Key Question Chapter Outline

How Is Consciousness Related to Other Mental Processes?

- Tools for Studying Consciousness
- The Conscious and Nonconscious Minds

What Cycles Occur in Everyday Consciousness?

- Daydreaming
- Sleep: The Mysterious Third of Our Lives
- Dreaming: The Pageants of the Night

What Other Forms Can Consciousness Take?

- Hypnosis
- Meditation
- Psychoactive Drug States

Consciousness: The State of the Art

CORE CONCEPTS

Consciousness can take many forms, while other mental processes occur simultaneously outside our awareness.

Consciousness changes in cycles that correspond to our biological rhythms and to the patterns of stimulation in our environment.

An altered state of consciousness occurs when some aspect of normal consciousness is modified by mental, behavioral, or chemical means.

Psychology in Your Life

The Unconscious—Reconsidered

An empirical approach suggests a simpler unconscious than the one portrayed by Sigmund Freud.

Sleep Disorders

Insomnia, sleep apnea, narcolepsy, and daytime sleepiness can be hazardous to your health—and perhaps even to your life.

Dependence and Addiction

Psychoactive drugs alter brain chemistry, and they can produce physical or psychological addiction. But is addiction a disease or a character flaw?

USING PSYCHOLOGY TO LEARN PSYCHOLOGY:
Connecting Consciousness with Memory

Chapter

5

States of Consciousness

ONE RAINY SWISS SUMMER day in the early 19th century, a housebound trio of writers eagerly challenged each other to craft ghost stories. Yet, after several days of uninspired effort, Mary Wollstonecraft Shelley feared she would come up empty handed. Then one night, with the problem turning over in her mind, she went to bed and soon fell asleep, only to awaken some time later with horrific dream images in her head. She later recalled them clearly:

> My imagination, unbidden, possessed and guided me . . . I saw the pale student of unhallowed arts kneeling beside the thing he had put together. I saw the hideous phantasm of a man stretched out, and then . . . show signs of life, and stir with an uneasy, half vital motion . . . [The creator] would rush away from his odious handiwork, horror-stricken.

Early the next day she penned the words: "It was on a dreary night of November . . ." (Shelley, 1831, p. x). Thus began her "ghost story," *Frankenstein, or The Modern Prometheus.*

Mary Shelley was far from the first to have been inspired by a dream. From ancient times, dreams have been regarded as sources of insight, creativity, and prophecy. We can see this, for example, in the Old Testament story of the Israelite Joseph, who interpreted Pharaoh's dreams of fat and lean cattle as predicting first the years of plenty and then the years of famine that lay in store for the Egyptian kingdom (Genesis, 41:i–vii).

● Spanish painter Salvador Dali found inspiration for his work in his dreams. © 2004 Gala-Salvador Dali Foundation, Figueres, Spain, © Salvador Dali Museum, Inc. St. Petersburg, Florida, USA/Bridgeman Art Library

In more modern times, the English poet Samuel Taylor Coleridge attributed the imagery of his poem "Kubla Khan" to a dream (possibly drug-induced) that he experienced after reading a biography of the famed Mongol warrior. Likewise, painters such as surrealist Salvador Dali have found their dreams to be vivid sources of imagery. Composers as varied as Mozart, Beethoven, the Beatles, and Sting have all credited their dreams with inspiring certain works. And in the scientific world, chemist August Kekule's discovery of the structure of the benzene molecule was sparked by his dream of a snake rolled into a loop, grasping its own tail tucked in its mouth. Even the famous horror writer Stephen King claims to have harvested story ideas from his own childhood nightmares.

Dreaming represents just one of many states of consciousness that are possible for the human mind. Others include, of course, our familiar state of wakefulness and the less-familiar states of dreamless sleep, hypnosis, and meditation, as well as the chemically altered states produced by alcohol and other drugs. But that's not all. Behind these conscious states, the brain has other levels of processing that occur outside consciousness (Wallace & Fisher, 1999). These range from information readily available in memory (What is seven times nine?) to the operations occurring in the deep, primitive regions of the brain, which control basic biological functions, such as blood pressure and body temperature. Somewhere between these extremes are parts of the mind that somehow deal with our once-conscious memories and gut-level responses, as varied as this morning's breakfast and your most embarrassing moment. As we will see, this netherworld of nonconscious ideas, feelings, desires, and images has been a magnet for controversy ever since Freud suggested that dreams may reflect our unrecognized fears and desires. In this chapter we will evaluate this claim and others that have been made for consciousness and the "deeper" levels of processing in the mind.

HOW IS CONSCIOUSNESS RELATED TO OTHER MENTAL PROCESSES?

In simplest terms, we can define **consciousness** as the process underlying the mental model we create of the world of which we are aware. It is also a part of the mind into which we can potentially retrieve a fact, an idea, an emotion, or a memory of an experience and recombine them in the processes we call "thinking." It's the part of the mind that helps us combine both reality and fantasy—the "movie" in your head. For example, if you see a doughnut when you are hungry, consciousness forms an image of the doughnut (based on external stimulation) and consults memory, which associates the image with food and also allows you to imagine eating the doughnut. Most likely, under these circumstances your consciousness will quickly fill with doughnutty imagery. But exactly *how* the brain does this is perhaps psychology's greatest mystery. How do the patterns in the firing of billions of neurons become the conscious image of a doughnut—or of the words and ideas on this page?

Folk wisdom merely attributes consciousness to an *anima,* a spirit or inner life force, an explanation that takes us no closer to understanding how consciousness works. A Biblical variation on this theme connects consciousness to the soul—although the Bible also suggests that evil spirits or devils sometimes take over consciousness and cause bizarre behavior.

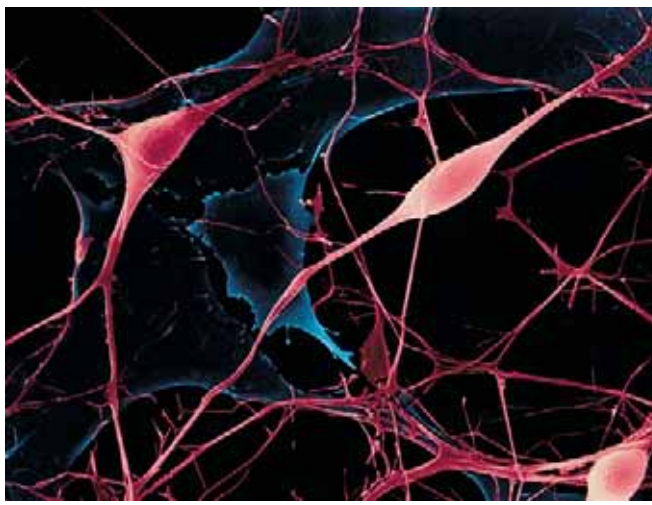
■ **Consciousness** The process by which the brain creates a model of internal and external experience.

For psychologists, the big difficulty presented by consciousness is that it is so subjective and illusive—like searching for the end of the rainbow (Damasio, 1999, 2000). That lesson was driven home when the structuralists attempted to dissect conscious experience more than a century ago. As you will recall, the structuralists used a simple technique called introspection: People were asked to report on their own conscious experience. The slippery, subjective nature of consciousness quickly became obvious to nearly everyone, and psychologists began to despair that science would never find a way to study objectively something so private as conscious experience. (Think about it: How could you prove that you have consciousness?)

CONNECTION: CHAPTER 1

Wundt and the structuralists pioneered the use of introspection in their search for "the elements of conscious experience."

The problem seemed so intractable that, early in the 20th century, the notorious and influential behaviorist John Watson declared that the mind was out of bounds for the young science of psychology. Mental processes were little more than by-products of our actions, he said. (You don't cry because you are sad, you are sad because some event makes you cry.) Under Watson's direction, psychology became simply the science of behavior. And so, psychology not only lost its consciousness but also lost its mind!



Francis Crick says that our consciousness is "no more than the behavior of a vast assembly of nerve cells and their associated molecules."

The psychology of consciousness remained in limbo until the 1960s, when a coalition of cognitive psychologists, neuroscientists, and computer scientists brought it back to life (Gardner, 1985). They did so for two reasons. First, many psychological issues had come to light that needed a better explanation than behaviorism could deliver: quirks of memory, perceptual illusions, drug-induced states (which were very popular in the 1960s). The second reason for the reemergence of consciousness came from technology. Scientists were acquiring new tools—especially computers, which allowed them to scan the brain and also gave them a model that could be used to explain how the brain processes information.

The combination of new tools and pressing problems, then, led to a multidisciplinary effort that became known as **cognitive neuroscience.** It includes scientists from a variety of fields, including cognitive psychology, neurology, biology, computer science, and linguistics—all interested in how the brain processes information and creates conscious experience. From the perspective of cognitive neuroscience, the brain acts like a biological computing device with vast resources—among them being 100 billion transistor-like neurons, each with thousands of interconnections—capable of creating the complex universe of imagination and experience we think of as consciousness (Chalmers, 1995; Churchland, 1995; Crick, 1994).

Cognitive neuroscience An interdisciplinary field involving cognitive psychology, neurology, biology, computer science, linguistics, and specialists from other fields who are interested in the connection between mental processes and the brain.

In this chapter we will see how neuroscientists have renewed the quest to understand the multiple conscious states of which we are capable, including sleep, dreaming, hypnosis, and drug-altered consciousness. We will also introduce you briefly to the mental processes that occur outside of consciousness, laying the groundwork for more in-depth exploration of that world in later chapters on emotion, motivation, perception, and memory. As we travel this path, please keep the following Core Concept readily available to your consciousness:

CORE CONCEPT

Consciousness can take many forms, while other mental processes occur simultaneously outside our awareness.

The big picture that emerges is one of a conscious mind that can take on a variety of roles, as we will see, but one that must focus sequentially, first on one thing and then on another, like a moving spotlight (see Tononi & Edelman,

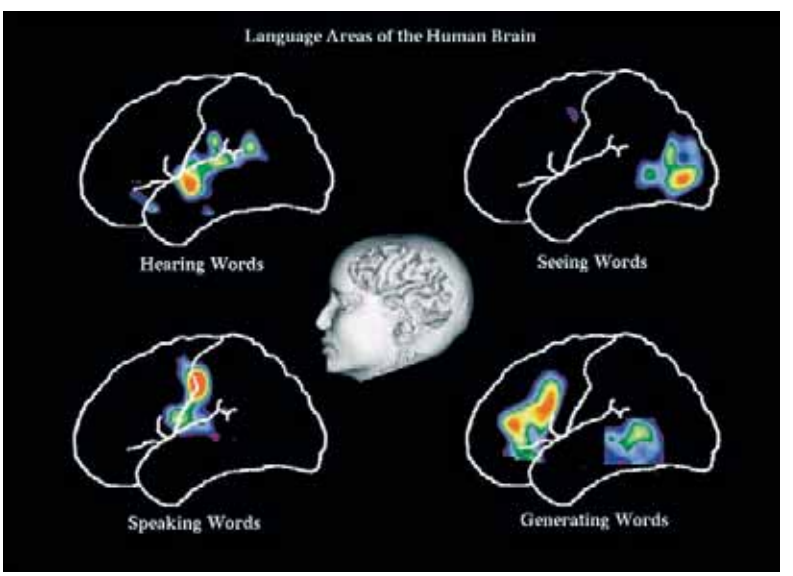
1998). Consciousness is not good at multitasking: So, if you try to drive while talking on your cell phone, you must shift your attention back and forth between tasks (Rubenstein et al., 2001; Strayer et al., 2003). Meanwhile, **nonconscious processes** have no such restriction and can work on many jobs at once—which is why you can walk, chew gum, and breathe simultaneously. In more technical terms, consciousness must process information serially, while nonconscious brain circuits can processes many streams of information in parallel. We will begin our exploration of these multifarious mental states and levels with a look at some of the tools and techniques that have opened up this line of research.

Tools for Studying Consciousness

As you will recall from the previous chapter, high-tech tools, such as the MRI, PET, and EEG, have opened new windows through which researchers can look into the brain to see which regions are active during various mental tasks—showing us the "what" of consciousness. These imaging devices, of course, do not show the actual contents of conscious experience, but they quite clearly reveal distinct groups of brain structures that "light up" when we read or speak, for example. (See Figure 5.1.) The resulting images have left no doubt that conscious processing involves simultaneous activity in many brain circuits, especially in the cortex and in the pathways connecting the thalamus to the cortex. But, to glimpse the underlying mental processes—the "how" of consciousness—psychologists have devised other, even more ingenious, techniques. We will see many of these techniques throughout this chapter—in fact, throughout this book. For the moment, though, we will give you just two examples, as previews of coming attractions.

Mental Rotation A classic experiment by Roger Shepard and Jacqueline Metzler (1971) showed that it's not merely a metaphor when people speak of "turning things over" in their conscious minds. Using images like those in Figure 5.2, Shepard and Metzler asked volunteers to decide whether the two images in each pair show the same object in different positions. They reasoned that if the mind actually rotates these images when comparing them, people would take longer to respond when the difference between the angles of the images

■ **Nonconscious processes** Any brain process that does not involve conscious processing, including both preconscious memories and unconscious processes.



● **FIGURE 5.1** PET Scans of the Brain at Work

These PET scans show how different regions of the brain become active during different conscious tasks.

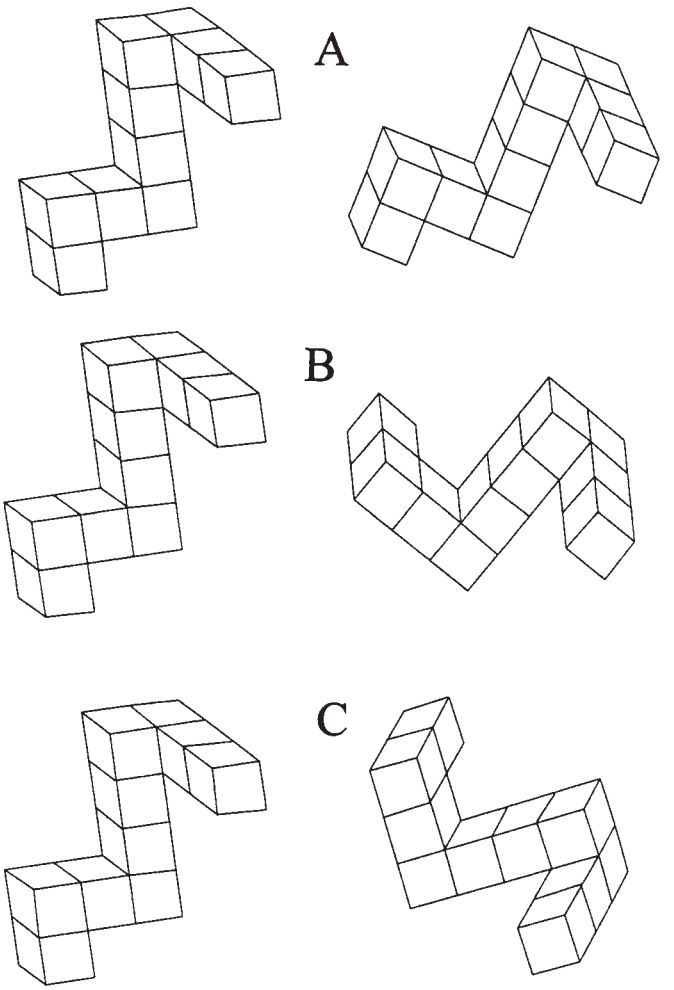


FIGURE 5.2 Figures for the Mental Rotation Experiment

These figures are similar to those used in Shepard and Metzler's mental rotation experiment. Results showed that people took longer to decide whether the images were the same or different, as the angles through which the images in each pair were rotated. You might try your own test to verify their findings.

in each pair is increased. And that is exactly what they found. If you try this experiment on your friends, it is likely that they, too, will respond more quickly to pair A—where the images have been rotated through a smaller angle—than to pairs B and C.

Zooming in with the Mind Another clever approach to the "how" of consciousness takes a different twist: Stephen Kosslyn found that we can use our conscious minds to "zoom in," camera-like, on the details of our mental images. To demonstrate this, Kosslyn (1976) first asked people to think of objects, such as an elephant or a cat or a chair. Then he asked questions about details of the imagined object (for example, "Is it a black cat?" or "Does it have a long tail?"), recording how long it took for his subjects to answer. He discovered that the smaller the detail he asked for, the longer subjects needed for a response. Subjects required extra time, Kosslyn proposed, to make a closer examination of their mental images. Both the Shepard and Metzler and the Kosslyn experiments suggest that we consciously manipulate our visual images in much the same way that we might manipulate physical objects in the outside world (Kosslyn, 1983). You can try this yourself with the demonstration in the accompanying box, "Do It Yourself! Zooming In on Mental Images."

DO IT YOURSELF! Zooming In on Mental Images

Ask a friend to close his or her eyes and imagine a house. Then, ask your friend to describe the color of the roof, the front door, and doorbell button. Using a watch or clock that displays seconds, record the amount of time it takes to get each answer. Based on Kosslyn's research, which item would you predict would require the longest response time? The shortest?

You will probably find that the smaller the detail you ask for, the longer it takes your friend to respond. Kosslyn interpreted this to mean that people need the extra time to "zoom in" on a mental image to resolve smaller features. In other words, we examine our mental images in the same way that we examine physical objects in the external world in order to perceive the "big picture" or the details.

● **FIGURE 5.3**

As we progress through the chapter, you will learn about other techniques used by neuroscientists to study consciousness and its allied mental processes. Now, let's see what picture has emerged from this work.

The Conscious and Nonconscious Minds

William James likened ordinary waking consciousness to a flowing stream that carries ever-changing sensations, perceptions, thoughts, memories, feelings, motives, and desires. This "stream of consciousness" can include awareness both of ourselves and of stimulation from our environment. And, as we have seen, it can also include physical sensations from within, such as hunger, thirst, pain, and pleasure.

Freud used another metaphor, comparing consciousness to the tip of an iceberg, which belies a much larger presence beneath the surface. A large body of evidence now confirms Freud's insight that much of the mind lurks and works out of sight, beneath the level of awareness—although probably not in exactly the way Freud believed, as we will see later. Most of the time our nonconscious machinery quietly operates in parallel with the conscious mind, but occasionally a nonconscious motive or emotion becomes so strong that it emerges into consciousness—as when a peculiar fragrance associated with an

emotional memory suddenly brings that emotion to consciousness or when a growing hunger drive spills into awareness as a "Mac attack." To get a better perspective on these processes, we will first consider the major functions of consciousness. Then we will review what research and theory can tell us about the architecture that organizes the layers of mind below its surface.

What Consciousness Does for Us At this very moment, your consciousness is focused on these words, written in black letters on a white page. But the words don't stand alone. They have meaning, which also flows through consciousness as you read. You can, of course, shift the spotlight of your attention to something else—music in the background, perhaps—and as you do so, the words on the page slip into the fringes of awareness. You may be moving your eyes across the page, but the meaning does not really register. (Every student has had this experience.)

Now, if we can have your attention again, we'd like to remind you that consciousness has many functions. But three especially important ones were illustrated by the scenario in the previous paragraph (Solso, 2001; Tononi & Edelman, 1998):

- Consciousness restricts our attention. Because consciousness processes information serially, it limits what you notice and think about. In this way, consciousness keeps your brain from being overwhelmed by stimulation. It is also the property that will not let you concentrate on what you are reading when you shift your attention to music playing in the background.
- Consciousness provides a mental "meeting place," where sensation can combine with memory, emotions, motives, and a host of other psychological processes. Thus, consciousness is the canvas on which we create a meaningful picture from the stimulation offered by our internal and external worlds. This is the aspect of consciousness that links meaning to words on a page or connects the emotion of joy to the sight of an old friend's face.
- Consciousness allows us to create a mental model of the world that we can manipulate. Unlike simpler organisms, we are not prisoners of the moment: We don't just react reflexively to stimulation. Instead, we can use a conscious model of our world that draws on memory, bringing both the past and the future into awareness. With this model in mind, we can think and plan by manipulating our mental world to evaluate alternative responses and imagine how effective they will be. It is this feature of consciousness that helps you generate your own examples for concepts in this text—or keeps you from being too brutally honest with a friend wearing clothes you don't like.

These three features—restriction, combination, and manipulation—apply in varying degrees to all states of consciousness, whether dreaming, hypnosis, meditation, a drug state, or our "normal" waking state. On the other hand, nonconscious processes operate in a much different way, as we have said. To show you how this region of the mind works, let's begin by distinguishing two levels of nonconscious processing.

Levels of the Nonconscious Mind Sigmund Freud originally proposed that processing outside awareness could influence our conscious thoughts, feelings, dreams, fantasies, and actions. And, although many cognitive psychologists would reject most details of Freud's theory as little more than fantasies, they would retain the notion that the nonconscious mind has two main divisions, often called the *preconscious* and the *unconscious.*

The Preconscious Psychologists define memories of events (a date last weekend, for example) and facts (Salem is the capital of Oregon) that have once

been the focus of attention as **preconscious memories.** They can return to consciousness with relative ease when something cues their recall. Otherwise, they lie in the background of the mind, just beyond the boundary of consciousness until needed. Preconsciousness doesn't operate under the serial, one-thing-at-a-time limitation of consciousness. On the other hand, it doesn't have the ability that consciousness has for actively manipulating information.

The Unconscious A dictionary might define the term *unconscious* as the absence of all consciousness, as in one who has fainted, has become comatose, or is under anesthesia. But there is another meaning for *unconscious:* cognition occurring without awareness. In this sense, the **unconscious** consists of many levels of processing that occur without awareness, ranging from brain systems that run on "automatic pilot" to those that can have subtle influences on consciousness and behavior (Kihlstrom, 1987). You can get some idea of how these unconscious processes affect us if you think about how you often follow a familiar route to work or school without apparent thought. Let us show you another way in which psychologists have demonstrated the existence of this sort of unconscious processing in the laboratory.

A Demonstration of Unconscious Processing Try filling in the blanks to make a word from the following stem:

D E F ___ ___ ___

Preconscious memories Information that is not currently in consciousness but can be recalled to consciousness voluntarily or after something calls attention to them.

Unconscious In classic Freudian theory, a part of the mind that houses memories, desires, and feelings that would be threatening if brought to consciousness. Many modern cognitive psychologists view the unconscious in less sinister terms, merely as a collection of mental processes that operate outside of awareness—but not typically suppressing information or working at odds with consciousness.

Using a technique called priming, psychologists can have some influence on the answers people give to such problems without their being conscious that they were influenced. In the example just given, there are a number of possible ways to complete the word stem, including *defend, defeat, defect, defile, deform, defray, defuse*, and *define.* We don't know for sure what your answer was, but we have carefully set you up to increase the probability that you would pick the word *define.* To do so, we deliberately "primed" your response by twice using the word *define* in the two paragraphs preceding our test. With priming methods such as this, psychologists have a powerful tool for probing the interaction of conscious and unconscious processes.

PSYCHOLOGY IN YOUR LIFE: THE UNCONSCIOUS—RECONSIDERED

CONNECTION: CHAPTER 8

In Freud's *psychoanalytic theory,* the unconscious makes up the major part of the mind. In this view, it serves as the source of sexual and aggressive desires.

As we have seen, the term *unconscious* can have many meanings. In Freud's psychoanalytic theory, for example, powerful unconscious forces actively work to block (or repress) sexual desires and traumatic memories (Freud, 1925). If allowed to break through into consciousness, these would cause extreme anxiety, Freud taught. In this view, the unconscious mind serves as a mental dungeon where terrible urges and threatening memories can be kept "locked up" outside of awareness.

Ever since Freud, the art and literature of the Western world have been captivated by the idea of an unconscious mind filled with dark and sinister motives and memories. For example, Joseph Conrad's novel *Heart of Darkness* tells the story of a person's internal and unconscious struggle with the most evil of desires for power, destruction, and death. Unconscious desires can be sexual, as well. What else could account for the dubious success of the titillating stories splashed so obviously across the pages of the tabloids and the screens of the "soaps"?

Freud also taught that we "forget" anniversaries because we have unconscious reservations about the relationship. He said that we choose mates who are, on an unconscious level, just substitutes for our fathers and mothers. And he gave us the concept of the "Freudian slip," which one wag defined as "saying one thing when you really mean your mother."

In essence, Freud's view is just a variation on the anima hypothesis mentioned earlier: He placed the ego—the rational decision-maker part of the mind—at the center of consciousness. There, said Freud, it assumes the responsibility of keeping the sexual and aggressive forces of the unconscious in check. But was he right? Although most psychologists today would say that Freud's views were better as metaphors than as objective science, his ideas are still widely accepted by the general public.

Advances in research methods (such as priming) have made it possible to analyze unconscious thought processes in ways never dreamed of by Freud (Kihlstrom, 1990; Kihlstrom et al., 1992; Rozin, 1976). As a result, the mind beneath consciousness does not appear to be so dramatic or sinister as Freud portrayed it. Rather, a cognitive view suggests a much simpler structure than the complicated censoring and repressing system that Freud proposed (Greenwald, 1992).

For the most part, the nonconscious mind seems to devote its resources to simple background tasks such as screening the incoming stream of sights, sounds, smells, and textures, rather than to repressing memories of traumatic experiences. This ability also provides a quick appraisal of events for their attractiveness or harmfulness (LeDoux, 1996). These unconscious pathways can even save your life, as when you react "without thinking" to a swerving car or a deadly snake on the path in front of you. In this fashion, the less-than-conscious mind works *with* consciousness, rather than against it. Ironically, the cognitive view of an unconscious that monitors, sorts, discards, and stores the flood of data we encounter may give the unconscious a larger role than Freud originally conceived.

CHECK YOUR UNDERSTANDING

1. **RECALL:** Who objected most strenuously to defining psychology as the science of consciousness?
   - **a.** the behaviorists
   - **b.** the cognitive psychologists
   - **c.** the Freudians
   - **d.** the humanists
   - **e.** the neurologists

2. **RECALL:** According to cognitive neuroscience,
   - **a.** consciousness has no relationship to the brain.
   - **b.** consciousness is a product of the brain.
   - **c.** creativity arises from altered states of consciousness.
   - **d.** consciousness does not exist.
   - **e.** the conscious mind has little access to the larger world of mental activity in the unconscious.

3. **APPLICATION:** Suppose you wanted to sample the contents of preconsciousness in a group of volunteers. Which technique would be most appropriate?
   - **a.** Ask them to recall specific memories to consciousness.
   - **b.** Ask them to recall a dream.
   - **c.** Do a priming experiment.
   - **d.** Have them undergo psychoanalysis.
   - **e.** Give them MRI scans.

4. **UNDERSTANDING THE CORE CONCEPT:** Which of the following is a description of consciousness suggested by the Core Concept for this section?
   - **a.** Consciousness processes information serially.
   - **b.** Consciousness allows us to respond reflexively, without thinking.
   - **c.** Consciousness controls the autonomic nervous system.
   - **d.** Consciousness makes us more alert.
   - **e.** Consciousness is just an abstract concept.

ANSWERS: 1. a 2. b 3. a 4. a

KEY QUESTION

WHAT CYCLES OCCUR IN EVERYDAY CONSCIOUSNESS?

If you are a "morning person," you are probably at your peak of alertness soon after you awaken. But this mental state doesn't last all day. Like most other people, you probably experience a period of mental lethargy in the afternoon. At this low point in the cycle of wakefulness, you may join much of the Latin world, which wisely takes a siesta. Later, your alertness increases for a time, only to fade again during the evening hours. Punctuating this cycle may be periods of heightened focus and attention (as when you are called on in class) and periods of reverie, known as daydreams. Finally, whether you are a "morning" or "night" person, you eventually drift into that third of your life spent asleep, where conscious contact with the outside world nearly ceases.

Psychologists have traced these cyclic changes in consciousness, looking for reliable patterns. Our Core Concept for this section of the chapter summarizes what they have found:

CORE CONCEPT

Consciousness changes in cycles that correspond to our biological rhythms and to the patterns of stimulation in our environment.

In this section we will devote most of our attention to the cyclic changes in consciousness involved in sleep and nocturnal dreaming. We begin, however, with another sort of "dreaming," that occurs while we are awake.

Daydreaming

Daydreaming, common among people of all ages, may be a source of creativity.

Daydreaming A common (and quite normal) variation of consciousness in which attention shifts to memories, expectations, desires, or fantasies and away from the immediate situation.

In the mildly altered state of consciousness that we call **daydreaming,** attention turns inward to memories, expectations, and desires—often with vivid mental imagery (Roche & McConkey, 1990). Daydreaming occurs most often when people are alone, relaxed, engaged in a boring or routine task, or just about to fall asleep (Singer, 1966, 1975). But is daydreaming normal? You may be relieved to know that most people daydream every day. Research shows, however, that young adults report the most frequent daydreams, with the amount of daydreaming declining significantly with increasing age (Singer & McCraven, 1961).

Daydreams can serve valuable, healthy functions (Klinger, 1987). They often dwell on practical and current concerns in people's lives, such as classes, goals (trivial or significant), and interpersonal relationships. As we ruminate on these concerns, daydreaming can help us make plans and solve problems.

On the other hand, daydreams can feature persistent and unwelcome wishes, worries, or fantasies. What can you do if that happens? Suppose that you decide to stop entertaining a particular thought—fantasies of an old flame, a persistent tune running through your head, or worries about a grade. Studies suggest that deliberate efforts to suppress unwanted thoughts are likely to backfire. In the "white bear" experiment (Wegner et al., 1987), students were asked to speak into a tape recorder about anything that came to mind. They were instructed, however, not to think about "a white bear." The results: Despite the instructions, the students mentioned a white bear about once per minute! Obviously, trying to suppress a thought or put something out of your mind can result in an obsession with the very thought you seek to escape. Yet, when you don't try to censor your thoughts but, instead, allow your mind to roam freely, as daydreaming and fantasy naturally do, unwanted or upsetting thoughts usually become less intrusive and finally cease (Wegner, 1989).

And how do daydreams compare with dreams of the night? No matter how realistic our fantasies may be, daydreams are rarely as vivid as our most colorful night dreams. Neither are they as mysterious—because they are more under our control. Nor do they occur, like night dreams, under the influence of biological cycles and the strange world that we call sleep. It is to this world that we now turn our attention.

Sleep: The Mysterious Third of Our Lives

If you live to be 90, you will have slept for nearly 30 years. Even though this means we "lose" a third of our lives, most of us take this lengthy alteration of daily consciousness for granted. In fact, we often anticipate sleep with pleasure. But what is this mysterious mental state? Once the province of psychoanalysts, prophets, poets, painters, and psychics, the world of sleep has now become a vibrant field of study for scientific researchers, who have shown that sleep must be understood as one of our natural biological cycles (Beardsley, 1996). We begin our exploration of this realm of altered consciousness with an examination of these cycles.

Circadian Rhythms All creatures fall under the influence of nature's cyclic changes, especially the daily pattern of light and darkness. Among the most important for we humans are those known as **circadian rhythms,** bodily patterns that repeat approximately every 24 hours. (*Circadian* comes from the Latin *circa* for "about" + *dies* for "a day.") Internal control of these recurring rhythms resides in a "biological clock" that sets the cadence of such functions as metabolism, heart rate, body temperature, and hormonal activity. Although we don't know precisely how this clock works, we know its locus is the hypothalamus—the suprachiasmatic nucleus, to be exact (Pinel, 2003). This group of cells receives input from the eyes and so is especially sensitive to the light–dark cycles of day and night (Barinaga, 2002). From a biological perspective, then, the cycle of sleep and wakefulness is just another circadian rhythm.

For most individuals, the normal sleep–wakefulness pattern is naturally a bit longer than a day in length. When placed for long periods in an environment in which there are no time cues, most people settle into a circadian cycle of about 25 hours. But under more normal circumstances, the pattern undergoes daily readjustment by our exposure to light and by our habitual routines (Dement & Vaughan, 1999).

Anything that throws off your biological clock affects how you feel and behave. Work schedules that shift from day to night are notorious for such effects (Dement & Vaughan, 1999; Moore-Ede, 1993). Staying up all night studying for an exam will have similar consequences. Likewise, flying across several time zones results in jet lag because the internal circadian cycle is disrupted by your new temporal environment. If it is 1:00 A.M. to your body but only 10:00 P.M. to the people around you, you must use energy and resources to adapt to your surroundings. The resulting symptoms of jet lag include fatigue, irresistible sleepiness, and temporary cognitive deficits. Air travelers should note that our biological clocks can adjust more readily to longer days than to shorter ones. Therefore, traveling eastbound (losing hours in your day) creates greater jet lag than traveling westbound (gaining hours). Apparently, it is easier to stay awake a bit longer than it is to fall asleep sooner than usual.

The Main Events of Sleep Sleep has been a mystery for most of human history—until late one night in 1952. It was then that graduate student Eugene Aserinsky decided to make recordings of his sleeping son's brain waves and muscle movements of the eyes (Brown, 2003). The session proceeded uneventfully for about an hour and a half, with nothing but the slow rhythms of sleep

■ **Circadian rhythms** Physiological patterns that repeat approximately every 24 hours, such as the sleep–wakefulness cycle.

appearing as tracks on the EEG. Then suddenly, a flurry of eye movements appeared. The recording showed the boy's eyeballs darting back and forth, as though he were watching a fast-changing scene. At the same time, the brain wave patterns told Aserinsky that the boy was alert. Expecting to find that his son had awakened and was looking around, Aserinsky entered the bedroom and was surprised to see him lying quietly, with his eyes closed and fast asleep. What was going on? Wisely, the researcher ran more volunteers through the same procedure, and he found that essentially the same pattern occurred periodically throughout the night in all of them.

About every 90 minutes during sleep, we enter a stage called **REM sleep,** marked by rapid eye movements (REM) beneath closed eyelids. These take place for several minutes and then abruptly cease (Aserinsky & Kleitman, 1953). The interim periods, without rapid eye movements, are known as **non-REM (NREM) sleep.** And what happens in the mind and brain during these two different phases of sleep?

To find out, researchers awakened sleepers during either REM sleep or NREM sleep and asked them to describe their mental activity (Dement & Kleitman, 1957). The NREM reports typically contained either brief descriptions of ordinary daily events or no mental activity at all. By contrast, REM reports were usually filled with vivid cognitions, featuring fanciful, bizarre scenes. In other words, rapid eye movements were a sign of dreaming. Strangely, while the eyes dance during REM sleep, the voluntary muscles in the rest of the body are immobile—paralyzed—a condition now known as **sleep paralysis.** From an evolutionary perspective, we can see that this probably kept our ancestors from wandering out of their caves and into trouble while acting out their dreams. Sleepwalking and sleep talking don't occur during REM sleep but in the deepest stage of NREM sleep.) We'll have much more to say about dreaming in a moment. For now, let's see how REM sleep fits with the other phases of sleep.

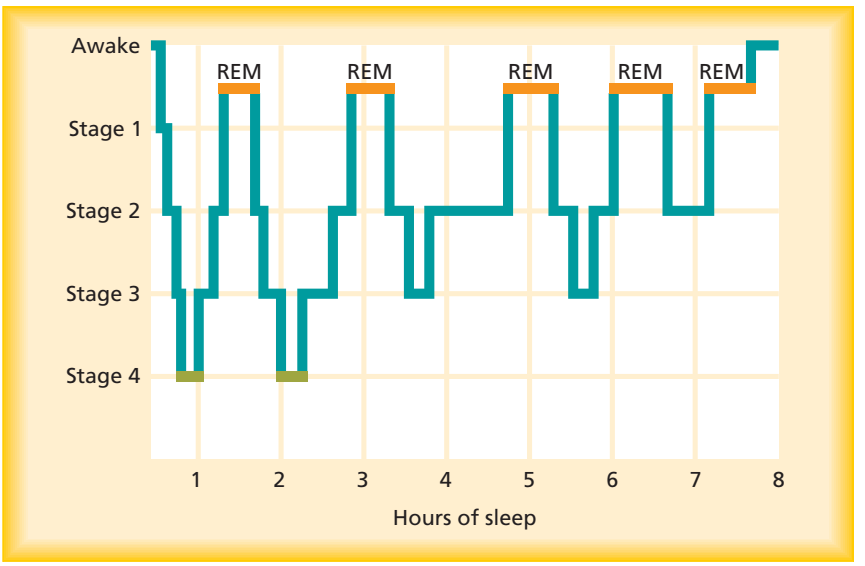
The Sleep Cycle Imagine that you are a volunteer subject in a laboratory specializing in sleep research. Already connected to EEG recording equipment, you soon become comfortable with the wires linking your body to the machinery, and you are settling in for a night's sleep. While you are still awake and alert, the EEG shows your brain waves pulsing at a rate of about 14 cycles per second (cps). As you begin to relax and become drowsy, they slow to about 8 to 12 cps. When you fall asleep, the EEG shows further changes. Then, over the course of the night, your brain waves begin a cycle of activity much like the pattern you see in Figure 5.4—a cycle that repeats itself over and over through the night. A closer look at the recording of this cycle the next morning will show several distinct stages, each with a characteristic EEG signature (see Figure 5.5):

- In Stage 1 sleep, the EEG displays some slower (theta) activity, along with fast brain (beta) waves similar to those seen in the waking state.
- During the next phase, Stage 2, the generally slower EEG is punctuated by sleep spindles—short bursts of fast electrical activity that reliably signals the end of Stage 1.
- In the following two stages (3 and 4), the sleeper enters a progressively deeper state of relaxed sleep. The heart rate and breathing rate slow down. Brain waves also slow dramatically, with delta waves appearing for the first time. The deepest point in the sleep cycle occurs, in Stage 4, about a half hour after sleep onset.
- As Stage 4 ends, the electrical activity of the brain increases, and the sleeper climbs back up through the stages in reverse order.

REM sleep A stage of sleep that occurs approximately every 90 minutes, marked by bursts of rapid eye movements occurring under closed eyelids. REM sleep periods are associated with dreaming.

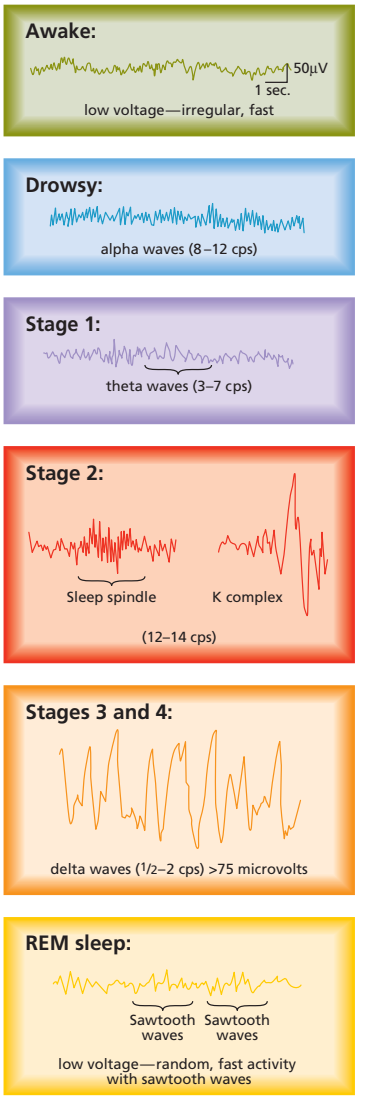
Non-REM (NREM) sleep The recurring periods, mainly associated with the deeper stages of sleep, when a sleeper is not showing rapid eye movements.

Sleep paralysis A condition in which a sleeper is unable to move any of the voluntary muscles, except those controlling the eyes. Sleep paralysis normally occurs during REM sleep.



● **FIGURE 5.4** Stages Of Sleep

In a typical night, the deepest sleep (Stages 3 and 4) occurs mainly in the first few hours. As the night progresses, the sleeper spends more and more time in the stages of light sleep and in REM sleep.



● **FIGURE 5.5** EEG Patterns in Stages of Sleep

As the sleeper reaches Stage 1 again, fast beta waves recorded by the EEG reappear. In addition, the sleeper now enters REM sleep for the first time. Then, after a few minutes of REMing, the entire cycle begins to repeat itself.

Over the course of an average night's sleep, most people make the circuit up and down through the stages of sleep four to six times. In each successive cycle, the amount of time spent in deep sleep (Stages 3 and 4) decreases, and the amount of time spent in REM sleep increases. During the first cycle, the REM period may last only 10 minutes, while in the last cycle, we may spend as much as an hour in REM sleep. A look at Figure 5.4 will show you how this pattern plays out through a typical night's sleep. Studying this pattern will not only help you understand your normal night's sleep but will also provide the framework for understanding the abnormal patterns found in most sleep disorders, which we will consider a little later. Again, please note the three most important features of normal sleep: (a) the 90-minute cycles, (b) the occurrence of deepest sleep near the beginning of the night, and (c) the increase in REM duration as sleep progresses.

What do you suppose would happen if a person were deprived of a substantial amount of REM sleep for a whole night? Laboratory studies show that REM-deprived subjects feel tired and irritable the next day. Then, during the following night, they spend much more time in REM sleep than usual, a condition known as **REM rebound.** This observation suggests that one of the functions of sleep is to satisfy a basic biological need for REM. Sleep-deprived college students take note: Because we get most of our REM sleep during the last few cycles of the night, we inevitably suffer some REM deprivation and REM rebound if we cut our night's sleep short.

■ **REM rebound** A condition of increased REM sleep caused by REM-sleep deprivation.

The Function of Sleep Sleep is so common among animals that it surely must have some essential function, but sleep scientists disagree on what that function is (Maquet, 2001; Pinel, 2003; Rechtschaffen, 1998). There are several possibilities. Evolutionary psychology suggests that sleep may have evolved because it enabled animals to conserve energy and stay out of harm's way at times when there was no need to forage for food or search for mates (Dement &

Vaughan, 1999). These functions, then, are coordinated by the brain's circadian clock. Some experiments also suggest that sleep aids mental functioning, particularly memory and problem solving (Wagner et al., 2004).

Yet another function of sleep was poetically described by William Shakespeare, when he spoke of "sleep that knits up the ravell'd sleave of care." Thus sleep may have a restorative function for the body and mind. But exactly how might sleep restore us? It may be a time when the body replenishes its energy supplies and purges itself of toxins built up during the day. In fact, some studies suggest that damaged brain cells do get repaired during sleep (Siegel, 2003).

In 1983, Francis Crick and Graeme Mitchison proposed another function of dream sleep. According to the Crick–Mitchison view, we dream in order to forget. As we go through the day we learn and experience things, and when we do, we create new neural networks. Crick and Mitchison propose that we dream to unravel those neural nets. In the words of Francis Crick, "In this model, attempting to remember one's dreams should perhaps not be encouraged. . . ." They stated that dreaming is, in a sense, taking out the "mental trash" we accumulate during the day. Truth be told, however, no one has been able to show how sleep actually restores us—although there's no doubt that it makes us feel restored (Dement & Vaughan, 1999).

The Need for Sleep How much sleep we need depends on several factors. For one thing, genetics sets broad sleep requirements that differ for each species. And although sleep duration is influenced by circadian rhythms, there is some individual variation (Barinaga, 1997b; Haimov & Lavie, 1996). Part of that variation is genetic, but the amount of sleep we require is linked to our personal characteristics and habits. For example, those who sleep longer than average tend to be more nervous, worrisome, artistic, creative, and nonconforming. Short sleepers tend to be more energetic and extroverted (Hartmann, 1973). And, it is no surprise that the amount of exercise a person gets influences the need for sleep. Oddly, however, strenuous physical activity during the day increases the amount of slow-wave sleep in Stage 4, but it has no effect on REM time (Horne, 1988).

From a developmental perspective, we see that sleep duration and the shape of the sleep cycle change over one's lifetime. As Figure 5.6 shows, newborns sleep about 16 hours per day, with half that time devoted to REM. Dur-

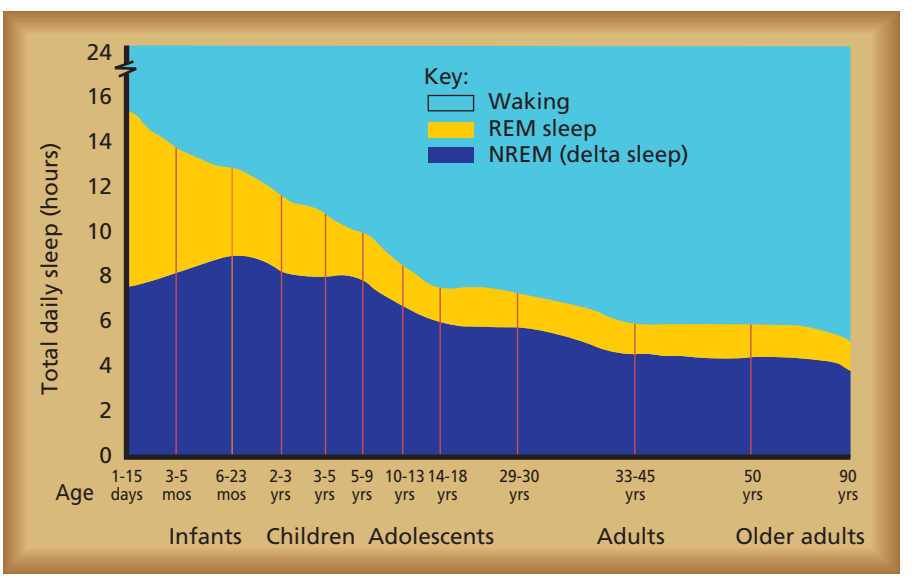


FIGURE 5.6 Patterns of Human Sleep Over a Lifetime

The graph shows changes with age in the total amounts of REM and NREM sleep and in the percentage of time spent in REM sleep. Note that, over the years, the amount of REM sleep decreases considerably, while NREM diminishes less sharply.

DO IT YOURSELF! How Much Sleep Do You Need?

Many college students operate in a chronic state of sleep deprivation. Because their schedules are crowded with study, work, and social events, students may convince themselves that they need only a few hours sleep each night. And, in fact, the average college student sleeps only about 6.8 hours a night (Hicks, 1990). Does too little sleep really make a difference in how well you perform in your classes? Psychologist Cheryl Spinweber (1990) has found that sleep-deprived undergraduates get lower grades than their counterparts who get enough sleep.

How can you tell if you need more sleep? Answer the following questions honestly:

1. Do you often get sleepy in your classes?
2. Do you sleep late on weekends?
3. Do you usually get sleepy when you get bored?
4. Do you often fall asleep while reading or watching TV?
5. Do you usually fall asleep within five minutes of going to bed?
6. Do you awake in the morning feeling that you are not rested?
7. Would you oversleep if you did not use an alarm clock to drive you out of bed?

If you answered "Yes" to any of these questions, chances are that you are shorting yourself on sleep. You may also be paying the price in the quality of your learning and in your grades.

ing childhood, those numbers gradually decline. Young adults typically sleep seven to eight hours (although they may need more), with about 20% REM. By old age, we sleep even less, with only 15% of sleep spent in REM. You can find out whether you are getting enough sleep by answering the questions in the above "Do It Yourself!" box.

Sleep Debt versus the Circadian Clock So, how much sleep do we humans need—and what happens if we don't get enough? Your mother was right: Most adults need to sleep about eight hours, or a bit more, to feel good and function efficiently. But that's only an average. For different individuals, the amount of sleep needed ranges from about six to nine hours (although most people need more sleep than they think they do). In the sleep laboratory, when volunteers are placed in a dark room and allowed to sleep without interruption and without reference to clocks, the average adult settles into a pattern that produces about eight and one-half hours of sleep each night. Yet, in their daily lives, most Americans get significantly less—night after night (Maas, 1999). This creates a sleep shortage that researcher William Dement calls a **sleep debt** (Dement & Vaughan, 1999).

People who pile up a chronic sleep debt usually don't realize it (Dement, 2000; Dement & Vaughan, 1999). They may be groggy and sleepy when the alarm clock rouses them in the morning. But they don't see this as a sign of a sleep debt because their circadian clocks make them "wake up" and begin to feel alert over the next few hours. Afternoon drowsiness may be attributed to a big lunch—which, in truth, does not cause sleepiness. (It's the clock, again.) They may also rationalize away their struggle to stay awake in a meeting or class by telling themselves that sleepiness is a normal response to boredom (Van Dongen et al., 2003). In fact, the normal response to boredom is restlessness—not sleepiness—unless one is sleep deprived.

What is actually happening is that the sleep-deprived individual gets caught in a daily tug-of-war between the pulls of a sleep debt and our relentless circadian rhythms. But our internal clocks can fool us, too. Even when we have not had enough sleep, the clock in the brain can make us feel relatively alert at certain times of the day—usually late morning and late afternoon. But this alertness can also be illusory. With a chronic sleep debt, you are never as alert and mentally efficient as you could be if the sleep debt were paid with a few good nights of sleep (Van Dongen et al., 2003). Unfortunately, the sleep debt is sometimes "paid" with a tragedy—as happened dramatically a few years ago, when *Exxon Valdez,* a giant tanker, ran aground, spilling oil across a pristine bay in the Alaskan wilderness. The ensuing investigation revealed

■ **Sleep debt** A sleep deficiency caused by not getting the amount of sleep that one requires for optimal functioning.

that a crew member who was steering the ship at the time had had only six hours of sleep in the previous two days.

Of special interest to students is this fact: Sleep deprivation can have a devastating effect on cognitive and motor functioning (Pilcher & Walters, 1997). In plainer language, William Dement says that a big sleep debt "makes you stupid" (Dement & Vaughan, 1999, p. 231). Evidence of this is found in a study that deprived one group of volunteers of sleep and gave another group enough alcohol to make them legally drunk (their blood alcohol content reached .1 percent). After 24 hours of sleep loss—like staying up all night studying for a test—the sleepy volunteers were performing just like the intoxicated group on tests of thinking and coordination (Fletcher et al., 2003).

Unfortunately, sleep-deprived people usually don't realize how impaired they actually are. Further, the pressures and opportunities of modern life commonly make us underestimate the amount of sleep we need. We may also believe that we can combat sleepiness and successfully reduce our need for sleep by dint of will power and caffeine. But such measures never give us the clarity of mind that a good night's sleep does. As a result, we may struggle much of our lives with a chronic sleep deficit, never realizing why we must wage a daily battle with drowsiness.

● Death-related images appear more often in dreams of Mexican American college students than in those of Anglo-American college students. This probably occurs because death is more prominently a part of Mexican culture, as can be seen in this figure, used in the Day of the Dead celebration.

Dreaming: The Pageants of the Night

Every night of your life, you experience a spectacular series of events staged only in your dreams. What produces these fantastic cognitive spectacles? And, what—if anything—do they mean? As we saw earlier, sleep scientists now know that dreams occur regularly throughout the night, most often in REM sleep. They have also identified the parts of the brain that control dreaming—including, especially, parts of the brain stem. What remains most mysterious about this stage of sleep is why we dream.

Sleep scientists have approached dreaming with this question: What function do dreams have? On a biological level, dreams may be necessary for healthy brain functioning, although the evidence for that is not certain (Siegel, 2003). From a cognitive perspective, some experts see dreams as meaningful mental events, serving pressing cognitive needs or reflecting important events or fantasies in the dreamer's mental world. Others argue that dreams are merely the brain's random activity during sleep—and, therefore, their content may have no special meaning. Let's look at both sides of this debate on the meaningfulness of dreams.

Dreams as Meaningful Events At the beginning of the 20th century, Sigmund Freud laid out the most complex and comprehensive theory of dreams and their meanings ever developed—a theory that has since enjoyed enormous influence, despite a lack of scientific evidence to support it (Squier & Domhoff, 1998). In this view, dreams represent "the royal road to the unconscious," lined with clues to an individual's hidden mental life. For this reason, Freud made the analysis of dreams the cornerstone of psychoanalysis, as set out in his classic book *The Interpretation of Dreams* (1900).

Freud's Theory of Dreams In psychoanalytic theory, dreams have two main functions: to *guard* sleep (by disguising disruptive thoughts with symbols) and to serve as sources of wish fulfillment. Freud believed that dreams play their guardian role by relieving psychic tensions created during the day. They serve their wish-fulfillment function by allowing the dreamer to work harmlessly through unconscious desires.

In his explanation of the meaning of dreams, Freud distinguished between the **manifest content**—the dream's story line—and the **latent content**—the (supposed) symbolic meaning of the dream. Psychoanalytic therapists, therefore, scrutinize the manifest content of their patients' dreams for clues that relate to latent motives and conflicts that may lurk in the unconscious. For example, clues relating to sexual conflicts might take the form of long rigid objects or containers, which, in Freudian theory, symbolize the male and female genitals.

Must you be a trained psychoanalyst to understand dreams? Not necessarily. The manifest content in many of our dreams has a fairly obvious connection to our waking lives. You have probably noticed that frightening dreams often relate to life stressors that have found their way into your sleeping thoughts. Research has lent support to such observations. For example, one study found that individuals depressed about divorce often had dreams that were fixed on past relationships (Cartwright, 1984). By analyzing the patterns and content of your own dreams, you may find it is not difficult to assign meaning to many of the images and actions you recall (Hall, 1953/1966; Van de Castle, 1994). We must emphasize, however, that there is no solid scientific support for Freudian interpretations of latent dream content.

Dreams Vary by Culture, Gender, and Age Freudian dream analysis has also been challenged on the grounds that Freud was not always scrupulous in his research. For example, he asserted that boys frequently dream of strife with their fathers—but he did no careful studies to verify his theoretical suspicions. Rather, on the basis of a few cases, he jumped to the conclusion that such dreams were signs of unconscious sexual jealousy. Many other explanations are possible, however, as anthropologists have shown by studying dreams of the Trobriand Islanders. Boys in that culture don't dream of their fathers so much as of their uncles, who act as the disciplinarians in that society (Malinowski, 1927; Segall et al., 1990). Freud's theory, then, may be an example of confirmation bias.

CONNECTION: CHAPTER 1

Confirmation bias leads us to notice evidence that agrees with our views and to ignore evidence that does not.

Modern sleep scientists have taken a more objective approach to dreams than Freud did (see Domhoff, 1996). They now know that the content of dreams varies by age, gender, and culture. Children are more likely to dream about animals than adults are, and the animals in their dreams are more likely to be large, threatening, and wild. In contrast, college students dream more usually of small animals, pets, and tame creatures. This may mean that children feel less in control of their world than adults do and so may find that world depicted in scarier imagery while they sleep (Van de Castle, 1983, 1994).

Women everywhere more commonly dream of children, while men more often dream of aggression, weapons, and tools (Murray, 1995). In a sample of over 1800 dreams collected by dream researcher Calvin Hall, American women dreamed about both men and women, while men dreamed about men twice as often as about women. In another sample of over 1300 dreams, Hall found that hostile interactions between characters outnumbered friendly exchanges and that 64% of dreamed emotions had a negative complexion, such as anger and sadness (Hall, 1951, 1984).

The highly specific effects of culture can be seen in reports from the West African nation of Ghana, where dreams often feature attacks by cows (Barnouw, 1963). Likewise, Americans frequently find themselves embarrassed by public nakedness in their dreams, although such reports rarely occur in cultures where people customarily wear few clothes. Images of death appear more often in the dreams of Mexican American college students than in the dreams of Anglo American students, probably because concerns about

■ **Manifest content** The story line of a dream, taken at face value without interpretation.

■ **Latent content** The symbolic meaning of objects and events in a dream. Latent content is usually an interpretation based on Freud's psychoanalytic theory or one of its variants. The latent content of a dream involving clocks might involve fear of the menstrual cycle and, hence, of one's sexuality.

death are more a part of life in Latin American cultures (Roll et al., 1974). In general, the cross-cultural research lends support to Rosalind Cartwright's hypothesis (1977) that dreams merely reflect life events that are important to the dreamer.

Dreams and Recent Experience Sleep research has also found—as we might expect—that dream content frequently connects with recent experience. If you're struggling with your taxes all day, you're likely to dream about your taxes at night, especially during your first REM period. Typically, the first dream of the night connects with events of the previous day. Then, dreaming in the second REM period (90 minutes later) may build on a theme that emerged during the first REM period. And so it goes through the night, like a rumor passed from one person to another: The final dream that emerges may have a connection—but only a remote one—to events of the previous day. But because the final dream of the night is the one most likely to be remembered, we may not recognize the link with the previous day's events (Cartwright, 1977; Kiester, 1980).

Dreams and Cognition The relationship between dreams and recent experience may belie yet another possible function of dreams. Comparisons of individuals who were selectively deprived of REM sleep with those deprived of NREM sleep suggest that REM sleep helps us remember—although we must add that this conclusion is still controversial (Kinoshita, 1992; Maquet, 2001; Siegel, 2001; Stickgold et al., 2001; Winson, 1990). It may be that REM sleep is a normal part of weaving new experiences into the fabric of old memories (Barinaga, 1994; Cartwright, 1978; Dement, 1980; Karni et al., 1994).

Dreams as Random Activity of the Brain Not everyone believes that dream content has any special meaning of consequence—certainly not any latent content that warrants psychoanalytic interpretation. In particular, the **activation-synthesis theory** says that dreams result when the sleeping brain tries to make sense of its own spontaneous bursts of activity (Leonard, 1998; Squier & Domhoff, 1998). In this view, dreams have their origin in periodic neural discharges emitted by the sleeping brain stem. As this energy sweeps over the cerebral cortex, the sleeper experiences impressions of sensation, memory, motivation, emotion, and movement. Although the cortical activation is random, and the images it generates may not be logically connected, the brain tries to make sense of the stimulation it receives. To do so, the brain synthesizes, or pulls together, the "messages" in these random electrical bursts by creating a coherent story. A dream, then, could merely be the brain's way of making sense out of nonsense.

The proponents of this theory, J. Allan Hobson and Robert McCarley (1977), argued that REM sleep furnishes the brain with an internal source of needed stimulation. This internal activation promotes the growth and development of the brain at the time when the sleeping brain has blocked out external stimulation. Dream content, therefore, results from brain activation, not unconscious wishes or other meaningful mental processes. Although Hobson (1988, 2002) claims that the story line in our dreams is added as a "brainstorm afterthought," he does acknowledge that dream content may nevertheless have some psychological meaning in that the dream story is influenced by culture, gender, personality factors, and recent events. Thus, when brain activations are synthesized, dreams seem familiar and meaningful.

■ **Activation-synthesis theory**
The theory that dreams begin with random electrical *activation* coming from the brain stem. Dreams, then, are the brain's attempt to make sense of–to *synthesize*–this random activity.

Dreams as a Source of Creative Insights Even if Hobson and McCarley are right—that dreams have no special meaning other than an attempt by the brain to make sense out of nonsense—they could still be a source of creative ideas.

Sleep and dreaming have inspired much art, as we see here in Rousseau's *Sleeping Gypsy.*

In fact, it would be astonishing if we did not turn to such wild and sometimes wonderful scenes in the night for inspiration. As we have seen, writers, composers, and scientists have done just that.

PSYCHOLOGY IN YOUR LIFE: SLEEP DISORDERS

You may be among the more than 100 million Americans who get insufficient sleep or poor-quality sleep (Dement & Vaughan, 1999). Some of these sleep problems are job related. Among people who work night shifts, for example, more than half nod off at least once a week on the job. And it may be no coincidence that some of the world's most serious accidents—the disastrous radiation emissions at the Three Mile Island and Chernobyl nuclear plants and the massive toxic chemical discharge at Bhopal—have occurred during late evening hours when people are likely to be programmed for sleep. Sleep experts speculate that many accidents occur because key personnel fail to function optimally as a result of insufficient sleep—as we noted earlier in the case of the *Exxon Valdez* oil spill (Dement, 1980; Dement & Vaughan, 1999).

Along with these job-related sleep problems, there are several clinical sleep disorders that sleep researchers have studied in their laboratories. Some are common; others are both rare and bizarre. Some are relatively benign, and some are potentially life threatening. The single element that ties them together is a disruption in one or more parts of the normal sleep cycle.

Insomnia is usually the diagnosis when people feel dissatisfied with the amount of sleep they get. Its symptoms include chronic inability to fall asleep quickly, frequent arousals during sleep, or early-morning awakening. Insomnia sufferers number about one-third of all adults, making this the most common of sleep disorders (Dement & Vaughan, 1999).

Insomnia The most common of sleep disorders—involving insufficient sleep, the inability to fall asleep quickly, frequent arousals, or early awakenings.

An occasional bout of sleeplessness is normal, especially when you have exciting or worrisome events on your mind. These incidents pose no special danger in themselves, unless attempts are made to treat the problem with

barbiturates or over-the-counter "sleeping pills." These drugs disrupt the normal sleep cycle by cutting short REM sleep periods (Dement, 1980). As a result, they can actually aggravate insomnia by making the user feel less rested and more sleepy. Much more effective is psychological treatment employing cognitive behavioral therapy, which has had remarkable success (Smith, 2001).

CONNECTION: CHAPTER 13

Cognitive behavioral therapy combines cognitive and behavioral techniques in treating psychological disorders.

Sleep apnea, another common disorder, may be apparent only in a person's complaints of daytime sleepiness and a sleep partner's complaints about snoring. Behind the curtain of the night, the cause can be found in an abnormal breathing pattern. The apnea sufferer actually stops breathing for up to a minute, as often as several hundred times each night! (In case you're concerned, the brief cessation of breathing a few times each hour during the night is normal.) Most commonly, this results from collapse of the airway when the sleeper's muscle tone relaxes. The result is another major symptom of sleep apnea: frequent loud snoring, occurring each time the patient runs short of oxygen and tries mightily to get air through the collapsed airway (Seligson, 1994). As breathing stops and the sleeper's blood oxygen level plummets, the body's emergency system kicks into gear, causing distress hormones to course through the body. In the process, the sleeper awakens briefly, begins breathing again, and then falls back to sleep. Because most of this happens in deep sleep, there is usually no memory of the episode.

Insomnia is a complex disorder caused by a variety of psychological, environmental, and biological factors. This college student anxiously contemplates her inability to get enough rest for the next day's classes.

Failure to recognize the nature of the problem can cause sufferers—and their families and coworkers—to interpret unusual daytime behavior as laziness or neglect. Sleep apnea can also have harmful biological effects, including elevated blood pressure, and can put dangerous levels of stress on the blood vessels and heart (Anch et al., 1988; Stavish, 1994b).

Occasional episodes of sleep apnea are likely to occur in premature infants, who may need physical stimulation to start breathing again. Further, any tendency toward sleep apnea can be aggravated by putting a young child to bed on its stomach. (Sleep scientists strongly recommend "back to sleep.") Obviously, the problem can be lethal, and it is one possible cause of sudden infant death syndrome (SIDS). Until their underdeveloped respiratory systems mature, these infants must remain connected to breathing monitors. For adults with sleep apnea, permanent breathing failure is not a strong concern. In adults, treatment focuses on the hundreds of nightly apnea episodes, which can be alleviated by use of a device that pumps extra air into the lungs and keeps the airway open during sleep.

Night terrors, which occur primarily in children, pose no health threat. Typically, a night terror attack presents itself as the screaming of a terrified-looking child who is actually in Stage 4 sleep and very difficult to awaken. When finally alert, the child may still feel fearful but have no specific memory of what mental events might have caused the night terror. In fact, the whole experience is likely to be more memorable to the beleaguered family members than to the child.

Unlike garden-variety nightmares, sleep-terror episodes occur in deep sleep, rather than in REM sleep. In this respect they are like sleepwalking and sleep talking, which also occur in Stage 4. All three of these conditions seem to have a genetic component. In themselves, they are not dangerous, although sleepwalkers can inadvertently climb out of upper-story windows or walk into a busy street—so it pays to take some precautions. In most cases, sleepwalking and night terrors diminish or disappear in adulthood, but if they pose persistent and chronic problems, the individual should be evaluated by a sleep specialist.

Narcolepsy, one of the most unusual of sleep disorders, produces sudden daytime sleep attacks, often without warning. But these are no ordinary waves

Sleep apnea A respiratory disorder in which the person intermittently stops breathing many times while asleep.

Night terrors Deep sleep episodes that seem to produce terror, although any terrifying mental experience (such as a dream) is usually forgotten upon awakening. Night terrors occur mainly in children.

Narcolepsy A disorder of REM sleep, involving sleep-onset REM periods and sudden daytime REM-sleep attacks usually accompanied by cataplexy.

of drowsiness. So suddenly do these sleep attacks develop that narcolepsy sufferers have reported falling asleep while driving a car, climbing a ladder, or scuba diving under 20 feet of water. Narcoleptic sleep attacks may also be preceded by a sudden loss of muscle control, a condition known as **cataplexy.**

Strangely, anything exciting can trigger a narcoleptic episode. For example, these patients commonly report that they fall asleep while laughing at a joke or even while having sex. Obviously, narcolepsy can be dangerous—and not so good for intimate relationships, either.

Assembling the pieces of this puzzle of symptoms, we find that narcolepsy is fundamentally a disorder of REM sleep. Specifically, a sleep recording will show that the narcolepsy victim has an abnormal sleep-onset REM period. That is, instead of waiting the usual 90 minutes to begin REMing, the narcoleptic person enters REM as sleep begins. You may have already guessed that the accompanying cataplexy is simply REM sleep paralysis.

Studies of narcoleptic animals show that the disorder is a genetic problem affecting the sleep-control circuitry in the brain stem (Harder, 2004). It has no known cure, but we have drugs that diminish the frequency of both the sleep attacks and the cataplexy. And now that we know that the cause is biological, narcoleptic patients are no longer sent to psychotherapy aimed at searching for the unconscious conflicts that were once assumed to underlie the disorder.

So, what should you do if you suspect that you have a serious sleep disorder, such as chronic insomnia, sleep apnea, or narcolepsy? An evaluation by a sleep expert is the place to start. Many hospitals have sleep disorder clinics to which your physician or clinical psychologist can refer you.

● The discovery of narcolepsy in dogs showed that the disorder has a biological basis.

■ **Cataplexy** Sudden loss of muscle control.

CHECK YOUR UNDERSTANDING

1. **RECALL:** Which statement is true about daydreaming?
   a. Daydreams help focus your attention.
   b. Most people daydream every day.
   c. Daydreams are usually more vivid than night dreams.
   d. Daydreams usually serve as an escape from the concerns of real life.
   e. Most people can easily suppress unwanted thoughts.

2. **RECALL:** All of the following are related to our circadian rhythms, except
   a. daydreaming.
   b. waking.
   c. dreaming.
   d. sleep.
   e. jet lag.

3. **RECALL:** Suppose that you are working in a sleep laboratory, where you are monitoring a subject's sleep recording during the night. As the night progresses, you would expect to see that
   a. dreaming becomes less frequent.
   b. the four-stage cycle gradually lengthens.
   c. Stage 3 and 4 sleep periods lengthen.
   d. REM periods become longer.
   e. Stage 1 keeps reappearing.

4. **RECALL:** According to the activation-synthesis theory, dreams are
   a. replays of events during the previous day.
   b. wish fulfillments.
   c. mental garbage.
   d. storylike episodes that provide clues about problems in the unconscious mind.
   e. an attempt by the brain to make sense of random activity in the brain stem.

5. **APPLICATION:** Which of the following symptoms suggests the presence of a sleep disorder?
   a. needing nine hours of sleep each night in order to feel rested
   b. napping during the day
   c. not remembering your dreams
   d. a REM period at the beginning of sleep
   e. a brief cessation of breathing once or twice a night

6. **UNDERSTANDING THE CORE CONCEPT:** Our Core Concept states that consciousness changes in cycles that normally correspond to our biological rhythms and to the patterns of our environment. Which of the following illustrates this concept?
   a. the Crick–Mitchison view
   b. priming
   c. consciousness, preconsciousness, and the unconscious
   d. sleep and dreaming
   e. REM rebound

ANSWERS: 1.b 2.a 3.d 4.e 5.d 6.d

KEY QUESTION

WHAT OTHER FORMS CAN CONSCIOUSNESS TAKE?

A roller coaster ride is one way to alter your consciousness.

Children stand on their heads or spin around to make themselves dizzy. You may seek similar sensations on hair-raising theme-park rides or by sky diving. But why do people do these strange things to themselves? One view says that "human beings are born with a drive to experience modes of awareness other than the normal waking one; from very young ages, children experiment with techniques to change consciousness" (Weil, 1977, p. 37). So, sleep, dreams, fantasies, and thrilling experiences offer compelling alternatives to everyday conscious experience.

In this section of the chapter, we will see how certain psychological techniques, such as hypnosis and meditation, can alter consciousness, too. But, for some people, these conventional alternatives may not provide the states of consciousness they seek. Instead, they may turn to drugs that alter ordinary awareness. We will also examine this approach to changing consciousness. Our discussion of drugs will include both legal substances, such as alcohol, tobacco, and caffeine, and illegal drugs, such heroin, PCP, cannabis, and amphetamines. What is the theme that ties these altered states of consciousness together? The Core Concept of this section says:

CORE CONCEPT

An altered state of consciousness occurs when some aspect of normal consciousness is modified by mental, behavioral, or chemical means.

This may sound simplistic at first, but it carries the important implication that altered states do not involve any mysterious or paranormal phenomena that defy rational explanation. Rather, altered states are modifications of ordinary consciousness that we can study with the tools of science. Let's begin with what is known about hypnosis.

Hypnosis

The cartoon images have it wrong. Neither the hypnotist's eyes nor fingertips emit strange, mesmerizing rays that send subjects into a compliant stupor—nor does a dangling shiny bauble have the power to control people's minds.

Hypnosis can help to control pain in many individuals. Here, a woman is learning hypnotic techniques that she will use in natural childbirth.

A more accurate (but much less dramatic) picture would show the hypnotist making suggestions to promote concentration and relaxation (Barber, 1976, 1986). Soon the subject appears to be asleep, although he or she can obviously hear suggestions and carry out requests. In some cases, the individual under hypnosis also seems to have amazing powers to ignore pain, remember long-forgotten details, and create hallucinations. But what mental processes make these things happen? To find out, we will explore several viewpoints on the nature of hypnosis. Then, we will consider some of its valid and practical uses by psychologists.

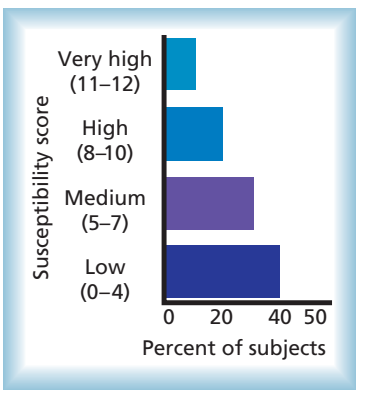
The term *hypnosis* derives from *Hypnos,* the name of the Greek god of sleep. Yet, the EEG record tells us that ordinary sleep plays no role in hypnosis, even though hypnotized individuals may appear to be in a relaxed, sleeplike state. (There is no unique EEG signature for hypnosis.) Most authorities would say **hypnosis** involves a state of awareness characterized by deep relaxation, heightened suggestibility, and focused attention.

When deeply hypnotized, some people have the special ability to respond to suggestion with dramatic changes in perception, memory, motivation, and sense of self-control (Orne, 1980). And, yes, stage hypnotists can make carefully selected volunteers quack like a duck or seem to like the taste of a bitter lemon. After the experience is over, people often report that they experienced heightened responsiveness to the hypnotist's suggestions and felt that their behavior was performed without intention or any conscious effort.

Hypnotizability Dramatic stage performances of hypnosis give the impression that hypnotic power lies with the hypnotist. However, the real star is the person who is hypnotized. The hypnotist is more like an experienced guide showing the way. Some individuals can even practice self-hypnosis, or autohypnosis, by inducing the hypnotic state through self-administered suggestions.

The single most important factor in achieving a hypnotic state is a participant's susceptibility. Experts call this hypnotizability, and they measure it by a person's responsiveness to standardized suggestions. Individuals differ in this susceptibility, varying from complete unresponsiveness to any suggestion, at one extreme, to total responsiveness to virtually every suggestion, at the other. A highly hypnotizable person may respond to suggestions to move their arms, walk about, experience hallucinations, have amnesia for important memories, and become insensitive to painful stimuli. And, we should add, because hypnosis involves heightened suggestibility, any "recovered memories" obtained by this means are highly suspect.

Figure 5.7 shows the percentage of college-age people who achieved various levels of hypnotizability the first time they were given a hypnotic induction test. For example, a hypnotist may test a new subject's acceptance of suggestion by saying, "Your right hand is lighter than air," and observing whether the subject allows his or her arm to float upward. High scorers are more likely than low scorers to experience pain relief, or hypnotic analgesia, and to respond to hypnotic suggestions for experiencing perceptual distortions.



● **FIGURE 5.7** Level of Hypnosis Reached at First Induction
This graph shows the results achieved by 533 subjects hypnotized for the first time. (Hypnotizability was measured by the 12-item Stanford Hypnotic Susceptibility Scale.)

Hypnosis as an Altered State The experts disagree about the psychological mechanisms involved in hypnosis (Fromm & Shor, 1979; Kihlstrom, 1998; Kirsch & Lynn, 1995, 1998; Woody & Sadler, 1998). Some believe that hypnosis is a distinct state of consciousness, quite separate from sleep or our normal waking state (Fromm & Shor, 1979). Other experts propose that hypnosis is simply heightened motivation (Barber, 1979; Kirsch & Braffman, 2001). In this view, hypnotic subjects are not entranced but merely motivated to focus their attention and to channel more energy into suggested activities. They are hypnotized because they want or expect to be, so they focus on expressing and

■ **Hypnosis** An induced state of awareness, usually characterized by heightened suggestibility, deep relaxation, and highly focused attention.

achieving the responses the hypnotist tries to evoke. Still other experts think that hypnosis is usually a social process, involving role playing, often to please the hypnotist (Sarbin & Coe, 1972).

CONNECTION: CHAPTER 12

Extreme forms of dissociation are associated with clinical disorders, known as *dissociated states.* These include *dissociative identity disorder* (formerly called "multiple personality disorder").

A widely held view, originally proposed by researcher Ernest Hilgard (1992), portrays hypnosis as a dissociated state involving a "hidden observer" in the person's mind, operating in parallel with normal consciousness. Hilgard has shown that hypnotized individuals who say they feel no pain when their hand is placed in ice water will nevertheless respond affirmatively to the instruction, "If some part of you does feel pain, please raise your right index finger." Hilgard believed that attention to the painful sensation was shifted to the hidden observer, leaving normal consciousness blissfully unaware.

Recent theories have attempted to find common ground among these perspectives. And perhaps all have a bit of the truth. It may be that hypnosis, like the normal waking state, can cover a whole range of dissociated states, intensified motives, heightened expectations, and social interactions (Kirsch & Lynn, 1995; Woody & Sadler, 1998).

Practical Uses of Hypnosis Stage tricks aside, what is hypnosis good for? Because it can exert a powerful influence on psychological and body functions in some people, hypnosis can be a useful tool for researchers (Bowers, 1983; Hilgard, 1968, 1973; Miller & Bowers, 1993; Nash, 2001). By using normal volunteers under hypnosis, an experimenter can induce temporary mental conditions, such as anxiety, depression, or hallucinations, instead of having to find individuals who already have these problems. For example, in one study of the psychological issues associated with hearing loss, college students given the hypnotic suggestion to become deaf on cue reported feeling paranoid and excluded because they could not hear what other subjects were saying and assumed they were being deliberately whispered about and excluded (Zimbardo et al., 1981).

Hypnosis has uses in psychological treatment, too. For instance, it can be an effective tool in desensitizing phobic patients who are afraid of heights or spiders. It can also be a part of a relaxation training program designed to combat stress. In addition, therapists find it useful for eliminating unwanted behaviors, such as smoking. A frequently used technique calls for planting posthypnotic suggestions that can diminish a patient's cravings (Barnier & McConkey, 1998; Kihlstrom, 1985). By means of posthypnotic suggestion, a therapist can also induce the patient to forget events that occurred during or before the hypnotic session, an effect called *posthypnotic amnesia*.

Finally, hypnosis has a place in medical and dental treatment, especially for managing pain during procedures in which the patient wants to avoid the risks of anesthesia (Nash, 2001). For example, the Lamaze method of natural childbirth uses a hypnosis-like procedure as a primary means of pain control. However, it is important to note that not everyone can be hypnotized deeply enough for effective analgesia (Callahan, 1997; Miller & Bowers, 1993; Orne, 1980). Still, in some cases, hypnosis alone will allow patients to undergo treatments that would otherwise cause excruciating pain (Finer, 1980). And for some highly suggestible individuals, hypnosis may actually be superior to conventional anesthesia for controlling pain.

How does hypnosis produce pain relief? Hilgard's hidden-observer explanation is one possibility, although other scientists have taken a more biological approach to the problem. Currently there is no universally accepted explanation, although we can rule out one contender. Experiments have demonstrated that endorphins, which account for the pain-relieving property of placebos, are *not* responsible for hypnotic analgesia (Grevert & Goldstein, 1985; Mayer,

CONNECTION: CHAPTER 3

Endorphins are the body's own opiate-like substances.

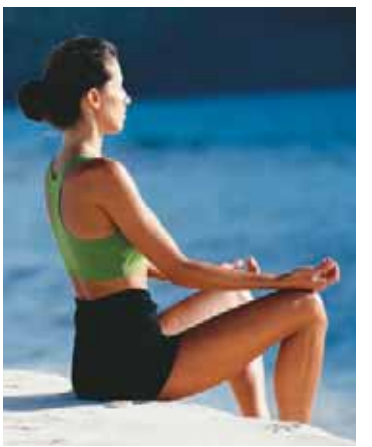
1979; Watkins & Mayer, 1982). Another possibility, called the *gate-control theory*, was covered in the discussion of pain, in Chapter 4. For now, we will accept hypnosis as a valuable tool about which much remains to be learned concerning the ways in which it alters consciousness.

Meditation

Many religions and traditional psychologies of the Asian and Pacific cultures use forms of **meditation** to direct consciousness away from worldly concerns and temptations. Although the purpose of meditation varies among practitioners, many use it to seek some form of spiritual enlightenment and to increase self-knowledge and well-being. Although meditators may use a variety of techniques, they commonly begin by concentrating on a repetitive behavior (such as breathing), assuming certain body positions (yogic postures), and minimizing external stimulation. (You can see the similarities with hypnosis.)

To view meditation as an altered state of consciousness may reflect a particularly Western worldview, because Asian beliefs about the mind are typically different from those of Western cultures (Austin, 1998, Rosch, 1999). Buddhism, for example, teaches that the visible universe is an illusion of the senses. To become enlightened, a Buddhist tries to control bodily yearnings, to stop the ordinary experiences of the senses and mind, and to discover how to see things in their truest light. Thus, in the Buddhist view, meditation more accurately captures reality. In contrast, Western cognitive scientists often view meditation as an altered form of consciousness, and they aspire to understand it and to harness it for therapeutic purposes (Barinaga, 2003b).

What exactly are the mental and physical effects of meditation? Experienced meditators show changes in their brain-wave patterns (Kasamatsu & Hirai, 1966). Along the same lines, a recent study by Richard Davidson and his colleagues showed that meditation produces frontal lobe changes that are also associated with positive emotions (Davidson et al., 2003). Other studies have linked meditation with beneficial changes in blood pressure and stress hormones (Seeman et al., 2003). And, as still other studies have shown, meditation produces relaxation and reduces anxiety, especially in people who function in stress-filled environments (Benson, 1975; Bjork, 1991; Shapiro, 1985; van Dam, 1996). In many ways, then, meditating is like resting, because it has been found to reduce various signs of bodily arousal (Dillbeck & Orme-Johnson, 1987; Holmes, 1984; Morrell, 1986). As for some of the more subjective benefits attributed to meditation, such as its power to bring new understandings and meaning to one's life, such issues lie beyond the limits in which science can operate objectively.



● Meditation produces relaxation and, perhaps, new insights.

Psychoactive Drug States

For millennia, humans have used alcohol, opium, cannabis, mescaline, coca, caffeine, and other drugs to alter their everyday perceptions of reality. Especially under stress, people throughout the world take drugs for pleasure, for relaxation, or just to avoid the unpleasantness of their lives. Some drugs, such as LSD, are taken by those seeking the hallucinations they produce. Other drugs (alcohol is an example) can act as "social lubricants" to help people feel comfortable with each other. Still other drugs are used by individuals seeking a euphoric "rush," a "buzz," a state of tranquility, or even stupor. What, if anything, do all these drugs have in common?

To some extent, all **psychoactive drugs** impair the brain mechanisms that usually help us make good decisions (Gazzaniga, 1998a). In addition, the most widely abused drugs—cocaine, heroin, and amphetamines—all stimulate the

■ **Meditation** A state of consciousness often induced by focusing on a repetitive behavior, assuming certain body positions, and minimizing external stimulation. Meditation may be intended to enhance self-knowledge, well-being, and spirituality.

■ **Psychoactive drugs** Chemicals that affect mental processes and behavior by their effects on the brain.

brain's "reward circuits." From an evolutionary perspective, we know that our brains are built to find pleasure in many substances (such as the taste of sweet or fatty foods) that helped our ancestors survive and reproduce. Cocaine, heroin, and amphetamines trick the brain by exploiting these same mechanisms with strong, direct, and pleasurable signals that make our bodies "think" that these substances are good for us (Nesse & Berridge, 1997).

Cultural trends influence drug-taking behavior, too. The United States saw this vividly during the 1960s and 1970s, when the country entered a period of casual experimentation with recreational drugs and other mind-altering techniques. By 1989, nearly 55% of American high school seniors had reported using one or more illegal drugs in their senior year (Johnston et al., 1989). Data from several sources, including emergency room visits, drug arrests, and surveys, indicate that overall illicit drug use has declined since the early 1990s. There has been, however, a rise in drug use among young teenagers (Martin, 1999). Credit for the overall decline in illicit drug use is often claimed by proponents of antidrug education programs, although the evidence does not show most of these programs to be especially effective (Murray, 1997).

Let us now have a closer look at the most commonly used and abused psychoactive drugs. We do so by grouping them in categories: *hallucinogens, opiates, depressants,* and *stimulants* (see Table 5.1). In general, we will find that all the drugs in each category have similar effects on the mind and brain.

Hallucinogens Drugs known as **hallucinogens** produce changes in consciousness by altering perceptions, creating hallucinations, and blurring the boundary between self and the external world. For example, an individual experiencing hallucinogenic effects might listen to music and suddenly feel that he or she is producing the music or that the music is coming from within. Most hallucinogenic drugs act in the brain at specific receptor sites for the neurotransmitter serotonin (Jacobs, 1987).

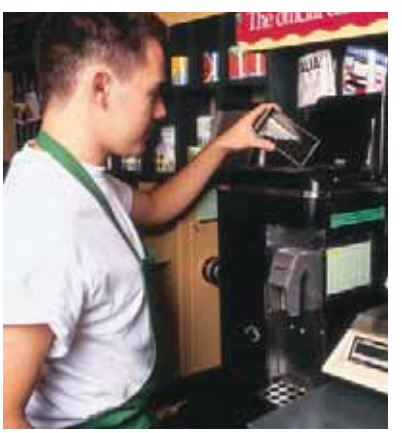
CONNECTION: CHAPTER 3

Serotonin is a neurotransmitter involved with reward, sleep, memory, and depression.

Commonly used hallucinogens include mescaline (made from a type of cactus), psilocybin (from a mushroom), LSD or "acid," and PCP (also called phencyclidine). Both LSD and PCP are synthetic drugs made in chemical laboratories. PCP, or "angel dust," was a favorite of young people who used hallucinogens until the word got around that the intensity and duration of its effects were quite unpredictable. The drug produces a strange dissociative reaction, in which the user feels disembodied or removed from parts of his or her personality. Users may become confused, grow insensitive to pain, and feel separated (dissociated) from their surroundings.

■ **Hallucinogens** Drugs that create hallucinations or alter perceptions of the external environment and inner awareness.

Cannabis, derived from the hemp plant (used, therefore, to make rope, as well as dope), also acts as a hallucinogen. Its active ingredient is THC (tetrahy-



● When psychologists talk about drugs, they include legal substances such as tobacco and caffeine, two extremely popular stimulants in most cultures.

TABLE 5.1 Psychoactive Drugs: Medical Uses, Effects, Likelihoods of Dependence

Category	Medical Uses	Dependence	
		Psychological	Physical
Opiates			
Morphine	Painkiller, cough suppressant	High	High
Heroin	Under investigation	High	High
Codeine	Painkiller, cough suppressant	Moderate	Moderate
Methadone	Treatment of heroin addiction	Low	High
Hallucinogens			
Mescaline	None	None	Unknown
Psilocybin	None	Unknown	Unknown
LSD	None	None	None
PCP	Veterinary anesthetic	Unknown	High
Cannabis	Reduces nausea from chemotherapy	Low	Low
Depressants			
Barbiturates	Sedative, sleep, anticonvulsant, anesthetic	Moderate–high	Moderate–high
Benzodiazepines	Antianxiety, sleep, anticonvulsant, sedative	Low–moderate	Low–moderate
Alcohol	Antiseptic	Moderate	Moderate
Rohypnol	None in U.S. (elsewhere for sedation, anesthesia, and treatment of insomnia)	Low–moderate	Low–moderate
Stimulants			
Amphetamines	Weight control, counteract anesthesia	High	High
Methamphetamine	ADHD, weight control (rarely)	High	High
MDMA (ecstasy)	None (originally developed as an appetite suppressant)	Moderate	Moderate
Cocaine	Local anesthetic	High	High
Nicotine	Gum, patch for cessation of smoking	Low–high	Low–high
Caffeine	Weight control, stimulant in acute respiratory failure, analgesia	Low	Low

drocannabinol), found both in the plant's dried leaves and flowers (marijuana) and in its solidified resin (hashish). Most commonly it is smoked, although it can also be eaten.

The experience obtained from ingesting THC depends on its dose. Small doses may create mild, pleasurable highs, and larger doses can cause long hallucinogenic reactions. Unlike alcohol, its effects can last for many hours—and long after users feel themselves to be impaired (Julien, 2001). The pleasant effects include altered perception, sedation, pain relief, mild euphoria, and distortions of space and time—similar in some respects to the effects of heroin (Wickelgren, 1997). Alternatively, depending on the social context, and expectations, the effects can be an unpleasant mixture of fear, anxiety, and confusion. Cannabis also produces temporary failures in memory, as well as impairments in motor coordination (Julien, 2001). Those who work or drive under its influence suffer a higher risk of accidents (Moskowitz, 1985)—and those who study under its influence are likely to remember nothing.

Some habitual cannabis users become psychologically addicted to its pleasurable effects and may crave the drug so often that it interferes with other pursuits, including school or work. Nevertheless, the potential for physical

dependence on this drug is lower than most other psychoactive substances (Grinspoon et al., 1997; Pinel, 2003).

What causes the mind-altering effects of this drug? In the brain, THC causes the release of dopamine, which suggests an effect on the brain's reward system (Carlson, 2004). Neuroscientists have also discovered cannabis receptors in the brain (Wilson & Nicoll, 2002). This suggests that the brain makes its own THC-like chemicals, which it uses to modulate information flow. So, marijuana and hashish produce their mind-altering effects by exploiting the natural chemistry of the brain. It is no wonder, then, that they can interfere with cognition, because these receptors are particularly abundant in pathways involving learning, thinking, and memory.

Opiates Another class of drugs, known as **opiates,** includes morphine, heroin, and codeine—all made from the opium poppy. These are highly addictive drugs that suppress physical sensation and response to stimulation, including painful stimulation. From a medical standpoint, morphine and codeine have particularly good analgesic (pain-relieving) properties that result from their similarity to the body's own pain-relieving chemicals, the endorphins.

Derived from morphine, heroin originally was developed in 19th-century Germany by the Bayer Company (of aspirin fame), but it was abandoned because it is even more highly addictive than morphine. For the intravenous heroin user, however, the drug is attractive because it gives a strong rush of pleasurable sensations. These feelings of euphoria supplant all worries and awareness of bodily needs, although—surprisingly—there are no major changes in cognitive abilities. Under the influence of these drugs, the user is usually able to converse normally and to think clearly. Unfortunately, serious addiction is likely once a person begins to inject heroin. To avoid heightened sensitivity to pain and the intense cravings of withdrawal, the addict must take the drug frequently—at least daily—making it a very expensive habit to maintain. Because addicts often steal to support their habit, the use of heroin underlies much of the property crime in cities around the world.

Methadone, a synthetic opiate, can be taken orally and therefore doesn't require injection. It has essentially the same euphoric, analgesic, and addictive effects as heroin, but when taken orally, methadone doesn't produce the same "rush" because the drug level in the brain increases slowly. This feature makes methadone useful as a substitute for heroin in drug treatment programs, in which the patient is switched to methadone and then gradually weaned from opiates altogether.

Paradoxically, patients who take opiates for pain control under medical supervision rarely become highly addicted. The reason for the difference in effects between the use of opiates for pleasure and for pain is unclear. It appears, however, that the presence of pain causes opiates to affect parts of the brain other than the "reward centers" involved in pleasure. The practical point is this: There is little to fear from the legitimate medical use of these drugs for controlling pain (Melzack, 1990).

Depressants Drugs that slow the mental and physical activity of the body by inhibiting activity in the central nervous system are collectively known as **depressants.** (Depressants don't necessarily make people feel clinically depressed, in the sense of "sad.") They include barbiturates (usually prescribed for sedation), benzodiazepines (antianxiety drugs), and alcohol (a social stimulant and nervous system depressant). By inhibiting the transmission of messages in the central nervous system, depressants tend to slow down the mental and physical activity of the body. In appropriate dosages, depressants can

■ **Opiates** Highly addictive drugs, derived from opium, that can produce a profound sense of well-being and have strong pain-relieving properties.

■ **Depressants** Drugs that slow down mental and physical activity by inhibiting transmission of nerve impulses in the central nervous system.

relieve symptoms of pain or anxiety, but overuse or abuse of depressants is dangerous because these drugs impair reflexes and judgment. They may also be addictive.

Barbiturates, commonly used in "sleeping pills," can induce sleep. Unfortunately, they have the side effect of reducing REM-sleep time. This leaves the user feeling unrested, despite a full night's sleep. In addition, withdrawal from barbiturates causes severe REM rebound, filling sleep with unpleasant dreams. Worse yet, overdoses of barbiturates may cause loss of consciousness, sometimes to the point of coma and even death. Fatal reactions to barbiturates are made all the more likely because the lethal dose is relatively close to the dose required for inducing sleep or other desired effects. The chance of accidental overdose can be compounded by alcohol or other depressant drugs, which magnify the depressant action of barbiturates (Maisto et al., 1995).

The benzodiazepines (pronounced *BEN-zo-dye-AZ-a-peens*), commonly prescribed to treat anxiety, are safer than barbiturates. Physicians frequently prescribe them to calm patients without causing sleepiness or sedation. For this reason, they are often referred to as "minor tranquilizers"—the best known and most widely prescribed of which include Valium and Xanax. (The tranquilizing drugs used to treat psychotic disorders work differently and are not classified as depressants.)

While the benzodiazepines are relatively safe, compared to barbiturates, they can also be overused and abused. Addiction occurs and is of special concern because these drugs are so commonly prescribed. Overdoses produce poor muscle coordination, slurred speech, weakness, and irritability, while withdrawal symptoms include increased anxiety, muscle twitching, and sensitivity to sound and light. Significantly, the benzodiazepines are almost never taken by recreational drug users because people who are not suffering from anxiety usually do not like their effects (Wesson et al., 1992).

Alcohol, another drug that acts as a brain depressant, was one of the first psychoactive substances used by humankind. Under its influence, people have a variety of reactions that involve loosening of inhibitions. At first, this may seem like a contradiction: How can a depressant make people less inhibited? What actually happens is that the alcohol depresses activity in the brain circuits that normally control self-monitoring of our thoughts and behavior. The result depends on the context and the personality of the imbiber, who may become more talkative or quiet, friendly or abusive, ebullient—or, sometimes, psychologically depressed. Alcohol's effects also depend on whether other drugs, such as MDMA ("ecstasy") or rohypnol (the "date-rape drug"), are being used simultaneously. Such drugs are believed by users to enhance social interaction and empathy, although their effects can easily spin out of control, especially in combination with alcohol (Gahlinger, 2004).

Physically, alcohol in very small doses can induce relaxation and even slightly improve an adult's reaction time. In slightly larger amounts, it can impair coordination and mental processing—sometimes even when drinkers believe their performance has been improved. Moreover, it is quite easy for alcohol to accumulate in the system because the body may not metabolize it as fast as it is ingested. In general, the body breaks down alcohol at the rate of only one ounce per hour, and greater amounts consumed in short periods stay in the body and depress activity in the central nervous system. When the level of alcohol in the blood reaches a mere 0.1% (1/1000 of the blood), an individual experiences deficits in thinking, memory, and judgment, along with emotional instability and coordination problems. In most parts of the United States, this level of blood alcohol automatically qualifies a driver as being legally drunk.

● Physical dependence, tolerance, and addiction to alcohol often begin with binge drinking, common on many college campuses.

CONNECTION: CHAPTER 13

Benzodiazepines are used to treat anxiety-related problems, such as panic disorder and obsessive–compulsive disorder.

Distillers, brewers, and wine makers spend millions of dollars annually depicting the social and personal benefits of alcoholic beverages. And, to be sure, many adults use alcohol prudently. Nevertheless, an estimated 5 to 10% of American adults who use alcohol drink to the extent that it harms their health, career, or family and social relationships (Julien, 2001). Physical dependence, tolerance, and addiction all develop with prolonged heavy drinking—of the sort that often begins with binge drinking, common on college campuses. When the amount and frequency of drinking alcohol interfere with job or school performance, impair social and family relationships, and create serious health problems, the diagnosis of alcoholism is appropriate (see Julien, 2001; Vallee, 1998).

Abuse of alcohol has become a significant problem for about 15 million Americans (Pinel, 2003). The effects of the problem are much more widespread, however. When ingested by pregnant women, alcohol can affect the fetus. In fact, alcohol use by expectant mothers is a leading cause of mental retardation (Committee on Substance Abuse, 2000). Estimates suggest that 40% of Americans see the effects of alcohol abuse in a family member (Vallee, 1998). For many Americans aged 15 to 25, the problem becomes a lethal one: Alcohol-related automobile accidents are the leading cause of death in this age group.

Stimulants In contrast with depressants, **stimulants** speed up central nervous system activity. The result is a boost in both mental and physical activity level. Surprisingly, stimulants can also increase concentration and reduce the hyperactive behavior seen in attention-deficit/hyperactivity disorder (ADHD). With narcoleptic patients, they also have a use in preventing sleep attacks.

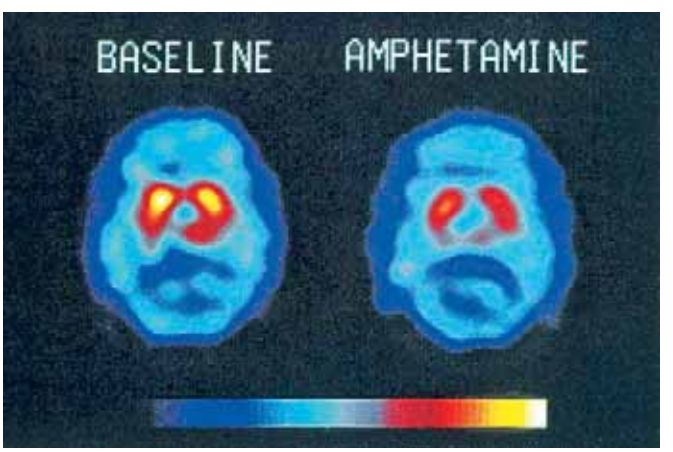
CONNECTION: CHAPTER 13

ADHD is a relatively common disorder of attention span and behavior, usually diagnosed in children but sometimes found in adults.

Recreational users of certain stimulants seek still other effects: intense pleasurable sensations, increased self-confidence, greater energy and alertness, and euphoria. Cocaine, in particular, packs what may be the most powerfully rewarding punch of any illegal drug (Landry, 1997). Crack, an especially addictive form of cocaine, produces a swift, pleasurable high that wears off quickly. Amphetamine (often called "speed") and related drugs have effects comparable to cocaine. Among these, a particularly powerful variant known as methamphetamine came into widespread use during the 1990s. Still another stimulant known as MDMA (often called "ecstasy") has grown popular in the "rave" culture, where it has a reputation for creating a feeling of euphoria and for energizing young users to dance for hours, sometimes leading to dehydration, convulsions, and other unpleasant consequences (Gahlinger, 2004; Yacoubian et al., 2004). Ecstasy is also known to impair memory (Verbaten, 2003).

■ **Stimulants** Drugs that arouse the central nervous system, speeding up mental and physical responses.

Stimulant drugs hold other dangers, as well. Heavy amphetamine and cocaine users may experience frightening hallucinations and paranoid delu-



● Brain changes during use of drugs can be seen on PET-scan images. Much less activity is seen in the limbic system of the brain under the influence of amphetamines.

sions—symptoms also associated with severe mental disorder. And these drugs can send users on an emotional roller coaster of euphoric highs and depressive lows. This leads users to increase the frequency and dosage, quickly making the abuse of these drugs spiral out of control. Yet another danger accrues to "secondhand" users: children who were exposed to cocaine in their mother's blood while in the womb. Studies show that such children are at increased risk for developing cognitive problems, emotional difficulties, and behavior-control disorders (Vogel, 1997b).

Two other stimulants that you may not even think of as psychoactive drugs are caffeine and nicotine—yet their effects on the brain are swift and powerful. Within 10 minutes, two cups of strong coffee or tea deliver enough caffeine to have a measurable effect on the heart, blood circulation, and signaling in the brain. Nicotine inhaled in tobacco smoke can have similar effects within just seconds. Both drugs are addictive, and both augment the effects of the natural rewarding chemicals released by the brain. In this way, nicotine and caffeine tease the brain's reward pathways into responding as if using these substances were associated with something beneficial for us. Fortunately, in the case of caffeine, the negative effects are minor for most people. Further, caffeine has a built-in "braking" action that limits its intake because high dosages also produce uncomfortable anxiety-like feelings.

In contrast to caffeine, nicotine is a much more dangerous drug for two reasons: Nicotine is highly addictive, and it has been associated with a variety of health problems, including cancer, emphysema, and heart disease. In fact, the negative impact of smoking on health is greater than that of all other psychoactive drugs combined—including heroin, cocaine, and alcohol. According to the U.S. Public Health Service, smoking is the leading cause of preventable disease, with a human cost of more than 350,000 deaths annually. As a result, the American Medical Association has formally recommended that the U.S. Food and Drug Administration regard nicotine as a drug to be regulated. Currently, however, nicotine is both legal and actively promoted—with a $2.7 billion budget from the tobacco industry. Although antismoking campaigns have been somewhat effective in reducing the overall level of smoking in the United States, some 47 million Americans still smoke. Most worrisome is the fact that more than 3 million teenagers smoke, and their numbers are increasing by about 3000 who start every day (Gardyn & Wellner, 2001; Julien, 2001).

PSYCHOLOGY IN YOUR LIFE: DEPENDENCE AND ADDICTION

We have seen that psychoactive drugs can alter the functioning of neurons in your brain and, as a consequence, temporarily change your consciousness. Once in your brain, they usually act on synapses to block or stimulate neural messages. In this way, drugs profoundly alter the brain's communication system, affecting perception, memory, mood, and behavior.

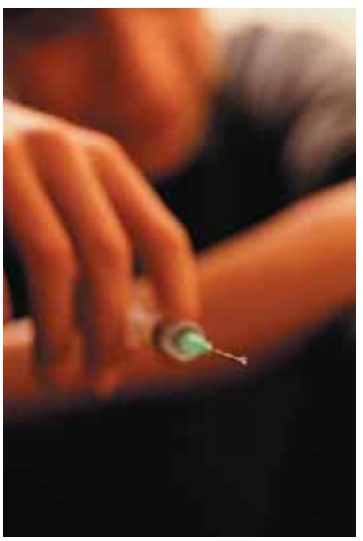
Significantly, a given dose of many psychoactive drugs comes to have a weaker consciousness-altering effect with continued use. As a result, the user needs larger and larger dosages to achieve the same effect. This reduced effectiveness with repeated use of a drug is called **tolerance.** Hand-in-hand with tolerance goes **physical dependence**—a process in which the body adjusts to and comes to need the substance, in part because the production of neurotransmitters in the brain is affected by the frequent presence of the drug (Wickelgren, 1998c). A person with a physical dependence requires the drug in his or her body and may suffer unpleasant withdrawal symptoms if the drug is not present. Further, a person who develops tolerance to a highly

CONNECTION: CHAPTER 3

Most psychoactive drugs mimic neurotransmitters or enhance or dampen their effects at the synapses.

■ **Tolerance** The reduced effectiveness a drug has after repeated use.

■ **Physical dependence** A process by which the body adjusts to, and comes to need, a drug for its everyday functioning.



● The line between substance use and abuse is easy to cross for those who become addicted.

addicting drug such as heroin becomes less sensitive to all sorts of natural reinforcers, including the pleasures of friendship, food, and everyday entertainment: The drug, in increasing dosages, becomes the only thing capable of providing pleasure (Helmuth, 2001a). **Addiction** is said to occur when the person continues to use a drug in the face of adverse effects on his or her health or life—often despite repeated attempts to stop.

Withdrawal involves uncomfortable physical and mental symptoms that occur when drug use is discontinued. It can include physical trembling, perspiring, nausea, increased sensitivity to pain, and, in the case of extreme alcohol withdrawal, even death. Although heroin and alcohol are the drugs that most commonly come to mind when we think of withdrawal symptoms, nicotine and caffeine, as well as certain sleeping pills and "tranquilizing" drugs, can also cause unpleasant withdrawal symptoms.

Individuals may find themselves craving or hungering for the drug and its effects, even though they are not physically dependent—a condition known as **psychological dependence** or psychological addiction. This usually results from the powerfully rewarding effects that many psychoactive drugs produce. Psychological dependence can occur with many drugs, including caffeine and nicotine, prescription medications, and over-the-counter drugs.

Addiction, whether biological or psychological, ultimately affects the brain (Gazzaniga, 1998a; Koob & Le Moal, 1997; Nestler, 2001). Consequently, in the view of many public health professionals, this makes both forms of addiction brain diseases (Leshner, 1997). On the other hand, the general public has been reluctant to view drug addicts as people who have an illness. Instead, the public often thinks of addicts as weak or bad individuals who should be punished (MacCoun, 1998).

What difference does our characterization of addiction make? When addicts are seen as persons suffering from a disease, they are most logically placed in treatment programs. By contrast, when they are seen as persons with character defects, addicts are sent to prison for punishment—which does little to break the cycle of drug use, crime, and addiction.

Strange as it may seem, some experts argue that viewing addiction as a disease may also interfere with the effective treatment of drug addicts. How could this be? The disease model of addiction, with its emphasis on biological causes and medical treatment, does little to deal with the social and economic context in which addictions develop. This may account for the fact that psychologically based treatment programs that treat alcohol abuse as a behavioral problem may work better than medically based programs (Miller & Brown, 1997).

We can also see the blind spots of the disease model in heroin addiction. Treatment programs have a notoriously poor record with heroin addicts who have picked up their habits on the streets of the United States. On the other hand, they had far greater success with the thousands of veterans who became addicted to the heroin that was readily available to troops in Vietnam. What made the difference? The addicted veterans did not remain in the environment where they had become addicted—which was the wartime culture of Vietnam. Instead, they returned home to an environment that was not usually so supportive of a heroin habit. In contrast, heroin users who become addicted in the United States tend to return, after treatment, to the same environment that originally led to their addiction.

Whether physical or psychological, disease or character flaw, drug addiction poses many personal and social problems. Clearly, this is a field that has much room for new ideas and new research.

■ **Addiction** A condition in which a person continues to use a drug despite its adverse effects–often despite repeated attempts to discontinue using the drug. Addiction may be based on physical or psychological dependence.

■ **Withdrawal** A pattern of uncomfortable or painful physical symptoms and cravings experienced by the user when the level of drug is decreased or the drug is eliminated.

■ **Psychological dependence** A desire to obtain or use a drug, even though there is no physical dependence.

CHECK YOUR UNDERSTANDING

1. **RECALL:** Hypnosis is sometimes used by psychological researchers to
   - **a.** cure patients suffering from severe mental disorders.
   - **b.** improve memory.
   - **c.** create mental states, such as anxiety or euphoria.
   - **d.** study the effects of psychoactive drugs.
   - **e.** induce amnesia for traumatic experiences.

2. **RECALL:** Psychoactive drugs usually create their effects by _____ in the brain.
   - **a.** causing delayed stress reactions
   - **b.** stimulating reward circuits
   - **c.** rewiring neural pathways
   - **d.** disabling dendrites
   - **e.** altering memories

3. **RECALL:** Which of the following statements is true?
   - **a.** Research has proven conclusively that addiction is a brain disease.
   - **b.** The reinforcing nature of drugs ensures low addiction rates.
   - **c.** Some psychologists suggest that treating addiction as a disease ignores the social and economic factors that surround the problem.
   - **d.** The cycle of addiction is most efficiently broken with a combination of punishment for relapses and drugs that counteract the effects of psychoactive drugs.
   - **e.** Most public health professionals view addiction as a character weakness.

4. **APPLICATION:** Which of the following groups of drugs have the opposite effects on the brain?
   - **a.** stimulants and depressants
   - **b.** depressants and opiates
   - **c.** hallucinogens and sedatives
   - **d.** opiates and sedatives
   - **e.** hallucinogens and stimulants

5. **UNDERSTANDING THE CORE CONCEPT:** An altered state of consciousness occurs when some aspect of normal consciousness is modified either by mental, behavioral, or chemical means. This suggests that
   - **a.** some states of consciousness are mystical phenomena that cannot ever be explained.
   - **b.** altered states of consciousness are the primary source of creativity in our minds.
   - **c.** consciousness is immutable.
   - **d.** all states of consciousness are controlled by unconscious needs, desires, and memories.
   - **e.** psychologists can study altered states of consciousness with scientific methods.

ANSWERS: 1. c 2. b 3. c 4. a 5. e

CONSCIOUSNESS: THE STATE OF THE ART

We have seen that, aside from our familiar state of wakefulness, consciousness can occur in many forms. More surprising, perhaps, is the discovery that mental processing can also occur outside of consciousness. We have also seen that neuroscientists have developed techniques with which they can study these once private and subjective worlds that occur both in consciousness and in the preconscious and unconscious. Among their achievements with these techniques, scientists have flung open the gates of the sleeping and dreaming mind. They have also learned much about the workings of the mind under the influence of hypnosis, meditation, and drugs.

What remains to be learned? Still hotly debated and poorly understood is the function of dreams: Do they mean anything, or are they merely a by-product of an always-active brain cut off from the outside world? Also remaining to be discovered are better treatments for certain sleep disorders, such as narcolepsy and insomnia, as well as more effective treatments for addictions.

But the biggest and most elusive prize of all is a full understanding of consciousness itself. How can the activity of neurons "lighting up" in our brains produce the ongoing movie-of-the-mind that we call consciousness? At this point, no one really knows.

USING PSYCHOLOGY TO LEARN PSYCHOLOGY

Connecting Consciousness with Memory

Expand your consciousness? In the strictest sense, it is not really possible, because consciousness has a limited capacity. As we noted at the beginning of the chapter, consciousness can focus on only one thing at a time. What can be expanded, however, is the access your consciousness has to information you have stored in preconscious memory. Learning how to do this can be of tremendous help to students who need to absorb a large amount of information and to prove it on an exam.

You will, of course, have an advantage if you face an exam with your consciousness unimpaired by the massive sleep debt that students sometimes incur in an "all-nighter" study session. No amount of caffeine can bring your sleep-deprived consciousness back to optimum functioning. Just as your teachers have always preached, it is far better to spread your studying over several days or weeks, rather than trying to learn everything at once and losing sleep over it.

It can also help when we reach Chapter 7 to understand that consciousness is fundamentally the same as working memory, a mental "work space" that holds only a few items at once. Because of its severely limited capacity, you cannot possibly hold in consciousness all the information you need to remember for an exam. Most of the material must be stored outside of consciousness in preconscious long-term memory. The trick is to be able to bring it back into consciousness when needed. Here are some strategies that you may find helpful in doing this:

1. *Study for the gist*. Students sometimes think their professors ask "trick questions," although professors almost never do so intentionally. In reality, a good exam question will show whether students understand the meaning of a term—the gist—rather than having merely memorized a definition. A twofold study strategy can help you get the gist of a concept. First, paraphrase the definition given in the text or in class. Second, think of an example from your own experience that illustrates the concept.
2. *Look for connections among concepts*. Even if you have the gist of the concepts you have studied, you will probably need to know how those concepts are related to each other. The professor may ask you to explain, for example, what happens to the *sleep cycle* in people with *narcolepsy*. Therefore a good study strategy is to ask yourself, "How is this new concept related to what I learned previously?"
3. *Anticipate the most likely cues*. Just because you know the material doesn't mean that the exam questions will make the right answer spill from long-term memory back into consciousness. It pays, therefore, to spend some of your study time thinking about the kinds of questions your professor might ask. For example, you may have learned about the effects of various psychoactive drugs, but you could be stumped when the professor asks you to explain why alcohol is more like the barbiturates than the opiates. (Do you know?) You can often anticipate such questions by noting what the professor emphasizes in lecture. It also helps to think of the kinds of questions that your professor is known to favor. (A study partner helps a lot with this.) Some of the most frequently seen test questions begin with terms such as "Explain," "Evaluate," or "Compare and contrast."

In general, the relationship between consciousness and memory suggests that learning the kind of material required in your college classes requires that the material be actively processed while it is in consciousness. To do so effectively, it must be made meaningful. This requires making connections between new information and information that is already in your memory. It also requires organizing the information so that you see how it is interconnected. And, finally, it requires anticipating the cues that will be used to bring it back to consciousness.

CONNECTION: CHAPTER 7

Working memory (also called short-term memory) is a main component of consciousness, but it holds only a small number of items at any time.

CHAPTER SUMMARY

● HOW IS CONSCIOUSNESS RELATED TO OTHER MENTAL PROCESSES?

Consciousness represents one of the major mysteries of psychology. Cognitive scientists agree that consciousness involves restricted attention. It also involves the mental model we create of our internal and external world. Consciousness employs mental processes that not only integrate all the mental activity in our awareness but also enable us to manipulate their contents. Moreover, consciousness exists in various states, including the normal waking state, states of sleep and dreaming, hypnosis, meditation, and drug states. Aspects of consciousness can be studied with the techniques of cognitive psychology.

In addition to consciousness, the mind has many nonconscious modes that can operate outside awareness. These include the preconscious and various levels of unconscious processing. Consciousness is limited to serial processing, but the mind can process information nonconsciously in parallel channels. New technologies and techniques have opened windows on conscious processes for researchers. Increasingly, cognitive scientists are disputing the Freudian concept of an unconscious that works in opposition to the conscious mind.

● **Consciousness can take many forms, while other mental processes occur simultaneously outside our awareness.**

● WHAT CYCLES OCCUR IN EVERYDAY CONSCIOUSNESS?

Consciousness shifts and changes in everyday life, commonly taking the form of daydreaming, sleep, and nocturnal dreams. Although the function of sleep is not altogether clear, everyone agrees that sleep and wakefulness are part of the circadian cycle. Sleep researchers have revealed the features of the normal sleep cycle, including the four stages of sleep, which undergo 90-minute cycles, including both REM and non-REM periods. Over the course of the night, each ensuing sleep cycle involves less deep sleep and more REM sleep. The sleep cycle also changes dramatically with age. Most adults need at least eight hours of sleep every night.

The function of dreams is also unclear, but they often occur in REM sleep. While Freud's dream theory has been influential, it has no empirical support. Dreams have, however, always been a source of inspiration and creativity for humankind.

Aberrations in the sleep cycle can produce various sleep disorders. Narcolepsy is a disorder of REM sleep, insomnia involves shortened sleep, and sleep apnea involves abnormalities in deep sleep. Other disorders of a less serious nature include night terrors, sleep talking, and sleepwalking.

● **Consciousness changes in cycles that correspond to our biological rhythms and to the patterns of stimulation in our environment.**

● WHAT OTHER FORMS CAN CONSCIOUSNESS TAKE?

Altered states of consciousness include hypnosis, meditation, and the effects of psychoactive drugs. From a cognitive-neuroscience perspective, these may involve changes in psychological processes rather than entirely new forms of awareness. Hypnosis remains a puzzle, although it is known to block pain and to have other uses in therapy and research. Likewise, experts dispute whether meditation is a distinct state of consciousness, even though it has measurable effects on arousal. To understand the effects of psychoactive drugs, it is helpful to group them as hallucinogens, opiates, depressants, and stimulants. Most psychoactive drugs that are abused produce sensations of pleasure and well-being that make the drugs especially attractive and potentially addictive.

● **An altered state of consciousness occurs when some aspect of normal consciousness is modified by mental, behavioral, or chemical means.**

REVIEW TEST

For each of the following items, choose the single correct or best answer. The correct answers appear at the end of the test.

1. What was the objection by Watson and other behaviorists to the study of consciousness?
   - **a.** Consciousness is the result of an inner life force, which they did not have the tools to study.
   - **b.** Consciousness is an essential component of learning.
   - **c.** Consciousness could not be accessed by introspection.
   - **d.** Consciousness is not affected by rewards and punishments.
   - **e.** Conscious processes cannot be directly observed and measured.
2. Imaging techniques, such as MRI and PET scans, allow cognitive scientists to connect mental activity with
   - **a.** cognition.
   - **b.** behavior.
   - **c.** learning.
   - **d.** brain activity.
   - **e.** priming.
3. Which of the following is *not* one of the functions of consciousness cited by your text?
   - **a.** manipulating a mental image of the world
   - **b.** relinquishing control to enhance self-awareness
   - **c.** combining sensation with memory
   - **d.** selecting pertinent information for further processing
   - **e.** restricting attention to what is relevant

4. Which one of the following did Freud believe to be a function of the unconscious mind?
   a. regulation of sleep, wakefulness, blood pressure, heart rate, body temperature, and habit patterns
   b. the construction of grammatically correct sentences, without having to think consciously about the grammatical rules
   c. logical thinking
   d. the unconscious mind serves no purpose
   e. protecting consciousness from sexual desires and traumatic experiences
5. Rapid eye movements are reliable behavioral signs that
   a. a person is very low in hypnotizability.
   b. a sleeper is dreaming.
   c. one has achieved a genuine meditative state.
   d. an individual has reached the deepest level of sleep.
   e. an individual is under the influence of alcohol or other drugs.
6. Which one of the following is a sleep disorder characterized by brief interruptions when the sleeper stops breathing, wakens, resumes breathing, and falls back asleep?
   a. analgesia
   b. night terrors
   c. apnea
   d. daytime sleepiness
   e. insomnia
7. Which of the following statements about hypnosis is true?
   a. Anyone can be hypnotized if the hypnotist knows the most effective techniques to use.
   b. Hypnosis has no medical value.
   c. Hypnotizability relies on a person's ability to respond to suggestion.
   d. Hypnosis is actually a form of NREM sleep.
   e. The less intelligent or educated a person is, the more hypnotizable he or she will be.
8. Psychology has verified that meditation can be useful for producing
   a. heightened cognitive arousal.
   b. a deeper understanding of oneself.
   c. enlightenment.
   d. increased metabolic rates.
   e. a state of relaxation.
9. Which of the following drugs would be most likely to produce hallucinations (sensory experiences with no basis in reality)?
   a. benzodiazepines
   b. mescaline
   c. amphetamines
   d. alcohol
   e. nicotine
10. Three major effects sought by users of _____ are increased alertness, greater self-confidence, and euphoria.
    a. barbiturates
    b. stimulants
    c. depressants
    d. opiates
    e. hallucinogens

ANSWERS: 1. e 2. d 3. b 4. e 5. b 6. c 7. c 8. e 9. b 10. b

KEY TERMS

Consciousness (p. 158)
Cognitive neuroscience (p. 159)
Nonconscious processes (p. 160)
Preconscious memories (p. 164)
Unconscious (p. 164)
Daydreaming (p. 166)
Circadian rhythms (p. 167)
REM sleep (p. 168)
Non-REM (NREM) sleep (p. 168)
Sleep paralysis (p. 168)
REM rebound (p. 169)
Sleep debt (p. 171)
Manifest content (p. 173)
Latent content (p. 173)
Activation-synthesis theory (p. 174)
Insomnia (p. 175)
Sleep apnea (p. 176)
Night terrors (p. 176)
Narcolepsy (p. 176)
Cataplexy (p. 177)
Hypnosis (p. 179)
Meditation (p. 181)
Psychoactive drugs (p. 181)
Hallucinogens (p. 182)
Opiates (p. 184)
Depressants (p. 184)
Stimulants (p. 186)
Tolerance (p. 187)
Physical dependence (p. 187)
Addiction (p. 188)
Withdrawal (p. 188)
Psychological dependence (p. 188)

AP* REVIEW: VOCABULARY

Match each of the following vocabulary terms to its definition.

1. Consciousness
2. Nonconscious processes
3. Circadian rhythms
4. REM rebound
5. Manifest content
6. Latent content
7. Sleep apnea
8. Cataplexy
9. Tolerance
10. Withdrawal

_____ **a.** A condition of increased REM sleep caused by REM-sleep deprivation.
_____ **b.** The story line of a dream without interpretation.
_____ **c.** The process by which the brain creates a model of internal and external experience.

_____ **d.** The reduced effectiveness a drug has after repeated use.

_____ **e.** Sudden loss of muscle control.

_____ **f.** A respiratory disorder in which the person stops breathing many times while asleep.

_____ **g.** The symbolic meaning of objects and events in a dream.

_____ **h.** A physiological pattern that repeats approximately every 24 hours.

_____ **i.** A pattern of painful physical symptoms experienced by the user when the level of drug is decreased or eliminated.

_____ **j.** Any brain process that does not involve conscious processing.

KEY 1. c 2. j 3. h 4. a 5. b 6. g 7. f 8. e 9. d 10. i

AP* REVIEW: ESSAY

Use your knowledge of the chapter concepts to answer the following essay question.

Over time, contrasting theories of dreaming have evolved. Compare and contrast these theories, being sure that your response uses appropriate psychological terminology.

Identify the following theories: activation-synthesis hypothesis, Crick–Mitchison view, and memory consolidation. Compare and contrast them using the following:

1. Main concepts
2. Arguments for
3. Arguments against

OUR RECOMMENDED BOOKS AND VIDEOS

ARTICLE

Nash, M. R. (2001, July). The truth and hype of hypnosis. *Scientific American, 285,* 46–49, 52–55. Everyone has images of hypnosis: the shiny watch, the command to become "verrry sleepy . . ." Advances in cognitive science have left the fascination and much of the mystery intact, while answering questions about how hypnosis works in alleviating pain, retrieving memories, and other applications.

BOOKS

Coren, S. (1996). *Sleep thieves: An eye-opening exploration into the science and mysteries of sleep.* Free Press Paperbacks. Coren gives us the "A to ZZZZs of sleep," including whether dogs and cats dream, determining whether you are getting enough sleep, how to help children sleep better, and the dangers of Daylight Savings Time.

Hobson, A. (2002). *Dreaming: An introduction to the science of sleep.* New York: Oxford University Press. Have you wakened from realistic dreams, confused about what is real? Hobson identifies the qualities that distinguish one's dreaming from waking life and links these to specific brain processes.

Jaynes, J. (2001). *The origin of consciousness in the breakdown of the bicameral mind.* New York: Mariner Books/Houghton Mifflin. Reissued since its original publication in 1976, this continually popular and intriguing work examines how consciousness may have originally evolved when the brain's two hemispheres, connected but separate, "heard" each other—and were experienced by early humans as the voices of spirits, gods—and finally of the self. Don't be disheartened by the mega-title; it's highly readable and provocative.

Peacock, R., & Gorman, R. (Eds.). (1998). *Sleep: Bedtime reading.* Universe Publishing. Wide awake and trying not to worry about it? Try some bedtime reading by the best authors. Includes short works by authors ranging from Alice Walker to John Updike, along with poetry, pictures, and photographs—all designed to take your mind off what's keeping you awake so you can get some rest.

Samorini, M., Calliope, T., & Montgomery, R. (2002). *Animals and psychedelics: The natural world and the instinct to alter consciousness.* New York: Park Street Press. How natural is it for people to deliberately alter consciousness by ingesting psychoactive substances? From observations of our nonhuman relatives, pretty natural! Like humans, wild animals and insects seek out substances (e.g., caffeine, nectar) that alter perception, possibly expanding their behavioral responses—thus increasing adaptation and survival. How and why do substances stop expanding and begin impairing the mind?

VIDEOS

Mesmer. (1994, color, 107 min.). Directed by Roger Spottiswoode; starring Alan Rickman, Amanda Ooms. In 18th-century Vienna and Paris, Franz Anton Mesmer discovers the power of "animal magnetism" to heal the sick. Derided as a charlatan, his methods dubbed "mesmerism," Mesmer brings clinical hypnosis to Paris, where it becomes an entertainment for the bored aristocracy (in the doomed reign of Marie Antoinette). Mesmer's true story is interesting, here romanticized with subplots and piqued with terrific dialogue. (*Not rated*)