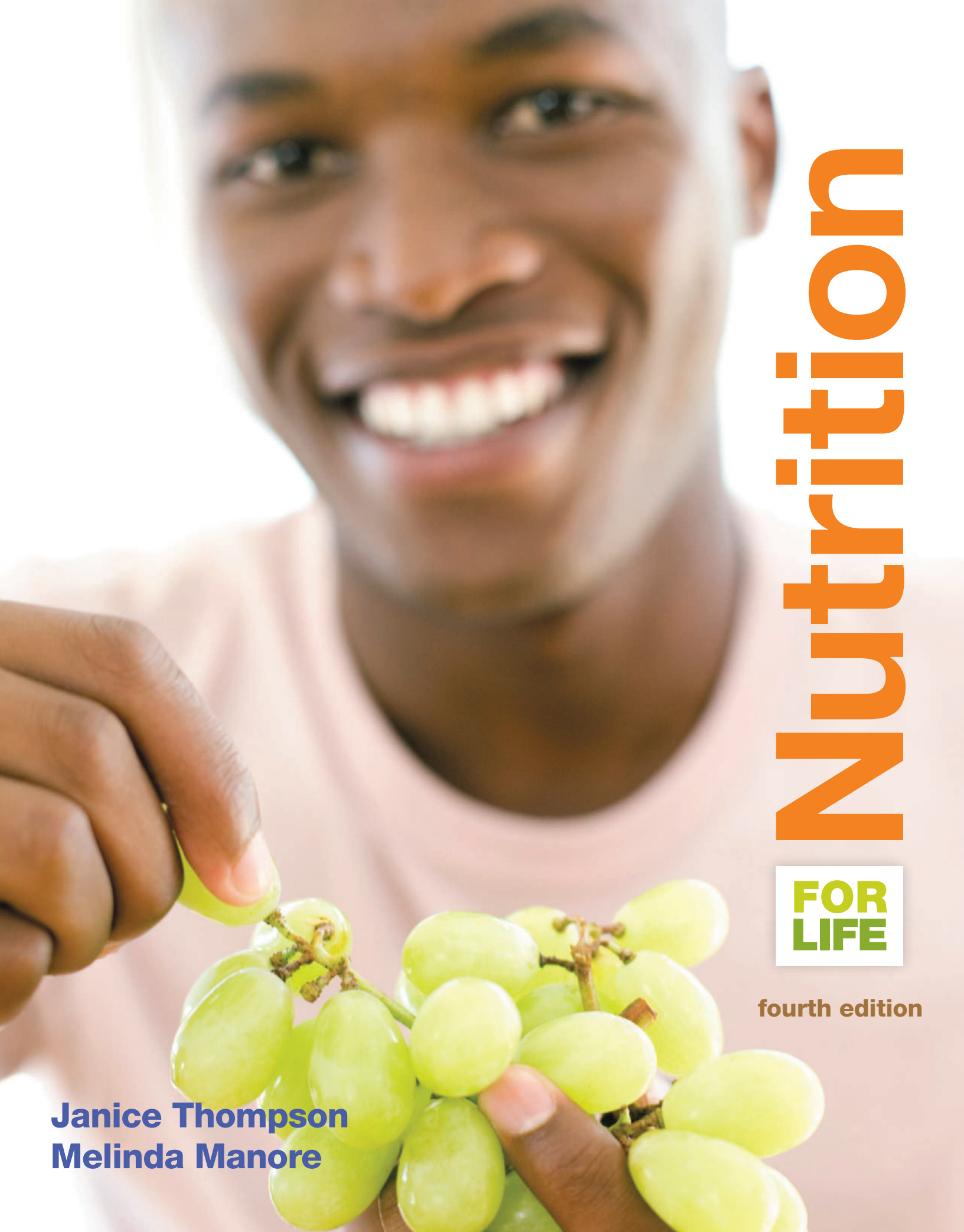

Nutrition

FOR LIFE

fourth edition

Janice Thompson
Melinda Manore

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WHAT'S A SERVING SIZE?

FRUITS

1 serving of fruit looks like:

1 medium peach	or	3 apricots	=	tennis ball
1 mango		2 large plums	=	2 tennis balls
1 medium apple	or 1 cup chopped apples	or 1 cup mixed berries	=	baseball
1 8-inch banana		1/2 cup raisins	=	1/2 baseball
1 cup (8 fl. oz) 100% fruit juice	compare with	16 fl. oz	or	12 fl. oz

VEGETABLES

1 serving of vegetables looks like:

2 cups lettuce	or	2 cups leafy greens	=	2 baseballs
1 cup cooked broccoli	or	1 cup cooked squash	=	1 baseball
7 baby carrots; 1 large bell pepper		1 medium potato	=	1 mouse

DAIRY

1 serving of dairy looks like:

		1 - 1/2 oz cheese	=	dice
8 oz yogurt		1/2 cup ice cream	=	light bulb
1 cup (8 fl. oz) milk	compare with	16 fl. oz	or	12 fl. oz

How Much Should I Eat Each Day?

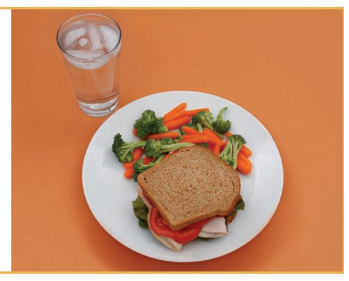
MyPlate food guidance system helps you decide how much of each food you should eat daily. Go to www.ChooseMyPlate.gov for information on recommended amounts. Here is an example of what one day's worth of food might look like if you are eating 2,200 calories per day.

Meals with Foods High in Nutrient Density

BREAKFAST
1 cup cooked oatmeal with 1/2 cup skim milk
1 slice whole-wheat toast with 1 tsp. butter
6 fl. oz grapefruit juice

SNACK
1 peeled orange
1 cup nonfat yogurt

LUNCH
Turkey sandwich
3 oz turkey breast
2 sliceswhole-grain bread
2 tsp. Dijon mustard
3 slices fresh tomatoes
2 leaves red leaf lettuce
1 cup baby carrot with broccoli crowns
20 fl. oz (2.5 cups) water



SNACK
1/2 whole-wheatbagel
1 tbsp.peanut butter
1 medium apple

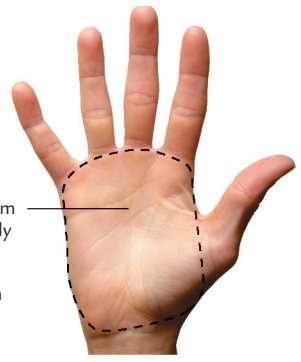
DINNER
Spinach salad
1 cup fresh spinach leaves
1/4 cup diced tomatoes
1/4 cup diced green pepper
1/2 cup kidney beans
1 tbsp. fat-free Italian salad dressing
3 oz broiled chicken breast
1/2 cup cooked brown rice
1/2 cup steamed broccoli
8 fl. oz (1 cup)skim milk

How Much Do I Eat?

When you're creating a healthful diet for yourself, or doing a diet assessment project, it's important to keep in mind not only the types of foods you eat, but also how much. However, it can be difficult to know what a particular number of cups, ounces, or ounce-equivalents looks like. Here is a visual tip sheet that will help you translate the food on your plate into common serving sizes. Tear it out and bring it with you to the dining hall, the café, or the kitchen table.

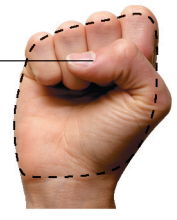
A "Hand-y" Way to Estimate Serving Size

The following photos show how to judge serving sizes with something you always have with you—your hand.



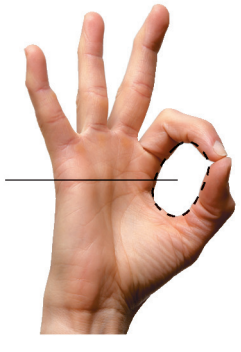
A woman's palm is approximately 3 ounces of cooked meat, chicken, or fish

(a)



A woman's fist is about 1 cup of pasta or vegetables (a man's fist is the size of about 2 cups)

(b)



About 1 tbsp. of vegetable oil

(c)

GRAINS

1 serving of grains looks like:

1/2 cup rice

or

1/2 cup pasta

or

1/2 cup oatmeal

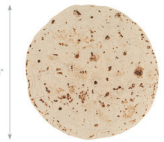
=

1/2 baseball

1 slice bread

1 cup cereal

1 piece cornbread



one 6-inch tortilla

one 3-inch (mini) bagel

MEAT & BEANS

1 serving of meat or beans looks like:

3 oz chicken

or

5 oz steak

or

4 oz pork

or

6 oz tofu

=

mouse

3 oz fish

=

checkbook

1/2 cup garbanzo beans

or

1/2 cup pinto beans

=

light bulb

1 oz peanuts

or

1 oz almonds

or

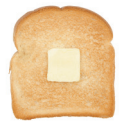
2 T. peanut butter

=

ping pong ball

FATS

1 serving of fats looks like:



1 t. butter

1 oz potato chips

1 T. salad dressing

2 T. cream cheese

or

2 T. olive oil

=

ping pong ball

ALCOHOL

One "drink" of alcohol is defined as the amount of a beverage that provides 1/2 fl. oz of alcohol, which normally equals 1-1/2 oz of distilled spirits, 5 oz of wine, or 12 oz of beer or wine cooler.

Nutrition FOR LIFE

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Nutrition FOR LIFE

fourth edition

Janice Thompson, PhD, FACSM
University of Birmingham, UK

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Oregon State University

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about the authors

Janice Thompson, PhD, FACSM

University of Birmingham, UK

Janice Thompson earned a PhD from Arizona State University in exercise science with an emphasis in exercise physiology and nutrition. She is currently a professor of Public Health Nutrition in the School of Sport, Exercise and Rehabilitation Sciences at The University of Birmingham, UK. Her research focuses on developing nutrition and physical activity interventions to reduce the risks for obesity and type 2 diabetes in high-risk populations. Janice retains her U.S. affiliation by regularly collaborating with colleagues across the United States and maintaining strong professional links with the American College of Sport Medicine (ACSM).

Janice is a Fellow of the ACSM and recently served as Vice President of ACSM. She is also a member of the American Society for Nutrition (ASN), the British Association of Sport and Exercise Science (BASES), The Nutrition Society in the United Kingdom, and the European College of Sports Science (ECSS), where she serves as a member of the Scientific Committee. Janice won an undergraduate teaching award while at the University of North Carolina, Charlotte. In addition to *Nutrition for Life*, Janice coauthored the Pearson textbooks *Nutrition: An Applied Approach*, with Melinda Manore, and *The Science of Nutrition,* with Melinda Manore and Linda Vaughan. Janice loves traveling, yoga, hiking, and cooking and eating delicious food. She likes almost every vegetable except canned peas and believes chocolate should be listed as a food group.

Melinda Manore, PhD, RD, FACSM

Oregon State University

Melinda Manore earned a PhD in human nutrition with a minor in exercise physiology at Oregon State University (OSU). She is the past chair of the Department of Nutrition and Food Management at OSU and is currently a professor of nutrition in the School of Population and Biological Sciences. Prior to her tenure at OSU, she was a professor at Arizona State University. Melinda's area of expertise is nutrition and exercise, especially the role of diet and exercise in health, energy balance, and weight management; chronic disease prevention; and the energy and nutrient needs of active people, especially active girls and women. She is currently engaged in two large community-based, obesity prevention projects in families with children and in high school soccer players.

Melinda is an active member of the Academy of Nutrition and Dietetics (AND). She is a current Fellow of the American College of Sports Medicine (ACSM) and a past vice president. She is the past chair of the AND Research Committee and the Research Dietetic Practice Group, and she served on the AND Obesity Steering Committee. She is an active member of SCAN, a nutrition and exercise practice group of AND. Melinda is also a member of the American Society of Nutrition (ASN) and the Obesity Society. She is also the past chair of USDA's Nutrition and Health Planning and Guidance Committee and the USDA, ACSM, and AND Energy Balance Working Group. Melinda is the past nutrition column author and associate editor for ACSM's *Health and Fitness Journal* and *Medicine and Science in Sports and Exercise*, and she serves on the editorial boards of numerous research journals. She has won awards for excellence in research and teaching. She also coauthored the Pearson textbooks *Nutrition: An Applied Approach*, with Janice Thompson, and *The Science of Nutrition*, with Janice Thompson and Linda Vaughan. Melinda is an avid walker, hiker, and former runner who loves to cook and eat great food. She is now trying her hand at cycling, gardening, and birding.

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Welcome to *Nutrition for Life*, Fourth Edition!

Why We Wrote the Book

You stop at the convenience store for a snack. Blaring across the front of a bag of chips is the banner *No Trans Fats!* while a bag of pretzels claims *Now with Whole Grains!* What do these claims really mean, you wonder, and why should you care? You buy the chips and take them to a party, where a football game is on TV. It's half-time and an athlete is pushing some new protein supplement. A friend comes up and offers you a can of something called *Action!* "It's this new high-energy drink," he explains. But then your roommate snickers, "Yeah, and the caffeine in it can give you a heart attack! You know, they've banned that stuff in France!"

No doubt about it, nutrition is a hot topic, but do you ever wind up with information overload? Everybody claims to be an expert, but what's their advice based on? Is it reliable? How do you navigate through the endless recommendations and arrive at a way of eating that's right for *you*—one that energizes you, allows you to maintain a healthful weight, and helps you avoid disease and promote good health?

We Wrote This Book to Help You Answer These Questions

Nutrition for Life began with the conviction that students would benefit from an engaging, accurate, and clear textbook that links essential nutrition content to their own health and encourages them to make nutrition part of their everyday life. As authors and educators, we know that students have a natural interest in their body, their health, their weight, and their success in sports and a range of life activities. By demonstrating how nutrition relates to these interests, *Nutrition for Life*, Fourth Edition, empowers students to reach their personal health and nutritional goals. We use multiple strategies to capture students' interest, from highlighting how nutrients are critical to health, to discussing the vitamins and minerals based on their clear functions within the body, to a variety of special features and activities that bring nutrition to life. Throughout the text, material is presented in a lively narrative style that consistently links the essential facts to students' lifestyles and goals. Information on current topics and research keeps the inquisitive spark alive, illustrating that nutrition is very much a "living" science, and the source of ongoing debate, research, and interest. We present nutritional basics in an easy-to-read, friendly narrative with engaging features that reduce students' apprehensions and encourage them to apply the information directly to their lives. We've also ensured that the organization and flow of the content and the art work together to provide a learning resource that is enjoyable to engage for both instructors and students.

As educators, we're familiar with the myriad challenges of presenting nutrition information in the classroom, and we have included tools in the book and ancillary materials that will assist instructors in successfully meeting these challenges. Through broad instructor and student support with print and media supplements, we hope to contribute to the excitement of teaching and learning about nutrition: a subject that affects all of us, one so important and relevant that correct and timely information can make the difference between health and disease.

Features of *Nutrition for Life*

The following features are integrated throughout *Nutrition for Life,* Fourth Edition, to help you learn, study, and apply all the fascinating concepts of nutrition to your own life. As you read through each chapter, be sure to look at the feature boxes and test your knowledge with the Review Questions. You can also find more information, resources, and self-quizzing activities in the Study Area of MasteringNutrition.

- **Test Yourself** questions are located at the beginning of each chapter. These targeted prompts will help you dispel common myths about nutrition. The answers can be found at the end of each chapter.
- **Learning Outcomes** are a new feature to this edition and highlight key lessons students should take away from each section. The Learning Outcomes have been repeated throughout the chapter so students can regularly stop and evaluate their understanding of the main concept.
- **What About You?** feature boxes help you figure out where you stand with regard to important nutrition issues. This feature, appearing in most chapters, provides self-assessment prompts and exercises that enable you to determine whether your diet and lifestyle are as healthful as they could be, and whether you should be concerned about any particular nutrition-related issues.
- **Game Plan** feature boxes offer detailed strategies for adopting healthful eating and lifestyle changes. They have been updated and reconfigured in this edition into a consistent checklist format, making it even easier to follow the recommended tips and guidelines.
- **Nutrition Label Activities** will show you how to evaluate the labels from actual food products so that you can make educated decisions about the foods you consume. Updated for this edition, these activities have been made even more interactive, providing hands-on practice that you can apply when you do your own food shopping. Answers to Nutrition Label Activities, when applicable, can be found in MasteringNutrition.
- **Nutrition Myth or Fact?** feature boxes provide the facts behind the hype surrounding many current nutrition and dietary issues. They dispel common misconceptions and show you how to critically evaluate information you encounter every day from the Internet, media sources, and your peers.
- **Highlight** feature boxes provide deeper background into topics you'll recognize from the Internet, mass media, and popular culture, including issues such as sports beverages, alternative sweeteners, and fad diets. Highlight boxes review the facts and theories surrounding widely discussed subjects and help you sort out the core issues they relate to.
- **Foods You Don't Know You Love Yet** feature boxes describe "emerging foods" you might not be familiar with (and which pack a surprising nutritional punch) or more common foods you might have overlooked.
- **What Can I Do *Today?*** appears at the end of each chapter and prompts you to think in active, concrete ways about three key things you can do right now to incorporate your new nutritional knowledge into your life.
- **Nutrition Online** icons appear throughout each chapter, directing you to web links, videos, podcasts, and other useful online and new media resources.
- **Healthwatch** sections found throughout the text are special subject areas designed to highlight the health effects of various key nutrients and foods, illuminating the consequences of diet on your health.
- **Recaps** are placed strategically throughout each chapter to clearly review and highlight the key points, helping you to grasp the full concepts in easily understood terms.
- **Organization of vitamins and minerals** is unique in this book. Traditionally, students are taught vitamin and mineral content by memorizing each nutrient, along with its deficiency and toxicity symptoms. We've found that, with that approach, students quickly forget the information and don't truly understand why these nutrients are important and how they affect the body. In *Nutrition for Life,* Fourth Edition, we organize the vitamins and minerals based on their *functions* inside your body, giving you a framework for understanding why they're

important, what they do, and what happens when you don't get enough—or get too much!—of each one. This breakthrough approach has enjoyed enormous success and popularity with students and instructors alike.
- **Art, photos, and tables** in this edition have been updated and designed to take you clearly through your body's processing of nutrients. Figures are constructed to show step-by-step what happens to the food you eat, as well as which foods are good sources of key nutrients. Photos illustrate various conditions created by deficiency and toxicity and identify foods that you may not immediately think of as good sources for specific nutrients.
- **Chapter Summaries** have been added and have been correlated to Learning Outcomes so students can see what the standout lessons are for each section.
- **Review Questions** at the end of each chapter help you assess your retention and understanding of the material covered in each chapter. Answers to Review Questions appear at the end of the book.
- **Web Links** at the end of each chapter identify additional web-based resources for further information and study.
- **References,** located in this edition at the end of the book, provide students with references to all the research used within the chapters.

New to the Fourth Edition

For this edition, our goal was to make the book even more practical and relevant to students in applying the information to their own lives. We also wanted to include more material on how to evaluate nutrition information and to provide the most up-to-date and accurate nutrition information currently available.

New to this edition, we have added **Learning Outcomes** to each chapter, allowing students to track their own understanding and knowledge of the key concepts of each chapter. Each Learning Outcome has been correlated to the individual sections so students know what to focus on. The **Review Questions** and **Chapter Summary** bullet points have also been correlated to Learning Outcomes in an integrated Study Plan so the message and key points are repeated throughout the chapter.

Also new to this edition are dynamic and eye-catching full-page **Focus Figures** that depict some of the most important and complex processes or concepts discussed in the chapter. These figures provide a visual, step-by-step walkthrough that will help students understand and master these topics.

Another new feature is the **Meal Focus Figures**. These figures depict one day's poor meal choices versus healthy meal choices and provide a nutrient analysis of each day's meals so that students can compare the nutritional differences. Each Meal Focus Figure shows students two different options for breakfast, lunch, and dinner.

In addition to these exciting new features in this edition, we have modified or expanded many of the existing features to be even more practical, often appearing as worksheets or checklists that students can work through. The design and art programs have been updated with dynamic colors to add to visual clarity and interest. To provide a focused and streamlined text, we've moved the **Nutri-Case** features and **Cooking 101** videos online where they will be available through **MasteringNutrition**. The visual summary of features in the front of the book provides an overview of these and other important features in the fourth edition. For specific changes to each chapter, please see below.

Chapter 1

- Added Learning Outcomes and revised and updated Test Yourself questions
- Updated Figure 1.4 with new statistics on obesity
- Replaced DRI figures with a new Focus Figure
- Replaced former Figure 1.7 comparing high- versus low-density meals with new Meal Focus Figure
- Replaced Mediterranean diet pyramid and Latin diet pyramid with "plate" versions to correspond to MyPlate. Deleted Asian diet pyramid.

Chapter 2

- Added Learning Outcomes and revised and updated Test Yourself questions
- Deleted former Figure 2.3 on the organization of the human body
- Replaced figure of gastrointestinal tract anatomy with new Focus Figure
- Replaced figure of absorptive features of the small intestine with new Focus Figure
- Fully updated the information about nutrigenomics in the Nutrition Myth or Fact? box
- Fully updated the information about probiotics—and added prebiotics—to the Highlight box
- Expanded content discussing the importance of fiber to GI health
- Moved figure of enzyme function from the protein chapter to this chapter, where enzymes are first discussed
- Updated content on ulcers
- Updated content and figure on GERD
- Added information on non-celiac gluten sensitivity
- Updated the Review Questions

Chapter 3

- Added Learning Outcomes and revised and updated Test Yourself questions
- Moved table of terms related to grains into the Highlight on what constitutes a whole grain
- Replaced figure of carbohydrate digestion with new Focus Figure
- Updated information on glycemic index and load
- Revised information on high fructose corn syrup
- Converted the Highlight on artificial sweeteners into a narrative section and entirely updated it
- Replaced former Figure 3.14 comparing high- versus low-fiber meals with new Meal Focus Figure
- Slightly expanded the information on the consequences of uncontrolled diabetes
- Deleted former Figure 3.15 (race/ethnicity graph of type 2 diabetes)

Chapter 4

- Added Learning Outcomes and revised and updated Test Yourself questions
- Updated information on *trans* fats to reflect FDA preliminary finding on partially hydrogenated oils (PHOs) no longer being recognized as safe
- Moved information on Urquhart's research with the Inuits from the Nutrition Milestone into the narrative
- In the Nutrition Myth or Fact? box on butter versus margarine, added a table providing nutritional information
- Added information on the role of steroids in steroid hormones
- Replaced former Figure 4.7 of lipid digestion with new Focus Figure
- Added a new Meal Focus Figure comparing meals high and low in saturated fat
- Moved the information and table comparing reduced-fat, low-fat, and nonfat foods from a separate Highlight box into the Nutrition Label Activity on fat on food labels
- Deleted the discussion of fat replacers
- Added chia seeds and pumpkin seeds to the Foods You Don't Know You Love Yet on flaxseeds
- Replaced former Figure 4.12 of photos of atherosclerotic blood vessels with full-page atherosclerosis Focus Figure

Chapter 5

- Added Learning Outcomes and revised and updated Test Yourself questions
- Moved former Figure 5.5 on enzymes to Chapter 2 where enzymes are introduced
- Replaced former Figure 5.7 on protein digestion with new Focus Figure
- Slightly expanded information on the waste products of protein digestion
- Reorganized the discussion of protein deficiency and protein excess to improve flow

- Fully updated the Nutrition Myth or Fact? box on high-protein diets
- Added a new Meal Focus Figure comparing meals with poor versus healthful protein sources
- Fully updated the Highlight on soy and moved tips on increasing soy into the Game Plan on adding legumes to your diet
- Fully updated the information on protein and amino acid supplements
- Fully updated the information on vegetarian diets and replaced the vegetarian food pyramid with a link to the Vegetarian Resource Group's vegan MyPlate

Chapter 6

- Added Learning Outcomes and revised and updated Test Yourself questions
- Updated the information on vitamin DRIs
- Added a new narrative section called Vitamins Are Vulnerable on preventing excessive losses during storage and cooking
- Converted the information on dietary supplements—which had been in a Highlight box—into a narrative section and updated to include new research questioning the benefits of MVM supplements for most consumers, and removed information on functional foods (which is now mentioned in Chapter 2)
- Added a new Meal Focus Figure comparing meals poor versus rich in a variety of vitamins

Chapter 7

- Added Learning Outcomes and revised and updated Test Yourself questions
- Revised chapter-opening story to introduce both osteopenia and osteoporosis
- Expanded modestly the content on sodium in foods, specifically on sodium in fast foods
- Added a new figure identifying key components of the DASH diet
- Simplified the figure showing the structure of hemoglobin
- Added a bulleted list of tips for boosting iron intake
- Expanded the discussion on osteoporosis prevention

Chapter 8

- Added Learning Outcomes and revised and updated Test Yourself questions
- Revised the chapter opener to introduce the FDA's concerns related to energy drinks
- Fully revised and updated the discussion of sources of drinking water
- Shortened the discussion of tea
- Added a new discussion of alkaline water and black water as examples of many types of bottled water marketed with ungrounded health claims
- Fully revised, updated, and expanded the discussion of energy drinks
- Added a discussion of coconut water
- Added a discussion of the Calorie costs of alcoholic beverages

Chapter 9

- Added Learning Outcomes and revised and updated Test Yourself questions
- Updated the chapter opener
- Added information on new research into the protective effects of being modestly overweight
- Replaced the former figure on the energy balance equation with a new Focus Figure and added a brief discussion of the limitations of the energy balance equation
- Added photos for visual interest to the table on the energy costs of physical activities
- Fully updated the information on the genetic, metabolic, and social factors influencing body weight
- Added a new Meal Focus Figure comparing meals high in empty Calories versus lower Calorie meals high in nutrient density

- Deleted Figure 9.12, the graph that showed rising rates of childhood obesity
- Fully updated the information on pharmacologic and surgical treatments for obesity
- Fully revised the material on eating disorders to reflect DSM-5 classifications

Chapter 10

- Added Learning Outcomes and revised and updated Test Yourself questions
- Updated the chapter opener
- Comprehensively revised and updated the information on designing a quality fitness program
- Replaced former Figure 10.6 with a new Focus Figure on energy use during physical activity
- Condensed the narrative on dehydration, heatstroke, and other heat-related problems, because these are discussed fully in Chapter 8
- Modestly expanded the information on ergogenic aids

Chapter 11

- Added Learning Outcomes and revised and updated Test Yourself questions
- Modestly condensed the discussions of a pregnant woman's specific nutrient needs and of smoking and substance abuse during pregnancy
- Modestly condensed the section on breastfeeding
- Deleted the former Nutrition Myth or Fact? box on feeding a vegan diet to toddlers
- Replaced the MyPyramid for Kids poster with the new MyPlate food plan for preschoolers
- Revised and expanded the material on school lunches
- Revised and expanded the material on food insecurity among children
- Fully updated the discussion of obesity in children
- Replaced the old Tufts food pyramid for older adults with the new Tufts MyPlate for Older Adults
- Expanded the discussion of polypharmacy among older adults
- Fully revised the discussion of calorie restriction to boost life span

Chapter 12

- Added Learning Outcomes and revised and updated Test Yourself questions
- Replaced the chapter introduction to highlight the problem of norovirus
- Fully updated all foodborne illness statistics and governmental regulations related to food safety
- Updated and expanded discussion of the viral sources of foodborne illness
- Entirely updated Table 12.2 on the six most common bacterial causes of foodborne illness
- Updated the data in the Nutrition Myth or Fact? feature box on mad cow disease
- Revised and expanded the discussion of toxins in foods, for example, toxic algae
- Replaced FightBac figure with similar figure from foodsafety.gov
- Included link to FSIS information on thawing foods safely
- Deleted Thermy figure
- Updated information on the GRAS list, including FDA proposal to remove PHOs
- Fully updated all information on GMOs, including in the Highlight feature box
- Discussed effects of endocrine disruptors—BPA, phthalates, and dioxins—as residues in foods
- Updated research into the increased nutrients and reduced pesticide levels of organic foods
- Added EWG's "Dirty Dozen" and "Clean Fifteen" lists of pesticide levels in foods
- Comprehensively revised the chapter-closing section on the food movement, including the discussions of sustainability issues, food diversity, slow food, local food, food equity, food insecurity, and fair trade
- Moved the discussion of global food insecurity to the website

Appendices and Back Matter

- Appendix A is The USDA Food Guide Evolution, which provides an overview of the development of the USDA nutritional recommendations and MyPlate
- Appendix D is the most up to date Choose Your Food List for Diabetes from 2014 which provides a variety of meal planning choices for carbohydrates, proteins, beverages, and many more
- Available on MasteringNutrition are the Cooking 101 Videos and Glossary, with adaptations from the *Eat Right! Healthy Eating and Beyond* print ancillary, including recipes, shopping lists, tips for eating on a budget, and essential cooking terms and concepts
- The 2010 Dietary Guidelines are posted on the inside front cover of the text. Located on the inside back cover, and in adjoining back pages of this text, are the current Tolerable Upper Intake Levels (ULs) for Vitamins and Elements (minerals), and the Dietary Reference Intakes (DRIs) for Macronutrients, Vitamins, and Elements (minerals)

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Students today want options when it comes to their learning and especially their textbooks. ***Nutrition for Life*** gives students the flexibility they desire, offering a wide range of formats for the book and a large array of online learning resources. Let your students find a version that works best for them!

Whether it's on a laptop, tablet, or cell phone, *Nutrition for Life* lets students access media and other tools about nutrition.

Nutrition for Life MasteringNutrition with eText

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No matter the format, with each new copy of the text students will receive full access to the Study Area of MasteringNutrition, providing a wealth of videos, MP3 study podcasts, animations, and more. Give your students all the learning options with *Nutrition for Life*.

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acknowledgments

It is always eye opening to write a textbook and realize how many people actually contribute to the final, completed product!

We would like to thank the fabulous staff at Pearson Higher Education for their incredible support and dedication to this book. Frank Ruggirello, Publisher, committed extensive resources to ensuring the quality of this text, and his support and enthusiasm helped us maintain the momentum we needed to continue to enhance this project. Our Acquisitions Editor, Sandy Lindelof, encouraged us to be authors and provided unwavering support and guidance throughout the entire process of writing and publishing this book. We could never have written this text without the exceptional writing and organizational skills of Laura Bonazzoli, our Developmental Editor. Laura's energy, enthusiasm, and creativity significantly enhanced the quality of this text. Tu-Anh Dang-Tran, our dedicated Project Manager, kept us sane and focused with her excellent editorial skills. And Leah Sherwood, Editorial Assistant, managed endless critical details and tasks with grace and aplomb.

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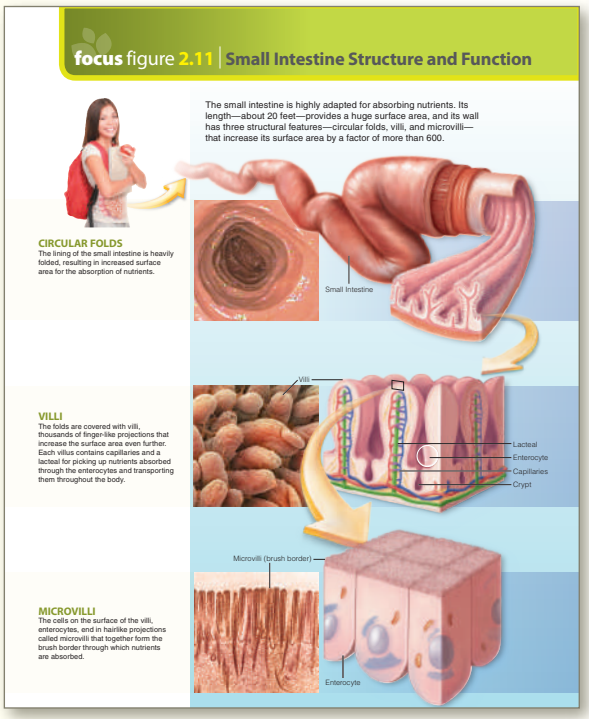
Bring Your Nutrition Class

INTO FOCUS

Bring Nutrition Into Focus

The Fourth Edition of ***Nutrition for Life*** provides students with the tools that they need to effectively learn and master nutrition concepts and to apply those concepts to their daily lives.



NEW! Focus Figures

These colorful, full-page figures teach students key concepts in nutrition through bold, clear, and detailed visual presentations. The dynamic new figures also have corresponding tutorials in MasteringNutrition.

Focus Figures include introductory text that explains how the figure is central to concepts that students will cover throughout the text.

- Students get clear directions via text and stepped-out art that guide the eye through complex processes, breaking them down into manageable pieces that are easy to teach and understand.
- Focus Figures provide dynamic illustrations—often paired with photographs—that make topics come alive.
- Full-page format enables micro-to-macro levels of explanation for complex topics.

NEW! Meal Focus Figures

Students get a visual comparison of possible meal choices, ranging from high- and low-density meals to meals high in refined carbohydrates vs fiber-rich meals. Each figure offers easy-to-understand comparisons of the key nutrients for that topic as well as clear images of the foods being assessed. New coaching activities complement each figure in MasteringNutrition.

4 Fats
Essential Energy-Supplying Nutrients

learning outcomes

After studying this chapter, you should be able to:

1. Compare and contrast the three types of lipids found in foods, pp. 101–106.
2. Discuss how the level of saturation of a fatty acid affects its shape and the form it takes, pp. 101–106.
3. Explain the health benefits and dietary sources of the essential fatty acids, pp. 101–106.
4. List five functions of fat, pp. 107–108.
5. Describe the steps involved in fat digestion, absorption, and transport, pp. 109–111.
6. Identify the dietary recommendations for intakes of total fat, saturated fat, *trans* fats, and the essential fatty acids, pp. 112–117.
7. Identify common food sources of less healthful versus more healthful fats, pp. 112–117.
8. Summarize our current understanding of the relationship between intake of dietary fats and the development of cardiovascular disease and cancer, pp. 118–124.

test yourself

Are these statements true or false? Circle your guess.

1. T F **Dietary cholesterol is not required because our body makes all the cholesterol it needs.**
2. T F **Fat is an important fuel source during rest and exercise.**
3. T F **Certain fats protect against heart disease.**

Test Yourself answers can be found at the end of the chapter.

MasteringNutrition™
Go online for chapter quizzes, pre-tests, Interactive Activities, and more!

NEW! Learning Outcomes and Study Plan

Learning Outcomes now introduce every chapter, giving students a roadmap for their reading. Each chapter concludes with a Study Plan, which summarizes key points of the chapter and provides review questions to check understanding, both tied to the chapter's learning outcomes.

chapter summary

Scan to hear an MP3 Chapter Review in MasteringNutrition.

LO 1 Summarize the two main reasons that foodborne illness is a critical concern in the United States

- According to the CDC, about 48 million Americans report experiencing foodborne illness each year. Moreover, food production is increasingly complex, with more foods mass-produced than ever before, using a combination of ingredients from a much greater number of sources, including fields, feedlots, and a variety of processing facilities all over the world. Contamination can occur at any point from farm to table, and when it does, it can be difficult to trace.

LO 2 Identify the types of microorganisms most commonly involved in foodborne illness

- Food infections result from the consumption of food containing pathogenic microorganisms, such as bacteria, whereas food intoxications result from consuming food in which microorganisms have secreted toxins. Chemical residues in food can also cause illness.
- Food infections are most commonly caused by viruses, especially the norovirus; bacteria such as *Salmonella*; and parasites, such as helminths.

LO 3 Describe strategies for preventing foodborne illness at home, while eating out, and when traveling to other countries

- To reproduce in foods, microorganisms require a precise range of temperature, humidity, acidity, and oxygen content. You can prevent foodborne illness at home by washing your hands and kitchen surfaces often, separating foods to prevent cross-contamination, storing foods in the refrigerator or freezer, and cooking foods to their proper temperatures.
- When traveling, avoid raw foods and choose beverages that are boiled, bottled, or canned, without ice.

LO 4 Compare and contrast the different methods manufacturers use to preserve foods

- Some of the oldest techniques for food preservation include salting, sugaring, drying, smoking, and cooling.

review questions

LO 1 Compare and contrast the three types of lipids found in foods

1. Cholesterol is
   a. a triglyceride.
   b. a form of saturated fatty acid.
   c. a sterol.
   d. a phospholipid.

LO 2 Discuss how the level of saturation of a fatty acid affects its shape and the form it takes

2. Triglycerides with a double carbon bond at one part of the molecule are referred to as
   a. monounsaturated fats.
   b. hydrogenated fats.
   c. saturated fats.
   d. sterols.

LO 3 Explain the health benefits and dietary sources of the essential fatty acids

3. EPA and DHA
   a. are omega-3 fatty acids.
   b. are found in fatty fish.
   c. reduce the risk of cardiovascular disease.
   d. all of the above.

LO 4 List five functions of fat

4. Fats
   a. provide energy, but less per gram than carbohydrates.
   b. provide energy for resting functions, but not for physical activity.
   c. enable the transport of proteins.
   d. enable the transport of fat-soluble vitamins.

STUDY PLAN | MasteringNutrition™

Customize your study plan—and master your nutrition!—in the Study Area of **MasteringNutrition**.

what can I do **today?**

Now that you've read this chapter, try making these three changes.

1. Before every meal, whether you're preparing it yourself or eating out, wash your hands!
2. Buy a thermometer for your refrigerator and freezer. If you eat meat, buy a meat thermometer. Then start to use them!
3. If you purchase an apple today, pay the extra cash for organic. Apples top the list of high-pesticide foods.

test yourself | *answers*

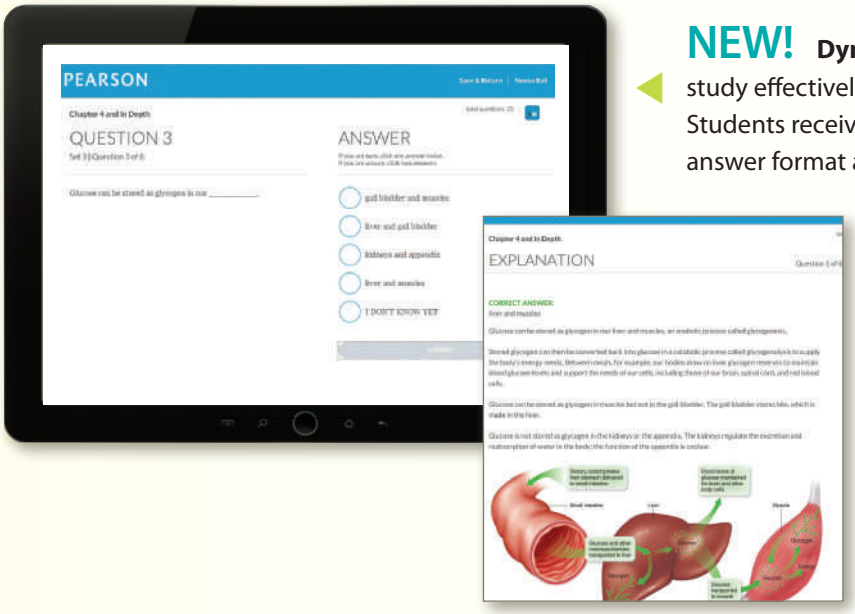
1. **False.** A majority of cases of foodborne illness are caused by just one species of virus, called norovirus. Bacteria also commonly cause foodborne illness. Mold is not usually a culprit.
2. **False.** Freezing destroys some microorganisms but only inhibits the ability of other microorganisms to reproduce. When the food is thawed, these cold-tolerant microorganisms resume reproduction.
3. **True.** In 2008 through 2012, the last five years for which data are available, more than 14% of American households have experienced food insecurity.

Continuous Learning
Before, During & After Class with
MasteringNutrition™ with MyDietAnalysis

MasteringNutrition with MyDietAnalysis is the most effective and widely used online homework, tutorial, and assessment system for the sciences. It delivers self-paced tutorials that focus on your course objectives, provides individualized coaching, and responds to each student's progress.

BEFORE CLASS

Dynamic Study Modules and Pre-Class Assignments provide students with a preview of what's to come.

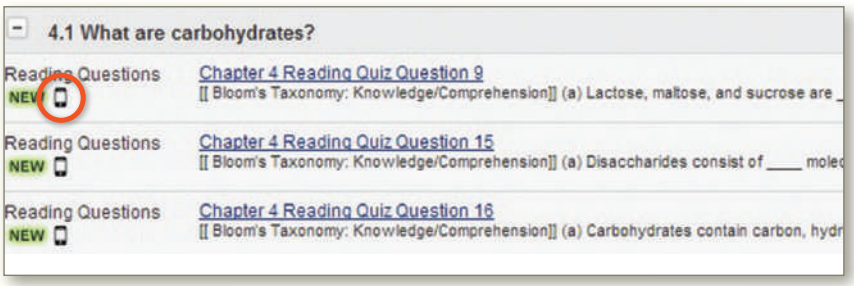


NEW! **Dynamic Study Modules** enable students to study effectively on their own in an adaptive format. Students receive an initial set of questions with a unique answer format asking them to indicate their confidence level.

Once completed, Dynamic Study Modules include explanations using materials taken directly from the text. These modules can be accessed on smartphones, tablets and computers. You can also assign an individual Dynamic Study Module for completion as a graded assignment prior to class.

Mastering offers Pre-Lecture Quiz Questions that are easy to customize and assign.

NEW! **Reading Questions** ensure that students complete the assigned reading before class and stay on track with reading assignments. Reading Questions are 100% mobile ready and can be completed by students on mobile devices.



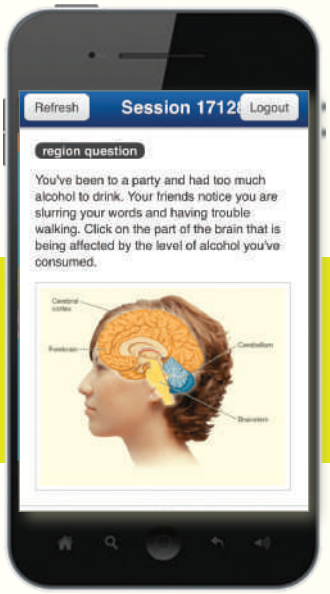
DURING CLASS

Learning Catalytics™ and Engaging Media

What has professors and students so excited? Learning Catalytics, a "bring your own device" student engagement, assessment, and classroom intelligence system, allows students to use their smartphone, tablet, or laptop to respond to questions in class. With Learning Catalytics, you can:

- Assess students in real-time using open ended question formats to uncover student misconceptions and adjust lectures accordingly.
- Automatically create groups for peer instruction based on student response patterns, to optimize discussion productivity.

> "My students are so busy and engaged answering Learning Catalytics questions during lecture that they don't have time for Facebook."
>
> Declan De Paor
> *Old Dominion University*



Engaging In-class Media

Instructors can also incorporate dynamic media from the **Teaching Toolkit DVD** into lecture and build class discussions and activities around Nutrition Animations, *ABC News* Lecture Launchers, NutriTools, and more. For more information, please see the last page of this walkthrough.

MasteringNutrition™

AFTER CLASS

Easy-to-Assign, Customizable, and Automatically Graded Assignments

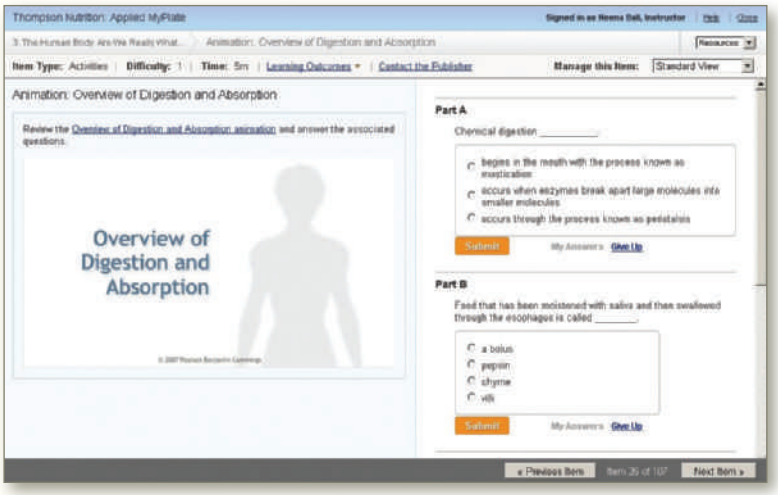
The breadth and depth of content available to you to assign in Mastering is unparalleled, allowing you to quickly and easily assign homework to reinforce key concepts.

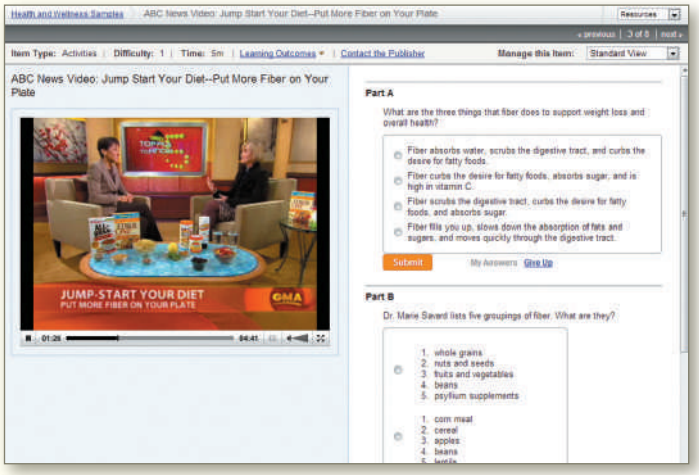
Focus Figure Coaching Activities

Coaching activities guide students through key nutrition concepts with interactive mini-lessons that provide hints and feedback.

Nutrition Animations

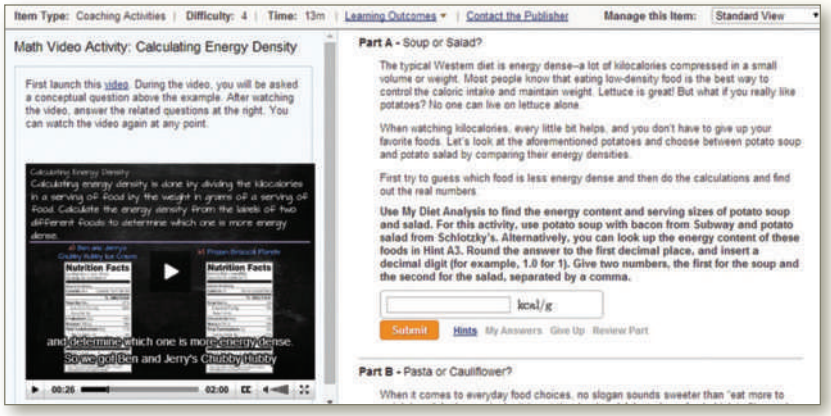
Animations built specifically for nutrition help students master tough topics with assessment and feedback.





ABC News Videos

27 *ABC News* videos with assessment and feedback help nutrition come to life and show how it's related to the real world.



Math Video Activities

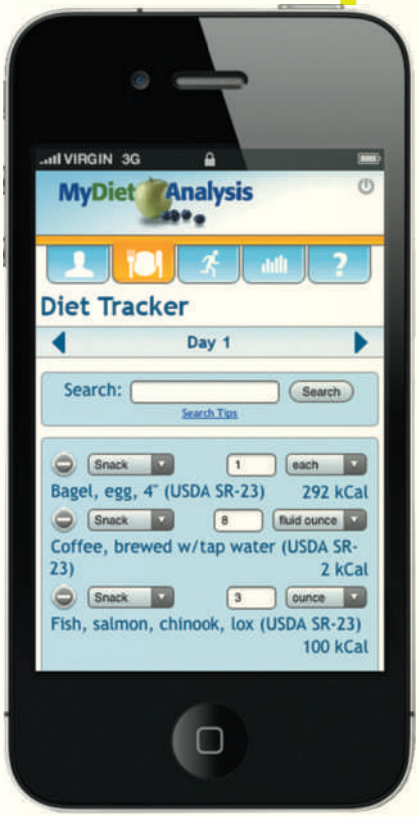
These interactive activities walk students through important calculations and provide hands-on practice with wrong-answer feedback to help students understand and apply the material.

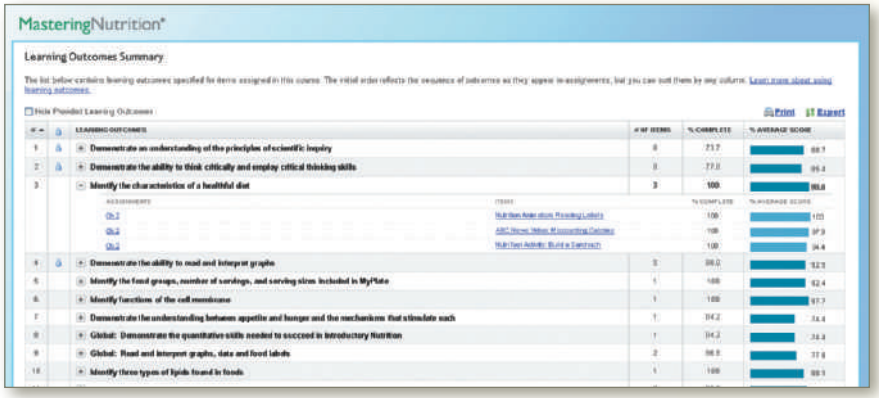
NutriTool Build-A-Meal Activities

These unique activities allow students to combine and experiment with different food options and learn first-hand how to build healthier meals.

MasteringNutrition also Includes Access to MyDietAnalysis

MyDietAnalysis is now available as a single sign on to MasteringNutrition. For smartphone users, a new mobile website version of MyDietAnalysis is available. Students can track their diet and activity intake accurately, anytime and anywhere, from their mobile device.

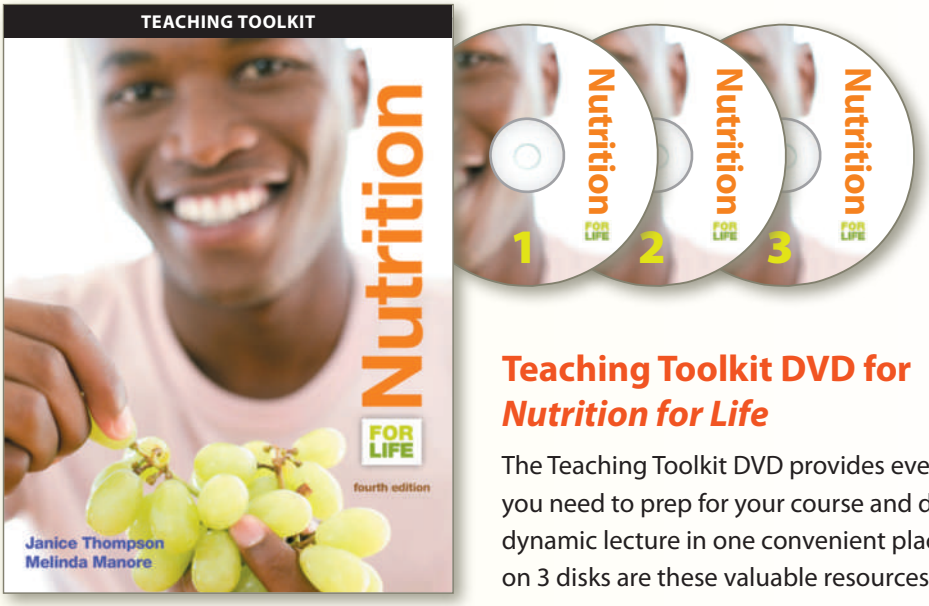




Learning Outcomes

All of the MasteringNutrition assignable content is tagged to book content and to Bloom's Taxonomy. You also have the ability to add your own outcomes, helping you track student performance against your learning outcomes. You can view class performance against the specified learning outcomes and share those results quickly and easily by exporting to a spreadsheet.

Everything You Need to Teach
In One Place



Teaching Toolkit DVD for *Nutrition for Life*

The Teaching Toolkit DVD provides everything that you need to prep for your course and deliver a dynamic lecture in one convenient place. Included on 3 disks are these valuable resources:

DISK 1

Robust Media Assets for Each Chapter

- 27 *ABC News* Lecture Launcher videos
- *Cooking 101* videos
- Nutrition Animations
- NutriTools
- PowerPoint Lecture Outlines
- Media Link PowerPoint slides for easy importing of videos, animations, and NutriTools
- PowerPoint clicker questions and Jeopardy-style quiz show questions
- Files for all illustrations and tables and selected photos from the text

DISK 2

Comprehensive Test Bank

- Test Bank in Word and RTF formats
- Computerized Test Bank, which includes all of the questions from the test bank in a format that allows you to easily and intuitively build exams and quizzes

DISK 3

Additional Innovative Supplements for Instructors and Students

For Instructors

- Instructor's Resource Support Manual
- Introduction to Mastering Nutrition
- Introductory video for Learning Catalytics

For Students

- *Eat Right! Healthy Eating in College and Beyond*
- *Food Composition Table*

User's Quick Guide for *Nutrition for Life*

This easy-to-use printed supplement accompanies the Teaching Toolkit and offers easy instructions for both experienced and new faculty members to get started with rich Toolkit content, how to access assignments within MasteringNutrition, and how to "flip" the classroom with Learning Catalytics.

1

Nutrition
Making It Work for You

learning outcomes

After studying this chapter, you should be able to:

1. Define the term *nutrition* and explain why nutrition is important to health, pp. 2–5.
2. Identify the six classes of nutrients essential for health, pp. 5–9.
3. Identify the characteristics of a healthful diet, pp. 9–10.
4. Compare and contrast the six types of Dietary Reference Intakes for nutrients, pp. 10–26.
5. Describe the *Dietary Guidelines for Americans* and discuss how these Guidelines can be used to design a healthful diet, pp. 10–26.
6. Identify the food groups in the USDA food patterns and the amounts adults should eat each day, pp. 10–26.
7. Explain how to read and use the Nutrition Facts panel found on food labels, pp. 10–26.
8. List at least four sources of reliable and accurate nutrition information, pp. 26–29.
9. Describe the steps of the scientific method used in research studies, pp. 29–33.

test yourself

Are these statements true or false? Circle your guess.

1. T F **Cookies, ice cream, and other "treats" can be part of a healthful diet.**
2. T F **A Calorie is a measure of the amount of fat in a food.**
3. T F **A nutritionist has at least an associate's degree in nutrition and has passed a national certification exam.**

Test Yourself answers can be found at the end of the chapter.

MasteringNutrition™

Go online for chapter quizzes, pre-tests, Interactive Activities, and more!

Miguel hadn't expected that college life would make him feel so tired. After classes, he just wanted to go back to his dorm room and sleep. Plus, he had been having difficulty concentrating and was worried that his first-semester grades would be far below those he'd achieved in high school. Scott, his roommate, had little sympathy. "It's all that junk food you eat!" he insisted. "Let's go down to the organic market for some real food." Miguel dragged himself to the market with Scott but rested at the juice counter while his roommate went shopping. A woman wearing a white lab coat approached him and introduced herself as the market's staff nutritionist. "You're looking a little pale," she said. "Anything wrong?" Miguel explained that he had been feeling tired lately. "I don't doubt it," the woman answered. "I can see from your skin tone that you're anemic. You need to start taking an iron supplement." She took a bottle of pills from a shelf and handed it to him. "This one is the easiest for you to absorb, and it's on special this week. Take it twice a day, and you should start feeling better in a day or two."

Miguel purchased the supplement and began taking it that night with the meal his roommate prepared. He took it twice the next day as well but didn't feel any better. After 2 more days on the supplement, he visited the university health clinic, where a nurse drew some blood for testing. When the results of the blood tests came in, the physician told him that his thyroid gland wasn't functioning properly. She prescribed a medication and congratulated Miguel for catching the problem early. "If you had waited," she said, "it would only have gotten worse, and you could have become seriously ill." Miguel asked if he should continue taking his iron supplement. The physician looked puzzled. "Where did you get the idea that you needed an iron supplement?"

Like Miguel, you've probably been offered nutrition-related advice from well-meaning friends and self-professed "experts." Perhaps you found the advice helpful, or maybe, as in Miguel's case, it turned out to be all wrong. Where can you go for reliable advice about nutrition? What exactly *is* nutrition, anyway? And how does our diet influence our health? In this chapter, we'll explore these questions and help you begin to design a diet that works for you.

Nutrition is the science that studies all aspects of food.

LO1 Define the term *nutrition* and explain why nutrition is important to health.

What is nutrition, and why is it important?

If you think that the word *nutrition* means pretty much the same thing as food, you're right—partially. But the word has a broader meaning that will gradually become clear as you make your way in this course. Specifically, **nutrition** is the science that studies food and how food nourishes our body and influences our health. It encompasses how we consume, digest, use, and store nutrients and how these nutrients affect our body. Nutrition science also studies the factors that influence our eating patterns, makes recommendations about the amount we should eat of each type of food, and addresses issues related to food safety and the global food supply. You can think of nutrition, then, as the discipline that encompasses everything about food.

nutrition The scientific study of food and how food nourishes the body and influences health.

Thousands of years ago, people in some cultures believed that the proper diet could cure criminal behavior, cast out devils, and bring us into alignment with the divine. Although modern science has failed to find evidence to support these claims, we do know that proper nutrition can help us improve our health, prevent certain diseases, achieve and maintain a healthy weight, and maintain our energy and vitality. Think about it: if you eat three meals a day, then by this time next year, you'll have

had more than a thousand chances to influence your body's functioning! Let's take a closer look at how nutrition supports health and wellness.

Nutrition Is One of Several Factors Supporting Wellness

Wellness can be defined in many ways. Traditionally considered simply the absence of disease, wellness is now described as a multidimensional state of being that includes physical, emotional, and spiritual health (FIGURE 1.1). Wellness is not an end point in our lives but is an active process we work on every day.

In this book, we focus on a critical aspect of wellness: physical health, which is influenced by both our nutrition and our level of physical activity. The two are so closely related that you can think of them as two sides of the same coin: our overall state of nutrition is influenced by how much energy we expend doing daily activities, and our level of physical activity has a major impact on how we use the nutrients in our food. Several studies have even suggested that healthful nutrition and regular physical activity can increase feelings of well-being and reduce feelings of anxiety and depression. In other words, wholesome food and physical activity just plain feel good!

FIGURE 1.1 Many factors contribute to our wellness. Primary among these are a nutritious diet and regular physical activity.

A Healthful Diet Can Prevent Some Diseases and Reduce Your Risk for Others

Nutrition appears to play a role—from a direct cause to a mild influence—in the development of many diseases (FIGURE 1.2). Poor nutrition is a direct cause of deficiency diseases such as scurvy and pellagra. Scurvy is caused by a deficiency of vitamin C, whereas pellagra is a result of a deficiency of niacin, one of the B-vitamins. Early nutrition research focused on identifying the missing nutrient

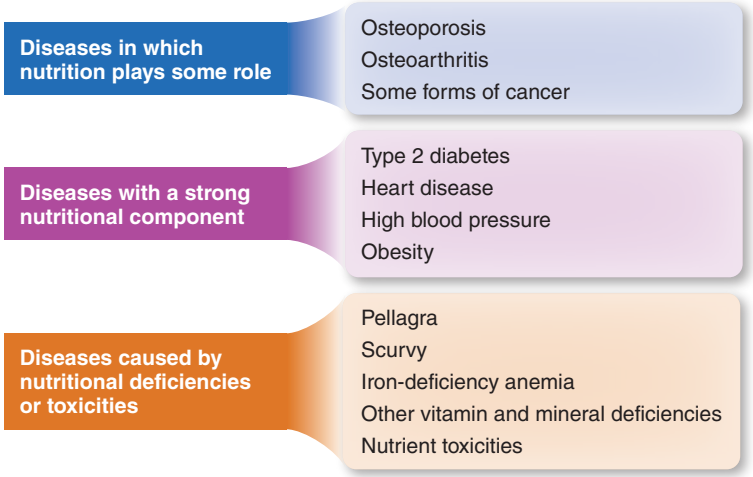


FIGURE 1.2 The relationship between nutrition and human disease. Notice that, whereas nutritional factors are only marginally implicated in the diseases of the top row, they are strongly linked to the development of the diseases in the middle row, and truly causative of those in the bottom row.

wellness A multidimensional, lifelong process that includes physical, emotional, and spiritual health.

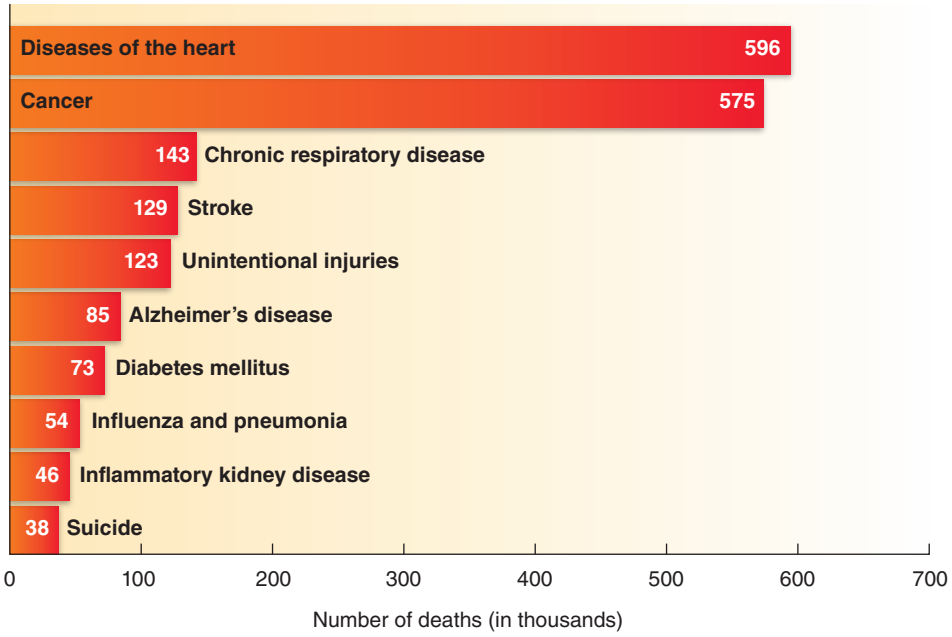


FIGURE 1.3 Of the ten leading causes of death in the United States in 2011, three—heart disease, stroke, and diabetes—are strongly associated with poor nutrition. In addition, nutrition plays a more limited role in the development of some forms of cancer.

Data from: "Deaths: Preliminary Data for 2011" (U.S. Department of Health and Human Services). Data from Centers for Disease Control and Prevention, NCHS. FastStats. Death and Morality. www.cdc.gov/nchs/fastats/deaths.htm

behind such diseases and on developing guidelines for nutrient intakes that are high enough to prevent them. Over the years, nutrition scientists successfully lobbied for fortification of foods with the nutrients of greatest concern. These measures, along with a more abundant and reliable food supply, have almost completely wiped out the majority of nutrient-deficiency diseases in developed countries. However, they are still major problems in many developing nations.

In addition to directly causing disease, poor nutrition can have a more subtle influence on our health. For instance, it can contribute to the development of brittle bones (a disease called *osteoporosis*), as well as to the progression of some forms of cancer. These associations are considered mild; however, poor nutrition is also strongly associated with three chronic diseases that are among the top ten causes of death in the United States **(FIGURE 1.3)**. These are heart disease, stroke, and diabetes.

A recent study examining the burden of diseases, injuries, and risk factors in the United States from 1990 to 2010 found that the leading risk factors contributing to disability and premature mortality include poor dietary habits, physical inactivity, smoking, high blood pressure, high fasting blood glucose levels, alcohol use, and obesity.[1] These researchers identified diets low in fruits, vegetables, and nuts and seeds, and high in sodium, processed meats, and *trans* fats as the most important dietary risks facing Americans today. As you are probably aware, obesity is a well-established risk factor for heart disease, stroke, type 2 diabetes, and some forms of cancer. Unfortunately, the prevalence of obesity has dramatically increased throughout the United States during roughly the past 30 years **(FIGURE 1.4)**. Throughout this text, we will discuss in detail how nutrition and physical activity affect the development of obesity.

Want to see how the prevalence of obesity has changed in the United States year-by-year for the past 25 years? Go to www.cdc.gov and enter "obesity data trend maps" into the search bar.

recap Nutrition is the science that studies food and how food affects our body and our health. Nutrition is an important component of wellness and is strongly associated with physical activity. One goal of a healthful diet is to prevent nutrient-deficiency diseases, such as scurvy and pellagra; a second goal is to lower the risk for chronic diseases, such as type 2 diabetes and heart disease.

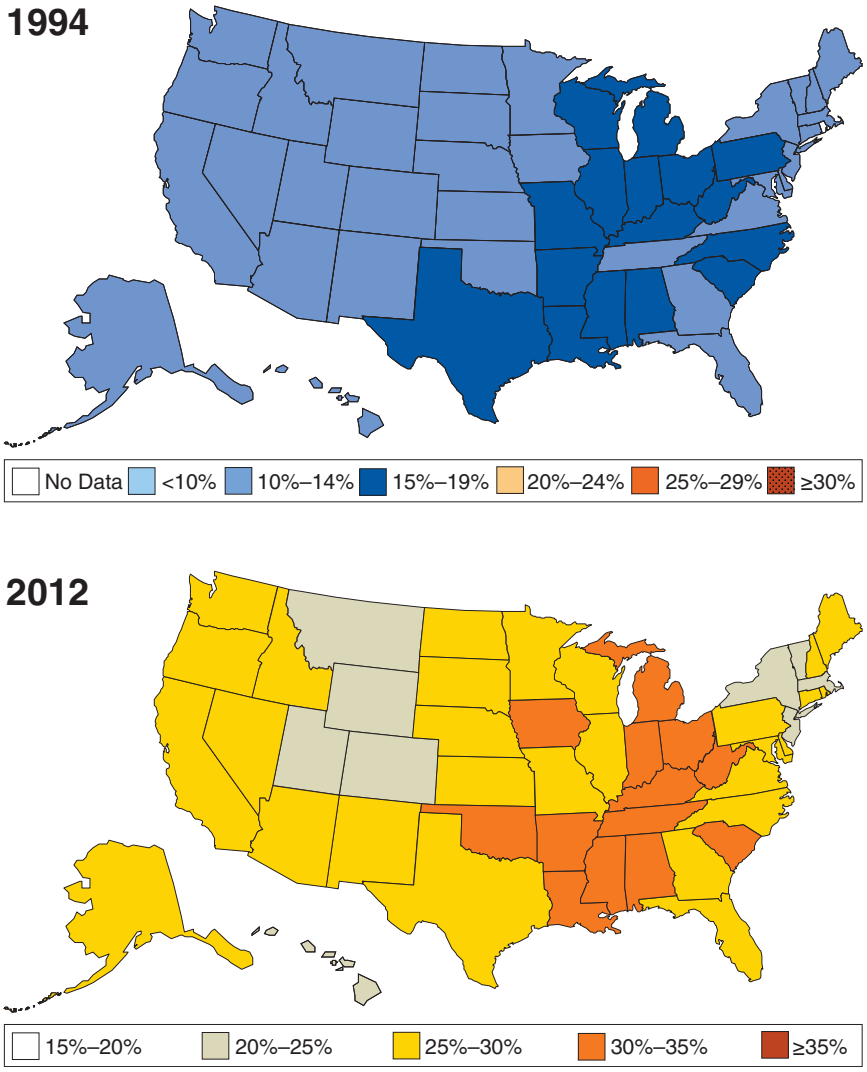


FIGURE 1.4 These diagrams illustrate the increase in obesity rates across the United States from 1994 to 2012 as documented in the Behavioral Risk Factor Surveillance System. Obesity is defined as a body mass index greater than or equal to 30, or approximately 30 lb overweight for a 5′4″ woman.

Graphics and data from: "Prevalence of Self-Reported Obesity Among U.S. Adults" and "Percent of Obese (BMI ≥ 30) in U.S. Adults: 1994" (Centers for Disease Control and Prevention).

What are nutrients?

LO2 Identify the six classes of nutrients essential for health.

A spoonful of peanut butter may seem as if it is all one substance, but in reality most foods are made up of many different chemicals. Some of these chemicals are not useful to the body, whereas others are critical to human growth and function. These latter chemicals are referred to as **nutrients**. The following are the six groups of nutrients found in the foods we eat **(FIGURE 1.5)**:

- carbohydrates
- fats (solid fats and liquid oils)
- proteins
- vitamins
- minerals
- water

Carbohydrates, Fats, and Proteins Are Macronutrients That Provide Energy

Carbohydrates, fats, and proteins are the only nutrients in foods that provide energy. By this we mean that these nutrients break down and reassemble into fuel that our body uses to support physical activity and basic functioning. Although taking

nutrients Chemicals found in foods that are critical to human growth and function.

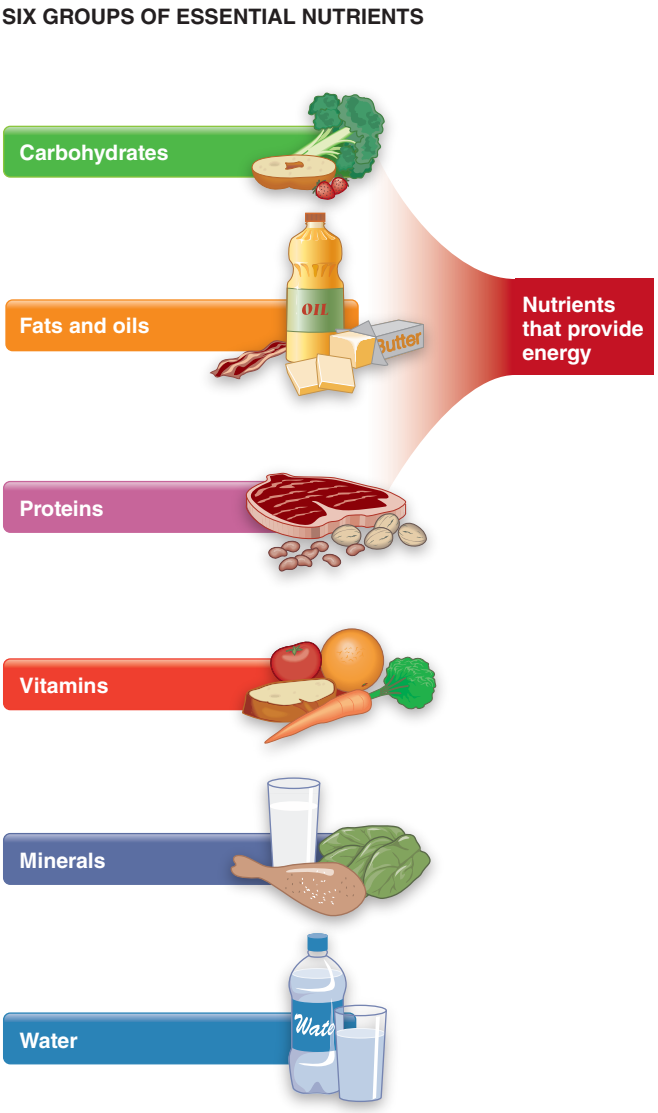


FIGURE 1.5 The six groups of essential nutrients found in the foods we consume.

a multivitamin and a glass of water might be beneficial in other ways, it will not provide you with the energy you need to do your 20 minutes on the stair-climber! The energy nutrients are also referred to as **macronutrients**. *Macro* means "large," and our body needs relatively large amounts of these nutrients to support normal functioning. Macronutrient needs are measured in grams, metric units of weight. Grams are small: ¼ teaspoon of sugar weighs about 1 gram.

Alcohol is a chemical found in food, and it provides energy. Nevertheless, it is not technically considered a nutrient because it does not support body functions or the building or repair of tissues. In fact, the alcohol in beverages is technically classified as a narcotic drug.

Nutrition scientists describe the amount of energy in food as units of *kilocalories* (*kcal*). A kilocalorie is the amount of heat required to raise the temperature of 1 kilogram of water (the weight of about 1 quart of water) by 1 degree Celsius. *Kilo-* is a prefix used in the metric system to indicate 1,000; so a kilocalorie is technically 1,000 Calories. However, for the sake of simplicity, food labels use the term *Calories* to indicate kilocalories. Thus, if the wrapping on an ice cream bar states that it contains 150 Calories, it actually contains 150 *kilo*calories. In this textbook, we use the term *kilocalories* as a unit of energy; we use the term *Calories* when discussing food labels or for everyday usage.

macronutrients Nutrients that our body needs in relatively large amounts to support normal function and health. Carbohydrates, fats, and proteins are macronutrients.

Carbohydrates Are a Primary Fuel Source

Carbohydrates are the primary source of fuel for our active body, particularly for the brain. They provide 4 kcal per gram. Many carbohydrates are *fiber rich*; that is, they contain nondigestible parts of plants that offer a variety of health benefits. Many are also rich in *phytochemicals*, plant chemicals that are thought to reduce our risk for cancer and heart disease.

Carbohydrates encompass a wide variety of foods. Grains, fruits, and vegetables contain carbohydrates, as do legumes (a class of vegetable including lentils, dry beans, and peas), seeds and nuts, and milk and other dairy products.

Fats Provide More Energy Than Carbohydrates

Fats are also an important source of energy for our body, especially during rest and low-intensity activity. Because they pack together tightly, fats yield more energy per gram than carbohydrates, 9 kcal versus 4 kcal. Dietary fats come in a variety of forms. Solid fats include such foods as butter, lard, and margarine. Liquid fats are referred to as *oils* and include vegetable oils, such as corn, canola, and olive oils. You've probably heard about a fatty substance called *cholesterol*, which is present in animal foods such as meats and egg yolks. Cholesterol is synthesized in our body, so we don't need to consume it; thus, it's not an essential nutrient.

Fat-soluble vitamins are found in a variety of fat-containing foods, including dairy products.

Proteins Support Tissue Growth, Repair, and Maintenance

Although **proteins** can provide energy (4 kcal per gram), they are not a primary source of energy for our body. Proteins play a major role in building new cells and tissues, maintaining the structure and strength of bone, repairing damaged structures, and assisting in many body functions. Meats and dairy products are primary sources of proteins for many Americans, but we can also obtain adequate amounts from nuts and seeds, legumes and other vegetables, and whole grains.

Vitamins and Minerals Are Micronutrients

Vitamins and minerals are referred to as **micronutrients** because we need relatively small amounts of them (*micro* means "small") to support normal health and body functions.

Vitamins Assist in Regulating Body Functions

Vitamins are compounds that contain the substance carbon and assist us in regulating the processes of our body. For example, vitamins play a critical role in building and maintaining healthy bone, blood, and muscle tissue; supporting the immune system so we can fight illness and disease; and maintaining healthy vision. Contrary to popular belief, vitamins do not provide energy (kilocalories); however, vitamins do play an important role in assisting our body with releasing and using the energy found in carbohydrates, fats, and proteins.

A vitamin's ability to dissolve in water versus fat affects how it is absorbed, transported, stored, and excreted from our body. Thus, nutrition experts classify vitamins into two groups **(TABLE 1.1)**:

- water soluble
- fat soluble

Because our body cannot synthesize most vitamins, we must consume them in our diet. Both water-soluble and fat-soluble vitamins are essential for our health and are found in a variety of foods, from animal products, nuts, and seeds to fruits and vegetables. Many vitamins break down upon prolonged exposure to heat and/or light, which explains why vitamin supplements are not sold in clear bottles.

carbohydrates The primary fuel source for our body, particularly for the brain and for physical exercise.

fats An important energy source for our body at rest and during low-intensity exercise.

proteins Macronutrients that the body uses to build tissue and regulate body functions. Proteins can provide energy but are not a primary source.

micronutrients Nutrients needed in relatively small amounts to support normal health and body functions. Vitamins and minerals are micronutrients.

vitamins Micronutrients that contain carbon and assist us in regulating the processes of our body. They are classified as water soluble or fat soluble.

Peanuts are a good source of the major minerals magnesium and phosphorus, which play important roles in the formation and maintenance of our skeleton.

TABLE 1.1 Overview of Vitamins

Type	Names	Characteristics
Fat soluble	A, D, E, and K	Soluble in fat Stored in the human body Toxicity can occur from consuming excess amounts, which accumulate in the body
Water soluble	C, B vitamins (thiamin, riboflavin, niacin, vitamin B_6, vitamin B_{12}, pantothenic acid, biotin, and folate)	Soluble in water Not stored significantly in the human body Excess is excreted in urine Toxicity generally only occurs as a result of vitamin supplementation

Minerals Are Not Broken Down During Digestion

The sodium in table salt, the calcium in milk, and the iron in red meat are all examples of minerals essential to human health and functioning. **Minerals** are substances that

- are single elements of matter, not compounds,
- are not broken down during digestion, and
- are not destroyed by heat or light.

Thus, all minerals maintain their structure no matter what environment they are in. This means that the calcium in our bones is the same as the calcium in the milk we drink, and the sodium in our cells is the same as the sodium in table salt. Among their many important functions, minerals assist in fluid regulation and energy production, are essential to the health of our bones and blood, and help rid our body of harmful chemicals. They are classified into two groups, according to the amounts we need in our diet and how much of the mineral is found in our body (TABLE 1.2):

- major minerals
- trace minerals

Major minerals earned their name from the fact that we need to consume at least 100 milligrams (mg) per day in our diet and because the total amount found in our body is at least 5 grams (5,000 mg). **Trace minerals** are those we need to consume in amounts less than 100 mg per day, and the total amount in our body is less than 5 grams (5,000 mg). Food sources of major and trace minerals are varied and include meats, dairy products, fruits and vegetables, and nuts and seeds.

Water Supports All Body Functions

Water is a nutrient vital for our survival. We consume water in its pure form; in juices, soups, and other liquids; and in solid foods, such as fruits and vegetables. Adequate water intake ensures the proper balance of fluid both inside and outside our cells and assists in the regulation of nerve impulses, muscle contractions, nutrient transport, and excretion of waste products.

minerals Micronutrients that are single elements of matter, not compounds, are not broken down during digestion, and are not destroyed by heat or light. Minerals assist in the regulation of many body processes and are classified as major minerals or trace minerals.

major minerals Minerals we need to consume in amounts of at least 100 mg per day and of which the total amount in our body is at least 5 grams.

trace minerals Minerals we need to consume in amounts less than 100 mg per day and of which the total amount in our body is less than 5 grams.

TABLE 1.2 Overview of Minerals

Type	Names	Characteristics
Major minerals	Calcium, phosphorus, sodium, potassium, chloride, magnesium, sulfur	Needed in amounts greater than 100 mg/day in our diet Amount present in the human body is greater than 5 grams (5,000 mg)
Trace minerals	Iron, zinc, copper, manganese, fluoride, chromium, molybdenum, selenium, iodine	Needed in amounts less than 100 mg/day in our diet Amount present in the human body is less than 5 grams (5,000 mg)

recap The six essential nutrient groups found in foods are carbohydrates, fats, proteins, vitamins, minerals, and water. Carbohydrates, fats, and proteins are macronutrients, and they provide our body with the energy necessary to thrive. Vitamins and minerals are micronutrients that do not provide energy but are essential to human functioning. Adequate water intake ensures the proper balance of fluid both inside and outside our cells.

What is a healthful diet?

LO3 Identify the characteristics of a healthful diet.

A **healthful diet** provides the proper combination of energy and nutrients. It has four characteristics: it is adequate, moderate, balanced, and varied. Whether you are young or old, overweight or underweight, healthy or coping with illness, if you keep in mind these characteristics of a healthful diet, you will be able to select foods that provide you with the optimal combination of nutrients and energy each day.

A Healthful Diet Is Adequate

An **adequate diet** provides enough energy, nutrients, and fiber to maintain a person's health. A diet may be inadequate in many areas or only one. For example, many people in the United States do not eat enough vegetables and therefore are not consuming enough of many of the important nutrients found in vegetables, such as fiber-rich carbohydrate, vitamin C, beta-carotene, and potassium. Other people may eat only plant-based foods. Unless they supplement or use fortified foods, their diet will be inadequate in a single nutrient, vitamin B_{12}.

A Healthful Diet Is Moderate

Moderation refers to eating the right amounts of foods to maintain a healthy weight and to optimize the functioning of our body. People who eat too much or too little of certain foods may not be able to reach their health goals. For example, let's say a person drinks 60 fluid ounces (three 20 oz bottles) of soft drinks each day. These drinks contribute an extra 765 kcal of energy to the person's diet. To avoid weight gain from these kilocalories, most people would need to reduce their food intake, probably by cutting out healthful food choices. Consuming soft drinks in moderation keeps more energy available for nourishing foods.

A Healthful Diet Is Balanced

A **balanced diet** is one that contains the combinations of foods that provide the proper balance of nutrients. As you will learn in this course, our body needs many types of foods in varying amounts to maintain health. For example, fruits and vegetables are excellent sources of fiber, vitamin C, beta-carotene, potassium, and magnesium. Meats are not good sources of these nutrients, but they are excellent sources of protein, iron, zinc, and copper. By eating a proper balance of healthful foods, we can be confident that we are consuming enough of the nutrients we need.

A Healthful Diet Is Varied

Variety refers to eating different foods each day. In many communities in the United States, there are thousands of healthful foods to choose from. By trying new foods on a regular basis, we optimize our chances of consuming the multitude of nutrients our body needs. In addition, eating a varied diet prevents boredom and avoids getting into a "food rut."

recap A healthful diet provides adequate nutrients and energy in moderate amounts. A healthful diet also includes an appropriate balance and a wide variety of foods.

healthful diet A diet that provides the proper combination of energy and nutrients and is adequate, moderate, balanced, and varied.

adequate diet A diet that provides enough energy, nutrients, and fiber to maintain a person's health.

moderation Eating the right amounts of foods to maintain a healthy weight and to optimize our body's functioning.

balanced diet A diet that contains the combinations of foods that provide the proper proportion of nutrients.

variety Eating different foods each day.