Unit Overview

We take our consciousness for granted. We like to think we are conscious and psychologically “present” at any given point in our day and confuse our wakefulness with our being conscious. Yet, our consciousness is not just being aware or being awake. Being conscious involves a complex mix of different levels of awareness and wakefulness—it even includes times during which we are not aware or even awake! This unit explores several types of consciousness beyond our being aware and awake: hypnosis, sleep, and psychoactive drug effects. Each state of consciousness has its own biological and psychological effects on our awareness and wakefulness. We consider each a different state of consciousness, but we do process information and can even solve problems in these “altered” states. So are we awake and aware even when we are not? This unit helps us start to answer that question. After reading this unit, students will be able to:

- Describe how people have been fascinated with the study of consciousness throughout history.
- Define hypnosis and how the process generally works.
- Debate whether hypnosis is an altered state of consciousness.
- Describe how the body’s biological rhythms influence daily life.
- Outline the different stages of sleeping and dreaming.
- Analyze the different biological and environmental influences on our sleep patterns.
- Explain why sleep is important.
- Evaluate the effects of sleep loss.
- Identify major sleep disorders.
- Understand common dream content.
- Explain why we might dream.
- Describe how tolerance and addiction work physiologically and psychologically.
- Understand common misconceptions about addiction.
- Identify and describe the effects of depressants.
- Identify and describe the effects of stimulants.
- Identify and describe the effects of hallucinogens.

Alignment to AP® Course Description

Topic 5: States of Consciousness (2–4% of AP® Examination)

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Unit Resources

**Module 22**

**STUDENT ACTIVITY**
- Fact or Falsehood?
- The Creative Imagination Scale
- Hypnosis as Heightened Suggestibility

**TEACHER DEMONSTRATIONS**
- Hypnosis—A Stage Demonstration
- The Relaxation Response

**FLIP IT VIDEO**
- Theories of Hypnosis

**Module 23**

**STUDENT ACTIVITIES**
- The Sleep IQ Test
- Remembering Daydreams
- Sleep Deficit Scale
- Keeping a Sleep Diary

**FLIP IT VIDEO**
- REM Sleep

**Module 24**

**STUDENT ACTIVITIES**
- Fact or Falsehood?
- School Start Times: An Informal Debate
- Visiting SleepNet
- Sleep Profile
- Sleep Strategies
- Dream Journal

**FLIP IT VIDEO**
- Why Do We Dream?

**Module 25**

**STUDENT ACTIVITIES**
- Fact or Falsehood?
- Signs of Drug Abuse
- Eyescube Drug Addiction Simulation
- The Internet Addiction Test
- Blood Alcohol Concentrations

**FLIP IT VIDEOS**
- The Psychology of Addiction
- Neurotransmitters and Drugs
States of Consciousness

Modules

22 Understanding Consciousness and Hypnosis
23 Sleep Patterns and Sleep Theories
24 Sleep Deprivation, Sleep Disorders, and Dreams
25 Psychoactive Drugs

Consciousness can be a funny thing. It offers us weird experiences, as when entering sleep or leaving a dream, and sometimes it leaves us wondering who is really in control. After zoning me out with nitrous oxide, my dentist tells me to turn my head to the left. My conscious mind resists: "No way," I silently say. "You can't boss me around!" Whereupon my robotic head, ignoring my conscious mind, turns obligingly under the dentist's control.

During my noontime pickup basketball games, I am sometimes mildly irritated as my body passes the ball while my conscious mind is saying, "No, stop! Sarah is going to intercept!" Alas, my body completes the pass. Other times, as psychologist Daniel Wegner (2002) noted in The Illusion of Conscious Will, people believe their consciousness is controlling their actions when it isn't. In one experiment, two people jointly controlled a computer mouse. Even when their partner (who was actually the experimenter's accomplice) caused the mouse to stop on a predetermined square, the participants perceived that they had caused it to stop there.

Then there are those times when consciousness seems to split. Reading Green Eggs and Ham to one of my preschoolers for the umpteenth time, my obliging mouth could say the words while my mind wandered elsewhere. And if someone asks what you’re doing for lunch while you’re texting, it’s not a problem. Your thumbs complete the message as you suggest getting tacos.

What do such experiences reveal? Was my drug-induced dental experience akin to people’s experiences with other psychoactive drugs (mood- and perception-altering substances)? Was my automatic obedience to my dentist like people’s...
TEACH

Discussion Starter

Use the Module 22 Fact or Falsehood? activity from the TRM to introduce the concepts from this module.

TEACH

Common Pitfalls

Help students see that what we know about unconscious processing is different from Freud’s ideas about the unconscious mind. Freud described the unconscious as a repository of childhood experiences that influenced behavior without our conscious knowledge. The modern understanding of the unconscious views it as a parallel processing system that enables us to deal with all sorts of information and stimuli outside the conscious. This system helps us to be more cognitively efficient.

TEACH

Concept Connections

Be sure students understand the content presented in Unit III about the two-track mind and Unit IV about selective attention. The study of the brain and consciousness demonstrates that we are able to process many kinds of information at the same time, with much of it processed unconsciously.

Module 22

Understanding Consciousness and Hypnosis

Module Learning Objectives

22-1 Describe the place of consciousness in psychology’s history.

22-2 Define hypnosis, and describe how a hypnotist can influence a hypnotized subject.

22-3 Discuss whether hypnosis is an extension of normal consciousness or an altered state.

Defining Consciousness

What is the place of consciousness in psychology’s history?

At its beginning, psychology was “the description and explanation of states of consciousness” (Ladd, 1887). But during the first half of the twentieth century, the difficulty of scientifically studying consciousness led many psychologists—including those in the emerging school of behaviorism (Module 26)—to turn to direct observations of behavior. By the 1960s, psychology had nearly lost consciousness and was defining itself as “the science of behavior.” Consciousness was likened to a car’s speedometer: “It doesn’t make the car go, it just reflects what’s happening” (Seligman, 1991, p. 24).

After 1960, mental concepts reemerged. Neuroscience advances related brain activity to sleeping, dreaming, and other mental states. Researchers began studying consciousness responses to a hypnotist? Does a split in consciousness, as when our minds go elsewhere while reading or texting, explain people’s behavior while under hypnosis? And during sleep, when do those weird dream experiences occur, and why? Before considering these questions and more, let’s ask a fundamental question: What is consciousness?
altered by hypnosis and drugs. Psychologists of all persuasions were affirming the importance of cogniton, or mental processes. Psychology was regaining consciousness.

Most psychologists now define consciousness as our awareness of ourselves and our environment. As we saw in Module 13, our conscious awareness is one part of the dual processing that goes on in our two-track minds. Although much of our information processing is conscious, much is unconscious and automatic—outside our awareness. Module 16 highlighted our selective attention, which directs the spotlight of our awareness, allowing us to assemble information from many sources as we reflect on our past and plan for our future. We are also attentive when we learn a complex concept or behavior. When learning to ride a bike, we focus on obstacles that we have to steer around and on how to use the brakes. With practice, riding a bike becomes semi-automatic, freeing us to focus our attention on other things. As we do so, we experience what the early psychologist William James called a continuous “stream of consciousness,” with each moment flowing into the next. Over time, we filter between different states of consciousness, including sleeping, waking, and various altered states (FIGURE 22.1).

Hypnosis

Imagine you are about to be hypnotized. The hypnotist invites you to sit back, fix your gaze on a spot high on the wall, and relax. In a quiet voice the hypnotist suggests, “Your eyes are growing tired. . . . Your eyelids are becoming heavy . . . now heavier and heavier . . . They are beginning to close . . . You are becoming more deeply relaxed . . . Your breathing is now deep and regular. . . . Your muscles are becoming more and more relaxed. Your whole body is beginning to feel like lead.”

After a few minutes of this hypnotic induction, you may experience hypnosis. When the hypnotist suggests, “Your eyelids are shutting so tight that you cannot open them even if you try,” it may indeed seem beyond your control to open your eyelids. Told to forget the number 6, you may be puzzled when you count 11 fingers on your hands. Invited to smell a sensuous perfume that is actually ammonia, you may linger delightedly over its pungent odor. Told that you cannot see a certain object, such as a chair, you may indeed report that it is not there, although you manage to avoid the chair when walking around (illustrating once again that two-track mind of yours).

But is hypnosis really an altered state of consciousness? Let’s start with some frequently asked questions.

Frequently Asked Questions About Hypnosis

Hypnotists have no magical mind-control power. Their power resides in the subjects’ openness to suggestion, their ability to focus on certain images or behaviors (Bowers, 1984). But how open to suggestions are we?

- How popular is hypnosis? Have any studies been conducted on its effectiveness?
- Are there concerns about the use of drugs during labor that would prompt women to choose hypnosis over drugs?
- Does self-hypnosis pose dangers? How does one come out of a self-hypnotic state? Are there liability issues or ethical obligations for doctors who advocate this practice?

TEACH

Teaching Tip

Point out the margin note about Unit VII’s coverage of reconstructed memories. It is a good idea to emphasize to students that memory is not a computer file that can be opened and reviewed at will. Memory is an active system that is reworked as memories are replayed in the conscious mind. Because of this fact, the claim that hypnosis enables the recall of memories with vivid detail is something to view with skepticism.

ENGAGE

Online Activities

What do contemporary researchers believe about hypnosis? For answers to this question, students can browse the Society for Psychological Hypnosis’s website www.apa.org/divisions/div30.

ENGAGE

TRM Enrichment

A stage hypnotist makes ready use of our openness to suggestion when announcing to audience members that they will begin to experience itching sensations on various parts of their bodies: the head . . . arms . . . back . . . legs. To underscore the suggestion, the performer may casually but not obtrusively scratch him- or herself. Before long, many in the audience will follow suit.

Use Teacher Demonstration: Hypnosis—A Stage Demonstration from the TRM to show students some techniques used for this type of entertainment.
Can anyone experience hypnosis? To some extent, we are all open to suggestion. When people stand upright with their eyes closed and are told that they are swaying back and forth, most will indeed sway a little. In fact, postural sway is one of the items assessed on the Stanford Hypnotic Susceptibility Scale. People who respond to such suggestions without hypnosis are the same people who respond with hypnosis (Kirsch & Braun, 2001).

Highly hypnotizable people—say, the 20 percent who can carry out a suggestion not to smell or react to a bottle of ammonia held under their nose—typically become deeply absorbed in imaginative activities (Barnier & McConkey, 2004; Silva & Kirsch, 1992). Many researchers refer to this as hypnotic ability—the ability to focus attention totally on a task, to become imaginatively absorbed in it, to entertain fanciful possibilities.

Can hypnosis enhance recall of forgotten events? Most people believe (wrongly, as Module 32 will explain) that our experiences are all “in there,” recorded in our brain and available for recall if only we can break through our own defenses (Lotus, 1980). But 60 years of memory research disputes such beliefs. We do not encode everything that occurs around us. We permanently store only some of our experiences, and we may be unable to retrieve some memories we have stored.

“Hypnotically refreshed” memories combine fact with fiction. Since 1980, thousands of people have reported being abducted by UFOs, but most such reports have come from people who are predisposed to believe in aliens, are highly hypnotizable, and have undergone hypnosis (Newman & Baumester, 1996; Nickell, 1996). Without either person being aware of what is going on, a hypnotist’s hints—“Did you hear loud noises?”—can plant ideas that become the subject’s pseudomemory.

So should testimony obtained under hypnosis be admissible in court? American, Australian, and British courts have agreed it should not. They generally ban testimony from witnesses who have been hypnotized (Druckman & Bjork, 1994; Gibson, 1995; McConkey, 1995).

Can hypnosis force people to act against their will? Researchers have induced hypnotized people to perform an apparently dangerous act: plunging one hand briefly into fuming “acid,” then throwing the “acid” in a researcher’s face (Orne & Evans, 1965). Interviewed a day later, these people emphatically denied their acts and said they would never follow such orders. Had hypnosis given the hypnotist a special power to control others against their will? To find out, researchers Martin Orne and Frederich Evans unleashed that enemy of so many illusory beliefs—the control group. Orne asked other individuals to pretend they were hypnotized. Laboratory assistants, unaware that those in the experiment’s control group had not been hypnotized, treated both groups the same. The result? All the unhypnotized participants (perhaps believing that the laboratory context ensured safety) performed the same acts as those who were hypnotized.

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Explaining the Hypnotized State

Is hypnosis an extension of normal consciousness or an altered state?

We have seen that hypnosis involves heightened suggestibility. We have also seen that hypnotic procedures do not endow a person with special powers but can sometimes help people overcome stress-related ailments and cope with pain. So, just what is hypnosis? Psychologists have proposed two explanations.

HYPNOSIS AS A SOCIAL PHENOMENON

Our attentional spotlight and interpretations powerfully influence our ordinary perceptions. Might hypnotic phenomena reflect such workings of normal consciousness, as well as the power of social influence (Lynn et al., 1998; Spanos & Coe, 1992)? Advocates of the social influence theory of hypnosis believe they do.

Does this mean that subjects consciously fake hypnosis? No—like actors caught up in their roles, they begin to feel and behave in ways appropriate for “good hypnotic subjects.”

The more they like and trust the hypnotist, the more they allow that person to direct their attention and fantasies (Giller et al., 1987). “The hypnotist’s ideas become the subject’s thoughts,” explained Theodore Barber (2000), “and the subject’s thoughts produce the hypnotic experiences and behaviors.” Told to scratch their ear later when they hear the word “hypnosis,” some subjects will likely do so—but only if they think the experiment is still under way. If an experimenter eliminates their motivation for acting hypnotized—by stating that hypnosis reveals their “gullibility”—subjects become unresponsive. Such findings support the idea that hypnotic phenomena are an extension of normal social and cognitive processes.

These views illustrate a principle that Module 75 emphasizes: An authoritative person in a legitimate context can induce people—hypnotized or not—to perform some unlikely acts. Or as hypnotism researcher Nicholas Spanos (1982) put it, “The overt behaviors of hypnotic subjects are well within normal limits.”

HYPNOSIS AS DIVIDED CONSCIOUSNESS

Other hypnotism researchers believe hypnosis is more than inducing someone to play the role of “good subject.” How, they ask, can we explain why hypnotized subjects sometimes carry out suggested behaviors on cue, even when they believe no one is watching (Braggini et al., 1998)? And why do distinctive brain activity accompany hypnotism (Oakley & Halligan, 2009)? In one

ENGAGE

Enrichment

Herbert Benson suggests that 4 basic components are necessary to elicit the relaxation response:

1. A quiet, calm environment with as few distractions as possible. A quiet room or place of worship would be suitable.
2. A mental device to prevent “mind wandering” (a sound, a word, or a phrase repeated silently or aloud). Attending to the normal rhythm of breathing is also useful.
3. A passive, “let-it-happen” attitude. Don’t worry about distracting thoughts or about how well you are doing. When distractions occur, simply return to repetition of the sound, word, or phrase.
4. A comfortable position to prevent muscular tension. A sitting position is probably best. If you lie down, you may fall asleep.

TEACH

Flip It

Students can get additional help understanding the different theories of hypnosis by watching the Flip It Video: Theories of Hypnosis.
ERNEST HILGARD

Active Learning
Divide students into groups, and have them research how hypnosis is portrayed in different types of movies and television shows. If possible, have them bring in clips to demonstrate their conclusions.

- How do legal shows and movies portray hypnosis?
- How do comedic and cartoon shows and movies portray hypnosis?
- Do either type of media cite the drawbacks or limitations of hypnosis? What claims are made about what hypnosis is capable of providing?

TEACH
Concept Connections
What other explanations can students come up with to explain hypnotic behavior? Have students research the following social psychology concepts related to the social influence theory. Students should apply their research by explaining orally or in writing how these concepts reinforce the social influence theory:

- Conformity
- Peer pressure
- Groupthink
- Social desirability

ENGAGE
Enrichment
Ernest Hilgard is considered to be one of the most influential psychologists of the 20th century. After joining the faculty at Stanford in 1933, he pursued many interests, one of which was hypnosis. Hypnosis was viewed largely as the tool of magicians and quacks, but Hilgard’s scientific studies of the phenomenon helped shed light on why it worked for some people and what applications were beneficial. He developed the Stanford Hypnotic Suggestibility Scale, which helped to standardize the study of hypnosis.

Experiment, deeply hypnotized people were asked to imagine a color, and areas of their brain activated as if they were really seeing the color. To the hypnotized person’s brain, mere imagination had become a compelling hallucination (Kosslyn et al., 2000). In another experiment, researchers invited hypnotizable and nonhypnotizable people to say the color of letters. This is an easy task, but it slows if, say, green letters form the conflicting word RED, a phenomenon known as the Stroop effect (Raz et al., 2005). When easily hypnotized people were given a suggestion to focus on the color and to perceive the letters as irrelevant gibberish, they were much less slowed by the word-color conflict (Brain areas that decode words and detect conflict remained inactive.)

These results would not have surprised famed researcher Ernest Hilgard (1986, 1992), who believed hypnosis involves not only social influence but also a special dual-processing state of dissociation—a split between different levels of consciousness. Hilgard viewed hypnotic dissociation as a vivid form of everyday mind splits—similar to doodling while listening to a lecture or typing the end of a sentence while starting a conversation. Hilgard felt that when, for example, hypnotized people lower their arm into an ice bath, as in Figure 22.2, the hypnosis dissociates the sensation of the pain stimulus (of which the subjects are still aware) from the emotional suffering that defines their experience of pain. The ice water therefore feels cold—very cold—but not painful.

Another form of dual processing—selective attention—may also play a role in hypnotic pain relief. PET scans show that hypnosis reduces brain activity in a region that processes painful stimuli, but not in the sensory cortex, which receives the raw sensory input (Rainville et al., 1997). Hypnosis does not block sensory input, but it may block our attention to those stimuli. This helps explain why an injured athlete, caught up in the competition, may feel little or no pain until the game ends.

Although the divided-consciousness theory of hypnosis is controversial, this much seems clear: There is, without doubt, much more to thinking and acting than we are conscious of. Our information processing, which starts with selective attention, is divided into simultaneous conscious and nonconscious realms. In hypnosis as in life, much of our behavior occurs on autopilot. We have two-track minds. (Figure 22.3.)

TEACH
Concept Connections
The problems of hypnotic suggestion have called into question the diagnosis of dissociative identity disorder (DID), formerly known as multiple personality disorder. Have students research the criticism against DID as a legitimate psychological disorder:

- What role does hypnosis play in this debate?
- What position has the American Psychiatric Association taken on this disorder? Is it still included in the current version of DSM? Are there plans to remove it from the manual?
Enrichment

Irving Kirsch and Steven Jay Lynn provide an excellent review of the literature on hypnosis, including the question of whether hypnosis produces an out-of-the-ordinary, trance-like, “altered” state of consciousness. Research indicates the following:

- The ability to be hypnotized does not indicate gullibility or weakness.
- Participants retain the ability to control their behavior during hypnosis.
- Spontaneous posthypnotic amnesia is relatively rare.
- Hypnosis is not a dangerous procedure when practiced by qualified researchers and clinicians.
- Hypnosis does not increase the accuracy of memory.
- Hypnosis does not foster a literal re-experiencing of childhood events.


CLOSE & ASSESS

Exit Assessment

Have students write a paragraph comparing and contrasting the 2 main theories of hypnosis. Ask them to decide which one is more convincing and why.
Multiple-Choice Questions

1. What do we call awareness of our environment and ourselves?
   a. Selective attention
   b. Hypnosis
   c. Posthypnotic suggestion
   d. Dissociation
   e. Consciousness

2. Which of the following is true about daydreaming?
   a. It occurs spontaneously.
   b. It is physiologically induced.
   c. It is psychologically induced.
   d. It is considered the same as waking awareness.
   e. It is more like meditation than it is like dreaming.

3. Which of the following states of consciousness occurs when one person suggests to another that certain thoughts or behaviors will spontaneously occur?
   a. Dreaming
   b. Hypnosis
   c. Daydreaming
   d. Hallucination
   e. Waking awareness

4. Which of the following is the term most closely associated with the split in consciousness that allows some thoughts and behaviors to occur simultaneously with others?
   a. Consciousness
   b. Hypnosis
   c. Hallucination
   d. Dissociation
   e. Meditation

Answers to Multiple-Choice Questions

1. e
2. a
3. b
4. d

Answer to Practice FRQ 2

1 point: Biological influence: either distinctive brain activity or unconscious information processing.

1 point: Psychological influence: focused attention, expectations, heightened suggestibility, or dissociation between normal sensations and conscious awareness.

1 point: Social-cultural influence: either presence of an authoritative person or role-playing a “good subject.”

Practice FRQs

1. Identify two states of consciousness that are psychologically induced and two that occur spontaneously.

Answer

1 point: For any two psychologically induced states: sensory deprivation, hypnosis, or meditation.

1 point: For any two spontaneously occurring states: daydreaming, drowsiness, or dreaming.

2. According to the biopsychosocial approach, identify a biological, a psychological, and a social-cultural influence on hypnosis.

(3 points)
Module 23

Sleep Patterns and Sleep Theories

Module Learning Objectives

23-1 Describe how our biological rhythms influence our daily functioning.
23-2 Describe the biological rhythm of our sleeping and dreaming stages.
23-3 Explain how biology and environment interact in our sleep patterns.
23-4 Describe sleep's functions.

Sleep—the irresistible tempter to whom we inevitably succumb. Sleep—the equalizer of teachers and teens. Sleep—sweet, renewing, mysterious sleep. While sleeping, you may feel “dead to the world,” but you are not. Even when you are deeply asleep, your perceptual window is open a crack. You move around on your bed, but you manage not to fall out. The occasional roar of passing vehicles may leave your deep sleep undisturbed, but a cry from a baby’s room quickly interrupts it. So does the sound of your name. Electroencephalograph (EEG) recordings confirm that the brain’s auditory cortex responds to sound stimuli even during sleep (Kutas, 1990). And when you are asleep, as when you are awake, you process most information outside your conscious awareness.

Many of sleep’s mysteries are now being solved as some people sleep, attached to recording devices, while others observe. By recording brain waves and muscle movements, and by observing and occasionally waking sleepers, researchers are glimpsing things that a thousand years of common sense never told us. Perhaps you can anticipate some of their discoveries. Are the following statements true or false?

1. When people dream of performing some activity, their limbs often move in concert with the dream.
2. Older adults sleep more than young adults.
3. Sleepwalkers are acting out their dreams.
4. Sleep experts recommend treating insomnia with an occasional sleeping pill.
5. Some people dream every night; others seldom dream.

All these statements (adapted from Palladino & Carducci, 1983) are false. To see why, read on.

Biological Rhythms and Sleep

Like the ocean, life has its rhythmic tides. Over varying periods, our bodies fluctuate, and with them, our minds. Let’s look more closely at two of those biological rhythms—our 24-hour biological clock and our 90-minute sleep cycle.

"I love to sleep. Do you? Isn’t it great? It really is the best of both worlds. You get to be alive and unconscious." - Comedian Rita Rudner, 1993
**ENgAGE**
Active Learning

There are actually 3 types of body rhythms:

- **Circadian rhythms** occur once each day. Our circadian rhythm spans 24 hours and is responsible for our varying levels of arousal throughout the course of a day.
- **Ultradian rhythms** occur more than once each day and include the cycles of appetite and hormonal release.
- **Infradian rhythms** occur once per month or season and include the menstrual cycle.

**ENgAGE**
Active Learning

Have students conduct a sleep survey with a representative sample of students at your school. They should ask how much sleep students get each night, whether they nap in class or feel extremely tired during the day, and why they may or may not get enough sleep each night.

Be sure to get approval from an institutional review board and obtain informed consent from subjects before embarking on any research project.

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**Circadian Rhythm**

How do our biological rhythms influence our daily functioning?

The rhythm of the day parallels the rhythm of life—from our waking at a new day’s birth to our nightly return to what Shakespeare called “death’s counterfeit.” Our bodies roughly synchronize with the 24-hour cycle of day and night by an internal biological clock, called the circadian rhythm (from the Latin circa, “about,” and dies, “day”). As morning approaches, body temperature rises, then peaks during the day, dips for a time in early afternoon (when many people take naps), and begins to drop again in the evening. Thinking is sharpest and memory most accurate when we are at our daily peak in circadian arousal. Try pulling an all-nighter or working an occasional night shift. You’ll feel groggier in the middle of the night but may gain new energy when your normal wake-up time arrives.

Age and experience can alter our circadian rhythm. Most teens and young adults are evening-energized “owls,” with performance improving across the day (May & Hasher, 1998). Most older adults are morning-loving “larks,” with performance declining as the day wears on. By mid-evening, when the night has hardly begun for many young adults, retirement homes are typically quiet. At about age 20 (slightly earlier for women), we begin to shift from being owls to being larks (Roenneberg et al., 2004). Women become more morning-oriented as they have children and also as they transition to menopause (Leonhard & Randler, 2009; Randler & Bausback, 2010). Morning types tend to do better in school, to take more initiative, and to be less vulnerable to depression (Randler, 2008, 2009; Randler & Fisch, 2009).

**Sleep Stages**

What is the biological rhythm of our sleeping and dreaming stages?

Sooner or later, sleep overtakes us and consciousness fades as different parts of our brain’s cortex stop communicating (Massimini et al., 2003). Yet the sleeping brain remains active and has its own biological rhythm.

About every 90 minutes, we cycle through four distinct sleep stages. This simple fact apparently was unknown until 8-year-old Armond Aserinsky went to bed one night in 1952. His father, Eugene, a University of Chicago graduate student, needed to test an electroencephalograph (EEG) he had repaired that day (Aserinsky, 1988; Seligman & Yellen, 1987). Placing electrodes near Armond’s eyes to record the rolling eye movements then believed to occur during sleep, Aserinsky watched the machine go wild, tracing deep zigzags on the graph paper. Could the machine still be broken? As the night proceeded and the activity recurred, Aserinsky had discovered what we now know as REM sleep. As he woke, he realized that the periods of fast, jerky eye movements were accompanied by energetic brain activity. Awakened during one such episode, Armond reported having a dream. Aserinsky had discovered what we now know as REM sleep (rapid eye movement sleep).

Similar procedures used with thousands of volunteers showed the cycles were a normal part of sleep (Kleitman, 1963). To appreciate these studies, imagine yourself as a participant. As the hour grows late, you feel sleepy and yawn in response to reduced brain metabolism. (Yawning, which can be socially contagious, stretches your neck muscles and increases your heart rate, which increases your alertness [Moorcroft, 2003].) When you are ready for bed, a
Understanding Consciousness and Hypnosis

Module 22

Teaching Tip

Use Figure 23.2 to help students identify the different types of brain waves characterizing the different stages of sleep. A diagram like this may show up on the AP® exam. Students could need to identify which waves correspond to each stage.

ENGAGE

TRM Enrichment

The waves people exhibit when they are awake and active are called beta waves. These are high-frequency, low-amplitude waves. Theta waves characterize the transition from NREM-1 to NREM-2. Theta waves are slower, so they have a higher amplitude and lower frequency than alpha waves, the type of waves that are present as we move from relaxation to deeper sleep.

Use Student Activity: Remembering Daydreams from the TRM to help students see that daydreams can be just as helpful to our lives as night dreams.

ENGAGE

Enrichment

Another type of wave found in sleep NREM-2 is the K-complex. As you can see in Figure 23.2, in NREM-2 there is a sharp upturn followed by a rapid downturn of the wave, which looks similar to a heartbeat pattern on an EKG. This wave is the precursor to the large delta waves that characterize NREM-3 sleep.

Sleep Patterns and Sleep Theories

Module 23

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A researcher comes in and tapes electrodes to your scalp (to detect your brain waves), on your chin (to detect muscle tension), and just outside the corners of your eyes (to detect eye movements) (FIGURE 23.1). Other devices will record your heart rate, respiration rate, and genital arousal.

When you are in bed with your eyes closed, the researcher in the next room sees on the EEG the relatively slow alpha waves of your awake but relaxed state (FIGURE 23.2). Alpha waves are high-frequency, low-amplitude waves. Theta waves characterize the transition from NREM-1 to NREM-2. Theta waves are slower, so they have a higher amplitude and lower frequency than alpha waves, the type of waves that are present as we move from relaxation to deeper sleep.

In one of his 15,000 research participants, William Dement (1999) observed the moment the brain’s perceptual window to the outside world slammed shut. Dement asked this sleep-deprived young man, lying on his back with eyelids taped open, to press a button every time a strobe light flashed in his eyes (about every 6 seconds). After a few minutes the young man missed one. Asked why, he said, “Because there was no flash.” But there was a flash. He missed it because (as his brain activity revealed) he had fallen asleep for 2 seconds, missing not only the flash 6 inches from his nose but also the awareness of the abrupt moment of entry into sleep.

Sleep researchers measure brain-wave activity, eye movements, and muscle tension by electrodes that pick up weak electrical signals from the brain, eye, and facial muscles. (From Dement, 1978.)

Waking Beta
Waking Alpha
REM
NREM-1
NREM-2
NREM-3 (Delta waves)

Figure 23.2

Brain waves and sleep stages

The beta waves of an alert, waking state and the regular alpha waves of an awake, relaxed state differ from the slower, larger delta waves of deep NREM-3 sleep. Although the rapid REM sleep waves resemble the more-waking NREM-1 sleep waves, the body is more aroused during REM sleep than during NREM sleep.

Left eye movements
Right eye movements
EMG (muscle tension)
EEG (brain waves)

Figure 23.1

Measuring sleep activity

Sleep researchers measure brain-wave activity, eye movements, and muscle tension by electrodes that pick up weak electrical signals from the brain, eye, and facial muscles. (From Dement, 1978.)

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During this brief NREM-1 sleep you may experience fantastic images resembling hallucinations—sensory experiences that occur without a sensory stimulus. You may have a sensation of falling (at which moment your body may suddenly jerk) or of floating weightlessly. These hypnagogic sensations may later be incorporated into your memories. People who claim to have been abducted by aliens—often shortly after getting into bed—commonly recall being floated off of or pinned down on their beds (Clancy, 2005).

You then relax more deeply and begin about 20 minutes of NREM-2 sleep, with its periodic sleep grunfts—bursts of rapid, rhythmic brain-wave activity (see Figure 23.2). Although you could still be awakened without too much difficulty, you are now clearly asleep.

Then you transition to the deep sleep of NREM-3. During this slow-wave sleep, which lasts for about 30 minutes, your brain emits large, slow delta waves and you are hard to awaken. Ever say to classmates, “That thunder was so loud last night,” only to have them respond, “What thunder?” Those who missed the storm may have been in delta sleep. (It is at the end of the deep, slow-wave NREM-3 sleep that children may wet the bed.)

REM SLEEP
About an hour after you first fall asleep, a strange thing happens. You start to leave behind the stages known as NREM sleep. Rather than continuing in deep slumber, you ascend from your initial sleep dive. Returning through NREM-2 (where you spend about half your night), you enter the most intriguing sleep phase—REM sleep (FIGURE 23.4). For about 10 minutes, your brain waves become rapid and saw-toothed, more like those of the nearly awake NREM-1 sleep. But unlike NREM-1, during REM sleep your heart rate rises, your breathing becomes regular and regular, and even half-minute or so your eyes dart around in momentary bursts of activity behind closed lids. These eye movements announce the beginning of a dream—often emotional, usually story-like, and richly hallucinatory. Because anyone watching a sleeper’s eyes can notice these REM bursts, it is amazing that science was ignorant of REM sleep until 1952.

**Concept Connections**

The device used to measure sleep waves is the EEG—electroencephalogram—which was discussed in Unit III. This device captures the electrical activity given off by the neurons as they fire action potentials. The speed with which the action potentials occur creates the brain wave patterns seen during wakefulness and sleep. Sleep researchers use other devices during sleep studies to measure eye movements and muscle activity to gain a better understanding of the physiology of sleep.
Except during very scary dreams, your genitals become aroused during REM sleep. You have an erection or increased vaginal lubrication, regardless of whether the dream’s content is sexual (Kataan et al., 1966). Men’s common “morning erection” stems from the night’s last REM period, often just before waking. Your brain’s motor cortex is active during REM sleep, but your brainstem blocks its messages. This leaves your muscles relaxed, so much so that, except for an occasional finger, toe, or facial twitch, you are essentially paralyzed. Moreover, you cannot easily be awakened. This immobility may occasionally linger as you awaken from REM sleep, producing a disturbing experience of sleep paralysis (Santomauro & French, 2009). REM sleep is thus sometimes called paradoxical sleep: The body is internally aroused, with waking-like brain activity; yet asleep and externally calm.

The sleep cycle repeats itself about every 90 minutes. As the night wears on, deep NREM-3 sleep grows shorter and disappears. The REM and NREM-2 sleep periods get longer (see Figure 23.4). By morning, we have spent 20 to 25 percent of an average night’s sleep—some 110 minutes—on REM sleep. Thirty-seven percent of people report rarely or never having dreams “that you can remember the next morning” (Moore, 2004). Yet even they will, more than 80 percent of the time, recall a dream after being awakened during REM sleep. We spend about 600 hours a year experiencing some 1500 dreams, or more than 100,000 dreams over a typical lifetime—dreams swallowed by the night but not acted out, thanks to REM’s protective paralysis.

What Affects Our Sleep Patterns?

How do biology and environment interact in our sleep patterns?

The idea that “everyone needs 8 hours of sleep” is untrue. Newborns often sleep two-thirds of their day, most adults no more than one-third. Still, there is more to our sleep differences than age. Some of us thrive with fewer than 6 hours per night; others regularly rack up 9 hours or more. Such sleep patterns are genetically influenced (Her & Taft, 2010). In studies of fraternal and identical twins, only the identical twins had strikingly similar sleep patterns and durations (Webb & Campbell, 1983). Today’s researchers are discovering the genes that regulate sleep in humans and animals (Donea et al., 2009; He et al., 2009).

Sleep patterns are also culturally influenced. In the United States and Canada, adults average 7 to 8 hours per night (Hunt, 2008; National Sleep Foundation, 2010; Robinson & Martin, 2009). (The workweek sleep of many students and workers falls short of this average [NSF, 2008].) North Americans are nevertheless sleeping less than their counterparts a century ago. Thanks to modern lighting, shift work, and social media and other diversions, those who would have gone to bed at 9:00 P.M. are now up until 11:00 P.M. or later. With sleep, as with waking behavior, biology and environment interact.

Bright morning light tweaks the circadian clock by activating light-sensitive retinal proteins. These proteins control the circadian clock by triggering signals to the brain’s suprachiasmatic nucleus (SCN)—a pair of grain-of-rice-sized, 10,000-cell clusters in the hypothalamus (Witz-Justice, 2009). The SCN does its job in part by causing the brain’s pineal gland to decrease its production of the sleep-inducing hormone melatonin in the morning and to increase it in the evening (Figure 23.5, on the next page).

Enrichment

Dreams do not usually occur in NREM sleep, but they can and do happen. Have you ever fallen asleep and started “dreaming” about something mundane—like walking down the sidewalk or talking with a friend—only to jerk awake when you dreamed that you are tripping or falling? This experience can be explained as an NREM dream. Normally in REM sleep, the body is completely relaxed, so people do not react physically to their dreams. But, if we dream during NREM, then our bodies may interpret our dreams as reality and react to them, causing us to jump or startle at an apparent fall.
Figure 23.5: The biological clock. Light striking the retina signals the suprachiasmatic nucleus (SCN) to suppress the pineal gland’s production of the sleep hormone melatonin. At night, the SCN quiets down, allowing the pineal gland to release melatonin into the bloodstream.

Try This
If our natural circadian rhythm were attuned to a 25-hour cycle, would we instead need to discipline ourselves to stay up later at night and sleep in longer in the morning?

A circadian disadvantage: One study of a decade’s 24,121 Major League Baseball games found that teams who had crossed three time zones before playing a multiday series had nearly a 60 percent chance of losing their first game (Winter et al., 2009).

Sleep Theories

What are sleep’s functions?

1. Sleep protects. When darkness shut down the day’s hunting, food gathering, and travel, our distant ancestors were better off asleep in a cave, out of harm’s way. Those who didn’t try to navigate around rocks and cliffs at night were more likely to lose descendants. This fits a broader principle: A species’ sleep pattern tends to suit its ecological niche (Siegel, 2009). Animals with the greatest need to graze and the least ability to hide tend to sleep less (for a sampling of animal sleep times, see Figure 23.6).

2. Sleep helps us recover. It helps restore and repair brain tissue. Bats and other animals with high waking metabolism burn a lot of calories, producing a lot of free radicals, molecules that are toxic to neurons. Sleeping a lot gives resting neurons time to repair themselves, while pruning or weakening unused connections (Gleistø et al., 2009; Siegel, 2003; Vyazovskiy et al., 2008). Think of it this way: When consciousness leaves your house, brain construction workers come in for a makeover.

Figure 23.6: Animal sleep time. Would you rather be a brown bat and sleep 20 hours a day or a giraffe and sleep 2 hours daily? Data from NIH, 2010.

Sleep often eludes those who stay up late and sleep in on weekends, and then go to bed earlier on Sunday evening in preparation for the new school week (Oren & Terman, 1998). They are like New Yorkers whose biology is on California time. For North Americans who fly to Europe and need to be up when their circadian rhythm cries “SLEEP,” bright light (spending the next day outdoors) helps reset the biological clock (Czeisler et al., 1986, 1989; Eastman et al., 1995).

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3. **Sleep helps restore and rebuild our fading memories of the day’s experiences.** Sleep consolidates our memories—it strengthens and stabilizes neural memory traces (Racmány et al., 2010; Rasch & Born, 2008). People trained to perform tasks therefore recall them better after a night’s sleep, or even after a short nap, than after several hours awake (Stickgold & Ellenbogen, 2008). Among older adults, more sleep leads to better memory of recently learned material (Drummond, 2010). After sleeping well, seniors remember more. And in both humans and rats, neural activity during slow-wave sleep re-enacts and promotes recall of prior novel experiences (Peigneux et al., 2004, Ribeiro et al., 2004). Sleep, it seems, strengthens memories in a way that being awake does not.

4. **Sleep feeds creative thinking.** On occasion, dreams have inspired noteworthy literary, artistic, and scientific achievements, such as the dream that chemist August Kekulé to the structure of benzene (Ross, 2006). More commonplace is the boost that a complete night’s sleep gives to our thinking and learning. After working on a task, then sleeping on it, people solve problems more insightfully than do those who stay awake (Wagner et al., 2004). They also are better at spotting connections among novel pieces of information (Ellenberg et al., 2007). To think smart and see connections, it often pays to sleep on it.

5. **Sleep supports growth.** During deep sleep, the pituitary gland releases a growth hormone. This hormone is necessary for muscle development. A regular full night’s sleep can also “dramatically improve your athletic ability,” report James Maas and Rebecca Robbins (see Close-up: Sleep and Athletic Performance). As we age, we release less of this hormone and spend less time in deep sleep (Pekkanen, 1982).

Given all the benefits of sleep, it’s no wonder that sleep loss hits us so hard.

---

**Close-up**

**Sleep and Athletic Performance**

Exercise improves sleep. What’s not as widely known, report James Maas and Rebecca Robbins (2010), is that sleep improves athletic performance. Well-rested athletes have faster reaction times, more energy, and greater endurance, and teams that build 8 to 10 hours of daily sleep into their training show improved performance. Top athletes also report sleeping 8.5 hours a day on average, and rate practice and sleep as the two most important improvement-fostering activities (Ericsson et al., 1993).

Slow-wave sleep, which occurs mostly in the first half of a night’s sleep, produces the human growth hormone necessary for muscle development. REM sleep and NREM-2 sleep, which occur mostly in the final hours of a long night’s sleep, help strengthen the neural connections that build enduring memories, including the “muscle memories” learned while practicing tennis or shooting baskets.

The optimal exercise time is late afternoon or early evening. Maas and Robbins advise, when the body’s natural cooling is most efficient. Early morning workouts are ill-advised, because they increase the risk of injury and rob athletes of valuable sleep. Heavy workouts within three hours of bedtime should also be avoided because the accompanying sleeplessness drags you down. Precision muscle training, such as shooting free throws, may, however, benefit what followed by sleep.

Maas has been a sleep consultant for college and professional athletes and teams. On Maas’ advice, the Orlando Magic cut early morning practices. He also advised one young woman, Sarah Hughes, who felt stymied in her efforts to excel in figure-skating competition. “Cut the early morning practice,” he instructed, as part of the recommended sleep regimen. Soon thereafter, Hughes’ performance scores rose, ultimately culminating in her 2002 Olympic gold medal.

Ample sleep supports skill learning and high performance. This was the experience of Olympic gold medalist Sarah Hughes.
CLOSE & ASSESS
Exit Assessment
Provide students with either Figure 23.2 or 23.4, and have them label the graph. This activity will help you assess each student's knowledge of the different stages of sleep and give all students practice working with graphs.

Module 23 Review

23-1 How do our biological rhythms influence our daily functioning?
- Our bodies have an internal biological clock, roughly synchronized with the 24-hour cycle of night and day.
- This circadian rhythm appears in our daily patterns of body temperature, arousal, sleeping, and waking. Age and experiences can alter these patterns, resetting our biological clock.

23-2 What is the biological rhythm of our sleeping and dreaming stages?
- We cycle through four distinct sleep stages about every 90 minutes.
- Leaving the alpha waves of the awake, relaxed stage, we descend into the irregular brain waves of non-REM stage 1 sleep (NREM-1), often with the sensation of falling or floating.
- NREM-2 sleep (in which we spend the most time) follows, lasting about 20 minutes, with its characteristic sleep spindles.
- We then enter NREM-3 sleep, lasting about 30 minutes, with large, slow delta waves.
- About an hour after falling asleep, we begin periods of REM (rapid eye movement) sleep.
- Most dreaming occurs in this REM stage (also known as paradoxical sleep) of internal arousal but outward paralysis.
- During a normal night's sleep, NREM-3 sleep shortens and REM and NREM-2 sleep lengthens.

23-3 How do biology and environment interact in our sleep patterns?
- Biology—our circadian rhythm as well as our age and our body's production of melatonin (influenced by the brain's suprachiasmatic nucleus)—interacts with cultural expectations and individual behaviors to determine our sleeping and waking patterns.

23-4 What are sleep's functions?
- Sleep may have played a protective role in human evolution by keeping people safe during potentially dangerous periods.
- Sleep also helps restore and repair damaged neurons.
- REM and NREM-2 sleep help strengthen neural connections that build enduring memories.
- Sleep promotes creative problem solving the next day.
- During slow-wave sleep, the pituitary gland secretes human growth hormone, which is necessary for muscle development.
Multiple-Choice Questions

1. Which of the following represents a circadian rhythm?
   a. A burst of growth occurs during puberty.
   b. A full Moon occurs about once a month.
   c. Body temperature rises each day as morning approaches.
   d. When it is summer in the northern hemisphere, it is winter in the southern hemisphere.
   e. Pulse rate increases when we exercise.

2. In which stage of sleep are you likely to experience hypnagogic sensations of falling?
   a. Alpha sleep
   b. NREM-1
   c. NREM-2
   d. NREM-3
   e. REM

3. What is the role of the suprachiasmatic nucleus (SCN) in sleep?
   a. It induces REM sleep approximately every 90 minutes during sleep.
   b. It causes the pineal gland to increase the production of melatonin.
   c. It causes the pituitary gland to increase the release of human growth hormone.
   d. It causes the pituitary gland to decrease the release of human growth hormone.
   e. It causes the pineal gland to decrease the production of melatonin.

4. Which of the following sleep theories emphasizes sleep’s role in restoring and repairing brain tissue?
   a. Memory
   b. Protection
   c. Growth
   d. Recuperation
   e. Creativity

Practice FRQs

1. Sleep serves many functions for us. Briefly explain how sleep can
   • provide protection.
   • promote physical growth.

   Answer
   1 point: Sleep kept our ancestors safe from nighttime dangers.
   1 point: Sleep promotes the release of pituitary growth hormone.

2. Name and briefly describe three stages of sleep when rapid eye movements are not occurring.

   (3 points)

   Answer
   1 point: NREM-1, a brief stage of light sleep that may include hallucinations and sensations of falling.
   1 point: NREM-2, moderately deep sleep that includes rapid bursts of brain activity called sleep spindles.
   1 point: NREM-3, deep sleep, characterized by large, slow delta waves, from which it is difficult to awaken.
Module 24
Sleep Deprivation, Sleep Disorders, and Dreams

Module Learning Objectives
- Describe the effects of sleep loss, and identify the major sleep disorders.
- Describe the most common content of dreams.
- Identify proposed explanations for why we dream.

Sleep Deprivation and Sleep Disorders

How does sleep loss affect us, and what are the major sleep disorders?

When our body yearns for sleep but does not get it, we begin to feel terrible. Trying to stay awake, we will eventually lose. It’s easy to spot students who have stayed up late to study for a test or finish a term paper: They are often fighting the “nods” (their heads bobbing downward in seconds-long “microsleeps”) as they fight to stay awake.

In the tiredness battle, sleep always wins. In 1989, Michael Doucette was named America’s Safest Driving Teen. In 1990, while driving home from college, he fell asleep at the wheel and collided with an oncoming car, killing both himself and the other driver. Michael’s driving instructor later acknowledged never having mentioned sleep deprivation and drowsy driving (Dement, 1999).

Effects of Sleep Loss

Today, more than ever, our sleep patterns leave us not only sleepy but drained of energy and feelings of well-being. After a succession of 5-hour nights, we accumulate a sleep debt that need not be entirely repaid but cannot be satisfied by one long sleep. “The brain keeps an accurate count of sleep debt for at least two weeks,” reported sleep researcher William Dement (1999, p. 64).

Obviously, then, we need sleep. Sleep commands roughly one-third of our lives—some 25 years, on average. But why?

Allowed to sleep unhindered, most adults will sleep at least 9 hours a night (Coren, 1996). With that much sleep, we awake refreshed, sustain better moods, and perform more efficient and accurate work. The U.S. Navy and the National Institutes of Health have demonstrated the benefits of unrestricted sleep in experiments in which volunteers spent 14 hours daily in bed for at least a week. For the first few days, the volunteers averaged 12 hours of sleep a day or more, apparently paying off a sleep debt that averaged 25 to 30 hours.
That accomplished, they then settled back to 7.5 to 9 hours nightly and felt energized and happier (Dement, 1999). In one Gallup survey (Mason, 2005), 63 percent of adults who reported getting the sleep they needed also reported being “very satisfied” with their personal life (as did only 36 percent of those needing more sleep). And when 909 working women reported on their daily moods, the researchers were struck by what mattered little (such as money, so long as the person was not battling poverty), and what mattered a lot: less time pressure at work and a good night’s sleep (Kahneman et al., 2004). Perhaps it’s not surprising, then, that when asked if they had felt well rested on the previous day, 3 in 10 Americans said they had not (Pelham, 2010).

College and university students are especially sleep-deprived. 69 percent in one national survey reported “feeling tired” or “having little energy” on several or more days in the last two weeks (AP, 2009). In another survey, 28 percent of high school students acknowledged falling asleep in class at least once a week (Sleep Foundation, 2006). The going needn’t get boring before students start snoring. (To test whether you are one of the many sleep-deprived students, see Table 24.1.)

Sleep loss is a predictor of depression. Researchers who studied 15,560 young people, 12 to 18 years old, found that those who slept 5 or fewer hours a night had a 71 percent higher risk of depression than their peers who slept 8 hours or more (Gangwish et al., 2010). This link does not appear to reflect sleep difficulties caused by depression. When children and youth are followed through time, sleep loss predicts depression rather than

### Table 24.1

<table>
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<th>False</th>
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<tbody>
<tr>
<td>1. I need an alarm clock in order to wake up at the appropriate time.</td>
<td></td>
</tr>
<tr>
<td>2. It’s a struggle for me to get out of bed in the morning.</td>
<td></td>
</tr>
<tr>
<td>3. Weekday mornings I hit snooze several times to get more sleep.</td>
<td></td>
</tr>
<tr>
<td>4. I feel tired, irritable, and stressed out during the week.</td>
<td></td>
</tr>
<tr>
<td>5. I have trouble concentrating and remembering.</td>
<td></td>
</tr>
<tr>
<td>6. I feel slow with critical thinking, problem solving, and being creative.</td>
<td></td>
</tr>
<tr>
<td>7. I often fall asleep watching TV.</td>
<td></td>
</tr>
<tr>
<td>8. I often fall asleep in boring meetings or lectures or in warm rooms.</td>
<td></td>
</tr>
<tr>
<td>9. I often fall asleep after heavy meals.</td>
<td></td>
</tr>
<tr>
<td>10. I often fall asleep while relaxing after dinner.</td>
<td></td>
</tr>
<tr>
<td>11. I often fall asleep within five minutes of getting into bed.</td>
<td></td>
</tr>
<tr>
<td>12. I often feel drowsy while driving.</td>
<td></td>
</tr>
<tr>
<td>13. I often sleep extra hours on weekend mornings.</td>
<td></td>
</tr>
<tr>
<td>14. I often need a nap to get through the day.</td>
<td></td>
</tr>
<tr>
<td>15. I have dark circles around my eyes.</td>
<td></td>
</tr>
</tbody>
</table>

If you answered “true” to three or more items, you probably are not getting enough sleep. To determine your sleep needs, Maas recommends that you “go to bed 15 minutes earlier than usual every night for the next week—and continue this practice by adding 15 more minutes each week—until you wake without an alarm clock and feel alert all day.” (Sleep Quiz reprinted with permission from James B. Maas, “Sleep to Win!” (Bloomington, IN: AuthorHouse, 2013.).)
The benefits of sleep are so clear, why does Western culture seem to disdain it? Have students consider the factors that keep people in the United States and other industrialized cultures from sleeping. How do economic factors play into the lack of sleep? What about social influences? How can policy makers encourage people to get more sleep?

Many students try to get by on less and less sleep to try to fit everything in. The irony is that if you stay up too late studying, it can be counterproductive. Sleep deprivation makes it difficult to concentrate and increases the likelihood you will make silly mistakes on tests. The impact on your immune system means you are more likely to get sick. To be the best student you can be, make sleep a priority.

Many students try to get by on less and less sleep to try to fit everything in. The irony is that if you stay up too late studying, it can be counterproductive. Sleep deprivation makes it difficult to concentrate and increases the likelihood you will make silly mistakes on tests. The impact on your immune system means you are more likely to get sick. To be the best student you can be, make sleep a priority.

So shut your eyes
Kiss me goodbye
And sleep
Just sleep,*
-Song by Mr. O'Keefe, Roberson

Vice versa (Gregory et al., 2009). Moreover, REM sleep’s processing of emotional experiences helps protect against depression (Walker & van der Helm, 2009). After a good night’s sleep, we often do feel better the next day. And that may help to explain why parentally enforced bedtimes predict less depression, and why pushing back school start time leads to improved adolescent sleep, alertness, and mood (Gregory et al., 2009; Owens et al., 2010).

Even when awake, students often function below their peak. And they know it: Four in five teens and three in five 18- to 26-year-olds wish they could get more sleep on weekdays (Mason, 2003, 2005). Yet that teen who staggers glumly out of bed in response to an unwelcome alarm, yawns through morning classes, and feels half-depressed much of the day may be energized at 11:00 p.m. and mindless of the next day’s looming sleepiness (Carskadon, 2002). “Sleep deprivation has consequences—difficulty studying, diminished productivity, tendency to make mistakes, irritability, fatigue,” noted Dement (1999, p. 231). A large sleep debt “makes you stupid.”

It can also make you fatter. Sleep deprivation increases ghrelin, a hunger-rousing hormone, and decreases its hunger-suppressing partner, leptin (more on these in Module 38). It also increases cortisol, a stress hormone that stimulates the body to make fat. Sure enough, children and adults who sleep less than normal are fatter than those who sleep more (Chen et al., 2008; Knutson et al., 2007; Schwenkhorst & Adams, 2008). And experimental sleep deprivation of adults increases appetite and eating (Nixon et al., 2010; Patel et al., 2006; Spiegel et al., 2004; Van Cauter et al., 2007). This may help explain the common weight gain among sleep-deprived students (although a review of 11 studies reveals that the mythical college student’s “freshman 15” is, on average, closer to a “first-year 4” [Hull et al., 2007]).

In addition to making us more vulnerable to obesity, sleep deprivation can suppress immune cells that fight off viral infections and cancer (Motivala & Irwin, 2007). One experiment exposed volunteers to a cold virus. Those who had been averaging less than 7 hours sleep a night were 3 times more likely to develop a cold than were those sleeping 8 or more hours a night (Cohen et al., 2009). Sleep’s protective effect may also help explain why people who sleep 7 to 8 hours a night tend to outlive those who are chronically sleep deprived, and why older adults who have no difficulty falling or staying asleep tend to live longer than their sleep-deprived agemates (Dement, 1999; Dew et al., 2008). When infections do set in, we typically sleep more, boosting our immune cells.

Sleep deprivation slows reactions and increases errors in visual attention tasks similar to those involved in screening airport baggage, performing surgery, and reading X-rays (Lam & Dinges, 2010). Similarly, the result can be devastating for driving, piloting, and equipment operating. Driver fatigue has contributed to an estimated 20 percent of American traffic accidents (Jricky, 2002) and to some 30 percent of Australian highway deaths (Maas, 1999). One two-year study examined the driving accident rates of more than 20,000 Virginia 16- to 18-year-olds in two major cities. In one city, the high schools started 75 to 80 minutes later than in the other. The late starters had about 25 percent fewer crashes (Vorona et al., 2011). Consider, too, the timing of four industrial disasters—the 1989 Exxon Valdez tanker hitting rocks and spilling millions of gallons of oil on the shores of Alaska, Union Carbide’s 1984 release of toxic gas that killed thousands in Bhopal, India; and the 1979 Three Mile Island and 1986 Chernobyl nuclear accidents. All occurred after midnight, when operators in charge were likely to be drowsiest and unresponsive to signals requiring an alert response. Likewise, the 2013 Asiana Airlines crash landing at San Francisco Airport happened at 3:30 a.m. Korea time, after a 10-hour flight from Seoul. When sleepy front lobes confront an unexpected situation, misfortune often results.

Stanley Coren capitalized on what is, for many North Americans, a semi-annual sleep manipulation experiment—the “spring forward” to “daylight savings” time and “fall backward” to “standard” time. Searching millions of records, Coren found that in both Canada and the United States, accidents increased immediately after the time change that shortens sleep (FIGURE 24.1).
According to legend, Leonardo da Vinci slept a mere 90 minutes a day, in catnaps of 15 minutes every 4 hours. Salvador Dali liked to doze off while sitting up with a spoon in his hand. As he fell asleep, the spoon would fall and clatter to the ground, and he would wake rejuvenated. Thomas Edison and Winston Churchill also seemed to thrive on catnaps. Lyndon B. Johnson put on his pajamas in the middle of the day and slept for 30 minutes. Bill Clinton naps in cars, buses, trains, and planes. He jokes that Arkansans might come naturally to sleeping anywhere because “most of us don’t have to go very far back to find a family without a bed.”

**FIGURE 24.2** summarizes the effects of sleep deprivation. But there is good news! Psychologists have discovered a treatment that strengthens memory, increases concentration, boosts mood, moderates hunger and obesity, fortifies the disease-fighting immune system, and lessens the risk of fatal accidents. Even better news: The treatment feels good, it can be self-administered, the supplies are limitless, and it’s available free! If you are a typical high school student, often going to bed near midnight and dragged out of bed six or seven hours later by the dreaded alarm, the treatment is simple: Each night just add 15 minutes to your sleep. Ignore that last text, resist the urge to check in with friends online, and succumb to sleep, “the gentle tyrant.”

**Figure 24.2** How sleep deprivation affects us

<table>
<thead>
<tr>
<th>Brain</th>
<th>Reduced attentional focus and memory consolidation, and increased risk of depression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immune system</td>
<td>Suppression of immune cell production and increased risk of viral infections, such as colds</td>
</tr>
<tr>
<td>Fat cells</td>
<td>Increased production and greater risk of obesity</td>
</tr>
<tr>
<td>Joints</td>
<td>Increased inflammation and arthritis</td>
</tr>
<tr>
<td>Heart</td>
<td>Increased risk of high blood pressure</td>
</tr>
<tr>
<td>Stomach</td>
<td>Increased hunger-arousing ghrelin and decreased hunger-suppressing leptin</td>
</tr>
<tr>
<td>Muscles</td>
<td>Reduced strength, and slower reaction time and motor learning</td>
</tr>
</tbody>
</table>

**Figure 24.1**

**Canadian traffic accidents** On the Monday after the spring time change, when people lose one hour of sleep, accidents increased, as compared with the Monday before. In the fall, traffic accidents normally increase because of greater snow, ice, and darkness, but they diminished after the time change. (Adapted from Czeisler, 1996.)
Common Pitfalls

Gregg Jacobs and his colleagues report much better success in treating insomnia when a combination of behavioral techniques is used. Subjects who had serious difficulty falling asleep were told to try the following strategies:

- Sleep restriction: Do not spend more than 7 hours in bed. Avoid naps, and arise at the same time every morning, including weekends.
- Stimulus control: Go to bed only when sleepy, and use the bed exclusively for sleep or relaxing activities. If you cannot fall asleep within 20 minutes, stop trying and do something relaxing.
- Relaxation response training: Use soothing visual imagery, rhythmic breathing, and muscle relaxation to calm yourself.


MAJOR SLEEP DISORDERS

No matter what their normal need for sleep, 1 in 10 adults, and 1 in 4 older adults, complain of insomnia—not an occasional inability to sleep when anxious or excited, but persistent problems in falling or staying asleep (Irwin et al., 2006). From middle age on, awakening occasionally during the night becomes the norm, not something to fret over or treat with medication (Vitiello, 2009). Ironically, insomnia is worsened by fretting about one’s insomnia. In laboratory studies, insomnia complainers do sleep less than others, but they typically overestimate—by about double—how long it takes them to fall asleep. They also underestimate by nearly half how long they actually have slept. Even if we have been awake only an hour or two, we may think we have had very little sleep because it’s the waking part we remember.

The most common quick fixes for true insomnia—sleeping pills and alcohol—can aggravate the problem, reducing REM sleep and leaving the person with next-day blahs. Such aids can also lead to tolerance—a state in which increasing doses are needed to produce an effect. An ideal sleep aid would mimic the natural chemicals that are abundant during sleep, without side effects. Until scientists can supply this magic pill, sleep experts have offered some tips for getting better quality sleep (Table 24.2).

Falling asleep is not the problem for people with narcolepsy (from nouns, “numbness,” and lipsy, “seize”), who have sudden attacks of overwhelming sleepiness, usually lasting less than 5 minutes. Narcolepsy attacks can occur at the most inopportune times, perhaps just after taking a terrific swing at a softball or when laughing loudly, shouting angrily, or having sex (Dement, 1978, 1999). In severe cases, the person collapses directly into a brief period of REM sleep, with loss of muscular tension. People with narcolepsy—1 in 2000 of us, estimated the Stanford University Center for Narcolepsy (2002)—must therefore live with extra caution. As a traffic menace, “smoozing is second only to boozing,” says the American Sleep Disorders Association, and those with narcolepsy are especially at risk (Aldrich, 1989).

Researchers have discovered genes that cause narcolepsy in dogs and humans (Miyagawa et al., 2008; Taheri, 2004). Genes help sculpt the brain, and neuroscientists are searching the brain for narcolepsy-linked abnormalities. One team discovered a relative absence of a hypothalamic neural center that produces orexin, also called hypocretin, a neurotransmitter linked to alertness (Tobin et al., 2002; Thannickal et al., 2000). (That discovery has led to the clinical testing of a new sleeping pill that works by blocking orexin’s arousing activity.)

Table 24.2 Some Natural Sleep Aids

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>Exercise regularly but not in the late evening. (Late afternoon is best.)</td>
</tr>
<tr>
<td>•</td>
<td>Avoid caffeine after early afternoon, and avoid food and drink near bedtime. The exception would be a glass of milk, which provides raw materials for the manufacture of serotonin, a neurotransmitter that facilitates sleep.</td>
</tr>
<tr>
<td>•</td>
<td>Relax before bedtime, using dimmer light.</td>
</tr>
<tr>
<td>•</td>
<td>Sleep on a regular schedule (rise at the same time even after a restless night) and avoid naps.</td>
</tr>
<tr>
<td>•</td>
<td>Hide the clock face so you aren’t tempted to check it repeatedly.</td>
</tr>
<tr>
<td>•</td>
<td>Remind yourself that occasional sleep loss causes no great harm.</td>
</tr>
<tr>
<td>•</td>
<td>Realize that for any stressed organism, being vigilant is natural and adaptive. A personal conflict during the day often means a fitful sleep that night (Åkesson et al., 2007; Brissaut &amp; Cohen, 2002). And a traumatic stressful event can take a lingering toll on sleep (Babson &amp; Feldman, 2013). Managing your stress levels will enable more restful sleeping. (See Modules 43, 44, and 84 for more on stress.)</td>
</tr>
<tr>
<td>•</td>
<td>If all else fails, settle for less sleep, either by going to bed later or getting up earlier.</td>
</tr>
</tbody>
</table>

Some Natural Sleep Aids

| Insomnia | Recurring problems in falling or staying asleep. |
| Narcolepsy | A sleep disorder characterized by uncontrollable sleep attacks. The sufferer may lapse into REM sleep, often at inopportune times. |
Narcolepsy, it is now clear, is a brain disease; it is not just “in your mind.” And this gives hope that narcolepsy might be effectively relieved by a drug that mimics the missing orexin and can sneak through the blood-brain barrier (Fujiki et al., 2003; Siegel, 2000). In the meantime, physicians are prescribing other drugs to relieve narcolepsy’s sleepiness in humans.

Although 1 in 20 of us have sleep apnea, it was unknown before modern sleep research. Apnea means “with no breath,” and people with this condition intermittently stop breathing during sleep. After an airless minute or so, decreased blood oxygen arouses them and they wake up enough to snort in air for a few seconds, in a process that repeats hundreds of times each night, depriving them of slow-wave sleep. Apnea sufferers don’t recall these episodes the next day. So, despite feeling fatigued and depressed—and hearing their mate’s complaints about their loud “snoring”—many are unaware of their disorder (Peppard et al., 2006).

Sleep apnea is associated with obesity, and as the number of obese Americans has increased, so has this disorder, particularly among overweight men, including some football players (Keller, 2007). Other warning signs are loud snoring, daytime sleepiness and irritability, and (possibly) high blood pressure, which increases the risk of a stroke or heart attack (Dement, 1999). If one doesn’t mind looking a little goofy in the dark (imagine a snorkeler in a room), a masklike device with an air pump that keeps the sleeper’s airway open—can effectively relieve apnea symptoms.

Unlike sleep apnea, night terrors target mostly children, who may sit up or walk around, talk incoherently, experience distortions of memory, and appear terrified (Hartmann, 1981). They seldom wake up fully during an episode and recall little or nothing the next morning—at most, a fleeting, frightening image. Night terrors are not nightmares (which, like other dreams, are seldom remembered) but are usually child nightmares, and can occur during NREM-3 sleep, within the first few hours of NREM-3.

Sleepwalking—another NREM-3 sleep disorder—and sleep talking are usually childhood disorders, and like narcolepsy, they run in families. (Sleep talking—usually garbled or nonsensical—can occur during any sleep stage [Mahowald & Ettinger, 1990].) Occasional childhood sleepwalking occurs for about one-third of those with a sleepwalking fraternal twin and half of those with a sleepwalking identical twin. The same is true for sleep talking (Hublin et al., 1997, 1998). Sleepwalking is usually harmless. After returning to bed on their own or with the help of a family member, few sleepwalkers recall their trip the next morning. About 20 percent of 3- to 12-year-olds have at least one episode of sleepwalking each night, depriving them of slow-wave sleep. Apnea sufferers don’t recall these episodes the next day. So, despite feeling fatigued and depressed—and hearing their mate’s complaints about their loud “snoring”—many are unaware of their disorder (Peppard et al., 2006).

Some studies have shown a link between Type 2 diabetes and apnea. Dr. Arthur Friedlander (2000) published a study suggesting that diabetic patients were 3 times more likely to develop sleep apnea. The link may be correlation rather than causal; that is, being overweight may be a factor in both disorders.
Enrichment

Stanley Krippner and his colleagues compared the dreams of more than 400 Argentinean, Brazilian, and American adults:

- Americans tended to dream about animals and food, whereas Brazilians had more sexual and emotional dreams.
- Americans and Argentinians reported more dreams about architecture than Brazilians did.
- Argentinians reported more dreams about aggression and good fortune than Brazilians or Americans did.

The dreams of Americans from different parts of the country differed in content:

- Northeasterners have dreams with images of time, activity, streets, and architecture.
- Southerners dream of nature, good fortune, emotion, and family members.
- Westerners dream about architecture, objects, negative emotions, and indoor settings.

Krippner also found some differences between the genders:

- In the United States, men were more likely to dream about aggression and tools; women were more likely to dream about children, clothes, food, and friendly interactions.
- There were relatively few gender differences in dreams within the Latin American sample. Other researchers have found that Mexican women’s dreams are significantly more emotional than men’s.


Dreams

Enrichment

Students are fascinated by dream analysis. Popularized by Sigmund Freud as being the key to understanding our unconscious thoughts, dream analysis is still used by some psychoanalysts to help clients understand the causes of their current life problems. Typically, however, these professionals leave most of the interpretation up to the client, forcing the practice of imposing symbolic interpretation on the patient. Most dream interpretation books on the market today are not based on scientific testing and shouldn’t be used as evaluation tools.

Use Student Activity: Dream Journal from the TRM to help students assess their nightly dreaming experiences.
Our two-track mind is also monitoring our environment while we sleep. Sensory stimuli—a particular odor or a phone’s ringing—may be instantly and ingeniously woven into the dream story. In a classic experiment, researchers lightly sprayed cold water on dreamers’ faces (Dement & Wolpert, 1958). Compared with sleepers who did not get the cold-water treatment, these people were more likely to dream about a waterfall, a leaky roof, or even about being sprayed by someone.

So, could we learn a foreign language by hearing it played while we sleep? If only it were so easy. While sleeping we can learn to associate a sound with a mild electric shock (and to react to the sound accordingly). But we do not remember recorded information played while we are soundly asleep (Eich, 1986; Wyatt & Bootzin, 1994). In fact, anything that happens during the 5 minutes just before we fall asleep is typically lost from memory (Roth et al., 1988). This explains why sleep apnea patients, who repeatedly awaken with a gasp and then immediately fall back to sleep, do not recall the episodes. It also explains why dreams that momentarily awaken us are mostly forgotten by morning. To remember a dream, get up and stay awake for a few minutes.

Why We Dream

To satisfy our own wishes. In 1900, in his landmark book The Interpretation of Dreams, Sigmund Freud offered what he thought was “the most valuable of all the discoveries it has been my good fortune to make.” He proposed that dreams provide a psychic safety valve that discharges otherwise unacceptable feelings. He viewed a dream’s manifest content (the apparent and remembered story line) as a censored, symbolic version of its latent content, the unconscious drives and wishes that would be threatening if expressed directly. Although most dreams have no overt sexual imagery, Freud nevertheless believed that most adult dreams could be “traced back by analysis to erotic wishes.” Thus, a gun might be a disguised representation of a penis.

Freud considered dreams the key to understanding our inner conflicts. However, his critics say it is time to wake up from Freud’s dream theory, which is a scientific nightmare. Based on the accumulated science, “there is no reason to believe any of Freud’s specific claims about dreams and their purposes,” observed dream researcher William Domhoff (2003). Some contend that even if dreams are symbolic, they could be interpreted any way one wished. Others maintain that dreams hide nothing. A dream about a gun is a dream about a gun. Loged has it that even Freud, who loved to smoke cigars, acknowledged that “sometimes, a cigar is just a cigar.” Freud’s wish-fulfillment theory of dreams has in large part given way to other theories.

To file away memories. The information-processing perspective proposes that dreams may help sift, sort, and fix the day’s experiences in our memory. Some studies support this view. When tested the next day after learning a task, those deprived of both slow-wave and REM sleep did not do as well on their new learning as those who slept undisturbed (Stickgold et al., 2000, 2001). People who hear unusual phrases or learn to find hidden visual images before bedtime remember less the next morning if awakened every time they begin REM sleep than they do if awakened during other sleep stages (Emspin & Clarke, 1970; Karni & Sagi, 1994).

Brain scans confirm the link between REM sleep and memory. The brain regions that buzz as rats learn to navigate a maze, or as people learn to perform a visual-discrimination task given way to other theories.

The Interpretation of Dreams, 1900

Fry, the underlying meaning of a dream (as distinct from its manifest content), it is quackery.”—Suzy Kaszewski J. Allan Hobson (1985)

To file away memories.

To satisfy our own wishes.

To file away memories.
Sleep across the life span. As we age, our sleep patterns change. During our first few months, we spend progressively less time in REM sleep. During our first 20 years, we spend progressively less time asleep. (Adapted from Snyder & Scott, 1982.)

**Critical Questions**

Does the sleep bulimia as described by Robert Stickgold occur among your students? Have them discuss whether they use the weekend to play catch-up on their sleep or to become night owls, staying up extremely late participating in social activities. Have them discuss the effect of this erratic sleep behavior on their daily performance.

**Applying Science**

Have students correlate GPA with hours of sleep to try to replicate the findings of the Wolfson and Carskadon study. Ask them to hypothesize the reasons why those with higher GPAs may get more sleep than those with lower GPAs. Have students share their experiences with sleep and academic achievement.

**Concept Connections**

Point out to students how sleep differences occur in a developmental pattern, with infants spending up to 16 hours a day sleeping. Older adults actually sleep about 1 hour less a night than their younger counterparts. This was described in more detail earlier in the unit, but students should be aware of the developmental differences in sleep patterns.

---

**Table: Average Daily Sleep (Hours)**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Sleep (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infancy (0-1 mos.)</td>
<td>2-3</td>
</tr>
<tr>
<td>Childhood (1-4 yrs.)</td>
<td>12-14</td>
</tr>
<tr>
<td>Adolescence (14-18 yrs.)</td>
<td>8-10</td>
</tr>
<tr>
<td>Adulthood and Old Age (18+ yrs.)</td>
<td>7-9</td>
</tr>
</tbody>
</table>

---

**Figure 24.3**

- REM sleep
- Non-REM sleep
- Wake

- Marked drop in REM during infancy
- Progressively less time in REM
- Progressive drop in REM

---

**Question:** Does eating spicy foods cause one to dream more?

**Answer:** Any food that causes a flush can disrupt sleep, and a flush is due to vasodilation. This dilation increases local blood flow, which dilates the constricting neurons in the brain that control dreaming. To make sense of neural static.

Other theories propose that dreams erupt from neural activation spreading upward from the brainstem (Antrobus, 1991; Hobson, 2003, 2004, 2009). According to one version, dreams are the brain’s attempt to make sense of random neural activity. Much as a neurosurgeon can produce hallucinations by stimulating different parts of a patient’s cortex, so can stimulation originating within the brain. These internal stimuli activate brain areas that process visual images, but not the visual cortex area, which receives raw input from the eyes. As Freud might have expected, PET scans of sleeping people also reveal increased activity in the emotion-related limbic system (in the amygdala) during REM sleep. In contrast, frontal lobe regions responsible for inhibition and logical thinking seem to idle, which may explain why we are less inhibited in our dreams than when awake (Maquet et al., 1996). Add the limbic system’s emotional tone to the brain’s visual bursts and—voila!—we dream. Damage either the limbic system or the visual centers active during dreaming, and dreaming itself may be impaired (Domhoff, 2003).
To reflect cognitive development. Some dream researchers dispute both the Freudian and neural activation theories, preferring instead to see dreams as part of brain maturation and cognitive development (Domhoff, 2010, 2011, Foulkes, 1999). For example, prior to age 4, children’s dreams seem more like a slide show and less like an active story in which the dreamer is an actor. Dreams overlap with waking cognition and feature coherent speech. They simulate reality by drawing on our concepts and knowledge. They engage brain networks that also are active during daydreaming. Unlike the idea that dreams arise from bottom-up brain activation, the cognitive perspective emphasizes our mind’s top-down control of our dream content (Nir & Tononi, 2010).

**TABLE 24.2** compares major dream theories. Although today’s sleep researchers debate dreams’ function—and some are skeptical that dreams serve any function—there is one thing they agree on. We need REM sleep. Deprived of it by repeatedly being awakened, people return more and more quickly to the REM stage after falling back to sleep. When finally allowed to sleep undisturbed, they literally sleep like babies—with increased REM sleep, a phenomenon called REM rebound. Withdrawing REM-suppressing sleeping medications also increases REM sleep, but with accompanying nightmares.

Most other mammals also experience REM rebound, suggesting that the causes and functions of REM sleep are deeply biological. That REM sleep occurs in mammals—and not in animals such as fish, whose behavior is less influenced by learning—also fits the information-processing theory of dreams.

So does this mean that because dreams serve physiological functions and extend normal cognition, they are psychologically meaningless? Not necessarily. Every psychologically meaningful experience involves an active brain. We are once again reminded of a basic principle: Biological and psychological explanations of behavior are partners, not competitors.

<table>
<thead>
<tr>
<th><strong>Table 24.2: Dream Theories</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory</strong></td>
</tr>
<tr>
<td>Freud’s wish-fulfillment</td>
</tr>
<tr>
<td>Information-processing</td>
</tr>
<tr>
<td>Physiological function</td>
</tr>
<tr>
<td>Neural activation</td>
</tr>
<tr>
<td>Cognitive development</td>
</tr>
</tbody>
</table>

**REM rebound** the tendency for REM sleep to increase following REM sleep deprivation (created by repeated awakenings during REM sleep).
CLOSE & ASSESS

Exit Assessment

Use Table 24.2 to help students keep the theories of dreaming distinct in their minds. Note how Freud’s theory differs from the other theories, especially the neural activation theory. A useful exercise may be to have students write a compare-and-contrast essay on the theories.

Module 24 Review

24-1 How does sleep loss affect us, and what are the major sleep disorders?

- Sleep deprivation causes fatigue and irritability, and it impairs concentration, productivity, and memory consolidation. It can also lead to depression, obesity, joint pain, a suppressed immune system, and slowed performance (with greater vulnerability to accidents).
- Sleep disorders include insomnia (recurring wakefulness), narcolepsy (sudden uncontrollable sleepiness or lapsing into REM sleep), sleep apnea (the stopping of breathing while asleep; associated with obesity, especially in men), night terrors (high arousal and the appearance of being terrified; NREM-3 disorder found mainly in children); sleepwalking (NREM-3 disorder also found mainly in children); and sleep talking.

24-2 What do we dream?

- We usually dream of ordinary events and everyday experiences, most involving some anxiety or misfortune.
- Fewer than 10 percent (and less among women) of dreams have any sexual content.
- Most dreams occur during REM sleep, those that happen during NREM sleep tend to be vague fleeting images.

24-3 What are the functions of dreams?

- There are five major views of the function of dreams.
- Freud’s wish-fulfillment: Dreams provide a psychic “safety valve,” with manifest content (story line) acting as a censored version of latent content (underlying meaning that gratifies our unconscious wishes).
- Information-processing: Dreams help us sort out the day’s events and consolidate them in memory.
- Physiological function: Regular brain stimulation may help develop and preserve neural pathways in the brain.
- Neural activation: The brain attempts to make sense of neural static by weaving it into a story line.
- Cognitive development: Dreams reflect the dreamer’s level of development.
- Most sleep theorists agree that REM sleep and its associated dreams serve an important function, as shown by the REM rebound that occurs following REM deprivation in humans and other species.
Multiple-Choice Questions
1. Sleep deprivation can lead to weight gain, reduced muscle strength, suppression of the cells that fight common colds, and most likely which of the following?
   a. Increased productivity
   b. Depression
   c. Decreased mistakes on homework
   d. Increased feeling of well-being
   e. Sleep apnea
2. What do we call the sleep disorder that causes you to stop breathing and awaken in order to take a breath?
   a. Narcolepsy
   b. Insomnia
   c. Sleep apnea
   d. Nightmares
   e. Night terrors
3. Which of the following dream theories states that dreams help us sort out the day’s events and consolidate our memories?
   a. Information-processing
   b. Wish-fulfillment
   c. Physiological function
   d. Neural activation
   e. Neural disconnection
4. According to research, which of the following are we most likely to experience after sleep deprivation?
   a. Night terrors
   b. Sleep apnea
   c. Manifest content dreams
   d. Narcolepsy
   e. REM rebound

Practice FRQs
1. Identify and briefly describe the three major sleep disorders experienced by adults.
   Answer
   2 points: Sleep apnea: stops breathing during sleep.
   2 points: Narcolepsy: falls asleep suddenly.
   2 points: Insomnia: can’t fall asleep.
2. Explain the following two theories regarding why we dream. Include a criticism each faces:
   • Freud’s theory
   • Neural activation theory
   (4 points)

Answers to Multiple-Choice Questions
1. b 3. a
2. c 4. e

Answer to Practice FRQ 2
2 points: Freud’s wish-fulfillment theory states that dreams are a psychic safety valve to express otherwise unacceptable feelings. Criticism: It has no scientific support.
2 points: The neural activation theory states that REM evokes random visual images and the brain turns them into stories. Criticism: The individual’s brain is weaving stories, which still tells us something about the dreamer.
Psychoactive Drugs

Module Learning Objectives

25-1 Define substance use disorders, and explain the roles of tolerance, withdrawal, and addiction.
25-2 Identify the depressants, and describe their effects.
25-3 Identify the stimulants, and describe their effects.
25-4 Identify the hallucinogens, and describe their effects.

Tolerance and Addiction

25-1 What are substance use disorders, and what role do tolerance, withdrawal, and addiction play in these disorders?

Most of us manage to use some nonprescription drugs in moderation and without disrupting our lives. But some of us develop a self-harming substance use disorder (TABLE 25.1). In such cases, the substances being used are psychoactive drugs, chemicals that change perceptions and moods. A drug’s overall effect depends not only on its biological effects but also on the psychology of the user’s expectations, which vary with social and cultural contexts (Ward, 1994). If one culture assumes that a particular drug produces euphoria (or aggression or sexual arousal) and another does not, each culture may find its expectations fulfilled. In Module 81, we’ll take a closer look at these interacting forces in the use and potential abuse of particular psychoactive drugs. But here let’s consider how our bodies react to the ongoing use of psychoactive drugs.

Why might a person who rarely drinks alcohol get buzzed on one can of beer while a long-term drinker shows few effects until the second six-pack? The answer is tolerance. With continued use of alcohol and some other drugs (marijuana is an exception), the user’s brain chemistry adapts to offset the drug effect (a process called neuroadaptation). To experience the
same effect, the user requires larger and larger doses (FIGURE 25.1). In chronic alcohol abuse, for example, the person's brain, heart, and liver suffer damage from the excessive amounts of alcohol being “tolerated.” Ever-increasing doses of most psychoactive drugs can pose a serious threat to health and may lead to addiction: The person craves and uses the substance despite its adverse consequences. (See Thinking Critically About: Addiction on the next page.) The World Health Organization (2008) has reported that, worldwide, 90 million people suffer from such problems related to alcohol and other drugs. Regular users often try to fight their addiction, but abruptly stopping the drug may lead to the undesirable side effects of withdrawal.

Impaired Control
1. Uses more substance, or for longer, than intended.
2. Tries unsuccessfully to regulate substance use.
3. Spends much time gaining, using, or recovering from substance use.
4. Craves the substance.

Social Impairment
5. Use disrupts obligations at work, school, or home.
6. Continues use despite social problems.
7. Use causes reduced social, recreational, and work activities.

Risky Use
8. Continues use despite hazards.
9. Continues use despite worsening physical or psychological problems.

Drug Action
10. Experiences tolerance (needing more substance for the desired effect).
11. Experiences withdrawal when attempting to end use.

Figure 25.1
Drug tolerance With repeated exposure to a psychoactive drug, the drug's effect lessens. Thus, it takes larger doses to get the desired effect.

Table 25.1 When Is Drug Use a Disorder?
A person may be diagnosed with substance use disorder when drug use continues despite significant life disruption. Resulting changes in brain circuits may persist after quitting use of the substance (thus leading to strong cravings when exposed to people and situations that trigger memories of drug use). The severity of substance use disorder varies from mild (two to three symptoms) to moderate (four to five symptoms) to severe (six or more symptoms) (American Psychiatric Association, 2013).

Impaired Control
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Teaching Tip
Contact a local psychologist who specializes in substance dependence to get his or her thoughts on the various addictions found in the U.S. population.
- Does the psychologist believe addictions to the Internet, shopping, or sex have the same fundamental basis as substance dependence? Why or why not?
- Does the psychologist treat all addictions to substances the same way? Why or why not?

Concept Connections
Teens often feel as though their own behaviors do not qualify as addictive or destructive. They attribute them to situational factors and the behavior of others to dispositional factors—a type of attribution known as the fundamental attribution error (discussed in Unit XIV). Students will say they drink or take drugs due to stress or social pressure. They will say that others drink or take drugs due to weakness or bad decision making. Help students evaluate their own behaviors critically, asking themselves whether their own behavior would qualify as destructive.

Use Student Activity: The Internet Addiction Test from the TRM to help students see that many types of behaviors are addictive behaviors.
Neurotransmitters and Drugs.

Many antidepressants are known as SSRIs or selective serotonin reuptake inhibitors. These drugs block the reabsorption of serotonin so it remains in the synapse longer. Some disorders that these drugs are effective in treating include depression, bulimia nervosa, obsessive-compulsive disorder, anorexia nervosa, and panic disorder.

Types of Psychoactive Drugs

The three major categories of psychoactive drugs are depressants, stimulants, and hallucinogens. All do their work at the brain’s synapses, inhibiting, stimulating, or mimicking the activity of the brain’s own chemical messengers, the neurotransmitters.

**Depressants**

Depressants are drugs such as alcohol, barbiturates (tranquilizers), and opiates that calm neural activity and slow body functions.

**ALCOHOL**

True or false? In small amounts, alcohol is a stimulant. False. Low doses of alcohol may, indeed, enliven a drinker, but they do so by acting as a disinhibitor—they slow brain activity that controls judgment and inhibitions. Alcohol is an equal-opportunity drug: It increases disinhibitory tendencies, as when tipsy restaurant patrons leave extravagant tips (Lyne, 1988).

**AP® Exam Tip**

These three categories—depressants, stimulants, and hallucinogens—are important. There are likely to be questions on the AP® exam that will require you to know how a particular psychoactive drug is classified.
And it increases harmful tendencies, as when sexually aroused men become more disposed to sexual aggression.

Alcohol + sex = the perfect storm. When drinking, both men and women are more disposed to casual sex (Cooper, 2006; Ebel-Lam et al., 2009). The urge you would feel if sober are the ones you will more likely act upon when intoxicated.

**SLOWED NEURAL PROCESSING** Low doses of alcohol relax the drinker by slowing sympathetic nervous system activity. Larger doses cause reactions to slow, speech to slur, and skilled performance to deteriorate. Paired with sleep deprivation, alcohol is a potent sedative. Add these physical effects to lowered inhibitions, and the result can be deadly. Worldwide, several hundred thousand lives are lost each year in alcohol-related accidents and violent crime. As blood-alcohol levels rise and judgment falters, people’s qualms about drinking and driving lessen. In experiments, virtually all drinkers who had insisted when sober that they would not drive under the influence later decided to drive home from a bar, even when given a breathalyzer test and told they were intoxicated (Denton & Krebs, 1990; MacDonald et al., 1995). Alcohol can also be life threatening when heavy drinking follows an earlier period of moderate drinking, which depresses the vomiting response. People may poison themselves with an overdose that their bodies would normally throw up.

**MEMORY DISRUPTION** Alcohol can disrupt memory formation, and heavy drinking can have long-term effects on the brain and cognition. In rats, at a developmental period corresponding to human adolescence, binge drinking contributes to nerve cell death and reduces the birth of new nerve cells. It also impairs the growth of synaptic connections (Crews et al., 2006, 2007). In humans, heavy drinking may lead to blackouts, in which drinkers are unable to recall people they met the night before or what they said or did while intoxicated. These blackouts result partly from the way alcohol suppresses REM sleep, which helps fix the day’s experiences into permanent memories.

The prolonged and excessive drinking that characterizes alcohol use disorder can shrink the brain (FIGURE 25.2). Girls and young women (who have less of a stomach enzyme that digests alcohol) can become addicted to alcohol more quickly than boys, and young men do, and they are at risk for lung, brain, and liver damage at lower consumption levels (CASA, 2003; Wuethrich, 2003).

**REDUCED SELF-AWARENESS AND SELF-CONTROL.** In one experiment, those who consumed alcohol (rather than a placebo beverage) were doubly likely to be caught mind-wandering during a reading task, yet were less likely to notice that they zoned out (Sayette et al., 2009).

Alcohol not only reduces self-awareness, it also produces a sort of “myopia” by focusing attention on an arousing situation (such as a provocation) and distracting attention from normal inhibitions and future consequences (Giancola et al., 2010; Hull et al., 1986; Steele & Josephs, 1990).

Reduced self-awareness may help explain why people who want to suppress their urges you would feel if sober are the ones you will more likely act upon when intoxicated.

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Reduced self-awareness may help explain why people who want to suppress their awareness of failures or shortcomings are more likely to drink than are those who feel good about themselves. Losing a business deal, a game, or a romantic partner sometimes elicits a drinking binge.

**ENGAGE**

**Active Learning**

Have students explore the rates of violent crime that occur when people are acting under the influence of alcohol:

- What percentage of murders occurs while either the victim or assailant is under the influence?
- What percentage of sexual assaults occurs while either the victim or assailant is under the influence? Does this percentage change depending on the age of either person?
- How does the influence of alcohol affect other violent crimes such as theft, battery, or domestic abuse?

**TRM**

**Critical Questions**

Alcohol is a controversial drug. Its misuse has led to countless tragedies. Moderate, thoughtful use is linked to significant health benefits. Have students explore the following questions related to alcohol consumption:

- Why have efforts to prohibit alcohol’s sale and consumption failed in the past?
- Are current laws that regulate the sale and consumption of alcohol effective? Why or why not? What laws or enforcement techniques should be enacted for better effect?
- What are some of the health benefits of alcohol consumption? What recommendations do doctors give for healthful alcohol consumption?
- Should there be different blood alcohol limits for men and women considering how the drug affects each gender differently? Why or why not?

Use Student Activity: Blood Alcohol Concentrations from the TRM to help students understand the physical effects of different levels of alcohol.

**TEACH**

**Concept Connections**

Alcohol has been shown to affect the hippocampus, the area of the brain that is responsible for forming new memories. This effect helps explain why people who drink heavily lose their memories of the period during which they were intoxicated.
similar decreases in these same dopaminergic systems. Patients with Parkinson's disease experience slowness of movement, verbal slowing, and memory impairment. Patients who have been addicted to amphetamines often lose some key dopamine transporters crucial to movement, verbal performance, and memory. Patients with Parkinson's disease experience similar decreases in these same dopamine transporters.

**ENGAGE**

**Concept Connections**

Explain to students that expectancy effects are similar to the placebo effect. Both involve the mind convincing the body that an effect will occur. The effects that the body expects may or may not be the actual effects of the drug or treatment, or the effects may be an exaggerated effect of the drug or treatment.

**TEACH**

**Enrichment**

Laudanum was a common medicine used in the Victorian era to treat a variety of different ailments. Most successfully, it was used as a painkiller and cough suppressant. It was also found to help with loose stool. Mothers used it often to soothe their fussy babies. What made laudanum so effective? It was a special mixture of alcohol and opium. Doctors during the Victorian period were so impressed with the medicinal properties of opium and laudanum that they neglected to tell their patients about its addictive properties. Officials in the United States banned the practice of prescribing opium in 1914.

**TEACH**

**Concept Connections**

Link information about amphetamines to neuroscience by pointing out that recent research has shown that detoxified former methamphetamine users often lose some key dopamine transporters crucial to movement, verbal performance, and memory. Patients with Parkinson's disease experience similar decreases in these same dopamine transporters.

**ENGAGE**

**Active Learning**

Have students research the effects of caffeine. They should investigate both the negative effects and health benefits of caffeinated products. While caffeine may not be dangerous in and of itself, the products that contain caffeine (coffee, sodas, and so on) are not considered healthful products.
Tobacco companies have come under intense scrutiny over the last decade as states sued them for reimbursement of the medical expenses of tobacco users. The companies signed a record-setting agreement to settle the claims brought by the states as their legal costs began to mount.

What were the details of this settlement? What did the companies have to do differently as a result? What benefits did the states get by settling? Did they relinquish any rights regarding future litigation?

Some of the carcinogenic chemicals inhaled by tobacco smokers include formaldehyde, ammonia, and tar—all of which are potentially lethal if ingested into the body separately. Over time, the buildup of these chemicals in the lungs is what leads to lung cancer.
ENGAGE
Active Learning

Tobacco companies were banned from advertising on television in the 1960s. Their advertising efforts, however, center on print media and sponsoring sports events. The recent tobacco settlement put limits on such advertising since those ads could be seen by teens. Divide students into groups to study advertising by tobacco companies today.

- One group can study magazine ads. In what magazines do tobacco ads regularly appear? To what demographic do they seem to be appealing? Do antismoking ads also appear in the same magazines?

- Another group can study tobacco companies’ sponsorship of sports events. What events do tobacco products directly sponsor? Whom do these events appeal to? What events do subsidiaries of tobacco companies sponsor? Is their relationship to a tobacco company ever mentioned?

TEACH
Concept Connections

Help students see that operant conditioning is a factor in nicotine and other drug addiction. The faster the high, the more reinforcing the drug-taking behavior is. For many drug users, the cycle of taking drugs and withdrawal from them is a negatively reinforcing system. Once the drug’s effects start to wane, painful withdrawal symptoms occur. Taking more of the drug eliminates the negative symptoms, reinforcing the drug-taking behavior even more.

ENGAGE
Active Learning

The United States has a strained relationship with some countries due to cocaine trafficking. In Peru, for example, cultivation of the coca bush is legal, as long as farmers sell their crop to the state. But studies show that farmers can earn much more money selling to illegal markets, making cocaine a problem in the developing world. Some leaders in foreign countries and groups within the United States argue that if the U.S. government cracked down on the demand of people who use drugs, then drug traffickers would not find dealing to be as profitable, thus ending the drug problem altogether.

- What should the U.S. government do to curb the drug trade? Have such efforts been successful in the past?

- Should the U.S. government cut off diplomatic and economic ties with drug-trafficking countries? Why or why not?

COCAIN
The recipe for Coca-Cola originally included an extract of the coca plant, creating a cocaine tonic for tired elderly people. Between 1896 and 1905, Coke was indeed “the real thing.” But no longer. Cocaine is now snorted, injected, or smoked. It enters the bloodstream quickly, producing a rush of euphoria that depletes the brain’s supply of the neurotransmitters dopamine, serotonin, and noradrenergine (FIGURE 25.4).

Within the hour, a crash of agitation follows as the drug’s effect wears off. Many regular cocaine users chasing this high become addicted. In the lab, cocaine-addicted monkeys have pressed levers more than 12,000 times to gain one cocaine injection (Siegel, 1990).

COCAIN leads to emotional disturbances, convulsions, cardiac arrest, or respiratory failure. In national surveys, 3 percent of U.S. high school seniors and 6 percent of British 18- to 24-year-olds reported having tried cocaine during the past year (ACMD, 2009; Johnston et al., 2011). Nearly half had smoked crack, a faster-working, crystallized form of cocaine that produces a briefer but more intense high, followed by a more intense crash. After several hours, the craving for more wanes, only to return several days later (Gawin, 1991). These nonsmokers may live not only healthier but also happier lives. Smoking correlates with higher rates of depression, chronic disabilities, and divorce (Doherty & Doherty, 1998; Vitar et al., 1998). Healthy living seems to add both years to life and life to years.

Whether smokers quit abruptly or gradually, the demand of people who use drugs, then drug traffickers would not find dealing to be as profitable, thus ending the drug problem altogether.
when combined with prolonged dancing—can lead to severe overheating, increased however, reasons not to be ecstatic about Ecstasy. One is its dehydrating effect, which—
and all-night raves (Landry, 2002). The drug’s popularity crosses national borders, with
 Essen to serotonin-producing neurons in the brain. “While the drug does not produce
produce a crash. When the cocaine level drops, the absence of
methamphetamine triggers the release of the neurotransmitter dopamine, which stimulates brain cells that enhance energy and mood, leading to eight hours or so of heightened energy and euphoria. Its altereffects may include irritability, insomnia, hypertension, seizures, social isolation, depression, and occasional violent outbursts (Homer et al., 2008). Over time, methamphetamine may reduce baseline dopamine levels, leaving the user with depressed functioning.

ECSTASY

Ecstasy, a street name for MDMA (methyleneoxyamphetamine), is both a stimulant and a mild hallucinogen. As an amphetamine derivative, Ecstasy triggers the release of serotonin in the brain. This finding seems to be the basis of the popular notion that taking Ecstasy causes “holes in the brain.” While the drug does not produce visible holes, it does cause significant damage, which is about as close to making holes in the brain as you can get.

ENGAGE Enrichment

Ecstasy, or MDMA, is a highly addictive and dangerous drug. As Myers points out, studies show that taking Ecstasy only once can lead to significant degeneration of serotonin neurons in the brain. This finding seems to be the basis of the popular notion that taking Ecstasy causes “holes in the brain.” While the drug does not produce visible holes, it does cause significant damage, which is about as close to making holes in the brain as you can get.
Flashbacks are associated with LSD use. These experiences can occur days, months, or years after an initial "trip." Flashbacks can be as intense as the original trip, but because of their unpredictable nature, they are often terrifying for the user.

**Hallucinogens**

Hallucinogens distort perceptions and evoke sensory images in the absence of sensory input (which is why these drugs are also called psychedelics, meaning "mind-manifesting"). Some, such as LSD and MDMA (Ecstasy), are synthetic. Others, including the mild hallucinogen marijuana, are natural substances.

**LSD**

Chemist Albert Hofmann created—and on one Friday afternoon in April 1943 accidentally ingested—LSD (lysergic acid diethylamide). The result—"an uninterrupted stream of fantastic pictures, extraordinary shapes with intense, kaleidoscopic play of colors"—reminded him of a childhood mystical experience that had left him longing for another glimpse of "a miraculous, powerful, unfathomable reality" (Siegel, 1984; Smith, 2006).

The emotions of an LSD trip vary from euphoria to detachment to panic. The user's current mood and expectations color the emotional experience, but the perceptual distortions and hallucinations have some commonalities. Whether provoked to hallucinate by drugs, loss of oxygen, or extreme sensory deprivation, the brain hallucinates in basically the same way (Siegel, 1982). The experience typically begins with simple geometric forms, such as a lattice, cobweb, or spiral. The next phase consists of more meaningful images; some may be superimposed on a tunnel or funnel, others may be replays of past emotional experiences. As the hallucination peaks, people frequently feel separated from their body and experience dreamlike scenes so real that they may become panic-stricken or harm themselves.

**Meth bust**

As use of the dangerously addictive stimulant methamphetamine has increased, enforcement agencies have increased their efforts to snuff out the labs that produce it.

**Methamphetamine**

A stimulant drug; also known as meth or ice, it is abused for its euphoric effects. Methamphetamine use can cause paranoia, aggression, and cognitive impairments. It also carries the risk of multiple physical health complications, including respiratory failure, convulsions, and death.
These sensations are strikingly similar to the near-death experience, an altered state of consciousness reported by about 15 percent of patients revived from cardiac arrest (Aguilera, 2011; Greyson, 2010). Many describe visions of tunnels (FIGURE 25.5), bright lights or beings of light, a replay of old memories, and out-of-body sensations (Siegel, 1980). Given that oxygen deprivation and other insults to the brain are known to produce hallucinations, it is difficult to resist wondering whether a brain under stress manufactures the near-death experience. Following temporal lobe seizures, patients have reported similarly profound mystical experiences. So have solitary sailors and polar explorers while enduring monotony, isolation, and cold (Suedfeld & Mocellin, 1987).

MARIJUANA

For 5000 years, hemp has been cultivated for its fiber. The leaves and flowers of this plant, which are sold as marijuana, contain THC (delta-9-tetrahydrocannabinol). Whether smoked (getting to the brain in about 7 seconds) or eaten (causing its peak concentration to be reached at a slower, unpredictable rate), THC produces a mix of effects. Synthetic marijuana (also called K2 or Spice) mimics THC. Its harmful side effects, which can include agitation and hallucinations, led to its ingredient becoming illegal under the U.S. Synthetic Drug Abuse Prevention Act of 2012.

Marijuana is a difficult drug to classify. It is a mild hallucinogen, amplifying sensitivities to colors, sounds, tastes, and smells. But like alcohol, marijuana relaxes, disinhibits, and may produce a euphoric high. Both alcohol and marijuana impair the motor coordination, perceptual skills, and reaction time necessary for safely operating an automobile or other machinery. “THC causes animals to misjudge events,” reported Ronald Siegel (1990, p. 163). “Pigeons wait too long to respond to buzzers or lights that tell them food is available for brief periods; and rats turn the wrong way in mazes.”

Marijuana and alcohol also differ. The body eliminates alcohol within hours. THC and its by-products linger in the body for a week or more, which means that regular users experience less abrupt withdrawal and may achieve a high with smaller amounts of the drug than would be needed by occasional users. This is contrary to the usual path of tolerance, in which repeat users need to take larger doses to feel the same effect.

A user’s experience can vary with the situation. If the person feels anxious or depressed, using marijuana may intensify these feelings. The more often the person uses marijuana, especially during adolescence and in today’s stronger, purified form, the greater the risk of anxiety or depression (Bambico et al., 2010; Hall, 2006; Murray et al., 2007). Daily use bodes a worse outcome than infrequent use.

hallucinations. The more often the person uses marijuana, which repeat users need to take larger doses to feel the same effect. This is contrary to the usual path of tolerance, in which users may produce a worse outcome than infrequent use.

Psychoactive Drugs

Enrichment

Marijuana smokers typically take longer drags on a marijuana cigarette than on a traditional cigarette.

Marijuana cigarettes are not usually filtered, as most tobacco cigarettes are.

Enrichment

A study released by the Substance Abuse and Mental Health Services Administration (SAMHSA) showed that teen marijuana use increased by about 20 percent during the last half of the 1990s. In 1994, 43 percent of teens treated for substance abuse used marijuana, but in 1999, that number was 60 percent.
Cancer and AIDS advocacy groups have been pushing for the legalization of marijuana for medicinal purposes. Marijuana has been shown to help curb the nausea associated with chemotherapy for cancer and AIDS, helping patients to keep up their strength as they endure uncomfortable treatments. Explore laws across the United States that address the medical use of marijuana.

- How many states authorize the medical use of marijuana?
- How does the federal government handle cases of people authorized to use marijuana medicinally?
- Does the federal government supply the drug to people authorized to use marijuana medically? Why or why not?

Despite their differences, the psychoactive drugs summarized in Table 25.2 share a common feature: They trigger negative aftereffects that offset their immediate positive effects and grow stronger with repetition. And this helps explain both tolerance and withdrawal. As the opposing, negative aftereffects grow stronger, it takes larger and larger doses to produce the desired high (tolerance), causing the aftereffects to worsen in the drug’s absence (withdrawal). This in turn creates a need to switch off the withdrawal symptoms by taking yet more of the drug (which may lead to addiction).

### Table 25.2 A Guide to Selected Psychoactive Drugs

<table>
<thead>
<tr>
<th>Drug</th>
<th>Type</th>
<th>Pleasurable Effects</th>
<th>Adverse Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td>Depressant</td>
<td>Initial high followed by relaxation and disinhibition</td>
<td>Depression, memory loss, organ damage, impaired reactions</td>
</tr>
<tr>
<td>Heroin</td>
<td>Depressant</td>
<td>Rush of euphoria, relief from pain</td>
<td>Depressed physiology, agonizing withdrawal</td>
</tr>
<tr>
<td>Caffeine</td>
<td>Stimulant</td>
<td>Increased alertness and wakefulness</td>
<td>Anxiety, restlessness, and insomnia in high doses; uncomfortable withdrawal</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>Stimulant</td>
<td>Euphoria, alertness, energy</td>
<td>Irritability, insomnia, hypertension, seizures</td>
</tr>
<tr>
<td>Cocaine</td>
<td>Stimulant</td>
<td>Rush of euphoria, confidence, energy</td>
<td>Cardiovascular stress, suspiciousness, depressive crash</td>
</tr>
<tr>
<td>Nicotine</td>
<td>Stimulant</td>
<td>Arousal and relaxation, sense of well-being</td>
<td>Heart disease, cancer</td>
</tr>
<tr>
<td>Ecstasy (MDMA)</td>
<td>Stimulant; mild hallucinogen</td>
<td>Emotional elevation, disinhibition</td>
<td>Dehydration, overheating, depressed mood, impaired cognitive and immune functioning</td>
</tr>
<tr>
<td>Marijuana</td>
<td>Hallucinogen</td>
<td>Enhanced sensation, relief of pain, distortion of time, relaxation</td>
<td>Impaired learning and memory, increased risk of psychological disorders, lung damage from smoke</td>
</tr>
</tbody>
</table>

As AIDS, glaucoma, and cancer (Munsey, 2010; Watson et al., 2000). In such cases, the Institute of Medicine recommends delivering the THC with medical inhalers. Marijuana smoke, like cigarette smoke, is toxic and can cause cancer, lung damage, and pregnancy complications.
Psychoactive Drugs

Module 25 Review

25-1 What are substance use disorders, and what role do tolerance, withdrawal, and addiction play in these disorders?

- Those with a substance use disorder may exhibit impaired control, social disruption, risky behavior, and the physical effects of tolerance and withdrawal.
- Psychoactive drugs alter perceptions and moods.
- These drugs may produce tolerance—requiring larger doses to achieve the desired effect—and withdrawal—significant discomfort accompanying efforts to quit.
- Addiction is compulsive craving and use of drugs or certain behaviors (such as gambling) despite known adverse consequences.

25-2 What are depressants, and what are their effects?

- Depressants, such as alcohol, barbiturates, and the opiates (which include narcotics), dampen neural activity and slow body functions.
- Alcohol tends to disinhibit, increasing the likelihood that we will act on our impulses, whether harmful or helpful. It also impairs judgment, disrupts memory processes by suppressing REM sleep, and reduces self-awareness and self-control.
- User expectations strongly influence alcohol’s behavioral effects.

25-3 What are stimulants, and what are their effects?

- Stimulants—including caffeine, nicotine, cocaine, the amphetamines, methamphetamines, and Ecstasy—excite neural activity and speed up body functions, triggering energy and mood changes. All are highly addictive.
- Nicotine’s effects make smoking a difficult habit to kick, yet the percentage of Americans who smoke has been dramatically decreasing.
- Cocaine gives users a fast high, followed within an hour by a crash. Its risks include cardiovascular stress and suspiciousness.
- Use of methamphetamines may permanently reduce dopamine production.
- Ecstasy (MDMA) is a combined stimulant and mild hallucinogen that produces euphoria and feelings of intimacy. Its users risk immune system suppression, permanent damage to mood and memory, and (if taken during physical activity) dehydration and escalating body temperatures.

25-4 What are hallucinogens, and what are their effects?

- Hallucinogens—such as LSD and marijuana—distort perceptions and evoke hallucinations—sensory images in the absence of sensory input. The user’s mood and expectations influence the effects of LSD, but common experiences are hallucinations and emotions varying from elation to panic.
- Marijuana’s main ingredient, THC, may trigger feelings of disinhibition, euphoria, relaxation, relief from pain, and intense sensitivity to sensory stimuli. It may also increase feelings of depression or anxiety, impair motor coordination and reaction time, disrupt memory formation, and damage lung tissue (because of the inhaled smoke).

CLOSE & ASSESS

Exit Assessment

Use Table 25.2 as an assessment tool. Have students fill in important details from this chart from memory. You can use this exercise to assess their knowledge of psychoactive drugs.

ASK YOURSELF

Do you think people can become addicted not only to psychoactive drugs but also to other repetitive, pleasure-seeking behaviors (such as gambling or “Internet game playing”)?

TEST YOURSELF

Why do tobacco companies try so hard to get customers hooked as teens?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

Module 25 Review

25-1 What are substance use disorders, and what role do tolerance, withdrawal, and addiction play in these disorders?

- Those with a substance use disorder may exhibit impaired control, social disruption, risky behavior, and the physical effects of tolerance and withdrawal.
- Psychoactive drugs alter perceptions and moods.
- These drugs may produce tolerance—requiring larger doses to achieve the desired effect—and withdrawal—significant discomfort accompanying efforts to quit.
- Addiction is compulsive craving and use of drugs or certain behaviors (such as gambling) despite known adverse consequences.

25-2 What are depressants, and what are their effects?

- Depressants, such as alcohol, barbiturates, and the opiates (which include narcotics), dampen neural activity and slow body functions.
- Alcohol tends to disinhibit, increasing the likelihood that we will act on our impulses, whether harmful or helpful. It also impairs judgment, disrupts memory processes by suppressing REM sleep, and reduces self-awareness and self-control.
- User expectations strongly influence alcohol’s behavioral effects.

25-3 What are stimulants, and what are their effects?

- Stimulants—including caffeine, nicotine, cocaine, the amphetamines, methamphetamines, and Ecstasy—excite neural activity and speed up body functions, triggering energy and mood changes. All are highly addictive.
- Nicotine’s effects make smoking a difficult habit to kick, yet the percentage of Americans who smoke has been dramatically decreasing.
- Cocaine gives users a fast high, followed within an hour by a crash. Its risks include cardiovascular stress and suspiciousness.
- Use of methamphetamines may permanently reduce dopamine production.
- Ecstasy (MDMA) is a combined stimulant and mild hallucinogen that produces euphoria and feelings of intimacy. Its users risk immune system suppression, permanent damage to mood and memory, and (if taken during physical activity) dehydration and escalating body temperatures.

25-4 What are hallucinogens, and what are their effects?

- Hallucinogens—such as LSD and marijuana—distort perceptions and evoke hallucinations—sensory images in the absence of sensory input. The user’s mood and expectations influence the effects of LSD, but common experiences are hallucinations and emotions varying from elation to panic.
- Marijuana’s main ingredient, THC, may trigger feelings of disinhibition, euphoria, relaxation, relief from pain, and intense sensitivity to sensory stimuli. It may also increase feelings of depression or anxiety, impair motor coordination and reaction time, disrupt memory formation, and damage lung tissue (because of the inhaled smoke).

CLOSE & ASSESS

Exit Assessment

Use Table 25.2 as an assessment tool. Have students fill in important details from this chart from memory. You can use this exercise to assess their knowledge of psychoactive drugs.

ASK YOURSELF

Do you think people can become addicted not only to psychoactive drugs but also to other repetitive, pleasure-seeking behaviors (such as gambling or “Internet game playing”)?

TEST YOURSELF

Why do tobacco companies try so hard to get customers hooked as teens?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.
Answers to Multiple-Choice Questions

1. d  3. e
2. c  4. d

Answer to Practice FRQ 2

2 points: Alcohol is classified as a depressant. Effects include reduced self-awareness.

2 points: Caffeine is classified as a stimulant. Effects include impaired sleep.

2 points: Nicotine is classified as a stimulant. Effects include diminished appetite.

Multiple-Choice Questions

1. Which of the following represents drug tolerance?
   a. Hans has grown to accept the fact that his wife likes to have a beer with her dinner, even though he personally does not approve of the use of alcohol.
   b. Jose often wakes up with a headache that lasts until he has his morning cup of coffee.
   c. Pierre enjoys the effect of marijuana and is now using the drug several times a week.
   d. Jacob had to increase the dosage of his pain medication when the old dosage no longer effectively controlled the pain from his chronic back condition.
   e. Chau lost his job and is now homeless as a result of his drug use.

2. Which of the following drugs is classified as an opiate?
   a. Nicotine
   b. Marijuana
   c. Heroin
   d. Methamphetamine
   e. Cocaine

3. Which of the following drugs produces effects similar to a near-death experience?
   a. Ecstasy
   b. Nicotine
   c. Barbiturate
   d. Methamphetamine
   e. LSD

4. Which of the following statements is true of alcohol?
   a. Alcohol is a stimulant because it produces insomnia.
   b. Alcohol is a depressant because it produces bipolar disorder.
   c. Alcohol is a stimulant because people do foolish things while under its influence.
   d. Alcohol is a depressant because it calms neural activity and slows body function.
   e. Alcohol is a stimulant because it increases instances of casual sex.

Practice FRQs

1. Name and compare the effects of the two hallucinogens discussed in the text.
   
   Answer
   1 point: LSD creates vivid hallucinations and strong emotions.
   1 point: Marijuana creates mild hallucinations, enhanced sensory experiences, and impaired judgment.

2. Three of the most widely used psychoactive drugs—alcohol, caffeine, and nicotine—are legal for large segments of the population. Name the category that each of these drugs belongs to, and describe one effect of each.
   
   (6 points)
Unit V Review

Key Terms and Concepts to Remember

- Consciousness, p. 219
- Hypnosis, p. 219
- Posthypnotic suggestion, p. 220
- Dissociation, p. 222
- Circadian (ser-KAY-dee-AN) rhythm, p. 226
- REM sleep, p. 226
- Alpha waves, p. 227
- Sleep, p. 227
- Hallucinations, p. 228
- Delta waves, p. 228
- NREM sleep, p. 228
- Suprachiasmatic nucleus (SCN), p. 229
- Insomnia, p. 258
- Narcolepsy, p. 238
- Sleep apnea, p. 239
- Night terrors, p. 239
- Dream, p. 240
- Manifest content, p. 241
- Latent content, p. 241
- REM rebound, p. 243
- Substance use disorder, p. 246
- Psychoactive drug, p. 246
- Tolerance, p. 246
- Addiction, p. 247
- Withdrawal, p. 247
- Depressants, p. 248
- Alcohol use disorder, p. 249
- Barbiturates, p. 250
- Opiates, p. 250
- Stimulants, p. 250
- Amphetamines, p. 250
- Nicotine, p. 250
- Cocaine, p. 252
- Methamphetamine, p. 253
- Ecstasy (MDMA), p. 253
- Hallucinogens, p. 254
- Near-death experience, p. 255
- THC, p. 255
- William James, p. 219
- Ernest Hilgard, p. 222
- Sigmund Freud, p. 241

Key Contributors to Remember

- William James, p. 219
- Ernest Hilgard, p. 222
- Sigmund Freud, p. 241

AP® Exam Practice Questions

Multiple-Choice Questions

1. Sudden sleep attacks at inopportune times are symptomatic of which sleep disorder?
   a. Sleep apnea
   b. Insomnia
   c. Night terrors
   d. Sleepwalking
   e. Narcolepsy

2. Deep sleep occurs in which stage?
   a. Hypnagogic
   b. REM
   c. Alpha
   d. NREM-1
   e. Delta

3. Recurring problems in falling asleep or staying asleep are characteristic of which sleep disorder?
   a. Sleep apnea
   b. Narcolepsy
   c. Insomnia
   d. Sleep talking
   e. Sleepwalking

4. What is the pineal gland’s role in sleep?
   a. Activating the suprachiasmatic nucleus
   b. The production of melatonin
   c. The location of hypnagogic images
   d. Remembering dreams upon waking
   e. Emitting alpha waves

Answers to Multiple-Choice Questions

1. e  
2. e  
3. c  
4. b
5. What are bursts of rapid, rhythmic brain-wave activity that occur during NREM-2 sleep?
   - a. Hallucinations
   - b. Circadian rhythms
   - c. Alpha waves
   - d. Sleep spindles
   - e. Delta waves

6. Increasing amounts of paradoxical sleep following a period of sleep deprivation is known as what?
   - a. Circadian sleep
   - b. Sleep shifting
   - c. Narcolepsy
   - d. Sleep apnea
   - e. REM rebound

7. Which of these drugs, which acts as both a stimulant and a hallucinogen, can also cause dangerous dehydration?
   - a. LSD
   - b. Ecstasy
   - c. Alcohol
   - d. Cocaine
   - e. Caffeine

8. Recent research most consistently supports the effectiveness of hypnosis in which of the following areas?
   - a. Pain relief
   - b. Recovery of lost memories
   - c. Reduction of sleep deprivation
   - d. Forcing people to act against their will
   - e. Cessation of smoking

9. What are the three major categories of drugs?
   - a. Hallucinogens, depressants, and stimulants
   - b. Stimulants, barbiturates, and hallucinogens
   - c. Amphetamines, barbiturates, and opioids
   - d. MDMA, LSD, and THC
   - e. Alcohol, caffeine, and nicotine

10. Jarod’s muscles are relaxed, his body is basically paralyzed, and he is hard to awaken. Which sleep state is Jarod probably experiencing?
    - a. Sleep apnea
    - b. Hypnagogic
    - c. Paradoxical
    - d. Delta
    - e. Sleep deprivation

11. The effects of opiates are similar to the effects of which neurotransmitter?
    - a. Barbiturates
    - b. Endorphins
    - c. Tranquilizers
    - d. Norepinephrine
    - e. Acetylcholine

12. Slowed reactions, slurred speech, and decreased skill performance are associated with abuse of which drug?
    - a. Nicotine
    - b. Methamphetamine
    - c. Caffeine
    - d. Alcohol
    - e. Ecstasy

13. What term did Ernest Hilgard use to describe a split between different levels of consciousness?
    - a. Hypnagogic imagery
    - b. REM sleep
    - c. Delta waves
    - d. Spindles
    - e. Dissociation

14. Psychologists who study the brain’s activity during sleep are most likely to use which of these technologies?
    - a. MRI
    - b. CT scan
    - d. PET scan
    - e. EEG
    - e. EKG

15. What term describes the brain’s adaptation to a drug’s chemistry, requiring larger and larger doses to experience the same effect?
    - a. Withdrawal
    - b. Tolerance
    - c. Addiction
    - d. Substance use disorder
    - e. Dissociation

Rubric for Free-Response Question 2

1 point: Posthypnotic suggestions have been used by therapists to help people overcome health issues. Patients typically don’t remember these suggestions that are made during a hypnotic state, but such suggestions may influence a patient’s behavior after the hypnosis session. These deliberate posthypnotic suggestions are unique to hypnosis and contradict Phil’s claim that dreams and hypnosis are equivalent states of consciousness. pp. 220–221

1 point: Some physiological studies indicate that hypnotic states are associated with unique patterns of activation in the brain. If brain scans indicate specific patterns unique to hypnotic states that are different from those associated with dreaming or other states of consciousness, Phil’s claim may not be accurate. pp. 221–222

1 point: Social influence theory explains the impact of hypnosis through the powerful social pressures experienced by people being hypnotized. Some studies show that people pretending to be hypnotized and people who are “really” hypnotized behave in similar ways, indicating that hypnosis may not lead to a “different state of consciousness,” as claimed by Phil. pp. 221–222

1 point: Hilgard’s studies in support of the divided-consciousness theory indicate that dissociation may occur during hypnosis. If there is a “split” between different levels of consciousness, one level may be aware of information that another level is ignorant of, Phil’s claim that hypnosis is similar to dreaming needs to be modified. p. 222
Free-Response Questions

1. Different biological changes are associated with different states of consciousness. Explain the biological changes (if any) typically associated with the following consciousness-related concepts:
   - Sleep deprivation
   - REM
   - Tolerance
   - Opiates

Rubric for Free-Response Question 1

1 point: Sleep deprivation causes a wide range of biological changes in the body, all associated with decreased performance while awake. These biological changes include lack of energy, falling asleep during the day, changes in appetite, suppression of the immune system, decreased focus and attention, and decreased mood. (Pages 234–237)

1 point: The REM stage of the sleep cycle is associated with dramatic biological changes. Brain waves and breathing become irregular, heart rate increases, and eyes dart back and forth beneath the eyelids. (Pages 228–229)

1 point: After repeated use of some drugs, humans develop tolerance for those substances, meaning that increasing dosages of those drugs are needed to produce the same effect. Tolerance occurs because of biological changes in the brain. The brain’s chemistry changes when some psychoactive drugs are repeatedly ingested, interfering with the brain’s ability to produce or use some neurotransmitters. (Pages 246–247)

1 point: Drugs categorized as opiates cause a range of biological changes in the body. Some of the changes mentioned in the text are: pupil constriction, slower breathing, lethargy, and eventually, painful withdrawal symptoms as the brain loses its ability to produce “natural” endorphins. (Page 250)

2. Ernest, a psychology major, is discussing hypnosis with his roommate, Phil. Phil says: “I can’t believe so many people fall for that hypnosis stuff. Hypnosis is just like dreaming. It’s just a different state of consciousness, and a dream can affect someone just like a supposed hypnotic state can.”

Explain how Ernest might use the following terms as he discusses the validity of Phil’s claims.
   - Posthypnotic suggestion
   - Divided-consciousness theory
   - Social influence theory
   - Dissociation

(4 points)

3. Consciousness has been defined and studied differently throughout the history of psychology. In your own words, explain how modern psychologists define consciousness, and explain how the following “altered” states of consciousness relate to your definition.
   - Hypnosis
   - Sleep stages
   - Dreams
   - Psychoactive drugs

(5 points)

Rubric for Free-Response Question 3

1 point: Students should establish a definition that includes the idea that consciousness is related to awareness of our internal and external environments. (pp. 218–219)

1 point: Hypnosis relates to this definition because hypnotic states can influence awareness of both environments. Hypnotized individuals can be given suggestions that lead them to forget events that occurred while hypnotized, indicating a loss of awareness of the environment during hypnosis. (pp. 219–222)

1 point: As we pass through the stages of sleep, we become less and less aware of our outside environment. During deeper stages of sleep, we are less likely to be awakened by noise in our environment, indicating a change in consciousness according to this definition. (pp. 226–229)

1 point: Environmental stimuli are often incorporated into dreams, indicating that we are partially aware of our outside environment even during this sleep stage. (pp. 240–241)

1 point: Psychoactive drugs by definition alter our perceptions of the world. These altered perceptions influence our awareness of the external and internal worlds. Changes in perception may influence us, causing us to ignore some environmental stimuli, react powerfully to others, or even react to stimuli that we hallucinate because of the influence of the drugs. (Module 25)