

THIRD EDITION

PERSPECTIVES IN NUTRITION

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As with earlier editions of this textbook, our goal is to provide the most accurate, up-to-date, and useful introductory nutrition text available. We would like to recognize and thank the people whose direction and insight guided us through the three editions.

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A unique feature of this book is its collection of Expert Opinion commentaries. In addition, several authorities addressed specialized topics in Nutrition Perspective essays. We would like to thank the experts whose outstanding and insightful articles highlight this text.

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Preface to the Instructor

If you teach nutrition, you undoubtedly already find it a fascinating topic. However, nutrition can also be quite frustrating to teach. Claims and counter-claims abound regarding the need for certain constituents in our diets. Sodium is a good example. One group of researchers promotes a low-sodium diet for the general population as an effective preventive measure for hypertension. Other groups believe that normal blood pressure values can often be maintained despite the excess intakes of sodium common among Americans.

As authors, we too are aware of conflicting opinions in our field and thus draw on as many sources as possible in the continual updating of this textbook, now in its third edition. We have incorporated much new material, especially from the recently published supplements to the *American Journal of Clinical Nutrition* and the latest edition of *Modern Nutrition in Health and Disease*, edited by Shils, Olson, and Shike. We have also consulted a number of experts and continue to include their insights about the current state of nutrition research.

We believe that this textbook continues to differ significantly from all others in the field. Like other textbooks, it focuses on the latest research in nutrition, but goes further by documenting important research studies throughout the chapters, listing those references at the end of each chapter, and providing Expert Opinion boxes in each chapter to examine more closely the most controversial issues introduced in the text. In all, we strive to present many perspectives in current nutrition research so that you and your students can better understand and participate in debates about current nutrition issues.

Personalizing Nutrition

One prominent theme in nutrition research today is *individuality*. Not all of us, for example, find that saturated fat in our diets raises our blood cholesterol values above recommended standards. Each person responds individually, often idiosyncratically, to nutrients, and that is something we continually point out in this textbook.

As well, even at this basic level we do not assume that all nutrition students are alike. We repeatedly ask students to learn more about themselves and their health status and to use this new knowledge to improve their health. After reading this textbook, students will understand much more clearly how the nutrition information given on the evening news, on cereal box labels, in popular magazines, and by government agencies applies to them. They will become sophisticated consumers of both nutrients and nutrition information. They will understand that their knowledge of nutrition allows them to personalize information, rather

than follow every guideline issued for an entire population. After all, a population by definition consists of individuals with varying genetic and cultural backgrounds, and these individuals have varying responses to diet.

In addition, we cover important questions that students often raise concerning ethnic diets, eating disorders, nutrient supplements, phytochemicals, vegetarianism, diets for athletes, food safety, and fad diets. We emphasize the importance of understanding one's food choices and changing one's diet as needed.

Audience

This book is designed for a diverse audience. It is most useful for students majoring in nutrition, the health sciences, home economics, nursing, physical education, and other health-related areas and for premedical and pre dental students. However, because the chapter organization and content are flexible, the book can be adapted to meet the needs of students of diverse backgrounds. Although it is not absolutely necessary, most students will find that having taken a course in biology or having an understanding of basic biological concepts provides a helpful background for taking the introductory nutrition course.

Organization

Although the book is most suitable for a semester-length course, it can also be used in a quarter-length course by omitting chapters or by skipping various sections. A useful feature of this text is that it is presented in six segments:

Part One: Nutrition Basics

Part Two: The Energy-Yielding Nutrients

Part Three: Energy Production and Energy Balance

Part Four: The Vitamins and Minerals

Part Five: Nutrition Applications in the Life Cycle

Part Six: Putting Nutrition Knowledge into Practice

This organization makes it easy to tailor the text to specific course needs.

New to This Edition

The third edition of *Perspectives in Nutrition* incorporates several new features designed to enhance student learning and understanding:

NEW CRITICAL THINKING QUESTIONS

Each chapter presents three scenarios that allow students to apply information they have learned to practical situations. These questions will help students put the information in the chapter into the perspective of daily life and, by doing

so, will enhance learning. Answers are provided in the back of the book so that students can compare their thinking with that of the authors.

EXPANDED COVERAGE OF NUTRITION LABELING

Constance J. Geiger, Ph.D., R.D., a noted authority on food labeling issues and a consultant to the food industry, wrote the Nutrition Perspective in Chapter 2. This accurate and up-to-date essay reviews food labeling in detail. Then, in the remaining chapters of the book, sample labels are shown to reinforce the value of reading food labels and to help the student practice obtaining important information from this nutrition tool.

EXPANDED COVERAGE OF ETHNIC DIETS

The Nutrition Perspective in Chapter 18 takes a broad look at ethnic influences on the American diet. It also covers the recently proposed Mediterranean diet pyramid.

EXPANDED COVERAGE OF THE IMMUNE SYSTEM

The Nutrition Perspective in Chapter 15 explores the physiology of the immune system and the role of nutrients in its various functions. Previously the focus was primarily on nutrients, but we believe that students will benefit from a wider discussion of the biological intricacies of the system.

NEW NUTRITION FOCUS BOXES

Phytochemicals and other breaking topics are now discussed in these new sections in each chapter.

MANY NEW EXPERT OPINION BOXES

Nutrition experts discuss intense sweeteners, women and heart disease, chromium picolinate, and vitamin E supplements. One expert provides a personal look at the fight against hunger and poverty in the United States.

OVER 100 NEW FULL-COLOR ILLUSTRATIONS

New figures provide greater anatomical detail and effectively convey important nutrition concepts.

FOOD GUIDE PYRAMID ILLUSTRATIONS

Twenty-five colorful variations on the USDA Food Guide Pyramid illustrate the nutrient density of the various food groups.

Additional Features

We have organized this text in response to the needs of instructors and students:

GENERAL CONTENT AND CONTROVERSIAL TOPICS ARE WELL REFERENCED

Approximately 80% of the referenced material is from sources published since the last edition of this text, in 1993. As instructors, we demand the latest information to present to our students. Providing this up-to-date research will not only

give students the most accurate picture of nutrition today but will also direct them to current materials for further study.

SEPARATE CHAPTERS ON ENERGY BALANCE, WEIGHT CONTROL, AND EATING DISORDERS

A thorough discussion is presented of these very controversial and current topics.

EMPHASIS ON NUTRIENT DENSITY

Discussions of nutrients are based on the most nutrient-dense sources of foods. Leading food sources in the U.S. diet are identified for each nutrient when those data are available.

EMPHASIS ON THE EXCHANGE SYSTEM

An outline of the 1995 version of the Exchange System is presented in Chapter 2 and can be used or omitted at your option. The use of the Exchange System is reinforced in Chapters 3 through 5 and in the Student Study Guide and Mosby's new NutriTrac software.

MINIMAL USE OF CHEMISTRY

An explanation of chemistry principles is presented in Appendix B to help students whose chemistry backgrounds are weak. We use some chemistry concepts to help students comprehend the nature of nutrient metabolism. Overall, this is kept to a minimum, and chemical structures are found primarily in the margins.

EMPHASIS ON BEHAVIOR-CHANGE STRATEGIES

Behavior-change strategies have been integrated into Chapter 9, Weight Control, to encourage students to plan diets that will enhance health maintenance. The strategies allow students to apply the foundations of the course to daily life. Once students are able to put the main nutrition concepts into perspective, they can set nutritional goals and change their diets accordingly.

SUMMARY TABLES

Some chapters contain large, detailed summary tables that include the major points made in the chapter. These tables are convenient capsules for reference.

Design

Choosing the illustrations for this textbook was quite exciting. Because we drew heavily on the biological and physiological expertise of our publisher, this textbook is far ahead of any in the field in depicting important biological and physiological phenomena, such as transport across cell membranes, emulsification, glucose regulation, digestion and absorption, cancer progression, and fetal development. The extensive three-dimensional graphic presentations in this book make nutrition and relevant physiological principles come alive for students.

In addition, we have used many sources to provide what we consider to be the best photographic program in any

nutrition text. The many full-color photographs in this text were researched and selected to reflect a modern view of food presentation and food consumption, providing the student with the most outstanding and timely perspective in the nutrition arena today.

Humor has been used throughout the text to aid the learning process. *Perspectives in Nutrition* includes some of the best work of our nation's leading cartoonists. The cartoons make important nutrition points in a way that students will remember.

Pedagogy

The following extensive pedagogical features were designed not only to interest the student but also to continually reinforce the learning process:

NUTRITION AWARENESS INVENTORIES

These sets of true or false questions heighten students' awareness of chapter content. This feature also allows students to gauge how much they have learned. The answers are listed by chapter at the end of the book.

MARGIN NOTES

Margin notes throughout the book provide clinical examples, references to other chapters, clarification of ideas, and further details about key concepts.

MARGIN DEFINITIONS

Important terms are set in boldface type at first mention. More difficult terms are defined in the text's margins. All boldface terms appear in the glossary.

CONCEPT CHECK BOXES

Concept Checks summarize chapter content every few pages, reinforcing students' understanding of the material.

NUTRITION FOCUS BOXES

Each chapter contains one or two short essays, often on controversial topics in nutrition, such as fat replacements.

TAKE ACTION BOXES

These activity boxes at the end of each chapter let students put theory into practice. The suggested assignments are usually proactive and at times involve students in the kinds of activities that registered dietitians perform.

CRITICAL THINKING QUESTIONS

Each chapter contains three scenarios that ask students to apply information they have learned to practical situations. Answers are provided at the end of the book.

CHAPTER SUMMARY POINTS

The content of each chapter is summarized in seven to ten major points. This feature, together with the Concept Checks, will help students to review for examinations.

*Available to qualified adopters.

STUDY QUESTIONS

Ten questions at the end of each chapter encourage students to probe deeper into the chapter content, making connections and gaining new insights.

UP-TO-DATE REFERENCES

Each chapter contains approximately 30 current references, most published since 1993.

NUTRITION PERSPECTIVE BOXES

These essays at the end of each chapter extend the chapter content by adding more detailed and controversial material.

EXPERT OPINION BOXES

Each chapter contains an Expert Opinion commentary written by a noted researcher. In most cases, the expert has been recognized by the American Dietetic Association or the American Institute of Nutrition.

GLOSSARY

A comprehensive glossary of more than 500 key terms is included for the student's reference. The glossary contains pronunciation keys for many unfamiliar words.

Supplementary Materials

The latest supplementary materials are provided to both the student and the instructor to make better use of the text and the concepts presented in the course:

***INSTRUCTOR'S MANUAL AND TEST BANK**

Prepared by Jan Goshert, M.S., R.D., this comprehensive teaching aid includes chapter summaries with suggestions for teaching difficult material; activities; suggested readings; nutrition assessments; source lists of supplementary materials; and a "survival" chapter, addressed to the novice instructor, that discusses class organization, scheduling, and problem areas such as cheating.

Extensively reviewed for clarity and accuracy, the test bank features approximately 2000 test items (multiple choice, short answer, true/false, and matching questions) coded for level of difficulty, type of knowledge being tested, and text page reference. The resource manual also includes 75 transparency masters of key illustrations.

STUDENT STUDY GUIDE

Prepared by Gordon M. Wardlaw, this student aid has been thoroughly reviewed by experienced instructors and developed in consultation with a learning theory expert. This comprehensive guide reinforces concepts presented in the text and integrates them with study activities, such as flash cards, to emphasize key concepts. It features vocabulary review and sample examinations structured to reflect the actual examinations students will face in the classroom.

***COMPUTERIZED TEST BANK**

Instructors who adopt the text receive EsaTest, a comput-

erized test bank package compatible with IBM and Macintosh microcomputers. This test-generation software combines a number of user-friendly aids, enabling the instructor to select, edit, delete, or add questions and construct and print tests and answer keys. EsaTest also offers EsaGrade, a convenient electronic gradebook.

***TRANSPARENCY ACETATES**

One hundred and fifty full-color transparency acetates are provided in a binder. They feature key illustrations from the text, with large, easy-to-read labels.

MOSBY'S NUTRITRAC™ SOFTWARE

Available for Windows and Macintosh, this nutrient-analysis software allows you and your students to analyze diets easily, using an icon-based interface and on-screen help features. Foods for breakfast, lunch, dinner, and snacks may be selected from more than 2250 items in the database. Records may be kept for any number of days. The program can provide intake analyses for individual foods, meals, days, or for an entire intake period. Intake analyses can compare nutrient values to RDA or RNI values and to the USDA Food Guide Pyramid, and provide breakdowns of fat and calorie sources.

***VIEWSTUDY™ PRESENTATION SOFTWARE**

This CD-ROM, compatible with either Windows or Macintosh, contains key illustrations from the text. Images are arranged by chapter, and a slide show tool allows selection of prearranged images. Illustrations can also be printed full size for use as acetates and may be exported for use with other programs and applications, such as the computerized testbank.

*Available to qualified adopters.

Acknowledgments

TEXT DEVELOPMENT

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This book began with a dream. Each new edition is fostered by the excitement that improvements bring and ends with the revision of an innovative textbook that we believe continues to set a standard for introductory nutrition textbooks.

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Preface to the Student

Cholesterol, sports drinks, food labeling, bulimia nervosa, alternative sweeteners, vegetarianism, and *Salmonella* food-borne illness—we suspect you have heard about these topics. Which of them are important enough to be a consideration in your life or in the life of someone you know?

Americans pride themselves on their individuality. Nutritional advice should be given accordingly. For example, not all of us have high serum cholesterol and thus don't have a significant risk of premature development of heart disease. The need to tailor dietary advice to each person's individual nature is the basic approach of this book. First we give you a brief introduction to the study of nutrition and discuss how to be a knowledgeable consumer. With so much information floating around—both accurate and inaccurate—you should know how to make informed decisions about your nutritional well-being. Then we encourage you to learn the basic principles of nutrition and to discover how to apply the concepts in this book that pertain specifically to you.

The text discusses some of the most interesting and important elements of nutrition and food consumption to help you understand both how your body works and how your food choices affect your health.

Features

PLANNING A NEW WAY OF EATING

Early in the text we present many of the basic guidelines for planning a healthy diet, including a description of the USDA Food Guide Pyramid, in Chapter 2. Later, in Chapter 9, we show you the steps involved in setting nutritional goals and designing a diet plan to attain those goals.

UNDERSTANDING THE WORLD AROUND US

In a college environment, it is often difficult to envision how real the problem of world hunger is. Chapter 20 examines the problem of undernutrition and the conditions that create it. The chapter allows you to explore possible solutions that offer hope for the future of our world.

CHEMISTRY REVIEW

In Appendix B we discuss in detail the critical chemistry concepts you need to know for an introductory study of nutrition. This information will give you a better understanding of how nutrients work and how nutrition information applies to you.

Pedagogy

The third edition of *Perspectives in Nutrition* incorporates some important tools (called *pedagogy*) to help you learn nutrition. Following is a guide to those tools:

1. Each chapter begins with a Nutrition Awareness Inventory. This group of 15 true or false questions helps you determine how much you already know about the chapter content. Take this examination again when you finish the chapter, and you will see how much you've learned.
2. Throughout each chapter are boldfaced key terms. The more difficult terms are defined in the margin. All boldfaced terms appear with their definitions and pronunciations in the glossary at the end of the text.
3. The numerous tables throughout the text provide convenient capsules of information for reference.

4. At the end of each chapter is a Take Action box that focuses on major concepts in each chapter as they pertain to your own life. The activity may include looking more carefully at your diet, examining your family history, or applying information you've learned to friends or family.
5. The Concept Checks that follow the major sections within each chapter list the key points made in each section. If you don't understand the material in the Concept Check, you should reread the preceding section.
6. Each chapter ends with summary points that convey the main ideas in the chapter. We also include several study questions per chapter. Both of these elements provide an excellent review for examinations.
7. In the Expert Opinion boxes, experts in the field of nutrition and health outline information you need to understand regarding nutrition issues of our day. Consider these boxed discussions to be like "visiting speakers" who come into your classroom to talk about the latest research findings.
8. We provide you with detailed references to back up material presented in the chapter. The research cited is from the most current publications—approximately 80% has been published since 1993. If you are preparing a research paper for your class or would just like more information on specific topics, consult these sources.
9. Nutrition Focus boxes allow you to explore current topics that your instructor may not have time to cover but that may nevertheless be of interest to you.
10. Critical Thinking questions ask you to apply information as you learn it. This fosters understanding of the material.
11. Nutrition Perspective essays at the end of each chapter develop current topics in nutrition in greater detail than in the chapter. Topics include nutrition labeling, the effects of alcohol, nutrition and cancer, and heart disease.

A Student Study Guide and Mosby's NutriTrac software are available to you with *Perspectives in Nutrition*. These instructional aids are designed to help you learn the major concepts developed in each chapter and prepare for class examinations.

Student Study Guide

The valuable Student Study Guide, by Gordon M. Wardlaw, Ph.D., R.D., reinforces concepts presented in the text and integrates them with activities to facilitate learning. Sample examinations reflect the actual tests you will face in the classroom. Vocabulary reviews increase your knowledge of the terminology. Flash cards help you review the major concepts in the chapter and, in turn, test your understanding of these important concepts. Activities include fill-in tables, labeling, and matching terms. These activities follow the text discussion and are anchored with quotations and page citations from the text.

A Request to Professors and Students Who Use This Book

As you might imagine, it is difficult for two people to range across the vast areas of nutrition science, following all of the various controversies and new developments. We try our best but realize that sometimes we make mistakes and sometimes we miss a side of an argument that deserves attention. If as you read this book you find content that you question or believe warrants a more detailed or broader look, feel free to contact the senior author by mail, fax, or e-mail.

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CHAPTER ONE

We are continually bombarded with information about nutrition and health. Almost daily, the news media report new studies showing how our diets affect our well-being. The best-seller list usually contains at least one book about diet and health, and bookstores and libraries display row upon row of books telling us what to eat and what to avoid. This diverse mass of information often contains contradictory and confusing mixed messages. Worse, some diet "experts" promote unbalanced and gimmicky diets. These so-called experts try to exploit our desire for dietary shortcuts that promise health and beauty.

Turning to a more authoritative source, the 1988 Surgeon General's *Report on Nutrition and Health* reminded us that "for the two out of three adult Americans who do not smoke and do not drink excessively, one personal choice seems to influence long-term health prospects more than any other: what we eat." The nutritional lifestyles of some Americans are out of balance with their physiology. And since we live longer than our ancestors, preventing the nutrition-related diseases that develop later in life is more important than in the past.

By changing our "problem" food habits, we can strive to bring the goal of a healthy life within reach. This is a primary theme not just in this chapter, but throughout this entire book.

What Nourishes You?



NUTRITION AWARENESS

NUTRITION AWARENESS INVENTORY

Answer these 15 statements about nutrition and food habits to test your current knowledge. If you think the answer is true or mostly true, circle T. If you think the answer is false or mostly false, circle F. Use the scoring key at the end of the book to compute your total score. Repeat this test after you have read this chapter, and compare your results.

1. **T F** Many foods are almost entirely water.
2. **T F** Minerals can be changed into vitamins in the body.
3. **T F** The terms *kilocalorie* and *calorie* can be used interchangeably; they refer to the same amount of food energy.
4. **T F** Fats yield more energy per gram than carbohydrates.
5. **T F** Vitamins directly provide energy to the body.
6. **T F** Nutritional stores are reserve nutrients that the body can mobilize when needed.
7. **T F** The body generally requires greater daily amounts of vitamins than minerals.
8. **T F** One gram of water can provide 1 kilocalorie of energy when metabolized by the body.
9. **T F** The chemical term *organic* is related to the concept of organic gardening.
10. **T F** In reference to nutritional status, the terms *undernutrition* and *malnutrition* can be used interchangeably.
11. **T F** Fatigue and ineffective control of body temperature may be evidence of advanced iron deficiency.
12. **T F** In our society, problems related to overnutrition are more common than those associated with undernutrition.
13. **T F** Taking vitamin and mineral supplements in any amount is considered a desirable practice.
14. **T F** Alcoholic beverages are a major source of energy for some people.
15. **T F** People's food choices are most often determined by their nutritional knowledge.

The Importance of Exploring Your Own Food Habits

In this opening chapter, you will be encouraged to explore your own food habits and to discover the underlying reasons for them. This is an important first step in your study of nutrition. Health authorities warn that what we eat can influence our prospects for long-term good health. People with nutritional lifestyles out of balance with their physiology are likely to have or eventually develop health problems.³ Ironically, people often have good intuitions about healthy food choices but fail to act on them. Yet even small changes in behavior toward food can make big differences in achieving a long and vigorous life. The more you know about both nutrition and personal health risks, the better you can plan a diet to meet your nutritional needs.

A poor diet is a **risk factor** for the major **chronic** diseases that are the leading causes of adult death: **heart disease, stroke, hypertension, diabetes**, and some **forms of cancer**. Together, these disorders account for two thirds of all deaths in the United States.¹⁸ In addition, **cirrhosis** of the liver, accidents, and suicides are associated with excessive alcohol consumption (Table 1-1). All of these consequences of modern living are partly an "affliction of affluence."

The great tragedy is that these diseases are often preventable. Government scientists have calculated that a poor diet combined with a lack of sufficient physical activity accounted for 300,000 fatal cases of heart disease, cancer, and diabetes in 1990. The combination of poor diet and lack of physical activity thus is indirectly the second leading cause of death.¹⁸ An understanding of nutrition and the role it plays in your short-term and long-term health can significantly minimize your risks for these diseases.

heart disease A disease characterized by the deposition of fatty material in the blood vessels that serve the heart. These deposits restrict blood flow through the heart, which in turn can lead to heart damage and death.

diabetes A disease characterized by high blood sugar caused by inadequate insulin (a hormone) action. Although this disease is commonly referred to as "diabetes," its technical name is *diabetes mellitus*. There are several forms of this disease.

TABLE 1-1

Ten leading causes of death in the United States

Rank	Cause of death	Percent of total deaths
	All causes	100.0
1	Diseases of the heart*	29
2	Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues (cancer)*	26
3	Cerebrovascular diseases (stroke)*	5
4	Chronic obstructive pulmonary diseases and allied conditions (lung diseases)	4
5	Accidents and adverse effects†	6
	Motor vehicle accidents	3
	All other accidents and adverse effects	3
6	Pneumonia and influenza	3
7	Diabetes*	2
8	Acquired immunodeficiency syndrome (AIDS)	2
9	Suicide†	2
10	Homicide and legal intervention†	2

From Centers for Disease Control and Prevention, *Morbidity and mortality weekly report*, December 16, 1994. Data are age-adjusted to the 1990 population.

*Causes of death in which diet plays a part.

†Causes of death in which excessive alcohol consumption plays a part.

What Is Nutrition?

The Council on Food and Nutrition of the American Medical Association defines **nutrition** as “the science of food, the nutrients and the substances therein, their action, interaction, and balance in relation to health and disease, and the process by which the organism ingests, digests, absorbs, transports, utilizes, and excretes food substances.”

To begin your study of nutrition, we must start at the foundation—the **nutrients** themselves. We will first examine the nutrients and their functions in the body. This discussion sets the stage for understanding the Food Guide Pyramid, which is described in Chapter 2. Then, we will discuss how to assess a person’s nutritional health and introduce the four components commonly used to evaluate a person’s nutritional status. Next, we evaluate the “health” status of the American diet. Finally, we will describe the factors that influence our food habits.

nutrients Chemical substances in food that nourish the body by providing energy, building materials, and factors that regulate needed chemical reactions.

Classes and Sources of Nutrients

Food, water, and oxygen are life-giving and life-sustaining substances essential to human life. Food provides both energy and the materials needed to build and maintain all body cells.

It is important to distinguish between food and nutrients. Food is the source of nutrients. Nutrients are the nourishing substances in food that are essential for growth of the infant, development from childhood to adulthood, and the maintenance of body functions throughout life. In nutrition, an **essential nutrient** is one whose omission from the diet leads to a decline in certain aspects of human health, such as function of the nervous system. If the omitted nutrient is restored to the diet before permanent damage occurs, those aspects of human health hampered by its absence regain normal function. In other words, the lost aspects of health are recovered when the body receives the essential nutrient.

The nutrients in food can be organized into six classes (Table 1-2). The energy-yielding nutrients—carbohydrates, fats, and proteins—constitute the major portion of most food, as may water, another class. In contrast, vitamins and minerals constitute a minor portion of foods.

Some nutrients that perform life-sustaining functions can be produced by the body if they are missing from the diet. The essential nature of such nutrients sometimes is not clear cut. For example, the body requires a daily source of vitamin D, but the skin is capable of synthesizing its own vitamin D upon receiving sunlight. This reduces the daily need from dietary sources.

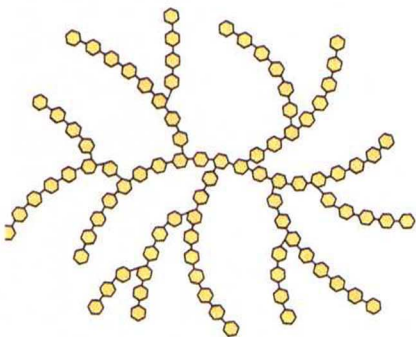
CRITICAL THINKING

Believing that nutritional supplements provide the nutrition her body needs, Janice regularly takes such supplements while skimping on normal meals. How would you explain to her that the foods in a well-balanced diet are a more reliable source of essential nutrients than supplements?

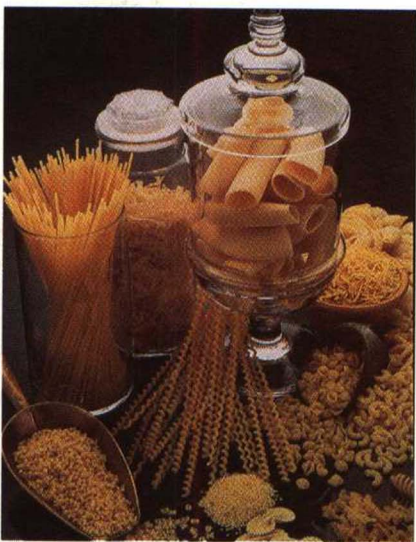
For suggested answers to the Critical Thinking Questions in each chapter, turn to the back of the book.

Glycogen

Storage form of carbohydrate in the body



Each yellow circle represents one glucose molecule.



Carbohydrate is the nutrient most promoted for the American diet during the last two decades.

TABLE 1-2

Essential nutrients in the human diet and their classes*

Energy-yielding nutrients				
Carbohydrate	Fat (lipids)†	Protein (amino acids)	Water	
Glucose‡ (or a carbohydrate that yields glucose)	Linoleic acid (omega-6) α-Linolenic acid (omega-3)	Histidine	Water	
		Isoleucine		
		Leucine		
		Lysine		
		Methionine		
		Phenylalanine		
		Threonine		
		Tryptophan		
		Valine		
Vitamins		Minerals		
Water-soluble	Fat-soluble	Major	Trace	Questionable
Thiamin	A	Calcium	Chromium	Arsenic
Riboflavin	D§	Chloride	Copper	Boron
Niacin	E	Magnesium	Fluoride	Cadmium
Pantothenic acid	K	Phosphorus	Iodide	Cobalt
Biotin		Potassium	Iron	Lithium
B-6		Sodium	Manganese	Nickel
B-12		Sulfur	Molybdenum	Silicon
Folate			Selenium	Tin
C			Zinc	

*This table includes nutrients that the current RDA publication lists for humans. Some disagreement exists over the questionable and other minerals not listed. Dietary fiber could be added to the list of essential substances, but it is not a nutrient (see Chapter 3).

†The lipids listed are needed only in slight amounts, about 2% of total energy needs (see Chapter 4).

‡In order to prevent ketosis and thus the muscle loss that would occur if protein was used to synthesize carbohydrate (see Chapter 3).

§Sunshine on the skin also allows the body to make vitamin D for itself (see Chapter 12).

||Primarily for dental health (see Chapter 15).

CARBOHYDRATES

Carbohydrates are composed mainly of carbon, hydrogen, and oxygen. Carbohydrates provide a major source of fuel for the body. Small carbohydrate structures are called sugars or simple sugars. Table sugar (sucrose) is an example. Some simple sugars, such as glucose, link chemically to form large storage carbohydrates, called polysaccharides or complex carbohydrates. An example is the starch in potatoes.

Some sugars impart sweetness to many foods we eat. Aside from enjoying their taste, we need sugars and other carbohydrates in our diets primarily to satisfy the energy needs of body cells. Glucose, which the body can produce from most carbohydrates, is the primary source of energy in many cells. When not enough carbohydrate is eaten to supply sufficient glucose, the body is forced to make glucose from proteins. However, a typical diet contains more than enough carbohydrate to prevent this from happening.¹⁴

Digestion of some dietary starch intake begins in the mouth. The digestive process continues in the small intestine until starches and large sugars break down into single sugar molecules (such as glucose), which are absorbed into the bloodstream. However, the links between the sugar molecules in certain complex carbo-