Body Rhythms and Mental States
Ask questions. . . be willing to wonder

If you didn’t know what time it was, would your body?

Why do we need to sleep—and dream?

Can hypnotized people be made to do things against their will?

Why can a glass of wine make a person feel happy and excited on one occasion but tired and depressed on another?

In Lewis Carroll’s *Alice's Adventures in Wonderland*, the ordinary rules of everyday life keep dissolving in a sea of logical contradictions. “Dear dear!” muses the harried heroine. “How queer everything is today! . . . I wonder if I’ve been changed in the night? Let me think: was I the same when I got up this morning? I almost think I can remember feeling a little different. But if I’m not the same, the next question is, ‘Who in the world am I?’ Ah, that’s the great puzzle!”

In a way, we all live in a sort of Wonderland. For a third of our lives, we reside in a realm where the ordinary rules of logic and experience are suspended: the dream world of sleep. Throughout the day, mood, alertness, efficiency, and consciousness itself—our awareness of ourselves and the environment—are in perpetual flux. Sometimes we are hyperalert and attentive; at other times we daydream, “space out,” or go on “automatic pilot.”

Starting from the assumption that mental and physical states are interconnected, psychologists, along with other scientists, are exploring the links between fluctuations in subjective experience and changes in brain activity and hormone levels. They have come to view changing states of consciousness as part of the rhythmic ebb and flow of experience over time. For example, dreaming, traditionally classified as a state of consciousness, is also part of a 90-minute cycle of brain activity.

Examining a person’s ongoing rhythmic cycles is like watching a motion picture of consciousness. Studying the person’s distinct states of consciousness is more like looking at separate snapshots. In this chapter, we will first run the motion picture, to see how functioning and consciousness vary predictably over time. Then we will zoom in on one specific snapshot—the world of dreams—and examine it in some detail. Finally, we will turn to two techniques that have been used to “retouch” or alter the film: hypnosis and the use of recreational drugs.

OUTLINE

- Biological Rhythms
  - Circadian Rhythms
  - Moods and Long-Term Rhythms
- The Rhythms of Sleep
  - The Stages of Sleep
  - Why We Sleep
- Exploring the Dream World
  - Dreams as Efforts to Deal with Problems
  - Dreams as Thinking
  - Dreams as Interpreted Brain Activity
  - Evaluating Dream Theories
- The Riddle of Hypnosis
  - The Nature of Hypnosis
  - Theories of Hypnosis
  - BIOLOGY and Hypnosis
- Consciousness-Altering Drugs
  - Classifying Drugs
  - The Physiology of Drug Effects
  - The Psychology of Drug Effects
- Taking Psychology with You
  - The Drug Debate

Explore the Concept

The Big Picture: States of Consciousness in MyPsychLab
Biological Rhythms

You may have come across an advertisement on the internet for “biorhythm charts,” which supposedly foretell fluctuations in mood, alertness, and physical performance over your entire lifetime—solely on the basis of when you were born. Those who sell these charts claim they can foresee your good days and tell when you will be susceptible to accidents, errors, and illness. Well, save your money. Whenever researchers have taken the trouble to test such claims scientifically—for example, by examining occupational accidents in light of the charts’ predictions—they have found the charts completely useless (Hines, 1998).

It is true, however, that the human body changes over the course of a day, a week, a year. We all experience dozens of periodic, fairly regular ups and downs in physiological functioning, which is what scientists mean when they speak of biological rhythms. A biological clock in our brains governs the rise and fall of hormone levels, urine volume, blood pressure, and even the responsiveness of brain cells to stimulation. Biological rhythms are typically synchronized with external events, such as changes in clock time, temperature, and daylight—a process called entrainment. But many of these rhythms continue to occur even in the absence of external time cues; they are endogenous, or generated from within.

Many biological rhythms, called circadian rhythms, occur approximately every 24 hours. The best-known circadian rhythm is the sleep–wake cycle, but there are hundreds of others that affect physiology and performance. For example, body temperature fluctuates about one degree centigrade each day, peaking, on average, in the late afternoon and hitting a low point, or trough, in the wee hours of the morning.

Other rhythms occur less often than once a day—say, once a month, or once a season. In the animal world, seasonal rhythms are common. Birds migrate south in the fall, bears hibernate in the winter, and marine animals become active or inactive, depending on bimonthly changes in the tides. In human beings, the female menstrual cycle occurs every 28 days on average. And some rhythms occur more frequently than once a day, many of them on about a 90-minute cycle. These include physiological changes during sleep, and stomach contractions, hormone levels, susceptibility to visual illusions, verbal and spatial performance, brain-wave responses during cognitive tasks, alertness, and daydreaming (Escera, Cilveti, & Grau, 1992; Klein & Armitage, 1979; Kripke, 1974; Lavie, 1976).

Biological rhythms influence everything from the effectiveness of medicines taken at different times of the day to alertness and performance on the job. With a better understanding of these internal tempos, we may be able to design our days to take better advantage of our bodies’ natural tempos. Let’s look more closely at how these cycles operate.

Circadian Rhythms

Circadian rhythms exist in plants, animals, insects, and human beings. They reflect the adaptation of organisms to the many changes associated with the rotation of Earth on its axis, such as changes in light, air pressure, and temperature.
In most societies, external time cues abound, and people's circadian rhythms become entrained to them, following a strict 24-hour schedule. To identify endogenous rhythms, therefore, scientists must isolate volunteers from sunlight, clocks, environmental sounds, and all other cues to time. Some hardy souls have spent weeks or even months alone in caves and salt mines, linked to the outside world only by a one-way phone line and a cable transmitting physiological measurements to the surface. Nowadays, however, volunteers usually live in specially designed rooms equipped with stereo systems, comfortable furniture, and temperature controls.

When participants in these studies have been allowed to sleep, eat, and work whenever they wished, a few have lived a “day” that is much shorter or longer than 24 hours. If allowed to take daytime naps, however, most participants soon settle into a day that averages about 24.3 hours (Moore, 1997). And when people are put on an artificial 28-hour day, in an environment free of all time cues, their body temperature and certain hormone levels follow a cycle that is very close to 24 hours—24.18 hours, to be precise (Czeisler et al., 1999). These rhythms are remarkably similar in length from one person to the next. For many people, alertness, like temperature, peaks in the late afternoon and falls to a low point in the very early morning (Lavie, 2001).

The Body's Clock. Circadian rhythms are controlled by a biological clock, or overall coordinator, located in a tiny teardrop-shaped cluster of cells in the hypothalamus called the suprachiasmatic nucleus (SCN). Neural pathways from special receptors in the back of the eye transmit information to the SCN and allow it to respond to changes in light and dark. The SCN then sends out messages that cause the brain and body to adapt to these changes. Other clocks also exist, scattered around the body, and some may operate independently of the SCN, but for most circadian rhythms the SCN is regarded as the master pacemaker.

The SCN regulates fluctuating levels of hormones and neurotransmitters, and they in turn provide feedback that affects the SCN's functioning. For example, during the dark hours, one hormone regulated by the SCN, melatonin, is secreted by the pineal gland, that is involved in the regulation of daily biological (circadian) rhythms.
Body Rhythms and Mental States

The pineal gland, deep within the brain. When you go to sleep in a darkened room, your melatonin level rises; when you wake up in the morning to a lightened room, it falls. Melatonin, in turn, appears to help keep the biological clock in phase with the light-dark cycle (Haimov & Lavie, 1996; Lewy et al., 1992).

Melatonin therapy has been used to treat insomnia and synchronize the disturbed sleep–wake cycles of blind people who lack light perception and whose melatonin production does not cycle normally (Sack & Lewy, 1997). But efforts to treat the insomnia of sighted people by giving them melatonin have had mixed results. Many people take over-the-counter melatonin supplements to help them sleep or to reduce jet lag, but it’s unlikely that these supplements are very helpful. There are no federal standards to assure their quality, and no one has yet identified which dosages are effective (if any) or studied their long-term safety.

When the Clock Is out of Sync. Under normal conditions, the rhythms governed by the SCN are synchronized, just as watches can be synchronized. Their peaks may occur at different times, but they occur in phase with one another; if you know when one rhythm peaks, you can predict fairly well when another will. But when your normal routine changes, your circadian rhythms may be thrown out of phase with one another. Such internal desynchronization often occurs when people take airplane flights across several time zones. Sleep and wake patterns usually adjust quickly, but temperature and hormone cycles can take several days to return to normal. The resulting jet lag affects energy level, mental skills, and motor coordination.

Internal desynchronization also occurs when a worker must adjust to a new shift. Efficiency drops, the person feels tired and irritable, accidents become more likely, and sleep disturbances and digestive disorders may occur. For police officers, emergency room personnel, airline pilots, truck drivers, and operators of nuclear power plants, the consequences can be a matter of life and death. Even relatively small desynchronizations can have deadly effects. University of British Columbia researcher Stanley Coren (1996) studied the records of all accidental deaths in the United States over a three-year period. He found that the spring shift to daylight saving time (and the minimal sleep loss associated with it) produced a short-term increase in the likelihood of accidental death, but that the fall shift back to standard time had little effect.

One reason that scientists have not yet found a simple cure for desynchronization is that circadian rhythms are not perfectly regular in daily life. They can be affected by illness, stress, fatigue, excitement, exercise, drugs, mealtimes, and ordinary daily experiences. In research with mice, these rhythms were even influenced by diet. Mice usually sleep during the day, but putting them on a high-fat diet altered the activity of genes involved in appetite and metabolism, and the mice began waking up and eating during the day (Kohsaka et al., 2007).

Further, circadian rhythms differ greatly from individual to individual because of genetic differences (Hur, Bouchard, & Lykken, 1998). For example, a variation in a single gene seems to be the reason that some people are early birds (or “larks”), bouncing out of bed at the crack of dawn, while others are night owls who do their best work late at night and can’t be pried out of bed until noon (Archer et al., 2003). Scientists call your identity as a lark or owl your “chronotype.” Genetic influences may
contribute to chronotypes, although early attempts to find “chronotype genes” have proven difficult to replicate (Chang et al., 2011; Osland et al., 2011). Moreover, your chronotype may change as you age: Adolescents are more likely than children and older adults to be owlish (Biss & Hasher, 2012), which may be why many teenagers have trouble adjusting to school schedules. (Schools are not designed to accommodate night owls.) You may be able to learn about your own personal pulses through careful self-observation, and you may want to try putting that information to use when planning your daily schedule.

Moods and Long-Term Rhythms

Long-term cycles have been observed in everything from the threshold for tooth pain to conception rates. Folklore holds that our moods follow similar rhythms, particularly in response to seasonal changes and, in women, to menstrual changes. But do they?

Does the Season Affect Moods? Clinicians report that some people become depressed during particular seasons, typically winter, when periods of daylight are short—a pattern that has come to be known as seasonal affective disorder (SAD) (N. E. Rosenthal, 2009). During the winter months, SAD patients report feelings of sadness, lethargy, drowsiness, and a craving for carbohydrates. To counteract the presumed effects of sunless days, some physicians and therapists treat SAD patients with seasonal affective disorder (SAD)

A controversial disorder in which a person experiences depression during the winter and an improvement of mood in the spring.

GET INVOLVED! Measuring Your Alertness Cycles

For at least three days, except when you are sleeping, keep an hourly record of your mental alertness level, using this five-point scale: 1 = extremely drowsy or mentally lethargic, 2 = somewhat drowsy or mentally lethargic, 3 = moderately alert, 4 = alert and efficient, 5 = extremely alert and efficient. Does your alertness level appear to follow a circadian rhythm, reaching a high point and a low point once every 24 hours? Or does it follow a shorter rhythm, rising and falling several times during the day? Are your cycles the same on weekends as during the week? Most important, how well does your schedule mesh with your natural fluctuations in alertness?

This woman is receiving light therapy for seasonal affective disorder (SAD). This type of treatment has become popular and appears to be effective. But fewer people actually have SAD than is commonly thought, and the causes remain uncertain.
phototherapy, having them sit in front of bright fluorescent lights at specific times of the day, usually early in the morning. In some cases, they have also begun prescribing antidepressants and other drugs.

Evaluating the actual prevalence of SAD is difficult, however. Information comes mainly from clinical case reports rather than controlled studies, and as we saw in Chapter 2, case studies have serious drawbacks. As for the effectiveness of light treatments, research on this question too has been flawed. A review of 173 light-treatment studies published between 1975 and 2003 found that only 20 had used an acceptable design and suitable controls (Golden et al., 2005). However, a meta-analysis of the data from those 20 studies did show that SAD patients’ symptoms were reduced when they were exposed to either a brief period (such as 30 minutes) of bright light after waking or to light that slowly became brighter, simulating the dawn. Light therapy even helped people with mild to moderate nonseasonal depression (Pail et al., 2011) (see also Wirz-Justice et al., 2005).

Many researchers believe that the circadian rhythms of SAD patients are out of sync—that, in essence, they have a chronic form of jet lag (Lewy et al., 2006). Some researchers have concluded that SAD patients must have some abnormality in the way they produce or respond to melatonin. For example, in one study, SAD patients produced melatonin for about half an hour longer at night in the winter than in the summer, whereas control subjects showed no such seasonal pattern (Wehr et al., 2001). However, why would light therapy also help some people with nonseasonal cases of depression? True cases of SAD may in fact have a biological basis, but the evidence to date remains inconclusive. When people get the winter blues, the reason could also be that they hate cold weather, are physically inactive, do not get outside much, or feel lonely during the winter holidays.

Does the Menstrual Cycle Affect Moods? Controversy has persisted about another long-term rhythm, the female menstrual cycle, which occurs, on average, every 28 days. During the first half of this cycle, an increase in the hormone estrogen causes the lining of the uterus to thicken in preparation for a possible pregnancy. At mid-cycle, the ovaries release a mature egg, or ovum. Afterward, the ovarian sac that contained the egg begins to produce progesterone, which helps prepare the uterine lining to receive the egg. Then, if conception does not occur, estrogen and progesterone levels fall, the uterine lining sloughs off as the menstrual flow, and the cycle begins again. The interesting question for psychologists is whether these physical changes are correlated with emotional or intellectual changes, as folklore and tradition would have us believe.

Many people seem to think so. In the 1970s, a vague cluster of physical and emotional symptoms—including fatigue, headache, irritability, and depression—associated with the days preceding menstruation came to be thought of as an illness and was given a label: “premenstrual syndrome” (“PMS”) (Parlee, 1994). Since then, most laypeople, doctors, and psychiatrists have assumed, uncritically, that many women “suffer” from PMS or from its supposedly more extreme and debilitating version, “premenstrual dysphoric disorder” (“PMDD”).

What does the evidence actually show? Many women do have physical symptoms associated with menstruation, including cramps, breast tenderness, and water retention, although women vary tremendously in this regard. And of course these physical symptoms can make some women grumpy or unhappy, just as pain can make men grumpy or unhappy. But emotional symptoms associated with menstruation—notably, irritability and depression—are pretty rare, which is why we put “PMS” in quotation marks. Just as with SAD, more people claim to have symptoms than actually do. In reality, fewer than 5% of all women have such symptoms predictably over their cycles (Brooks-Gunn, 1986; Reid, 1991; Walker, 1994).
Chapter 5  Body Rhythms and Mental States 145

The Rhythms of Sleep

Perhaps the most perplexing of all our biological rhythms is the one governing sleep and wakefulness. Sleep, after all, puts us at risk: Muscles that are usually ready to respond to danger relax, and one's senses grow dull. So why is sleep such a profound necessity?

The Stages of Sleep

Let's start with some of the changes that occur in the brain during sleep. Until the early 1950s, little was known about these changes. Then a breakthrough occurred in the laboratory of physiologist Nathaniel Kleitman. He had given one of his graduate students, Eugene Aserinsky, the tedious task of finding out whether the slow, rolling eye movements that characterize the onset of sleep continue throughout the night. To both men's surprise, eye movements did occur but they were rapid, not slow (Aserinsky & Kleitman, 1955). Using electroencephalography (EEG) to measure the brain's electrical activity (see Chapter 4), these researchers, along with another of Kleitman's students, William Dement, were able to correlate the rapid eye movements with changes in sleepers' brain-wave patterns (Dement, 1992). Adult volunteers were soon spending their nights sleeping in laboratories while scientists measured changes in their brain activity, muscle tension, breathing, and other physiological responses.

As a result of this research, today we know that during sleep, periods of rapid eye movement (REM) sleep alternate with periods of fewer eye movements, or non-REM (NREM) sleep, in a cycle that recurs every 90 minutes or so. The REM periods last from a few minutes to as long as an hour, averaging about 20 minutes in length. Whenever they begin, the pattern of electrical activity from the sleeper's brain changes to resemble that of alert wakefulness. Non-REM periods are themselves divided into distinct stages, each associated with a particular brain-wave pattern (see Figure 5.1).
When you first climb into bed, close your eyes, and relax, your brain emits bursts of alpha waves. On an EEG recording, alpha waves have a regular, slow rhythm and a high amplitude (height). Gradually, these waves slow down even further, and you pass through four stages, each deeper than the previous one:

**Stage 1.** Your brain waves become small and irregular, and you feel yourself drifting on the edge of consciousness, in a state of light sleep. If awakened, you may recall fantasies or a few visual images.

**Stage 2.** Your brain emits occasional short bursts of rapid, high-peaking waves called sleep spindles. Minor noises probably won’t disturb you.

**Stage 3.** In addition to the waves that are characteristic of stage 2, your brain occasionally emits delta waves, very slow waves with very high peaks. Your breathing and pulse have slowed down, your muscles are relaxed, and you are hard to rouse.

**Stage 4.** Delta waves have now largely taken over, and you are in deep sleep. It will probably take vigorous shaking or a loud noise to awaken you. Oddly, though, if you walk in your sleep, this is when you are likely to do so. No one yet knows what causes sleepwalking, which occurs more often in children than adults, but it seems to involve unusual patterns of delta-wave brain activity (Bassetti et al., 2000).

This sequence of stages takes about 30 to 45 minutes. Then you move back up the ladder from stage 4 to 3 to 2 to 1. At that point, about 70 to 90 minutes after the onset of sleep, something peculiar happens. Stage 1 does not turn into drowsy wakefulness, as one might expect. Instead, your brain begins to emit long bursts of very rapid, somewhat irregular waves. Your heart rate increases, your blood pressure rises, and your breathing speeds up and becomes more irregular. Small twitches in your face and fingers may occur. In men, the penis becomes somewhat erect as vascular tissue relaxes.
and blood fills the genital area faster than it exits. In women, the clitoris enlarges and vaginal lubrication increases. At the same time, most skeletal muscles go limp, preventing your aroused brain from producing physical movement. You have entered the realm of REM.

Because the brain is extremely active while the body is entirely inactive, REM sleep has also been called “paradoxical sleep.” It is during these periods that vivid dreams are most likely to occur. People report dreams when they are awakened from non-REM sleep, too, but non-REM dreams tend to be shorter, less vivid, and more realistic than REM dreams, except in the hour or so before a person wakes up in the morning.

Occasionally, as the sleeper wakes up, a curious phenomenon occurs. The person emerges from REM sleep before the muscle paralysis characteristic of that stage has entirely disappeared, and becomes aware of an inability to move. About 30% of the general population has experienced at least one such episode, and about 5% have had a “waking dream” in this state. Their eyes are open, but what they “see” are dreamlike hallucinations, most often shadowy figures. They may even “see” a ghost or space alien sitting on their beds or hovering in a hallway. Some people interpret this experience literally and come to believe they have been visited by aliens or are being haunted by ghosts (Clancy, 2005; McNally, 2003).

REM and non-REM sleep continue to alternate throughout the night. As the hours pass, stages 3 and 4 tend to shorten or even disappear and REM periods tend to lengthen and occur closer together (see Figure 5.2). This pattern explains why you are likely to be dreaming when the alarm clock goes off in the morning. But the cycles are far from regular. An individual may bounce directly from stage 4 back to stage 2 or go from REM to stage 2 and then back to REM. Also, the time between REM and non-REM is highly variable, differing from person to person and also within any given individual.

The reasons for REM sleep are still controversial. If you wake people up every time they lapse into REM sleep, nothing dramatic will happen. When finally allowed to sleep normally, however, they will spend a longer time than usual in the REM phase, and it will be hard to rouse them. Electrical brain activity associated with REM may burst through into non-REM sleep and even into wakefulness, as if the person is making up for something he or she had been deprived of.

Some researchers have proposed that this “something” is connected with dreaming, but that idea has problems. For one thing, in rare cases, brain-damaged patients have lost the capacity to dream, yet they continue to show the normal sleep stages, including REM (Bischof & Bassetti, 2004). Moreover,
Whatever your age, sometimes the urge to sleep is irresistible, especially because in fast-paced modern societies, many people—even young children—do not get as much sleep as they need.

Although all mammals experience REM sleep—the only known exceptions are the bottlenose dolphin and the porpoise—it seems unlikely that rats and anteaters have the cognitive abilities required to construct dreams. According to one well-known dream researcher, “no one, but no one, has been able to come up with a convincing explanation for REM sleep” (G. William Domhoff, personal communication).

**Why We Sleep**

Generally speaking, sleep appears to provide a time-out period, so that the body can eliminate waste products from muscles, repair cells, conserve or replenish energy stores, strengthen the immune system, or recover abilities lost during the day. When we do not get enough sleep, our bodies operate abnormally. For example, levels of hormones necessary for normal muscle development and proper immune system functioning decline (Leproult, Van Reeth, et al., 1997).

Although most people can still get along reasonably well after a day or two of sleeplessness, sleep deprivation that lasts for four days or longer is quite uncomfortable, and soon becomes unbearable. In animals, forced sleeplessness leads to infections and eventually death, and the same seems to be true for people. In one tragic case, a 51-year-old man abruptly began to lose sleep. After sinking deeper and deeper into an exhausted stupor, he developed a lung infection and died. An autopsy showed that he had lost almost all of the large neurons in two areas of the thalamus that have been linked to sleep and hormonal circadian rhythms (Lugaresi et al., 1986).

**The Mental Consequences of Sleeplessness.** Sleep is also necessary for normal mental functioning. Chronic sleep deprivation increases levels of the stress hormone cortisol, which may damage or impair brain cells that are necessary for learning and memory (Leproult, Copinschi, et al., 1997). Also, new brain cells may either fail to develop or may mature abnormally (Guzman-Marin et al., 2005). Perhaps in part because of such damage, after the loss of even a single night’s sleep, mental flexibility, attention, and creativity all suffer. After several days of staying awake, people may even begin to have hallucinations and delusions (Dement, 1978).

Of course, sleep deprivation rarely reaches that point, but people frequently suffer milder versions. According to Statistics Canada, 3.3 million Canadians (about one out of seven people over the age of 15) are plagued by chronic insomnia—difficulty falling or staying asleep (Statistics Canada, 2005). Insomnia can result from worry and anxiety, psychological problems, physical problems such as arthritis, and irregular or overly demanding work and study schedules. The result can be grogginess the next day. In a Canadian study of insomnia, Laval University’s Charles Morin followed almost 400 insomniacs undergoing treatment for the condition. More than half the group...
(54%) improved with treatment, but 27% relapsed afterward, indicating that the treatment was only a short-term solution (Morin et al., 2009).

Another cause of daytime sleepiness is sleep apnea, a disorder in which breathing periodically stops for a few moments, causing the person to choke and gasp. Sleep apnea is seen most often in older males and overweight people but also occurs in others. It has several causes, from blockage of air passages to failure of the brain to control respiration correctly. Over time, it can cause high blood pressure and irregular heartbeat; it may gradually erode a person’s health, and is associated with a shortened life expectancy (Young et al., 2008).

In narcolepsy, another serious disorder, an individual is subject to irresistible and unpredictable daytime attacks of sleepiness lasting from five to 30 minutes. When the person lapses into sleep, he or she is likely to fall immediately into the REM stage. Some people with narcolepsy experience an unusual symptom called cataplexy, which brings on the paralysis of REM sleep although they are still awake. Some 27 000 Canadians suffer from narcolepsy. The condition seems to be caused by the degeneration of certain neurons in the hypothalamus, possibly owing to an autoimmune malfunction or genetic abnormalities (Lin, Hungs, & Mignot, 2001; Mieda et al., 2004).

Other disorders also disrupt sleep, including some that involve odd or dangerous behaviour. For example, in REM behaviour disorder, the muscle paralysis associated with REM sleep does not occur, and the sleeper (usually a male) becomes physically active, often acting out a dream (Randall, 2012). If dreaming about football, he may try to “tackle” a piece of furniture. A person with this disorder is unaware of what he is doing, and other people may consider it amusing. But it is no joke; sufferers may hurt themselves or others, and they have an increased risk of later developing Parkinson’s disease and dementia (Postuma et al., 2008).

However, the most common cause of daytime sleepiness is probably the most obvious one—staying up late and therefore not getting enough sleep. Two-thirds of all North Americans get fewer than the recommended seven or eight hours of sleep and students get only about six hours of sleep per night on average. Some people do fine on relatively few hours of sleep, but most adults need more than six hours for optimal performance and many adolescents need ten. When people don’t get enough sleep, they are more likely to get into traffic and work accidents. Many countries limit work hours for airline pilots, truck drivers, and nuclear-plant operators, but medical residents still often work 24- to 30-hour shifts (Landrigan et al., 2008).

The driver of this truck crashed when he apparently fell asleep at the wheel. Thousands of serious and fatal car and truck accidents occur each year because of driver fatigue.

sleep apnea  A disorder in which breathing briefly stops during sleep, causing the person to choke and gasp and momentarily awaken.

narcolepsy  A disorder involving sudden and unpredictable daytime attacks of sleepiness or lapses into REM sleep.

REM behaviour disorder  A disorder in which the muscle paralysis that normally occurs during REM sleep is absent or incomplete, and the sleeper is able to act out his or her dreams.
Don’t doze off as we tell you this, but lack of sleep has also been linked to lower grades (Wolfson & Carskadon, 1998). In one real-world experiment, researchers had elementary and middle-school students go to sleep at their normal time for a week, earlier than usual for a week, and much later than usual for a week. Their teachers, who were blind to which condition a child was in during any given week, reported more academic and attention problems when a child stayed up late (Fallone et al., 2005). And it is not just young children who need their sleep. As sleep researcher James Maas (1998) has noted, many high school and college students drag themselves through the day “like walking zombies . . . moody, lethargic, and unprepared or unable to learn.”

The Mental Benefits of Sleep. Just as sleepiness can interfere with good mental functioning, so a good night’s sleep can promote it—and not just because you are well rested. Today, many scientists believe that sleep contributes actively to consolidation, in which the synaptic changes associated with recently stored memories become durable and stable, making memory more reliable (Stickgold, 2005) (see Chapter 10). One theory is that during sleep the neural changes involved in a recent memory are reactivated, making those changes in memory more permanent (Rasch et al., 2007). Reactivation of the original experience promotes the transfer of memories from temporary storage in the hippocampus to long-term storage in the cortex and thus making those changes more permanent (Born & Wilhelm, 2012).

Improvements in memory have been associated most closely with REM sleep and slow-wave sleep (stages 3 and 4), and with memory for specific motor and perceptual skills. For example, in one study, when people or animals learned a perceptual task and were allowed to get normal REM sleep, their memory for the task was better the next day, even when they had been awakened during non-REM periods. When they were deprived of REM sleep, however, their memories were impaired (Karni et al., 1994). But sleep also seems to strengthen other kinds of memories, including the recollection of events, locations, and facts (Rasch & Born, 2008). Emotional memories, especially, are improved with sleep: When people look at emotionally arousing scenes in the morning or evening and are then tested for their memory of the materials after 12 hours of daytime wakefulness or nighttime sleep, those tested after sleeping recall the emotional scenes more reliably than the neutral ones (Hu, Stylos-Allan, & Walker, 2006). They also do better on negative emotional scenes than other participants do (Payne et al., 2008). (See Figure 5.3.)

**FIGURE 5.3 Sleep and Consolidation in Memory**

When college students studied neutral scenes (e.g., an ordinary car) and emotionally negative scenes (e.g., a car totalled in an accident), sleep affected how well they later recognized the objects in the scenes. Students who studied the scenes in the evening and then got a night’s sleep before being tested did better at recognizing emotional objects than did those who studied the scenes in the morning and were tested after 12 hours of daytime wakefulness (Payne et al., 2008).
At least one study suggests that sleep also enhances problem solving, which relies on information stored in memory. German researchers gave volunteers a math test, but did not tell the volunteers about a hidden shortcut that would help them complete the test almost immediately.

One group was trained on the test in the evening and then got to snooze for eight hours before returning to the problem. Another group was also trained in the evening but then stayed awake for eight hours before coming back to the problem. A third group was trained in the morning and stayed awake all day, as the individuals normally would, before taking the test. Those people who had the nighttime sleep were nearly three times likelier to discover the hidden shortcut than those in the other two groups (Wagner et al., 2004). On the basis of other research, the scientist who led this study attributed the insight-enhancing effects of sleep to the long-term storage of memories during deep (slow-wave) sleep, which occurs primarily during the first four hours of the night.

Researchers are not unanimous on the role of sleep in learning and memory; some studies have produced negative results (Vertes & Siegel, 2005). In one study, researchers were surprised to find that depriving people of REM sleep actually improved memory for motor and perceptual skills involving finger tapping and mirror tracing (Rasch et al., 2009). Nonetheless, evidence is mounting to support the importance of sleep in memory and problem solving. The underlying biology appears to involve not only the formation of new synaptic connections in the brain but also the weakening of connections that are no longer needed (Donlea, Ramanan, & Shaw, 2009; Gilestro, Tononi, & Cirelli, 2009). In other words, we sleep to remember, but we also sleep to forget, so that the brain will have space and energy for new learning. Even a quick nap may help your mental functioning and increase your ability to put together separately learned facts in new ways (Lau, Alger, & Fishbein, 2011; Mednick et al., 2002). Sleep is not a waste of time; it’s an excellent use of it.

Recite & Review

Recite: Consolidate your memory for the previous material by saying out loud everything you can about REM versus non-REM sleep, the stages of sleep, the consequences of sleeplessness, sleep apnea, narcolepsy, REM behaviour disorder, and the role of sleep in memory consolidation.

Review: Next, go back and read this section again.

Now take this Quick Quiz:

Wake up and take this quiz!

A. Match each term with the appropriate phrase.

1. REM periods
   a. delta waves and talking in one’s sleep
2. Alpha
   b. irregular brain waves and light sleep
3. Stage 4 sleep
   c. person is relaxed but awake
4. Stage 1 sleep
   d. active brain but inactive muscles

B. What happens when someone deprived of REM sleep over a short period finally falls asleep?

C. True or false: Most people need more than six hours of sleep a night.

D. True or false: Only REM sleep has been associated with dreaming and memory consolidation.

Answers:
Exploring the Dream World

In some cultures, dreams are believed to occur when the spirit leaves the body to wander the world or speak to the gods. In others, dreams are thought to reveal the future. A Chinese Taoist of the third century BCE pondered the possible reality of the dream world. He told of dreaming that he was a butterfly flitting about. “Suddenly I woke up and I was indeed Chuang Tzu. Did Chuang Tzu dream he was a butterfly, or did the butterfly dream he was Chuang Tzu?”

For years, researchers believed that everyone dreams, and, indeed, most people who claim they never have dreams will in fact report them if they are awakened during REM sleep. However, as we noted earlier, there are rare cases of people who apparently do not dream at all. Most of these individuals have suffered some brain injury (Pagel, 2003).

In dreaming, the focus of attention is inward, though occasionally an external event, such as a wailing siren, can influence the dream’s content. While a dream is in progress, it may be vivid or vague, terrifying or peaceful. It may also seem to make perfect sense—until you wake up and recall it as illogical, bizarre, and disjointed. Although most of us are unaware of our bodies or where we are while we are dreaming, some people say that they occasionally have **lucid dreams**, in which they know they are dreaming and feel as though they are conscious (LaBerge & Levitan, 1995). A few even claim that they can control the action in these dreams, although this ability is probably rare.

One issue that has bothered sleep researchers for years is whether the eye movements of REM sleep correspond to events and actions in a dream. Are the eyes tracking these images? Some researchers believe that in adult dreamers, eye movements do resemble those of waking life, when the eyes and head move in synchrony as the person moves about and shifts his or her gaze (J. H. Herman, 1992). But others think that eye movements are no more related to dream content than are inner-ear muscle contractions, which also occur during REM sleep.

Why do the images in dreams arise at all? Why doesn’t the brain just rest, switching off all thoughts and images and launching us into a coma? Why, instead, do we spend our nights taking a chemistry exam, reliving an old love affair, flying through the air, or fleeing from monsters in the fantasy world of our dreams?

In popular culture, many people still hold to Freudian psychoanalytic notions of dreaming. Freud (1900/1953) claimed that dreams are “the royal road to the unconscious” because our dreams reflect unconscious conflicts and wishes, often sexual or violent in nature. The thoughts and objects in these dreams, he said, are disguised symbolically to make them less threatening: Your father might appear as your brother, a penis might be disguised as a snake or a cigar, or intercourse with a forbidden partner might be expressed as a train entering a tunnel.

Most psychologists today accept Freud’s notion that dreams are more than incoherent ramblings of the mind and that they can have psychological meaning, but they also consider psychoanalytic interpretations of dreams to be far-fetched. No reliable rules exist for interpreting the unconscious meaning of dreams, and there is no objective way to know whether a particular interpretation is correct. Nor is there any convincing empirical support for most of Freud’s claims. Psychoanalytic interpretations are common in popular books and on the internet, but they are only the writers’ personal hunches. Even Freud warned against simplified “this symbol means that”
interpretations; each dream, said Freud, must be analyzed in the context of the dreamer’s waking life. Not everything in a dream is symbolic.

Now, let’s consider three modern theories of dreaming and then evaluate them.

**Dreams as Efforts to Deal with Problems**

Another explanation holds that dreams reflect the ongoing conscious preoccupations of waking life, such as concerns over relationships, work, sex, or health (Cartwright, 1977; Hall, 1953a, b). In this problem-focused approach to dreams, the symbols and metaphors in a dream do not disguise its true meaning; they convey it.

The problem-focused explanation of dreaming is supported by findings that dreams are more likely to contain material related to a person’s current concerns than chance would predict (Domhoff, 1996). For example, among university and college students, who are often worried about grades and tests, test-anxiety dreams are common: The dreamer is unprepared for or unable to finish an exam, or shows up for the wrong exam, or can’t find the room where the exam is being given (Halliday, 1993; Van de Castle, 1994). (Sound familiar?) For their part, instructors sometimes dream that they have forgotten their lecture notes at home, or that their notes contain only blank pages and they have nothing to say! Traumatic experiences can also affect people’s dreams. In a cross-cultural study in which children kept dream diaries for a week, Palestinian children living in neighbourhoods under threat of violence reported more themes of persecution and violence than did Finnish or Palestinian children living in peaceful environments (Punamäki & Joustie, 1998).

Some psychologists believe that dreams not only reflect our waking concerns but also provide us with an opportunity to resolve them (Barrett, 2001; Cartwright, 1996). Rosalind Cartwright has been investigating this hypothesis for many years. Among people suffering the grief of divorce, she has found, recovery is related to a particular pattern of dreaming: The first dream of the night often comes sooner than it ordinarily would, lasts longer, and is more emotional and storylike. Depressed people’s dreams tend to become less negative and more positive as the night wears on, and this pattern, too, predicts recovery (Cartwright et al., 1998). Cartwright concludes that getting through a crisis or a rough period in life takes “time, good friends, good genes, good luck, and a good dream system.”

**Dreams as Thinking**

Like the problem-focused approach, the cognitive approach to dreaming emphasizes current concerns, but it makes no claims about problem solving during sleep. In this view, dreaming is simply a modification of the cognitive activity that goes on when we are awake. In dreams, we construct reasonable simulations of the real world, drawing on the same kinds of memories, knowledge, metaphors, and assumptions about the world that we do when we’re not sleeping (Antrobus, 1991, 2000; Domhoff, 2003; Foulkes, 1999). Thus the content of our dreams may include thoughts, concepts, and scenarios that are or are not related to our daily problems. We are most likely to dream about our families, friends, studies, jobs, or recreational interests—topics that also occupy our waking thoughts.

In the cognitive view, the brain is doing the same kind of work during dreams that it does when we are awake, which is why parts of the cerebral cortex involved in perceptual and cognitive processing are highly activated during dreaming. The difference is that when we are asleep we are cut off from sensory input and feedback from the world and our bodily movements; the only input to the brain is its own output. Our dreaming thoughts therefore tend to be more unfocused and diffuse than our waking ones—unless, of course, we’re daydreaming! Our brains show similar patterns of
These drawings from dream journals show that the images in dreams can be either abstract or literal. In either case, the dream may reflect a person's concerns, problems, and interests. The two fanciful paintings at the top represent the dreams of a person who worked all day long with brain tissue, which the drawings rather resemble. The desk was sketched in 1939 by a scientist to illustrate his dream about a mechanical device for instantly retrieving quotations—a sort of early desktop computer!

**activation–synthesis theory**  The theory that dreaming results from the cortical synthesis and interpretation of neural signals triggered by activity in the lower part of the brain.

Activity when we are night dreaming as when we are daydreaming—a finding that suggests that nighttime dreaming, like daydreaming, might be a mechanism for simulating events that we think (or fear) might occur in the future (Domhoff, 2011).

This view predicts that if a person could be totally cut off from all external stimulation while awake, mental activity would be much like that during dreaming, with the same hallucinatory quality. In Chapter 6, we will see that this is, in fact, the case. The cognitive approach also predicts that as cognitive abilities and brain connections mature during childhood, dreams should change in nature, and they do. Toddlers may not dream at all, in the sense that adults do. And although young children may experience visual images during sleep, their cognitive limitations keep them from creating true narratives until age seven or eight (Foulkes, 1999). Their dreams are infrequent and tend to be bland and static (“I saw a dog; I was sitting”). But as they grow up, their dreams gradually become more and more intricate, dynamic, and storylike.

**Dreams as Interpreted Brain Activity**

A third modern approach to dreaming, the activation–synthesis theory, draws heavily on physiological research. According to this explanation, first proposed by psychiatrist J. Allan Hobson (1988, 1990), dreams are largely the result of neurons firing spontaneously in the lower part of the brain, in the pons, during REM sleep. These neurons control eye movement, gaze, balance, and posture, and they send messages to sensory and motor areas of the cortex responsible during wakefulness for visual processing and voluntary action.

According to the activation–synthesis theory, the signals originating in the pons have no psychological meaning in themselves. But the cortex tries to make sense of them by synthesizing, or integrating, them with existing knowledge and memories to
produce some sort of coherent interpretation. This is what the cortex does when signals come from sense organs during ordinary wakefulness. The idea that one part of the brain interprets what has gone on in other parts—whether you are awake or asleep—is consistent with many modern theories of how the brain works (see Chapter 4).

When neurons fire in the part of the brain that handles balance, for instance, the cortex may generate a dream about falling. When signals occur that would ordinarily produce running, the cortex may manufacture a dream about being chased. Because the signals from the pons occur randomly, the cortex’s interpretation—the dream—is likely to be incoherent and confusing. And because the cortical neurons that control the initial storage of new memories are turned off during sleep, we typically forget our dreams upon waking unless we write them down or immediately recount them to someone else.

Hobson and his colleagues have since added further details and modifications to this theory (Hobson, Pace-Schott, & Stickgold, 2000; Hobson et al., 2011). The brain stem, they say, sets off responses in emotional and visual parts of the brain. At the same time, brain regions that handle logical thought and sensations from the external world shut down. These changes would account for the fact that dreams tend to be emotionally charged, hallucinatory, and illogical.

Wishes, in this view, do not cause dreams; brain mechanisms do. Dream content, says Hobson (2002), may be “as much dross as gold, as much cognitive trash as treasure, and as much informational noise as a signal of something.” But that does not mean dreams are always meaningless. Hobson (1988) has argued that the brain “is so inexorably bent upon the quest for meaning that it attributes and even creates meaning when there is little or none to be found in the data it is asked to process.” By studying these attributed meanings, you can learn about your unique perceptions, conflicts, and concerns—not by trying to dig below the surface of the dream, as Freud would, but by examining the surface itself.

Evaluating Dream Theories

How are we to evaluate these attempts to explain dreaming? All three modern approaches account for some of the evidence, but each one also has its drawbacks (see Review 5.1).

**REVIEW 5.1 Three Modern Dream Theories Compared**

<table>
<thead>
<tr>
<th>Theory</th>
<th>Purpose of Dreaming</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem-focused</td>
<td>To express ongoing concerns of waking life and/or resolve current concerns and problems</td>
<td>Some theorists are skeptical about the ability to resolve problems during sleep</td>
</tr>
<tr>
<td>Cognitive</td>
<td>Same as in waking life—to express concerns and interests</td>
<td>Some specific claims remain to be tested</td>
</tr>
<tr>
<td>Activation–synthesis</td>
<td>None; dreams occur because of random brain-stem signals, though cortical interpretations of those signals may reflect concerns and conflicts</td>
<td>Does not explain coherent, storylike dreams or non-REM dreams</td>
</tr>
</tbody>
</table>
Are dreams a way to solve problems? It seems pretty clear that some dreams are related to current worries and concerns. But skeptics doubt that people can actually solve problems or resolve conflicts while sound asleep (Blagrove, 1996; Squier & Domhoff, 1998). Dreams, they say, merely give expression to our problems. The insights into those problems that people attribute to dreaming could be occurring after they wake up and have a chance to think about what is troubling them.

The activation–synthesis theory has also received criticism (Domhoff, 2003). Not all dreams are as disjointed or as bizarre as the theory predicts; in fact, many tell a coherent, if fanciful, story. Moreover, the activation–synthesis approach does not account well for dreaming that goes on outside REM sleep. Some neuropsychologists emphasize different brain mechanisms involved in dreams, and many believe that dreams do reflect a person's goals and desires.

Finally, the cognitive approach to dreams is a fairly new one, so some of its specific claims remain to be tested against neurological and cognitive evidence. At present, however, it is a leading contender because it incorporates many elements of other theories and fits what we currently know about waking cognition and cognitive development.

Perhaps it will turn out that different kinds of dreams have different purposes and origins. We all know from experience that some of our dreams seem to be related to daily problems, some are vague and incoherent, and some are anxiety dreams that occur when we are worried or depressed. For the time being, we are going to have to live with the uncertainty about what those fascinating stories and images in our sleeping brains really mean.

**Recite & Review**

**Recite:** No, it's not a dream: It's time for you to say everything you can remember about lucid dreams, activation–synthesis theory, Freud's ideas about dreams, and the differences between three modern theories of dreaming.

**Review:** Next, read this section again.

**Quick Quiz:**

See if you can dream up answers to this question.

In his dreams, Andy is an infant crawling through a dark tunnel looking for something he has lost. Which theory of dreams would be most receptive to each of the following explanations?

1. Andy recently found a valuable watch he had misplaced.
2. While Andy was sleeping, neurons in his pons that would ordinarily stimulate parts of the brain involved in leg-muscle movements were active.
3. Andy has repressed an early sexual attraction to his mother; the tunnel symbolizes her vagina.
4. Andy has broken up with his lover and is working through the emotional loss.

**Answers:**

1. The cognitive approach (the dream is thinking about a recent experience)  
2. The activation–synthesis approach  
3. Freud's psychoanalytic theory  
4. The problem-focused approach

**Learning Objectives**

11. Summarize some common misconceptions about hypnosis, and outline the legitimate uses of hypnosis in psychology and medicine.

12. Compare two theories that explain what happens during hypnosis.
The Riddle of Hypnosis

For many years, stage hypnotists, “past-lives channellers,” and some psychotherapists have been reporting that they can “age regress” hypnotized people to earlier years or even earlier centuries. Some therapists claim that hypnosis helps their patients accurately retrieve long-buried memories, and a few even claim that hypnosis has helped their patients recall alleged abductions by extraterrestrials. What are we to make of all this?

Hypnosis is a procedure in which a practitioner suggests changes in the sensations, perceptions, thoughts, feelings, or behaviour of the participant (Kirsch & Lynn, 1995). The participant, in turn, tries to alter his or her cognitive processes in accordance with the hypnotist’s suggestions (Nash & Nadon, 1997). Hypnotic suggestions typically involve performance of an action (“Your arm will slowly rise”), an inability to perform an act (“You will be unable to bend your arm”), or an experience of distorted perception or memory (“You will feel no pain,” “You will forget being hypnotized until I give you a signal”). People usually report that their response to a suggestion feels involuntary, as if it happened without their willing it.

To induce hypnosis, the hypnotist typically suggests that the person being hypnotized feels relaxed, is getting sleepy, and feels the eyelids getting heavier and heavier. In a singsong or monotonous voice, the hypnotist assures the participant that he or she is sinking “deeper and deeper.” Sometimes the hypnotist has the person concentrate on a colour or a small object, or on certain bodily sensations. People who have been hypnotized report that the focus of attention turns outward, toward the hypnotist’s voice. They sometimes compare the experience to being totally absorbed in a good book, play, or favourite piece of music. Almost always the hypnotized person remains fully aware of what is happening and remembers the experience later, unless explicitly instructed to forget it—and even then, the memory can be restored by a prearranged signal.

Because hypnosis has been used for everything from parlour tricks and stage shows to medical and psychological treatments, it is important to understand just what this procedure can and cannot achieve. We will begin with a general look at the major findings on hypnosis; then we will consider two leading explanations of hypnotic effects.

The Nature of Hypnosis

Since the late 1960s, thousands of articles on hypnosis have appeared. Based on controlled laboratory and clinical research studies, most researchers agree on the following points (Kirsch & Lynn, 1995; Nash, 2001; Nash & Nadon, 1997):

1. **Hypnotic responsiveness depends more on the efforts and qualities of the person being hypnotized than on the skill of the hypnotist.** Some people are more responsive to hypnosis than others, but why they are is unknown. Surprisingly, hypnotic susceptibility is unrelated to general personality traits such as gullibility, trust, submissiveness, or conformity (Nash & Nadon, 1997). And it is only weakly related to the ability to become easily absorbed in activities and the world of imagination (Council, Kirsch, & Grant, 1996; Green & Lynn, 2010; Nash & Nadon, 1997).

2. **Hypnotized people cannot be forced to do things against their will.** Like drunkenness, hypnosis can be used to justify letting go of inhibitions (“I know this looks silly but, after all, I’m hypnotized”). Hypnotized individuals may even comply with a suggestion to do something that looks embarrassing or dangerous. But the individual is choosing to turn responsibility over to the hypnotist and to cooperate with the hypnotist’s suggestions (Lynn, Rhue, & Weekes, 1990). There is no evidence that hypnotized people will do anything that actually violates their morals or that constitutes a real danger to themselves or others (Laurence & Perry, 1988).
Feats performed while under hypnosis can be performed by motivated people without hypnosis. Hypnotized subjects sometimes perform what seem like extraordinary mental or physical feats, but most research finds that hypnosis does not actually enable people to do things that would otherwise be impossible. With proper motivation, support, and encouragement, the same people could do the same things even without being hypnotized (Chaves, 1989; Spanos, Stenstrom, & Johnson, 1988).

Hypnosis does not increase the accuracy of memory. In rare cases, hypnosis has been used successfully to jog the memories of crime victims, but usually the memories of hypnotized witnesses have been completely mistaken. Although hypnosis does sometimes boost the amount of information recalled, it also increases errors, perhaps because hypnotized people are more willing than others to guess, or because they mistake vividly imagined possibilities for actual memories (Dinges et al., 1992; Kihlstrom, 1994). Because errors and pseudo memories are so common in hypnotically induced recall, Canadian law does not permit the use of “hypnotically refreshed” testimony in courts of law.

Hypnosis does not produce a literal re-experiencing of long-ago events. When clinical psychologist Michael Yapko (1994) surveyed 869 family therapists, he was alarmed to discover that more than half believed that “hypnosis can be used to recover memories from as far back as birth.” This belief is just dead wrong. When people are regressed to an earlier age, their mental and moral performance remains adult-like (Nash, 1987). Their brain-wave patterns and reflexes do not become childish; they do not reason as children do or show child-size IQs. They may use baby talk or report that they feel four years old again, but they are not reliving the experience of being four; they are just willing to play the role.

Hypnotic suggestions have been used effectively for many medical and psychological purposes. Although hypnosis is not of much use for finding out what happened in the past, it can be useful in treating psychological and medical problems. Its greatest success is in pain management; some people experience dramatic relief of pain resulting from conditions as diverse as burns, cancer, and childbirth; others have learned to cope better emotionally with chronic pain. Hypnotic suggestions have also been used in the treatment of stress, anxiety, obesity, asthma, irritable bowel syndrome, chemotherapy-induced nausea, and even skin disorders (Nash & Barnier, 2007; Patterson & Jensen, 2003).

Theories of Hypnosis

Over the years, people have proposed many explanations for what hypnosis is and how its effects are produced. Today, two competing theories predominate, with most scientists taking a position somewhere in the middle.

Dissociation Theories. The late Ernest Hilgard (1977, 1986) argued that hypnosis, like lucid dreaming and even simple distraction, involves dissociation, a split in consciousness in which one part of the mind operates independently of the rest of consciousness. In many hypnotized persons, said Hilgard, while most of the mind is...
subject to hypnotic suggestion, one part is a hidden observer, watching but not participating. Unless given special instructions, the hypnotized person remains unaware of the observer.

In his research, Hilgard attempted to question the hidden observer directly. In one procedure, hypnotized volunteers had to submerge an arm in ice water for several seconds, an experience that is normally excruciating. They were told that they would feel no pain, but that the nonsubmerged hand would be able to signal the level of any hidden pain by pressing a key. In this situation, many people said they felt little or no pain—but at the same time, the free hand was busily pressing the key. After the session, these people continued to insist that they had been pain-free, unless the hypnotist asked the hidden observer to issue a separate report.

### DISSOCIATION THEORIES OF HYPNOSIS

A person whose arm is immersed in ice water normally feels intense pain. But Ernest Hilgard, a pioneer in hypnosis research, found that when hypnotized people are told the pain will be minimal, they report little or no discomfort and seem unperturbed.

The late Ken Bowers and colleagues at the University of Waterloo advanced a related theory, which holds that the control of executive function (probably subserved by the frontal lobes) is weakened during hypnosis. However, this does not result in a unique dissociated state (Woody & Bowers, 1994; Woody & Sadler, 2012). The result is an altered state of consciousness similar to that found in patients with frontal lobe disorders. Because the dissociated systems are freed from control by the executive, they are more easily influenced by suggestions from the hypnotist.

Like the activation–synthesis theory of dreaming, dissociation theories of hypnosis are consistent with modern brain theories, which hold that one part of the brain operates as a reporter and interpreter of activities carried out unconsciously by other brain parts (see Chapter 4).

### The Sociocognitive Approach

The second major approach to hypnosis, the sociocognitive explanation of hypnosis, holds that the effects of hypnosis result from an interaction between the social influence of the hypnotist (the “socio” part) and the abilities, beliefs, and expectations of the subject (the “cognitive” part) (Kirsch, 1997; Sarbin, 1991; Spanos, 1991). The hypnotized person is basically playing a role, one that has analogies in ordinary life, in which we willingly submit to the suggestions of parents, teachers, doctors, therapists, and television commercials. In this view, even the “hidden observer” is simply a reaction to the social demands of the situation and the suggestions of the hypnotist (Lynn & Green, 2011).

The hypnotized person is not merely faking or playacting, however. A person who has been instructed to fool an observer by faking a hypnotic state will tend to overlay the role and will stop playing it as soon as the observer leaves the room. In contrast, hypnotized participants continue to follow the hypnotic suggestions even when they think they are not being watched (Kirsch et al., 1989; Spanos et al., 1993). Like many social
roles, the role of hypnotized person is so engrossing and involving that actions required by the role may occur without the person’s conscious intent.

Sociocognitive views explain why some people under hypnosis report spirit possession or “memories” of alien abductions (Clancy, 2005; Spanos, 1996). The individual goes to a therapist looking for an explanation of his or her loneliness, unhappiness, nightmares, puzzling symptoms, or the waking dreams we described earlier. If the therapist already believes in alien abduction, he or she may hypnotize the person and then shape the client’s story by giving subtle and not-so-subtle hints about what the person should say.

The sociocognitive view can also explain apparent cases of past-life regression. In a fascinating program of research, Nicholas Spanos and his colleagues directed hypnotized Canadian university students to regress past their own births to previous lives. About a third of the students (who already believed in reincarnation) reported being able to do so. But when they were asked, while supposedly reliving a past life, to name the leader of their country, say whether the country was at peace or at war, or describe the money used in their community, the students could not do it. Not knowing anything about the language, dates, customs, and events of their “previous lives” did not deter the students from constructing a story about them, however. They tried to fulfill the requirements of the role by weaving events, places, and persons from their present lives into their accounts, and by picking up cues from the experimenters. The researchers concluded that the act of “remembering” another self involves the construction of a fantasy that accords with the rememberer’s own beliefs and also the beliefs of others—in this case, those of the authoritative hypnotist (Spanos et al., 1991).

THINKING CRITICALLY

Consider other interpretations.

Under hypnosis, Jim describes the chocolate cake at his fourth birthday and Joan remembers a former life as a twelfth-century French peasant. But lemon cake was served at Jim’s party and Joan can’t speak twelfth-century French. What explanation best accounts for these vivid but incorrect memories?

BIOLOGY and Hypnosis

Now You See It . . .

Debates over what hypnosis really is and how it works have intensified as scientists have begun to use technology in the hope of better understanding this mysterious phenomenon. We have known for some time from EEG studies that alpha waves are common when a person is in a relaxed hypnotic state. This is not surprising, because alpha waves are associated with relaxed wakefulness. The invention of brain scans, however, permits a far more detailed and useful picture of what is going on in the brain of a hypnotized person.

One recent brain-scan study showed that hypnosis can reduce conflict between two mental tasks (Raz, Fan, & Posner, 2005). The researchers gave participants the Stroop test, which is often used to study what happens when colour perception conflicts with reading. You look at words denoting colours (blue, red, green, yellow . . .), with some words printed in the corresponding colour (e.g., red printed in red) and others in a different colour (e.g., red printed in blue). It is a lot harder to identify the colour of the ink a word is printed in when the word’s meaning and its colour are different. To see what we mean, try identifying as quickly as you can the colours of the words in the adjacent illustration. It’s pretty hard, right?

In the study, hypnotized participants were told that later, after they were no longer hypnotized, they would see words from the Stroop test on a computer screen, but the words would seem like strings of meaningless symbols—like “characters in a foreign language that you do not know.” During the test, easily hypnotized people were faster and better at identifying the clashing colours the words were printed in than people who were less easily hypnotized; in fact, the “Stroop effect” virtually disappeared. Apparently, the easily hypnotized people were literally not seeing the words; they were seeing gibberish. Moreover, during the task, these people had reduced activity in a brain area that decodes
written words and in another area toward the front of the brain that monitors conflicting thoughts. Because of the suggestions made while under hypnosis, these individuals apparently were able to pay less attention to the words themselves during the task and thus were able to avoid reading them. They could focus solely on the colour of the ink.

Other research has found changes in various regions of the brain when people are hypnotized and lying in a PET scanner. In one study, highly hypnotizable people, under hypnosis, were able to visually drain colour from a drawing of red, blue, green, and yellow rectangles, or to see colour when the same drawing was presented in grey tones. When they were told to see colour in the grey drawing, their brains showed activation in areas associated with colour perception; when they were told to see grey in the coloured drawing, the same areas showed decreased activation (Kosslyn et al., 2000).

But what do findings like these mean for theories of hypnosis? The fact that hypnosis can affect patterns of activity in the brain has encouraged those who believe that hypnosis is a special state, different from elaborate role-playing or extreme concentration. Others feel that it is far too soon to draw any conclusions from this research about the mechanisms or nature of hypnosis. Every experience alters the brain in some way; there is no reason to think that hypnosis is any exception, however it may work. Moreover, recent research finds that suggestion can reduce the Stroop effect in highly suggestible people even without hypnosis (Raz et al., 2006).

Further research may tell us whether there is something special about hypnosis or not. But whatever the outcome of this debate, the study of hypnosis is teaching us much about human suggestibility, the power of imagination, and the way we perceive the present and remember the past.

Recite & Review

Recite: We’d like to plant a suggestion in your mind that you say aloud what you know about hypnosis, hypnotic susceptibility, dissociation theories of hypnosis, the sociocognitive approach to hypnosis, and the biology of hypnosis.

Review: You are not getting sleepy . . . you are not getting sleepy . . . so reread this section.

Now take this Quick Quiz:
We’d like to plant a suggestion in your mind—that you’d be wise to take this quiz.

A. True or false:
1. A hypnotized person is usually aware of what is going on and remembers the experience later.
2. Hypnosis gives us special powers that we do not ordinarily have.
3. Hypnosis reduces errors in memory.
4. Hypnotized people play no active part in their behaviour and thoughts.
5. According to Hilgard, hypnosis is a state of consciousness involving a “hidden observer.”
6. Sociocognitive theorists view hypnosis as mere faking or conscious playacting.

B. Some people believe that hypnotic suggestions can bolster the immune system and help a person fight disease. However, support for this belief has been modest so far, and many studies have had methodological flaws (Miller & Cohen, 2001). One therapist dismissed these concerns by saying that a negative result just means that the hypnotist lacks skill or the right personality. As a critical thinker, can you spot what is wrong with his reasoning? (Think back to the qualities of the ideal scientist, discussed in Chapter 2.)

Answers:
B. The therapist’s argument violates the principle of falsifiability. If a result is positive, he counts it as evidence. But if a result is negative, he refuses to count it as counterevidence (“Maybe the hypnotist just wasn’t good enough”). With this kind of reasoning, there is no way to be certain the hypothesis is false, much less to reject it. Further research is needed to test the hypothesis and to determine its validity.
Consciousness-Altering Drugs

In Jerusalem, hundreds of Hasidic men celebrate the completion of the annual reading of the holy Torah by dancing for hours in the streets. For them, dancing is not a diversion; it is a path to religious ecstasy. In Saskatchewan, several Dakota–Sioux adults sit naked in the darkness and crushing heat of the sweat lodge; their goal is euphoria, the transcendence of pain, and connection with the Great Spirit of the Universe. In the Amazon jungle, a young man training to be a shaman, a religious leader, takes a whiff of hallucinogenic snuff made from the bark of the virola tree; his goal is to enter a trance and communicate with animals, spirits, and supernatural forces.

These three rituals, although seemingly quite different, are all aimed at release from the confines of ordinary consciousness. Cultures around the world have devised such practices, often as part of their religions. Because attempts to alter mood and consciousness appear to be universal, some writers believe they reflect a human need, one as basic as the need for food and water (Siegel, 1989).

William James (1902/1936), who was fascinated by alterations in consciousness, would have agreed. After inhaling nitrous oxide (“laughing gas”), he wrote, “Our normal waking consciousness, rational consciousness as we call it, is but one special type of consciousness, whilst all about it, parted from it by the filmiest of screens, there lie potential forms of consciousness entirely different.” James hoped that psychologists would study these other forms of consciousness, but, for half a century, few did. Then, in the 1960s, attitudes changed. During that decade of social upheaval, millions of people began to seek ways of deliberately producing altered states of consciousness, especially through the use of psychoactive drugs. Researchers became interested in the psychology, as well as the physiology, of such drugs. The “filmy screen” described by James finally began to lift.

All cultures have found ways to alter consciousness. The Mevlevi of Turkey (left), the famous whirling dervishes, spin in an energetic but controlled manner in order to achieve religious rapture. People in many cultures meditate (centre) as a way to quiet the mind and achieve spiritual enlightenment. And in some cultures, psychoactive drugs are used for religious or artistic inspiration, as in the case of the Huichol Indians of western Mexico, shown here (right) collecting peyote.
Classifying Drugs

A psychoactive drug is a substance that alters perception, mood, thinking, memory, or behaviour by changing the body’s biochemistry. Around the world and throughout history, people have used psychoactive drugs: tobacco, alcohol, marijuana, opium, cocaine, peyote, mescaline—and, of course, tea and coffee. The reasons for taking such drugs vary: to alter consciousness as part of a religious ritual, for recreation, to decrease physical pain or discomfort, or for psychological escape.

In western societies, a whole pharmacopoeia of recreational drugs exists, and new ones, both natural and synthetic, seem to appear every year. Most of these drugs can be classified as stimulants, depressants, opiates, or psychedelics, depending on their effects on the central nervous system and their impact on behaviour and mood (see Review 5.2).

REVIEW 5.2 Some Psychoactive Drugs and Their Effects

<table>
<thead>
<tr>
<th>Class of Drug</th>
<th>Type</th>
<th>Common Effects</th>
<th>Some Results of Abuse/Addiction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphetamines</td>
<td>Stimulants</td>
<td>Wakefulness, alertness, raised metabolism, elevated mood</td>
<td>Nervousness, headaches, loss of appetite, high blood pressure, delusions, psychosis, heart damage, convulsions, death</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>Stimulants</td>
<td>Wakefulness, alertness, raised metabolism, elevated mood</td>
<td>Nervousness, headaches, loss of appetite, high blood pressure, delusions, psychosis, heart damage, convulsions, death</td>
</tr>
<tr>
<td>MDMA (Ecstasy)*</td>
<td></td>
<td></td>
<td>Excitability, sleeplessness, sweating, paranoia, anxiety, panic, depression, heart damage, heart failure, injury to nose if sniffed</td>
</tr>
<tr>
<td>Cocaine</td>
<td>Stimulant</td>
<td>Euphoria, excitation, feelings of energy, suppressed appetite</td>
<td>Nicotine: heart disease, high blood pressure, impaired circulation, erectile problems in men, damage throughout the body due to lowering of a key enzyme</td>
</tr>
<tr>
<td>Tobacco (nicotine)</td>
<td>Stimulant</td>
<td>Varies from alertness to calmness, depending on mental set, setting, and prior arousal; decreases appetite for carbohydrates</td>
<td>Tar (residue from smoking cigarettes): lung cancer, emphysema, mouth and throat cancer, many other health risks</td>
</tr>
<tr>
<td>Caffeine</td>
<td>Stimulant</td>
<td>Wakefulness, alertness, shortened reaction time</td>
<td>Restlessness, insomnia, muscle tension, heartbeat irregularities, high blood pressure</td>
</tr>
<tr>
<td>Alcohol (1–2 drinks)</td>
<td>Depressant</td>
<td>Depends on setting and mental set; tends to act like a stimulant because it reduces inhibitions and anxiety</td>
<td>Blackouts, cirrhosis of the liver, other organ damage, mental and neurological impairment, psychosis, death with very large amounts</td>
</tr>
<tr>
<td>Alcohol (several/many drinks)</td>
<td>Depressant</td>
<td>Slowled reaction time, tension, depression, reduced ability to store new memories or to retrieve old ones, poor coordination</td>
<td>Increased dosage needed for effects; impaired motor and sensory functions, impaired permanent storage of new information, withdrawal symptoms; possibly convulsions, coma, death (especially when taken with other drugs)</td>
</tr>
<tr>
<td>Tranquilizers</td>
<td>Depressants</td>
<td>Reduced anxiety and tension, sedation</td>
<td></td>
</tr>
<tr>
<td>(e.g., Valium); barbiturates (e.g., phenobarbital)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opium, heroin, morphine, codeine, codeine-based pain relievers</td>
<td>Opiates</td>
<td>Euphoria, relief of pain</td>
<td>Loss of appetite, nausea, constipation, withdrawal symptoms, convulsions, coma, possibly death</td>
</tr>
<tr>
<td>LSD, psilocybin, mescaline, Salvia divinorum</td>
<td>Psychedelics</td>
<td>Depending on the drug: Exhilaration, visions and hallucinations, insightful experiences</td>
<td>Psychosis, paranoia, panic reactions</td>
</tr>
<tr>
<td>Marijuana</td>
<td>Mild psychedelic (classification controversial)</td>
<td>Relaxation, euphoria, increased appetite, reduced ability to store new memories, other effects depending on mental set and setting</td>
<td>Throat and lung irritation, possible lung damage if smoked heavily</td>
</tr>
</tbody>
</table>

*Ecstasy also has psychedelic properties.
Here we describe only their physiological and psychological effects; Chapter 15 covers addiction, and Chapter 16 reviews drugs used in treating mental and emotional disorders.

1 **Stimulants speed up activity in the central nervous system.** Stimulants include, among other drugs, nicotine, caffeine, cocaine, amphetamines (“uppers”), and methamphetamine hydrochloride (“crank,” “speed”). In moderate amounts, stimulants produce feelings of excitement, confidence, and well-being or euphoria. In large amounts, they make a person anxious, jittery, and hyper-alert. In very large doses, they may cause convulsions, heart failure, and death.

Amphetamines are synthetic drugs taken in pill form, injected, smoked, or inhaled ("snorted"). Methamphetamine is structurally similar to amphetamines and is used in the same ways; it comes in two forms, as a powder ("crank," “speed”) or in a purer form, a crystalline solid (“glass,” “ice”). Cocaine ("coke") is a natural drug, derived from the leaves of the coca plant. Rural workers in Bolivia and Peru chew coca leaf every day, without apparent ill effects. In North America, the drug is usually inhaled, injected, or smoked in the highly refined form known as crack. These methods give the drug a more immediate, powerful, and dangerous effect than when coca leaf is chewed. Amphetamines, methamphetamine, and cocaine make users feel peppy but do not actually increase energy reserves. Fatigue, irritability, and depression may occur when the effects of these drugs wear off.

2 **Depressants slow activity in the central nervous system.** Depressants include alcohol, tranquilizers, barbiturates, and most of the common chemicals that some people inhale ("huffing"). Depressants usually make a person feel calm or drowsy, and they may reduce anxiety, guilt, tension, and inhibitions. In large amounts, they may produce insensitivity to pain and other sensations. Like stimulants, in very large doses they can cause irregular heartbeats, convulsions, and death.

People are often surprised to learn that alcohol is a central nervous system depressant. In small amounts, alcohol has some of the effects of a stimulant because it suppresses activity in parts of the brain that normally inhibit impulsive behaviour, such as loud laughter and clowning around. In the long run, however, it slows down nervous system activity. Like barbiturates and opiates, alcohol can be used as an anesthetic; if you drink enough, you will eventually pass out. Over time, alcohol damages the liver, heart, and brain. Extremely large amounts of alcohol can kill, by inhibiting the nerve cells in the brain areas that control breathing and heartbeat. On the other hand, **moderate** social drinking—a drink or two of wine or liquor per day—is associated with a variety of health benefits, especially for adults over age 40. These benefits include reduced risk of heart attack and stroke, and antidiabetic effects (Davies et al., 2002; Mukamal et al., 2003; Reynolds et al., 2003).

3 **Opiates relieve pain.** Opiates include opium, derived from the opium poppy; morphine, a derivative of opium; heroin, a derivative of morphine; and synthetic drugs such as methadone. All these drugs mimic the action of endorphins, and most have a powerful effect on the emotions. When injected, they may produce a rush—a sudden feeling of euphoria. They may also decrease anxiety and motivation, although the effects vary.

4 **Psychedelic drugs disrupt normal thought processes, such as the perception of time and space.** Sometimes, psychedelic drugs produce hallucinations, especially visual ones. Some psychedelics, such as lysergic acid diethylamide (LSD), are made in the laboratory. Others, such as mescaline (from
Chapter 5  Body Rhythms and Mental States  165

the peyote cactus), Salvia divinorum (a plant native to Mexico), and psilocybin (from certain species of mushrooms), are natural substances. Emotional reactions to psychedelics vary from person to person and from one time to another for any individual. A “trip” may be mildly pleasant or unpleasant, a mystical revelation or a nightmare.

Some commonly used drugs fall outside these four classifications, combine elements of more than one category, or have uncertain effects. For example, athletes and bodybuilders often illegally use anabolic steroids, synthetic derivatives of testosterone that are taken in pill form or by injection to increase muscle mass and strength. Perhaps the most famous instance of steroid use by a professional athlete was Ben Johnson’s record-setting 100-metre dash at the Seoul Olympics in 1988. Sixty-two hours after winning the race in 9.79 seconds, Johnson was stripped of his gold medal and Olympic record because examiners found illegal anabolic steroids in his blood. Steroids have been implicated in numerous physical problems in men, including heart and liver disease, decreased testicle size, and erection difficulties (Pope & Katz, 1992).

Marijuana (“pot,” “grass,” “weed”), which is smoked or, less commonly, eaten in foods such as brownies, is probably the most widely used illicit drug in North America and Europe. Some researchers classify it as a mild psychedelic, but others feel that its chemical makeup and psychological effects place the substance outside the major classifications. The active ingredient in marijuana is tetrahydrocannabinol (THC), which is derived from the hemp plant, Cannabis sativa. In some respects, THC appears to be a mild stimulant, increasing heart rate and making tastes, sounds, and colours seem more intense. But users often report reactions ranging from mild euphoria to relaxation or even sleepiness. Although THC has not been shown to be carcinogenic, some researchers believe that very heavy smoking of the drug (which is high in tar) may increase the risk of lung damage (Barsky et al., 1998; Zhu et al., 2000). In moderate doses, marijuana can interfere with the transfer of information to long-term memory, a characteristic it shares with alcohol. In large doses, it can cause hallucinations and a sense of unreality. Sometimes the drug impairs coordination, concentration, visual perception, and reaction times, though it is not clear how long these effects last. On the other hand, studies find that marijuana has some medical benefits, such as relief from pain, as we will see later when we discuss debates about legalizing drugs.

anabolic steroids  Synthetic derivatives of testosterone that are taken in pill form or by injection to increase muscle mass and strength.
The Physiology of Drug Effects

Psychoactive drugs produce their effects primarily by acting on brain neurotransmitters, the chemical substances that carry messages from one nerve cell to another. A drug may:

- Increase or decrease the release of neurotransmitters at the synapse
- Prevent the reabsorption of excess neurotransmitter molecules by the cells that have released them
- Block the effects of a neurotransmitter on a receiving nerve cell
- Bind to receptors that would ordinarily be triggered by a neurotransmitter (see Chapter 4)

Figure 5.4 shows how one drug, cocaine, increases the amount of norepinephrine and dopamine in the brain by blocking the reabsorption of these substances. Cocaine also seems to increase the transmission of serotonin (Rocha et al., 1998).

These biochemical changes affect cognitive and emotional functioning. For example, because of alcohol’s effect on parts of the brain involved in judgment, drinkers are often unable to gauge their own competence. Just a couple of drinks can affect perception, response time, coordination, and balance, despite the drinker’s own impression that his or her performance is unchanged or even improved. Alcohol also affects memory, possibly by interfering with the work of serotonin.

Information stored before a drinking session remains intact during the session but is retrieved more slowly (Haut et al., 1989). The ability to store new memories for later use also suffers after the consumption of only two or three drinks (Parker, Birnbaum, & Noble, 1976). Consuming small amounts does not seem to affect sober mental performance, but even occasional heavy drinking impairs later abstract thought. Binge-drinking college students often have impaired executive functioning: They are less able to hold on to, and work with, verbal information (Parada et al., 2012). In other words, a Saturday night binge is potentially more dangerous than a daily drink.

Not all drugs are equally dangerous, however. Controversy exists especially about Ecstasy (MDMA), a synthetic drug that has properties of both a hallucinogen and a stimulant and that is said to increase empathy, insight, and energy. Ecstasy has provoked a great deal of hysteria; claims have been made, mostly on the basis of research with animals receiving huge doses, that the drug permanently damages serotonin cells, wipes out memory, and causes tremors like those of Parkinson’s disease. But some of the best-known reports of these presumed dangers were based on research having major methodological problems. An impartial review of Ecstasy research concluded that there was no evidence that Ecstasy causes lasting damage “with the possible (but as yet unproven) exception of mild memory loss” (Kish, 2003). Heavy use may cause a reduction in serotonin levels, but this change has not been shown to be permanent, and it could be caused by other drugs that most heavy users take (Buchert et al., 2003).

As for other recreational drugs, there is no evidence that light or moderate use can damage the human brain enough to affect cognitive functioning, but nearly all researchers agree that heavy or very frequent use is another matter (see Chapter 15). For example, one study found that heavy users of methamphetamine had damage to dopamine cells and performed more poorly than other people on tests of memory, attention, and movement, even though they had not used the drug for at least 11 months (Volkow et al., 2001).
The use of some psychoactive drugs, such as heroin and tranquilizers, can lead to **tolerance**: Over time, more and more of the drug is needed to get the same effect. When habitual heavy users stop taking a drug, they may suffer severe **withdrawal** symptoms, which, depending on the drug, may include nausea, abdominal cramps, sweating, muscle spasms, depression, and sleep problems.

### The Psychology of Drug Effects

People often assume that the effects of a drug are automatic, the inevitable result of the drug’s chemistry (“I couldn’t help what I said—the booze made me do it”). But reactions to a psychoactive drug involve more than the drug’s chemical properties. They also depend on a person’s individual condition, experience with the drug, environmental setting, and mental set.

1. **Individual factors include body weight, metabolism, initial state of emotional arousal, personality characteristics, and physical tolerance for the drug.** For example, women generally get drunker than men on the same amount of alcohol because women are smaller, on average, and their bodies metabolize alcohol differently (Fuchs et al., 1995). (Female alcoholics also seem to suffer more rapid and severe organ damage than do male alcoholics.) Similarly, many Asians have a genetically determined adverse reaction to even small amounts of alcohol, which can cause severe headaches, facial flushing, and diarrhea (Cloninger, 1990). For individuals, a drug may have one effect after a tiring day and a different one after a rousing quarrel, or the effect may vary with the time of day because of the body’s circadian rhythms. And some differences among individuals in their responses to a drug may be due to their personality traits. PET scans show that when people prone to anger and irritability wear nicotine patches, dramatic bursts of activity occur in the brain while they are working on competitive or aggressive tasks. These changes do not occur, however, in more relaxed and cheerful people, or in control subjects wearing fake patches (Fallon et al., 2004).

2. **“Experience with the drug” refers to the number of times a person has taken it.** Trying a drug—a cigarette, an alcoholic drink, a stimulant—for the first time is often a neutral or unpleasant experience. But reactions typically change once a person has become familiar with the drug’s effects.

---

**tolerance** Increased resistance to a drug’s effects accompanying continued use.

**withdrawal** Physical and psychological symptoms that occur when someone addicted to a drug stops taking it.

---

**THINKING CRITICALLY**

Consider other interpretations.

One person takes a drink and flies into a rage. Another has a drink and “mellows out.” What qualities of the user rather than the drug might account for this difference?

---

The motives for using a drug, expectations about its effects, and the setting in which it is used all contribute to a person’s reactions to the drug. For example, drinking alone to drown your sorrows is likely to produce a different reaction than partying with friends.
"Environmental setting" refers to the context in which a person takes the drug. A person might have one glass of wine at home alone and feel sleepy but have three glasses of wine at a party and feel full of energy. Someone might feel happy and high drinking with good friends but fearful and nervous drinking with strangers. In one study of reactions to alcohol, most of the drinkers became depressed, angry, confused, and unfriendly. Then it dawned on the researchers that anyone might become depressed, angry, confused, and unfriendly if asked to drink bourbon at 9:00 a.m. in a bleak hospital room, which was the setting for the experiment (Warren & Raynes, 1972).

"Mental set" refers to expectations about the drug's effects, as well as reasons for taking it. Some people drink to become more sociable, friendly, or seductive; some drink to try to reduce feelings of anxiety or depression; and some drink in order to have an excuse for abusiveness or violence. Addicts use drugs to escape from the real world; people living with chronic pain use the same drugs in order to function in the real world (Portenoy, 1994). As we will see again in Chapter 13, the motives for taking a drug greatly influence its effects.

Sometimes expectations can have a more powerful effect than the chemical properties of the drug itself. In several imaginative studies, researchers compared people who were drinking liquor (vodka and tonic) with those who thought they were drinking liquor but were actually getting only tonic and lime juice. (Vodka has a subtle taste, and most people could not tell the real and phony drinks apart.) The experimenters found a “think–drink” effect: Men behaved more belligerently when they thought they were drinking vodka than when they thought they were drinking plain tonic water, regardless of the actual content of the drinks. And both sexes reported feeling sexually aroused when they thought they were drinking vodka, whether or not they actually got vodka (Abrams & Wilson, 1983; Marlatt & Rohsenow, 1980).

The culture in which you live shapes the expectations and beliefs about drugs. Many people start their day with a cup of coffee because it increases alertness, but...
Recite & Review

Recite: Say aloud everything you can about psychoactive drugs (stimulants, depressants, opiates, psychedelics), anabolic steroids, withdrawal, tolerance, and psychological influences on drug reactions, including environmental setting and mental set.

Review: Next, reread this section.

Quick Quiz:
There’s no debate about whether or not you should take this quiz.

A. Name the following:
   1. Three stimulants used illegally
   2. Two drugs that interfere with the formation of new long-term memories
   3. Three types of depressant drugs
   4. A legal recreational drug that acts as a depressant on the central nervous system
   5. Four factors that influence a person’s psychological reactions to a drug

B. A bodybuilder who has been taking anabolic steroids says the drugs make him more aggressive. What are some other possible interpretations? What are some other possible interpretations?

Answers:

When coffee was first introduced in Europe, people protested. Women said it suppressed their husbands’ sexual performance and made men inconsiderate—and maybe it did! In the nineteenth century, North Americans regarded marijuana as a mild sedative with no mind-altering properties. They did not expect it to give them a high, and it didn’t; it merely put them to sleep (Weil, 1972/1986). Today, motives for using marijuana have changed, and these changes have no doubt affected how people respond to the drug.

None of this means that alcohol and other drugs are merely placebos; psychoactive drugs, as we have seen, do have physiological effects, many of them extremely potent. But an understanding of the psychological factors involved in drug use may help us think critically about the ongoing national debate about which drugs, if any, should be legal. In “Taking Psychology With You,” we discuss some points to consider as you decide what your own position is on this issue.

As we have seen in this chapter, changes in consciousness and body rhythms are not only interesting in themselves; they also show us how our expectations and explanations of our own mental and physical states affect what we do and how we feel. Research on SAD and PMS, the purposes of sleep, the meaning of dreams, the nature of hypnosis, and the dangers and benefits of drugs have done much to dispel many popular but mistaken ideas about these topics. And the scientific scrutiny of biological rhythms, dreaming, hypnotic suggestion, and drug-induced states has deepened our understanding of the intimate relationship between body and mind.
The Drug Debate

Because the consequences of drug abuse are so devastating to individuals and to society, people often have trouble thinking critically about drug laws and policies: Which drugs should be legal, which should be illegal, and which should be “decriminalized” (that is, not made legal, but not used as a reason for arresting and jailing their users)? At one extreme, some people cannot accept evidence that their favourite drug—be it coffee, tobacco, alcohol, or marijuana—might have harmful effects. At the other extreme, some cannot accept the evidence that their most hated drug—be it alcohol, morphine, marijuana, or the coca leaf—might not be dangerous in all forms or amounts and might even have some beneficial effects. Both sides often confuse potent drugs with others that have only subtle effects and confuse light or moderate use with heavy or excessive use.

Once a drug is declared illegal, many people assume it is deadly, even though some legal drugs are more dangerous than illegal ones. Addiction to prescription painkillers and sedatives used for recreational rather than medical purposes (“pharming”) has risen dramatically among teenagers and adults. Nicotine, which of course is legal, is as addictive as heroin and cocaine, which are illegal. Tobacco use contributes to more than 45,000 deaths a year in Canada, significantly more deaths than those from all other forms of drug use combined (Health Canada, 1999). Yet most people have a far more negative view of heroin and cocaine than of nicotine and prescription painkillers.

Emotions run especially high in debates over marijuana. Heavy use has some physical risks, just as heavy use of any drug does. However, a review of studies done between 1975 and 2003 failed to find any compelling evidence that marijuana causes chronic mental or behavioural problems in teenagers or young adults. The researchers observed that cause and effect could just as well work in the other direction; that is, people with problems could be more likely to abuse the drug (MacLeod et al., 2004).

Moreover, marijuana has certain medical benefits: It reduces the nausea and vomiting that often accompany chemotherapy treatment for cancer and treatments for AIDS; it reduces the physical tremors, loss of appetite, and other symptoms caused by multiple sclerosis; it helps reduce the frequency of seizures in some patients with epilepsy; and it alleviates the retinal swelling caused by glaucoma (Grinspoon & Bakalar, 1993; Zimmer & Morgan, 1997). In some studies, it has reduced the frequency of seizures in people who already suffer from them. However, in other studies, cannabinoids have had pro-epileptic effects, making convulsions stronger or more frequent (Corcoran et al., 2005). In Canada, the government amended the Narcotic Control Regulations in July 2001, and the Marijuana Medical Access Regulations came into force. Unlike the previous, unconditional ban on marijuana, these regulations outline a framework that allows the use of marijuana by people suffering from serious illnesses (such as multiple sclerosis or cancer) wherein the benefits of using marijuana are expected to outweigh the risks associated with the drug’s use.

For these reasons, Canada’s National Health Service has begun a pilot project that allows pharmacies in British Columbia to sell medicinal marijuana without a prescription. In doing so, Canada became the first country in the world to regulate and sell marijuana to patients. In the U.S., some states (such as Colorado and Washington) have legalized possession of non-medical marijuana, but this process is ongoing and it currently faces vehement opposition. Canada’s Senate Special Committee on Illegal Drugs has actually recommended the legalization of marijuana. Other countries have already taken this step, including Spain, Italy, Portugal, the Netherlands, and Belgium.

Canadian organizations have also taken steps to provide supervised “safe injection sites” to drug addicts in the hope of “harm reduction” from overdoses and the spread of diseases like HIV/AIDS. In September 2003, the first such site in North America opened in downtown Vancouver. To enable it to operate, Health Canada granted the site an exemption under the Controlled Substances Act. The site has been very popular, and it currently supervises about 650 injections each day (Wood et al., 2002). The very existence of such sites is still extremely controversial in Canada, and debate rages about their implementation and funding.

Where, given the research findings, do you stand in this debate? Which illegal psychoactive drugs, if any, do you think should be legalized? Can we create mental sets and environmental settings that promote safe recreational use of some drugs, minimize the likelihood of drug abuse, and permit the medicinal use of beneficial drugs? What do you think?
Summary

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Biological Rhythms: The tides of Experience

• Consciousness is the awareness of oneself and the environment. Changing states of consciousness are often associated with biological rhythms—periodic fluctuations in physiological functioning. These rhythms are typically entrained (synchronized) to external cues, but many are also endogenous, generated from within even in the absence of time cues. Circadian fluctuations occur about once a day; other rhythms occur less frequently or more frequently than that.

• When people live in isolation from all time cues, they tend to live a day that is just slightly longer than 24 hours. Circadian rhythms are governed by a biological “clock” in the suprachiasmatic nucleus (SCN) of the hypothalamus. The SCN regulates, and in turn is affected by, the hormone melatonin, which responds to changes in light and dark and which increases during the dark hours. When a person’s normal routine changes, the person may experience internal desynchronization, in which the usual circadian rhythms are thrown out of phase with one another. The result may be fatigue, mental inefficiency, and an increased risk of accidents.

• Some people show a recurrence of depression every winter, in a pattern that has been labelled seasonal affective disorder (SAD), but serious seasonal depression is rare. The causes of SAD are not yet clear, but may involve an abnormality in the secretion of melatonin. Light treatments can be effective.

• Another long-term rhythm is the menstrual cycle, during which various hormone levels rise and fall. Well-controlled double-blind studies on “PMS” do not support claims that emotional symptoms are reliably and universally tied to the menstrual cycle. Overall, women and men do not differ in the emotional symptoms they report or in the number of mood swings they experience over the course of a month.

• Expectations and learning affect how both sexes interpret bodily and emotional changes. Few people of either sex are likely to undergo dramatic monthly mood swings or personality changes because of hormones.

The Rhythms of Sleep

• During sleep, periods of rapid eye movement (REM) alternate with non-REM sleep in approximately a 90-minute rhythm. Non-REM sleep is divided into four stages on the basis of characteristic brain-wave patterns. During REM sleep, the brain is active, and there are other signs of arousal, yet most of the skeletal muscles are limp; vivid dreams are reported most often during REM sleep. Some people have had “waking dreams” when they emerge from REM sleep before the paralysis of that stage has subsided and, occasionally, people have interpreted the resulting hallucinations as real. The purposes of REM are still a matter of controversy.

• Sleep is necessary not only for bodily restoration but also for normal mental functioning. Many people get less than the optimal amount of sleep. Some suffer from insomnia, sleep apnea, narcolepsy, or REM behaviour disorder. Researchers are concerned about the growing number of sleep-deprived people in modern societies.

• Sleep may be necessary for the consolidation of memories. Improvements in memory due to sleep have been associated most closely with REM sleep and slow-wave sleep and with memory for specific skills. Sleep also seems to improve insight and problem solving.

Exploring the Dream World

• Dreams are sometimes recalled as illogical and disjointed. Some people say they have lucid dreams, in which they know they are dreaming.

• Freud thought that dreams allow us to express forbidden or unrealistic wishes and desires that have been forced into the unconscious part of the mind and disguised as symbolic images. This approach is called the psychoanalytic theory of dreams. However, there is no objective way to verify Freudian interpretations of dreams and no convincing support for most of his claims.

• Three modern theories of dreaming emphasize the connections between dreams and waking thoughts. The problem-solving approach to dreams holds that they express current concerns. They may even help us solve current problems and work through emotional issues, especially
Hypnosis involves making a person suggestible, a split in consciousness. In one version of this approach, the split is between an executive-control system in the brain and other brain systems responsible for thinking and acting. Dissociation theories are consistent with modern models of the brain.

Another leading approach, the socio-cognitive explanation, regards hypnosis as a product of normal social and cognitive processes. In this view, hypnosis is a form of role-playing in which the hypnotized person uses active cognitive strategies, including imagination, to comply with the hypnotist’s suggestions. The role is so engrossing that the person interprets it as real. Sociocognitive processes can account for the apparent age and past-life “regressions” of people under hypnosis and their reports of alien abductions. These individuals are simply playing a role based on fantasy, imagination, and suggestion.

As we saw in Biology and Hypnosis, brain-scan studies are increasing our understanding of what happens in the brain during hypnosis. But it is too soon to draw any conclusions from this research about what hypnosis really is and how it works.

Consciousness-Altering Drugs

In all cultures, people have found ways to produce altered states of consciousness. For example, psychoactive drugs alter cognition and emotion by acting on neurotransmitters in the brain. Most psychoactive drugs are classified as stimulants, depressants, opiates, or psychedelics, depending on their central nervous system effects and their impact on behavior and mood. However, some common drugs, such as marijuana, fall outside these categories.

When used frequently and in large amounts, some psychoactive drugs can damage neurons in the brain and impair learning and memory. Their use may lead to tolerance, in which increasing dosages are needed for the same effect, and withdrawal symptoms if a person tries to quit. But certain drugs, such as alcohol and marijuana, also have some health benefits when used in moderation. And the effects of Ecstasy are controversial; much of the research has been flawed, and permanent negative effects so far are unproven.

Reactions to a psychoactive drug are influenced not only by its chemical properties but also by the user’s individual condition, prior experience with the drug, environmental setting, and mental set—the person’s expectations and motives for taking the drug. Expectations can be even more powerful than the drug itself, as shown by the “think–drink” effect. Expectations and beliefs about drugs are affected by a person’s culture.

Taking Psychology with You

People often find it difficult to distinguish drug use from drug abuse, to differentiate between heavy use and light or moderate use, and to separate issues of a drug’s legality or illegality from the drug’s potential dangers and benefits.
Chapter 5  Body Rhythms and Mental States  173

Key Terms

biological rhythm 140  
entrainment 140  
endogenous 140  
circadian rhythm 140  
suprachiasmatic nucleus (SCN) 141  
melatonin 141  
internal desynchronization 142  
chronotype 142  
seasonal affective disorder (SAD) 143  
rapid eye movement (REM) sleep 145  
sleep apnea 149  
narcolepsy 149  
REM behaviour disorder 149  
consolidation 150  
lucid dream 152  
activation–synthesis theory 154  
hypnosis 157  
dissociation 158  
psychoactive drug 163  
stimulants 164  
depressants 164  
opiates 164  
psychedelic drugs 164  
anabolic steroids 165  
tolerance 167  
withdrawal 167