

Lesson 15 Adaptations of Organisms

Assessment Anchors/Eligible Content: S8.B.2.1.2 Explain how different adaptations in individuals of the same species may affect survivability or reproduction success.

S8.B.2.1.3 Explain that mutations can alter a gene and are the original source of new variations.

S8.B.2.1.4 Describe how selective breeding or biotechnology can change the genetic makeup of organisms.

S8.B.2.1.5 Explain that adaptations are developed over long periods of time and are passed from one generation to another.

Academic Standards: 3.3.7.C, 3.3.7.D, 4.7.7.A, 4.7.7.B

Learn how adaptations develop and how they help living things survive and reproduce.

An **adaptation** is a trait that helps an organism survive or reproduce.

A **mutation** is a change in an organism's genetic instructions.

Biotechnology can involve changing an organism's genetic makeup.

Guided Instruction

DIRECTIONS Read the following information and answer the questions.

Living things have many different characteristics, or traits. A trait that helps an organism survive or reproduce is called an **adaptation**. Many adaptations are determined by an organism's genetic instructions, or DNA. As such, adaptations are passed on from one generation to another.



Cacti have adaptations that help them survive in dry environments. They have thick stems to store water. They also have small, spiny leaves and a waxy stem to slow the loss of water from the plants.

Some adaptations help organisms reproduce. Flowers are adaptations that help flowering plants reproduce. The colors and scents of many flowers attract insects that carry pollen from plant to plant. Many animals have adaptations to attract mates. For example, many male birds, toads, and insects use mating calls to attract females.

Individuals of the same species can have slightly different traits. Certain traits might make one individual better adapted to its environment. Individuals that are better adapted to their environment have a better chance of survival. For example, a giraffe that has a longer neck than other giraffes may be able to reach leaves on higher branches. The individual with a longer neck might get more food and have a better chance of survival than giraffes with shorter necks.

Guided Questions

What are three **adaptations** of cacti to dry environments?

Why might one individual have a better chance of survival than another individual of the same species?

Some traits can help an individual attract more mates than other members of the population. For example, peacocks attract mates by displaying showy tail feathers. A peacock with long and bright tail feathers generally attracts more mates than one with shorter, duller tail feathers. Long, showy feathers are an adaptation for reproductive success. An adaptation that helps an individual survive and reproduce more successfully than others is typically passed on to future generations. Over time, more and more individuals in a population have the adaptation.

Many individual differences within a species arise from mutations. A **mutation** is a change in an organism's genetic instructions. Mutations can cause an individual to have harmful traits. However, mutations can also result in beneficial traits that will prove to be adaptations.

In nature, mutations arise spontaneously. However, scientists can also engineer mutations in an organism's genes. **Biotechnology** involves manipulating DNA to advance science or meet human needs. Scientists can use biotechnology to change the genetic makeup of organisms. For example, scientists can make crops with traits such as larger fruits, more nutritious vegetables, and chemical defenses against pests.

Guided Questions

What has changed when a **mutation** occurs?

DIRECTIONS Answer the following questions.

1. What adaptations help many flowering plants reproduce?

2. What could cause one individual to have a different trait than another individual of the same species?

3. What are two ways mutations can arise?

4. How can scientists produce beneficial traits in organisms?

**Apply the
Pennsylvania
Academic
Standards**

DIRECTIONS Read the paragraph and answer the questions.

Through biotechnology, scientists can engineer particular traits and adaptations in domestic plants and animals. However, people also use selective breeding to choose the traits they want future generations of a species to have. In selective breeding, people choose parent organisms with desirable traits. Then they breed the parents. Some of the offspring may inherit the desirable traits.

People have used selective breeding to produce different breeds of dogs. For example, huskies can pull heavy loads across icy terrain. Long ago, people found that some dogs were stronger and better in the snow than others. They bred these dogs to produce offspring with the same adaptations. After many generations, they produced the husky breed. Many different breeds exist because breeders chose different desirable traits. People have also used selective breeding to produce faster horses, fatter chickens, and hardier crops.

1. How is selective breeding like modern biotechnology?

2. How is selective breeding different from modern biotechnology?

3. What are several traits a farmer might want to select for in tomato plants?

4. How could a farmer produce future generations of tomato plants with desirable traits?

**PSSA
Practice**

Directions: Read each question. Then circle the letter for the best answer.

Which of the following is **most likely** an adaptation that helps a bird fly?

- A sharp claws
- B pointed beak
- C lightweight bones
- D weak chest muscles

A mutation is defined as

- A a change that causes a flaw in an organism.
- B a change in an organism's reproductive success.
- C a change that eliminates variation among organisms.
- D a change in an organism's genetic instructions.



An individual frog can croak more loudly than other frogs in a population. Thus, the individual attracts more mates. Many of this frog's offspring inherit the loud-croak trait. What will **most likely** happen after many generations?

- A More frogs in the population will have the loud-croak trait.
- B Fewer frogs in the population will use mating calls.
- C More frogs in the population will develop new traits.
- D Fewer frogs in the population will pass on their adaptations.

Scientists have altered the genetic makeup of some crops of soybeans and corn. These plants have a new gene that makes them resistant to an herbicide. Farmers use herbicides to kill weeds that damage their crops.

A. How does making crops that are resistant to herbicides help farmers?

B. How could crops that are resistant to herbicides lead to pollution in the environment?

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S8.B.2.1.5 Explain that adaptations are developed over long periods of time and are passed from one generation to another.

Academic Standards: 3.3.7.C, 3.3.7.D, 4.7.7.A, 4.7.7.B

Explain how variations arise within a species.

Natural selection is the process in which individuals with particular traits survive and reproduce more successfully than individuals without those traits.

In **artificial selection**, people choose which individuals in a population will survive or reproduce.

In **selective breeding**, people choose individuals with particular traits to reproduce.

**Guided
Instruction**

DIRECTIONS Read the following information and answer the questions.

Organisms have a variety of traits. Two sources of this variety are mutations and sexual reproduction. We have learned that mutations are random changes in genes or chromosomes. Genes carry instructions for an organism's traits. Because a mutation can change those instructions, it can also change an organism's traits.



Most mutations that change a trait make it hard for an organism to survive. Some mutations make an organism better adapted for survival. Other mutations are neither harmful nor helpful.

Sexual reproduction is another source of variation. In sexual reproduction, each parent passes on some of its traits to its offspring. This is why a child can look a little like both parents. Sexual reproduction produces a unique combination of traits in each individual.

Guided Questions

How can a mutation change an organism's traits?

Why can a person look like both parents?

Some traits make it hard for an organism to survive in its environment. Because an organism with these traits is not well-adapted, it is less likely to reproduce and pass its traits on. Other traits help an organism survive in its environment. For example, hawks with better vision than other hawks are better able to catch prey. Hawks that catch more prey are more likely to survive and reproduce. When these hawks reproduce, their offspring might inherit the keen vision trait. After many generations, more hawks in the population will have keen vision.

The survival of hawks with keener vision is an example of natural selection. **Natural selection** is the process in which organisms with beneficial traits survive and reproduce more successfully than organisms without those traits. As a result of natural selection, some traits in a population disappear, and other traits become common over time.

Through **artificial selection**, humans can deliberately affect the traits of other organisms. Selective breeding is a form of artificial selection. In **selective breeding**, people choose which individuals will reproduce. People make this choice based on a trait that they determine is desirable. For example, farmers might decide that larger fruits are a desirable trait for their crops. They will choose to breed individuals that have this trait so that more individuals in future generations will produce larger fruits.

Guided Questions

What process causes the beneficial traits in a population to become common over time?

How can people change the traits of other organisms?

DIRECTIONS Answer the following questions.

1. Are all mutations harmful to an organism? Explain your answer.

2. What kinds of mutations are most likely to be passed on to offspring?

3. Describe the process of natural selection.

**Apply the
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Academic
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DIRECTIONS Read the paragraphs and answer the questions.

Changes in a population due to natural selection happen over many generations. Bacteria are small, single-celled organisms that reproduce quickly. They can produce many generations over several hours. Because of this, changes in a bacterial population due to natural selection can happen quickly.

Bacteria can enter people's bodies through wounds and cause infections. Scientists developed antibiotics to kill bacteria. However, mutations occur in some bacteria that make them resistant to certain antibiotics. Because they are resistant, these bacteria have an advantage in environments with antibiotics. They can survive and reproduce, while bacteria that are not resistant die. Offspring of resistant bacteria are also resistant to antibiotics. As doctors prescribe more antibiotics, more resistant bacteria survive and reproduce. Over time, the majority of bacteria in a population could be resistant to certain antibiotics.

1. Why does natural selection occur more quickly in a population of bacteria than in a population of deer?

2. What initially causes some bacteria to be resistant to antibiotics?

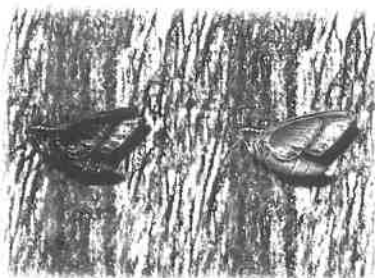
3. How do future generations become resistant to antibiotics?

4. Under what conditions do resistant bacteria have an advantage over nonresistant bacteria? Explain your answer.

**PSSA
Practice**

Directions: Read each question. Then circle the letter for the best answer.

1. Look at the light- and dark-colored moths shown below.



In this environment, what is **most likely** to happen to the moths?

- A The light moth will be more easily seen and eaten by a bird.
- B The light moth will be more likely to survive and reproduce.
- C The dark moth will be more likely to survive and reproduce.
- D The dark moth will become lighter in color.

2. Which statement about mutations is **true**?

- A All mutations are harmful.
- B All mutations are passed on.
- C All mutations affect genes.
- D All mutations are helpful.

3. Which of these **best** describes the result of selective breeding?

- A A desirable trait is passed on.
- B Organisms do not become better adapted for survival.
- C The environment eliminates harmful traits.
- D Mutations are eliminated.

4. In a population of cheetahs, some individuals have brighter coats than others. Poachers prefer to kill cheetahs with bright coats.

A. How will poaching likely affect this population of cheetahs?

B. Would a change in this population due to poaching be a form of natural selection or artificial selection? Explain.
