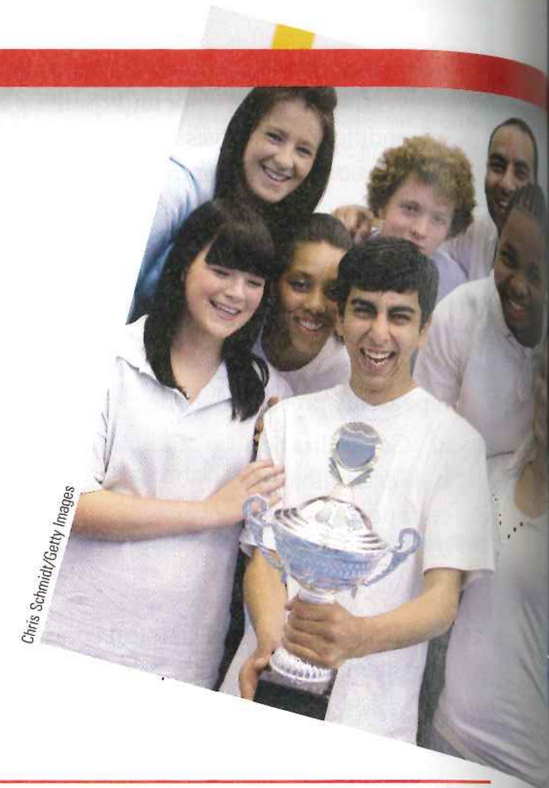
Module 29

Biology, Cognition, and Learning



Chris Schmidt/Getty Images

Module Learning Objectives

29-1 Explain how biological constraints affect classical and operant conditioning.

29-2 Explain how cognitive processes affect classical and operant conditioning.

29-3 Identify the two ways that people learn to cope with personal problems.

29-4 Describe how a perceived lack of control can affect people's behavior and health.

AP® Exam Tip

In the middle of the twentieth century, behaviorism was the dominant perspective in psychology, with little attention paid to the influence of biology and cognition in learning. Now we know better. As you read through this module, notice how important biological and cognitive factors are for understanding learning.

From drooling dogs, running rats, and pecking pigeons we have learned much about the basic processes of learning. But conditioning principles don't tell us the whole story. Today's learning theorists recognize that learning is the product of the interaction of biological, psychological, and social-cultural influences (**FIGURE 29.1**).

Biological Constraints on Conditioning

29-1 How do biological constraints affect classical and operant conditioning?

Ever since Charles Darwin, scientists have assumed that all animals share a common evolutionary history and thus share commonalities in their makeup and functioning. Pavlov and Watson, for example, believed the basic laws of learning were essentially similar in all animals. So it should make little difference whether one studied pigeons or people. Moreover, it seemed that any natural response could be conditioned to any neutral stimulus.

Limits on Classical Conditioning

In 1956, learning researcher Gregory Kimble proclaimed, "Just about any activity of which the organism is capable can be conditioned and . . . these responses can be conditioned to any stimulus that the organism can perceive" (p. 195). Twenty-five years later, he humbly acknowledged that "half a thousand" scientific reports had proven him wrong (Kimble, 1981). More than the early behaviorists realized, an animal's capacity for conditioning is constrained by its biology. Each species' predispositions prepare it to learn the associations that enhance its survival. Environments are not the whole story.

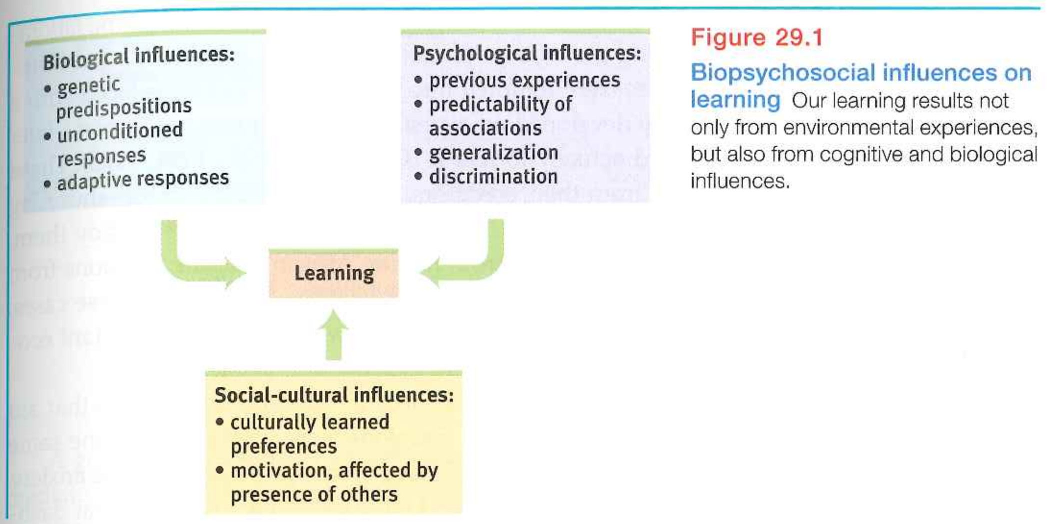


Figure 29.1
Biopsychosocial influences on learning Our learning results not only from environmental experiences, but also from cognitive and biological influences.

John Garcia As the laboring son of California farmworkers, Garcia attended school only in the off-season during his early childhood years. After entering junior college in his late twenties, and earning his Ph.D. in his late forties, he received the American Psychological Association's Distinguished Scientific Contribution Award "for his highly original, pioneering research in conditioning and learning." He was also elected to the National Academy of Sciences.

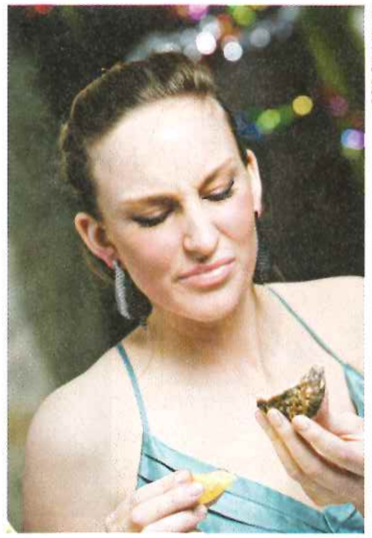
John Garcia was among those who challenged the prevailing idea that all associations can be learned equally well. While researching the effects of radiation on laboratory animals, Garcia and Robert Koelling (1966) noticed that rats began to avoid drinking water from the plastic bottles in radiation chambers. Could classical conditioning be the culprit? Might the rats have linked the plastic-tasting water (a CS) to the sickness (UR) triggered by the radiation (US)?

To test their hunch, Garcia and Koelling exposed the rats to a particular taste, sight, or sound (CS) and later also to radiation or drugs (US) that led to nausea and vomiting (UR). Two startling findings emerged: First, even if sickened as late as several hours after tasting a particular novel flavor, the rats thereafter avoided that flavor. This appeared to violate the notion that for conditioning to occur, the US must immediately follow the CS.

Second, the sickened rats developed aversions to tastes but not to sights or sounds. This contradicted the behaviorists' idea that any perceivable stimulus could serve as a CS. But it made adaptive sense. For rats, the easiest way to identify tainted food is to taste it; if sickened after sampling a new food, they thereafter avoid it. This response, called *taste aversion,* makes it difficult to eradicate a population of "bait-shy" rats by poisoning.

Humans, too, seem biologically prepared to learn some associations rather than others. If you become violently ill four hours after eating contaminated seafood, you will probably develop an aversion to the taste of seafood but usually not to the sight of the associated restaurant, its plates, the people you were with, or the music you heard there. (In contrast, birds, which hunt by sight, appear biologically primed to develop aversions to the *sight* of tainted food [Nicolaus et al., 1983].)

Garcia's early findings on taste aversion were met with an onslaught of criticism. As the German philosopher Arthur Schopenhauer (1788–1860) once said, important ideas are first ridiculed, then attacked, and finally taken for granted. Leading journals refused to publish Garcia's work: The findings are impossible, said some critics. But, as often happens in science, Garcia and Koelling's taste-aversion research is now basic textbook material.



BSIP SA / Alamy

Taste aversion If you became violently ill after eating oysters, you probably would have a hard time eating them again. Their smell and taste would have become a CS for nausea. This learning occurs readily because our biology prepares us to learn taste aversions to toxic foods.

It is also a good example of experiments that begin with the discomfort of some laboratory animals and end by enhancing the welfare of many others. In one conditioned taste-aversion study, coyotes and wolves were tempted into eating sheep carcasses laced with a sickening poison. Thereafter, they developed an aversion to sheep meat; two wolves later penned with a live sheep seemed actually to fear it (Gustavson et al., 1974, 1976). These studies not only saved the sheep from their predators, but also saved the sheep-shunning coyotes and wolves from angry ranchers and farmers who had wanted to destroy them. Similar applications have prevented baboons from raiding African gardens, raccoons from attacking chickens, and ravens and crows from feeding on crane eggs. In all these cases, research helped preserve both the prey and their predators, who occupy an important ecological niche (Dingfelder, 2010; Garcia & Gustavson, 1997).

"All animals are on a voyage through time, navigating toward futures that promote their survival and away from futures that threaten it. Pleasure and pain are the stars by which they steer." -Psychologists Daniel T. Gilbert and Timothy D. Wilson, "Prospection: Experiencing the Future," 2007

Such research supports Darwin's principle that natural selection favors traits that aid survival. Our ancestors who readily learned taste aversions were unlikely to eat the same toxic food again and were more likely to survive and leave descendants. Nausea, like anxiety, pain, and other bad feelings, serves a good purpose. Like a low-oil warning on a car dashboard, each alerts the body to a threat (Neese, 1991).

And remember those Japanese quail that were conditioned to get excited by a red light that signaled a receptive female's arrival? Michael Domjan and his colleagues (2004) report that such conditioning is even speedier, stronger, and more durable when the CS is *ecologically relevant*—something similar to stimuli associated with sexual activity in the natural environment, such as the stuffed head of a female quail. In the real world, observes Domjan (2005), conditioned stimuli have a natural association with the unconditioned stimuli they predict.

blickwinkel/Alamy

Animal taste aversion As an alternative to killing wolves and coyotes that preyed on sheep, some ranchers have sickened the animals with lamb laced with a drug.

The tendency to learn behaviors favored by natural selection may help explain why we humans seem to be naturally disposed to learn associations between the color red and sexuality. Female primates display red when nearing ovulation. In human females, enhanced bloodflow produces the red blush of flirtation and sexual excitation. Does the frequent pairing of red and sex—with Valentine's hearts, red-light districts, and red lipstick—naturally enhance men's attraction to women? Experiments (**FIGURE 29.2**) suggest that, without men's awareness, it does (Elliot & Niesta, 2008). In follow-up studies, men who viewed a supposed female conversation partner in a red rather than green shirt chose to sit closer to where they expected her to sit and to ask her more intimate questions (Kayser et al., 2010). And it's not just men: Women tend to perceive men as more attractive when seen on a red background or in red clothing (Elliot et al., 2010).

Figure 29.2
Romantic red In a series of experiments that controlled for other factors (such as the brightness of the image), men found women more attractive and sexually desirable when framed in red (Elliot & Niesta, 2008).

Both images Kathryn Brownson, Hope College

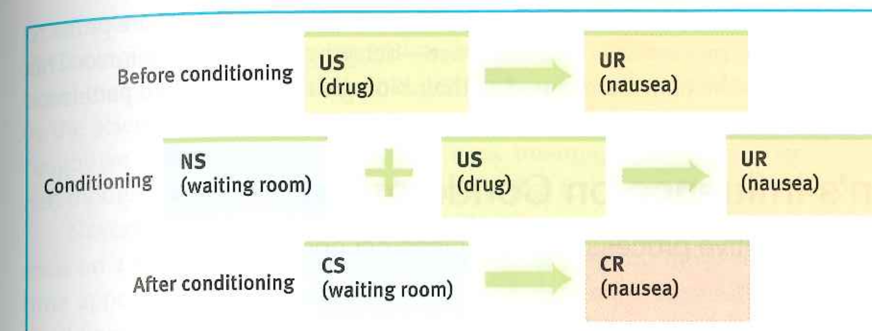


Figure 29.3
Nausea conditioning in cancer patients

A genetic predisposition to associate a CS with a US that follows predictably and immediately is adaptive: Causes often immediately precede effects. Often, but not always, as we saw in the taste-aversion findings. At such times, our predispositions can trick us. When chemotherapy triggers nausea and vomiting more than an hour following treatment, cancer patients may over time develop classically conditioned nausea (and sometimes anxiety) to the sights, sounds, and smells associated with the clinic (**FIGURE 29.3**) (Hall, 1997). Merely returning to the clinic's waiting room or seeing the nurses can provoke these conditioned feelings (Burish & Carey, 1986; Davey, 1992). Under normal circumstances, such revulsion to sickening stimuli would be adaptive.

"Once bitten, twice shy." -G. F. Northall, *Folk-Phrases*, 1894

Limits on Operant Conditioning

As with classical conditioning, nature sets limits on each species' capacity for operant conditioning. Mark Twain (1835–1910) said it well: "Never try to teach a pig to sing. It wastes your time and annoys the pig."

We most easily learn and retain behaviors that reflect our biological predispositions. Thus, using food as a reinforcer, you could easily condition a hamster to dig or to rear up, because these are among the animal's natural food-searching behaviors. But you won't be so successful if you use food as a reinforcer to shape face washing and other hamster behaviors that aren't normally associated with food or hunger (Shettleworth, 1973). Similarly, you could easily teach pigeons to flap their wings to avoid being shocked, and to peck to obtain food: Fleeing with their wings and eating with their beaks are natural pigeon behaviors. However, pigeons would have a hard time learning to peck to avoid a shock, or to flap their wings to obtain food (Foree & LoLordo, 1973). The principle: *Biological constraints predispose organisms to learn associations that are naturally adaptive.*

Natural athletes Animals can most easily learn and retain behaviors that draw on their biological predispositions, such as horses' inborn ability to move around obstacles with speed and agility.

AP Photo/The Gallup Independent, Jeffery Jones

In the early 1940s, University of Minnesota graduate students Marian Breland and Keller Breland witnessed the power of operant conditioning (1961; Bailey & Gillaspy, 2005). Their mentor was B. F. Skinner. Impressed with his results, they began training dogs, cats, chickens, parakeets, turkeys, pigs, ducks, and hamsters. The rest is history. The company they formed spent the next half-century training more than 15,000 animals from 140 species for movies, traveling shows, amusement parks, corporations, and the government. And along the way, the Brelands themselves mentored others, including Sea World's first director of training.

In their early training days, the Brelands presumed that operant principles would work on almost any response an animal could make. But along the way, they too learned about biological constraints. In one act, pigs trained to pick up large wooden "dollars" and deposit them in a piggy bank began to drift back

FYI

For more information on animal behavior, see books by (I am not making this up) Robin Fox and Lionel Tiger.

to their natural ways. They dropped the coin, pushed it with their snouts as pigs are prone to do, picked it up again, and then repeated the sequence—delaying their food reinforcer. This *instinctive drift* occurred as the animals reverted to their biologically predisposed patterns.

Cognition's Influence on Conditioning

29-2 How do cognitive processes affect classical and operant conditioning?

Cognitive Processes and Classical Conditioning

In their dismissal of "mentalistic" concepts such as consciousness, Pavlov and Watson underestimated the importance not only of biological constraints on an organism's learning capacity, but also the effects of cognitive processes (thoughts, perceptions, expectations). The early behaviorists believed that rats' and dogs' learned behaviors could be reduced to mindless mechanisms, so there was no need to consider cognition. But Robert Rescorla and Allan Wagner (1972) showed that an animal can learn the *predictability* of an event. If a shock always is preceded by a tone, and then may also be preceded by a light that accompanies the tone, a rat will react with fear to the tone but not to the light. Although the light is always followed by the shock, it adds no new information; the tone is a better predictor. The more predictable the association, the stronger the conditioned response. It's as if the animal learns an *expectancy,* an awareness of how likely it is that the US will occur.

"All brains are, in essence, anticipation machines." -Daniel C. Dennett, *Consciousness Explained,* 1991

Associations can influence attitudes (Hofmann et al., 2010). When British children viewed novel cartoon characters alongside either ice cream *(Yum!)* or brussels sprouts *(Yuck!),* they came to like best the ice-cream-associated characters (Field, 2006). Other researchers have classically conditioned adults' attitudes, using little-known Pokémon characters (Olson & Fazio, 2001). The participants, playing the role of a security guard monitoring a video screen, viewed a stream of words, images, and Pokémon characters. Their task, they were told, was to respond to one target Pokémon character by pressing a button. Unnoticed by the participants, when two other Pokémon characters appeared on the screen, one was consistently associated with various positive words and images (such as *awesome* or a hot fudge sundae); the other appeared with negative words and images (such as *awful* or a cockroach). Without any conscious memory for the pairings, the participants formed more gut-level liking for the characters associated with the positive stimuli.

Follow-up studies indicate that conditioned likes and dislikes are even stronger when people notice and are aware of the associations they have learned (Shanks, 2010). Cognition matters.

Such experiments help explain why classical conditioning treatments that ignore cognition often have limited success. For example, people receiving therapy for alcohol use disorder may be given alcohol spiked with a nauseating drug. Will they then associate alcohol with sickness? If classical conditioning were merely a matter of "stamping in" stimulus associations, we might hope so, and to some extent this does occur (as we will see in Module 71). However, one's awareness that the nausea is induced by the drug, not the alcohol, often weakens the association between drinking alcohol and feeling sick. So, even in classical conditioning, it is (especially with humans) not simply the CS-US association but also the thought that counts.

Cognitive Processes and Operant Conditioning

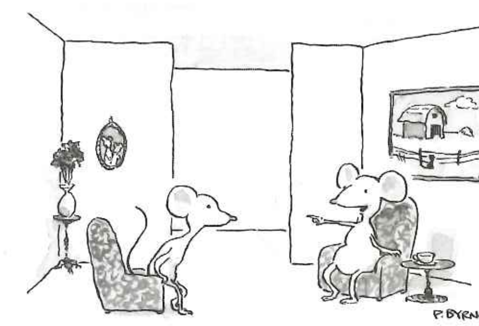
B. F. Skinner acknowledged the biological underpinnings of behavior and the existence of private thought processes. Nevertheless, many psychologists criticized him for discounting the importance of these influences.

A mere eight days before dying of leukemia in 1990, Skinner stood before the American Psychological Association convention. In this final address, he again resisted the growing belief that cognitive processes (thoughts, perceptions, expectations) have a necessary place in the science of psychology and even in our understanding of conditioning. He viewed "cognitive science" as a throwback to early twentieth-century introspectionism. For Skinner, thoughts and emotions were behaviors that follow the same laws as other behaviors.

Nevertheless, the evidence of cognitive processes cannot be ignored. For example, animals on a fixed-interval reinforcement schedule respond more and more frequently as the time approaches when a response will produce a reinforcer. Although a strict behaviorist would object to talk of "expectations," the animals behave as if they expected that repeating the response would soon produce the reward.

LATENT LEARNING

Evidence of cognitive processes has also come from studying rats in mazes, including classic studies by Edward Chase Tolman (1886–1959) and C. H. Honzik that were done in Skinner's youth. Rats exploring a maze, given no obvious rewards, seem to develop a **cognitive map,** a mental representation of the maze, much like your mental map of your school. This map, and the rats' learning, is not demonstrated until the experimenter places food in the maze's goal box, which motivates the rats to run the maze at least as quickly and efficiently as other rats that were previously reinforced with food for this result (Tolman & Honzik, 1930).



"Bathroom? Sure, it's just down the hall to the left, jog right, left, another left, straight past two more lefts, then right, and it's at the end of the third corridor on your right."

Like people sightseeing in a new town, the exploring rats seemingly experienced **latent learning** during their earlier tours. That learning became apparent only when there was some incentive to demonstrate it. Children, too, may learn from watching a parent but demonstrate the learning only much later, as needed. The point to remember: *There is more to learning than associating a response with a consequence; there is also cognition.* In Unit VII we will encounter more striking evidence of cognitive abilities in solving problems and in using language.

INSIGHT LEARNING

Some learning occurs after little or no systematic interaction with our environment. For example, we may puzzle over a problem, and suddenly, the pieces fall together as we perceive the solution in a sudden flash of **insight**—an abrupt, true-seeming, and often satisfying solution (Topolinski & Reber, 2010). Ten-year-old Johnny Appleton's insight solved a problem that had stumped construction workers: how to rescue a young robin that had fallen into a narrow 30-inch-deep hole in a cement-block wall. Johnny's solution: Slowly pour in sand, giving the bird enough time to keep its feet on top of the constantly rising pile (Ruchlis, 1990).

INTRINSIC MOTIVATION

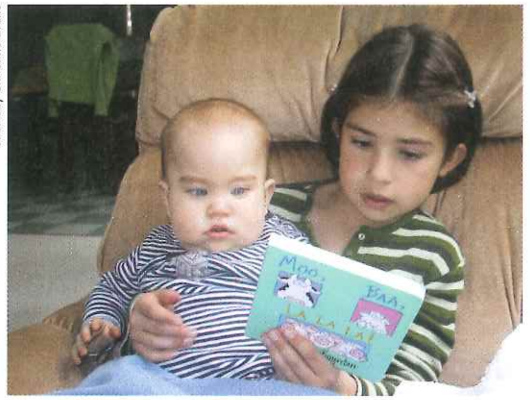
The cognitive perspective has also shown us the limits of rewards: Promising people a reward for a task they already enjoy can backfire. Excessive rewards can destroy **intrinsic motivation**—the desire to perform a behavior effectively for its own sake. In experiments, children have been promised a payoff for playing with an interesting puzzle or toy. Later, they played with the toy *less* than other unpaid children did (Deci et al., 1999; Tang & Hall, 1995). Likewise, rewarding children with toys or candy for reading diminishes the time they spend reading (Marinak & Gambrell, 2008). It is as if they think, "If I have to be bribed into doing this, it must not be worth doing for its own sake." This overuse of bribes—leading people to see their actions as externally controlled rather than internally appealing—has been called *overjustification.*

cognitive map a mental representation of the layout of one's environment. For example, after exploring a maze, rats act as if they have learned a cognitive map of it.

latent learning learning that occurs but is not apparent until there is an incentive to demonstrate it.

insight a sudden realization of a problem's solution.

intrinsic motivation a desire to perform a behavior effectively for its own sake.



Courtesy Christine Brune

Pure love If this girl were suddenly told that she must look after her baby cousin from now on, she might lose some of the joy that her intrinsic motivation to care for him has provided.

extrinsic motivation a desire to perform a behavior to receive promised rewards or avoid threatened punishment.

To sense the difference between intrinsic motivation and **extrinsic motivation** (behaving in certain ways to gain external rewards or avoid threatened punishment), think about your experience in this course. Are you feeling pressured to finish this reading before a deadline? Worried about your grade? Eager for college credit by doing well on the AP® Exam? If *Yes,* then you are extrinsically motivated (as, to some extent, almost all students must be). Are you also finding the material interesting? Does learning it make you feel more competent? If there were no grade at stake, might you be curious enough to want to learn the material for its own sake? If *Yes,* intrinsic motivation also fuels your efforts.

Youth sports coaches who aim to promote enduring interest in an activity, not just to pressure players into winning, should focus on the intrinsic joy of playing and of reaching one's potential (Deci & Ryan, 1985, 2009). Giving people choices also enhances their intrinsic motivation (Patall et al., 2008). Nevertheless, rewards used to signal a job well done (rather than to bribe or control someone) can be effective (Boggiano et al., 1985). "Most improved player" awards, for example, can boost feelings of competence and increase enjoyment of a sport. Rightly administered, rewards can raise performance and spark creativity (Eisenberger & Aselage, 2009; Henderlong & Lepper, 2002). And extrinsic rewards (such as the college scholarships and jobs that often follow good grades) are here to stay. **TABLE 29.1** compares the biological and cognitive influences on classical and operant conditioning.

Table 29.1 Biological and Cognitive Influences on Conditioning

	Classical Conditioning	Operant Conditioning
Biological predispositions	Natural predispositions constrain what stimuli and responses can easily be associated.	Organisms best learn behaviors similar to their natural behaviors; unnatural behaviors instinctively drift back toward natural ones.
Cognitive processes	Organisms develop expectation that CS signals the arrival of US.	Organisms develop expectation that a response will be reinforced or punished; they also exhibit latent learning, without reinforcement.

Learning and Personal Control

29-3 In what two ways do people learn to cope with personal problems?

coping alleviating stress using emotional, cognitive, or behavioral methods.

problem-focused coping attempting to alleviate stress directly—by changing the stressor or the way we interact with that stressor.

emotion-focused coping attempting to alleviate stress by avoiding or ignoring a stressor and attending to emotional needs related to one's stress reaction.

Problems in life are unavoidable. This fact gives us a clear message: We need to learn to **cope** with the problems in our lives by alleviating the *stress* they cause with emotional, cognitive, or behavioral methods.

Some problems, called stressors, we address directly, with **problem-focused coping.** If our impatience leads to a family fight, we may go directly to that family member to work things out. We tend to use problem-focused strategies when we feel a sense of control over a situation and think we can change the circumstances, or at least change ourselves to deal with the circumstances more capably.

We turn to **emotion-focused coping** when we cannot—or *believe* we cannot—change a situation. If, despite our best efforts, we cannot get along with that family member, we may search for stress relief by reaching out to friends for support and comfort. Emotion-focused strategies can be adaptive, as when we exercise or keep busy with hobbies to avoid thinking about an old addiction. Emotion-focused strategies can be maladaptive, however, as when students worried about not keeping up with the reading in class go out to party to get it off their mind. Sometimes a problem-focused strategy (catching up with the reading) more effectively reduces stress and promotes long-term health and satisfaction.

Huntstock, Inc/Alamy

Emotion-focused coping Reaching out to friends can help us attend to our emotional needs in stressful situations.

When challenged, some of us tend to respond with cool problem-focused coping, others with emotion-focused coping (Connor-Smith & Flachsbart, 2007). Our feelings of personal control, our explanatory style, and our supportive connections all influence our ability to cope. So, how might learning influence whether we cope successfully?

Learned Helplessness

29-4 How does a perceived lack of control affect people's behavior and health?

Picture the scene: Two rats receive simultaneous shocks. One can turn a wheel to stop the shocks. The helpless rat, but not the wheel turner, becomes more susceptible to ulcers and lowered immunity to disease (Laudenslager & Reite, 1984). In humans, too, uncontrollable threats trigger the strongest stress responses (Dickerson & Kemeny, 2004).

learned helplessness the hopelessness and passive resignation an animal or human learns when unable to avoid repeated aversive events.

Feeling helpless and oppressed may lead to a state of passive resignation called **learned helplessness** (**FIGURE 29.4**). Researcher Martin Seligman (1975, 1991) discovered this in some long-ago experiments in which dogs were strapped in a harness and given repeated shocks, with no opportunity to avoid them. Later, when placed in another situation where they *could* escape the punishment by simply leaping a hurdle, the dogs cowered as if without hope. In contrast, animals able to escape the first shocks learned personal control and easily escaped the shocks in the new situation.

Humans can also learn helplessness. When repeatedly faced with traumatic events over which they have no control, people come to feel helpless, hopeless, and depressed.

Perceiving a loss of control, we become more vulnerable to stress and ill health. A famous study of elderly nursing home residents with little perceived control over their activities found that they declined faster and died sooner than those given more control (Rodin, 1986). Workers able to adjust office furnishings and control interruptions and distractions in their work environment have experienced

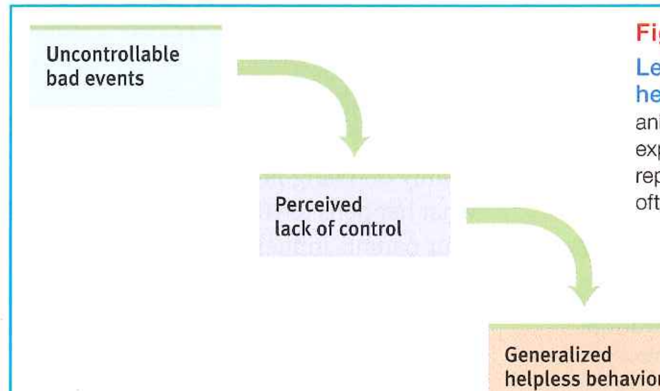


Figure 29.4 Learned helplessness When animals and people experience no control over repeated bad events, they often learn helplessness.

PRNewsFoto/Home Interiors & Gifts; Habitat for Humanity Women Build

Happy to have control After working on the building—alongside Habitat for Humanity volunteers—for several months, this family is finally experiencing the joy of having their own new home.

less stress (O'Neill, 1993). Such findings may help explain why British civil service workers at the executive grades have tended to outlive those at clerical or laboring grades, and why Finnish workers with low job stress have been less than half as likely to die of strokes or heart disease as those with a demanding job and little control. The more control workers have, the longer they live (Bosma et al., 1997, 1998; Kivimaki et al., 2002; Marmot et al., 1997).

Increasing self-control—allowing prisoners to move chairs and control room lights and the TV, having workers participate in decision making, offering nursing home patients choices about their environment—noticeably improves health and morale (Humphrey et al., 2007; Wang et al., 2010). In the case of the nursing home patients, 93 percent of those encouraged to exert more control became more alert, active, and happy (Rodin, 1986). As researcher Ellen Langer (1983, p. 291) concluded, "Perceived control is basic to human functioning."

Control may also help explain a well-established link between economic status and longevity (Jokela et al., 2009). In one study of 843 grave markers in an old graveyard in Glasgow, Scotland, those with the costliest, highest pillars (indicating the most affluence) tended to have lived the longest (Carroll et al., 1994). Likewise, those living in Scottish regions with the least overcrowding and unemployment have the greatest longevity. There and elsewhere, high economic status predicts a lower risk of heart and respiratory diseases (Sapolsky, 2005). Wealthy predicts healthy among children, too (Chen, 2004). With higher economic status come reduced risks of low birth weight, infant mortality, smoking, and violence. Even among other primates, individuals at the bottom of the social pecking order have been more likely than their higher-status companions to become sick when exposed to a cold-like virus (Cohen et al., 1997). But high status also entails stress: High-status baboons and monkeys who frequently have to physically defend their dominant position show high stress levels (Sapolsky, 2005).

Why does perceived loss of control predict health problems? Because losing control provokes an outpouring of stress hormones. When rats cannot control shock or when primates or humans feel unable to control their environment, stress hormone levels rise, blood pressure increases, and immune responses drop (Rodin, 1986; Sapolsky, 2005). Captive animals therefore experience more stress and are more vulnerable to disease than are wild animals (Roberts, 1988). Human studies have confirmed that crowding in high-density neighborhoods, prisons, and college and university dorms is another source of diminished feelings of control—and of elevated levels of stress hormones and blood pressure (Fleming et al., 1987; Ostfeld et al., 1987).

INTERNAL VERSUS EXTERNAL LOCUS OF CONTROL

If experiencing a loss of control can be stressful and unhealthy, do people who generally feel in control of their lives enjoy better health? Consider your own feelings of control. Do you believe that your life is beyond your control? That getting a decent summer job depends mainly on being in the right place at the right time? Or do you more strongly believe that what happens to you is your own doing? That being a success is a matter of hard work? Did your parents influence your feelings of control? Did your culture?

Hundreds of studies have compared people who differ in their perceptions of control. On one side are those who have what psychologist Julian Rotter called an **external locus of control**—the perception that chance or outside forces determine their fate. On the other are those who perceive an **internal locus of control,** who believe that they control their own destiny. In study after study, "internals" have achieved more in school and work,

external locus of control the perception that chance or outside forces beyond our personal control determine our fate.

internal locus of control the perception that you control your own fate.

acted more independently, enjoyed better health, and felt less depressed than did "externals" (Lefcourt, 1982; Ng et al., 2006). Moreover, they were better at delaying gratification and coping with various stressors, including marital problems (Miller & Monge, 1986). One study followed 7551 British people for two decades. Those who expressed a more internal locus of control at age 10 exhibited less obesity, hypertension, and distress at age 30 (Gale et al., 2008). Other studies have found that people who believe in free will, or that willpower is controllable, learn better, perform better at work, and are more helpful (Job et al., 2010; Stillman et al., 2010).

Compared with their parents' generation, more Americans now endorse an external locus of control (Twenge et al., 2004). This shift may help explain an associated increase in rates of depression and other psychological disorders in the new generation (Twenge et al., 2010).

DEPLETING AND STRENGTHENING SELF-CONTROL

Self-control is the ability to control impulses and delay short-term gratification for longer-term rewards. In studies, this ability has predicted good adjustment, better grades, and social success (Tangney et al., 2004). Students who planned their day's activities and then lived out their day as planned were also at low risk for depression (Nezlek, 2001).

Self-control often fluctuates. Like a muscle, self-control temporarily weakens after an exertion, replenishes with rest, and becomes stronger with exercise (Baumeister & Exline, 2000; Hagger et al., 2010; Vohs & Baumeister, 2011). Exercising willpower temporarily depletes the mental energy needed for self-control on other tasks (Gailliott & Baumeister, 2007). In one experiment, hungry people who had resisted the temptation to eat chocolate chip cookies abandoned a tedious task sooner than those who had not resisted the cookies. And after expending willpower on laboratory tasks, such as stifling prejudice or saying the color of words (for example, "red" even if the red-colored word was *green*), people were less restrained in their aggressive responses to provocation and in their sexuality (DeWall et al., 2007; Gaillot & Baumeister, 2007).

self-control the ability to control impulses and delay short-term gratification for greater long-term rewards.

LatitudeStock/Brian Fairbrother/Getty Images

AP Photo/Marty Lederhandler

Extreme self-control Our ability to exert self-control increases with practice, and some of us have practiced more than others! Magician David Blaine (above) endured standing in a block of ice (in which a small space had been carved out for him) for nearly 62 hours for a stunt in New York's Times Square. A number of performing artists make their living as very convincing human statues, as does this actress (left) performing on The Royal Mile in Edinburgh, Scotland.

Researchers have found that exercising willpower depletes the blood sugar and neural activity associated with mental focus (Inzlicht & Gutsell, 2007). What, then, might be the effect of deliberately boosting people's blood sugar when self-control is depleted? Giving energy-boosting sugar (in a naturally rather than an artificially sweetened lemonade) had a sweet effect: It strengthened people's effortful thinking and reduced their financial impulsiveness (Masicampo & Baumeister, 2008; Wang & Dvorak, 2010). Even dogs can experience both self-control depletion on the one hand and rejuvenation with sugar on the other (Miller et al., 2010).

In the long run, self-control requires attention and energy. With physical exercise and time-managed study programs, people have strengthened their self-control, as seen in both their performance on laboratory tasks and their improved self-management of eating, drinking, smoking, and household chores (Oaten & Cheng, 2006a,b). *The bottom line:* We can grow our willpower muscles—our capacity for self-regulation. But doing so requires some (dare I say it?) willpower.

Before You Move On

▶ ASK YOURSELF

How are you intrinsically motivated? What are some extrinsic motivators in your life?

▶ TEST YOURSELF

When faced with a situation over which you feel you have no sense of control, is it most effective to use emotion- or problem-focused coping? Why?

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

Module 29 Review

29-1 How do biological constraints affect classical and operant conditioning?

- Classical conditioning principles, we now know, are constrained by biological predispositions, so that learning some associations is easier than learning others.
- Learning is adaptive: Each species learns behaviors that aid its survival.
- Biological constraints also place limits on operant conditioning. Training that attempts to override biological constraints will probably not endure because animals will revert to predisposed patterns.

29-2 How do cognitive processes affect classical and operant conditioning?

- In classical conditioning, animals may learn when to expect a US and may be aware of the link between stimuli and responses.
- In operant conditioning, *cognitive mapping* and *latent learning* research demonstrate the importance of cognitive processes in learning.
- Other research shows that excessive rewards (driving *extrinsic motivation*) can undermine *intrinsic motivation*.

29-3 In what two ways do people learn to cope with personal problems?

- We use *problem-focused coping* to change the stressor or the way we interact with it.
- We use *emotion-focused coping* to avoid or ignore stressors and attend to emotional needs related to stress reactions.

29-4 How does a perceived lack of control affect people's behavior and health?

- Being unable to avoid repeated aversive events can lead to *learned helplessness.*
- People who perceive an *internal locus of control* achieve more, enjoy better health, and are happier than those who perceive an *external locus of control.*
- *Self-control* requires attention and energy, but it predicts good adjustment, better grades, and social success.
- A perceived lack of control provokes an outpouring of hormones that put people's health at risk.

Multiple-Choice Questions

1. What do we call a desire to perform a behavior in order to receive promised rewards or to avoid threatened punishment?

a. Latent learning
b. Extrinsic motivation
c. Intrinsic motivation
d. Insight learning
e. Emotion-focused coping

2. Which ability is a good predictor of good adjustment, better grades, and social success?

a. Self-control
b. Locus of control
c. Problem-focused coping
d. Learned helplessness
e. Emotion-focused coping

3. Elephants appear to have the capacity to remember large-scale spaces over long periods. Which of the following best identifies this capacity?

a. Latent learning
b. Insight
c. Cognitive maps
d. Intrinsic motivation
e. Extrinsic motivation

4. The perception that we control our own fate is also called what?

a. Self-control
b. Learned helplessness
c. Internal locus of control
d. External locus of control
e. Emotion-focused coping

5. A woman had been pondering a problem for days and was about to give up when, suddenly, the solution came to her. Her experience can be best described as what?

a. Cognitive mapping
b. Insight
c. Operant conditioning
d. Classical conditioning
e. Unconscious associative learning

Practice FRQs

1. Provide two specific examples of how biology can influence classical conditioning.

Answer

Any two examples from the module can be used to answer. Possibilities include:

1 point: Garcia's research showed that rats are more likely to develop a classically conditioned aversion to tastes than to sights or sounds.

1 point: Humans are biologically predisposed to form associations between the color red and sexuality.

2. Describe how each of the following can show the impact of cognition on operant conditioning.

- Latent learning
- Insight learning
- Intrinsic motivation

(3 points)