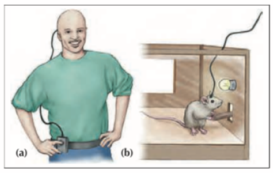
primary reinforcers, such as psychoactive drugs. One of the most powerful reinforcers is *intracranial self-stimulation*, which involves the direct activation of "pleasure centers" in the brain.

Suppose that you could have an electrode implanted in your brain and connected to a remote control. Slide the controller upward, and electrical impulses stimulate one of your brain's "pleasure centers." The few humans who have had a chance to try direct brain stimulation report feeling intense pleasure that is better than food, water, sex, drugs, or any other primary reinforcer (Heath, 1963; ● Figure 6.12).

Most of what we know about intracranial self-stimulation comes from studying rats with similar implants (Vlachou & Markou, 2011). A rat "wired for pleasure" can be trained to press the bar in a Skinner box to deliver electrical stimulation to its own limbic system (● Figure 6.12). Some rats will press the bar thousands of times per hour to obtain brain stimulation. After 15 or 20 hours of constant pressing, animals sometimes collapse from exhaustion. When they revive, they begin pressing again. If the reward circuit is not turned off, an animal will ignore food, water, and sex in favor of bar-pressing. (■ Electrical stimulation is a valuable tool for studying the functions of various brain structures. See Chapter 2.4.)

Many natural primary reinforcers activate the same pleasure pathways in the brain that make intracranial self-stimulation so powerful (Powell, Honey, & Symbaluk, 2017). So do psychoactive drugs, such as alcohol and cocaine (Lazenka, Legakis, & Negus, 2016; Prus, 2014). In fact, rats also will self-administer nicotine. When they do, they are even more likely to engage in



● **Figure 6.12 Electrical self-stimulation of the brain.** Humans have been "wired" for brain stimulation, as shown in (a). However, in humans, this has been done only as an experimental way to restrain uncontrollable outbursts of violence. Implants have not been done merely to produce pleasure. Most research has been carried out with rats. Using the apparatus shown in (b), the rat can press a bar to deliver mild electric stimulation to a "pleasure center" in the brain.

Secondary Reinforcement

Although human learning is still strongly tied to food, water, and other primary reinforcers, humans also respond to a much broader range of secondary reinforcers. Money, praise, attention, approval, success, affection, grades, and the like all can serve as a learned or **secondary reinforcer**.

How does a secondary reinforcer gain its ability to promote learning? Some secondary reinforcers are simply associated with a primary reinforcer. For example, if you want to train a dog to follow you ("heel") when you take a walk, you could reward the dog with small food treats for staying near you. If you praise the dog each time you give it a treat, praise will become a secondary reinforcer. In time, you will be able to skip giving treats and simply praise your pup for doing the right thing. The same principle applies to children. One reason that parents' praise becomes a secondary reinforcer is because it is frequently associated with food, candy, hugs, and other primary reinforcers.

Tokens and Token Economies

Some secondary reinforcers gain their value because they can be *exchanged* for primary reinforcers (Powell, Honey, & Symbaluk, 2017). Printed money obviously has little or no value of its own. You can't eat it, drink it, or sleep with it. However, it can be exchanged for food, water, lodging, and other necessities.

A **token reinforcer** is a tangible secondary reinforcer, such as money, a gold star, a poker chip, and the like. In a series of classic experiments, chimpanzees were taught to work for tokens. The chimps were first trained to put poker chips into a vending machine (● Figure 6.13). Each chip dispensed a few grapes or

Operant stimulus discrimination The tendency to make an operant response when stimuli previously associated with reward are present and to withhold the response when stimuli associated with nonreward are present.

Discriminative stimuli Stimuli that precede rewarded and nonrewarded responses in operant conditioning.

Primary reinforcers Nonlearned reinforcers; usually those that satisfy physiological needs.

Secondary reinforcement Reward that organisms learn to like.

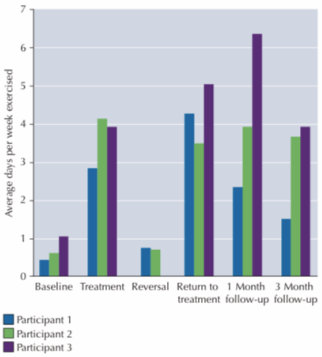
Secondary reinforcer A learned reinforcer; often one that gains reinforcing properties by association with a primary reinforcer.

Token reinforcement (reinforcer) A tangible secondary reinforcer such as money, gold stars, poker chips, and the like.

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● **Figure 6.13 Will work for tokens.** Poker chips normally have little or no value for chimpanzees, but this chimp will work hard to earn them once he learns that the "Chimp-O-Mat" will dispense food in exchange for them.



● **Figure 6.14 Reinforcement in a token economy.** Children with cystic fibrosis (a hereditary lung disease) benefit from exercise that clears blocked airways. This graph shows the effects of using tokens to reward aerobic exercise in three children with cystic fibrosis. The number of minutes of aerobic exercise each day was measured. Tokens earned could be exchanged for rewards such as going to see a movie or staying up past bedtime. The graph shows that all three children exercised relatively infrequently without the reinforcement (*baseline* and *reversal* phases) and relatively more when the reinforcement was in place (*training* and return to *treatment* phases). It is encouraging to note that exercise rates remained heightened for months after the token economy was first implemented. (Adapted from Bernard, Cohen, & Moffett, 2009.)

raisins. Once the animals had learned to exchange tokens for food, they would learn new tasks to earn the chips. To maintain the value of the tokens, the chimps were occasionally allowed to use the "Chimp-O-Mat" (Cowles, 1937).

A major advantage of tokens is that they don't lose reinforcing value as quickly as primary reinforcers. For instance, if you use candy to reinforce a developmentally disabled child for correctly naming things, the child might lose interest when he or she is no longer hungry. It would be better to use tokens as immediate rewards for learning. Later, the child can exchange tokens for candy, toys, or other treats.

Token economies, systems for managing and altering behavior through reinforcement of selected responses, have been used with troubled children and adults in special programs and even in ordinary school classrooms (Alberto & Troutman, 2013; Maggin et al., 2011; ● Figure 6.14). In each case, the goal is to provide an immediate reward for learning. Tokens may typically be exchanged for food, special privileges, or trips to movies, amusement parks, and so forth. Many parents find that tokens greatly reduce discipline problems with younger children. For example, children can earn points or gold stars during the week for good behavior. If they earn enough tokens, they are allowed on the weekend to choose one item out of a grab bag of small prizes. A *token economy* is a system for managing and altering behavior through reinforcement of selected responses. (■ See Chapter 15.5, for more information on the uses of token economies in behavior therapy.)

Social Reinforcement

As we have noted, secondary reinforcers such as learned desires for attention and approval (also called **social reinforcers**) often influence human behavior. This fact can be used in a classic, if somewhat mischievous, demonstration:

Shaping a Teacher

For this activity, about one-half (or more) of the students in a classroom must participate. First, select a target behavior. This should be something like "lecturing from the right side of the room." (Keep it simple, in case your teacher is a slow learner.) Begin training in this way: Each time the instructor turns toward the right or takes a step in that direction, participating students should look *really* interested. Also, smile, ask questions, lean forward, and make eye contact. If the teacher turns to the left or takes a step in that direction, participating students should lean back, yawn, check out their split ends, close their eyes, or generally look bored. Soon, without being aware of why, the instructor should be spending most of his or her time each class period lecturing from the right side of the classroom.

This trick has been a favorite of psychology graduate students for decades. For a time, one of your author's professors delivered all her lectures from the right side of the room while toying with the cords on the window shades. (The students added the cords the second week!) The point to remember from this example is that

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