

Benjamin B. Lahey

seventh edition



# PSYCHOLOGY

an introduction

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i n t r o d u c t i o n

seventh edition



Benjamin B. Lahey

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## PSYCHOLOGY: AN INTRODUCTION SEVENTH EDITION

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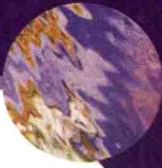
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## About the Cover

**T**he cover shows one of many self-portraits painted by Frida Kahlo (1907–1954). Kahlo was a painter whose intense and personal images received some attention in the Americas and Europe during her lifetime, but whose reputation has grown considerably in recent years. As a young woman growing up in Mexico, Kahlo was studying to be a physician when she was in a serious bus accident that resulted in a prolonged hospitalization. She took up painting during her period of recuperation from the accident and never returned to medicine. Kahlo was active in liberal politics in Mexico and was forced to live in the United States during the early 1930s. When she returned to Mexico, Kahlo taught painting in Mexico City at La Esmeralda School until her death at age 46.

A self-portrait was selected for the cover because psychology can be thought of as a "self-portrait" of the entire human race. In the field of art, artists closely study themselves in the mirror to create an accurate and revealing visual image of themselves. In the field of psychology, human beings also study and describe themselves. Psychologists use the methods of science to observe themselves and words to "paint the picture," but the image is no less revealing than the self-portrait of the artist.

# PREFACE



Although the preface is the first part of the book that you read, it is the last part that I write. It is my opportunity to reflect on the completed project in the hope that these reflections will help introduce you to the text. Over seven editions, the unchanging goal of *Psychology: An Introduction* has been to *teach*. We (referring to the large group of talented psychologists, editors, consultants, and reviewers who have worked with me) have centered our efforts on giving you a text that fully captures the immense importance and fascination of the scientific study of ourselves. You have my pledge that I have done my best to teach the concepts and facts of psychology in the clearest and most exciting manner possible. The gratifying responses of both instructors and students to the first six editions of this textbook have been a wonderful source of encouragement for these efforts.

Four kinds of changes were made in this edition in an effort to improve it, however: (1) an increased emphasis on the methods of research that psychologists use to learn about behavior and mental processes, (2) improvements in the presentation of information, (3) increased use of visual review exercises, and (4) the addition of new and timely information in all chapters.

1. *Increased emphasis on the methods of research.* There are many fields that attempt to understand people and other animals—from philosophy to biology. Psychology differs from many of these fields in its use of the methods of science to understand our behavior and mental processes. In order to help make this point clearer to students, the section on research methods, which was part of chapter 1 in the previous edition, has been placed in a separate chapter (the new chapter 2) and expanded slightly. As before, an appendix on statistics and measurement is supplied to build on the content of chapter 2 for those instructors who want particularly strong coverage of research methods. Alternatively, for those instructors who do not wish to cover research methods in this course, moving this material into a separate chapter will make it easier to skip the topic.
2. *Improvements in the presentation of information.* As in previous editions, we have worked very hard to provide you with a textbook that sets a standard for the field through the *clarity* of both the written language and the visual illustrations. Students cannot learn what they do not understand, and this book goes to great lengths to make the science of psychology understandable. Every sentence in the textbook was reconsidered, and many sections were rewritten to make them clearer to the student. Similarly, several new illustrations were added and several were redrawn for greater clarity.

As in previous editions, a concerted effort was made to estimate realistically the memory required to process the meaning of complex passages. Most textbooks are based on the assumption that all information from previous sentences has been encoded in memory, when this is obviously not always the case. In this book, sentences were written to avoid unrealistic reliance on previous sentences and to build repetition of key terms and concepts into the prose. These features are subtle, but they enhance readability.

3. *Increased use of visual reviews.* In the past several editions, I have presented illustrations at the end of the chapter on the biological foundations of behavior and the chapter on sensation and perception to help students review the material that they just learned. For example, students could attempt to fill in blank labels on an illustration of the eye to see if they could remember the names of all of the parts. In this edition, I have expanded this popular learning tool. I added visual reviews at the end of additional chapters that include important information that lends itself to visual presentation to help students test themselves to improve their learning.
4. *New information.* New information has been included in this edition in several other ways. First, as always, one of the pleasures of revising a textbook is seeing how much the field has advanced in three short years. Although coverage of the fundamental principles in this edition has not changed greatly, much new information has been integrated. The book is filled with important new information on virtually every aspect of psychology. Psychology is clearly a discipline that is still in an age of rapid accumulation of information. The responsibility of revising a basic textbook pushes me to read very broadly in the psychological literature. It is a fascinating field!

## REVIEWERS

The following individuals have helped tremendously by reviewing this or previous editions of *Psychology: An Introduction*; their helpful guidance has been carried forward into the current edition.

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Many talented editors and illustrators also played essential roles. The results of that combined effort are before you, and I hope that it will serve the needs of students and instructors even better than did the previous edition.

In the two sections that follow, the mechanics of *Psychology: An Introduction* are explained in detail. “To the Instructor” describes the pedagogical strategy used in the textbook and my reasons for selecting the elements that are included. The next section, titled “To the Student: How the Book Works,” explains in a step-by-step manner each teaching device I have used. It’s essential that the student understand the purpose of each teaching device to derive maximum benefit from this book.

\*A special thanks to Professor Whitten for her work on the Human Diversity boxes that were introduced in the fifth edition and have been retained in subsequent editions.

# TO THE INSTRUCTOR



*Psychology: An Introduction* offers thorough topic coverage and standard organization designed to fit courses as they are most commonly taught. But it differs significantly from other textbooks in two main ways. First, every effort has been made to create a writing style that is—as one former student kindly described it—“friendly.” This book does not attempt to impress students with the arcane complexities of the science of psychology. It was written to provide a clear, informative, challenging, exciting, and personal introduction to psychology. All of the necessary complexities are taught, but in the clearest manner possible.

Second, *Psychology: An Introduction* differs from other textbooks in its emphasis on meaningful learning. This book contains many elements designed to enhance learning and remembering based on an organizational model of semantic memory. The content of the first course in psychology can be thought of as a *hierarchical organization* of concepts and facts. Quite simply, this means that information about psychology is not a disorganized jumble of new facts. Some information “goes with” other information, some concepts are detailed elaborations of more general concepts, and so on. To improve learning and memory, it is as important for students to understand the overall organization of new information as it is for them to understand the individual concepts and facts themselves.

Based on what is well known about learning from textbooks, this book helps the student understand how new information about psychology is organized and to process that information more deeply in five primary ways:

1. *Advance organizers.* Considerable research indicates that students learn and retain information better when they have an advance understanding of the hierarchical organization of the information being learned. To accomplish this, the student is given two kinds of advance organizers before reading the main body of the text. The student is first presented with a **chapter outline** of the major topics covered within the chapter, a device common to many textbooks. But to add to the effectiveness of this bare-bones overview, a prose organizer, called the **prologue**, both piques the student’s interest with exciting information and highlights the major concepts in the forthcoming chapter. Thus, the student is provided with two forward looks at the chapter to create a cognitive organization on which to “hang” new facts and concepts. The prologues in this edition combine the best features of both the “prologue” and “preview” sections of previous editions by fusing high-interest material with an advance organizer.
2. *Questions to stimulate critical thinking.* An important feature of the book is the set of questions designed to stimulate critical thinking (Baron & Sternberg, 1987). These critical thinking questions appear at the end of each section. They are designed to catch the student’s attention and stimulate thought for two reasons. First, it is important that students not passively absorb new information but, rather, critically evaluate and ponder what they are learning. Moreover, it may be more effective to teach critical thinking skills through the content of a specific course than in the abstract. And what course is more appropriate than psychology—in which human beings ponder themselves? Second, current research suggests that thinking about what you have just learned leads to deeper semantic processing and better retention. Thus, both as an aid to student reading and as a stimulus for classroom discussion, these high-interest questions at the end of each section are important pedagogical tools. To help students prepare to use these critical thinking questions, a section on critical thinking appears in the “To the Student” section. In addition, the *Instructor’s Course Planner* includes pertinent information to help the instructor.
3. *Nested hierarchical reviews.* The interrelationships among new concepts are highlighted further in **review** and **summary** sections. Following each major section within each chapter, the content of that section is briefly reviewed in prose. In addition, the student can test his or her knowledge of each section in the **check your learning** sections. At the end of each chapter, the main content of the chapter is again summarized, but this time in a hierarchical outline that visually highlights the organization of the material.
4. *Visual organizational cues.* Using hierarchical outlines in the end-of-chapter summaries is only one way in which the student is actually shown the organization of the new material. Close attention has been paid to the use of visual cues—such as typeface, type size, color of type, and indentations—to indicate the organization of the text. The difference between this book and others is intentionally subtle in this respect, but students should have little trouble distinguishing the superordinate-subordinate structure of A, B, and C levels of headings. In diagrams and figures, colors were chosen not to be decorative but to show students which elements are related and which are different. In addition, lists—like the one you are reading now—have been frequently (but not excessively) used to show that each element in the list is at the

same level of organization and subordinate to the title of the list (“five ways to help students understand organizational structure,” in the case of the list you are reading now).

5. *Verbal cues to organization.* Another important way to help readers see how concepts and facts are related is simply to tell them in words. Therefore, this textbook makes many references to the organization of the new information. This is done in two main ways. First, when a newly introduced concept is related to another concept that was discussed in an earlier section, this fact is specifically pointed out. Second, information that is subordinate to a concept is frequently introduced in a way that makes that relationship very clear (e.g., “The two factors that cause forgetting in short-term memory are . . .”). Although these cues are subtle so as not to interrupt the flow of the discussion, they have been added to help improve the student’s comprehension and memory.

The use of these pedagogical devices was chosen over two other pedagogical approaches after much consideration. I chose not to use the SQ3R (survey, question, read, recite, review) method of organizing the text because the author, not the student, must ask the questions, which reduces student involvement and discourages the student from critically evaluating and deeply processing the new information. It is much better for the *student* to use SQ3R than for the *author* to use it. Therefore, instructions to the student on the use of SQ3R are included in the **study skills** section, which follows the preface. For those instructors who wish to use instructional objectives, we have included them in the *Student Study Guide* and the *Instructor’s Course Planner* that accompany this book.

## SUPPLEMENTARY MATERIALS

*Psychology: An Introduction* is accompanied by an integrated ancillary package designed to meet the unique needs of instructors and students. The goal has been to create a teaching package that is as enjoyable to teach with as it is to study from. Each element of the ancillary package has been created by talented individuals with many years of experience in teaching psychology.

### Supplements

The flexible *Instructor’s Course Planner* provides many useful tools to enhance teaching. For each chapter, learning objectives, an extended chapter outline, suggestions for teaching, lecture/discussion suggestions, video and film suggestions, classroom activities, and handout forms are provided.

The *Test Item File* with questions for all 17 chapters is available to instructors who adopt *Psychology: An Introduction*, Seventh Edition. The questions in the *Test Item File* are also available on *MicroTest III*, a powerful but easy-to-use test-generating program by Chariot Software Group. MicroTest is available for use in DOS (3.5” disks), Windows, and Macintosh versions. With

MicroTest, instructors can easily select questions from the *Test Item File* and print tests and answer keys. Instructors can also customize questions, headings, and instructions; add or import their own questions; and print tests in a choice of printer-supported fonts.

As in previous editions, the *Student Study Guide* was created by author Steven A. Schneider. For each chapter of the text, the student is provided with learning objectives, a detailed chapter outline, a guided review of terms and concepts, a section that promotes students’ understanding of human diversity, and a practice quiz that tests students’ mastery of the chapters’ main ideas and important material.

*Transparency acetates* of 60 key images drawn directly from this textbook are available for the instructor on adoption. In addition, the *Introductory Psychology Transparency Set* provides over 100 additional transparencies illustrating key concepts in general psychology. It also includes a handbook with specific suggestions for classroom use by Susan J. Shapiro of Indiana University East.

Multiple-choice *practice tests* have been compiled to give the instructor a glimpse of the type of test questions the instructor may encounter on the material covered in the seventh edition of *Psychology: An Introduction*. The practice tests provide a sample of the types of questions that often appear on exams.

*Psych On-Line* is designed to help students get the most out of the Internet for psychology research and provides general resource locations. Psychology sites are grouped by topic with a brief explanation of each site. Included in this booklet are a number of general resource sites for students seeking help.

## MULTIMEDIA



McGraw-Hill’s *Psycafe & the Lahey Online Learning Center* ([www.mhhe.com/psycafe](http://www.mhhe.com/psycafe)), the virtual coffeehouse for introductory psychology on the World Wide Web, is a treasure trove of resources for teaching and learning. Inside you will find images, links, newsletters, discussion groups, PowerPoint® slide shows, crossword puzzles, and interactive exercises all structured within a robust textbook website designed to facilitate learning.



The state-of-the-art *PRISM II* CD-ROM combines 60 interactive simulations and exercises with text-specific study materials, including learning objectives, review exercises, key terms, and practice quizzes to create a truly interactive learning experience. In addition to all of this, standard features include “Psychology Around the Globe” interactive articles, Web links, frequently asked questions, “Internet Primer,” “Statistics Primer,” “Study Skills and Time Management Primer,” and a psychology careers appendix.

The *Presentation Manager* CD-ROM includes the contents of the *Instructor's Manual*, Test Bank, and PowerPoint® slides. The *Presentation Manager* provides an easy-to-use interface for the design and delivery of multimedia classroom presentations.

The *Electronic Image Bank* provides the same outstanding graphics on a CD-ROM for presentation from PC or Macintosh. We provide a generic viewer, but the contents can be downloaded into your favorite presentation program—for instance, PowerPoint®.

Packaged for FREE, this user-friendly *Making the Grade Student CD-ROM* gives students an opportunity to test their comprehension of the course material in the manner that is most comfortable and beneficial to them. The CD-ROM opens with a “Learning Style/Study Skills” questionnaire that the student can complete to help them identify how they best study. Also included are practice tests that cover topics in the introductory psychology course, an Internet primer, a careers appendix, and more.

With PageOut™ even the most inexperienced computer user can quickly and easily create a professional-looking course website. Simply fill in our templates with your information and with excellent content provided by McGraw-Hill, choose a design, and you've got a bang-up website specifically designed for your course! Best of all, it's FREE! Visit us at [www.pageout.net](http://www.pageout.net) to find out more.

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convenient, inexpensive access to a wide range of current, carefully selected articles from magazines, newspapers, and journals. Written by psychologists, researchers, and educators, *Annual Editions: Psychology* provides useful perspectives on important and timely topics. *Annual Editions* is updated yearly and contains a number of features designed to make it particularly useful, including a topic guide, an annotated table of contents, and unit overviews. For the professor using *Annual Editions* in the classroom, an *Instructor's Resource Guide* with test questions is available.

## ***Taking Sides® and Sources***

Are you interested in generating classroom discussion or in finding a tool to fully involve your students in their experience of your course? Would you like to encourage your students to become more active learners and critical thinkers? *Taking Sides: Clashing Views on Psychological Issues* is a debate-style reader designed to introduce students to controversies in psychology. By requiring students to analyze opposing viewpoints and reach considered judgments, *Taking Sides* actively develops students' critical thinking skills.

*Sources: Notable Selections in Psychology*, second edition, brings together over 40 selections including classic articles, book excerpts, and research studies that have shaped the study of psychology. New to the second edition are 21 selections from some of the most distinguished researchers, theorists, writers, and practitioners of psychology. If you want your students to gain greater background knowledge in reading and interpreting firsthand from source material, *Sources* collects a diverse array of accessible but significant readings in one place.

# TO THE STUDENT



## HOW THE BOOK WORKS

This book contains several learning devices, each of which is designed to accomplish five goals:

1. To focus your attention on the subject of the chapter
2. To give you an advance overall view of what you are about to learn
3. To show you how each fact and concept is related to the overall theme of the chapter
4. To help you review what you have just learned to be sure that you have gotten it all and to strengthen the newly formed memories
5. To help you think critically about the new information that you have learned and relate it to your own life

These five goals must be reached if you are going to learn about psychology in a meaningful way, rather than just blindly memorizing facts and definitions. Let me show you how each feature of the book contributes to these five goals.

**1 Chapter Outline** Each chapter begins with an outline that organizes the key ideas of the chapter. Examine the outline carefully to see which topics will be studied, but notice also how the topics are arranged. Headings that show the major topics are called A heads (printed in capital letters); they define the breadth of coverage in each chapter. Under each A head are B heads (indented); they reveal the more specific topics related to the broader topic of each A head. Studying the outline for a few minutes will give you an advance look at the content of the chapter and show you how topics relate to one another. When you read a chapter, you may wish to refer to the outline from time to time. It will reinforce the relationships among topics and help you understand the structure of the chapter.

**2 Prologue** Each chapter begins with a short section designed to focus your attention on the theme of the chapter. It is a high-interest essay that introduces a bit of research or history to prepare you for the content of the chapter. The prologue also highlights the most important concepts that will be covered in the



## CHAPTER

### 4

#### CHAPTER OUTLINE

PROLOGUE 105  
**SENSATION: RECEIVING MESSAGES ABOUT THE WORLD 106**  
Stimuli: What Messages Can Be Received? 106  
Transduction: Translating Messages for the Brain 106  
Sensory Limits: How Strong Must Messages Be? 107  
**VISION: YOUR HUMAN CAMERA 110**  
Light: What Is It? 110  
The Eye: How Does It Work? 111  
Dark and Light Adaptation 113  
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**HEARING: SENSING SOUND WAVES 119**  
Sound: What Is It? 119  
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**BODY SENSES: MESSAGES FROM MYSELF 124**  
Orientation and Movement 124  
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Taste 133  
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Visual Perception 137  
Individual and Cultural Influences on Perception 145  
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SUMMARY 150  
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## Sensation and Perception

#### PROLOGUE

Last night I "saw" the University of North Carolina play Notre Dame in basketball—by listening to the radio. The play-by-play announcer watched the game, and he translated what he saw into a kind of information (words) that could be transmitted over the radio. Then I used that information to form a mental picture of the game. I did not see with my eyes, yet I was able to "watch" the game in my head.

I realized this morning that my way of seeing the game last night was not very different from how I see games in person. We never really "see" with our eyes alone. We use our eyes to gather information and translate it into a form that can be transmitted to the brain. It's in the brain that visual perception is created out of the incoming sensory information.

We usually assume that we simply "see" what is "out there." The processes of seeing, smelling, or touching seem so straightforward. In reality, however, perception is based on a complex chain of receiving, transmitting, and interpreting sensory information. Each step of this process actively changes the information in significant ways. Because we know "reality" only through our sensations and perceptions, we must understand the sense organs and the ways in which the processes of sensation and perception change sensory information.

In this chapter, we will study the four major senses: vision, hearing, the body senses, and the chemical senses. In vision, the eye collects, translates, and transmits energy from light to the brain. The ear—the sense organ for hearing—accomplishes the same for the energy in vibrating molecules of air. The body senses provide the brain with information from the skin about temperature, touch, and pain; and information from receptors in the inner ear, joints, and muscles tells us about the position and movement of the body—where we are and where we are going. The chemical senses use receptor cells in the nose and on the tongue to provide information to the brain about the chemicals in the air we breathe and in the things we drink and eat.

Raw sensations have little meaning until they are organized and interpreted in the process of perception. Perception is an active process that changes sensory information. As we discussed in chapter 1, we perceive actors as moving when we watch a motion picture. In reality, however, the sensory information is just a series of rapidly changing still photographs. The people on the movie screen don't actually move at all. We perceive them as moving only because the process of perception often goes well beyond the immediate sensory information. The brain creates the perception of motion in a movie that the sensory information only hints at.

In most cases, the ways in which the brain interprets information in the process of perception appear to be inborn. Our perceptions of reality are also colored by individual expectations, cultural learning experiences, and needs, however. As a result, different people sometimes have rather different views of the same world.

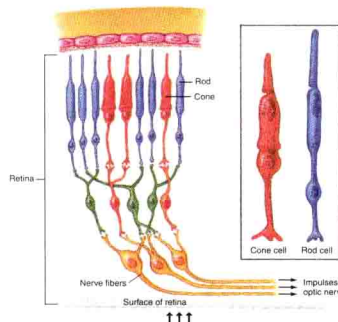
Human life would be very different without our ability to sense and perceive. Take friendships as an example. How could we have friends if we could not distinguish one person from another by sensing their differences? How could we communicate with our friends if we could not hear their words properly or read their notes accurately or notice the expressions on their faces? How could we let them know that we cared if they could not feel a pat on the back?

#### KEY TERMS

sense organs 106  
sensory receptor cells 106  
sensation 106  
perception 106  
stimulus 106  
transduction 106  
absolute threshold 107  
difference threshold 107  
sensory adaptation 107  
psychophysics 107  
Weber's law 109  
retina 111  
rods 112  
cones 112  
fovea 112  
optic nerve 112  
blind spot 113  
dark adaptation 113  
light adaptation 114  
trichromatic theory 115  
opponent-process theory 117  
audition 119  
eardrum 121  
hammer, anvil, stirrup 121  
cochlea 121  
basilar membrane 122  
organ of Corti 122  
vestibular organ 124  
kinesthetic receptors 124  
semicircular canals 125  
gustation 133  
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stereochemical theory 135  
perceptual constancy 138  
monocular and binocular cues 139

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**FIGURE 4.4**  
Diagram of the microscopic structure of a section of the retina showing the rods and cones and their principal neural interconnections. The blowup shows individual rod and cone cells.



The real business of transducing light waves is carried out in the retina by two types of receptor cells named the **rods** and the **cones** because of their shape (see fig. 4.4). The cones are far less numerous than the rods—about 6 million cones compared with 125 million rods in each eye (Pugh, 1988). Cones are concentrated in the center of the retina, with the greatest concentration at a central spot called the **fovea**. In good light, **visual acuity** (the clearness and sharpness of vision) is best for images that are focused directly on the fovea, largely because of the high concentration of cones.

The rods are located throughout the retina, except in the center (the fovea). Their role in vision differs from that of the cones in four main ways. First, because of their location, they are largely responsible for peripheral vision—vision at the top, bottom, and sides of the visual field—whereas the cones play little role in this aspect of seeing. Second, the rods are hundreds of times more sensitive to light than the cones. This means that they play a far more important role in vision in dim light than do the cones. Third, the rods produce images that are perceived with less visual acuity than do cones. This is largely because neurons leading from several rods often converge, so that their impulses are sent to the brain on a single nerve fiber (shown in fig. 4.4). In contrast, cones more commonly send their messages to the brain along separate nerve fibers, giving the brain more precise information about the location of the stimulation on the retina.

The fourth difference between the rods and cones concerns color vision. Both types of receptors respond to variations in light and dark (in terms of the number of receptors that fire and the frequency with which they fire), but only the cones can code information about color. Because the rods do not detect color, and because the cones can respond only in bright light, we can see only indistinct forms of black and gray in an almost dark room. Although light of different wavelengths is still present in the room during near darkness, the rods have no way of sending messages about them to the brain, so colors “disappear” from view.

Would you be surprised to learn that you are partially blind in each eye? The spot near the center of the retina where the **optic nerve** is attached contains no rods or cones.

**rods**  
The 125 million cells located outside the center of the retina that transduce light waves into neural impulses, thereby coding information about light and dark.

**cones**  
The 6 million receptor cells located mostly in the center of the retina that transduce light waves into neural impulses, thereby coding information about light, dark, and color.

**fovea**  
(fō-vē-ah) The central spot of the retina, which contains the greatest concentration of cones.

**visual acuity**  
(vī-zhū-ah-ū-ē) Clearness and sharpness of vision.

**optic nerve**  
The nerve that carries neural messages about vision to the brain.

chapter. Along with the chapter outline, it allows you to see what the chapter is going to be about before you read and start to grasp the details. A great deal of research suggests that having a general understanding of what is going to be learned will improve learning and memory of the new material. The prologue will help you *understand* what you are learning, which is far better than rote memorization of details.

**3 Key Terms** A list of the key terms you will encounter in the chapter is presented at the beginning of each chapter. You can use these terms to focus your learning. Because learning new vocabulary is half the battle in psychology, be sure you understand the meaning of each of these terms by the time you have finished studying each chapter. This will help you make sure that you have learned the most important terms when you are reviewing for a test.

**4 Margin Glossary** A running glossary with pronunciation guidelines defines new terms and shows you how to pronounce those that may be difficult. You will find these definitions and pronunciations in the outside margin of the text near the new terms that appear in boldface type within the text. These entries provide a convenient way of learning definitions without disrupting your reading.

**5 Section Reviews** Within each chapter are three to seven major sections. These are self-contained in the sense that they can be understood without an extensive understanding of the

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**5**

**6**

**7**

**Review**

Chemicals in the air we breathe and in the things we eat and drink are sensed by the gustatory receptors (taste buds) on the tongue and the olfactory receptors in the nose. For both chemical senses, combinations of a relatively small number of primary sensations apparently make up the entire variety of our experiences of taste and smell. Pheromones influence reproductive behavior in many animal species. It is not known if pheromones influence sexual behavior in humans, but they influence human menstrual cycles.

**Check Your Learning**

To be sure that you have learned the key points from the preceding section, cover the list of correct answers and try to answer each question. If you give an incorrect answer to any question, return to the page given next to the correct answer to see why your answer was not correct.

- Each of the 10,000 sensory receptors called taste cells on the tongue contains approximately a dozen.
- All of our sensations of taste appear to result from five basic sensations of taste: sweetness, fattiness, sourness, saltiness, and.
- The olfactory receptors are located in a dime-sized, mucous-coated sheet at the top of the nasal cavity called the.
  - gustatory center
  - olfactory epithelium
  - olfactory cortex
  - thalamus
- According to the theory, the molecules responsible for each of the primary odors have a specific shape that will fit into only one type of olfactory receptor cell.
  - opponent-process
  - trichromatic
  - stereochemical
  - camphoraceous
- Chemicals that influence reproductive behavior in many animals are called.
  - pheromones
  - olfactory bulbs
  - astrogents
  - stereochemicals

**Thinking Critically About Psychology**

- Why do you think some people love the smell of coffee, but other people dislike it?
- Why do you think there is an uneven distribution of taste buds on the tongue?

**Correct Answers** 1. taste buds p. 136, 2. bitterness p. 139, 3. a p. 139, 4. b p. 139, 5. a p. 139, 6. b p. 139, 7. b p. 139, 8. a p. 139, 9. c p. 139, 10. a p. 139.

sections that precede or follow them. This flexibility will allow your instructor to assign sections to be read when the need arises instead of an entire chapter.

Following each major section is a brief review that summarizes the main ideas introduced in that section. This device will help you keep the overall organization of the new material in mind as you study and master the details.

**6 Check Your Learning Questions** At the end of each section, you will also find “Check Your Learning” questions. These multiple-choice questions give you a chance to see if you have mastered the material in that section before moving on. The answers are provided to give you immediate feedback on the correctness of your own answers. If you give an incorrect answer, use the page number provided with each answer to guide you to the page or pages you should review.

**7 Critical Thinking Questions** Questions designed to stimulate critical thinking appear at the end of each section. These questions will further your critical thinking if you let them involve you actively in the process of learning. The few minutes of thought that each question provokes should help you personalize your new knowledge of psychology, making it “your own” to keep and use over your lifetime. Later in this preface is a short section titled “Critical Thinking.” Taking the time to read it now can help you get more out of the critical thinking questions in the rest of the book.

## HUMAN DIVERSITY

### CULTURE AND PAIN

In this chapter, we examine the ways in which neural impulses from the sense organs are experienced as sensations and perceptions. Although much of this process is determined by the biological nature of the sense organs and neurons, learning experiences in our cultures apparently can influence even basic sensations such as pain.

Let's consider an example of the impact of culture on the perception of pain. Members of the Bariba society in Benin, West Africa, appear to be able to tolerate pain more easily than members of most cultures. Bariba folklore includes many examples of honored people who showed strength in the face of pain, and this calm response to pain is seen as an integral part of Bariba pride (Sargent, 1984). For example, pregnant women are expected not to let the fact that they are experiencing labor pains show to others. When labor becomes advanced, they leave the company of others to go through labor and childbirth alone, only calling for help with cutting the umbilical cord.

To the Bariba, letting other people see that they are in pain is cause for great shame. When discussing pain, many Bariba quote a Bariba proverb that translates to "Between death and shame, death has the greater beauty." According to a Bariba physician, an individual who displays pain lacks courage, and cowardice is the essence of shame. Rather than live in shame, a Bariba would rather die (Sargent, 1984). In this cultural context, one would do everything possible to avoid displaying signs of pain.

Do Bariba women who are in labor actually experience less pain than women in other cultures, or have they simply learned not to let the pain show? It is difficult to answer such questions, partly because of the difficulties involved in describing pain to another person. Because pain is a private experience, language must be used to communicate the experience to others, and language is shaped by culture. It is not surprising that there is a more limited vocabulary for describing pain in the Bariba language than in most other languages. When the Bariba discuss the experience of pain, therefore, it is difficult to know how much their description is influenced by their language.

But there is some reason to believe that the cultural emphasis on not showing reactions to pain might actually reduce the amount of pain that the Bariba experience. As noted on page 390 of chapter 10, there is evidence that facial expressions are an important part of the experience of pain (Izard, 1977). Apparently, sensory feedback to the brain from facial muscles supplies part of the neural input for the perception of pain (along with input from the part of the body that is cramped or injured). Indeed, persons who were given electrical shocks reported less pain when they were told to make no facial reactions than when they let their emotions show in their faces (Coby, Lancelotti, & Klock, 1977). Maybe the calm face of a Bariba woman in labor results in the experience of less pain than does the agonized grimace of women in other cultures.

According to Linda Garro (1990), it is important for medical professionals who work with people in pain to understand the impact of culture on the expression of pain. Culture is not taken into account, the physician may overestimate or underestimate the amount of pain experienced by the patient. On the other hand, it is important to remember that not all members of the same are the same. As in all other aspects of human diversity, it is important to be aware of variation within cultures.

What did you learn about pain in your own culture? Were you taught to minimize pain because it is important to be tough? Did you learn that no one will pay attention to your pain unless you exaggerate it? How do you respond when your parent or friends are in pain? Such questions will help you think about cultural influences on perception.



mine recently wrote to say, "My mother, who lost her left leg to polio in her early 20s, is now 73, and sometimes when I ask how her arthritis is, she often responds, 'The foot I don't have aches as much as my good one.'" Amputees are not the only persons who experience such sensations. Persons with spinal cord injuries can experience no true sensations from the parts of their body below the break in the neural pathways in the spinal cord, but they sometimes experience phantom sensations in their limbs or genitals. Similarly, persons born with one arm or legs often experience phantom sensations in the missing limb (Melzack, 1992).

How is it possible to "feel" sensations from a limb that does not exist and, therefore, cannot be transmitting sensations to the brain? A team of researchers from Germany and the United States appears to have provided the answer (Flor & others, 1995). Using brain-imaging techniques, they found that, when sensory and pain neurons from one part of the body have been cut, the area of the somatosensory cortex that served that part of the body becomes sensitive to input from parts of the body that activate nearby portions of the

## 9

## Application of Psychology

### VISUAL PERCEPTION, ILLUSION, AND ART

During the winter of 1993, I went to New York with my best friend to see an amazing collection of paintings, drawings, and sculpture by Henri Matisse at the Museum of Modern Art. The works were arranged in chronological order, showing the progression in his art from his first paintings to the collages that he assembled on his death bed. The sheer beauty and emotional impact of these works was amazing. But, ever being the psychologist, I sometimes found myself thinking about his paintings in terms of the monocular cues to depth perception.

Now, I have never said, and will I ever say, that the study of depth perception is more than just barely interesting. I know that depth perception is important to understand, but it is just not very interesting. On the other hand, the paintings of Matisse and other great artists are extremely interesting. And, as I thought about it, I found that the way Matisse used monocular cues of depth perception in his art was pretty interesting. Too. Maybe looking at some paintings from this perspective will add to our appreciation of the visual arts and teach us something about depth perception.

#### Painting and Depth Cues: Art Appreciation

The artist who paints a landscape, a still life, or a portrait of a person is creating a visual illusion. He or she uses what is known about the monocular cues of depth perception to create the illusion of a three-dimensional object (one with height, width, and depth) on a two-dimensional canvas (one with height and width only). No part of the flat canvas is farther away from the viewer than any other part, but the artist creates the illusion of depth—the impression that some parts of the painting are farther away than others—mostly by using the cues of texture gradient, linear perspective, superposition, shadowing, and aerial perspective. Cues based on the way in which the eyes focus on objects that are different distances from the eye and the binocular cues that are based on differences in the

alignment of the two eyes cannot be used by the artist, but artists often achieve striking illusions of depth to the collages that he assembled on his death bed. The sheer beauty and emotional impact of these works was amazing. But, ever being the psychologist, I sometimes found myself thinking about his paintings in terms of the monocular cues to depth perception.

Look at the striking illusions of depth created in two paintings. The painting in figure 4.43 by the Spanish painter Diego Velázquez (Las Meninas, 1656) uses four depth perception cues to suggest depth very effectively. Notice that the man standing in the doorway is smaller than the man standing on the left (a self-portrait of the artist) and even smaller than the young blonde child to the right is painted on the canvas as if it is shorter at the rear of the room than in the front of the room. These are uses of the monocular cue of linear perspective, and they give a powerful illusion of depth to the room. Notice also that the persons that Velázquez wishes us to perceive as being in the front of the room partially cover the persons behind them (a cue of superposition). The detailed texture of the clothing of the persons in the front of the room is also clearer than that of persons at the rear of the room (the cue of texture gradient). Velázquez also uses shadowing effectively to create an illusion of depth, but let's study this cue in the even more effective example by Artemisia Gentileschi (fig. 4.44).

A more subtle, but wonderfully effective illusion of depth has been created in this extraordinary self-portrait. Gentileschi gives us an amazingly three-dimensional view of herself partly by using linear perspective. Notice, for example, that her right



FIGURE 4.43  
Las Meninas (1656) by Diego Velázquez.  
© Art Library Museum, NY

hand appears to be farther away from us partly because it is smaller on the canvas than her left hand, which seems to be very close to us. In addition, her face partially hides the right shoulder, which seems far away from us (superposition). But, it is Gentileschi's exceptional mastery of shadowing that brings the illusion of subtle depth to life. Her face is painted on a flat canvas, but it seems as rounded as an apple. As a result, her left cheek seems inches closer to us than does her nose.

Sometimes, Matisse was interested in creating a sense of depth, but sometimes he intentionally ignored depth. The reclining nude in figure 4.45 (L'Atelier du Quai Saint-Michel), for example, is positioned in a scene painted with powerful depth cues. Notice that the building seen outside the window is shorter on the canvas than the delicate table standing in front of the window. Compare that painting with a later painting in which he has portrayed exactly

**8 Human Diversity Features** Human diversity sections give special emphasis to major themes of this book, the importance of understanding and respecting the differences among people and learning about the sociocultural factors that can contribute to the variety among individuals. You'll find a human diversity section in most chapters.

**9 Applications of Psychology** An application of psychology is discussed near the end of every chapter. This section ties together the information in the chapter and helps you understand how your new knowledge of psychology can be used in your own life.

**10 Chapter Summaries** At the end of each chapter, the content of the chapter is summarized in outline form. This outline format is designed to give you one last look at the content of the chapter to see how all the pieces of new information fit together.

**11 Resources** A list of suggested readings and Web sites is presented at the end of each chapter. This information will help you learn more about a specific topic covered in the chapter.

**12 Visual Reviews** In many chapters, you'll find key illustrations from the chapter reprinted at the end of the chapter, only this time *without* the labels. Fill in the labels yourself to test your learning of the information. The original figure number, title, and page reference are given. Return to the original figure and description to check your answers and review if necessary.

#### Kicking Legal Drug Habits

What about people who want to stop using these legal consciousness-altering drugs? How can they stop? Some people just stop, of course. But, for those who find stopping difficult, psychologists have designed a number of programs to help individuals stop smoking and reduce caffeine consumption. Because most heavy smokers are physically addicted to the nicotine in cigarettes, one of the best, time-tested methods is to gradually reduce the individual's dependence on nicotine before asking him or her to stop smoking altogether (Fox & Brown, 1978). In an experimental evaluation of this method, smokers were given a list of cigarettes that stated the nicotine content of each brand.

During the first week, the smokers were allowed to smoke their accustomed number per day of their own high-nicotine brand. During the second week, they were asked to smoke the same number of a brand of cigarettes that contained 30 percent less nicotine. During the third week, they were instructed to smoke the same number of a brand containing 60 percent less nicotine, and the fourth week brought a change to a brand containing 90 percent less nicotine. At that time, 40 percent of the smokers were able to stop smoking permanently, and another 30 percent were able to smoke at reduced rates of nicotine and tar intake. Similar methods have also been developed to help people reduce caffeine consumption by gradually switching to

decaffeinated coffee (Fox & Rubini, 1981). There is also computer software to allow individuals to enter information about their progress in quitting smoking. The individuals receive feedback from the computer, telling them when it is time either to switch to the next lower level of nicotine cigarette or to quit altogether (Burling & others, 1988).

Because dependence on alcohol is a more complicated issue, the individual who cannot reduce drinking to a controlled and healthy level or quit altogether should, by all means, seek professional assistance. The same advice holds for any consciousness-altering drug from which anyone cannot walk away.

## 10

### Summary

Chapter 5 explores human awareness, normal waking consciousness, sleeping and dreaming, and altered states of consciousness.

- Consciousness is defined as "a state of awareness" and is experienced in a variety of states.
  - Directed consciousness occurs when awareness is directed toward a single focus.
  - In the state of flowing consciousness, awareness drifts from one thought to another.
  - Daydreams combine the features of directed consciousness and dreamlike fantasies.
  - At times, consciousness appears to become divided, with different conscious activities occurring simultaneously.
  - Psychologists have conducted studies that suggest that it makes sense to say that unconscious mental processes operate in our lives.
- Approximately one-third of our lives is spent in sleep, but not all of sleep is unconscious.
  - Sleep begins with a semiconscious, hypnagogic state and moves through stages of progressively deeper sleep.
  - Dreams occur mostly during the phase of sleep known as REM sleep, but a different type of dream is common in non-REM sleep as well.
  - Sleeping and dreaming seem important to health, but even extended periods of sleep deprivation have been shown to cause only fatigue, inefficiency, and irritability.
  - Nightmares, night terrors, sleepwalking, and sleep talking are fairly common sleep phenomena.
  - Some persons suffer from the sleep disorders of insomnia (inability to get sufficient sleep), narcolepsy (falling asleep during daily activities), and sleep apnea (breathing stops briefly during sleep).
- We sometimes experience more unusual altered states of consciousness.
  - Many individuals practice meditation to achieve a highly relaxed state.
  - Hypnosis is sometimes used to alter consciousness and to relieve pain.
  - Altered consciousness is sometimes experienced in the form of depersonalization.

- IV. Consciousness can also be altered through the use of various psychotropic drugs.
- Psychotropic drugs can be classified as stimulants, depressants, hallucinogens, and inhalants; the drug marijuana does not fit easily into this classification.
  - Though risks differ from drug to drug, drug use can lead to abuse, dependence, or addiction.
  - Even the most common legal drugs (caffeine, nicotine, alcohol) produce definite physical and psychological effects and can be quite harmful if used in excess.
  - The more powerful drugs cause radical changes in consciousness; they can lead to serious physical and psychological problems, and many are illegal.
    - Stimulants are not physically addictive but produce psychological dependence; they can be dangerous, particularly in their effects on the heart.
    - Sedatives and tranquilizers are highly addictive and can be highly dangerous, particularly when taken in large doses or with alcohol.
    - Narcotics are powerful and dangerous depressants; physiological addiction occurs rapidly, and prolonged use has profoundly damaging effects on the body.
    - Inhalants are usually toxic and often cause permanent brain damage.
    - Hallucinogens radically alter perception, cause hallucinations, and are often associated with bizarre or even violent behavior. Although hallucinogens are not physiologically addictive, psychological dependence is common.
    - Marijuana is a drug that produces a sense of well-being in most people and sometimes alters perception.

### Resources

- For a readable discussion of meditation without its metaphysical or religious trimmings, read Benson, H. (1975). *The relaxation response*. New York: Morrow. For an intelligent discussion of Zen meditation, see Austin, J. H. (1998). *Zen and the brain: toward an understanding of meditation and consciousness*. Cambridge, MA: MIT Press.
- For a fascinating and sensible look at hypnosis, see Bowers, K. S. (1978). *Hypnosis for the seriously curious*. Monterey, CA: Brooks/Cole.
- For more on the contents of dreams, written by Freudian psychologist, see Hall, C. S. (1951). What people dream about. *Scientific American*, 84: 60-63. For additional information on the study of sleeping and dreaming, see Webb, W. B., & Agnew, H. W. (1973). *Sleep and dreams*. Dubuque, IA: Wm. C. Brown. Home, J. (1988). *Why we sleep*. New York: Oxford University Press; Hobson, J. A. (1989). *Sleep*. New York: Scientific American Library; and Stauch, L., & Meier, B. (1999). *In search of dreams: Experimental dream research*. Albany: State University of New York Press.
- A fascinating and in-depth analysis of the hypnotic state is Mavromatis, A. (1987). *Hypnagogia*. London: Routledge.
- For thorough summaries of mind-altering drugs, see Carroll, C. R. (2000). *Drugs in modern society* (5th ed.). Boston: McGraw-Hill; and Jullien, R. M. (1992). *A primer of drug addiction* (8th ed.). San Francisco: Freeman.
- Broad overviews of the topic of consciousness are provided by Wallace, B., & Fisher, L. E. (1991). *Consciousness and behavior*, 2nd ed.). Boston: Allyn & Bacon; Ornstein, R. (1991). *The evolution of consciousness*. New York: Perigee-Hall; and Rychalski, J. F. (1997). *In defense of human consciousness*. Washington, DC: American Psychological Association.
- If you smoke or use smokeless tobacco and are thinking about quitting, this Web site offers useful information and links to other sites: <http://unr.edu/homepage/shubinsk/smoke.html>



## CRITICAL THINKING

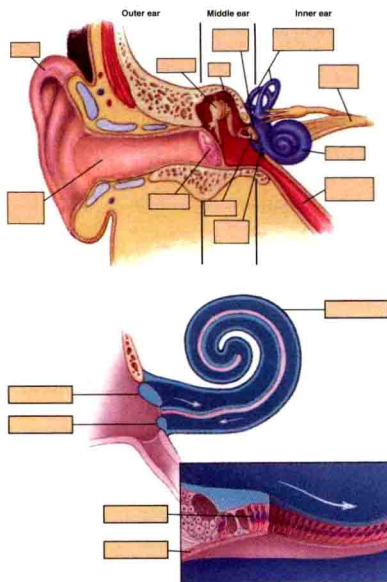
Like most college courses, the goal of this course is to teach you a great deal of new information. But there is a second goal even more important than the first—to teach you to *think critically about human beings*. You are enrolled in a college or university to become well educated. That means, of course, that you want to learn more information, but it also means that you want to be better prepared to make decisions, plan for the future, and realize your goals. If we human beings are to be able to continue to inhabit this fragile planet, and if we are to make the most of our time here, we must all try to hone our intellectual skills.

Psychology provides an excellent vehicle for teaching critical thinking skills. By its very nature—as a *science* of human behavior—we will be looking critically at ourselves. As we discuss the many new facts and concepts that make up this course, we will describe many of the experiments that have helped psychologists reach tentative conclusions about the nature of our behavior and experience. *Psychological research is critical thinking in practice*. As you read about each experiment, take a moment to consider the logic that went into its design. Think for a moment about the thinking that helped the researcher decide between rival explanations for that facet of human life.

But, more important than seeing how scientists use their critical thinking skills, a major goal of this course is to encourage *you* to improve your own critical thinking skills. Success in every walk of life and meaningful participation in democratic society require more than the simple knowledge of facts—they require using facts intelligently.

What, then, is critical thinking? There are many aspects of critical thinking, but the steps that I will describe are a good start. As you read this textbook or approach any other source of new information—from political speeches to newspaper articles—try the following steps:

- What is the evidence?* I will present you with many statements in this textbook, and I expect you to demand that I back up my statements with evidence. When I tell you that, unlike 20 years ago, women and men place the same importance on love in marriage, you should look to see if I present evidence to support that conclusion. If I make a statement without supporting evidence, you should strongly question my statement.
- How good is the evidence?* Suppose I tell you that the reason that I believe that women and men place the same value on romance today is because my wife and my daughters say so. My wife and daughters happen to be very smart people, but would you believe the opinions of just three people? Would you be more convinced if I cite a study of 20,000 men and women? Not only should we demand evidence to support statements of fact, we also should examine the quality of that evidence. In this book, I can tell you that I have thought carefully about the quality of evidence that supports every statement. But you should completely



**FIGURE 4.50**  
Key structures of the ear (based on fig. 4.14, p. 121).

**FIGURE 4.51**  
Key structures of the cochlea (based on fig. 4.15, p. 122).



disregard my reassurances and think critically about the evidence yourself. You might very well decide that I am wrong on some key issues, but, at the very least, you will sharpen your critical thinking skills.

3. *What are the alternative interpretations of the evidence?* Even if I do provide you with solid evidence to support every conclusion, critical thinking cannot stop there. Facts are meaningless until they are *interpreted*, and there is almost always more than one interpretation of every set of facts in psychology.

Let's think about an example. There is strong evidence that, other things being equal, women tend to be attracted to men as marriage partners if they are more intelligent, hardworking, and successful. Those are the "facts," but what do they mean? One group of scholars believe that women have an *innate* need (part of every female in the human species) to guarantee the well-being of their children that leads them to prefer successful husbands who can help them provide for their children. Do you agree? Even if you agree, are there alternative explanations of these facts that would make just as much sense? Take a moment now to think about alternative explanations for these facts (really—I hope you will stop reading and try to think of alternative interpretations of these facts for a moment). Did you come up with any alternative explanations? It doesn't matter if you didn't come up with a brilliant explanation, but it is important that you see that alternative explanations of almost any set of facts are possible.

So what do we do with facts that can be interpreted in several different ways? Critical thinking requires two approaches to this situation. The first and most important step is to look for *more facts* that will help you choose between the alternative explanations. For example, do women in *all* cultures find successful men to be attractive? Do highly successful women in our culture find the man's success to be unimportant? Do women who do not want to have children still find successful men to be attractive? If the answers to these questions are not all yes, you might be less likely to believe that the preference for successful men reflects an innate need shared by all women. There are many ways in which new facts can be sought that might allow you to decide between alternative explanations for facts. Indeed, that is what science is all about.

The other way in which the critical thinker deals with alternative explanations of facts, however, is to learn to live with alternative explanations. At this point in the history of the science of psychology, there are many alternative expla-

nations of facts that we cannot yet choose among. Indeed, one of the things that makes psychology exciting is that there is so much yet to learn. Many of the current disagreements among psychologists will be resolved ultimately through better experiments—the use of critical thinking to plan the logic of scientific studies. But, in other cases, the different ways of viewing the same phenomena will prove to be equally valid conceptions. Therefore, the ability to consider more than one perspective on issues in psychology—as in all walks of life—is important. Moreover, the discussion of these differing views will help refine your critical thinking about yourself and the human race in general.

4. *Go beyond the book.* This book only scratches the surface of psychology, and it provides only a few examples of how the facts and concepts of psychology might apply to your life. The final step in critical thinking is to ask questions about the information given in the textbook to expand its application to your experience. Each section of a chapter ends with critical thinking questions. These questions have no right or wrong answers but are designed to stimulate and challenge you as you read the book. (The *Student Study Guide* contains more of these kinds of questions in the sections titled "Encouraging Critical Thinking: Beyond the Text.") But these questions are just a start. The most important critical thinking questions that you ask will be your own.

Critical thinking is not only an academic exercise—it is a part of living. The thinking and evaluative skills that you develop in this and other courses will also serve you well as you solve problems and confront the challenges of daily life.

If you are concerned that critical thinking takes time and might detract from your ability to memorize information that will be on tests, I have good news for you. Thinking critically about the information that you have just read will improve your memory for that information. In chapter 7, we will discuss the "deep processing" of information and present evidence that the more you think about information the more information you will remember. So, although you will still need to use the strategies presented in the **study skills** section that follows, critical thinking will improve your memory for information presented in this book. But don't take my word for it. Read the section on levels of processing in chapter 7 and think about it critically. Better yet, try your own experiment to see if thinking critically about the information presented in this book makes this course a better learning experience.

# BEFORE YOU BEGIN: A Primer on Study Skills



You are about to begin your introduction to the science of psychology. Before you do, I would like to offer you some suggestions that are based on psychological principles. Psychology is a science that addresses a great many topics, most of which have some direct relevance to our lives. One topic that has long been of interest to psychologists is human learning—the ways in which we learn and remember new information, such as the new information that you are learning about the field of psychology. Much has been discovered about learning and memory that can be translated into suggestions for more efficient learning in this course and all of your other courses.

People do not absorb information as a sponge absorbs water; we have to *work* at learning new information in college courses. Human beings are highly effective learners, but we learn better in some ways than we do in others. If we understand the characteristics and quirks of the human learner, we can make better use of our study time. These characteristics will be discussed in some detail in chapters 6 and 7 on learning and memory, but, before you begin to study the science of psychology, it may be useful to summarize some of the more helpful hints provided by psychologists for more effective learning and recall.

I have kept this section brief because I know how busy the beginning of the term can be, but the information contained in this section is worth your attention. From my own experience as a student, and from working with many students since that time, I know that learning better ways to study can make the learning process more enjoyable, can increase the amount of information that you learn and retain, and can improve your grades. I hope that the following suggestions will help you.

## The SQ3R Method

Francis Robinson of Ohio State University suggested a method for studying textbooks known as the SQ3R method. These initials stand for the five steps in effective textbook study outlined by Robinson:

*S: Survey.* Look ahead at the content of the text before you begin to read.

*Q: Question.* Ask yourself questions about the material you are reading before and as you read.

*R: Read.* Read through the material in the normal way.

*R: Recite.* Recite the new information that you are learning out loud or silently.

*R: Review.* Go over the material that you have learned several times before you are tested on it.

Let's go through these steps in more detail to better understand them.

### Survey

Most of us think there is just one way to read—you start at the beginning and read to the end. That is the best way to read a novel because you don't want to know about the next plot twist or the surprise ending until you get there. But a very different strategy is needed when reading a textbook. It's important to

survey, or look ahead, at what you are going to read. In fact, you should try to find out as much as possible about the text material you are going to read *before* you read it.

The reason behind this strategy of surveying before reading is based on the way humans learn and store new information in memory. Speaking loosely, we “hang” new information on what we already know. If we learn a new fact about marijuana, we hang that information on what we already know about mind-altering drugs; and, the more organized knowledge we have of a topic, the better we are able to learn and remember new information about it. In particular, the more general information we possess about a topic, the easier it is to learn and remember new specific information about the topic (Ausubel, 1960; Deese & Deese, 1979).

There are several effective ways to survey this textbook. As in studying any text, you should look at the general content



Human beings are highly effective learners, but we learn better in some ways than we do in others. If we understand the characteristics and quirks of the human learner, we can make better use of our study time.

Where is the thyroid gland located? What role does the thyroid gland play in metabolism? What are the effects of thyroxin?

The **thyroid gland**, located just below the larynx, or voice box, plays an important role in the regulation of **metabolism**. It does so by secreting a hormone called **thyroxin**. The level of thyroxin in a person's bloodstream and the resulting metabolic rate are important in many ways. In children, proper functioning of the thyroid is necessary for proper mental development. A serious thyroid deficiency in childhood will produce sluggishness, poor muscle tone, and a type of mental retardation called **cretinism**.

of each chapter by reading the headings within it. For your convenience, the headings within each chapter of this text are placed in an outline on the chapter opening page. Novels do not have headings because there is no reason to survey their content in advance; textbooks have them because they greatly aid surveying and reviewing. For example, did you look ahead at the headings in this section before beginning to read it? If you did, you developed an overall view of its content.

Next look at the prologue section at the beginning of each chapter. It gives you an advance look at the main points of the content you will be reading. Study this section carefully before going on, and it will increase the amount of information you learn as you read. When surveying some textbooks, you may need to add to what you learn from the headings by briefly skimming sections and looking at illustrations, but, in this text, the chapter outlines and prologues provide the best sources of advance information. Is it really worth the time and effort to read the prologue section of each chapter to get an overview of what is ahead? Actually, I spent a considerable amount of time researching this question before I started writing this book. I didn't want to waste my time in writing the prologues—and your time in reading them—unless they would actually increase what you learn. The value of prologues was tested by David Ausubel (1960) in a classic experiment conducted at the University of Illinois. One hundred twenty students were divided into two groups that read a long passage with and without a prologue section preceding it. The passage covered the properties of carbon steel and contained many facts that were new to the students. After both groups had read the passage on carbon steel, they took a brief

multiple-choice test covering the facts presented in the passage. As predicted, the group that read the prologue first correctly answered approximately 20 percent more of the questions (the difference between an *F* and a *B* in most courses). That is why a prologue was written to precede each chapter in this text—and that is why giving them your close attention is worth the effort.

### Question

After you have surveyed the material you will be reading by reading the prologue and looking over the headings, Robinson suggests that you ask questions. Do this before and as you are reading. These questions should be those raised during your survey and first reading. They should reflect your own personal struggle to understand and digest the contents of this book. For example, included here are sample questions that you might ask while studying the thyroid gland in chapter 3, page 84. Asking such questions will help you become actively involved in the learning process and will focus your attention on relevant information. As you locate the information that answers your questions, you may find it helpful to underline or highlight such information with a felt-tip pen.

### Read

After the *S* and *Q* steps, you are ready to begin reading in the usual way. Although you have put in a lot of time preparing for this step, your reading probably will be so much more efficient that it's worth the extra time. In fact, if you have the time to invest, you could improve the efficiency of your reading even more by skimming the material quickly before reading it more closely.

### Recite

When studying, is it more beneficial to spend your time reading the material over and over again, or to read it and then practice reciting it (repeating it to yourself)? Reciting is definitely the most useful part of the study process. If nothing else, it alerts you to those things you do not really know yet (the things you cannot recite), and it may actually make learning more efficient. Regardless of how recitation works, it works. A. I. Gates (1917) found that individuals who spent 80 percent of their time reciting lists and only 20 percent reading them recalled twice as much as those who spent all of their time reading. This seems to be especially true of students who take the time to understand the meaning of what they are learning rather than memorizing it in rote fashion (Honeck, 1973). The "Check Your Learning" questions at the end of each section will help you "recite" what you have learned. In addition, the list of key terms at the beginning of each chapter and the marginal glossary can help you with this recitation. If you can recite the basic definitions of these terms, you will have learned the most important material.

### Review

After you have learned the new information in the text by reading and reciting, you will need to add one final step that most students neglect: Review what you have learned several times before you are tested on it. The goal of the review process is to overlearn the material, which means to continue studying material after you have first mastered it. The learning process is not over when you can first recite the new information to yourself without error. Your ability to recall this information can be significantly strengthened later by reciting it several more times before you are tested (Krueger, 1929). To aid you with the review step, this text provides you with a review section following each major heading within the chapter and a sentence outline summary at the end of each chapter.

## Strategies for Studying

The SQ3R method can improve your ability to learn information from textbooks. Several other study strategies may help