green tea (from Lipton Natural Green Tea bag)
- **c** 8-ounce cup of fresh-brewed black tea (from Lipton 100% Natural Tea bag)
- **d** 17-ounce bottle of Honest Tea Honey Green Tea®

connect NUTRITION **Think about your choice as you read Chapter 10, then see What the Dietitian Chose at the end of the chapter. To learn more about the health benefits of antioxidant phytochemicals, check out the Connect site: www.mcgrawhillconnect.com.**

Challenging Students to Think Critically

The pages of *Contemporary Nutrition: A Functional Approach* contain numerous opportunities for students to learn more about themselves and their diet and to use their new knowledge of nutrition to improve their health. These pedagogical elements include Critical Thinking, Case Studies, Nutrition and Your Health, What Would You Choose?, and Newsworthy Nutrition. Many of the thought-provoking topics highlighted in these features are expanded upon in the online resources found in Connect Nutrition.



Nutrition and Your Health

Lipids and Cardiovascular Disease

The typical forms of cardiovascular disease—coronary heart disease and strokes—are associated with inadequate blood circulation in the heart and brain related to buildup of this plaque. Blood supplies the heart muscle, brain, and other body organs with oxygen and nutrients. When blood flow via the coronary arteries surrounding the heart is interrupted, the heart muscle can be damaged. A heart attack, or **myocardial infarction,** may result (review Fig. 5-17). This may cause the heart to beat irregularly or to stop. About 25% of people do not survive their first heart attack. If blood flow to parts of the brain is interrupted long enough, part of the brain dies, causing a **cerebrovascular accident,** or stroke.

A heart attack can strike with the sudden force of a sledgehammer, with pain radiating up the neck or down the arm. It can sneak up at night, masquerading as indigestion, with slight pain or pressure in the chest. Crushing chest pain is a more common symptom in men (see Further Reading 12). Many times, the symptoms are so subtle in women that death occurs before she or the health professional realizes that a heart attack is taking place. If there is any suspicion at all that a heart attack is taking place, the person should first call 911

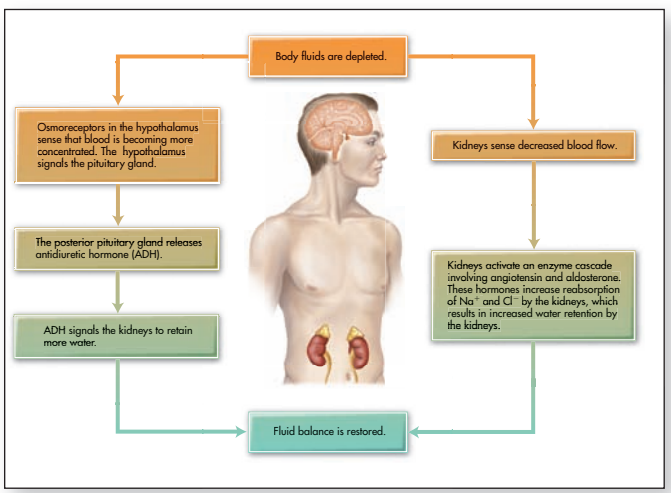
Connecting to Engaging Visuals

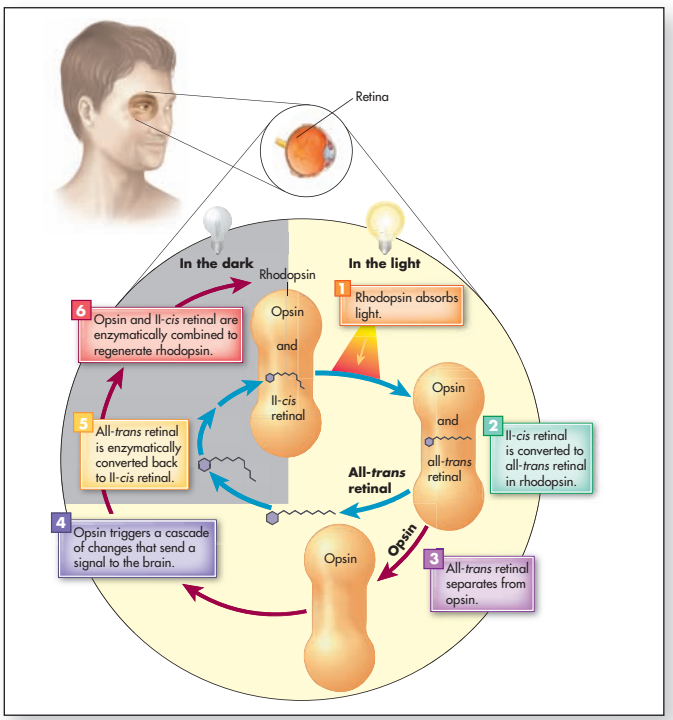
Attractive, Accurate Artwork

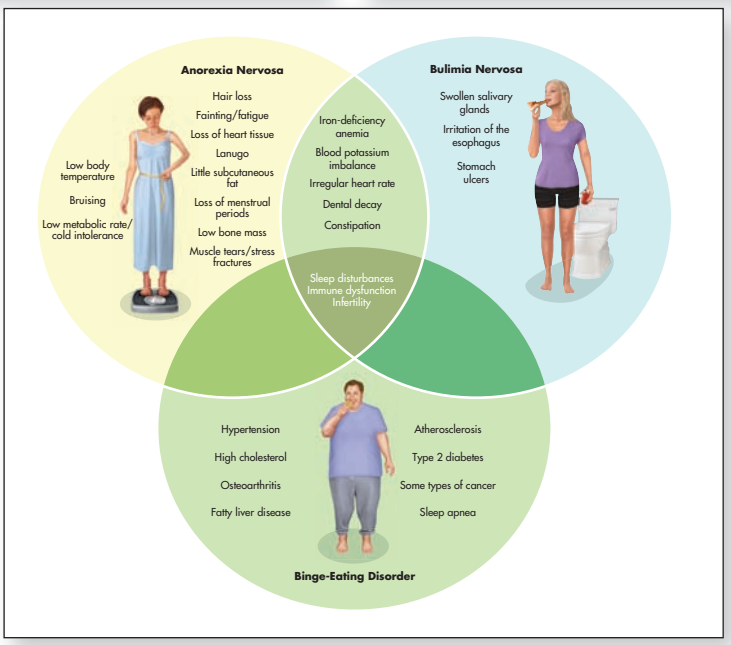
Illustrations, photographs, and tables in the text were created to help students more easily master complex scientific concepts.

- Many illustrations were updated or replaced to inspire student inquiry and comprehension and to promote interest and retention of information. Many were also redesigned to use brighter colors and a more attractive, contemporary style.
- In many figures, color-coding and directional arrows make it easier to follow events and reinforce interrelationships. Process descriptions appear in the body of the figures. This pairing of the action and an explanation walks students step-by-step through the process and increases teaching effectiveness.

The final result is a striking visual program that holds readers' attention and supports the goals of clarity, ease of comprehension, and critical thinking. The attractive layout and design of this edition are clean, bright, and inviting. This creative presentation of the material is geared toward engaging today's visually oriented students.







Connecting with the Latest Updates

Chapter-by-Chapter Revisions

Chapter 1: *Nutrition, Food Choices, and Health*

- Chapter 1 has a new title to reflect the discussion of food choices and their influence on overall health.
- Figure 1-2 is a new illustration depicting the marketing expenditures used to promote food and beverages to children and teens in the U.S. The pledge to limit food advertising to children as part of the Children's Food and Beverage Advertising Initiative (CFBAI) is also discussed.
- An update on restaurant menu label regulations is included.
- A grilled chicken sandwich is now used as the example food for calculating calories.
- A review of the scientific method behind nutrition recommendations has been moved to Chapter 1 (Section 1.5: How do we know what we know about nutrition?), along with an introduction to our *Newsworthy Nutrition* feature that is used throughout the book. The new Figure 1-5 illustrates the steps used for testing all types of hypotheses.
- Figure 1-7 showing the percentage of adults who were obese in 2011, as well as other obesity statistics, has been updated.
- A new *Newsworthy Nutrition,* Health Status of Baby Boomers Appears Lower Than Previous Generation, has been included.
- New evidence that most college students do not gain the "freshmen fifteen" is included in the Nutrition and Your Health on Eating Well in College.
- Further Readings have been updated with six new articles.

Chapter 2: *Guidelines for Designing a Healthy Diet*

- Chapter 2 has been reorganized to begin with discussion of the 2010 Dietary Guidelines and 2008 Physical Activity Guidelines for Americans, and end with a description of the Dietary Reference Intakes.
- "Food Labels and Diet Planning" has been moved to be the new Nutrition and Your Health followed by a new Case Study, "Using the Nutrition Facts Label to Make Food Choices."
- A new *What Would You Choose?* feature illustrates nutrient density and energy density of various beverage choices.
- The term *proportionality* has been introduced in chapter 2 to describe the concept of eating more nutrient dense foods.
- There are six new Further Readings.

Chapter 3: *The Human Body: A Nutrition Perspective*

- Of all the chapters in the book, Chapter 3 has the greatest number of illustrations. We realize that many of our students have very little background in human anatomy and physiology, and we know that developing a keen understanding of digestion and absorption early in the semester will help students understand nutrition in future chapters. Therefore, we have gone to great lengths to help students visualize the body systems, especially the digestive system, and the processes that enable the body to use the nutrients in food. For example, Figure 3-2 now illustrates the organ systems as we highlight the links between nutrition and each body system. Figure 3-5 now more clearly illustrates the exchange of nutrients and wastes between the body's internal and external environments. Figure captions, such as Figure 3-8, now more clearly explain the structures and step-by-step processes of digestion, absorption, and metabolism.
- Several new terms have been introduced into Chapter 3 to broaden students' understanding of the relationship between nutrition and human physiology.
- The discussion of the immune system has been shortened in Chapter 3 to make way for a new Chapter 13 on Nutrients That Support in Blood Health and Immunity.
- The presentation of body systems has been reorganized slightly to allow for greatest emphasis on the digestive system in Section 3.9
- We know that students look for quick summaries of important information, so we have made special efforts to make tables more informative and readable. For example, Table 3-2 has been expanded to clarify the roles of secretions of the GI tract.
- Discoveries in the field of nutritional genomics highlight the important relationship between nutrition and genetics. Section 3.11 has been expanded to show students the importance of tailoring nutrition recommendations to each individual.
- In the Nutrition and Your Health section, we have included many updates to help students sort fact from fiction when it comes to dietary strategies to prevent or treat common ailments of the digestive system. The section on irritable bowel syndrome has been revised and expanded. In addition, we have added information to answer many of students' questions about celiac disease and nonceliac gluten sensitivity.
- A new Medicine Cabinet feature highlights the nutrition implications of proton pump inhibitors and H_2 blockers.

Chapter 4: *Carbohydrates*

- A new *What Would You Choose?* focuses on using the MyPlate food guide to select a meal that provides several sources of carbohydrates.
- The Carbohydrate Concept Map has been enhanced to include definitions of each carbohydrate category.
- The Carbohydrates in Foods section has been rewritten to include subsections (from MyPlate) on whole grains, vegetables, fruits, and dairy.

- Information on alternative sweeteners has been updated and now includes luo han guo, the extract of the monk fruit.
- The section on blood glucose response to food has been updated to emphasize the concept of glycemic index rather than glycemic load of foods.
- Information on sugar intake has been rewritten to highlight the impact of excessive sugar intake on diet quality.
- A new *Newsworthy Nutrition* on the decreased consumption of added sugars in the United States is included.
- The Nutrition and Your Health on diabetes has been updated to include new recommendations for diagnosis from the American Diabetes Association.
- The *Medicine Cabinet* margin feature includes information about drugs used to manage diabetes.
- The Further Readings include 12 new references.

Chapter 5: *Lipids*

- Discussion of the essential fatty acids has been moved to the beginning of the chapter.
- Figure 5-1 has been updated to include numbered carbons on the fatty acids to emphasize the omega-3, -6, and -9 fatty acids.
- The triglyceride structure in Figure 5-5a now includes three specific fatty acids.
- The potential for mercury in fish is discussed relative to the recommendation to increase our intake of fatty fish.
- The hydrogenation illustration in Figure 5-10 is now more realistic showing the metal tanks in which the process takes place.
- The discussion of *trans* fats in foods has been updated and includes information on proposed legislation for foodservice establishments.
- More details are provided in the new illustration of fat digestion and absorption in Figure 5-12.
- The composition of each lipoprotein is now shown in Figure 5-14.
- More details are shown in the phospholipid membrane in Figure 5-16.
- Recommendations for fat intake have been expanded to include information on rich plant sources of the omega-3 alpha-linolenic acid.
- *Newsworthy Nutrition* focuses on new research on the primary prevention of cardiovascular disease with a Mediterranean diet.
- The Nutrition and Your Health section on the development of cardiovascular disease now includes a description of the action of macrophages and foam cells in the production of plaque in the arterial walls.
- The beneficial effects of dark chocolate on LDL and HDL cholesterol levels are highlighted.
- The Medicine Cabinet section summarizes medications commonly used to treat and prevent atherosclerosis.
- The Further Readings include 6 new references.

Chapter 6: *Proteins*

- The synthesis of a peptide bond is illustrated in Figure 6-2.
- A cookbook, with recipes and ingredients is used as an analogy to describe protein synthesis.
- New trends in meat and poultry consumption in the United States are compared to those around the world.
- The section on soy and nut allergy has been updated and includes a new illustration (Figure 6-10).
- Gluten sensitivity is highlighted in a margin note.
- *Newsworthy Nutrition* summarizes new research on the link between red meat consumption and increased premature mortality.
- Recent trends in vegetarianism are discussed including the *Meatless Monday* initiative.
- The Further Readings include 9 new references.

Chapter 7: *Energy Balance and Weight Control*

- The prevalence and recent trends in obesity are discussed and illustrated in the updated Figure 7-1.
- The discussion of the effect of lean body mass on basal metabolism has been expanded and illustrated in the new Figure 7-5.
- Body Mass Index categories are listed in Table 7-1.
- The metabolic effects of abdominal obesity are discussed as well as the effect of excess body fat on the appetite regulating hormone, leptin.
- An expanded discussion of portion control and the basics of the *Volumetrics Diet* are included.
- A new section, Controlling Hunger, including Conquering the Weight-Loss Plateau, has been added.
- Information on calorie estimations on exercise machines is featured in a margin box.
- Mindful Eating is included in the Behavior Modification section.
- Updated information on the use of online or mobile/smartphone applications is included.
- Research on the new weight loss drug, Lorcaserin, is summarized in Newsworthy Nutrition.
- Recent advances in bariatric surgery are presented.
- A new section, Gaining Weight as Muscle, Not Fat, is included.
- The risks of the hCG diet are emphasized.
- The Further Readings include 12 new references.

Chapter 8: *Overview of the Micronutrients*

- A new *What Would You Choose?* feature examines the nutritional differences between fresh, frozen, and canned produce.
- Tables 8-1, 8-2, 8-4, and 8-5 have been updated to enhance readability and quickly summarize pertinent information on the functions, requirements, food sources, deficiency, and toxicity of the vitamins and minerals.
- Nutrition and Your Health introduces students to proper use of dietary supplements (formerly in Chapter 10).

Chapter 9: *Nutrients Involved in Fluid and Electrolyte Balance*

- The presentation of water's many roles in the body has been expanded and reorganized.
- A new Figure 9-5 illustrates sources of water from MyPlate food groups in a manner consistent with our presentation of foods sources of other nutrients in the text.
- A new Figure 9-6 illustrates the steps involved in hormonal regulation of water balance to help students grasp this multi-step process.
- Results of recent research have been incorporated into the chapter, such as the link between sodium and appetite.
- The new Medicine Cabinet feature explains the nutritional relevance of diuretics.

Chapter 10: *Nutrients and Phytochemcials That Function as Antioxidants*

- The new *What Would You Choose?* examines beverages that will jump-start your day and provide antioxidants.
- Oxidative stress has been explained in more detail.
- The definition and discussion of "dietary antioxidant" has been updated.
- Vegetables rich in lutein and zeaxanthin are listed in Table 10-1.
- The Antioxidant Activity of Foods, is featured in a new expanded section.
- The *Newsworthy Nutrition* summarizes research on the ability of antioxidant-rich foods to reduce the risk of stroke.
- The new Nutrition and Your Health focuses on Nutrition and Cancer and has been updated to reflect current statistics and recommendations.
- The Further Readings include 9 new references.

Chapter 11: *Nutrients Involved in Bone Health*

- The reorganized chapter begins with sections on bone physiology, followed by information on the key nutrients involved in bone health and a discussion of osteoporosis.
- The sources and production of all of the various forms of vitamin D have been added.
- Mushrooms are highlighted as the newest addition to foods naturally high in vitamin D.
- Information on dairy alternatives is presented in the Nutrition and Your Health: Bone Health Without Dairy.
- Recent findings on the effectiveness of calcium supplements are discussed including the *Newsworthy Nutrition* on the ability of calcium supplements to decrease the risk of hip fractures in women.
- The T-score scale used for diagnosing osteoporosis is illustrated in Figure 11-19.
- The Medicine Cabinet summarizes the various types of osteoporosis medications.
- The Further Readings include 9 new references.

Chapter 12: *Micronutrient Function in Energy Metabolism*

- *What Would You Choose?* Explores the use of dietary supplements as a source of energy.
- This new chapter presents the micronutrients, especially the B-vitamins, that function in energy metabolism.
- The names of the vitamin coenzymes are introduced and illustrated in Figure 12-1.
- The advantages of whole-grains are emphasized and illustrated in Figure 12-2.
- A new Case Study focuses on the development of a vitamin deficiency while following a gluten-free, vegetarian diet.
- The trace minerals, iodine, chromium, and manganese are also discussed.
- Energy-sustaining snack ideas are presented in Table 12-1.
- Choline: The Newest Vitamin?, is featured in the Nutrition and Your Health.

Chapter 13: *Nutrients That Support Blood Health and Immunity*

- This is a new chapter for the 4th edition. We have moved the discussion of blood health from Chapter 12 into this chapter and have written all-new content to explain the relevance of nutrition for immune function.
- A new *What Would You Choose?* feature takes a look at the utility of dietary supplements for prevention or treatment of the common cold.
- In the part of the chapter on blood health, the discussion of the roles of vitamin K and calcium in blood clotting has been revised and expanded.
- Several new Medicine Cabinet features discuss the nutritional implications of anticoagulant medications, methotrexate, various medications that affect vitamin B-12 absorption, and use of vitamin A derivatives for acne treatment.
- A new *Newsworthy Nutrition* feature explores the relationship between B vitamins and cognitive function.
- Within the section on copper, two genetic defects of copper metabolism, Wilson's disease and Menkes disease, are introduced.
- Tables 13-2 and 13-3 summarize the roles of micronutrients in blood health and immune function.
- The immune system, first introduced in Chapter 3, is described in greater detail. This section shows how the skin, gastrointestinal system, and immune system work together to ward off pathogens.
- The role of inflammation in the development of chronic disease, a hot topic in nutrition research, is discussed.
- The amazing contributions of probiotics, prebiotics, and synbiotics to human health are highlighted in a new Nutrition and Your Health section at the end of Chapter 13.

Chapter 14: *Nutrition: Fitness and Sports*

- A new section on achieving and maintaining fitness shows how to use the FITT principle to design an effective fitness program at any level.

- A discussion of fat adaptation is now included in the section on energy sources for exercising muscles.
- The dangers of cutting weight and the female athlete triad are explored, pointing students to information on eating disorders presented in Chapter 15.
- The discussion of the controversial topic of protein needs of athletes has been updated with the latest research.
- New content on the relevance of B vitamins and antioxidants for athletic performance has been included.
- Tables 14-6 and 14-10 have been updated to reflect new sports nutrition products on the market.
- We realized that much of our discussion of sports nutrition in previous editions was strictly applicable to endurance activities, such as long-distance running and cycling. Advances in sports nutrition research allow for the application of dietary strategies for a wider variety of sports. Therefore, we have revised and reorganized the chapter to present dietary strategies to enhance physical performance in muscular strength and power sports in addition to aerobic, endurance activities.

Chapter 15: *Eating Disorders*

- Research now shows the importance of genetic factors in addition to environmental triggers in the development of eating disorders. Discussions of origins of eating disorders throughout the chapter have been updated accordingly.
- With the 2013 release of the *Diagnostic and Statistical Manual of Mental Disorders,* 5th edition, binge-eating disorder is now classified as a distinct eating disorder. Now, a new Section 15.4 is devoted to presenting the most current research on binge-eating disorder. Figure 15-1 now illustrates physical effects of binge-eating disorder in addition to those of anorexia nervosa and bulimia nervosa.
- Tables 15-1 and 15-2 have been updated to include *DSM-5* revised diagnostic criteria for anorexia nervosa and bulimia nervosa. References to *purging* have been revised to reflect the preferred term, *compensatory behaviors.* The new Figure 15-3 presents a striking example of one of the physical effects of self-induced vomiting.
- Although eating disorders are still most prevalent among young women, additional information is presented on eating disorders that occur among men and older women.
- References to famous figures who have dealt with eating disorder have been updated to be more relevant to a younger generation of students.
- In the discussions of treatment of anorexia nervosa, bulimia nervosa, and binge-eating disorder, the most up-to-date information has been broken down into components of nutrition, psychological, and pharmacological therapy.
- A new *Medicine Cabinet* feature discusses the use of antidepressant medications for treatment of eating disorders.
- The section on other, lesser-known eating disorders, such as pica, purging disorder, night eating syndrome, and subthreshold eating disorders has been updated to reflect new information in *DSM-5.* In addition, we have described several emerging disordered eating patterns, such as diabulimia and orthorexia.

Chapter 16: *Undernutrition Throughout the World*

- The concept of *nutrition security* is introduced in the discussion of world hunger and food security.
- Global undernutrition is discussed and illustrated region-by-region in Figure 16-1.
- The United Nations Millennium Development Goals (MDGs) and targets are presented in Table 16-1, and are used as benchmarks throughout the chapter.
- *Newsworthy Nutrition* summarizes research on the relationship between maternal iodine deficiency and lower educational outcomes in their offspring.
- Information on the impact of assistance programs in the United States has been updated.
- Progress on the eradication of "food deserts" including use of the Food Access Research Atlas, is discussed.
- Statistics on the impact of war and political unrest on poverty and hunger have been updated.
- Discussion of the positive impact of global efforts to combat HIV/AIDS has been added.
- The reductions in undernutrition that are occurring in the developing world are discussed relative to progress in achieving the MDGs.
- Recent debates over the safety of genetically modified foods are considered.
- Examples of the effects of undernutrition during pregnancy and childhood are given for specific countries.
- The Further Readings include ten new references.

Chapter 17: *Safety of Our Food Supply*

- Recent examples of foodborne illness outbreaks are discussed and are summarized in Table 17-1.
- The dramatic increase in the use and effects of antibiotics in livestock is discussed.
- The concerns of the American Heart Association regarding the GRAS listing for sodium, as well as the concerns of other groups about FDA procedures for regulating and monitoring the safety of food additives are considered.
- Positive health effects of coffee consumption are discussed.
- Table 17-10 lists updated information on what you can do to reduce exposure to pesticides.
- The Dirty Dozen™ and Clean Fifteen lists are now included.
- New sections, "Environmental Contaminants in Fish" and "Sustainable Seafood" have been added.
- The Hazard Analysis Critical Control Point (HACCP) tool in the battle against foodborne illness is now discussed, as well as food safety tips for what to do when the power goes out.
- The Further Readings include eight new references.

Chapter 18: *Nutrition During Pregnancy and Breastfeeding*

- Chapter 18 now opens with a new Section 18.1 on Nutrition and Fertility. In this section, we discuss the importance of weight management and other nutritional strategies for both men and women to optimize chances of conception. Polycystic ovary syndrome is defined and management options are discussed.
- Updated information on the fetal origins hypothesis of health and disease has been introduced. First defined in Section 18.1, current research that relates the fetal origins hypothesis to various aspects of nutritional status is woven throughout the chapter.
- In Section 18.2, the discussion of harmful exposures during pregnancy has been expanded to include more information on the effects of maternal use of both legal and illegal drugs.
- Our discussion of success in pregnancy places special emphasis on starting pregnancy at a healthy BMI and gaining weight within the recommendations of the Institute of Medicine. To highlight this point, a new *Newsworthy Nutrition* feature explains a link between gestational weight gain and future cognitive abilities of the offspring.
- In Section 18.4, we now include information on the importance of adequate vitamin D intake during pregnancy.
- The terminology regarding *hypertensive disorders of pregnancy* (formerly called *pregnancy-induced hypertension*) has been updated to reflect current medical literature.
- Section 18.7, including Table 18-5, has been revised to show even more advantages of breastfeeding for both the mother and the infant.
- A thorough discussion of folate and neural tube defects has been moved from the chapter on blood health to the Nutrition and Your Health section of Chapter 18.
- We have updated terminology used to describe *congenital hypothyroidism* (formerly called *cretinism*) to reflect current medical literature. In addition, a new Figure 18-11 illustrates an infant with this disorder.

Chapter 19: *Nutrition from Infancy Through Adolescence*

- In Section 19.1, we have updated Figure 19-1 to illustrate the application of revised growth charts from WHO and the CDC. The definitions of underweight, healthy weight, overweight and obesity, which are based on BMI-for-age, have been updated to reflect current medical literature.
- The section on failure to thrive has been extended to include an updated definition and a more thorough discussion of possible causes.
- Information on fiber and water needs of infants has been expanded in Section 19.2.
- Although covered in Chapter 19, we reemphasize the superiority of breastfeeding over formula feeding for infant nutrition in Section 19.3.
- The importance of food safety for infants and young children is highlighted throughout the chapter.
- In Sections 19.4 and 19.5, we have reorganized the presentation of strategies to improve nutritional status of preschool and school-age children. We included a new Table 19-5 to show the energy needs of young children. Throughout these sections, we have incorporated more hands-on examples of how to apply scientific recommendations at home. Table 19-7 has been updated to clearly identify foods that are potential choking hazards for young children.
- New information on avoidant/restrictive food intake disorder reflects the updated *DSM-5.*
- The latest research on the links between nutrition and autism spectrum disorders is presented in Section 19.4.
- We have updated statistics and recommendations for childhood obesity and comorbid conditions within Section 19.4. We point to specific strategies, such as eating breakfast and avoiding sugar-sweetened beverages, to prevent or correct this growing public health problem.
- An updated discussion of nutrition education and the school breakfast and lunch programs has been added.
- Special emphases on reducing intake of fast foods and caffeinated beverages now appear in Section 19.6 on nutrition for teenagers. In addition, we address the extremely harmful practice of underage alcohol consumption.
- A *Newsworthy Nutrition* feature on possible links between diet and acne is found in Section 19.6.
- The Nutrition and Your Health section on food allergies and intolerances has been updated with new statistics and terminology to reflect current medical literature.

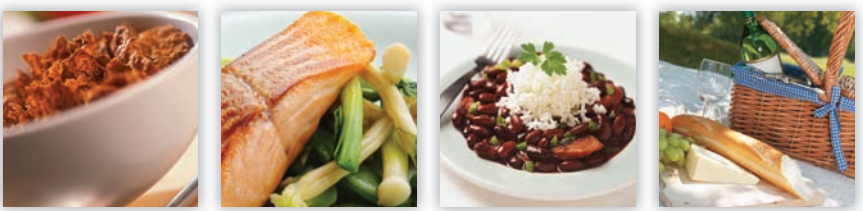
Chapter 20: *Nutrition During Adulthood*

- A new Figure 20-1 illustrates demographic changes that will impact health care in coming years.
- We present current research on nutrition and longevity that underscores the importance of maintaining a healthy weight, consuming a plant-based diet, and continuing to be physically active.
- In Section 20.2, the latest research on protein and sodium recommendations for older adults is presented.
- Our discussion of physiological factors that affect nutritional status of older adults in Section 20.3 and Table 20-2 has been reorganized and expanded to enhance students' understanding of the nutritional needs of the world's fastest-growing population group. In particular, we have updated our discussions of oral health and physical activity. To address the unique concerns of older adults, such as sarcopenic obesity and declining bone health, the exercise recommendations for older adults now include endurance, strength-training, flexibility, and balance exercises.
- Table 20-3 now includes a larger variety of complementary and alternative therapies commonly used by older adults.
- The Nutrition and Your Health feature now includes information on nutrition implications of alcohol consumption. The term *alcohol use disorders* now replaces older references to *alcohol abuse* and *alcohol dependence,* reflecting the updates of *DSM-5.* The diagnostic criteria for alcohol use disorders have been included in the feature.

Contents

Part One Nutrition: A Key to Health

Part Two Energy Nutrients and Energy Balance

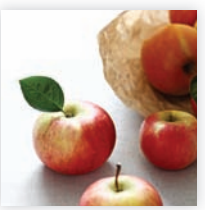







Part Four Nutrition: Beyond the Nutrients





Student Learning Outcomes

Chapter 1 is designed to allow you to:

1.1 Describe how our food habits are affected by the flavor, texture, and appearance of food; routines and habits; early experiences and customs; advertising; nutrition and health concerns; restaurants; social changes; and economic, as well as physiological processes affected by meal size and composition.

1.2 Identify diet and lifestyle factors that contribute to the 15 leading causes of death in North America.

1.3 Define the terms *nutrition, carbohydrate, protein, lipid (fat), alcohol, vitamin, mineral, water, phytochemical, kilocalorie (kcal),* and *fiber.*

1.4 Determine the total calories (kcal) of a food or diet using the weight and calorie content of the energy-yielding nutrients, convert English to metric units, and calculate percentages, such as percent of calories from fat in a diet.

Chapter 1

Nutrition, Food Choices, and Health

What Would You Choose?

We begin each chapter with this activity to get you thinking. We ask you to make a choice that is right for you using the concepts discussed in the chapter. At the end of each chapter, we provide the logic behind what a dietitian would recommend.

You were awake last night until 2:30 A.M. finishing a class project. Unfortunately, your Psychology 101 class meets at 9:00 this morning. When your alarm goes off at 7:30 A.M., you decide to sleep those extra 20 minutes it would take to sit down and enjoy breakfast at the dining hall. What's your best time-saving breakfast option? What factors may hold you back from making the correct choice?

a Skip breakfast but plan to consume a few extra calories at lunch and dinner.

b Eat a low-fat granola bar and iced coffee from the vending machines in your dorm.

c Fix yourself a quick bowl of Wheaties with a banana and low-fat milk along with a yogurt, all from your dorm room "pantry."

d Pick up a ham, egg, and cheese bagel.

connect plus+ NUTRITION **Think about your choice as you read Chapter 1, then see What the Dietitian Chose at the end of the chapter. To learn more about breakfast choices, check out the Connect site: www.mcgrawhillconnect.com.**

Research has clearly shown that a lifestyle that includes a diet rich in fruits, vegetables, and whole grains, coupled with regular exercise, can enhance our quality of life in the short term and keep us healthy for many years to come. Unfortunately, this healthy lifestyle is not always easy to follow. When it comes to "nutrition," it is clear that some of our diets are out of balance with our metabolism, physiology, and physical activity level.

We begin Chapter 1 with some questions. What influences your daily food choices? How important are factors such as taste, appearance, convenience, cost, or value? Is nutrition one of the factors you consider? Are your food choices influencing your quality of life and long-term health? By making optimal dietary choices, we can bring the goal of a long, healthy life within reach. This is the primary theme of Chapter 1 and throughout this book.

The ultimate goal of this book is to help you find the best path to good nutrition. The information presented is based on emerging science that is translated into everyday actions that improve health. After completion of your nutrition course, you should understand the knowledge behind the food choices you make and recommend to others. We call this achievement of making food choices that are right for you "nutrition literacy."

1.5 Understand the scientific method as it is used in developing hypotheses and theories in the field of nutrition, including the determination of nutrient needs.

1.6 List the major characteristics of the North American diet, the food habits that often need improvement, and the key "Nutrition and Weight Status" objectives of the *Healthy People 2020* report.

1.7 Describe a basic plan for health promotion and disease prevention, and what to expect from good nutrition and a healthy lifestyle.

1.8 Identify food and nutrition issues relevant to college students.

1.1 Why Do You Choose the Food You Eat?

In your lifetime, you will eat about 70,000 meals and 60 tons of food. Many factors influence our food choices including celebrations (see the comic below). Chapter 1 begins with a discussion of these factors and ends with a conversation specifically about eating well as a college student. In between, we examine the powerful effect of dietary habits in determining overall health and take a close look at the general classes of nutrients—as well as the calories—supplied by the food we eat. We also discuss the major characteristics of the North American diet, the food habits that often need improvement, and the key "Nutrition and Weight Status" objectives in the *Healthy People 2020* report. A review of the scientific process behind nutrition recommendations is also included, along with an introduction to our "Newsworthy Nutrition" feature that you will see throughout the book.

Understanding what drives us to eat and what affects food choice will help you understand the complexity of factors that influence eating, especially the effects of our routines and food advertising (Fig. 1-1). You can then appreciate why foods may have different meanings to different people and thus why food habits and preferences of others may differ from yours.

WHAT INFLUENCES YOUR FOOD CHOICES?

Food means so much more to us than nourishment—it reflects much of what we think about ourselves. In the course of our lives, we spend the equivalent of 4 years eating. The Bureau of Labor Statistics estimated that in 2011, Americans spent the equivalent of 19 days eating and drinking. If we live to be 80 years old, that will add up to 4.1 years of eating and drinking. Overall, our daily food choices stem from a complicated mix of biological and social influences (see Fig. 1-1). Let's examine some of the key reasons we choose what we eat.

Flavor, texture, and appearance are the most important factors determining our food choices. Creating more flavorful foods that are both healthy and profitable is a major focus of the food industry. These foods are often referred to as "healthy" choices or "better for you" products. The challenge to the food industry is to match the "taste" of the foods we prefer with the nutrition and health characteristics of these products.

Early influences that expose us to various people, places, and events have a continuing impact on our food choices. Many ethnic diet patterns begin as we are introduced to foods during childhood. Parents can lay a strong foundation knowing that early exposure to food choices during infancy, toddler, and preschool years is important in influencing later health behaviors. Developing healthy patterns during childhood will go a long way to ensuring healthy preferences and choices when we are teenagers and adults.

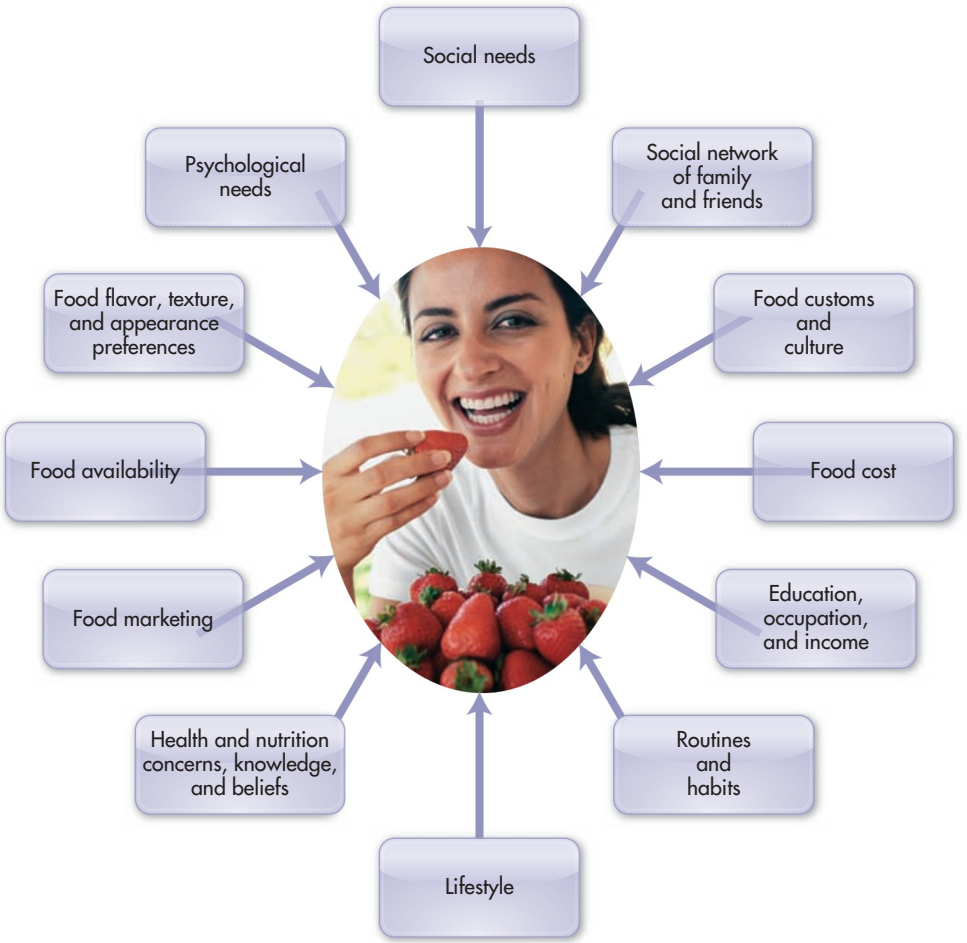


FIGURE 1-1 ◄ Food choices are affected by many factors. Which have the greatest impact on your food choices?

Routines and habits are tied to some food choices. Food habits, food availability, and convenience strongly influence choices. Most of us eat from a core group of foods with about 100 basic items accounting for 75% of our total food intake. Recent surveys indicate that the most commonly purchased foods in America are milk (about 30 gallons yearly), ready-to-eat cereal, bottled water (about 25 gallons per year), soft drinks (nearly 50 gallons per year), and bread. It is no surprise that milk and cereal are both on the top-five list because many Americans eat them together as their daily breakfast. Bread is also on the list because it is typically consumed at every meal in America, making it one of the most common forms of grain eaten. Bottled water has become the drink of choice for business meetings and other large-group gatherings, including outdoor activities. Despite the popularity of water and milk, Americans still drink nearly twice as many carbonated soft drinks per year as either water or milk. The large amount of sugar in many soft drinks is of particular concern because studies have found an association between consumption of sugar-sweetened drinks and obesity in children (see Chapter 19). In September 2012, the New York City Board of Health made an effort to combat obesity and encourage healthier choices by approving a ban on the sale of sugary drinks in containers larger than 16 ounces in restaurants and other establishments. This restriction was the first of its kind in the country and was championed by Mayor Michael Bloomberg.

Advertising is a major media tool for capturing the food interest of the consumer. Consumers have more food choices than ever and these choices are well advertised in newspapers, magazines, billboards, radio, television, and now the Internet. The food industry in the United States spends billions on advertising. Some of this

▲ Cereal and milk are two of the most commonly purchased foods in America largely because they are eaten together for breakfast every day by many.

advertising is helpful, as it promotes the importance of food components such as calcium and fiber in our diets. However, the food industry also advertises highly sweetened cereals, cookies, cakes, and soft drinks because they bring in the greatest profits. Researchers at Yale University found that in 2009, the 20 largest fast-food restaurant chains spent $3.8 billion on advertising, primarily television ads. Food advertising and marketing have been shown to have a definite effect on weight gain in children and adolescents. A 2012 Federal Trade Commission (FTC) report found that although food marketing to youth dropped from $2.1 billion in 2006 to $1.79 billion in 2009, much of the decline was the result of less spending on expensive TV advertising and more spending on cheaper online and mobile media (see Further Reading 9). Recent studies in several Western countries indicate that the association between TV advertising of foods and drinks, and childhood obesity is especially prevalent in the United States (see Further Readings 3 & 10). Concern for the negative effect of advertising and marketing on the diets and health of children has led to several strategies, including the Children's Food and Beverage Advertising Initiative (CFBAI), a self-regulatory program launched by the Council of Better Business Bureaus in 2006. CFBAI participants are 16 packaged-food companies and quick-serve restaurants that have pledged to limit their advertising to children to foods meeting science-based nutrition criteria or to not engage in child-directed advertising (see Further Reading 13). Research also indicates that mass media influences the onset of eating disorders through its depiction of extremely thin models as stereotypes of attractive bodies. The eating disorders that may result from this type of marketing lead to body distortion and dissatisfaction. Eating disorders will be introduced in the Eating Well in College section at the end of this chapter and discussed at length in Chapter 15.

Restaurant dining plays a significant role in our food choices. Restaurant food is often calorie-dense, in large portions, and of poorer nutritional quality compared to foods made at home. Fast-food and pizza restaurant menus typically emphasize meat, cheese, fried foods, and carbonated beverages. In response to recent consumer demands, restaurants have placed healthier items on their menus and many are listing nutritional content on their menus. Mandatory posting of the calorie content of restaurant items will go into effect soon as a result of the health care reform bill that President Barack Obama signed into law in March 2010. The law requires chain restaurants with 20 or more locations to post the calorie content of their offerings on menus or menu boards with other nutritional information available upon request. While many restaurants have placed calorie information on their menus, most have delayed their calorie disclosures until menu labeling regulations are approved by the Food and Drug Administration (FDA). FDA released the proposed regulations in November 2012, so calories may not appear on menus until 2014.

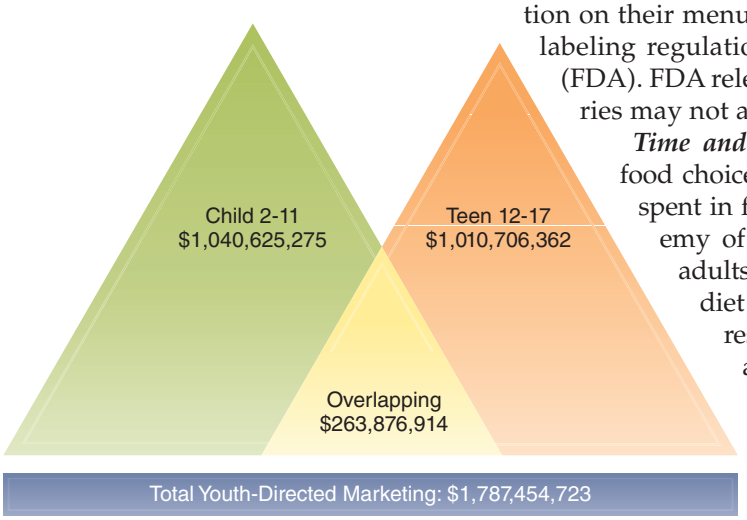


FIGURE 1-2 ▲ This chart shows the marketing expenditures used to promote food and beverages to children and teens in the United States in 2009. From Further Reading 9.

Source: Reading 9: 9. Federal Trade Commission: A Review of Food Marketing to Children and Adolescents, Follow-Up Report, December 2012. www.ftc.gov/os/2012/12/121221foodmarketingreport.pdf

Time and convenience have become significant influences affecting food choices and stem from a lifestyle that limits the amount of time spent in food preparation (see Further Reading 4). In the 2011 Academy of Nutrition and Dietetics Trends Survey, 62% of American adults indicated that it took too much time to keep track of their diet (see Further Reading 2). Restaurants and supermarkets have responded to our demanding work schedules and long hours away from home by supplying prepared meals, microwavable entrees, and various quick-prep frozen products.

Economics play a role in our food choices. The 2012 Food and Health Survey indicates that after taste, cost is now the number two reason why people choose the food they do. While the average American now spends less on food than in the past, young adults and those with higher incomes spend the most on food. As income increases, so do meals eaten away from home and preferences for foods such as cookies, chocolate, cheese, and meat. Also keep in mind that as calorie

intake increases, so does the food bill. Tips for eating well on a college student's budget are discussed in the Nutrition and Your Health feature at the end of the chapter.

Last but not least, ***nutrition***—or what we think of as "healthy foods"—also directs our food purchases. North Americans who tend to make health-related food choices are often well-educated, middle-class professionals. These same people are generally health-oriented, have active lifestyles, and focus on weight control. A recent study of the National Health Interview Survey showed that 74% of women surveyed habitually or always read the nutrition labels, whereas only 58% of the men read labels on food products. Label reading was associated with a lower body mass index (BMI, body weight relative to height), especially in women. Women who read labels had a BMI of 1.48 points lower than women who did not read nutrition labels, translating to a difference of 8.6 pounds for a woman who is 5 feet 3 inches tall weighing 163 pounds (see Further Reading 16).

WHY ARE YOU SO HUNGRY?

Two drives, **hunger** and **appetite,** influence our desire to eat. These drives differ dramatically. Hunger is primarily our physical biological drive to eat and is controlled by internal body mechanisms. For example, as foods are digested and absorbed by the stomach and small intestine, these organs send signals to the liver and brain to reduce further food intake.

hunger The primarily physiological (internal) drive to find and eat food, mostly regulated by internal cues to eating.

appetite The primarily psychological (external) influences that encourage us to find and eat food, often in the absence of obvious hunger.

satiety State in which there is no longer a desire to eat; a feeling of satisfaction.

Appetite, our primarily psychological drive to eat, is affected by many of the external food choice mechanisms we discussed in the last section, such as environmental and psychological factors and social customs (see Fig. 1-1). Appetite can be triggered simply by seeing a tempting dessert or smelling popcorn popping at the movie theater. Fulfilling either or both drives by eating sufficient food normally brings a state of **satiety,** a feeling of satisfaction that temporarily halts our desire to continue eating.

A region of the brain helps regulate satiety. Imagine a tug-of-war in the brain. The *feeding center* and the *satiety center* work in opposite ways to promote adequate availability of nutrients at all times. When stimulated, cells in the feeding center signal us to eat. As we eat, cells in the satiety center are stimulated and we stop eating. For example, when we haven't eaten for a while, stimulation of the feeding center signals us to eat. When the nutrient content in the blood rises after a meal, the satiety center is stimulated, and we no longer have a strong desire to seek food. Admittedly, this concept of a tug-of-war between the feeding and satiety centers is an oversimplification of a complex process. The various feeding and satiety messages from body cells to the brain do not single-handedly determine what we eat. We often eat because food comforts us (see Further Reading 20). Almost everyone has encountered a mouthwatering dessert and devoured it, even on a full stomach. It smells, tastes, and looks good. We might eat because it is the right time of day, we are celebrating, or we are seeking emotional comfort to overcome the blues. After a meal, memories of pleasant tastes and feelings reinforce appetite. If stress or depression sends you to the refrigerator, you are mostly seeking comfort, not food calories. Appetite may not be a physical process, but it does influence food intake. We will discuss more about this mechanism, including the effect of meal size and composition on satiety, in Chapter 7 on energy balance and weight control.

CRITICAL THINKING

Sarah is majoring in nutrition and is well aware of the importance of a healthy diet. She has recently been analyzing her diet and is confused. She notices that she eats a great deal of high-fat foods, such as peanut butter, cheese, chips, ice cream, and chocolate, and few fruits, vegetables, and whole grains. She also has become hooked on her daily cappuccino with lots of whipped cream. What three factors may be influencing Sarah's food choices? What advice would you give her on how to have her diet match her needs?

PUTTING OUR FOOD CHOICES INTO PERSPECTIVE

The next time you pick up a candy bar or reach for a second helping, remember the internal and external influences on eating behavior. You should now understand that daily food intake is a complicated mix of biological and social influences. Body cells, nutrients in the blood, hormones, brain chemicals, and our social and family customs all influence food choices. When food is abundant, appetite—not hunger—most

likely triggers eating. Satiety associated with consuming a meal may reside primarily in our psychological frame of mind. Also, because satiety regulation is not perfect, body weight can fluctuate. We become accustomed to a certain amount of food at a meal. Providing less than that amount leaves us wanting more. One way to use this observation for weight-loss purposes is to train your eye to expect less food by slowly decreasing serving sizes to more appropriate amounts. Your appetite then readjusts as you expect less food. Keep track of what triggers your eating for a few days. Is it primarily hunger or appetite? The Rate Your Plate activity in this chapter also asks you to keep track of what influences your food intake on a daily basis.

CONCEPT CHECK 1.1

1. What are the factors that influence our food choices?
2. How do hunger and appetite differ in the way they influence our desire to eat?
3. What factors influence satiety?

1.2 How Is Nutrition Connected to Good Health?

nutrients Chemical substances in food that contribute to health, many of which are essential parts of a diet. Nutrients nourish us by providing calories to fulfill energy needs, materials for building body parts, and factors to regulate necessary chemical processes in the body.

essential nutrient In nutritional terms, a substance that, when left out of a diet, leads to signs of poor health. The body either cannot produce this nutrient or cannot produce enough of it to meet its needs. If added back to a diet before permanent damage occurs, the affected aspects of health are restored.

Fortunately, the foods we eat can support good health in many ways depending on their components. You just learned, however, that lifestyle habits and other factors may have a bigger impact on our food choices than the food components themselves. Unfortunately, many North Americans suffer from diseases that could have been prevented if they had known more about the foods and, more importantly, had applied this knowledge to planning meals and designing their diet. We will now look at the effect these choices are having on our health both today and in the future.

WHAT IS NUTRITION?

Nutrition is the science that links foods to health and disease. It includes the processes by which the human organism ingests, digests, absorbs, transports, and excretes food substances.

NUTRIENTS COME FROM FOOD

▲ Many foods are rich sources of nutrients.

What is the difference between food and **nutrients?** Food provides the energy (in the form of calories) as well as the materials needed to build and maintain all body cells. Nutrients are the substances obtained from food that are vital for growth and maintenance of a healthy body throughout life. For a substance to be considered an **essential nutrient,** three characteristics are needed:

- First, at least one specific biological function of the nutrient must be identified in the body.
- Second, omission of the nutrient from the diet must lead to a decline in certain biological functions, such as production of blood cells.
- Third, replacing the omitted nutrient in the diet before permanent damage occurs will restore those normal biological functions.

WHY STUDY NUTRITION?

As we mentioned in the preface, we are all nutrition experts because we all eat several times a day. Nutrition knowledge can be confusing, however, and seem like a moving target. Recommendations may seem to differ depending on their source, and there are so many choices when shopping for food or eating out. We

just learned that nutrition is only one of many factors that influence our eating habits. There is a lot to learn, and we know that you are interested in what you should be eating and how the food you eat affects you. Studying nutrition will help you discern the conflicting messages you hear about food and help erase any misconceptions you have about food and nutrition. This book uses "a functional approach" to learning about nutrients, how they interact in food and in our bodies, and how they work together to support these key functions that sustain our health. Studying nutrition will help you make informed choices about the foods you eat and their relationship to health.

▲ Major health problems can be avoided by a healthy diet, moderate calories, and adequate physical activity.

Nutrition is a lifestyle factor that is a key to developing and maintaining an optimal state of health for you. A poor diet and a sedentary lifestyle are known to be **risk factors** for life-threatening **chronic** diseases such as **cardiovascular (heart) disease, hypertension, diabetes,** and some forms of **cancer** (Table 1-1). Together, these and related disorders account for two-thirds of all deaths in North America (Figure 1-3) (see Further Reading 11). Not meeting nutrient needs in younger years makes us more likely to suffer health consequences, such as bone fractures from the disease **osteoporosis,** in later years. At the same time, taking too much of a nutrient—such as a vitamin A supplement—can be harmful. Another dietary problem, drinking too much alcohol, is associated with many health problems.

U.S. government scientists have calculated that a poor diet combined with a lack of sufficient physical activity contributes to hundreds of thousands of fatal cases of cardiovascular disease, cancer, and diabetes each year among adults in the United States. Thus, the combination of poor diet and too little physical activity may be the second leading cause of death in the United States. In addition, **obesity,** which the American Medical Association recently declared as a disease, is considered the

glucose A six-carbon sugar that exists in a ring form; found as such in blood and in table sugar bound to fructose; also known as *dextrose,* it is one of the simple sugars.

TABLE 1-1 ▶ Glossary Terms to Aid Your Introduction to Nutrition*

Cancer	A condition characterized by uncontrolled growth of abnormal cells.
Cardiovascular (heart) disease	A general term that refers to any disease of the heart and circulatory system. This disease is generally characterized by the deposition of fatty material in the blood vessels (hardening of the arteries), which in turn can lead to organ damage and death. Also termed coronary heart disease (CHD), as the vessels of the heart are the primary sites of the disease.
Cholesterol	A waxy lipid found in all body cells; it has a structure containing multiple chemical rings. Cholesterol is found only in foods of animal origin.
Chronic	Long-standing, developing over time. When referring to disease, this term indicates that the disease process, once developed, is slow and lasting. A good example is cardiovascular disease.
Diabetes	A group of diseases characterized by high blood **glucose.** Type 1 diabetes involves insufficient or no release of the hormone insulin by the pancreas and therefore requires daily insulin therapy. Type 2 diabetes results from either insufficient release of insulin or general inability of insulin to act on certain body cells, such as muscle cells. Persons with type 2 diabetes may or may not require insulin therapy.
Hypertension	A condition in which blood pressure remains persistently elevated. Obesity, inactivity, alcohol intake, excess salt intake, and genetics may each contribute to the problem.
Kilocalorie (kcal)	Unit that describes the energy content of food. Specifically, a kilocalorie (kcal) is the heat energy needed to raise the temperature of 1000 grams (1 liter) of water 1° Celsius. Although kcal refers to a 1000 calorie unit of measurement, it is commonly referred to as calories. *Calories* is a familiar term for the energy content of a food, so we will use it in this book.
Obesity	A condition characterized by excess body fat.
Osteoporosis	Decreased bone mass related to the effects of aging (including estrogen loss during menopause in women), genetic background, and poor diet.
Risk factor	A term used frequently when discussing the factors contributing to the development of a disease. A risk factor is an aspect of our lives, such as heredity, lifestyle choices (e.g., smoking), or nutritional habits.

*Many bold terms are also defined in the page margins within each chapter and in the glossary at the end of this book.