



Homeostasis and Behavior

ESSENTIAL QUESTION


How does an organism's behavior help it to maintain homeostasis?

By the end of this lesson, you should be able to explain how organisms respond to external and internal stimuli in ways that enhance their survival.

TEKS 7.11B explain variation within a population or species by comparing external features, behaviors, or physiology of organisms that enhance their survival such as migration, hibernation, or storage of food in a bulb

TEKS 7.13A investigate how organisms respond to external stimuli found in the environment such as phototropism and fight or flight

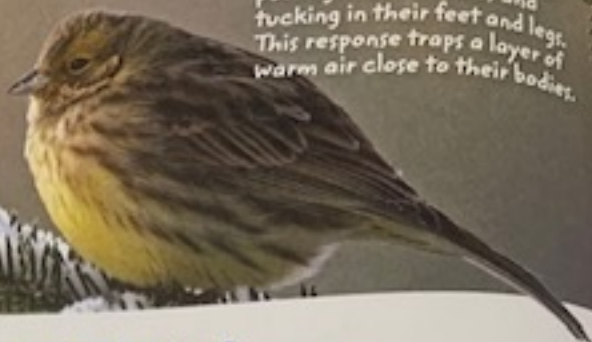
TEKS 7.13B describe and relate responses in organisms that may result from internal stimuli such as wilting in plants and fever or vomiting in animals that allow them to maintain balance



Hibernation is a deep sleep during which an animal's heart rate and breathing slow down. It is a behavior that allows dormice to survive in winter, when food is scarce.

Oh, Behave!

Birds respond to the cold by puffing their feathers and tucking in their feet and legs. This response traps a layer of warm air close to their bodies.



Active Reading

5 Identify As you read these two pages, underline three examples of stimuli.

What is behavior?

Every organism constantly interacts with its environment. A **stimulus** is anything that causes a reaction or change in an organism. A stimulus can be an environmental factor such as temperature. A **response** is an organism's reaction to a stimulus. For example, some animals respond to cold temperatures by growing extra fur to stay warm, while others respond by moving to warmer environments. A set of actions taken by an organism in response to a stimulus is called a **behavior**. Behaviors include birds building nests and moles and gophers digging underground tunnels.

Even though an organism's outside environment may change, conditions inside its body must stay relatively constant. **Homeostasis** is maintaining a stable balance in the body. Organisms' bodies constantly respond to stimuli to maintain homeostasis.

Visualize It!

6 Compare These animals have physical features that are suited for life in their specific environments. The frog is mostly active at night, and the mole lives mostly underground. How might their body structures help them survive in their environments?



Lemur leaf frogs, which are active at night, have large eyes and good vision. Their eyes help them take in sensory information in low-light environments.

How are stimuli detected?

All organisms are able to detect changes in their environments and respond to them. Multicellular organisms have sensory cells in their bodies that detect specific stimuli. *Sensory receptors* are found in sensory organs. *Sensory organs* include eyes, noses, skin, whiskers, and ears. Sensory receptors are sensitive to changes in specific stimuli. For example, sensory receptors in the eyes detect light, and sensory receptors in the ears detect sound. Plants detect stimuli, such as light and touch, by the movement of certain substances inside their cells. Each of these stimuli causes an organism to respond in a specific way.

Where do responses come from?

When an animal's sensory receptors detect stimuli, they send messages along the nervous system. A stimulus, such as sound, causes fast-moving electrical signals to be sent along nerves to the brain. The brain interprets the sensory information and sends signals along nerves to "tell" the body how to respond. Muscles may be activated by the electrical signals so that an animal behaves a certain way. Plants have an electrical message system, too.


Responses are also caused by hormones. A **hormone** is a chemical signal produced in one part of an organism that affects cell activity in another part of the organism. Hormones move more slowly than electrical signals. An organism's response is usually the result of the action of both hormones and electrical signals.

Active Reading 7 Compare What is the difference between a nerve response and a hormone response?

Even plants detect stimuli. When an insect touches two or more sensory hairs of a Venus flytrap, an electrical signal causes the specialized plant leaves to snap shut and catch the insect.



Moles live underground in total darkness. They have tiny eyes and poor vision. Sensitive whiskers help them feel their way around and find food.



Outside Influence

Stems' movement toward sunlight improves plants' ability to photosynthesize.

Active Reading

- 8 Identify** As you read, underline examples of responses to external stimuli.

What is an external stimulus?

An **external stimulus** is any stimulus that comes from outside the body of an organism and that influences the behavior of the organism. Temperature, sound, light, and other organisms are some external stimuli. **Taxis** is the movement of organisms toward or away from an external stimulus. An organism shows positive taxis when it moves toward a stimulus. For example, organisms will usually move toward a food source. Negative taxis is the movement away from a stimulus that is threatening. For example, cockroaches scurry away from bright light, which they dislike.

Tropism is the movement of a plant in response to an external stimulus, such as light or gravity. **Phototropism** is a plant's response to light. **Geotropism** is a plant's response to gravity. Roots show positive geotropism because they grow in the direction of gravity. Stems show negative geotropism because they grow in the opposite direction of gravity.

When an animal scratches a flea bite, it is responding positively to an external stimulus. Scratching can relieve the irritation and may remove the flea, preventing it from drawing more blood.

Think Outside the Book

- 9 Study** Some plants, such as sunflowers and black walnut trees, release chemicals to stop the growth of other plants around them. Research a plant species that shows a plant species that shows this behavior. Label a sketch or diagram that explains how the plant prevents the growth of other plants around it.



What is an internal stimulus?

An *internal stimulus* is a stimulus that comes from inside an organism's body. Hunger and thirst are internal stimuli that influence behavior. Getting sick can also influence behavior. If you develop a fever, you may feel tired and choose to rest. If you vomit, you will likely avoid the food that made you ill.

Certain responses to internal stimuli, such as the gradual change during insect metamorphosis or puberty in humans, are controlled by hormones. In animals, hormones are released into the blood stream by the endocrine system. In plants, the movement of certain hormones causes growth and tropisms, while others cause fruit to mature.

Too little water makes an animal feel thirsty. A thirsty animal moves toward water. A plant responds differently to lack of water, because it cannot move about. Tiny pores in the plant's leaves close to conserve water. Water pressure within plant cells helps the plant to remain upright. When a plant's cells lose too much water, the plant wilts because it cannot withstand the force of gravity. When water is available again, the plant takes in the water and it returns to normal.

Stomata are small openings found in plant leaves. They open and close in response to the movement of water out of cells, which is an internal stimulus.

Plants lose water through an open stoma. Closed stomata conserve water.



The release of hormones is an internal stimulus that causes a caterpillar to change into a butterfly.



When plants do not take in enough water, their cells lose water, and the plant wilts.



10 Compare What are some differences between how plants and animals respond to a lack of water?

I Will Survive!

When it's hot outside, sweating is a homeostatic response that helps some organisms to maintain a stable body temperature.

How does homeostasis work?

To maintain homeostasis, organisms must constantly respond to external and internal stimuli. An organism may not be aware of these responses, such as a change in blood pressure or the filtering of wastes by the kidneys. Homeostatic responses allow individual cells and complete body systems to function properly. Many homeostatic processes are controlled by hormones. If the body cannot maintain homeostasis, illness or disease may occur.

What are some behaviors that improve survival?

Maintaining homeostasis allows an organism's body to function well, but to survive, organisms need to avoid predators and find food and space to live. Animals also need to be able to learn certain behaviors, such as how to hunt. Other behaviors such as finding a mate, reproducing, and raising young help with the overall survival of a species.

Fight-or-Flight Response

When faced with a threatening stimulus such as a predator or natural disaster, organisms display the fight-or-flight response. This response is characterized by changes such as an increased heart rate, anxiety, decreased blood supply to certain muscles, and a release of hormones and other chemicals in the body. These changes give the body a burst of energy and strength, which allow an organism to physically fight or run away in times of danger.

Finding Food and Space to Live

Hunger is an internal stimulus that affects the behavior of an animal. Searching for food becomes increasingly important as the hunger stimulus grows. A positive result to a food-seeking response enhances the survival of an animal.

Animals make choices of where to live based on external stimuli such as food resources, lack of predators, and other environmental conditions. Plants also need nutrients and water to survive. Plant roots grow towards sources of water and rich nutrients to help keep the plant healthy.



Inquiry

- 11 Infer** Many animals cannot sweat to maintain a stable body temperature. What is one other way animals can cool down?



This hare shows the fight-or-flight response as it runs to avoid being caught by the fox.

Active Reading

Identify As you read this page, underline examples of behaviors that increase the survival of some organisms.

What behaviors help animals survive environmental changes?

People often add extra layers of clothes when they feel chilly and remove layers when they feel warm. Shivering is a response to cold temperatures that many animals have. Shivering generates extra warmth in the body. Many reptiles bask in the morning sun to warm themselves up. There are also longer-term behaviors that some animals have in response to environmental changes, such as migration and hibernation.

Migration

Animals that live in environments where it is difficult to survive year-round will move to environments where conditions are more favorable for survival. This movement is called migration. Migration helps animals to avoid harsh conditions that can come with seasonal changes. For example, monarch butterflies, many birds, whales, and fish migrate long distances at specific times of the year to find suitable conditions and food, to mate, or to give birth. Migration is triggered by external stimuli such as colder conditions or lack of food.

Hibernation

A deep sleep during which an animal slows down its body processes to save energy is called **hibernation**. The animal's heart rate, body temperature, and nutritional needs are lowered so that energy is conserved during periods of unsuitable weather or food shortage. Hibernation is triggered by external stimuli such as cold, dark conditions. When internal processes slow down during hot, dry weather, it is called **estivation**. The North American desert tortoise burrows underground to escape the intense heat of the desert during summer months.

Visualize It!

Synthesize The purple arrows show migratory routes of humpback whale populations. What might be the advantage to whales giving birth in warm water rather than staying in areas of cold water?



Humpback whales move between cold, northern waters where they feed and warm, southern waters where they give birth.



Active Reading

- 14 Identify** As you read, underline examples of behaviors that help plants to survive.

What behaviors help plants survive environmental changes?

Unlike animals, plants cannot move to another location to avoid harsh conditions. Instead, plants maintain homeostasis and conserve energy in other ways. Plants have behaviors to help them survive each day and behaviors that help them survive changing seasons. You have already learned that tropisms are behaviors that plants have in response to an external stimulus, such as light or gravity. Movement or growth is directed toward or away from a stimulus. Another type of tropism is a response to touch. This response allows plants, such as vines, to coil around objects. Other plant behaviors include food storage and dormancy.



Food is stored in the fleshy leaf base that forms the bulb of an onion. This bulb has sprouted leaves that show a geotropic response.

Food Storage

Some plants have specialized structures, such as bulbs, to store food. Bulbs are short stems surrounded by thick, short leaves. The thick leaves, also called scales, contain stored food that allows the plant to survive unfavorable conditions, such as cold, harsh winters. Tubers, such as sweet potatoes, and corms, such as gladioli, are other types of plant storage organs.

Dormancy

During dormancy, a plant conserves energy and stops growing. This temporary inactivity helps plants to survive during harsh conditions such as cold winter months or hot summers. Certain plants store energy in bulbs or roots before entering dormancy, providing a supply of food for when weather conditions improve.

Visualize It!

- 15 Infer** Deciduous trees drop their leaves to conserve energy as they enter winter dormancy. In spring, new leaves appear, and the trees begin to grow again. Is it likely that a deciduous tree photosynthesizes in winter? Explain your answer.



Lesson Review

Lesson 1

Vocabulary

In your own words, define the following terms.

1 hibernation

2 hormone

3 behavior

4 stimulus

Key Concepts

5 **Relate** What internal stimulus most likely drives a lioness to search for prey? Explain.

6 **Explain** What is an example of a homeostatic response that helps an organism survive?

7 **Identify** Is light an external or internal stimulus for a plant? In your answer, explain how plants react to light.

Critical Thinking

Use the image to answer the following question.



8 **Examine** The white tern is a seabird that catches fish by plunging into the water. What physical features of the bird likely make this feeding behavior possible?

9 **Infer** If hares with long legs run faster than hares with shorter legs, which hares do you expect would be most likely to survive and reproduce? Explain your answer.

10 **Conclude** Most bacteria that cause sickness in humans grow best at 37 °C, which is normal body temperature. Sometimes a fever is the body's response to an infection by harmful bacteria. What is the likely homeostatic reason for developing a fever?