

usually lasting 2 to 10 minutes; some 5 percent have repeated episodes (Giles et al., 1994). Young children, who have the deepest and longest NREM-3 sleep, are the most likely to experience both night terrors and sleepwalking. As we grow older and deep NREM-3 sleep diminishes, so do night terrors and sleepwalking. After being sleep deprived, we sleep more deeply, which increases any tendency to sleepwalk (Zadra et al., 2008).

**A dreamy take on dreamland** The 2010 movie *Inception* creatively played off our interest in finding meaning in our dreams, and in understanding the layers of our consciousness. It further explored the idea of creating false memories through the power of suggestion—an idea we will explore in Module 33.



Photofest/Warner Bros. Pictures

## Dreams

Now playing at an inner theater near you: the premiere showing of a sleeping person's vivid dream. This never-before-seen mental movie features captivating characters wrapped in a plot so original and unlikely, yet so intricate and so seemingly real, that the viewer later marvels at its creation.

Waking from a troubling dream, wrenched by its emotions, who among us has not won-

dered about this weird state of consciousness? How can our brain so creatively, colorfully, and completely construct this alternative world? In the shadowland between our dreaming and waking consciousness, we may even wonder for a moment which is real.

Discovering the link between REM sleep and dreaming opened a new era in dream research. Instead of relying on someone's hazy recall hours or days after having a dream, researchers could catch dreams as they happened. They could awaken people during or within 3 minutes after a REM sleep period and hear a vivid account.

### What We Dream

#### 24-2 What do we dream?

Daydreams tend to involve the familiar details of our life—perhaps picturing ourselves explaining to a teacher why a paper will be late, or replaying in our minds personal encounters we relish or regret. **REM dreams**—“hallucinations of the sleeping mind” (Loftus & Ketcham, 1994, p. 67)—are vivid, emotional, and bizarre—so vivid we may confuse them with reality. Awakening from a nightmare, a 4-year-old may be sure there is a bear in the house.

We spend six years of our life in dreams, many of which are anything but sweet. For both women and men, 8 in 10 dreams are marked by at least one negative event or emotion (Domhoff, 2007). Common themes are repeatedly failing in an attempt to do something; of being attacked, pursued, or rejected; or of experiencing misfortune (Hall et al., 1982). Dreams with sexual imagery occur less often than you might think. In one study, only 1 in 10 dreams among young men and 1 in 30 among young women had sexual content (Domhoff, 1996). More commonly, the story line of our dreams incorporates traces of previous days' nonsexual experiences and preoccupations (De Koninck, 2000):

- After suffering a trauma, people commonly report nightmares, which help extinguish daytime fears (Levin & Nielsen, 2007, 2009). One sample of Americans recording their dreams during September 2001 reported an increase in threatening dreams following the 9/11 terrorist attacks (Propper et al., 2007).
- After playing the computer game *Tetris* for 7 hours and then being awakened repeatedly during their first hour of sleep, 3 in 4 people reported experiencing images of the game's falling blocks (Stickgold et al., 2000).
- Compared with city-dwellers, people in hunter-gatherer societies more often dream of animals (Mestel, 1997). Compared with nonmusicians, musicians report twice as many dreams of music (Uga et al., 2006).

**dream** a sequence of images, emotions, and thoughts passing through a sleeping person's mind. Dreams are notable for their hallucinatory imagery, discontinuities, and incongruities, and for the dreamer's delusional acceptance of the content and later difficulties remembering it.

“I do not believe that I am now dreaming, but I cannot prove that I am not.” —PHILOSOPHER BERTRAND RUSSELL (1872–1970)

#### FYI

Would you suppose that people dream if blind from birth? Studies in France, Hungary, Egypt, and the United States all found blind people dreaming of using their nonvisual senses—hearing, touching, smelling, tasting (Buquet, 1988; Taha, 1972; Vekassy, 1977).

“For what one has dwelt on by day, these things are seen in visions of the night.” —MENANDER OF ATHENS (342–292 B.C.E.), *THE PRINCIPAL FRAGMENTS*

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, 1990; 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

#### 24-3 What are the functions of dreams?

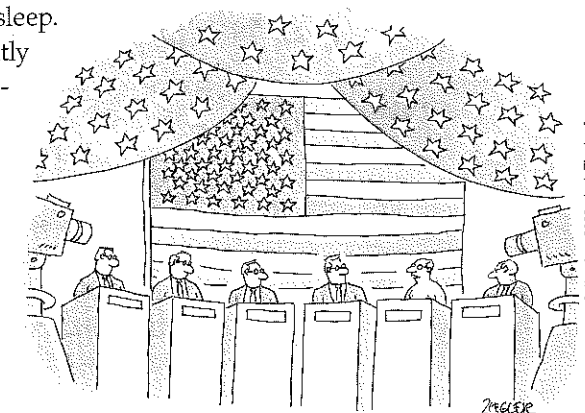
Dream theorists have proposed several explanations of why we dream, including these:

**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. Legend 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 (Empson & 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



“Uh-oh. I think I'm having one of those dreams again.”

“Follow your dreams, except for that one where you're naked at work.” —ATTRIBUTED TO COMEDIAN HENRY YOUNGMAN

#### FYI

A popular sleep myth: If you dream you are falling and hit the ground (or if you dream of dying), you die. (Unfortunately, those who could confirm these ideas are not around to do so. Some people, however, have had such dreams and are alive to report them.)

“When people interpret [a dream] as if it were meaningful and then sell those interpretations, it's quackery.” —SLEEP RESEARCHER J. ALLAN HOBSON (1995)

**manifest content** according to Freud, the remembered story line of a dream (as distinct from its latent, or hidden, content).

**latent content** according to Freud, the underlying meaning of a dream (as distinct from its manifest content).

task, buzz again during later REM sleep (Louie & Wilson, 2001; Maquet, 2001). So precise are these activity patterns that scientists can tell where in the maze the rat would be if awake. Others, unpersuaded by these studies, note that memory consolidation may also occur during non-REM sleep (Siegel, 2001; Vertes & Siegel, 2005). This much seems true: A night of solid sleep (and dreaming) has an important place in our lives. To sleep, perchance to remember.

This is important news for students, many of whom, observed researcher Robert Stickgold (2000), suffer from a kind of sleep bulimia—binge-sleeping on the weekend. “If you don’t get good sleep and enough sleep after you learn new stuff, you won’t integrate it effectively into your memories,” he warned. That helps explain why high school students with high grades have averaged 25 minutes more sleep a night than their lower-achieving classmates (Wolfson & Carskadon, 1998).

**FYI**

Rapid eye movements also stir the liquid behind the cornea; this delivers fresh oxygen to corneal cells, preventing their suffocation.

**To develop and preserve neural pathways.** Perhaps dreams, or the brain activity associated with REM sleep, serve a *physiological* function, providing the sleeping brain with periodic stimulation. This theory makes developmental sense. As you will see in Unit IX, stimulating experiences preserve and expand the brain’s neural pathways. Infants, whose neural networks are fast developing, spend much of their abundant sleep time in REM sleep (**FIGURE 24.3**).

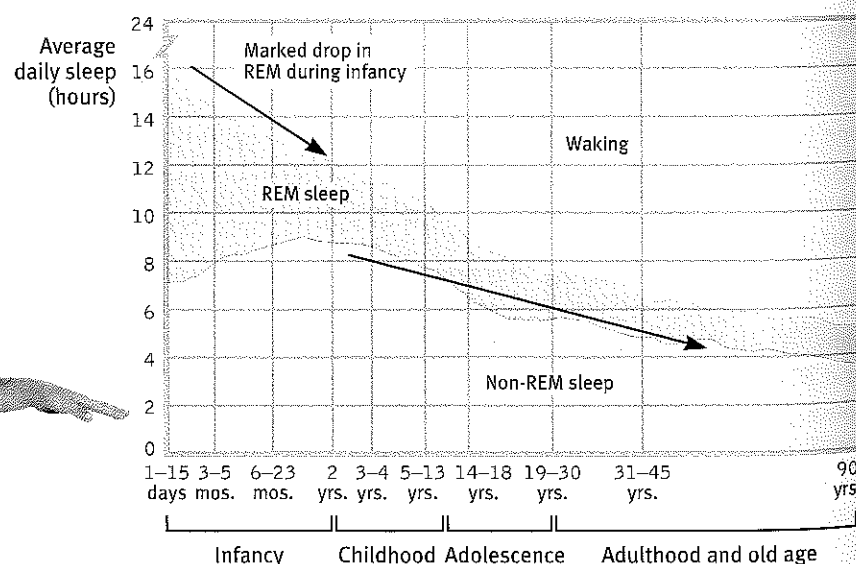
**To make sense of neural static.** Other theories propose that dreams erupt from *neural activation* spreading upward from the brainstem (Antrobus, 1991; Hobson, 2003, 2004, 2009). According to one version, dreams are the brain’s attempt to make sense of random neural activity. Much as a neurosurgeon 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—voilà!—we dream. Damage either the limbic system or the visual centers active during dreaming, and dreaming itself may be impaired (Domhoff, 2003).

**FYI**

**Question:** Does eating spicy foods cause one to dream more?  
**Answer:** Any food that causes you to awaken more increases your chance of recalling a dream (Moorcroft, 2003).

**Figure 24.3**

**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, 1972.)



**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 9, 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.*

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

**Table 24.2** Dream Theories

Theory	Explanation	Critical Considerations
<i>Freud’s wish-fulfillment</i>	Dreams provide a “psychic safety valve”—expressing otherwise unacceptable feelings; contain manifest (remembered) content and a deeper layer of latent content—a hidden meaning.	Lacks any scientific support; dreams may be interpreted in many different ways.
<i>Information-processing</i>	Dreams help us sort out the day’s events and consolidate our memories.	But why do we sometimes dream about things we have not experienced?
<i>Physiological function</i>	Regular brain stimulation from REM sleep may help develop and preserve neural pathways.	This does not explain why we experience meaningful dreams.
<i>Neural activation</i>	REM sleep triggers neural activity that evokes random visual memories, which our sleeping brain weaves into stories.	The individual’s brain is weaving the stories, which still tells us something about the dreamer.
<i>Cognitive development</i>	Dream content reflects dreamers’ cognitive development—their knowledge and understanding.	Does not address the neuroscience of dreams.



## Before You Move On

### ► ASK YOURSELF

In some places, the school day for teenagers runs from 9:00 A.M. to 4:00 P.M. But in the United States, the teen school day often runs from 8:00 A.M. to 3:00 P.M., or even 7:00 A.M. to 2:00 P.M. Early to rise isn't making kids wise, say critics—it's making them sleepy. For optimal alertness and well-being, teens need 8 to 9 hours of sleep a night. So, should early-start schools move to a later start time, even if it requires buying more buses or switching start times with elementary schools? Or is this impractical, and would it do little to remedy the tired-teen problem?

### ► TEST YOURSELF

Are you getting enough sleep? What might you ask yourself to answer this question?

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

## 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)