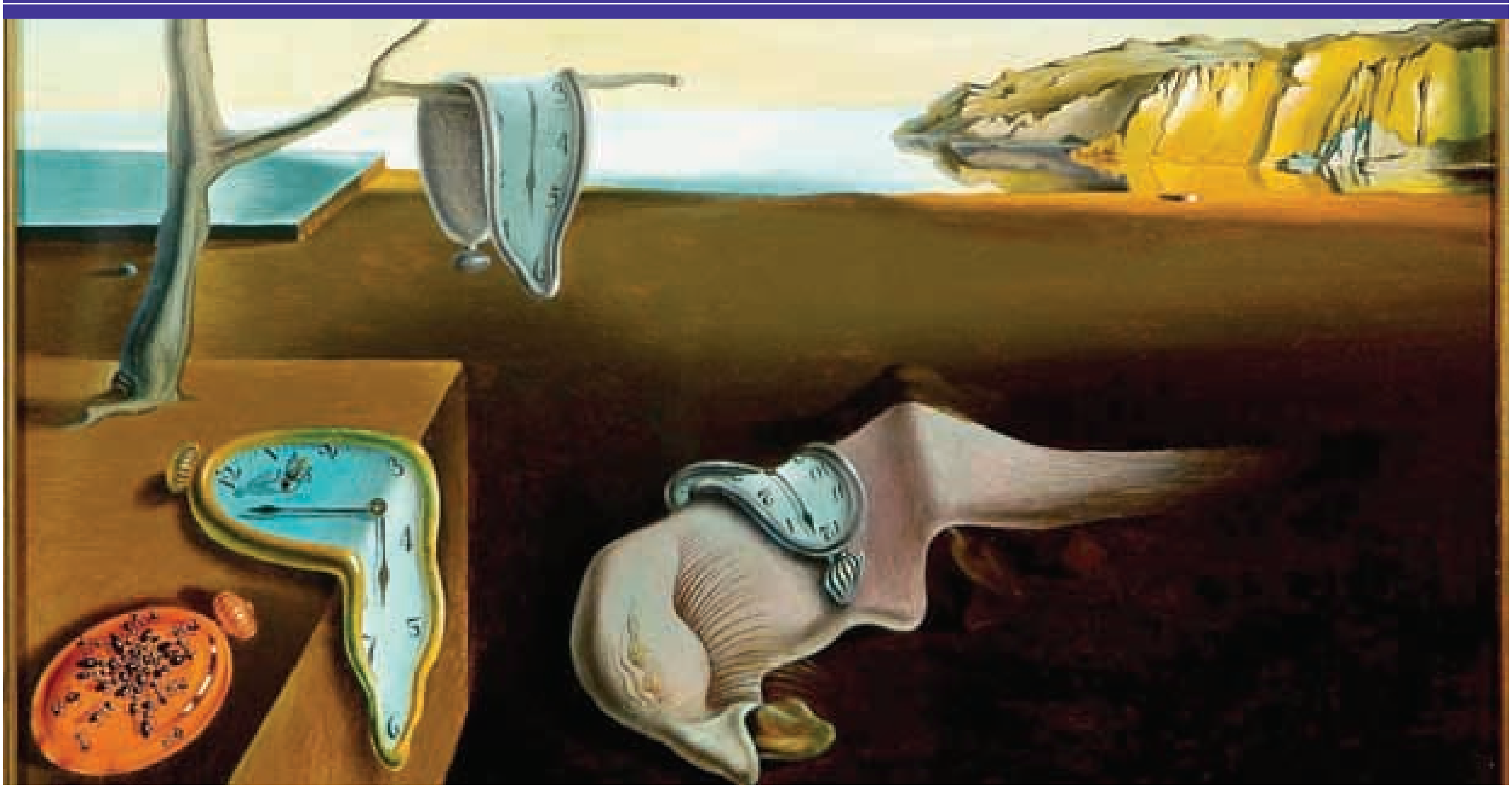
Key Questions/ Chapter Outline	Core Concepts	Psychology Matters
8.1 How Is Consciousness Related to Other Mental Processes? Tools for Studying Consciousness Models of the Conscious and Nonconscious Minds What Does Consciousness Do for Us? Levels of Consciousness	• The brain operates on many levels at once—both conscious and unconscious.	**Using Psychology to Learn Psychology** The trick is to organize material in preconscious long-term memory so that you can find it when you need it.
8.2 What Cycles Occur in Everyday Consciousness? Daydreaming Sleep: The Mysterious Third of Our Lives Dreaming: The Pageants of the Night	• Consciousness changes in cycles that correspond to our biological rhythms and to the patterns of stimulation in our environment.	**Sleep Disorders** Insomnia, sleep apnea, narcolepsy, and daytime sleepiness can be hazardous to your health—and perhaps even to your life.
8.3 What Other Forms Can Consciousness Take? Hypnosis Meditation Psychoactive Drug States	• An altered state of consciousness occurs when some aspect of normal consciousness is modified by mental, behavioral, or chemical means.	**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?

Critical Thinking Applied: **The Unconscious—Reconsidered**

chapter 8
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 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). Thus began the first draft of 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).

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.

So why do we dream? Do dreams help us solve problems? Do they reflect the workings of the unconscious mind? Or are dreams just random mental "junk"—perhaps the debris left over from the previous day? The difficulty in studying dreams with the methods of science is that these mental states are private experiences. No one else can experience your dreams directly. These issues, then, frame the problem on which we will focus in this chapter.

PROBLEM: How can psychologists examine objectively the worlds of dreaming and other subjective mental states?

Dreaming represents just one of many states of consciousness that are possible for the human mind. Others include 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 psychoactive drugs. But that's not all. Behind these conscious states, much of the brain's work occurs off-line—outside of awareness (Wallace & Fisher, 1999). This includes such mundane tasks as the retrieval of information from memory (What is seven times nine?), as well as the primitive operations occurring in the deep regions of the brain that 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 the recollection of this morning's breakfast and your most embarrassing moment. As we will see, the nature of this netherworld of nonconscious ideas, feelings, desires, and images has been controversial ever since Freud suggested that dreams may reflect our unrecognized and unconscious fears and desires. In this chapter we will evaluate this claim and others that have been made for the hidden levels of processing in the mind. But to do so, we begin with the more familiar state of consciousness that fills most of our waking hours.

CONNECTION • CHAPTER 2
The *hypothalamus*, for example, unconsciously regulates several biological drives.

8.1 KEY QUESTION
HOW IS CONSCIOUSNESS RELATED TO OTHER MENTAL PROCESSES?

In simplest terms, we can define **consciousness** as the brain process that creates our mental representation of the world and our current thoughts. One of its components is **attention,** a feature that makes one item stand out as *figure* in consciousness—as when someone calls your name—while everything else recedes into *ground*. Attention also makes it possible for you to follow the thread of a conversation against a background of other voices. (Psychologists call this the *cocktail party phenomenon* or *selective attention*.)

CONNECTION • CHAPTER 7
Similarly, attention accounts for the separation of *figure* from *ground* in perception.

We have previously studied another component of consciousness: *working memory*, the part of the mind into which we can combine incoming stimuli with facts, ideas, emotions, and memories of our experiences retrieved from long-term storage. There we stir the conscious stew of information in the processes that we called *thinking* in Chapter 5. In this context, you might think of attention as the ability to focus on a single "chunk" of information in conscious working memory (Engle, 2002; Gaffan, 2005). Everything entering consciousness passes through working memory. Likewise, we are conscious of everything that enters working memory. Therefore, some psychologists have suggested that working memory is actually the long-sought seat of consciousness (Engle; 2002; LeDoux, 1996).

CONNECTION • CHAPTER 4
Working memory imposes a limitation on consciousness, because it holds only about seven "chunks" of information.

You might also think of consciousness as 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, working memory forms a conscious image of the doughnut (based on external stimulation) and consults long-term memory, which associates the image with food and also allows you to imagine eating it. 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?

Prescientific Views of Consciousness 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. (See Mark 5, for example.)

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). The problem first presented itself 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?)

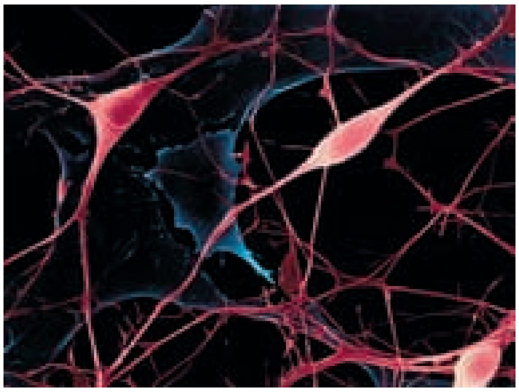
CONNECTION • CHAPTER 1
Wundt and the structuralists pioneered the use of *introspection* in their search for "the elements of conscious experience."

Behaviorism Rejects Consciousness 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!

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

Consciousness The process by which the brain creates a mental model of our experience. The most common, or ordinary, consciousness occurs during wakefulness, although there are can be altered states of consciousness.

Attention A process by which consciousness focuses on a single item or "chunk" in working memory.



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

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. Computers also gave them a model that could be used to explain how the brain processes information.

The Emergence of Cognitive Neuroscience The combination of new tools and unsolved problems, then, led to a multidisciplinary effort that became known as **cognitive neuroscience.** Attracting scientists from a variety of fields, cognitive neuroscience set out to unravel the mystery of 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).

In this chapter we will see how cognitive neuroscientists have pursued not only ordinary consciousness but the alternative mental states of which we are capable, including sleep, dreaming, hypnosis, and drug-altered awareness. As we travel this path, please keep the following Core Concept readily available to your consciousness:

core concept

The brain operates on many levels at once—both conscious and unconscious.

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 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 the same time—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 an earlier chapter, high-tech tools, such as the fMRI, 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," for example, when we read, speak, or shift our attention. (See Figure 8.1.) 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 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

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.

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

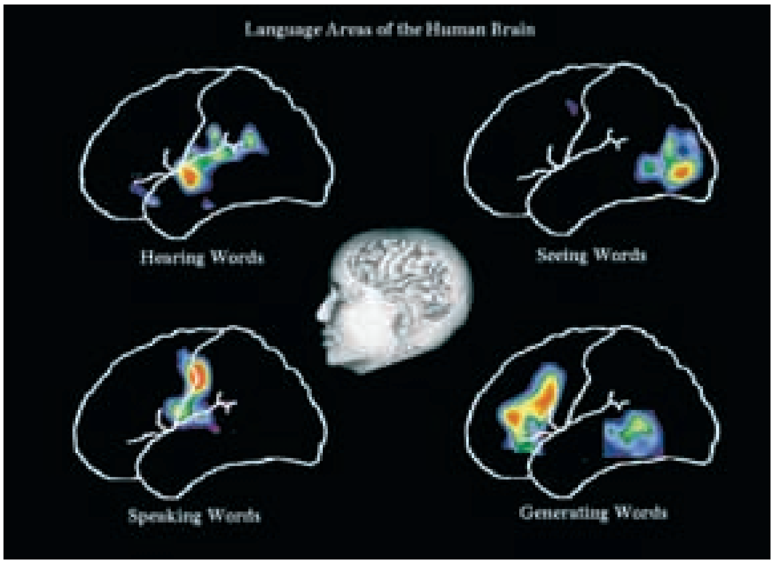


FIGURE 8.1
PET Scans of the Brain at Work

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

over" in their minds. Using drawings like those in Figure 8.2, 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 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 people to answer. He discovered that the smaller the detail he asked for, the longer subjects needed for a response. People 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. And we do so 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." 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.

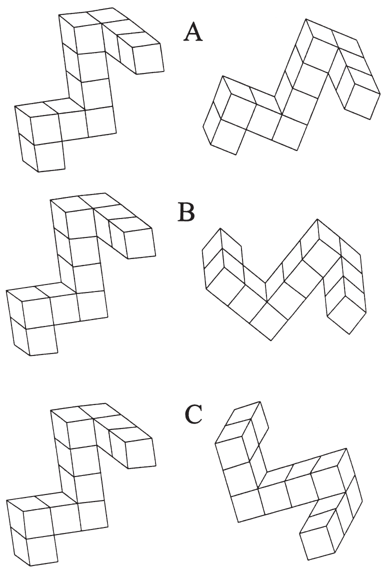


FIGURE 8.2
Figures for the Mental Rotation Experiment

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 images in each pair were rotated through greater angles. You might try your own test to verify their findings.

Models of 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 that compared consciousness to the tip of an iceberg, which suggests 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

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.

out of sight, beneath the level of awareness. But, as we will see later, the unconscious probably does not work in exactly the way Freud believed it did.

The modern cognitive perspective often uses yet another metaphor for the mind: the *computer metaphor*. This view likens consciousness to what appears on a computer screen, while nonconscious processes are like the electronic activity at work behind the scenes, deep inside the computer. Most of the time this nonconscious machinery quietly operates in parallel with consciousness, but occasionally a nonconscious motive or emotion becomes so strong that it emerges into consciousness—as when a peculiar odor associated with an emotional memory suddenly brings that emotion to awareness or when a growing hunger drive spills into awareness.

To get a better picture of consciousness as psychologists now understand it, we will first consider the major functions of consciousness, asking "What does consciousness do for us?" Then we will review what research and theory can tell us about the layers of mind believed to exist below the level of awareness.

What Does Consciousness Do 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, con-

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sciousness keeps your brain from being overwhelmed by stimulation. Unfortunately, the one-thing-at-a-time property of consciousness will not let you concentrate on what you are reading when you shift your attention to music playing in the background.

- *Consciousness also provides a mental "meeting place,"* where sensation can combine with memory, emotions, motives, and a host of other psychological processes in the process we have called *perception.* Consciousness, then, is the canvas on which we customarily create a meaningful picture from the palette of 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. Indeed, neuroimaging suggests that the essence of consciousness is to make linkages among different parts of the brain (Massimini et al., 2005). Consciousness, therefore, lies at the very heart of cognition.
- *And consciousness allows us to create a mental model of the world*—a model that we can manipulate in our minds. Unlike simpler organisms, consciousness frees us from being 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, for example, helps you associate your own experiences with concepts in this text or keeps you from being too brutally honest with a friend wearing clothes you don't like.

CONNECTION • CHAPTER 7
Perception is the process of adding *meaning* to sensation.

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 Consciousness

Sigmund Freud originally proposed that our minds operate on several levels at once. He conceived of the *unconscious* as a reservoir of needs, desires, wishes, and traumatic memories. Moreover, he believed that processing outside awareness could influence our conscious thoughts, feelings, dreams, fantasies, and actions. Today, cognitive psychologists reject much of Freud's theory as prescientific speculation. But they would retain the notion of processing outside of awareness.

The Preconscious

Psychologists often use Freud's term, the **preconscious,** in referring to memories of events (a date last weekend, for example) and facts (Salem is the capital of Oregon) that are not conscious but have once been the focus of attention. These memories 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. Thus, the preconscious, in the modern cognitive sense, is much the same as *long-term memory.*

Preconscious Freud's notion that the mind has a special unconscious storehouse for information not currently in consciousness but available to consciousness. Example: your telephone number is stored in the preconscious.

Preconscious processing isn't restricted to the serial, one-thing-at-a-time limitation of consciousness. That is, it can search for information in many places at once—an ability called *parallel processing.* On the other hand, the preconscious lacks the ability consciousness has for deliberate thinking. You might think of the preconscious as a memory storehouse, where the stock is constantly rotated so that the most recently used and most emotionally loaded information is most easily accessed.

CONNECTION • CHAPTER 4
Parallel processing involves two or more operations occurring simultaneously, as when preconscious memory is being searched in multiple locations at once.

The Unconscious A dictionary might define the term *unconscious* as the absence of all consciousness, as in one who has fainted, become comatose, or is under anesthesia. Freud, however, defined the unconscious as a reservoir of primitive motives and threatening memories hidden from awareness. But cognitive psychologists have still another meaning for unconscious that refers to any sort of nonconscious mental process produced in the brain. In this sense, we can define the **unconscious** as a broad term that refers to many levels of processing below the level of awareness, ranging from preconscious memory to brain activity that controls basic body functions to subtle processes that can, without our realization, produce anxiety or depression (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. But unconscious processing can also be studied in the laboratory, as you will see in the following demonstration. Try filling in the blanks to make a word from the following stem:

D E F __ __ __

CONNECTION • CHAPTER 4
Psychologists use *priming* to study *implicit memory*.

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 using the word *define* several times in the previous paragraph. (There is no certainty, of course, that you would respond as predicted—merely an increased probability.) With priming methods such as this, psychologists have a powerful tool for probing the interaction of conscious and unconscious processes.

Coma and Related States The general public profoundly misunderstands what it means to be in a **coma**. This misunderstanding stems, in part, from a few highly publicized and emotion-provoking cases that posed heated discussion about the ethics of discontinuing life support in severely brain-injured patients (Meyers, 2007). The flames have been fanned, too, by reports of "miraculous" recoveries. So what are the facts?

Comas are not stable, long-term states. Rather, they usually last only a few days—up to about two weeks. In a comatose state, patients lack the normal cycles of sleep and wakefulness, their eyes usually remain closed, and they cannot be aroused. Those who improve make a transition to a *minimally conscious state*, during which they may have limited awareness and a functioning brain. Recovery is usually gradual (National Institute of Neurological Disorders and Stroke, 2007).

Those who do not improve soon deteriorate into a *persistent vegetative state*. In this condition, they may open their eyes periodically, but they have only minimal brain activity and basic reflexes. The chances for full recovery from a persistent vegetative state are slim. To be sure, in a few highly publicized cases, persons have made dramatic recoveries from what the press erroneously described as a "coma." In fact, none of these cases has involved a persistent vegetative state.

Unconscious In classic Freudian theory, a part of the mind that houses emotional memories, desires, and feelings that would be threatening if brought to consciousness. Many modern cognitive psychologists, however, view the unconscious in less sinister terms, as including all nonconscious mental processes.

Coma An unconscious state, during which a person lacks the normal cycles of sleep and wakefulness, that usually lasts only a few days. The comatose state differs from the *minimally conscious state* and the *persistent vegetative state*.

PSYCHOLOGYMATTERS

Using Psychology to Learn Psychology

Want to 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.

Because of its severely limited capacity, you cannot possibly hold in consciousness all the information you need to remember for an exam. The material must be stored, readily accessible but 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 will 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 (pronounced *JIST*) 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, the relationship between *consciousness* and *preconsciousness*. Therefore a good study strategy is to ask yourself how a new concept (e.g., *preconscious*) is related to other concepts learned previously (e.g., *conscious* or *unconscious*).
3. *Anticipate the most likely cues.* Just because you "know" the material doesn't mean that the exam questions will make the answers 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 will learn in this chapter 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. 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 common 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 demands that it be actively processed while in consciousness. To do so effectively, the material must be made meaningful. This requires making connections between new information and old 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.

As we noted in the Learning chapter, cognitive learning and behavioral learning seem to involve different brain mechanisms. Most cognitive learning—e.g., your learning of the material in this chapter—involves consciousness. On the other hand, much behavioral learning, particularly classical conditioning—such as the acquisition of a phobic response—relies heavily on processes that can occur outside of consciousness.

CONNECTION • CHAPTER 3
Behavioral learning includes *operant conditioning* and *classical conditioning*.

CheckYourUnderstanding

1. **RECALL:** Why did behaviorist John Watson object to defining psychology as the science of consciousness?
2. **RECALL:** What technology would a cognitive neuroscientist be likely to use in studying consciousness?
3. **APPLICATION:** How would you sample the contents of another person's *preconscious* mind?
4. **UNDERSTANDING THE CORE CONCEPT:** What parts of the mind or mental states occur outside our conscious awareness?

Answers **1.** Watson and other behaviorists have argued that consciousness is a subjective mental state, that cannot be studied objectively with the methods of science. **2.** Cognitive neuroscientists commonly use fMRI and other brain scanning techniques. **3.** Ask him or her to recall specific information from memory, such as a phone number or a concept that had been previously learned. **4.** Among the parts of the mind and mental states that occur outside of consciousness, we have discussed the preconscious, unconscious, coma, persistent vegetative state, and the minimally conscious state.

8.2 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 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

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). It can also occur in class, while you are reading or any time the external environment doesn't hold your attention.

But is daydreaming normal? You may be relieved to know that most people daydream every day. In fact, it is abnormal if you do not! Research shows, however, that young adults report the most frequent daydreams, with the amount of daydreaming declining significantly with increasing age (Singer & McCraven, 1961).

Daydreaming as Default A study by Malia Mason and her colleagues (2007) shows that "mind-wandering" is associated with a "default network" in the brain that remains active during the restful waking state. Thus, daydreaming is what the mind does naturally when there are no external demands placed on it from incoming stimuli. The voices, images, thoughts, and feelings involved in these ruminations apparently arise from the activity in the brain circuits that produce consciousness.

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.

Moreover, 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.

Don't Think about a White Bear 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 famous "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 nighttime 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" and *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, 2005). 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 of us, 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 that is just slightly longer than 24 hours. But under more normal circumstances, the pattern undergoes daily readjustment by our exposure to light and by our habitual routines (Dement & Vaughan, 1999).

Circadian rhythm Physiological pattern that repeats approximately every 24 hours—such as the sleep–wakefulness cycle.

Without the light–dark cycles that continually update their "biological clocks" on Earth, these sleeping astronauts on board the space shuttle face novel problems in synchonizing their work schedule with their circadian rhythms.

You may think of sleep as a process that occurs in an approximately 8-hour period, from the time you go to bed until your alarm wakes you in the morning. But that pattern is rather new in human history and limited mainly to people living in industrialized countries. The more "natural" human tendency is to sleep in a more fluid pattern, whenever one feels like it, in shorter periods during the day or longer stretches during the night (Bosveld, 2007; Warren, 2007). Commonly, in rural villages throughout the world, sleepers will wake up for an hour or two during the middle of the night and converse, play, daydream, have sex, or tend the fire—all of which should show us just how malleable our sleep–wakefulness schedules can be.

Yet, anything that cuts your sleep short or throws your internal clock off its biological schedule can affect 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 8:00 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).

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 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 suddenly enter the state Aserinsky discovered. We now call it **REM sleep,** a stage marked by fast brain waves and 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.**

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; McNamara et al., 2005). The NREM reports typically contained either brief descriptions of ordinary daily events or no mental activity at all. By contrast, REM reports were filled with vivid cognitions, featuring fanciful, bizarre scenes, often of an aggressive nature. In other words, rapid eye movements were a sign of dreaming.

Strangely, while the eyes can dance during REM sleep, the voluntary muscles in the rest of the body remain 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. (In case you're wondering: Sleepwalking and sleep talking don't occur during REM sleep but in the deepest stage of NREM sleep.)

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.

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 sleep experiment. 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 snooze. 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, your brain waves register a cycle of activity much like the pattern you see in Figure 8.3—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 8.4):

- 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.
- Rather than going through Stage 1 again, the sleeper begins to produce fast beta waves on the EEG, along with rapid eye movements—the sign of a new stage called REM sleep, which sleep researchers now recognize as distinct from Stage 1. It is important to note that, in a normal night's sleep, this is the first appearance of REM. After about 10 minutes of REMing, the entire cycle begins to repeat itself, with each succeeding REM period getting longer and longer.

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,

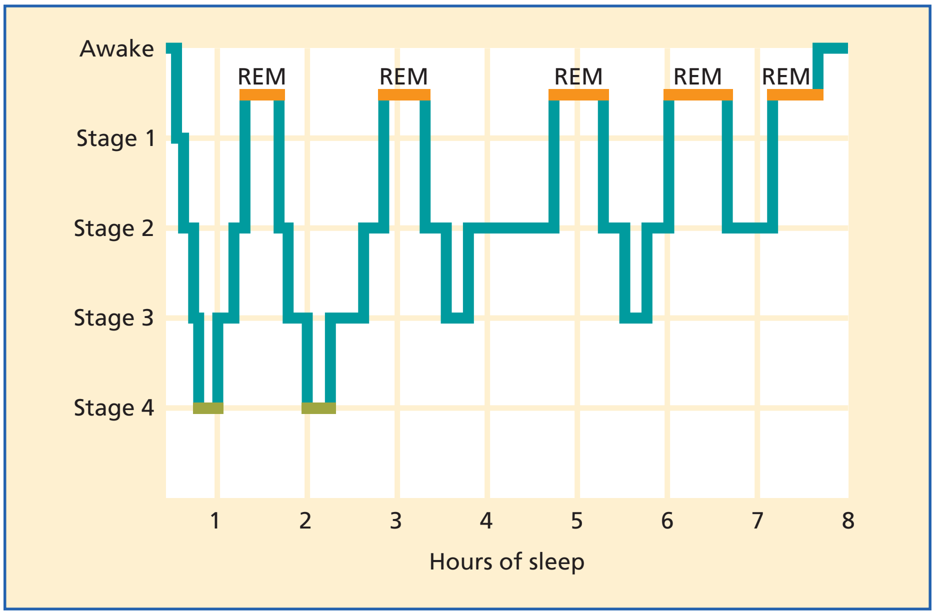


FIGURE 8.3
Stages of Sleep

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.

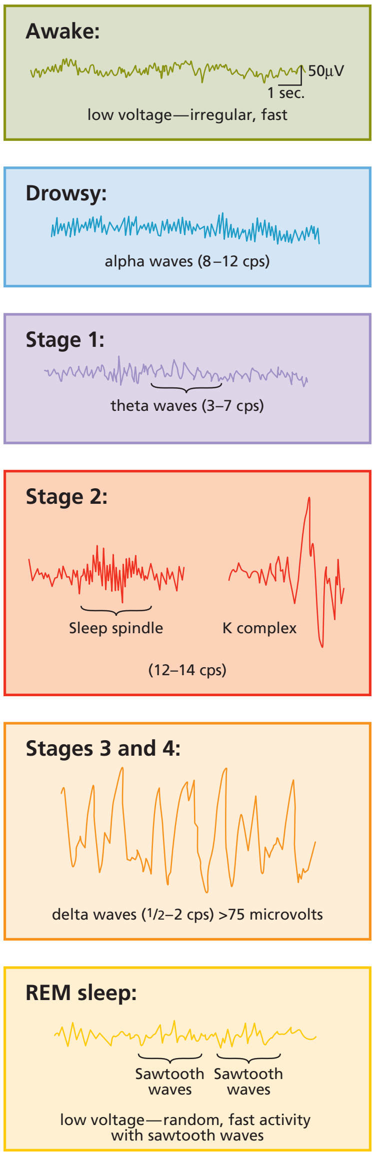


FIGURE 8.4
EEG Patterns in Stages of Sleep

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 REMing. A look at Figure 8.3 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 sleepers 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 function of sleep is to satisfy a 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.

Why Do We 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; 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; Miller, 2007). 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).

Another function of sleep was poetically described by William Shakespeare, when he spoke of "sleep that knits up the ravelled 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; others suggest that sleep promotes the formation of new neurons in the brain—while sleep deprivation inhibits this process (Siegel, 2003; Winerman, 2006b). Yet another possibility has been proposed by Francis Crick and Graeme Mitchison (1983), who believe that sleep and dreams help the brain to flush out the day's accumulation of unwanted and useless information—much like reformatting a computer disk. While progress has been made in learning how sleep actually restores us, a detailed picture still eludes sleep scientists (Winerman, 2006b).

The Need for Sleep How much sleep we need depends on several factors, including genetics, which sets the sleep requirements and individual variations that are built into our circadian rhythms (Barinaga, 1997b; Haimov & Lavie, 1996). The amount of sleep we require is also 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. 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 8.5 shows, newborns sleep about 16 hours per day, with half that time devoted to REM. During childhood,

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

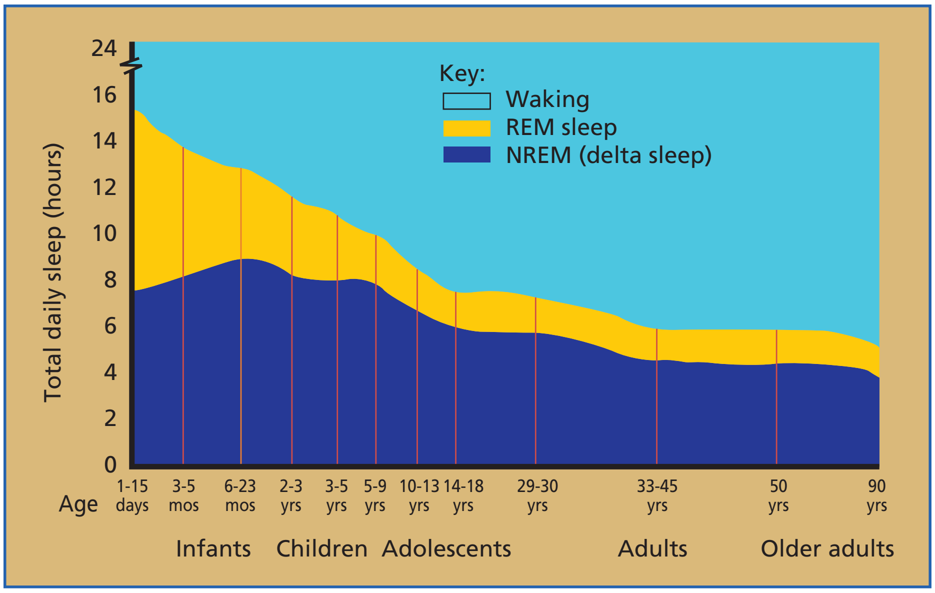


FIGURE 8.5
Patterns of Human Sleep over a Lifetime

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.

those numbers gradually decline, probably as a result of the maturing brain. 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 accompanying "Do It Yourself!" box.

CONNECTION • CHAPTER 6
The brain continues to develop and also to prune excessive neurons throughout childhood and adolescence.

Sleep Debt versus the Circadian Clock 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 (Greer, 2004; 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

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

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.

Recent studies also suggest that sleep deprivation contributes to weight gain: People who sleep less than seven hours a night have high rates of obesity (Harder, 2006).

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

1. Do you often feel 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.

alarm clock rouses them in the morning. But they don't see this as a sign of a sleep debt because their circadian clocks also nudge them into wakefulness over the next few hours. Afternoon drowsiness may be attributed to a big lunch—which, in truth, does not cause sleepiness. (It's the internal 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.

The sleep-deprived individual gets caught in a daily tug-of-war between the pulls of a sleep debt, on the one hand, and the combined forces of the environment and circadian rhythms, on the other. In this way your internal clock can fool you: Even when you have not had enough sleep, the clock in the brain can make you feel relatively alert at certain times of the day—usually late morning and late afternoon. But 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). Most people don't realize that sleep deprivation is associated with weight gain and even with a shortened lifespan (National Institute of Medicine, 2006). In addition, 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 that a crew member who was steering the ship at the time had had only six hours of sleep in the previous two days.

Sleep debt can be dangerous for drivers and others for whom life and limb depend on alertness. Likewise, students who build up a sleep debt jeopardize their mental performance.

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 0.1 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). What effects do you suppose chronic sleep deprivation, so common during medical internships and residencies, has on physician performance?[1]

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.

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, espe-

[1]Further information on the hazards associated with sleep deprivation in physicians is available online from PubMed: www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1200708

cially, parts of the brain stem. What remains most mysterious about this stage of sleep is *why* we dream.

The ancient Israelites interpreted dreams as messages from God. Their Egyptian contemporaries attempted to influence dreams by sleeping in temples dedicated to the god of dreaming, Serapis. And in India, the sacred Vedas described the religious significance of dreams. Meanwhile, in China dreaming held an element of risk. During a dream, the ancient Chinese believed, the soul wandered about outside the body. For that reason they were reluctant to awaken a sleeper hastily, lest the soul not find its way back to the body (Dement, 1980).

From the perspective of many African and Native American cultures, dreams are an extension of waking reality. Consequently, when traditional Cherokee Indians dreamed of snakebite, they received appropriate emergency treatment upon awakening. Likewise, when an African tribal chieftain dreamed of England, he ordered a set of European clothes; and, when he appeared in the new togs, his friends congratulated him on making the trip (Dement, 1980).

In contrast with such folk theories, sleep scientists have approached dreaming with this question: What biological function do dreams have? Most experts suspect that dreams may be necessary for healthy brain functioning, although the evidence for that is not certain, as you will see in a moment (Siegel, 2003).

A closely related issue concerns the *meaning* of dreams. Evolutionary psychologists have proposed that dreams may offer a safe way to rehearse ways of dealing with dangerous situations, but again the evidence is iffy (Franklin & Zyphur, 2005). 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. But others argue that dreams may have no meaning at all. Rather, they may be merely the brain's random activity during sleep. Let's look at both sides of this debate on the meaningfulness of dreams.

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.

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," paved with clues to an individual's hidden mental life. For this reason, Freud made the analysis of dreams the cornerstone of psychoanalysis, as described 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. And for Freud, symbols of death include a departure or a journey.

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 indi-

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. For example, the latent content of a dream involving clocks might involve fear of the menstrual cycle and, hence, of one's sexuality.

viduals depressed about divorce often had dreams that dealt with 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 dream about (Hall, 1953/1966; Van de Castle, 1994). We must emphasize, however, that there is little solid scientific support for Freudian interpretations of latent dream content.

Dreams Vary by Culture, Gender, and Age Freudian dream analysis has 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, because boys see their fathers as rivals for the mothers' affections—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 their uncles, who act as the disciplinarians in Trobriand society (Malinowski, 1927; Segall et al., 1990). Freud's dream theory, then, may be yet another example of the confirmation bias.

CONNECTION • CHAPTER 1

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

The highly specific effects of culture can also 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 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.

Taking a more objective approach to dreams than Freud did, modern sleep scientists now know that the content of dreams also varies by age and gender (see Domhoff, 1996). 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 emotional dreams had a negative complexion, such as anger and sadness (Hall, 1951, 1984).

Dreams and Recent Experience Sleep research has also found—as we might expect—that dream content frequently connects with recent experience and things we have been thinking about during the previous day. But, strangely, if you deliberately try *not* to think about something, it is even more likely to pop up in your dreams (Wegner et al., 2004). So, if you have been worrying about your job all day—or trying to forget about it—you're likely to dream about work tonight, especially during your first REM period.

Typically, then, the first dream of the night connects with events of the previous day. Dreams in the second REM period (90 minutes later) often build on a theme that emerged during the first REM period. And so it goes through the night, like an evolving 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. Because the last 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 Memory 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. Indeed, the brain replenishes neurotransmitters in its memory networks during REM, notes sleep researcher James Maas. It may be that REM sleep is a normal part of weaving new experiences into the fabric of old memories (Greer, 2004b).

Recent research suggests that NREM sleep also selectively reinforces certain kinds of memory (Miller, 2007). Recollection for facts and locations seem to be consolidated in NREM sleep, while REM deals more with motor skills and emotional memories. At this point no one knows why the sleeping brain seems to divide tasks up in this way.

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 "deep" 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 original 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. While 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.

Sleep and dreaming have inspired many artists, as seen here in Rousseau's **Sleeping Gypsy.**

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—dreams could still be a source of creative ideas. 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.

"Dream explorer" Robert Moss (1996) cites 19th-century physiologist Herman von Helmholtz, who insisted that creative dreaming would result from doing three things: first, saturating yourself in a problem or issue that interests you; next, letting your creative ideas incubate by not pushing yourself for a solution but by shifting attention to something that is relaxing; and finally, allowing yourself time to experience illumination, a sudden flash of insight into the answer you seek.

Moss himself recommends the following technique, which you may want to try (with your critical thinking skills at the ready) to find creative inspiration in your dreams: First, bring to mind an expert whom you admire in your field of

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.

endeavor. Before you go to sleep, imagine you are asking this person for help in solving your problem; then tell yourself to dream the answer. If you wake from a dream, quickly write or sketch all you can recall—no matter what the dream was about. Later, when you review your notes, you may find that your approach to the problem has been "given a distinct tilt" (Moss, 1996). Your later interpretation of your dream thoughts might surprise you with insights you didn't even know you could achieve. Perhaps, if you take creative control of your dreams, you can create your own "monster," just as Mary Shelley did in *Frankenstein*.

PSYCHOLOGYMATTERS

Sleep Disorders

You may be among the more than 100 million Americans who get insufficient sleep or poor-quality sleep. 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—including 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 catastrophic case of the *Exxon Valdez* oil spill (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, while 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).

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 the effects of insomnia by making the user feel less rested and more sleepy. A new generation of drugs for the treatment of insomnia—the ones you see heavily advertised on TV—seems to avoid most of these problems, although they have not been studied for long-term use (Harder, 2005). An alternative is psychological treatment employing cognitive behavioral therapy, which has had remarkable success in helping people learn effective strategies for avoiding insomnia (Smith, 2001).

CONNECTION • CHAPTER 13
Cognitive behavioral therapy combines cognitive and behavioral techniques in treating psychological disorders.

Incidentally, counting sheep won't help you break the insomnia barrier. Neither will some other boring mental task. Researchers at Oxford University have shown that it is better to imagine some soothing, but complex, scene, such as a waterfall. Counting one sheep after another apparently isn't interesting enough to keep the sleep-inhibiting worries of the day out of mind (Randerson, 2002).

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. But behind the curtain of the night, the cause can be found in an abnormality of breathing. The sleep apnea sufferer actually stops breathing for up to a minute, as often as several hundred times each night! (In case you're concerned,

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

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

This student struggles with insomnia, a problem that has many different psychological, environmental, and biological causes. About one-third of all adults are plagued by this most common of sleep disorders.

the brief cessation of breathing a few times each hour during the night is normal.) Most commonly, this results from collapse of the airway in the throat when the sleeper's muscle tone relaxes. The result is the second 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.

Failure to recognize the nature of the problem can cause apnea sufferers—and their families and coworkers—to interpret unusual daytime behavior, such as inattention or falling asleep, as laziness or neglect. While this may be disruptive to relationships, sleep apnea can also have harmful biological effects that include damage to brain cells, along with elevated blood pressure that can impose dangerous levels of stress on the blood vessels and heart (Gami et al., 2005).

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. (Instead, 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 while they sleep. In contrast, permanent breathing failure is not a strong concern for adults with sleep apnea, for whom treatment focuses on decreasing the hundreds of nightly apnea episodes. This is usually accomplished by using 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 it is 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, sleep talking,

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

The discovery of narcolepsy in dogs showed that the disorder has a biological basis. Here, pioneering sleep researcher William Dement holds one of his sleeping subjects.

and bed-wetting, which also occur in Stage 4. All these conditions seem to have a genetic component. In themselves, they pose no danger, although sleepwalkers can inadvertently climb out of upper-story windows or walk into a busy street—so it pays to take some precautions. (Incidentally, it's just a myth that waking a sleepwalker is dangerous.) In most cases, sleepwalking and night terrors will diminish or disappear in adulthood, but if they pose persistent and chronic problems, the individual should be evaluated by a sleep specialist. Bed-wetting can usually be ameliorated by a simple behavior modification procedure that employs a pad with a built-in alarm that sounds when damp.

Narcolepsy, one of the most unusual of sleep disorders, produces sudden daytime sleep attacks, often without warning. But these are no ordinary waves 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 a disorder of REM sleep (Marschall, 2007). 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 stems from a genetic problem affecting the sleep-control circuitry in the brain stem. Recent research implicates a diminished supply of *hypocretin,* a chemical produced in the hypothalamus (Harder, 2004; Marschall, 2007). So far there is no cure, but certain drugs can diminish the frequency of both the sleep attacks and the cataplexy. 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.

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

CheckYourUnderstanding

1. **RECALL:** What do brain scans tell us about the daydreaming brain?
2. **RECALL:** What muscular changes occur during REM sleep?
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. sleep becomes deeper and deeper.
   b. REM periods become longer.
   c. Stage 3 and 4 sleep periods lengthen.
   d. dreaming becomes less frequent.
4. **RECALL:** According to the activation-synthesis theory, what causes our dreams?
5. **APPLICATION:** Which sleep disorder is marked by a REM period at the beginning of sleep?
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. Give an example of a recurring mental state that illustrates this concept.

Answers **1.** Brain scans suggest that daydreaming is generated by activity in a "default network" of circuits in the brain that remains active during the restful waking state. **2.** Sleep paralysis affects all the voluntary muscles except those controlling eye movements. **3.** b **4.** According to the activation-synthesis theory, dreams are an attempt by the brain to make sense of random activity in the brain stem during sleep. **5.** narcolepsy **6.** Sleep and dreaming are among the cyclic changes in consciousness.

8.3 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 from hair-raising theme-park rides or 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, marijuana, meth, ecstasy, and cocaine. So, what is the theme that ties these altered states of consciousness together? The Core Concept of this section says:

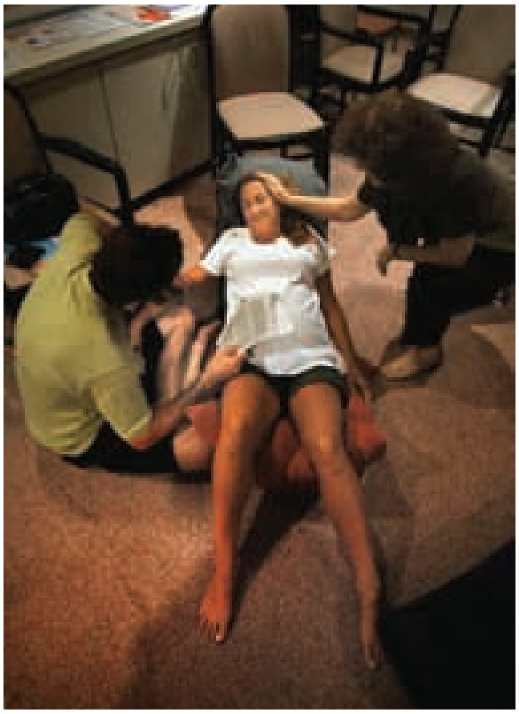
core concept

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

While this notion may, at first, sound simplistic, 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. 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.



For many people, hypnosis can help control pain. Here, a woman is learning hypnotic techniques that she will use in natural childbirth.

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.

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

When deeply hypnotized, some people will 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 his or her 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.

CONNECTION • CHAPTER 4

Studies in which false memories are created call into question 'recovered' memories obtained as the result of any sort of prompting or suggestion.

Hypnotizability depends on age. Among adults, 10 to 15% are highly hypnotizable, while up to 85% of children fall into that category (Blakeslee, 2005). Figure 8.6 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.

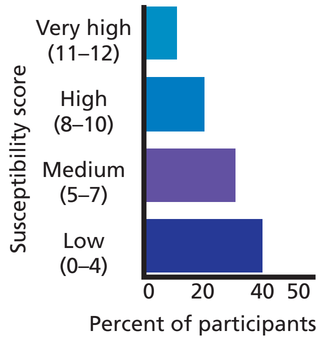


FIGURE 8.6
Level of Hypnosis Reached at First Induction

This graph shows the results achieved by 533 participants hypnotized for the first time. (Hypnotizability was measured by the 12-item Stanford Hypnotic Susceptibility Scale.)

Is Hypnosis a Distinct State of Consciousness?

The experts disagree about the psychological mechanisms involved in hypnosis (Kirsch & Lynn, 1995, 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 suggestibility (Barber, 1979; Kirsch & Braffman, 2001). In this latter view, hypnotic subjects are not entranced but merely motivated to focus their attention and respond to suggestion. In yet another view, some experts think that hypnosis is essentially a social process, involving role playing—in which they act as they believe a hypnotized person would, often to please the hypnotist (Sarbin & Coe, 1972). In support of this view, critics of hypnosis as an "altered state" note that people who have *not* been hypnotized can duplicate apparently amazing feats, such as becoming "human planks" suspended between two chairs.

An intriguing perspective, 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 when told, "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.

CONNECTION • CHAPTER 12

In certain clinical disorders, known as *dissociated states*, part of the personality becomes disconnected with rest of the personality. This is the defining feature of dissociative identity disorder—formerly called "multiple personality disorder."

Finally, a cognitive view proposes that hypnosis involves a shift in top-down processing—that is, thinking driven by expectations and mental imagery, rather than by incoming stimulation. Thus, they are hypnotized because they want or expect to be, so they focus on expressing and achieving the responses the hypnotist tries to evoke. To test this idea, neuroscientist Amir Raz and his colleagues altered volunteers' top-down processing by means of hypnotic suggestions that they would "forget" how to read. Brain scans showed that the suggestion temporarily inactivated the part of their brains that decodes words (Blakeslee, 2005; Raz et al., 2002).

In support of the idea that hypnosis creates profound top-down changes in the brain, another study showed that parts of the brain associated with pain perception "lit up" in deeply hypnotized patients who were given suggestions that they were touching uncomfortably warm metal. The same pattern was found in

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brain scans of a control group who actually touched a 120-degree metal rod (Derbyshire et al., 2004; Winerman, 2006b).

Theorists 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, shifted expectations, and social interactions.

Stage hypnotists have given the public a distorted view of hypnosis. Here, The Amazing Kreskin demonstrates the "human plank," which supposedly depends on hypnotic suggestion. In fact, it is a magician's trick. (Don't try this at home—or anywhere else—unless you learn the trick. There is a very real possibility that you could cause serious injury to the "plank.")

Practical Uses of Hypnosis Stage tricks aside, what is hypnosis good for? Because it can exert a powerful influence on psychological and physical functions in some people, hypnosis can be a useful tool for researchers studying the mind-body connection (Oakley, 2006). And 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, where a frequently used technique calls for planting posthypnotic suggestions that can diminish a patient's cravings for nicotine (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 pain management, especially during procedures that would otherwise involve the risks of anesthesia (Nash, 2001; Patterson, 2004). 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 pain relief (Callahan, 1997). Still, hypnosis alone will allow some patients to undergo treatments that would otherwise cause excruciating pain (Finer, 1980). And for some highly suggestible individuals, hypnosis may actually work better to mask pain than does acupuncture, aspirin, Valium, or even morphine (Stern et al., 1977).

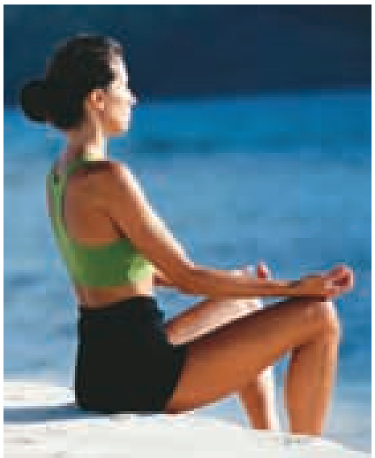
How does hypnosis produce pain relief? Hilgard's hidden-observer explanation is one possibility, although other scientists have taken a more biological approach to the problem. Currently there is no universally accepted explanation, although we can rule out one contender. Experiments have demonstrated that the opiate-like *endorphins*, which account for the pain-relieving property of placebos, are *not* responsible for hypnotic analgesia (Grevert & Goldstein, 1985). As you will recall, we considered another possibility, called the *gate-control theory,* in our discussion of pain (in Chapter 7). 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.

CONNECTION • CHAPTER 7
Endorphins are the body's own opiate-like substances.

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. Meditators may use a variety of techniques, but they commonly begin by concentrating on a repetitive behavior (such as breathing), assuming certain body positions (yogic postures), and minimizing external stimulation. You will note the similarities with hypnosis.

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.



Meditation produces relaxation, changes in brain waves, lower blood pressure, a decrease in stress hormones, and perhaps new insights. Research has not shown meditation to be superior to other relaxation techniques, however.

How is meditation done? There are many techniques, but most involve an attempt to clear the mind, either by focusing on a single process, such as one's breathing or an object, such as a visual icon—or attempting to void one's mind of all thoughts. The meditator typically seeks to remain in this state anywhere from a few minutes to a few hours.

Viewing 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).

In contrast with its long history in Asia and the Pacific, meditation has only recently been taken seriously by psychology as a subject for scientific study. Its spiritual aspects aside, studies suggest that meditating is in many ways like resting, because it has been found to reduce various signs of bodily arousal (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.

What effects of meditation can be demonstrated objectively? Experienced meditators show changes in their brain-wave patterns, especially in frontal lobe activity, associated with positive emotions (Davidson et al., 2003; Kasamatsu & Hirai, 1966). Other studies have linked meditation with beneficial changes in blood pressure and stress hormones (Seeman et al., 2003). And still other studies have shown that meditation produces relaxation and reduces anxiety, especially in people who live and work in stress-filled environments (Benson, 1975; van Dam, 1996)—although new research with control groups does not show meditation to be superior to other relaxation techniques (Toneatto & Nguyen, 2007). Finally, an intriguing recent study finds that a long-term habit of meditation is associated with an increased thickness of the brain's cortex in regions associated with attention and sensory processing (Lazar et al., 2005).

The overall picture shows meditation to be a method for relaxing, reducing stress, and disengaging from worldly concerns. It also produces health-promoting physical changes. But whether meditation holds an advantage over other techniques—psychological, physical, and spiritual—awaits the finding of future research.

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 cares of their daily 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 those 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 decisions (Gazzaniga, 1998a). In addition, the most widely abused drugs, such as cocaine, heroin, PCP, cannabis, and methamphetamines, all stimulate the 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

Psychoactive drug Chemical that affects mental processes and behavior by its effect on the brain.

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. Data from several sources, including emergency room visits, drug arrests, and surveys, indicate that overall illicit drug use has declined since the early 1990s. Among teenagers, drug use has shown a modest decline for the last decade—although Figure 8.7 shows that it was somewhat lower in 1990–1991. About half of all high school seniors have used an illegal drug (University of Michigan News Service, 2006). Credit for the 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 8.1.) 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).

Commonly used hallucinogens include *mescaline* (made from a type of cactus), *psilocybin* (from a mushroom), *LSD* or "acid," and *PCP* (also called phencyclidine or "angel dust"). Both LSD and PCP are synthetic drugs made in chemical laboratories. PCP 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, insensitive to pain, and feel separated (dissociated) from their surroundings.

CONNECTION • CHAPTER 2

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

Hallucinogen A drug that creates hallucinations or alters perceptions of the external environment and inner awareness.

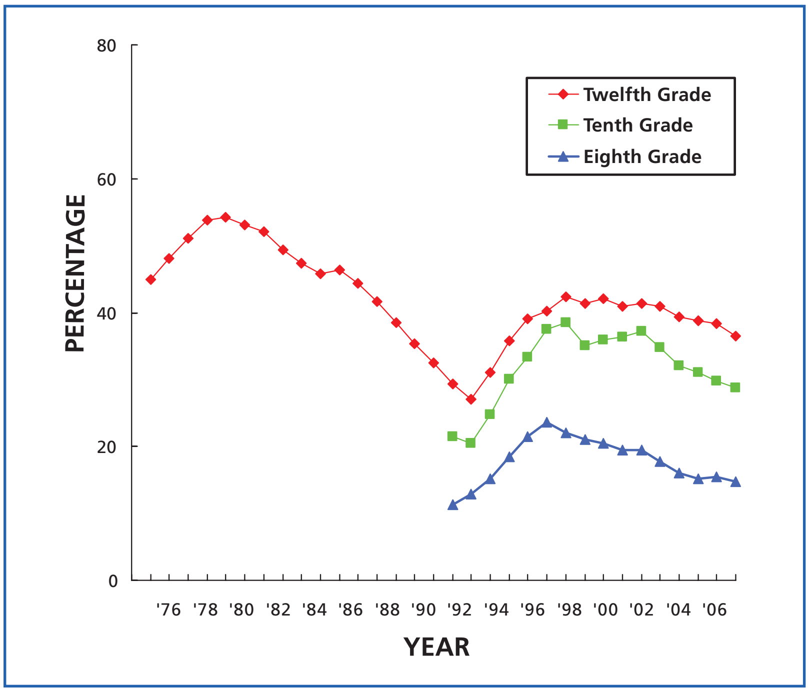


FIGURE 8.7
Trends in an Annual Use of Illicit Drug Use Index

This graph shows the percentage of teens reporting the use of illegal drugs. Note that although teen drug use in the United States has declined over the last decade, it still is not as low as in 1992. The causes of these changes are not clear.

(Source: From the Monitoring the Future Study, University of Michigan. Reprinted by permission of the Inter-University Consortium for Political and Social Research.)

TABLE 8.1 Characteristics of Psychoactive Drugs

Drug	Medical Uses	Common Effects Reported by Users
Opiates		
Morphine	Painkiller, cough suppressant	Euphoria ("rush"), tranquility, drowsiness
Heroin	No medical uses in the United States	Euphoria, tranquility, drowsiness (more powerful than morphine)
Codeine	Painkiller, cough suppressant	Euphoria, drowsiness, "silliness"
Methadone	Treatment of heroin addiction	Slow action prevents heroin craving
Hallucinogens		
Mescaline	None	Hallucinations, sensuality, similar to LSD but fewer reported emotional responses
Psilocybin	None	Well-being, perceptual distortions, less emotionally intense than LSD
LSD	None	Hallucinations, often emotional reactions
PCP	Veterinary anesthetic	Body image distortions, amnesia, unpredicable emotional reactions, dissociation (feeling of being cut off from one's environment)
Cannabis	Reduces nausea from chemotherapy; reduces pressure in the eye	Euphoria, time distortion, intensified sensory experience
Depressants and Antianxiety Drugs		
Barbiturates	Sedative, sleep, anticonvulsant, anesthetic	Relaxation, sedation, euphoria
Benzodiazepines	Antianxiety, sleep, anticonvulsant, sedative	Stress and anxiety reduction ("tranquilizing")
Rohypnol	None in United States (elsewhere: sedation, anxiety, anesthesia, and treatment of insomnia)	Same as other benzodiaepines, but longer lasting; also amnesia (hence its reputation as the "date-rape drug")
Alcohol	Antiseptic	Relaxation, well-being, cognitive and motor impairment
Stimulants		
Amphetamines	Weight control, ADHD, counteract anesthesia	Confidence, mental energy, alertness, hallucinations, paranoia
Methamphetamine	None	Same as other amphetamines, but more intense
MDMA (ecstasy)	None (originally an appetite suppressant)	Euphoria, hot flashes, perceptual distortions, excitement
Cocaine	Local anesthetic	Much the same as amphetamines, sexual arousal (except in chronic users), dramatic mood changes as effects wear off (irritability, depression)
Nicotine	Gum, patch for cessation of smoking	Stimulant effect, relaxation, concentration, reduces nicotine craving
Caffeine	Weight control, stimulant in acute respiratory failure, analgesia	Stimulant effect, increased alertness and concentration

Cannabis, derived from the hemp plant (used to make rope, as well as dope), also acts as a hallucinogen. Its active ingredient is *THC* (tetrahydrocannabinol), found in both 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 large doses can cause long hallucinogenic reactions. Unlike alcohol, its effects can last for many hours—and long after users feel the drug's influence has ended. 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). Depending on the social context, and expectations, the effects can also be an unpleasant mixture of fear, anxiety, and confusion. In addition, cannabis often produces temporary failures in memory, as well as impairments in motor coordination. Those who work or drive under its influence suffer a higher risk of accidents—and those who study under its influence are likely to remember little.

Some habitual cannabis users become psychologically addicted to its pleasurable effects. They 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, 2005). On a more positive note, cannabis has some medical uses, especially in treating nausea associated with chemotherapy and in reducing pressure in the eye associated with glaucoma. Needless to say, its use, even under prescription, is controversial.

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, 2007). Neuroscientists have discovered cannabis receptors in many parts of the brain, too (Nicoll & Alger, 2004; Wilson & Nicoll, 2002). This strongly suggests that the brain makes its own THC-like chemicals, which it uses to modulate information flow. Thus, 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.

An evolutionary perspective suggests that the brain's own cannabis must also have some beneficial function. Following this lead, a few neuroscientists are exploring just what the brain's "natural marijuana," more properly termed *endocannabinoids,* does for us. The hope, therefore, is for new therapies for a variety of human afflictions linked to the brain loci that respond to THC. These include circuits implicated in the control of appetite, pain, nausea, and addiction. Perhaps this research will lead to new treatments for obesity, chronic pain, the nausea produced by chemotherapy, and addiction to heroin and methamphetamine. Such treatments may not involve ingestion of cannabanoids themselves but drugs that regulate the body's use of its own endocannabinoids (Marx, 2006; Nicoll & Alger, 2004).

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. As a result, some of these drugs have found wide use in medicine, where they have particularly good analgesic (pain-relieving) properties and also serve as cough suppressants. (The only other medical use for opiates is in managing diarrhea.)

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, in the absence of pain, 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 for pleasure. To avoid the intense cravings and painful sensations 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.

In recent years, several opiate-based drugs have come on the market, under the brand names OxyContin, Vicodin, Darvon, Percodan, and Demerol. Medically, they are effective painkillers, although their potential for addiction is high in chronic users. Unfortunately, because they produce the same feel-good effects as other opiates, they are also widely abused.

Opiate Highly addictive drug, derived from opium, that can produce a profound sense of well-being and have strong pain-relieving properties.

Like marijuana, the opiates have special receptor sites in the brain. The discovery of these opiate receptors led to the realization that the brain makes its own opiates, the *endorphins,* which act as the body's natural analgesics, or painkillers. This research stimulated a quest for drugs that have the same pain-fighting qualities as opiates but without their addictive properties. The hope is, so far, unfulfilled.

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 it 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 & Antianxiety Drugs The broad class of drugs that slow the mental and physical activity of the body by inhibiting activity in the central nervous system is collectively known as **depressants.** (Depressants don't necessarily make people feel clinically depressed, in the sense of "sad.") By inhibiting the transmission of messages in the central nervous system, depressants slow down the mental and physical activity of the body. They include *barbiturates* (usually prescribed for sedation), *benzodiazepines* (antianxiety drugs), and *alcohol* (a social stimulant and nervous system depressant). In appropriate dosages, these drugs can relieve symptoms of pain or anxiety, but overuse or abuse is dangerous because they 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 interfering with REM-sleep. This leaves the user feeling unrested, despite a full night's slumber. 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).

Benzodiazepines (pronounced *BEN-zo-dye-AZ-a-peens*), commonly prescribed to treat anxiety, are safer than barbiturates. Physicians frequently prescribe them to calm patients' anxieties, 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.)

CONNECTION • CHAPTER 13
Benzodiazepines are used to treat anxiety-related problems, such as *panic disorder* and *obsessive–compulsive disorder*.

While most 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).

Depressant Drug that slows down mental and physical activity by inhibiting transmission of nerve impulses in the central nervous system.

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 initially depresses activity in the brain circuits that 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 (a form of benzodiazepine sometimes known as 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 small doses can induce relaxation and even slightly improve an adult's reaction time. In just 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 some parts of the United States, this level of blood alcohol qualifies a driver as being legally drunk. (Most states, in fact, set a somewhat lower limit of 0.08% as the legal threshold for drunkenness.)

Distillers, brewers, and wine makers spend millions of dollars annually promoting 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. To some extent, the problem is rooted in our genes—but genetics is far from the whole answer (Nurnberger & Bierut, 2007). People also *learn* to abuse alcohol, often in response to social pressure. Eventually, physical dependence, tolerance, and addiction 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 interferes with job or school performance, impairs social and family relationships, and creates serious health problems, the diagnosis of *alcoholism* is appropriate (see Julien, 2007; Vallee, 1998).

Abuse of alcohol has become a significant problem for more than 17 million Americans (Adelson, 2006; Grant & Dawson, 2006). The effects of the problem are much more widespread, however. For example, alcohol ingested by a pregnant woman can affect the fetus. In fact, alcohol use by expectant mothers is a leading cause of mental retardation (Committee on Substance Abuse, 2000). Alcohol abuse can affect other family members, too. In fact, some 40% of Americans see the effects of alcohol abuse in their families (Vallee, 1998). Among Americans, the problem is especially prevalent among white males and young adults. Too often the problem becomes a lethal one, because alcohol-related automobile accidents are the leading cause of death in the 15-to-25 age group.

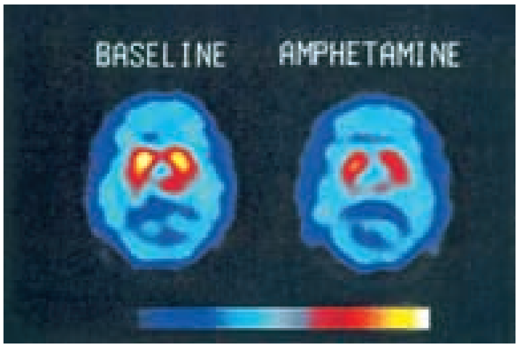
Physical dependence, tolerance, and addiction to alcohol may begin with social pressure and binge drinking—as seen in this student who readies himself to drink from an ice luge at a party.

Stimulants In contrast with depressants, **stimulants** speed up central nervous system activity. The result is a boost in both mental and physical activity level, which is why long-distance truck drivers sometimes use them to stay awake behind the wheel. Paradoxically, stimulants can also increase concentration and reduce activity level, particularly in hyperactive children with attention-deficit/hyperactivity disorder (ADHD). Physicians also prescribe them for narcoleptic patients, to prevent sleep attacks.

Stimulant A drug that arouses the central nervous system, speeding up mental and physical responses.

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 stimulants seek still other effects: intense pleasurable sensations, increased self-confidence, and euphoria. *Cocaine,* in particular, packs



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.

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 also wears off quickly. Amphetamine (often called "speed") and related drugs have effects comparable to cocaine. Among these, a particularly notorious variant known as *methamphetamine* came into widespread use during the 1990s. Use of "meth" can lead to severe health problems, including physical damage in the brain.

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 closeness to others (Thompson et al., 2007; Young, 2007). It is also known for energizing young users to dance for hours, sometimes leading to convulsions, death, and other unpleasant consequences (Gahlinger, 2004; Yacoubian et al., 2004). Ecstasy produces increased blood pressure and heart rate, hyperthermia (elevated temperature), and dehydration. Long-term use is also known to impair attention, learning, and memory, probably through impairment of serotonin-using neurons (Levinthal, 2008; Verbaten, 2003).

Stimulant drugs hold other dangers, as well. Heavy amphetamine and cocaine users may experience frightening hallucinations and paranoid delusions—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 such 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, 1997).

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

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 ten 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. 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, carrying a human cost of about 438,000 deaths annually (Centers for Disease Control, 2007). 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 45 million adult Americans still smoke. Most worrisome is the fact that more than 3 million teenagers smoke, and their numbers are increasing by about 4000 who start every day (Gardyn & Wellner, 2001; Julien, 2007).

General anesthetic Substance that suppresses consciousness and awareness of pain. Most anesthetics also produce sedation and immobility.

The Altered States of Anesthesia While anesthetics have come a long way in the 160 years since the discoveries of chloroform and ether, science has relatively little knowledge of how **general anesthetics** alter consciousness and suppress awareness of pain (Orser, 2007). Although anesthetized people appear to "go to sleep," general anesthesia is quite different from sleep. Anesthesia involves none of the REM and NREM stages that we associate with sleep, even though it induces these sleep-like components: *sedation* (greatly reduced arousal), *unconsciousness* (lack of awareness and responsiveness), *immobility* (temporary paralysis), and *amnesia* (lack of recall for the period under the influence of the anesthetic). Strangely, these four components of anesthesia seem to be independent of one another. For example, conscious patients often carry on lively conversations as they "go under"—yet they rarely have a memory of these events.

One tentative theory suggests that anesthetics interrupt the process by which different parts of the brain work together, or "synchronize," thereby preventing consciousness. They may do so by mimicking or enhancing the action of GABA, one of the brain's main inhibitory neurotransmitters. In this respect, we can think of anesthetics as just another group of psychoactive drugs that interfere with consciousness.

PSYCHOLOGY MATTERS

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. Incidentally, the same has recently been suggested about the steroids that some athletes use (Adelson, 2005). Once in your brain, such drugs 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.

CONNECTION • CHAPTER 2

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

Significantly, a given dose of many psychoactive drugs begins 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. Some scientists believe that the desire to avoid withdrawal is as important as the pleasurable effects of drugs in producing *addiction* (Everitt, 2006).

A person who develops tolerance to a highly 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.

Addiction is not all physical, however. When heroin addicts routinely "shoot up" in the same environment—say, in the bathroom—a *learned* response actually anticipates the drug and prepares the body for it. The result is that the addict can tolerate dosages that are larger than when the drugs are injected at a novel location (Dingfelder, 2004b). Overdoses may occur if the user attempts to shoot up with his or her "usual amount" in a novel location.

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.

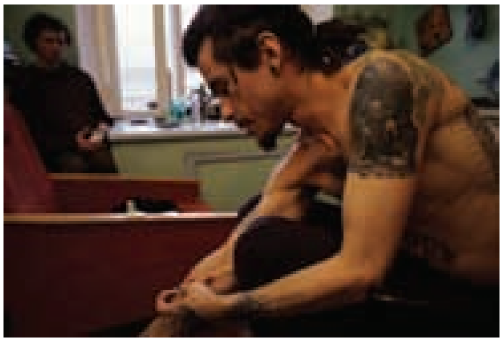
Individuals may find themselves craving or hungering for the drug and its effects, even though they are not physically dependent—a condition known as

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.

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.



The line between substance use and abuse is easy to cross with addictive drugs, most of which act on the brain's "pleasure centers."

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

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 (Nestler & Malenka, 2004). 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 it make whether or not we label addiction a "disease"? 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).

Treatment programs have an especially poor record with heroin addicts who have picked up their habits on the streets of the United States. In contrast, treatment has been more successful with the thousands of veterans who became addicted to the heroin that was readily available to troops during the war 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. On the other hand, heroin users who become addicted at home tend to return, after treatment, to the same environment that originally led to their addiction.

Whether it be physical or psychological, a disease or a 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.

CheckYourUnderstanding

1. **RECALL:** What does the evidence show concerning hypnosis as a distinct state of consciousness?
2. **RECALL:** What are the physical changes associated with meditation?
3. **RECALL:** Psychoactive drugs usually create their effects by stimulating _____ in the brain.
4. **RECALL:** Most hallucinogens act on brain sites that involve the neurotransmitter _____.
5. **SYNTHESIS:** In what respect are the opiates like cannabis?
6. **APPLICATION:** Which of the following groups of drugs have the opposite effects on the brain?
   a. hallucinogens and stimulants
   b. opiates and sedatives
   c. stimulants and depressants
   d. depressants and opiates
7. **RECALL:** Why do many psychologists object to the "disease model" of addiction?
8. **UNDERSTANDING THE CORE CONCEPT:** Altered states do not involve any mysterious or paranormal phenomena. Rather they are modifications of ordinary consciousness that we can study with the tools of science, because they are produced by _____.

Answers **1.** No solid evidence to date shows that hypnosis is a unique state of consciousness. **2.** Many physical changes occur with meditation, including changes in brain-wave patterns, frontal lobe changes associated with positive emotions, beneficial changes in blood pressure and stress hormones, and, over time, increased thickness of the brain's cortex. **3.** reward circuits (so called "pleasure centers") **4.** serotonin **5.** Both have specific receptor sites in the brain. **6.** c **7.** The disease model tends to emphasize biological causes and medical treatment at the expense of recognizing the social and economic context in which addictions develop. **8.** mental, behavioral, or physical changes in the person

Critical Thinking Applied: The Unconscious—Reconsidered

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*) traumatic memories and destructive urges (Freud, 1925). If allowed to break through into consciousness, these would cause extreme anxiety, Freud taught. In this view, the unconscious mind, then, serves as a mental dungeon where terrible needs 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 one man's internal and unconscious struggle with the most evil of desires for power, destruction, and death. Unconscious desires can be sexual, as well, said Freud. 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? Or were Freud's ideas better as metaphors than as objective science?

What Are the Issues?

Freud's theory can explain almost anything—and in very compelling language. He portrayed a mind perpetually locked in an internal struggle against itself. In fact, we can see evidence all around us of the sexual and aggressive urges that loomed so important in his theory: in advertising, in video games, in movies, in politics, and in the ways people fight and flirt. So the issue is not whether sexual and aggressive urges influence human behavior but whether these urges operate as Freud suggested: primarily at an unconscious level and in a mind that is continually in conflict with itself.

What Critical Thinking Questions Should We Ask?

Without a doubt, Freud was a perceptive observer of people and a creative theorist, and his views have been enormously influential. But his genius and his influence don't necessarily make his views correct. For example, his seeming obsession with sex makes sense in the context of the rigid and "proper" culture of early 20th century Europe, which frowned on public references to sexuality. (In some quarters, the term *leg* was considered inappropriate for mixed company.) Thus, we should consider whether the seething sexual cauldron of desire that was the Freudian unconscious might be the result of biases in Freud's thinking—biases produced not by the unconscious but by the sexually uptight culture of which he was a part. As we noted earlier, Freud may have been guilty of *confirmation bias*.

In fact, Freud seemed to find evidence of the unconscious everywhere: in dreams, forgetting, slips of the tongue and other everyday errors, developmental stages of childhood, and mental disorders. So perhaps he was also guilty of the common logical fallacy, known as *begging the question:* assuming the very thing one is trying to prove. We suggest that Freud begs the question by assuming that unconscious conflict is the cause of all the mental phenomena he describes—from forgetting an anniversary to a fear of dogs to having a dream about flying. Why is this a logical fallacy? Because Freud's argument is also an attempt to prove the existence of a conflicted unconscious. He even suggested that resistance to his arguments is evidence of the unconscious at work! Such arguments are sometimes called *circular reasoning*.

But we can question Freud and still respect his brilliance and his stature. After all, he developed an amazingly comprehensive and appealing theory of mind in the early days of the 20th century—long before brain scans and the other tools of modern psychology were available. Almost certainly, some of his ideas had to be erroneous in light of newer knowledge. The important question, then, is whether Freud's concept of consciousness and the unconscious mind is still reasonable in view of the evidence psychology has accumulated since Freud's time. Let's take a brief look at some of that evidence and see where it leads us.

What Conclusions Can We Draw?

You will recall that the study of dreams in Trobriand Islanders failed to support Freud's contention that young boys see their fathers as rivals for their mothers' affections. Moreover, from the perspective of 21st-century Europe and North America, with sexual content quite common in conversation and in the media, we have no reason to believe that sexual thoughts are mostly unconscious. If anything, many people seem consciously preoccupied with sex. This does not mean, of course, that the unconscious does not exist. But it does raise questions about the unconscious as Freud envisioned it.

As critical thinkers, we must be careful not to commit the fallacy often described as "throwing the baby out with the bath water." That is, we do not need to reject the concept of an unconscious altogether. In fact, as you will see in the next chapter, the unconscious plays a huge role in our motivations and emotions.

In recent years, techniques such as brain scans and priming have made it possible to probe unconscious thought processes in ways never dreamed of by Freud (Kihlstrom, 1990; Kihlstrom et al., 1992). In the resulting picture, the unconscious does not appear so sinister as Freud portrayed it. In fact, it has a much simpler structure than the complicated censoring and repressing system that Freud proposed (Greenwald, 1992).

Brain scans support this newer perspective on unconscious mental activity, suggesting that many parts of the brain can operate outside of consciousness. Most of this activity is devoted to simple background tasks, such as maintaining body temperature and controlling hunger and thirst. In addition, the brain performs a preconscious screening on the incoming stream of sights, sounds, smells, and textures. This screening also provides a quick-and-dirty appraisal of events for their attractiveness or harmfulness (LeDoux, 1996). Such unconscious processing can even save your life, as when you react "without thinking" to a swerving car coming at you.

But this is not the picture of a scheming, and plotting unconscious, full of sinister urges that must be vented (Baumeister, 2005; Wilson, 2002). Rather, the less-than-conscious mind seems to work, for the most part, in concert with consciousness, rather than against it—although, when we discuss mental disorders, we will see that a fearful experience can sometimes leave a lasting mark on the unconscious screening process that is difficult to eradicate.

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 even Freud originally conceived.

Chapter Summary

8.1 How Is Consciousness Related to Other Mental Processes?

Core Concept 8.1: The brain operates on many levels at once—both conscious and unconscious.

Consciousness represents one of the major mysteries of psychology, both in its ordinary waking state and in its many *altered states*. Consciousness involves both **attention** and *working memory*. The behaviorists rejected consciousness as a topic too subjective for scientific study, but cognitive neuroscience has shown that scientific methods can be applied to consciousness, using both psychological techniques and brain scanning technology.

Psychologists have used various metaphors for consciousness. James spoke of a "stream of consciousness"; Freud likened consciousness to an iceberg. The modern cognitive perspective uses a **computer metaphor.**

Consciousness involves at least three important factors: restricted attention, widespread connections among diverse areas of the brain, and an internal mental model of the world that is used in thinking. 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. While consciousness is limited to serial processing, the mind can process information nonconsciously in parallel channels. Patients in a **coma** lack consciousness, as well as most unconscious brain processes. Comas are short-term states that transition into either a *minimally conscious state* or a *persistent vegetative state*.

Because consciousness is limited, students using their knowledge of consciousness will employ study methods that facilitate the passage of information from consciousness into long-term memory, so that it remains accessible to consciousness. All such techniques involve making the material meaningful.

Attention (p. 337)
Cognitive neuroscience (p. 338)
Coma (p. 342)
Consciousness (p. 337)
Nonconscious process (p. 338)
Preconscious (p. 341)
Unconscious (p. 342)

MyPsychLab Resources 8.1:

Simulation: Mental Rotation

8.2 What Cycles Occur in Everyday Consciousness?

Core Concept 8.2: Consciousness changes in cycles that correspond to our biological rhythms and to the patterns of stimulation in our environment.

Consciousness shifts and changes in everyday life, commonly taking the form of daydreaming, sleep, and nocturnal dreams. **Daydreaming** is probably the default status of the waking brain and the source of much human creativity. Attempts to keep unwanted ("white bear") thoughts out of daytime reveries may have the unwanted effect of encouraging such thoughts.

Although the function of *sleep* is not altogether clear, everyone agrees that sleep and wakefulness are part of the **circadian rhythms.** Too little sleep incurs a **sleep debt,** which impairs mental functioning. Sleep researchers have revealed the features of the normal *sleep cycle,* including the four *stages of sleep,* as revealed by recordings of brain waves on the EEG. These sleep stages recur in 90-minute cycles, featuring 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, accompanied by **sleep paralysis.** Dreams have, however, always been a source of inspiration and creativity for humankind in cultures around the world. Among theories of dreams, Freud's has probably been the most influential—although it has little empirical support. Studies show that dreams vary by culture, gender, and age, often in contradiction to Freud. Many theories suggest that dreams are meaningful events, and research shows that they often involve problems of the previous day; **activation-synthesis theory** claims that dreams are essentially meaningless. Recent studies suggest that dreams may help in the consolidation of memory.

Abnormalities 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, bedwetting,* and *sleepwalking.*

Activation-synthesis theory (p. 353)
Circadian rhythm (p. 345)
Daydreaming (p. 344)
Insomnia (p. 354)
Latent content (p. 351)
Manifest content (p. 351)
Narcolepsy (p. 356)
Night terrors (p. 355)
Non-REM (NREM) sleep (p. 346)
REM rebound (p. 348)
REM sleep (p. 346)
Sleep apnea (p. 354)
Sleep debt (p. 349)
Sleep paralysis (p. 346)

MyPsychLab Resources 8.2:

Explore: Theories of Dreaming

Watch: Roberta: Insomnia

8.3 What Other Forms Can Consciousness Take?

Core Concept 8.3: An altered state of consciousness occurs when some aspect of normal consciousness is modified by mental, behavioral, or chemical means.

Altered states of consciousness include hypnosis, meditation, and psychoactive drug states. **Hypnosis** remains especially puzzling as to whether it is a separate state of consciousness. Some scientists view it merely as a suggestible state; others see it as role playing or involving a "hidden observer." Cognitive psychologists have suggested it involves a shift in top-down processing. It is known to block pain, although it does not act like placebos. While hypnosis has many uses in therapy and research, one drawback is that not everyone can be deeply hypnotized.

Meditation has a long history in Asian and Pacific cultures, but has only recently been studied by psychologists. Likewise, experts dispute whether meditation is a distinct state of consciousness, even though it has measurable effects on arousal and anxiety, as well as producing changes in brain waves, blood pressure, and stress hormones.

Most **psychoactive drugs** produce sensations of pleasure and well-being that make these drugs especially attractive and potentially addictive. The **hallucinogens** (such as cannabis, mescaline, psilocybin, LSD, and PCP) generally affect receptor sites for serotonin. Distinct receptor sites for THC and for the **opiates** (including morphine, heroin, codeine, and methadone) suggest that the brain makes its own version of these substances. The **depressants** (including barbiturates, benzodiazepines, and alcohol) act to inhibit communication within the brain; many depressants are among the commonly abused drugs. Medically, the **barbiturates** are often prescribed for their sleep-inducing properties, while the **benzodiazepines** are used to treat anxiety. Most people use alcohol responsibly, although between 5 and 10% of American adults are problem drinkers. **Stimulants** (such as amphetamines, cocaine, and MDMA) are widely abused, although amphetamines are prescribed for ADHD. Caffeine and nicotine also act as stimulants. **General anesthetics** alter consciousness and suppress pain. Their effects are different from sleep. In general, they produce sedation, unconsciousness, immobility, and amnesia for events occurring during anesthesia.

Many psychoactive drugs can lead to **addiction.** One indication of this potential is increased **tolerance;** another is **physical dependence,** marked by **withdrawal symptoms.** Some drugs that are not physically addicting produce **psychological dependence.** Although addiction has been characterized as a *disease,* some psychologists believe that the disease model of addiction is short-sighted.

Addiction (p. 367)
Depressant (p. 364)
General anesthetic (p. 366)
Hallucinogen (p. 361)
Hypnosis (p. 357)
Meditation (p. 359)
Opiate (p. 363)
Physical dependence (p. 367)
Psychoactive drug (p. 360)
Psychological dependence (p. 368)
Stimulant (p. 365)
Tolerance (p. 367)
Withdrawal (p. 367)

MyPsychLab Resources 8.3:

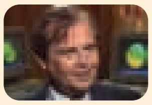
Simulation: Hypnosis

Watch: Hypnosis

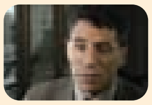
Watch: Kathy: Substance Abuse

Discovering Psychology Viewing Guide

Watch the following videos by logging into MyPsychLab (www.mypsychlab.com). After you have watched the videos, complete the activities that follow.



PROGRAM 13: THE MIND AWAKE AND ASLEEP



PROGRAM 14: THE MIND HIDDEN AND DIVIDED

PROGRAM REVIEW

1. Which of the following is an example of a circadian rhythm?
   a. eating three meals a day at approximately the same time
   b. experiencing alternate periods of REM and non-REM sleep
   c. having systematic changes in hormone levels during 24 hours
   d. having changes in fertility levels during a month
2. What is a positive function of daydreaming?
   a. It focuses attention on a task.
   b. It reduces demands made on the brain.
   c. It enables us to be mentally active when we are bored.
   d. It provides delta wave activity normally received only in sleep.
3. According to Freud, dreams are significant because they
   a. permit neurotransmitters to be regenerated.
   b. reveal unconscious fears and desires.
   c. forecast the future.
   d. supply a story line to patterns of electrical charges.
4. According to McCarley and Hobson, what is true about REM sleep?
   a. Adults spend more time in REM sleep than do infants.
   b. REM sleep is an unnecessary physiological function.
   c. The random burst of brain activity occurs first, followed by the dreamer's attempt to make sense of it.
   d. The subconscious expresses its deepest desires during REM sleep.
5. According to Freud, how do we feel when painful memories or unacceptable urges threaten to break into consciousness?
   a. relieved
   b. guilty
   c. sad
   d. anxious
6. What are Freudian slips thought to reveal?
   a. what we have dreamed about
   b. how we really feel
   c. who we would like to be transformed into
   d. why we make certain choices
7. What happens if a hypnotized person who expects to smell cologne actually smells ammonia?
   a. The ammonia smell wakes him from the trance.
   b. He recognizes the ammonia smell, but he remains hypnotized.
   c. He interprets the ammonia smell as a musky cologne.
   d. He overgeneralizes and finds the cologne smells like ammonia.
8. All of the following appear to fluctuate based on circadian rhythm, except
   a. intelligence.
   b. hormone levels.
   c. blood pressure.
   d. body temperature.
9. Consciousness performs all of the following functions, except
   a. filtering sensory data.
   b. enabling us to respond flexibly.
   c. allowing us to have a sense of our own mortality.
   d. guiding performance of highly routinized actions.
10. What occurs about every 90 minutes throughout sleep?
    a. rapid eye movement
    b. rapid irregular changes in brain activity
    c. dreaming
    d. more than one of the above

11. How normal is it to experience alternate states of consciousness?
    a. It happens to most people, mainly in times of stress.
    b. It is something we all experience every day.
    c. It is rare and generally indicates a mental disorder.
    d. It is common in childhood and becomes rarer with age.
12. In the program, the part of the brain that is identified as the "interior decorator" imposing order on experience is the
    a. pons.
    b. hippocampus.
    c. limbic system.
    d. cerebral cortex.
13. Ernest Hartmann points out the logic behind Shakespeare's description of sleep. According to Hartmann, a major function of sleep is that it allows the brain to
    a. process material too threatening to be dealt with consciously.
    b. integrate the day's events with previously learned material.
    c. make plans for the day ahead.
    d. discharge a buildup of electrical activity.
14. Which part of the brain is responsible for conscious awareness?
    a. cerebral cortex
    b. brain stem
    c. limbic system
    d. hypothalamus
15. When societies around the world were studied, what proportion of them practiced some culturally patterned form of altering consciousness?
    a. practically none
    b. about a third
    c. about half
    d. the vast majority
16. Instances in which people believe they have remembered long-forgotten traumatic events are known as
    a. repression.
    b. suppression.
    c. recovered memories.
    d. fugue states.
17. Sigmund Freud is to the unconscious as _________ is to discovered memories.
    a. B. F. Skinner
    b. Jonathan Schooler
    c. Michael Gazzaniga
    d. Stephen LaBerge
18. According to Freud, normal people banish undesirable memories from their conscious minds through
    a. repression.
    b. projection.
    c. anterograde amnesia.
    d. hysteria.
19. Which topic related to human consciousness is conveyed by the story of Dr. Jekyll and Mr. Hyde?
    a. witchcraft
    b. hypnosis
    c. identity transformation
    d. sleep disorders
20. Communication between the two hemispheres of the brain is disrupted when
    a. a person is in deep meditation.
    b. a person is in deep Freudian denial.
    c. a person has just recovered an early memory.
    d. the corpus callosum is severed.

QUESTIONS TO CONSIDER

1. How do you experience REM rebound effects when you have been deprived of sleep? Do you begin dreaming soon after falling asleep? Do you experience vivid visual imagery when you are awake?
2. Changes in perceptions, time sense, memory, feelings of self-control, and suggestibility are aspects of an altered state of consciousness. Would you consider illness, love, or grief to be altered states of consciousness?
3. Psychoactive drugs are only partially responsible for the changes in the drug taker's consciousness. Mental sets, expectations, and the context in which the drugs are taken can also have significant influences. What are the implications for alcohol and drug education and treatment?
4. Do you consider television or other electronic media to have mind-altering influence? What do they have in common with other mind-altering substances or experiences? Are children more susceptible to these effects than adults?
5. Do you think you could benefit from hypnosis or meditation? Do you believe you could easily enter these states? If someone finds it difficult to become hypnotized or to meditate, would you advise the person that it is worth the effort of learning? And how would you suggest he or she learns?

ACTIVITIES

1. Keep a pad and pencil by your bed and start a dream journal. Just before you fall asleep, remind yourself to remember your dreams. Immediately

after awakening, record what you remember: images, actions, characters, emotions, events, and settings. Does your ability to recall your dreams improve over time? Does this change if you set your alarm for different times during the sleep cycle? Does your recall become more vivid or more organized? Can you shape your dreams by telling yourself at bedtime what you want to dream about?

2. Use this visualization technique to achieve a state of relaxation and, perhaps, alter your consciousness. Select a quiet place where you won't be interrupted. Choose a scene in which you have been very relaxed. To help you create a good mental picture, recall all the sensations that enhance in you a feeling of deep calm. Focus on the scene for 15 to 30 minutes. Practice this visualization exercise several times over a period of a few weeks. With practice, calling up the visual image may trigger a sensation of calm whenever you want it to.

3. Go on the Internet and look up various cultures, religions, and communities that practice altered states of consciousness. See if you can develop any insights into what aspects of their art, social interaction, and values appear to be influenced by such practices.