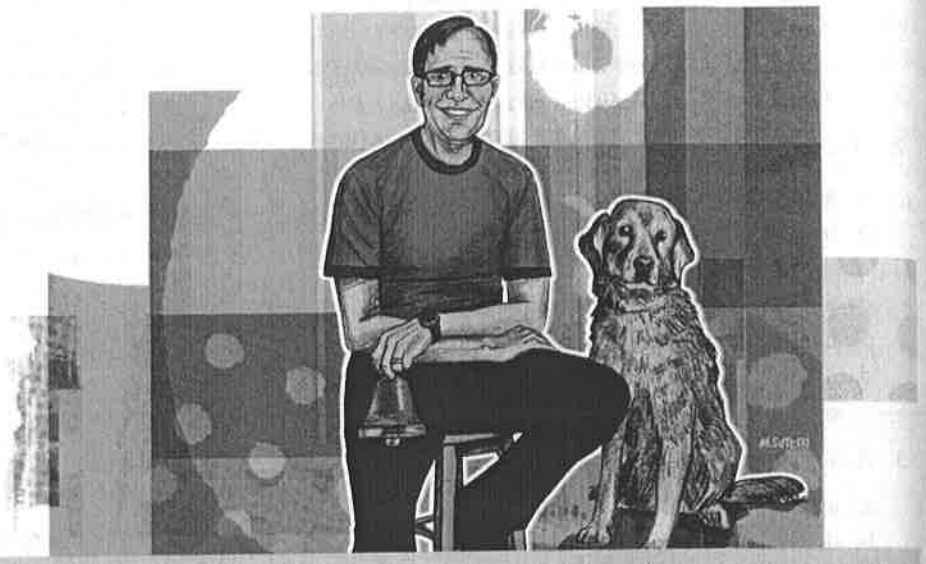
Module 16

Learning Goals

- **16-1** Define classical conditioning.
- **16-2** Identify and describe the four main components of classical conditioning.
- **16-3** Explain how acquisition and extinction occur in classical conditioning.
- **16-4** Describe how Ivan Pavlov discovered classical conditioning.
- **16-5** Define generalization and discrimination.
- **16-6** Define behaviorism, and describe John Watson and Rosalie Rayner's experiment to classically condition fear in Little Albert.
- **16-7** Explain the roles of cognition and biological predispositions in classical conditioning.

Classical Conditioning



Does the name Pavlov ring a bell with you? This module, which includes the story of Ivan Pavlov and his salivating dogs, will teach you the meaning of that old and not-so-very-funny punch line.

If you ask a dozen friends what the word *learning* means, most of them will probably respond by talking about cognitive (mental) processes. One might say, "Learning is when you understand something." Another might reply, "Learning is comprehension of a topic." A third might argue, "You've learned something when it's been memorized." Surprisingly, many of the psychologists who pioneered the study of learning steered in another direction. To them, it was difficult to scientifically study these between-the-ears phenomena. Since learning is usually reflected in what a person does, these psychologists defined it as a relatively permanent change in behavior caused by experience. This emphasis on behavior is no longer as strong as it once was because psychologists have developed ways to scientifically study cognition, and this has led to a new definition: the process of gaining, through experience, relatively permanent information and behaviors. The next three modules explore three different ways that learning can occur: classical conditioning, operant conditioning, and observational learning.

Experiencing Classical Conditioning

16-1 What is classical conditioning?

My freshman dorm in college was a cheaply built affair, and the college had cut costs on plumbing for the large, shared bathrooms on each floor. The cold water pipes were too small to supply enough water to both the showers and the toilets, which created a real problem if you were showering when someone flushed a toilet. The toilet would siphon off most of the cold water, and the shower temperature would momentarily turn hot enough to scald.

This reality led to a rule: When someone was about to flush a toilet while a dorm mate was in the shower, he was to yell, "Flush!" to warn the showerer. This was a good solution, once you learned to respond appropriately, but I had not made the

connection the morning of my first shower. I heard the word "Flush!" as I languished half asleep in the water, but I did not associate it with myself and my shower. When I was struck by the painfully hot water I jumped out of the way, but my jump was a reflexive, automatic response to the hot water. I still had not made the connection.

Much learning depends on these connections or associations that are formed when two events are linked. This is why we often associate habitual behaviors, like always following the same route between classes or always turning off the TV as dinner is about to be served, with particular contexts or environments.[1] So, was I able to make the connection in my dorm? You bet I was.

After I experienced a hot water dousing a few more times, **learning** occurred. When a dorm mate yelled, "Flush!" I instantly jumped to the side, with time to spare before the water temperature spiked. I did not realize it at the time, but I had experienced **classical conditioning,** a type of learning by association where a stimulus gains the power to cause a response. I had come to associate a new **stimulus** (the word *flush*) with another stimulus (hot water). "Flush!" was now a reliable predictor that scalding water was coming, and I began to respond to the word in the same way I had responded to the hot water itself. After repeated pairings, the two stimuli were associated in my mind, and each now produced the same **response**—an immediate jump to the side. This change in behavior was proof that learning had occurred.

Classical conditioning is learning (as evidenced by my changed behavior) in which a stimulus (Flush!) gains the power to cause a response (jumping away) because it predicts another stimulus (scalding water) that already produces the response (jumping away). Whew, that's a mouthful—but at its center it's really not too complicated (see **Figure 16.1**). One stimulus begins to produce the same response as another stimulus because the learner has developed an association between the two.

Classical conditioning can help us understand a variety of behavioral and emotional responses.

learning The process of gaining, through experience, relatively permanent information and behaviors.

classical conditioning A type of learning in which a stimulus gains the power to cause a response.

stimulus Anything in the environment that one can respond to.

response Any behavior or action.

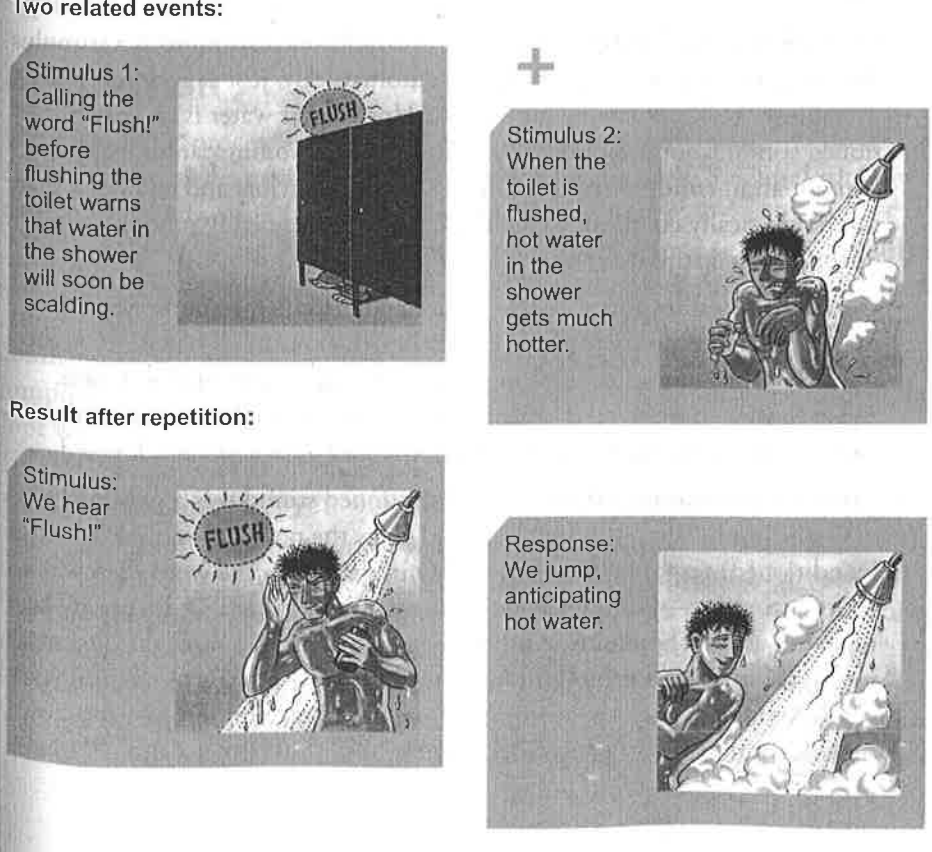


FIGURE 16.1
An Example of Classical Conditioning
Classical conditioning is a type of learning in which a stimulus gains the power to cause a response. In this example, classical conditioning led me to respond to the word *flush* in the same way I responded to painfully hot water.

MAKE IT STICK!

1. Learning is the process of gaining, through experience, relatively permanent _____ and _____.
2. Which of the following is an example of classical conditioning?
   a. A cat learns to take the same path through the garden each day because it has found mice there before.
   b. A parrot learns to say, Hello after hearing its owner repeat the word hundreds of times.
   c. A dog learns to flinch when it sees lightning because lightning is usually followed by loud thunder.
   d. A child practices her multiplication tables until she can do them perfectly.
3. True or false? If a person jumps every time he hears the word "Flush!" the word is a response.

Components of Classical Conditioning

16-2 How are the four main components of classical conditioning defined?

Classical conditioning is a straightforward, logical process. It is easier to understand after you have mastered a few key terms. Because we will use these terms over and over throughout our discussion of learning, it is a good idea to read through this section on the components of classical conditioning and the next section on the processes of classical conditioning a couple times. Pause at the end of each bulleted paragraph, reflect for a moment on the meaning of each term that has been introduced, and quiz yourself to make sure you've mastered the terms.

unconditioned stimulus (US)
A stimulus that triggers a response reflexively and automatically.

unconditioned response (UR)
An automatic response to the unconditioned stimulus.

conditioned stimulus (CS)
A previously neutral stimulus that, through learning, gains the power to cause a response.

- **Unconditioned stimulus (US)**—The unconditioned stimulus is a stimulus that triggers a response reflexively and automatically, just as scalding water in a shower makes someone jump away. Hot shower water is an unconditioned stimulus for jumping away. Classical conditioning cannot happen without an unconditioned stimulus. The only behaviors and emotions that can be classically conditioned are those that can be reliably produced by a unconditioned stimulus.
- **Unconditioned response (UR)**—The unconditioned response is the automatic response to the unconditioned stimulus. If hot water is the unconditioned stimulus, jumping away is the unconditioned response. Again, notice that the relationship between the unconditioned stimulus and the unconditioned response is *reflexive and automatic,* not learned.
- **Conditioned stimulus (CS)**—The conditioned stimulus is a previously neutral stimulus that, through learning, gains the power to cause a (conditioned) response. On my first day in the dorm, the word *flush* was a neutral stimulus—I did not associate it with showers, and it did not make me jump away. Thousands of other sights and sounds around the dormitory were equally neutral stimuli for jumping away. The process of classical conditioning changed the word *flush* from a neutral stimulus to a conditioned stimulus. (This constitutes learning!) All those other neutral stimuli

remained neutral. In basic classical conditioning, the neutral stimulus and the conditioned stimulus are always the same thing. The term *neutral stimulus* describes the stimulus *before* conditioning, and the term conditioned stimulus describes the stimulus *after* conditioning.

- **Conditioned response (CR)**—The conditioned response is the response to the conditioned stimulus. In basic classical conditioning, it is the same behavior that is identified as the unconditioned response. If I jump because of hot water (an unconditioned stimulus), my jumping is an unconditioned response. However, if I have learned to jump when someone yells, "Flush!" (a conditioned stimulus), my jumping is now a conditioned response.

conditioned response (CR) The response to the conditioned stimulus.

MAKE IT STICK!

1. James blinks when air is puffed through a straw toward his eye. In this case, the air puff is a(n) _____ and the blink is a(n) _____.
2. Jamie blinks when she hears a tuning fork. In this case, the sound of the tuning fork is a(n) _____ and the blink is a(n) _____.

Classical Conditioning Processes

16-3 What are the two basic processes in classical conditioning?

Now that you understand the four main components of classical conditioning, you need to know a little more about two basic processes in this type of learning: acquisition and extinction.

Remember:
- **Unconditioned** means automatic and reflexive
- **Conditioned** means learned
- A **stimulus** is something presented to the learner
- A **response** is something the learner does

Acquisition

The most basic process in classical conditioning is **acquisition,** the process of developing a new, learned response. Acquisition occurs when a neutral stimulus is repeatedly paired with a US. Each pairing is called a *trial.*

acquisition The process of developing a learned response.

In my dorm, I *acquired* the new conditioned response when a neutral stimulus—the word *flush*—was repeatedly paired with the unconditioned stimulus of hot water. Notice that we do not yet refer to the word *flush* as a conditioned stimulus because we have yet to demonstrate that the response, jumping away, was caused by anything other than the unconditioned stimulus (hot water).

To see if a conditioned response has actually been acquired, you could conduct a test trial. In this case, you would shout the word *flush* to a person (me!) in the shower without presenting scalding water (meaning you wouldn't flush the toilet). Then you would observe whether anything happened. If there is no response (no jumping away), it means the word is not yet a conditioned stimulus. However, if the person in the shower does jump away, this means "Flush!" has become a conditioned stimulus. The person jumps away because he heard the word, so the act of jumping away is a conditioned response (not an unconditioned response). "Flush!" has become a conditioned stimulus, and the jumping away has

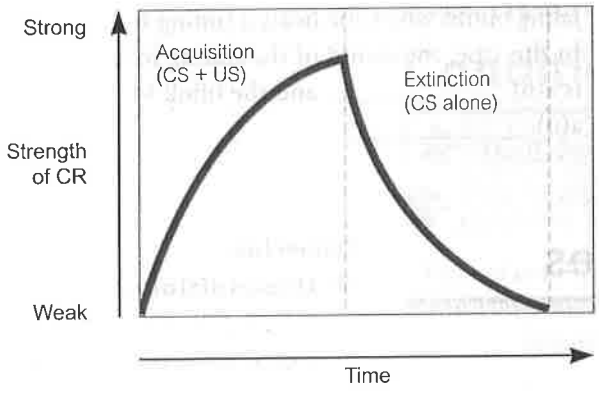
extinction In classical conditioning, the diminishing of a learned response after repeated presentation of the conditioned stimulus alone.

become a conditioned response. You have shown that the acquisition process in classical conditioning has occurred. Once acquired, the conditioned response will be maintained only if the conditioned stimulus continues to be paired with the US on some trials.

Extinction

In classical conditioning, **extinction** is the gradual disappearance of a learned response. Extinction occurs as the conditioned stimulus loses its power to trigger a conditioned response. Recall that when we want someone to acquire a conditioned response, we repeatedly pair a neutral stimulus with the unconditioned stimulus. But if we want to reverse this learning, we must weaken the association between the two stimuli. We do this by repeatedly presenting the conditioned stimulus alone.

FIGURE 16.2
Two Basic Classical Conditioning Processes
Acquisition occurs as the CS and the US are repeatedly paired. Extinction happens if the CS alone is presented over time.

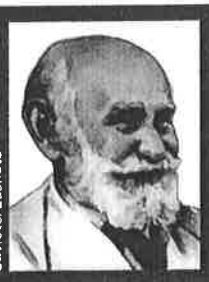


In the shower example, if prank-minded friends had repeatedly shouted, "Flush!" but the word was never followed by a hot-water dousing, the conditioned response to the word would eventually have weakened and died. This is because each prank "Flush!" alarm would weaken the association between *flush* and hot water. When a conditioned response has completely disappeared, we can say that it has been *extinguished*.

Figure 16.2 illustrates the processes of acquisition and extinction.

MAKE IT STICK!

1. How could you use a mild electric shock to classically condition a rat to flex its forepaw when a tone is sounded?
2. Extinction may occur when you present the _____ by itself repeatedly.
   a. unconditioned response
   b. unconditioned stimulus
   c. conditioned response
   d. conditioned stimulus
3. True or false? If a stimulus does not yet produce a conditioned response, it is called a neutral stimulus.


Sovfoto/Eastfoto

IVAN PAVLOV (1849–1936)
Russian physiologist and learning theorist famous for the discovery of classical conditioning, in which learning occurs through association.

Ivan Pavlov's Discovery

16-4 How did Ivan Pavlov discover classical conditioning?

One of the most famous names in the history of psychology is **Ivan Pavlov.** Pavlov, a Russian physiologist, earned a Nobel Prize for his studies of digestion in 1904. As happens to many good scientists, however, some unexpected findings sparked his curiosity and led him in new directions. He landed squarely in the realm of behavioral psychology.

At the time, Pavlov was investigating the effects of salivation (drool) on the digestive process. In a surgical procedure of his own design, he inserted a small

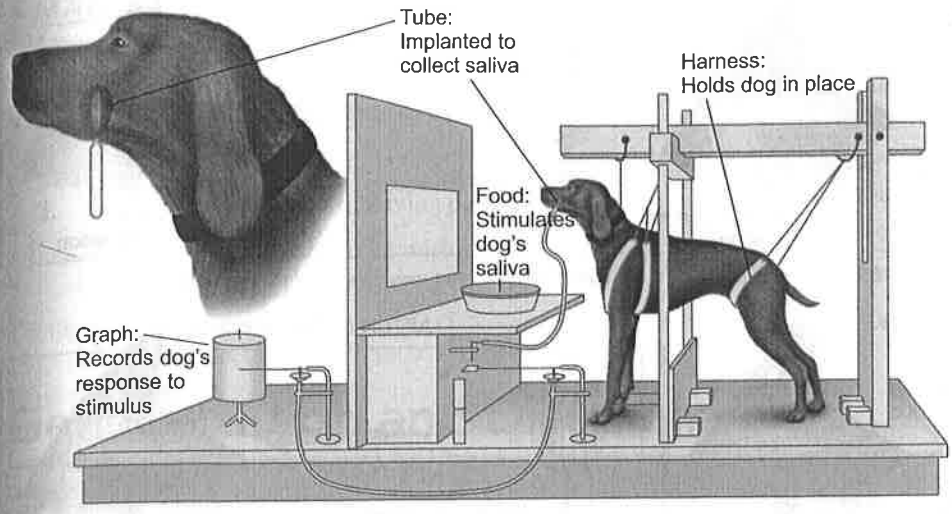


FIGURE 16.3
Pavlov's Method of Collecting Saliva
Pavlov performed surgery to divert the saliva to a collection tube. (Adapted from Goodwin, 1991.)

tube to divert and collect salivary secretions from dogs (see **Figure 16.3**). To stimulate the production of saliva, he then introduced meat into the dogs' mouths.

When Pavlov first began working with a dog, the procedure was just fine. Pavlov would restrain the animal in a harness and stimulate the production of saliva with the meat, but after Pavlov had worked with a dog for a while, problems began to crop up. The more familiar the dog became with the procedure, the less likely it was to wait for the food before salivating. Some dogs began to drool as they were being harnessed. Some even salivated when they heard the experimenter come toward the kennel around the same time each day. If you have a family dog, you may have noticed this learning by association yourself. As your dog's regular dinnertime draws near, does it begin to salivate in anticipation as you start to prepare the food? If so, you may find this behavior funny or interesting, but the premature drooling was disruptive for Pavlov.

Intrigued with his dogs' "misbehavior," Pavlov began to wonder if he could control the salivation response by manipulating other stimuli in the environment. Would it be possible to choose a stimulus, such as the sound of a tuning fork, and intentionally create a salivation response to that stimulus? As Pavlov began to investigate these new questions about the dogs' behavior, he identified the central features of classical conditioning.

Let's use Pavlov's basic demonstration of classical conditioning to review the concepts we have already discussed. His task was to teach a dog to salivate to the sound of a tuning fork. Think about the *components* of this experiment, and try to identify the neutral stimulus, unconditioned stimulus, unconditioned response, conditioned stimulus, and conditioned response. Then check your ideas by reading the summaries that follow and looking closely at **Figure 16.4**.

- The *unconditioned stimulus* (US) is the meat, because it automatically produces a salivation response without prior learning.

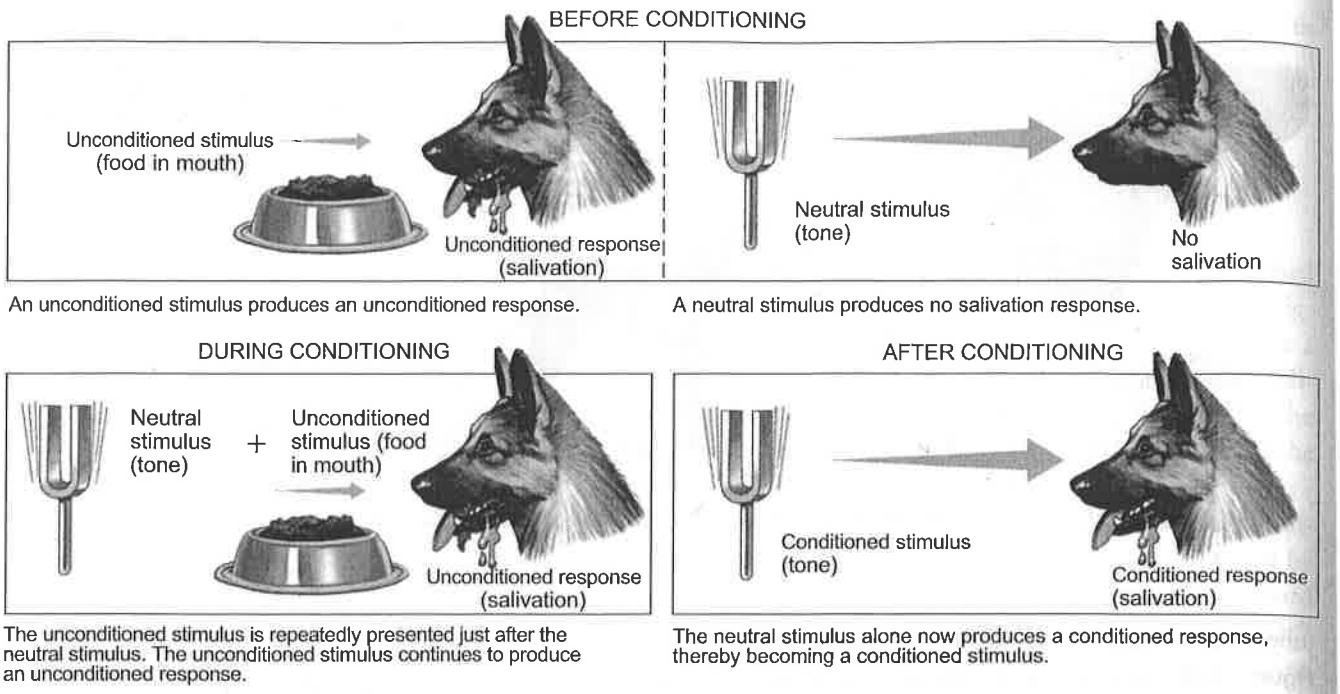
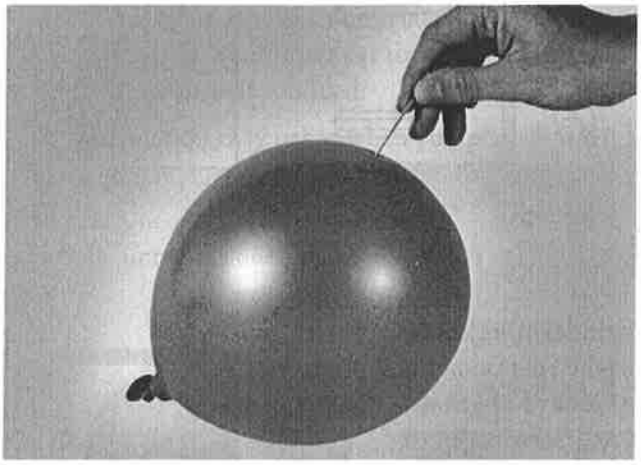


FIGURE 16.4
Pavlov's Experiment
Pavlov demonstrated the processes of classical conditioning by using meat to train a dog to salivate to the sound of a tuning fork.

- The *unconditioned response* (UR) is salivation, because salivation is the response to the unconditioned stimulus of meat. No learning has taken place yet. The ability of meat to make a hungry dog drool is reflexive, not learned.
- The neutral stimulus is the sound of the tuning fork before the dog has been conditioned. This stimulus is neutral because it does not produce a salivation response. Pavlov, of course, could have used many other stimuli—bells, whistles, or even lights or touches—as the neutral stimulus. None of these stimuli ordinarily produce salivation.



Science Source

- The *conditioned stimulus* (CS) is the sound of the tuning fork after the dog has been conditioned, because that tone now produces the response of salivation. Notice that the tone serves as both the neutral stimulus and the conditioned stimulus at different times in the conditioning process.
- The *conditioned response* (CR) is salivation, because salivation is now the response to the sound of the tuning fork. Notice that salivation can be either the unconditioned response or the conditioned response, depending on what stimulus led to the salivation.

Did You Flinch?
If so, you've been classically conditioned! Try to identify the unconditioned stimulus, unconditioned response, conditioned stimulus, and conditioned response for this example of conditioning. Check your answers by turning the page.

Now let's look at the processes in this classical conditioning experiment. To produce *acquisition,* Pavlov repeatedly sounded the tuning fork just before introducing meat into the dog's mouth. He knew acquisition had occurred because he tested for a learned response: He presented the sound of the tuning fork without the meat. If the dog salivated (and it did), the salivation was a conditioned response, proving that the sound of the tuning fork had become a CS.

To extinguish the classically conditioned response, Pavlov repeatedly sounded the tuning fork without the meat. The learned association between the sound of the tuning fork and the taste of meat gradually weakened under these circumstances, and as the link weakened, the dog produced less and less saliva. When the salivation response had disappeared, *extinction* had occurred.

MAKE IT STICK!

1. In what sense did Pavlov's dogs "misbehave"?
2. Pavlov used _____ for an unconditioned stimulus and a(n) _____ for a CS.
3. To produce acquisition, Pavlov paired the
   a. unconditioned stimulus with the unconditioned response.
   b. neutral stimulus with the unconditioned stimulus.
   c. unconditioned stimulus with the conditioned response.
   d. conditioned stimulus with the unconditioned response.

Generalization and Discrimination

16-5 What are generalization and discrimination?

generalization Producing the same response to two similar stimuli.

discrimination The ability to distinguish between two signals or stimuli and produce different responses.

Now that we've reviewed the components and processes of classical conditioning, we will look at two concepts that broaden our understanding of how we learn—generalization and discrimination.

Generalization occurs when an organism produces the same response to two similar stimuli. Assume for a moment that Pavlov somehow lost the tuning fork he had used with one of his dogs and was forced to substitute a different tuning fork, one with a slightly different tone. Let's also assume that Pavlov had progressed far enough so that the tone of the original tuning fork had become a conditioned stimulus that generated a strong conditioned response of salivation. What do you think would happen when Pavlov sounded the substitute tuning fork, producing a tone that had never been paired with meat? Pavlov discovered that the dog did respond by salivating and that the more similar the substitute tone was to the original tone, the stronger the salivation response was. **Figure 16.5** illustrates some generalization data Pavlov collected using touches to various body parts as stimuli.

Discrimination occurs when an organism produces different responses to two stimuli. Continuing with the example in the last paragraph, what would happen if Pavlov found his missing tuning fork and now had two (the original and the substitute)?

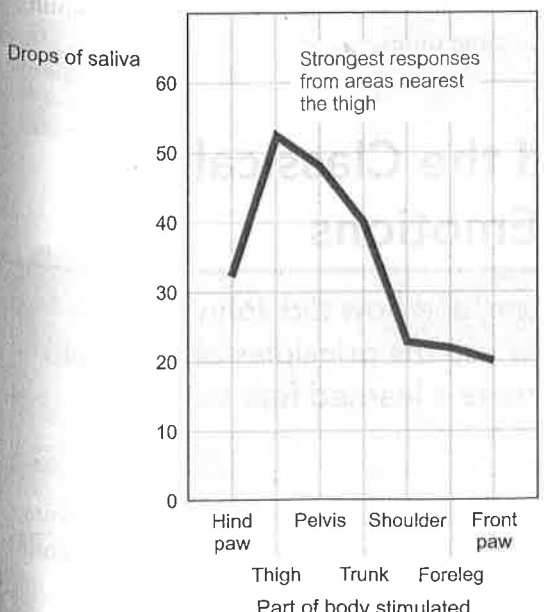


FIGURE 16.5
Generalization
Pavlov conditioned dogs to salivate when their thighs were stimulated by a slight vibration. This graph shows how much saliva was produced when other parts of the dogs' bodies were stimulated. The dogs salivated more when the stimulated spot was nearer to the point of original conditioning. If chemicals look too similar to food and drink packaging, a child may generalize and ingest dangerous products.

Kristoffer Tripplaar/Sipa USA via AP Images

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Generalizing and Discriminating
A little girl who fears all buzzing insects is generalizing. If she fears bees but not flies, she is discriminating.

Thanks to generalization, both would be capable of producing salivation. Finally, what would happen if he paired the original tuning fork with the US of meat on some trials, but never paired the substitute tuning fork with the US? Assuming the dog could actually hear the difference between the tones made by the two tuning forks, the conditioned salivation response to the sound of the original tuning fork would be maintained (because this tone tells the dog that food is on the way), but the response to the sound of the substitute tuning fork would be extinguished (because that tone never leads to meat). Now the dog is no longer generalizing (from one tone to a similar tone). Instead, the dog is discriminating (between the two tones).

Generalization and discrimination appear often in the world around us. For example, I know of a little girl named Antonia who developed a classically conditioned fear of buzzing insects after a painful bee sting on the ear. The sting paired pain—an unconditioned stimulus that naturally produces fear—with the buzzing bee. Through this learned association, the buzzing bee became a conditioned stimulus for the conditioned response of fear. This fear then generalized to all buzzing insects, and for a while, Antonia feared everything that buzzed. With additional real-life experience, however, Antonia soon began to make appropriate discriminations. Her conditioned response of fear stayed strong for buzzing things that give painful stings (like bees and hornets), but it was extinguished for buzzing things that don't give these stings (like disgusting flies or annoying gnats).

Antonia's example involves classical conditioning, but generalization and discrimination can occur for other types of learning as well. I was fascinated when my son Eric was learning animals and their names as a 1-year-old. He used the word *bow-wow* to describe all dogs (a generalization), but he could also discriminate between dogs and other animals, like *meow-meows* and *moo-moos*.

MAKE IT STICK!

1. Which of the following is an example of generalization?
   a. A dog both salivates and wags its tail when provided with meat.
   b. A dog barks when a researcher enters the laboratory.
   c. A dog responds to a stroke on its left side the same way it responds to a stroke on its right side.
   d. A dog learns to stop salivating to the sound of a tuning fork.
2. Provide an example of discrimination.
3. True or false? It is possible for a person to both generalize and discriminate between two stimuli at the same time.

● Answers to the Did You Flinch? questions on page 244: The unconditioned stimulus is the explosion of the popped balloon. The unconditioned response is the flinch produced by the pop. The conditioned stimulus is the sight of the pin approaching the balloon. The conditioned response is the flinch produced by the sight of the pin approaching the balloon.

John Watson and the Classical Conditioning of Emotions

16-6 What is behaviorism, and how did John Watson and Rosalie Rayner use the principles of classical conditioning to create a learned fear in Little Albert?

The beauty of classical conditioning is not that it explains all, or even most, things but rather that it explains some things really well. Psychologists like Pavlov could predict and control classically conditioned responses with great accuracy.

Therefore, classical conditioning was a core topic of introductory psychology textbooks early in the twentieth century. This type of learning relied on **behaviorism,** the view that psychology must restrict its efforts to studying observable behaviors, not mental processes. This school of psychology was led by U.S. psychologist **John B. Watson,** who believed you could control a learner's behavioral response by manipulating a stimulus in the environment. There was no need to consider what happened inside the learner's head. Indeed, we know that a dog has learned to sit if he does it when asked, that a musician has learned a new piece when she can play it, that a gymnast has learned a new routine when he can perform it, that a child has learned to walk when she can make it across the room on two legs, and that a student has learned psychology when he can do well on a test. In all these cases, learning is reflected in behavior.

behaviorism The theory that psychology should only study observable behaviors, not mental processes.

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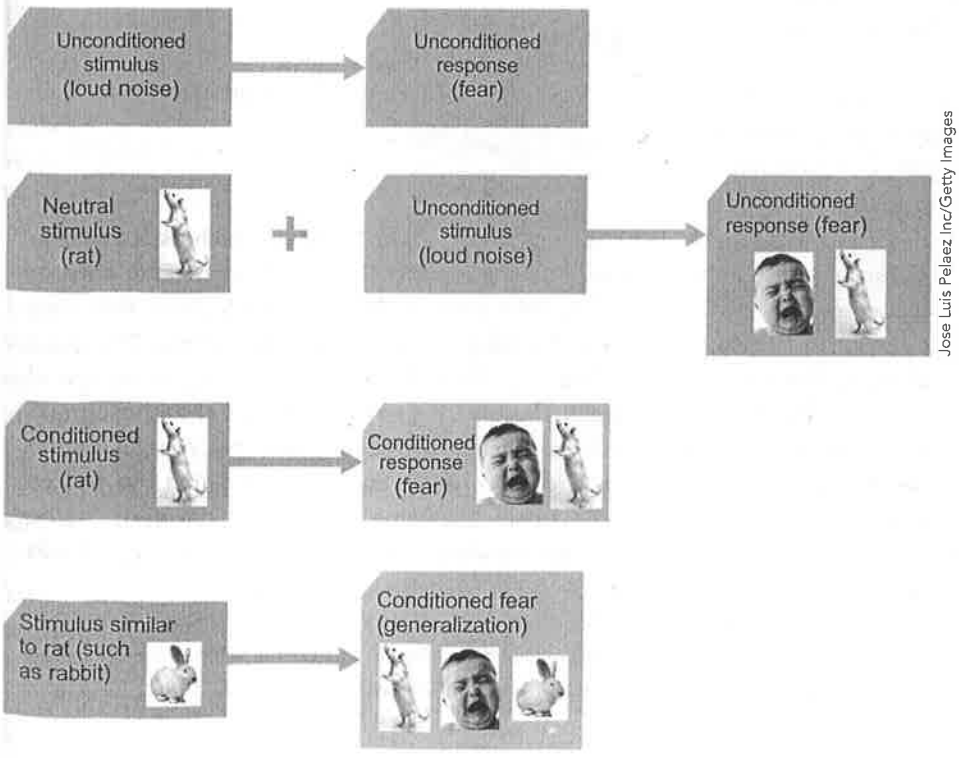
JOHN B. WATSON (1878–1958)
Founder of behaviorism, the theory that psychology should restrict its efforts to studying observable behaviors, not mental processes.

With his passionate belief that psychology should study only stimulus–response relationships, Watson was not pleased with the growing acceptance of Freud's psychodynamic viewpoint, which relied heavily on the unconscious mind as a means to explain human behavior. Freudian psychoanalysts, for example, viewed phobias (disruptive, irrational fears) as a symbolic result of unconscious fears left over from childhood.

Watson, working with Rosalie Rayner at Johns Hopkins University in 1920, set out to demonstrate that such phobias could be explained by the principles of classical conditioning. In one of the most famous and controversial demonstrations in the history of psychology in the United States, he intentionally established a fear of rats in an 11-month-old boy who became known as Little Albert. Initially, Albert was not afraid of the tame white laboratory rat. (In the world of classical conditioning, the rat was a neutral stimulus.) Albert did not respond to rats with crying or any facial expressions signifying fear. Watson and Rayner were able to change this quite easily by sneaking up behind Albert when he was in the presence of the rat and banging a steel bar to make a startling noise. The noise was an unconditioned stimulus that produced an unconditioned response of fear (crying). Because the unconditioned stimulus was paired with the rat, the rat became a CS to produce the same fear response (see **Figure 16.6**).



Jose Luis Pelaez Inc/Getty Images

FIGURE 16.6
Conditioning Little Albert
By pairing the neutral stimulus of a white rat with the unconditioned stimulus of a loud noise, John Watson and Rosalie Rayner were easily able to classically condition fear. They also demonstrated generalization when Little Albert became afraid of other white furry animals.

Watson and Rayner demonstrated that Little Albert's fear was a predictable outcome of an environmental condition and, in this case at least, did not represent a repressed, unconscious conflict.

They also demonstrated generalization (Albert also showed fear of a furry white rabbit) and discrimination (he did not show fear of dissimilar toys). Albert's mother apparently began to have some doubts about the research and withdrew the boy before Watson and Rayner were able to extinguish Albert's newly established phobia. Perhaps the mother's doubts about this demonstration match your own—how can it be considered appropriate or ethical to intentionally produce a fear in an innocent young child who could not give his consent? (For more on Little Albert, see Thinking Like a Psychological Scientist: What Ever Happened to Little Albert?)

THINKING LIKE A PSYCHOLOGICAL SCIENTIST

What Ever Happened to Little Albert?

Research by Hall Beck and Sharman Levinson in 2009 shed new light on one of the longstanding mysteries of American psychology[2]—what ever happened to Little Albert, the 11-month-old boy in Watson and Rayner's experiments? In establishing how widespread curiosity about Little Albert has been, Hall and Levinson even cite a previous edition of this book, where we speculated that Little Albert might still be alive, an old man with a lingering fear of rats. We are used to thinking of experimental research done in the here and now, but Beck and Levinson demonstrated that research techniques can also be used to deepen our understanding of the history of psychology.

Beck and Levinson approached the Little Albert mystery by gathering information from a wide variety of sources. They looked for clues about the identity of Little Albert in Watson and Rayner's published articles, expense reports, letters, and films they made of their research. They also scoured journals to learn what had been uncovered by others interested in the puzzle. In order to better understand a date discrepancy, they surveyed librarians to verify when the journal publishing the Little Albert study was actually received. They hoped to find evidence of Albert by examining the patient records of the hospital home at Johns Hopkins University, where they knew he lived, but the records had all been destroyed. Instead they sought out data from the 1920 national census and state birth certificates. They identified three babies who fit their criteria for possibly being Little Albert.

Behaviorism
John Watson and Rosalie Rayner set out to prove that all behavior was the result of environmental factors by classically conditioning a fear of rats and other small, furry animals in an 11-month-old boy known as Little Albert.

All this digging led these researchers to believe that Albert was really Douglas Merritte, the child of Arvilla Irons, born on March 9, 1919. From this, they used the Internet to locate Gary Irons, Douglas's half-brother. He was able to provide a photograph of young Douglas. Experts compared the photograph with stills of Little Albert made by Watson during the original research and concluded that the photos could be of the same child. They decided, "...the available evidence strongly supports the hypothesis that Douglas Merritte is Little Albert."

So, what happened to this "Albert"? Sadly, 6-year-old Douglas Merritte died in 1925 of a brain disorder called hydrocephalus. (His mother lived until 1988.) Beck and

THINKING LIKE A PSYCHOLOGICAL SCIENTIST (Continued)

Levinson found no evidence that he suffered any negative effects from Watson and Rayner's research.

But, there's more to the story! Russell Powell and Nancy Digdon did not believe that the evidence identifying Douglas Merritte was all that strong. Watson had described Little Albert as "healthy from birth," not a correct description of a hydrocephalic baby. Powell and Digdon think the evidence points to another of the three babies who fit the criteria, William Martin. William's middle name was Albert, and this was the name his family called him.[3] Hmm! This baby lived to be 87 and died in 2007, only a few years too soon to be "discovered"—if indeed he was the real baby Albert. As was the case with Douglas Merritte, there is no evidence that William Martin suffered ill effects from his participation (except, perhaps, that he had a lifelong fear of dogs).

We may never know the identity of Little Albert with certainty, but half the fun is in the search. Given the current ethical guidelines for human research (see module 2)—developed because of questionable studies like this one—we can only hope there will be no more Little Alberts in the future.

THINK ABOUT . . . Psychological Science

1. What are some of the techniques that have been used to try to identify Little Albert?
2. Why is the Watson and Rayner research now considered unethical?
3. Is it ever appropriate to put children in scary situations for research purposes?

What can we conclude from Watson and Rayner's research? The main point is that whenever you associate an emotional response with a particular stimulus, classical conditioning is probably involved. Advertisers learned this point quickly and have used it to their advantage for years. Nestea® commercials, for example, repeatedly pair images of cool, refreshing swimming pools and Nestea® instant iced tea. The images of the pools function as an unconditioned stimulus to produce in viewers a feeling of being cool and refreshed. After being repeatedly paired with these images, the product name becomes a conditioned stimulus. Alone, it, too, produces a conditioned response of being cool and refreshed. Thus, when I walk in the grocery store and see a dozen brands of instant iced tea mix, I am more likely to select Nestea because just looking at that label makes me feel cool and refreshed.

LIFE MATTERS

How do you think advertising has impacted your life? What have you purchased recently and how did it make you feel? Making yourself aware of the emotional associations you feel towards products can help you become a more critical and responsible consumer.

Advertisers spend millions of dollars to create classically conditioned emotional desire, often for products of questionable value. Marlboro ads establish a rugged, macho image. Mountain Dew® ads establish a youthful image. Victoria's Secret ads establish a sexy image. All are attempts to use the principles of classical conditioning to sell more products.

Michelle Pedone/Getty Images

Advertising and Classical Conditioning
Ads for particular beverages, like some iced teas, might use classical conditioning to try to link a specific feeling with a product. In this case, they want the cool and refreshing response we naturally associate with a day by the pool to be linked to a particular brand of iced tea. Can you think of other products that use advertising to connect an emotional response to a product?

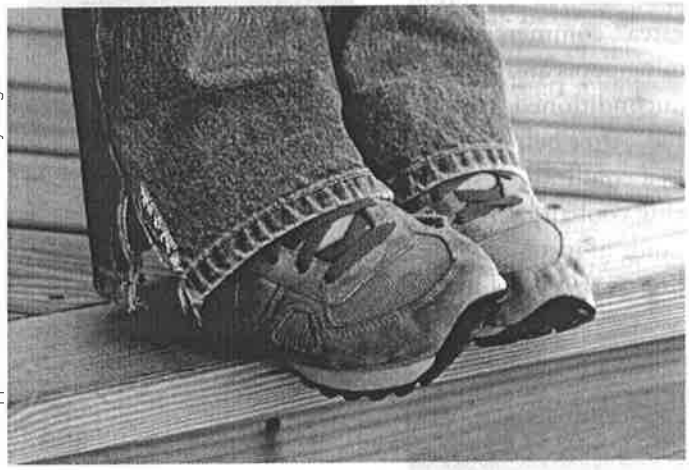
You don't need a big advertising budget to find other examples of classically conditioned emotions. Say you are seeing a new person and things

FREDERIC J. BROWN/AFP/Getty Images

Classically Conditioned Emotion
Apple spends advertising dollars to associate its products, like the iPhone, with a particular emotional response. If you have an iPhone, you must be cool!

are going delightfully well. The budding relationship is an unconditioned stimulus for positive emotions. During the evening, you hear a new song on the radio. What happens? The song becomes "your song." Whenever you hear it, you feel better because it produces the same positive emotions that the relationship itself does. The song has become a CS, and classical conditioning is at work. In my life, a similar thing happens with running shoes. For me, running functions as an unconditioned stimulus for relaxation and stress relief. The more miles I put on a new pair of shoes, the more comforting they become. Eventually, all I have to do is put on the shoes (now a CS) to start feeling better. Maybe this is one reason I generally prefer my old, broken-in clothes to brand new ones. The old jeans are associated with a wealth of pleasant memories that bring me comfort as reliably as the tone of Pavlov's tuning fork made a dog drool.

Negative emotions can be conditioned, too. Some women who have been raped destroy the clothes they were wearing at the time of the attack. The act of rape is an extraordinarily powerful unconditioned stimulus for negative feelings—powerful enough to produce conditioning with a single pairing. The clothes, because they were associated with the crime, become a conditioned stimulus that elicits the same feelings. Even buildings can take on emotional baggage. Watch the facial expressions of students walking into your high school in the morning. Those who find school to be a generally pleasant experience will brighten up as soon as they walk through the door. Because it's a place associated with good things happening, the building itself can produce positive feelings. Unfortunately, the school building will have the opposite effect on other students. Their associations are mostly negative, and the building will be a CS for negative emotions. Similarly, places of worship, favorite restaurants, hospitals, and sites of automobile accidents can all trigger emotions—some positive, some negative, but all classically conditioned.



Ron Chapple /Thinkstock/ PictureQuest/ Getty Images

Classically Conditioned Comfort
Because of the many pleasant events that may be associated with wearing them, old clothes and shoes often become conditioned stimuli that produce a relaxed, comforting response. New clothes may be stylish, but they don't have this ability to help us unwind.

MAKE IT STICK!

1. In Watson's research with Little Albert, which of the following functioned initially as an unconditioned stimulus for fear?
   a. Crying
   b. A white rat
   c. A loud noise
   d. Rosalie Rayner
2. Why did Watson want to use behaviorism to explain phobias?
3. True or false? Advertisers use classical conditioning to establish a logical reason for people to buy their products.

Cognition and Biological Predispositions

16-7 Why are the roles of cognition and biological predispositions important in learning?

Watson was influential in his day, but behaviorism no longer dominates psychology. A growing body of evidence indicates that all kinds of learning, including classical conditioning, can be understood only in light of **cognition**—mental processes like thinking and memory. To most of us, this is simply common sense. If you ask a group of friends to define *learning,* they will almost surely tell you that it is something that occurs in your head. *Learning is when you understand something* and *Learning occurs when you remember* are typical answers, and they both reflect the importance of cognition. Behaviorists like Watson were suspicious of using such explanations because they thought it was impossible to study cognitive processes in a truly scientific way. In contrast, contemporary psychologists believe it is impossible to understand classical conditioning without reference to cognitive processes.

cognition All mental processes associated with thinking, knowing, and remembering.

Cognition and Classical Conditioning

For several decades before the 1980s, original research in classical conditioning had largely come to a halt. From Pavlov on, a growing body of evidence seemed to support the idea that classical conditioning was purely behavioral and required only that a neutral stimulus be repeatedly paired with an unconditioned stimulus. This way of thinking became so well established that hardly anybody bothered to question it anymore. But **Robert Rescorla** and Allan Wagner began to think outside the box. They realized that certain aspects of classical conditioning situations simply could not be explained without reference to *cognition*—the dreaded mental processes the behaviorists were trying to avoid.

Rescorla and Wagner conducted clever experiments showing that a simple pairing of stimuli is not enough to ensure classical conditioning.[4] The key feature appears to be predictability. If a formerly neutral stimulus (Flush!) allows the learner to reliably predict that an unconditioned stimulus (hot water) is about to occur, the neutral stimulus will morph into a conditioned stimulus. If the unconditioned stimulus is not predictable, the neutral stimulus will stay neutral. If Pavlov's tuning fork tone had sometimes been followed by meat and sometimes not, it would not have become a conditioned stimulus, and the conditioned response of drooling would not have developed. The tone would not have *reliably predicted* the unconditioned stimulus (meat). Calculating whether an event is predictable is, of course, a cognitive process, a mental assessment that requires thinking.

courtesy of Robert Rescorla

ROBERT RESCORLA (1940–)
Developed, along with colleague Allan Wagner, a theory that emphasized the importance of cognitive processes in classical conditioning.

Macmillan Learning

JOHN GARCIA (1917–2012)
Raised in poverty, Garcia was unable to attend school regularly as a child. He was in his late twenties before starting junior college, and he didn't receive his Ph.D. until he was almost 50. Despite these obstacles, Garcia was elected to the National Academy of Sciences and received the American Psychological Association's Distinguished Scientific Contribution Award for his work in conditioning.

Taste Aversion and the Role of Biology

The biological perspective has influenced our understanding of another aspect of classical conditioning. In 1966, **John Garcia** and Robert Koelling showed how classically conditioned taste aversion—an avoidance of certain tastes—could develop.[5] While doing radiation research on rats, Garcia and Koelling noticed that the rats began to avoid drinking from the water bottles in the radiation

Grzegorz Gajewski/Alamy

Classically Conditioned Taste Aversion
Have you ever become sick after eating seafood? If so, you probably learned to avoid similar foods in the future. Why are taste aversions likely to develop?

chambers. Like Pavlov, these researchers became intrigued by this unexpected result of their research. In new trials, they discovered that it was possible to use a nausea-producing drug as an unconditioned stimulus to condition an aversion response to a particular taste. Paired with the drug that produced nausea, a particular food or drink became a conditioned stimulus that, without the nausea drug being present, also produced the feelings of nausea.

Originally, behaviorists thought the principles of classical conditioning would operate with any stimulus, for any species. This is not the case. Garcia's work on taste aversion shows that we are biologically predisposed to develop an aversion to the taste of the food we ate before becoming sick rather than, for example, to the place where we ate the food. I once became ill one evening after eating cheddar cheese soup, which had been one of my favorite foods. Sure enough, I now have no desire to smell or taste this soup. Note that of all the stimuli that were present the evening I became sick, *only* the smell and taste of the soup produced an aversion. I was with my wife that evening, but I did not develop an aversion to her—thank goodness!

This biological predisposition to develop taste aversions may protect us from revisiting foods that could be poisonous and may be part of our evolutionary heritage.

People who easily developed taste aversions were more likely to survive and have offspring. Those who snacked repeatedly on tainted food were less likely to live to reproduce. Other common fears—heights, thunderstorms, or snakes—may offer similar protection against threats that have existed since the beginning of human history.[6] Perhaps unfortunately, we are less likely to fear modern technological threats, like automobiles and unseen pollutants in the water supply. These significant threats to our well-being have not been around long enough to become part of the evolutionary baggage we will pass on to future generations.

Classical conditioning remains an important aspect of modern psychology. Research has moved us from a purely behavioral explanation of this type of learning to one that is more heavily influenced by cognitive and biological factors. Even so, classically conditioned behaviors and emotions are an important part of the world around us.

MAKE IT STICK!

1. Robert Rescorla believes cognition plays a key role in classical conditioning because
   a. emotions are always involved.
   b. a CS must have a predictive value.
   c. Watson's experiments proved that cognition was necessary.
   d. very primitive species cannot learn.
2. John Garcia's work with _____ in rats indicates that classical conditioning is influenced by biology.
3. We probably have biological predispositions to avoid certain foods because
   a. they enhance the predictive value of a stimulus.
   b. without them, our ancestors would have gained too much weight.
   c. without them, eating behavior would have been extinguished.
   d. without them, our ancestors would have been more likely to eat poisonous foods.