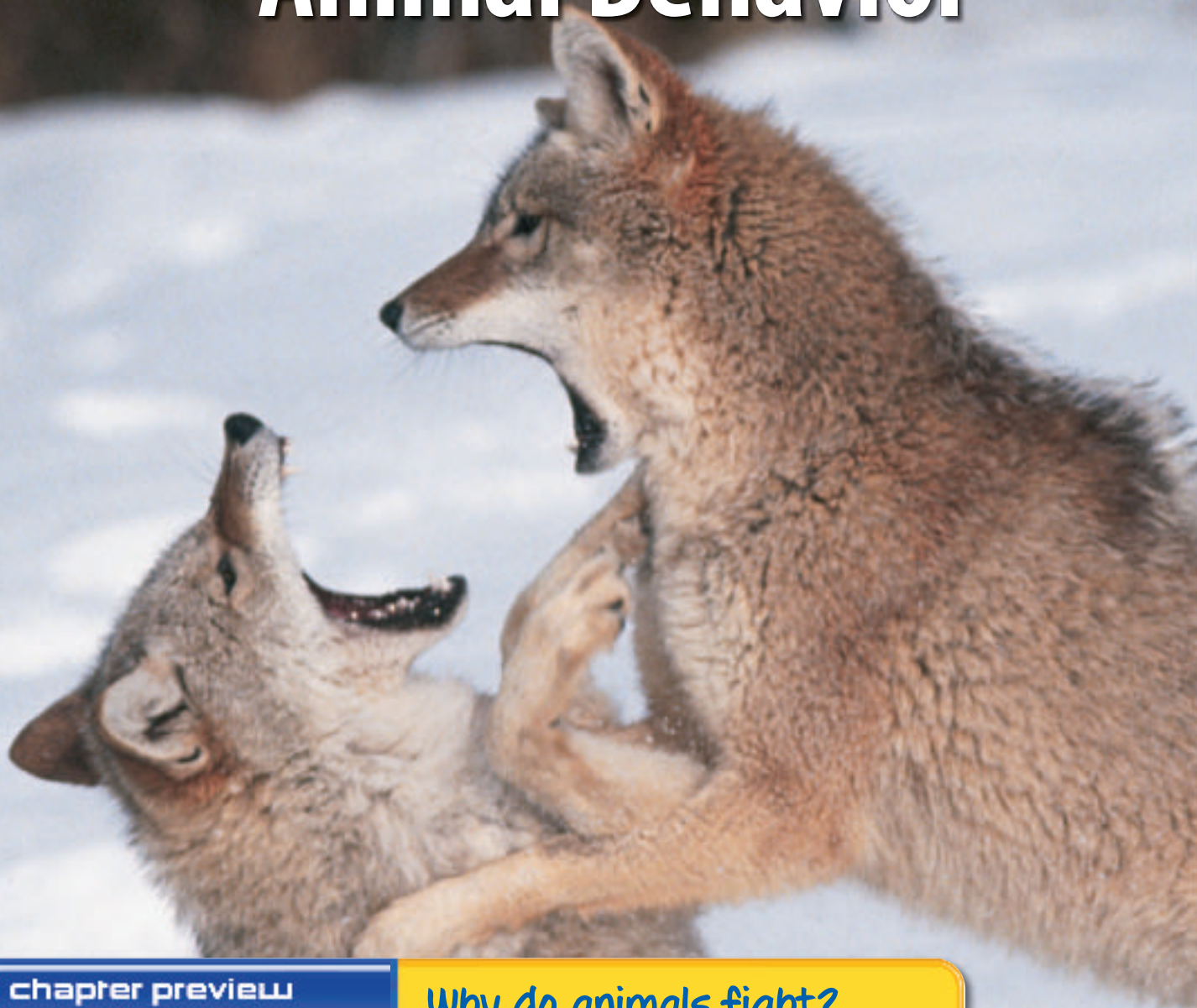


# Animal Behavior



## chapter preview

### sections

- 1 Types of Behavior
- 2 Behavioral Interactions
  - Lab** *Observing Earthworm Behavior*
  - Lab** *Animal Habitats*
  - Virtual Lab** *How do mealworms behave in response to various stimuli?*

## Why do animals fight?

Animals often defend territories from other members of the same species. Fighting is usually a last resort to protect a territory that contains food, shelter, and potential mates.

**Science Journal** What other behaviors might an animal use to signal that a territory is occupied?

# Start-Up Activities



## How do animals communicate?

One way humans communicate is by speaking. Other animals communicate without the use of sound. For example, a gull chick pecks at its parent's beak to get food. Try the lab below to see if you can communicate without speaking.

1. Form groups of students. One at a time, have each student choose an object and describe that object using gestures.
2. The other students observe and try to identify the object that is being described.
3. **Think Critically** In your Science Journal, describe how you and the other students were able to communicate without speaking to one another.



Preview this chapter's content and activities at [bookc.msscience.com](http://bookc.msscience.com)

## FOLDABLES™ Study Organizer

**Behavior** As you study behaviors, make the following Foldable to help you find the similarities and differences between the behaviors of two animals.

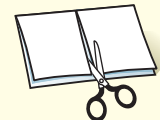
**STEP 1** **Fold** a vertical sheet of paper in half from top to bottom.



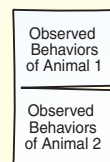
**STEP 2** **Fold** in half from side to side with the fold at the top.



**STEP 3** **Unfold** the paper once. **Cut** only the fold of the top flap to make two tabs.



**STEP 4** **Turn** the paper vertically and **label** the front tabs as shown.



**Read and Write** Before you read the chapter, choose two animals to compare. As you read the chapter, list the behaviors you learn about Animal 1 and Animal 2 under the appropriate tab.

# Types of Behavior

## as you read

### What You'll Learn

- **Identify** the differences between innate and learned behavior.
- **Explain** how reflexes and instincts help organisms survive.
- **Identify** examples of imprinting and conditioning.

### Why It's Important

Innate behavior helps you survive on your own.

### Review Vocabulary

**salivate:** to secrete saliva in anticipation of food

### New Vocabulary

- behavior
- innate behavior
- reflex
- instinct
- imprinting
- conditioning
- insight

## Behavior

When you come home from school, does your dog run to meet you? Your dog barks and wags its tail as you scratch behind its ears. Sitting at your feet, it watches every move you make. Why do dogs do these things? In nature, dogs are pack animals that generally follow a leader. They have been living with people for about 12,000 years. Domesticated dogs treat people as part of their own pack, as shown in **Figure 1**.

Animals are different from one another in their behavior. They are born with certain behaviors, and they learn others. **Behavior** is the way an organism interacts with other organisms and its environment. Anything in the environment that causes a reaction is called a stimulus. A stimulus can be external, such as a rival male entering another male's territory; or internal, such as hunger or thirst. You are the stimulus that causes your dog to bark and wag its tail. Your dog's reaction to you is a response.

**Figure 1** Dogs are pack animals by nature. A pack of wild dogs must work together to survive. This domesticated dog (right) has accepted a human as its leader.





Cliff swallows build nests out of mud.

Hummingbirds build delicate cup-shaped nests on branches of trees.



**Figure 2** Bird nests come in different sizes and shapes. This male weaverbird is knotting the ends of leaves together to secure the nest.

## Innate Behavior

A behavior that an organism is born with is called an **innate behavior**. These types of behaviors are inherited. They don't have to be learned.

Innate behavior patterns occur the first time an animal responds to a particular internal or external stimulus. For birds like the swallows and the hummingbird in **Figure 2** building a nest is innate behavior. When it's time for the female weaverbird to lay eggs, the male weaverbird builds an elaborate nest, also shown in **Figure 2**. Although a young male's first attempt may be messy, the nest is constructed correctly.

The behavior of animals that have short life spans is mostly innate behavior. Most insects do not learn from their parents. In many cases, the parents have died or moved on by the time the young hatch. Yet every insect reacts innately to its environment. A moth will fly toward a light, and a cockroach will run away from it. They don't learn this behavior. Innate behavior allows animals to respond instantly. This quick response often means the difference between life and death.

**Reflexes** The simplest innate behaviors are reflex actions. A **reflex** is an automatic response that does not involve a message from the brain. Sneezing, shivering, yawning, jerking your hand away from a hot surface, and blinking your eyes when something is thrown toward you are all reflex actions.

In humans a reflex message passes almost instantly from a sense organ along the nerve to the spinal cord and back to the muscles. The message does not go to the brain. You are aware of the reaction only after it has happened. Your body reacts on its own. A reflex is not the result of conscious thinking.



**Reflex** A tap on a tendon in your knee causes your leg to straighten. This is known as the knee-jerk reflex. Abnormalities in this reflex tell doctors of a possible problem in the central nervous system. Research other types of reflexes and write a report about them in your Science Journal.



**Figure 3** Spiders, like this orb weaver spider, know how to spin webs as soon as they hatch.

**Instincts** An **instinct** is a complex pattern of innate behavior. Spinning a web like the one in **Figure 3** is complicated, yet spiders spin webs correctly on the first try. Unlike reflexes, instinctive behaviors can take weeks to complete. Instinctive behavior begins when the animal recognizes a stimulus and continues until all parts of the behavior have been performed.

 **Reading Check**

*What is the difference between a reflex and an instinct?*

## Learned Behavior

All animals have innate and learned behaviors. Learned behavior develops during an animal's lifetime. Animals with more complex brains exhibit more behaviors that are the result of learning. However, the behavior of insects, spiders, and other arthropods is mostly instinctive behavior. Fish, reptiles, amphibians, birds, and mammals all learn. Learning is the result of experience or practice.

Learning is important for animals because it allows them to respond to changing situations. In changing environments, animals that have the ability to learn a new behavior are more likely to survive. This is especially important for animals with long life spans. The longer an animal lives, the more likely it is that the environment in which it lives will change.

Learning also can modify instincts. For example, grouse and quail chicks, shown in **Figure 4**, leave their nests the day they hatch. They can run and find food, but they can't fly. When something moves above them, they instantly crouch and keep perfectly still until the danger has passed. They will crouch without moving even if the falling object is only a leaf. Older birds have learned that leaves will not harm them, but they freeze when a hawk moves overhead.

**Figure 4** As they grow older, these quail chicks will learn which organisms to avoid.

**Describe** *why it is important for young quail to react the same toward all organisms.*





**Figure 5** When feeding chicks in captivity, puppets of adult condors are used so the chicks don't learn to associate humans with food.

**Imprinting** Learned behavior includes imprinting, trial and error, conditioning, and insight. Have you ever seen young ducks following their mother? This is an important behavior because the adult bird has had more experience in finding food, escaping predators, and getting along in the world. **Imprinting** occurs when an animal forms a social attachment, like the condor in **Figure 5**, to another organism within a specific time period after birth or hatching.

Konrad Lorenz, an Austrian naturalist, developed the concept of imprinting. Working with geese, he discovered that a gosling follows the first moving object it sees after hatching. The moving object, whatever it is, is imprinted as its parent. This behavior works well when the first moving object a gosling sees is an adult female goose. But goslings hatched in an incubator might see a human first and become imprinted on that human. Animals that become imprinted toward animals of another species have difficulty recognizing members of their own species.

**Trial and Error** Can you remember when you learned to ride a bicycle? You probably fell many times before you learned how to balance on the bicycle. After a while you could ride without having to think about it. You have many skills that you learned through trial and error, such as feeding yourself and tying your shoes, as shown in **Figure 6**.

Behavior that is modified by experience is called trial-and-error learning. Many animals learn by trial and error. When baby chicks first try to feed themselves, they peck at many stones before they get any food. As a result of trial and error, they learn to peck only at food particles.



**Figure 6** Were you able to tie your shoes on the first attempt? **List** other things you do every day that require learning.

Scienceonline

**Topic: Captive Breeding**

Visit [bookc.msscience.com](http://bookc.msscience.com) for Web links to information about captive breeding.

**Activity** Identify and describe techniques used to raise captive species and introduce them into the wild.

## Observing Conditioning

### Procedure

1. Obtain several photos of different foods and landscapes from your teacher.
2. Show each picture to a classmate for 20 s.
3. Record how each photo made your partner feel.

### Analysis

1. How did your partner feel after looking at the photos of food?
2. What effect did the landscape pictures have on your partner?
3. Infer how advertising might condition consumers to buy specific food products.

**Figure 7** In Pavlov's experiment, a dog was conditioned to salivate when a bell was rung. It associated the bell with food.

**Conditioning** Do you have an aquarium in your school or home? If you put your hand above the tank, the fish probably will swim to the top of the tank, expecting to be fed. They have learned that a hand shape above them means food. What would happen if you tapped on the glass right before you fed them? Soon the fish probably will swim to the top of the tank if you just tap on the glass. Because they are used to being fed after you tap on the glass, they associate the tap with food.

Animals often learn new behaviors by conditioning. In **conditioning**, behavior is modified so that a response to one stimulus becomes associated with a different stimulus. There are two types of conditioning. One type introduces a new stimulus before the usual stimulus. Russian scientist Ivan P. Pavlov performed experiments using this type of conditioning. He knew that the sight and smell of food made hungry dogs secrete saliva. Pavlov added another stimulus. He rang a bell before he fed the dogs. The dogs began to connect the sound of the bell with food. Then Pavlov rang the bell without giving the dogs food. They salivated when the bell was rung even though he did not give them food. The dogs, like the one in **Figure 7**, were conditioned to respond to the bell.

In the second type of conditioning, the new stimulus is given after the affected behavior. Getting an allowance for doing chores is an example of this type of conditioning. You do your chores because you want to receive your allowance. You have been conditioned to perform an activity that you may not have done if you had not been offered a reward.

**Reading Check** How does conditioning modify behavior?





**Insight** How does learned behavior help an animal deal with a new situation? Suppose you have a new math problem to solve. Do you begin by acting as though you've never seen it before, or do you use what you have learned previously in math to solve the problem? If you use what you have learned, then you have used a kind of learned behavior called insight. **Insight** is a form of reasoning that allows animals to use past experiences to solve new problems. In experiments with chimpanzees, as shown in **Figure 8**, bananas were placed out of the chimpanzees' reach. Instead of giving up, they piled up boxes found in the room, climbed them, and reached the bananas. At some time in their lives, the chimpanzees must have solved a similar problem. The chimpanzees demonstrated insight during the experiment. Much of adult human learning is based on insight. When you were a baby, you learned by trial and error. As you grow older, you will rely more on insight.

**Figure 8** This illustration shows how chimpanzees may use insight to solve problems.

## section 1 review

### Summary

#### Behavior

- Animals are born with certain behaviors, while other behaviors are learned.
- A stimulus is anything in the environment that causes a reaction.

#### Innate and Learned Behaviors

- Innate behaviors are those behaviors an organism inherits, such as reflexes and instincts.
- Learned behavior allows animals to respond to changing situations.
- Imprinting, trial and error, conditioning, and insight are examples of learned behavior.

### Self Check

1. **Compare and contrast** a reflex and an instinct.
2. **Compare and contrast** imprinting and conditioning.
3. **Think Critically** Use what you know about conditioning to explain how the term *mouthwatering food* might have come about.

### Applying Skills

4. **Use a Spreadsheet** Make a spreadsheet of the behaviors in this section. Sort the behaviors according to whether they are innate or learned behaviors. Then identify the type of innate or learned behavior.



# Behavioral Interactions

## as you read

### What You'll Learn

- **Explain** why behavioral adaptations are important.
- **Describe** how courtship behavior increases reproductive success.
- **Explain** the importance of social behavior and cyclic behavior.

### Why It's Important

Organisms must be able to communicate with each other to survive.

### Review Vocabulary

**nectar:** a sweet liquid produced in a plant's flower that is the main raw material of honey

### New Vocabulary

- social behavior
- society
- aggression
- courtship behavior
- pheromone
- cyclic behavior
- hibernation
- migration

## Instinctive Behavior Patterns

Complex interactions of innate behaviors between organisms result in many types of animal behavior. For example, courtship and mating within most animal groups are instinctive ritual behaviors that help animals recognize possible mates. Animals also protect themselves and their food sources by defending their territories. Instinctive behavior, just like natural hair color, is inherited.

## Social Behavior

Animals often live in groups. One reason, shown in **Figure 9**, is that large numbers provide safety. A lion is less likely to attack a herd of zebras than a lone zebra. Sometimes animals in large groups help keep each other warm. Also, migrating animal groups are less likely to get lost than animals that travel alone.

Interactions among organisms of the same species are examples of **social behavior**. Social behaviors include courtship and mating, caring for the young, claiming territories, protecting each other, and getting food. These inherited behaviors provide advantages that promote survival of the species.

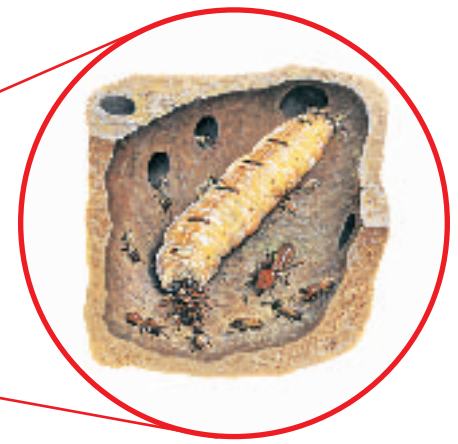


### Reading Check

*Why is social behavior important?*

**Figure 9** When several zebras are close together, their stripes make it difficult for predators to pick out one individual.





**Figure 10** Termites built this large mound in Australia. The mound has a network of tunnels and chambers for the queen termite to deposit eggs into.

**Societies** Insects such as ants, bees, and the termites shown in **Figure 10**, live together in societies. A **society** is a group of animals of the same species living and working together in an organized way. Each member has a certain role. Usually a specific female lays eggs, and a male fertilizes them. Workers do all the other jobs in the society.

Some societies are organized by dominance. Wolves usually live together in packs. A wolf pack has a dominant female. The top female controls the mating of the other females. If plenty of food is available, she mates and then allows the others to do so. If food is scarce, she allows less mating. During such times, she is usually the only one to mate.

## Territorial Behavior

Many animals set up territories for feeding, mating, and raising young. A territory is an area that an animal defends from other members of the same species. Ownership of a territory occurs in different ways. Songbirds sing, sea lions bellow, and squirrels chatter to claim territories. Other animals leave scent marks. Some animals, like the tiger in **Figure 11**, patrol an area and attack other animals of the same species who enter their territory. Why do animals defend their territories? Territories contain food, shelter, and potential mates. If an animal has a territory, it will be able to mate and produce offspring. Defending territories is an instinctive behavior. It improves the survival rate of an animal's offspring.

**Figure 11** A tiger's territory may cover several miles. It will confront any other tiger who enters it.

**Explain** what may be happening in this photo.





**Figure 12** Young wolves roll over and make themselves as small as possible to show their submission to adult wolves.

**Figure 13** During the waggle dance, if the food source is far from the hive, the dance takes the form of a figure eight. The angle of the waggle is equal to the angle from the hive between the Sun and nectar source.



**Aggression** Have you ever watched as one dog approached another dog that was eating a bone? What happened to the appearance of the dog with the bone? Did its hair on its back stick up? Did it curl its lips and make growling noises? This behavior is called aggression. **Aggression** is a forceful behavior used to dominate or control another animal. Fighting and threatening are aggressive behaviors animals use to defend their territories, protect their young, or to get food.

Many animals demonstrate aggression. Some birds let their wings droop below their tail feathers. It may take another bird's perch and thrust its head forward in a pecking motion as a sign of aggression. Cats lay their ears flat, arch their backs, and hiss.

**Submission** Animals of the same species seldom fight to the death. Teeth, beaks, claws, and horns are used for killing prey or for defending against members of a different species.

To avoid being attacked and injured by an individual of its own species, an animal shows submission. Postures that make an animal appear smaller often are used to communicate surrender. In some animal groups, one individual is usually dominant. Members of the group show submissive behavior toward the dominant individual. This stops further aggressive behavior by the dominant animal. Young animals also display submissive behaviors toward parents or dominant animals, as shown in **Figure 12**.

## Communication

In all social behavior, communication is important. Communication is an action by a sender that influences the behavior of a receiver. How do you communicate with the people around you? You may talk, make noises, or gesture like you did in this chapter's Launch Lab. Honeybees perform a dance, as shown in **Figure 13**, to communicate to other bees in the hive the location of a food source. Animals in a group communicate with sounds, scents, and actions. Alarm calls, chemicals, speech, courtship behavior, and aggression are forms of communication.



**Figure 14** This male Emperor of Germany bird of paradise attracts mates by posturing and fanning its tail.

**List** other behaviors animals use to attract mates.

**Courtship Behavior** A male bird of paradise, shown in **Figure 14**, spreads its tail feathers and struts. A male sage grouse fans its tail, fluffs its feathers, and blows up its two red air sacs. These are examples of behavior that animals perform before mating. This type of behavior is called **courtship behavior**. Courtship behaviors allow male and female members of a species to recognize each other. These behaviors also stimulate males and females so they are ready to mate at the same time. This helps ensure reproductive success.

In most species the males are more colorful and perform courtship displays to attract a mate. Some courtship behaviors allow males and females to find each other across distances.



**Chemical Communication** Ants are sometimes seen moving single file toward a piece of food. Male dogs frequently urinate on objects and plants. Both behaviors are based on chemical communication. The ants have laid down chemical trails that others of their species can follow. The dog is letting other dogs know he has been there. In these behaviors, the animals are using chemicals called pheromones (FER uh mohnz) to communicate. A chemical that is produced by one animal to influence the behavior of another animal of the same species is called a **pheromone**. They are powerful chemicals needed only in small amounts. They remain in the environment so that the sender and the receiver can communicate without being in the same place at the same time. They can advertise the presence of an animal to predators, as well as to the intended receiver of the message.

Males and females use pheromones to establish territories, warn of danger, and attract mates. Certain ants, mice, and snails release alarm pheromones when injured or threatened.

## Mini LAB

### Demonstrating Chemical Communication

#### Procedure

1. Obtain a sample of perfume or air freshener.
2. Spray it into the air to leave a scent trail as you move around the house or apartment to a hiding place.
3. Have someone try to discover where you are by following the scent of the substance.

#### Analysis

1. What was the difference between the first and last room you were in?
2. Would this be an efficient way for humans to communicate? Explain.



**Figure 15** Many animals use sound to communicate.



Frogs often croak loud enough to be heard far away.



Pileated woodpecker calls often can be heard above everything else in the forest.



Howler monkeys got their name because of the sounds they make.

**Sound Communication** Male crickets rub one forewing against the other forewing. This produces chirping sounds that attract females. Each cricket species produces several calls that are different from other cricket species. These calls are used by researchers to identify different species. Male mosquitoes have hairs on their antennae that sense buzzing sounds produced by females of their same species. The tiny hairs vibrate only to the frequency emitted by a female of the same species.

Vertebrates use a number of different forms of sound communication. Rabbits thump the ground, gorillas pound their chests, beavers slap the water with their flat tails, and frogs, like the one in **Figure 15**, croak. Do you think that sound communication in noisy environments is useful? Seabirds that live where waves pound the shore rather than in some quieter place must rely on visual signals, not sound, for communication.

**Light Communication** Certain kinds of flies, marine organisms, and beetles have a special form of communication called bioluminescence. Bioluminescence, shown in **Figure 16**, is the ability of certain living things to give off light. This light is produced through a series of chemical reactions in the organism's body. Probably the most familiar bioluminescent organisms in North America are fireflies. These insects are not flies, but beetles. The flash of light that is produced on the underside of the last abdominal segments is used to locate a prospective mate. Each species has its own characteristic flashing. Males fly close to the ground and emit flashes of light. Females must flash an answer at exactly the correct time to attract males.



### INTEGRATE History

**Morse Code** Samuel B. Morse created a code in 1838 using numbers to represent letters. His early work led to Morse code. Naval ships today still use Morse code to communicate with each other using huge flashlights mounted on the ships' decks. In your Science Journal, write what reasons you believe that Morse code is still used by the Navy.

**Figure 16**

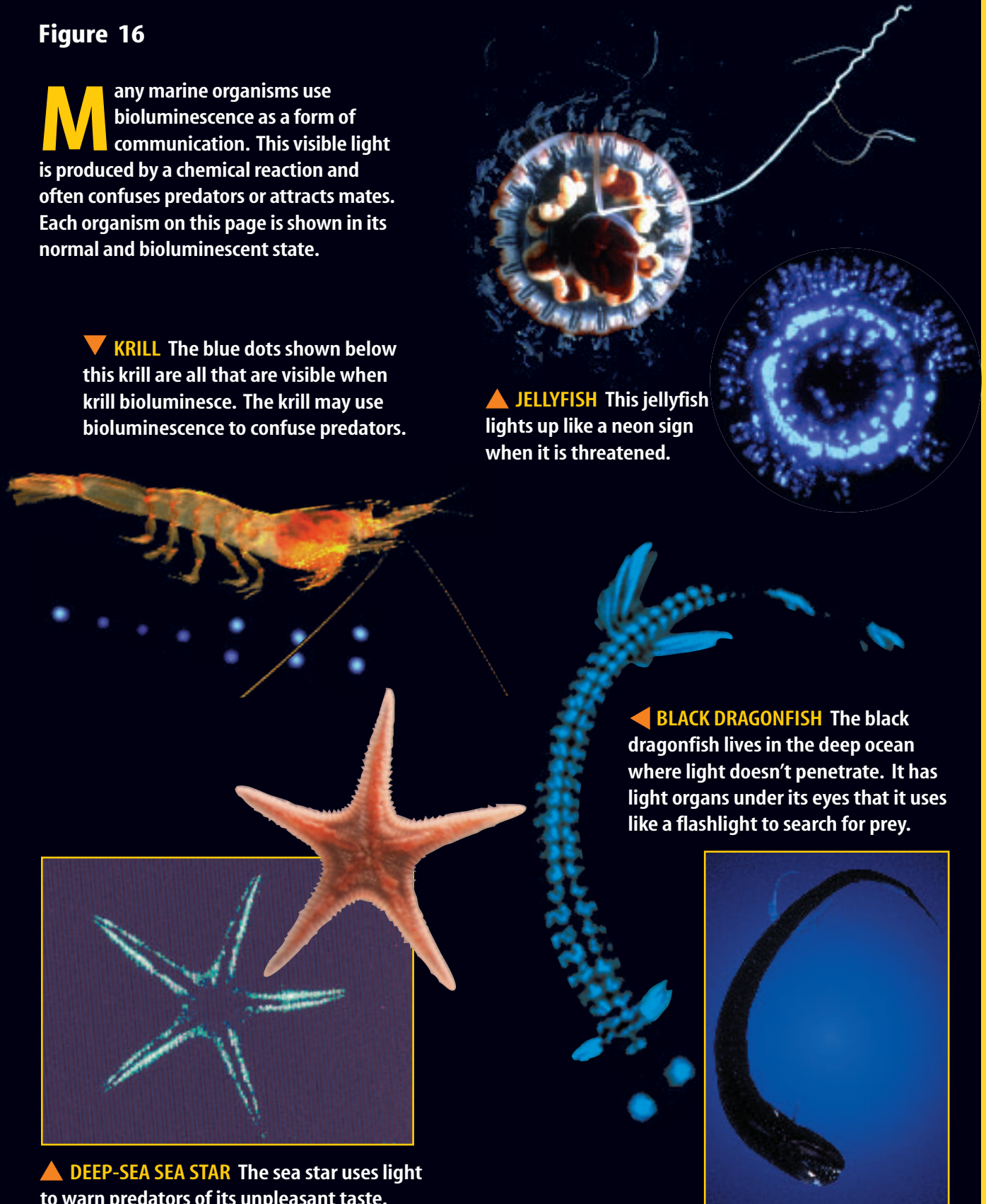
**M**any marine organisms use bioluminescence as a form of communication. This visible light is produced by a chemical reaction and often confuses predators or attracts mates. Each organism on this page is shown in its normal and bioluminescent state.

▼ **KRILL** The blue dots shown below this krill are all that are visible when krill bioluminesce. The krill may use bioluminescence to confuse predators.

▲ **JELLYFISH** This jellyfish lights up like a neon sign when it is threatened.

◀ **BLACK DRAGONFISH** The black dragonfish lives in the deep ocean where light doesn't penetrate. It has light organs under its eyes that it uses like a flashlight to search for prey.

▲ **DEEP-SEA SEA STAR** The sea star uses light to warn predators of its unpleasant taste.





### Topic: Owl Behavior

Visit [bookc.msscience.com](http://bookc.msscience.com) for Web links to information about owl behavior.

**Activity** List five different types of owl behavior and describe how each behavior helps the owl survive.

**Figure 17** Barn owls usually sleep during the day and hunt at night.

**Identify** the type of behavior the owl is exhibiting.

**Uses of Bioluminescence** Many bioluminescent animals are found deep in oceans where sunlight does not reach. The ability to produce light may serve several functions. One species of fish dangles a special luminescent organ in front of its mouth. This lures prey close enough to be caught and eaten. Deep-sea shrimp secrete clouds of a luminescent substance when disturbed. This helps them escape their predators. Patterns of luminescence on an animal's body may serve as marks of recognition similar to the color patterns of animals that live in sunlit areas.

## Cyclic Behavior

Why do most songbirds rest at night while some species of owls rest during the day? Some animals like the owl in **Figure 17** show regularly repeated behaviors such as sleeping in the day and feeding at night.

A **cyclic behavior** is innate behavior that occurs in a repeating pattern. It often is repeated in response to changes in the environment. Behavior that is based on a 24-hour cycle is called a circadian rhythm. Most animals come close to this 24-hour cycle of sleeping and wakefulness. Experiments show that even if animals can't tell whether it is night or day, they continue to behave in a 24-hour cycle.

Animals that are active during the day are diurnal (dy UR nul). Animals that are active at night are nocturnal. Owls are nocturnal. They have round heads, big eyes, and flat faces. Their flat faces reflect sound and help them navigate at night. Owls also have soft feathers that make them almost silent while flying.



**Reading Check**

What is a diurnal behavior?



**Hibernation** Some cyclic behaviors also occur over long periods of time. **Hibernation** is a cyclic response to cold temperatures and limited food supplies. During hibernation, an animal's body temperature drops to near that of its surroundings, and its breathing rate is greatly reduced. Animals in hibernation, such as the bats in **Figure 18**, survive on stored body fat. The animal remains inactive until the weather becomes warm in the spring. Some mammals and many amphibians and reptiles hibernate.



**Figure 18** Many bats find a frost-free place like this abandoned coal mine to hibernate for the winter when food supplies are low.

Animals that live in desertlike environments also go into a state of reduced activity. This period of inactivity is called estivation. Desert animals sometimes estivate due to extreme heat, lack of food, or periods of drought.

## Applying Science

### How can you determine which animals hibernate?

**M**any animals hibernate in the winter. During this period of inactivity, they survive on stored body fat. While they are hibernating, they undergo several physical changes. Heart rate slows down and body temperature decreases. The degree to which the body temperature decreases varies among animals. Scientists disagree about whether some animals truly hibernate or if they just reduce their activity and go into a light sleep. Usually, a true hibernator's body temperature will decrease significantly while it is hibernating.

#### Identifying the Problem

The table on the right shows the difference between the normal body temperature and the hibernating body temperature of several animals. What similarities do you notice?

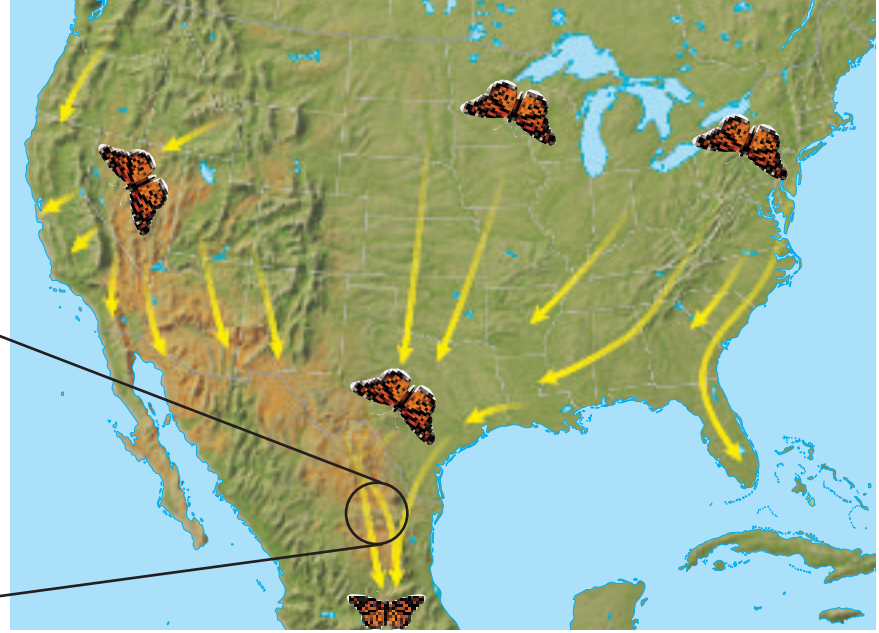
#### Average Body Temperatures of Hibernating Animals

Animal	Normal Body Temperature (°C)	Hibernating Body Temperature (°C)
Woodchuck	37	3
Squirrel	32	4
Grizzly bear	32–37	27–32
Whippoorwill	40	18
Hoary marmot	37	10

#### Solving the Problem

1. Which animals would you classify as true hibernators and which would you classify as light sleepers? Explain.
2. Some animals such as snakes and frogs also hibernate. Why would it be difficult to record their normal body temperature?





**Figure 19** Many monarch butterflies travel from the United States to Mexico for the winter.

**Migration** Instead of hibernating, many animals move to new locations when the seasons change. This instinctive seasonal movement of animals is called **migration**. Most animals migrate to find food or to reproduce in environments that are more favorable for the survival of offspring. Many bird species fly for hours or days without stopping. The blackpoll warbler flies more than 4,000 km, nearly 90 hours nonstop from North America to its winter home in South America. Monarch butterflies, shown in **Figure 19**, can migrate as far as 2,900 km. Gray whales swim from arctic waters to the waters off the coast of northern Mexico. After the young are born, they make the return trip.

## section 2 review

### Summary

#### Instinctive Behavior Patterns

- Instinctive behavior patterns are inherited.
- Courtship and mating are instinctive for most animal groups.

#### Social and Territorial Behaviors

- Interactions among organisms of a group are examples of social behavior.
- Many animals protect a territory for feeding, mating, and raising young.

#### Communication and Cyclic Behavior

- Species can communicate with each other using behavior, chemicals, sound, or bioluminescence.
- Cyclic behaviors occur in response to environmental changes.

### Self Check

1. **Describe** some examples of courtship behavior and how this behavior helps organisms survive.
2. **Identify** and **explain** two reasons that animals migrate.
3. **Compare and contrast** hibernation and migration.
4. **Think Critically** Suppose a species of frog lives close to a loud waterfall. It often waves a bright blue foot in the air. What might the frog be doing?

### Applying Math

5. **Solve One-Step Equations** Some cicadas emerge from the ground every 17 years. The population of one type of caterpillar peaks every five years. If the peak cycle of the caterpillars and the emergence of cicadas coincided in 1990, in what year will they coincide again?

# Observing Earthworm Behavior

Earthworms can be seen at night wriggling across wet sidewalks and driveways. Why don't you see many earthworms during the day?

## Real-World Question

How do earthworms respond to light?

### Goals

**Predict** how earthworms will behave in the presence of light.

### Materials

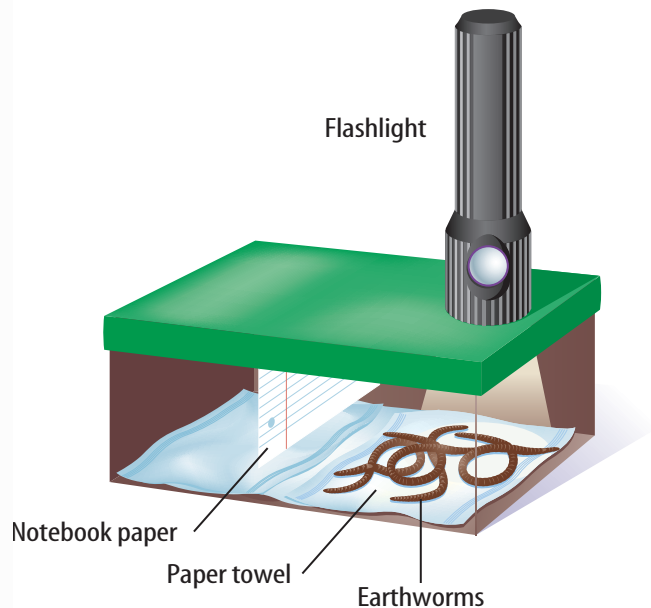
scissors	paper
shoe box with lid	moist paper towels
flashlight	earthworms
tape	timer

### Safety Precautions



## Procedure

1. Cut a round hole, smaller than the end of the flashlight, near one end of the lid.
2. Tape a sheet of paper to the lid so it hangs just above the bottom of the box and about 10 cm away from the end with the hole in it.
3. Place the moist paper towels in the bottom of the box.
4. Place the earthworms in the end of the box that has the hole in it.
5. Hold the flashlight over the hole and turn it on.
6. Leave the box undisturbed for 30 minutes, then open the lid and observe the worms.
7. **Record** the results of your experiment in your Science Journal.



## Conclude and Apply

1. **Identify** which direction the earthworms moved when the light was turned on.
2. **Infer** Based on your observations, what can you infer about earthworms?
3. **Explain** what type of behavior the earthworms exhibited.
4. **Predict** where you would need to go to find earthworms during the day.

## Communicating Your Data

Write a story that describes a day in the life of an earthworm. List activities, dangers, and problems an earthworm might face. Include a description of its habitat. **For more help, refer to the Science Skill Handbook.**

# Animal Habitats

## Goals

- **Research** the natural habitat and basic needs of one animal.
- **Design** and model an appropriate zoo, animal park, or aquarium environment for this animal. Working cooperatively with your classmates, design an entire zoo or animal park.

## Possible Materials

poster board  
markers or colored pencils  
materials that can be used to make a scale model

## Real-World Question

Zoos, animal parks, and aquariums are safe places for wild animals. Years ago, captive animals were kept in small cages or behind glass windows. Almost no attempt was made to provide natural habitats for the animals. People who came to see the animals could not observe the animal's normal behavior. Now, most captive animals are kept in exhibit areas that closely resemble their natural habitats. These areas provide suitable environments for the animals so that they can interact with members of their same species and have healthier, longer lives. What types of environments are best suited for raising animals in captivity? How can the habitats provided at an animal park affect the behavior of animals?



## Make a Model

1. Choose an animal to research. Find out where this animal is found in nature. What does it eat? What are its natural predators? Does it exhibit unique territorial, courtship, or other types of behavior? How is this animal adapted to its natural environment?



## Using Scientific Methods

- 2. Design** a model of a proposed habitat in which this animal can live successfully. Don't forget to include all of the things, such as shelter, food, and water, that your animal will need to survive. Will there be any other organisms in the habitat?
- 3. Research** how zoos, animal parks, or aquariums provide habitats for animals. Information may be obtained by contacting scientists who work at zoos, animal parks, and aquariums.
- 4. Present** your design to your class in the form of a poster, slide show, or video. Compare your proposed habitat with that of the animal's natural environment. Make sure you include a picture of your animal in its natural environment.

### **Test Your Model**

- Using all of the information you have gathered, create a model exhibit area for your animal.
- Indicate what other plants and animals may be present in the exhibit area.

### **Analyze Your Data**

- Decide** whether all of the animals studied in this lab can coexist in the same zoo or wildlife preserve.
- Analyze** problems that might exist in your design. Suggest some ways you might want to improve your design.

### **Conclude and Apply**

- Interpret Data** Using the information provided by the rest of your classmates, design an entire zoo or aquarium that could include the majority of animals studied.
- Predict** which animals could be grouped together in exhibit areas.
- Determine** how large your zoo or wildlife preserve needs to be. Which animals require a large habitat?

### **Communicating** **Your Data**

Give an oral presentation to another class on the importance of providing natural habitats for captive animals. **For more help, refer to the Science Skill Handbook.**



## Going to the Dogs

**A simple and surprising stroll showed that dogs really are humans' best friends**

**Y**ou've probably seen visually impaired people walking with their trusted "seeing-eye" dogs. Over 85 years ago, a doctor and his patient discovered this canine ability entirely by accident!

Near the end of World War I in Germany, Dr. Gerhard Stalling and his dog strolled with a patient—a German soldier who had been blinded—around hospital grounds.



**A dog safely guides its owner across a street.**

While they were walking, the doctor was called away. A few moments later, the doctor returned but the dog and the soldier were gone!

Searching the paths frantically, Dr. Stalling made an astonishing discovery. His pet had led the soldier safely around the hospital grounds. Inspired by what his dog could do,

Dr. Stalling set up the first school in the world dedicated to training dogs as guides.

German shepherds, golden retrievers, and Labrador retrievers seem to make the best guide dogs. They learn hand gestures and simple commands to lead visually impaired people safely across streets and around obstacles. This is what scientists call "learned behavior." Animals gain learned behavior through experience. But, a guide dog doesn't just learn to respond to special commands; it also must learn when *not* to obey. If its human owner urges the dog to cross the street and the dog sees that a car is approaching, the dog refuses because it has learned to disobey the command. This trait, called "intelligent disobedience," ensures the safety of the owner and the dog—a sure sign that dogs are still humans' best friends.



**German shepherds make excellent guide dogs.**

**Write** Lead a blindfolded partner around the classroom. Help your partner avoid obstacles. Then trade places. Write in your Science Journal about your experience leading and being led.

Science  online

For more information, visit  
[bookc.msscience.com/oops](http://bookc.msscience.com/oops)

Reviewing Main Ideas

**Section 1** Types of Behavior

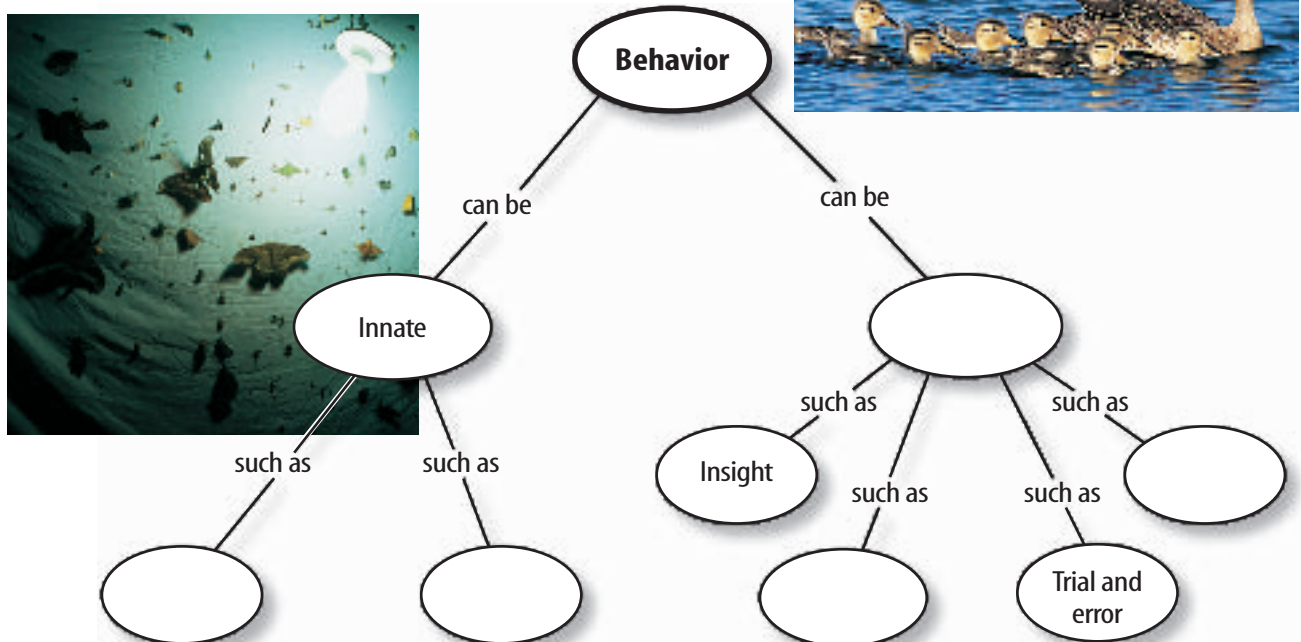
1. Behavior that an animal has when it's born is innate behavior. Other animal behaviors are learned through experience.
2. Reflexes are simple innate behaviors. An instinct is a complex pattern of innate behavior.
3. Learned behavior includes imprinting, in which an animal forms a social attachment immediately after birth.
4. Behavior modified by experience is learning by trial and error.
5. Conditioning occurs when the response to one stimulus becomes associated with another. Insight is the ability to use past experiences to solve new problems.

**Section 2** Behavioral Interactions

1. Behavioral adaptations such as defense of territory, courtship behavior, and social behavior help species of animals survive and reproduce.
2. Courtship behaviors allow males and females to recognize each other and prepare to mate.
3. Interactions among members of the same species are social behaviors.
4. Communication among organisms occurs in several forms, including chemical, sound, and light.
5. Cyclic behaviors are behaviors that occur in repeating patterns. Animals that are active during the day are diurnal. Animals that are active at night are nocturnal.

Visualizing Main Ideas

Copy and complete the following concept map on types of behavior.



**Using Vocabulary**

- |                           |                        |
|---------------------------|------------------------|
| aggression p. 142         | insight p. 139         |
| behavior p. 134           | instinct p. 136        |
| conditioning p. 138       | migration p. 148       |
| courtship behavior p. 143 | pheromone p. 143       |
| cyclic behavior p. 146    | reflex p. 135          |
| hibernation p. 147        | social behavior p. 140 |
| imprinting p. 137         | society p. 141         |
| innate behavior p. 135    |                        |

Explain the differences between the pairs of vocabulary words given below. Then explain how the words are related.

1. conditioning—imprinting
2. innate behavior—social behavior
3. insight—instinct
4. social behavior—society
5. instinct—reflex
6. hibernation—migration
7. courtship behavior—pheromone
8. cyclic behavior—migration
9. aggression—social behavior
10. behavior—reflex

**Checking Concepts**

Choose the word or phrase that best answers the question.

11. What is an instinct an example of?
  - A) innate behavior
  - B) learned behavior
  - C) imprinting
  - D) conditioning
12. What is an area that an animal defends from other members of the same species called?
 

A) society	C) migration
B) territory	D) aggression

13. Which animals depend least on instinct and most on learning?
 

A) birds	C) mammals
B) fish	D) amphibians
14. What is a spider spinning a web an example of?
 

A) conditioning	C) learned behavior
B) imprinting	D) an instinct
15. What is a forceful act used to dominate or control another called?
 

A) courtship	C) aggression
B) reflex	D) hibernation
16. What is an organized group of animals doing specific jobs called?
 

A) community	C) society
B) territory	D) circadian rhythm
17. What is the response of inactivity and slowed metabolism that occurs during cold conditions?
 

A) hibernation	C) migration
B) imprinting	D) circadian rhythm
18. Which of the following is a reflex?
 

A) writing	C) sneezing
B) talking	D) riding a bicycle

Use the photo below to answer question 19.

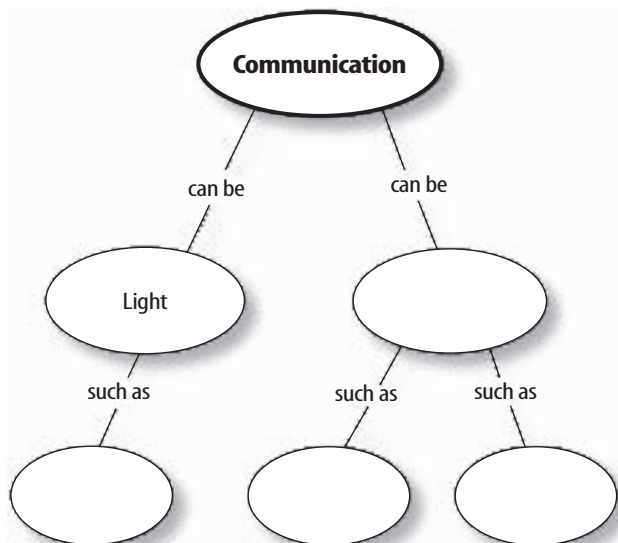


19. The photo above is an example of what type of communication?
 

A) light communication
B) sound communication
C) chemical communication
D) cyclic behavior

**Thinking Critically**

20. **Explain** the type of behavior involved when the bell rings at the end of class.
21. **Describe** the advantages and disadvantages of migration as a means of survival.
22. **Explain** how a habit, such as tying your shoes, is different from a reflex.
23. **Explain** how behavior increases an animal's chance for survival using one example.
24. **Infer** Hens lay more eggs in the spring when the number of daylight hours increases. How can farmers use this knowledge of behavior to their advantage?
25. **Record Observations** Make observations of a dog, cat, or bird for a week. Record what you see. How did the animal communicate with other animals and with you?
26. **Classify** Make a list of 25 things that you do regularly. Classify each as an innate or learned behavior. Which behaviors do you have more of?
27. **Concept Map** Copy and complete the following concept map about communication. Use these words: *sound*, *chirping*, *bioluminescence*, and *buzzing*.

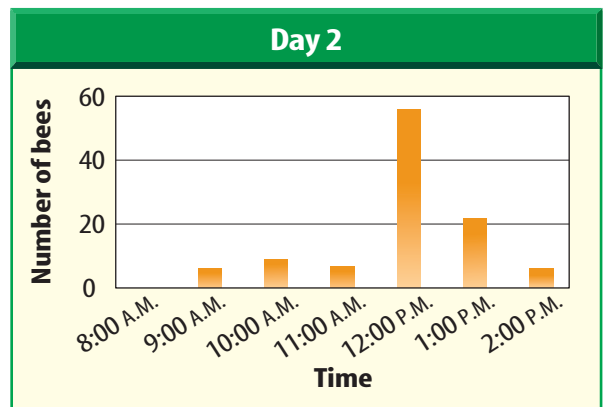
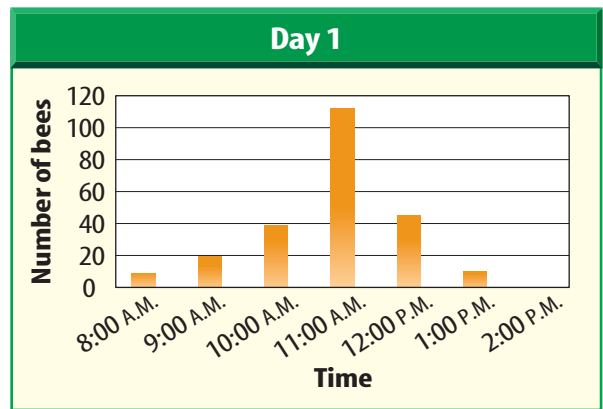


**Performance Activities**

28. **Poster** Draw a map showing the migration route of monarch butterflies, gray whales, or blackpoll warblers.

**Applying Math**

Use the graphs below to answer question 29.



29. **Bee Foraging** Bees were trained to forage from 1:00 P.M. to 2:30 P.M. in New York and then were flown to California. The graphs above show the number of bees looking for food during the first two days in California. What was the difference in peak activity from day 1 to day 2? Was there a difference in the proportion of bees active during peak hours?
30. **Bird Flight** A blackpoll warbler flies 4,000 km nonstop from North America to South America in about 90 hours. What is its rate of speed?



## Part 1 Multiple Choice

Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

- Which of the following is true about innate behaviors?
  - They are learned behaviors.
  - They are observed in only some animals.
  - They are the result of conscious thought.
  - They include reflexes.
- A spider spinning its web is an example of a(n)
  - reflex.
  - instinct.
  - imprinting.
  - conditioning.

Use the illustration below to answer questions 3 and 4.



- The illustration above describes what kind of learned behavior?
  - conditioning
  - trial and error
  - imprinting
  - insight
- Which of the following best describes this learned behavior?
  - The dog learns to salivate when presented with food.
  - The dog learns to eat only if the bell is rung.
  - The dog is conditioned to stop salivating when a bell is rung.
  - The dog is conditioned to salivate when a bell is rung.

- Which of the following is an example of territorial behavior?
  - A honeybee performs a waggle dance when it returns to the hive.
  - A peacock fans his tail while approaching a peahen.
  - A mountain goat charges and attacks an unfamiliar mountain goat.
  - A group of bats remain in hibernation for the winter.

Use the photo below to answer questions 6 and 7.



- The male wolf lying on its back is displaying what kind of behavior to the other male wolf?
  - aggressive behavior
  - submissive behavior
  - cyclic behavior
  - courtship behavior
- Which of the following statements best describes the behavior of the wolf that is standing?
  - The wolf is displaying its dominance over the wolf on the ground.
  - The wolf is displaying courtship behavior to the other wolf.
  - The wolf is using bioluminescence to communicate with the other wolf.
  - The wolf is watching the other wolf perform the waggle dance.

## Part 2 Short Response/Grid In

Record your answers on the answer sheet provided by your teacher or on a sheet of paper.

- Give an example of an innate behavior in a hummingbird.
- Which is simpler and more automatic, instincts or reflexes?

Use the illustration below to answer questions 10 and 11.



- What type of learning is shown above?
- What is required in order for an animal to use this type of learning to solve a problem?
- Could a young child solve a problem using insight? Why or why not?
- Give three examples of social behaviors.
- Why might an animal be submissive to another animal?

### Test-Taking Tip

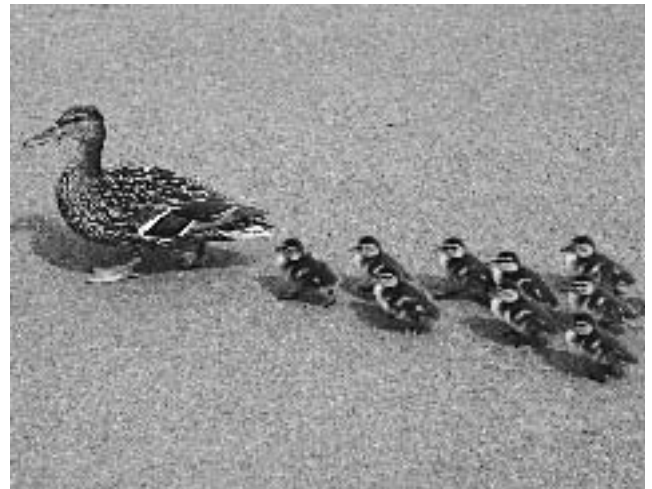
**Compare and Contrast** Make sure each part of the question is answered when listing discussion points. For example, if the question asks you to compare and contrast, make sure you list both similarities and differences.

## Part 3 Open Ended

Record your answers on a sheet of paper.

- Compare and contrast the innate behaviors of animals with short life spans and animals with long life spans.
- Give three examples of ways bioluminescence is used for communication.
- Explain the difference between a diurnal animal and a nocturnal animal. Give an example of each.
- Compare and contrast hibernation and estivation.

Use the photo below to answer questions 19 and 20.



- Explain the type of behavior that is shown above.
- How is this behavior related to why zoos feed newborn condors with hand puppets that look like adult condors?
- A male antelope approaches a female antelope during the breeding season. Is the male antelope responding to an external stimulus, an internal stimulus, or both? Explain.