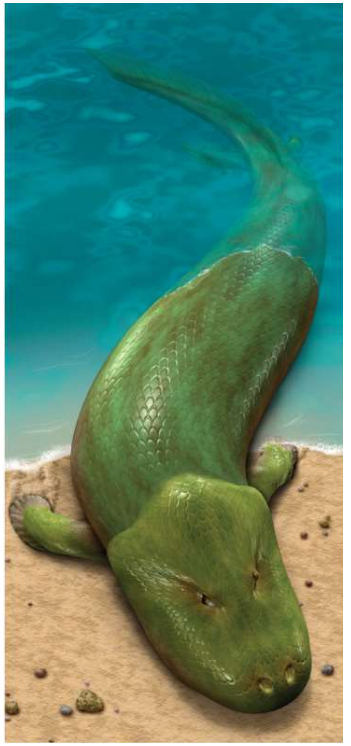
The Environment and Change Over Time

Chapter Menu



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How do species adapt to changing environments over time?

Get Ready

What do you think?

Before you begin, decide if you agree or disagree with each of these statements. As you view this presentation, see if you change your mind about any of the statements.

Get Ready

Do you agree or disagree?

1. Original tissues can be preserved as fossils.
2. Organisms become extinct only in mass extinction events.
3. Environmental change causes variations in populations.

Get Ready

Do you agree or disagree?

4. Variations can lead to adaptations.

5. Living species contain no evidence that they are related to each other.

6. Plants and animals share similar genes.

Lesson 1

Fossil Evidence of Evolution

Key Concepts

Copy the following questions:

- How do fossils form?
- How do scientists date fossils?
- How are fossils evidence of biological evolution?

Lesson 1

Fossil Evidence of Evolution

Vocabulary

- fossil record
- mold
- cast
- trace fossil
- geologic time scale
- extinction
- biological evolution

The Fossil Record

- The **fossil record** is made up of all the fossils ever discovered on Earth.
- The fossil record provides evidence that species have changed over time.
- Based on fossil evidence, scientists can recreate the physical appearance of species that are no longer alive on Earth.

Fossil Formation

After an animal dies, any soft tissues animals do not eat break down.

SCIENCE USE V. COMMON USE

tissue

Science Use similar cells that work together and perform a function

Common Use a piece of soft, absorbent paper

Fossil Formation (cont.)

- Only the dead animal's hard parts, such as bones, shells, and teeth, remain.
- Under rare conditions, these parts become fossils.

How Fossils Form

Mineralization	Carbonization
Rock-forming minerals in water filled in the small spaces in the tissue of these pieces of petrified wood. Water also replaced some of the wood's tissue. Mineralization can preserve the internal structures of an organism.	Fossil films made by carbonization are usually black or dark brown. Fish, insects, and plant leaves, such as this fern frond, are often preserved as carbon films.

Fossil Formation (cont.)

- The impression of an organism in a rock is called a **mold**.
- A **cast** is a fossil copy of an organism in a rock.

Fossil Formation (cont.)

A **trace fossil** is the preserved evidence of the activity of an organism.

WORD ORIGIN

fossil

from Latin *fossilis*, means "to obtain by digging"

Fossil Formation (cont.)

In rare cases, the original tissues of an organism can be preserved.

KEY CONCEPT CHECK

List the different ways fossils can form.

Determining a Fossil's Age

- Instead of dating fossils directly, scientists date the rocks the fossils are embedded inside.
- In relative-age dating, scientists determine the relative order in which rock layers were deposited.

Determining a Fossil's Age (cont.)

Relative-age dating helps scientists determine the relative order in which species have appeared on Earth over time.

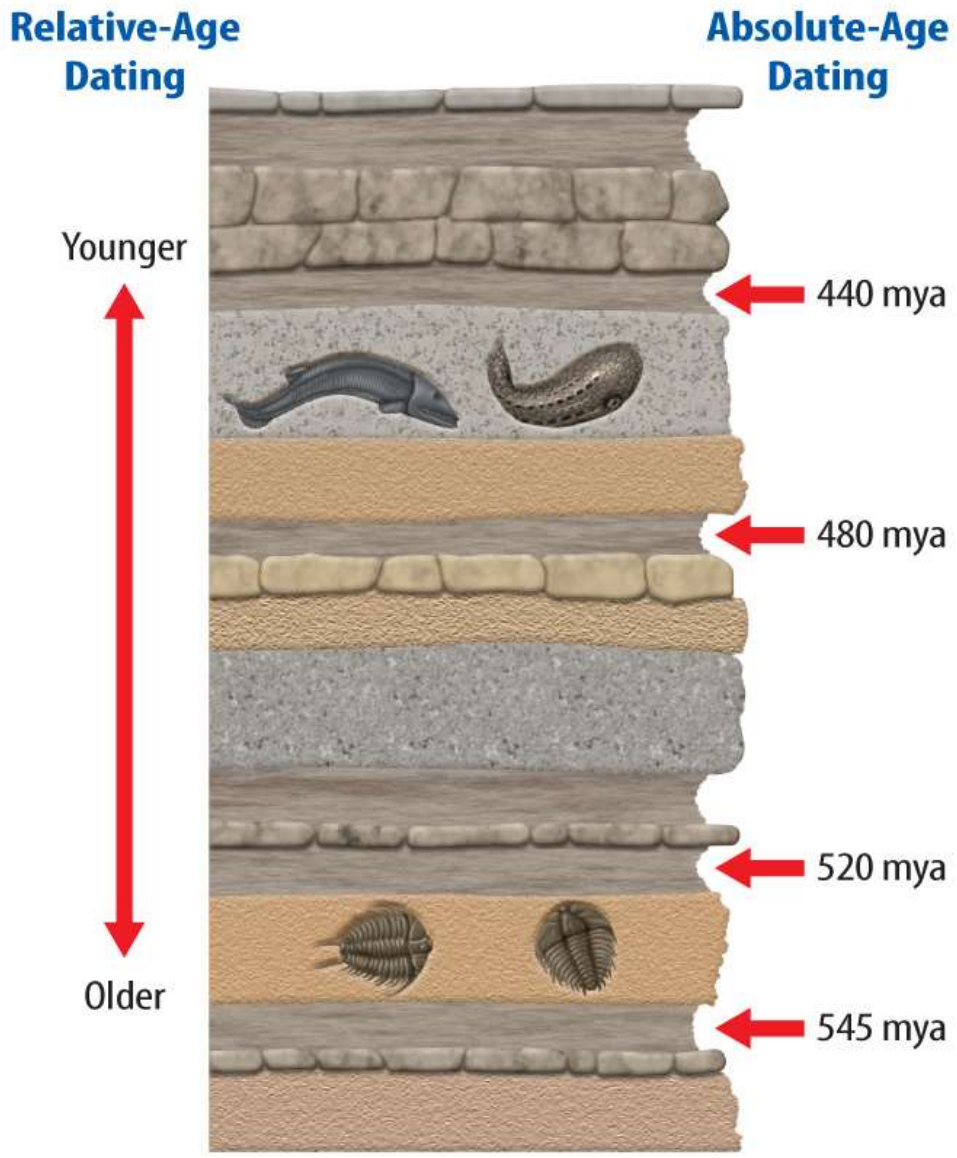
KEY CONCEPT CHECK

How does relative-age dating help scientists learn about fossils?

Determining a Fossil's Age (cont.)

- Scientists take advantage of radioactive decay, a natural clocklike process in rocks, to learn a rock's absolute age, or its age in years.
- To measure the age of sedimentary rock layers, scientists calculate the ages of igneous layers above and below them.

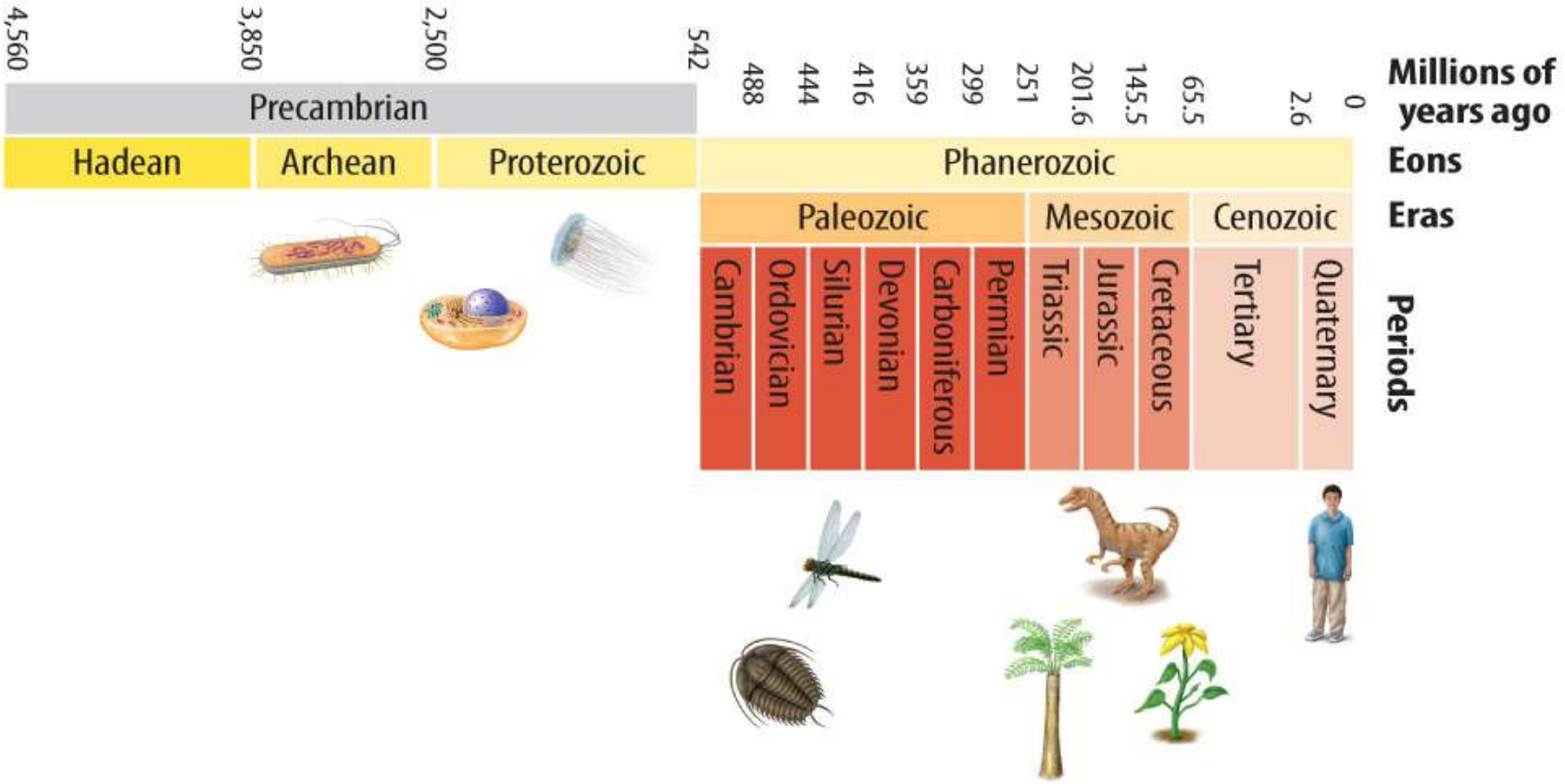
If the age of the igneous layers is known, it is possible to estimate the age of the sedimentary layers—and the fossils they contain—between them.



Fossils over Time

- The **geologic time scale** is a chart that divides Earth's history into different time units.
- Earth's history is divided into four eons—the longest time units in the geologic time scale.

The Geologic Time Scale



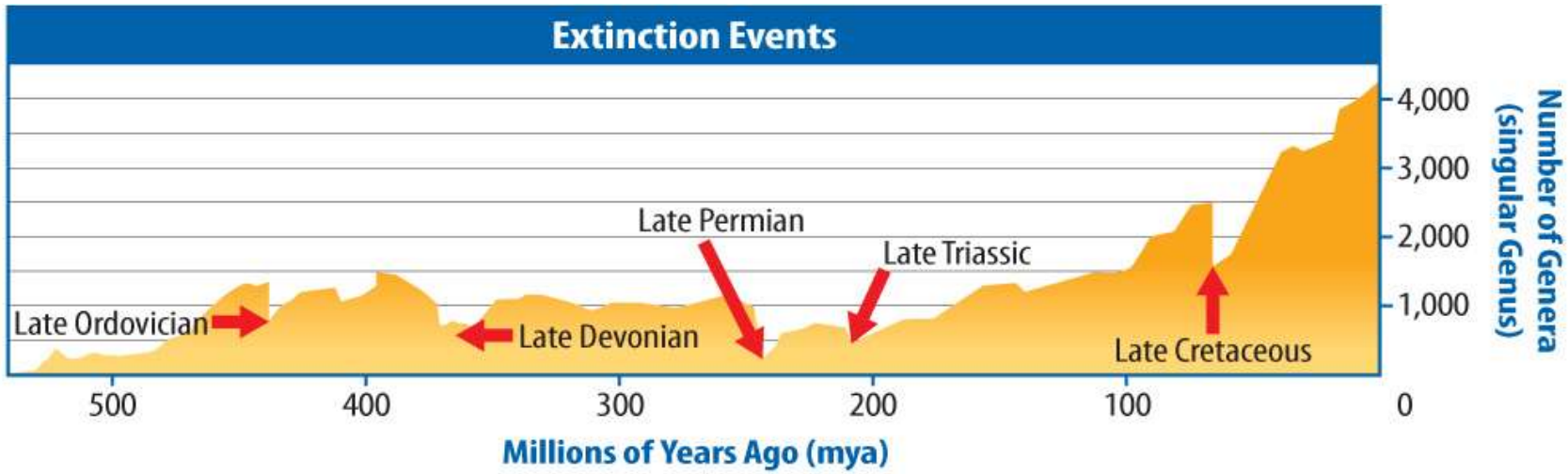
Get Animated

Extinctions

- **Extinction** occurs when the last individual organism of a species dies.
- A mass extinction occurs when many species become extinct within a few million years or less.
- Extinctions can occur when environments change.

Extinctions (cont.)

The fossil record contains evidence that five mass extinction events have occurred during the Phanerozoic eon.



Extinctions (cont.)

- The fossil record contains evidence of the appearance of many new species over time.
- **Biological evolution** is the change over time in populations of related organisms.

The fossil record is evidence that horses descended from organisms for which only fossils exist today.

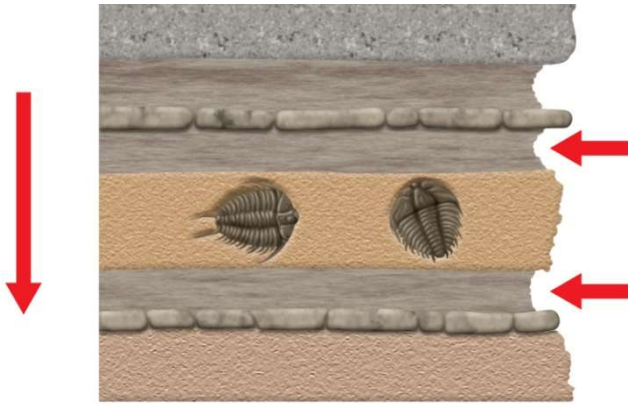
Extinctions (cont.)

KEY CONCEPT CHECK

How are fossils evidence of biological evolution?

Summary

- Fossils can consist of the hard parts or soft parts of organisms. Fossils can be an impression of an organism or consist of original tissues.
- Scientists determine the age of a fossil through relative-age dating or absolute-age dating.



Summary

- Scientists use fossils as evidence that species have changed over time.

Lesson Review

Which refers to a chart that divides Earth's history into different time units?

A. fossil record

B. geologic time scale

C. relative-age dating

D. trace fossil

Lesson Review

Which is the preserved evidence of the activity of an organism?

A. cast

B. fossil record

C. mold

D. trace fossil

Lesson Review

Which refers to the impression of an organism in a rock?

A. cast

B. fossil

C. mold

D. trace fossil

Lesson Review

What do you think NOW?

Do you agree or disagree?

1. Original tissues can be preserved as fossils.
2. Organisms become extinct only in mass extinction events.

Lesson 2

Theory of Evolution by Natural Selection

Key Concepts

- Who was Charles Darwin?
- How does Darwin's theory of evolution by natural selection explain how species change over time?
- How are adaptations evidence of natural selection?

Lesson 2

Theory of Evolution by Natural Selection

Vocabulary

- naturalist
- variation
- natural selection
- adaptation
- camouflage
- mimicry
- selective breeding

Charles Darwin

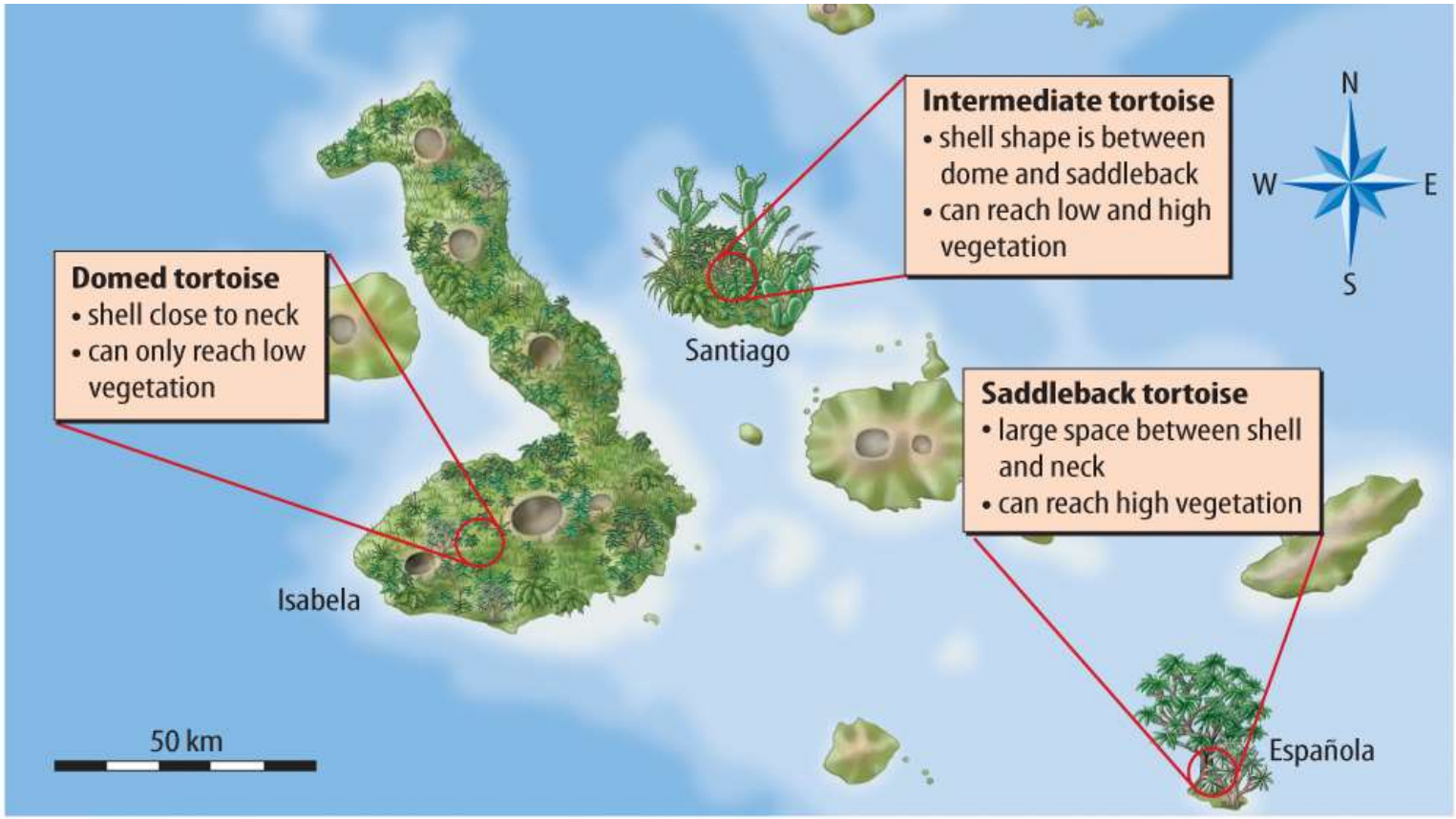
- A **naturalist** is a person who studies plants and animals by observing them.
- Charles Darwin was an English naturalist who, in the mid-1800s, developed a theory of how evolution works.

Charles Darwin (cont.)

KEY CONCEPT CHECK

Who was Charles Darwin?

Darwin found that each island in the Galápagos had a different environment, and tortoises looked different depending on which island environment they inhabited.



Darwin's Theory

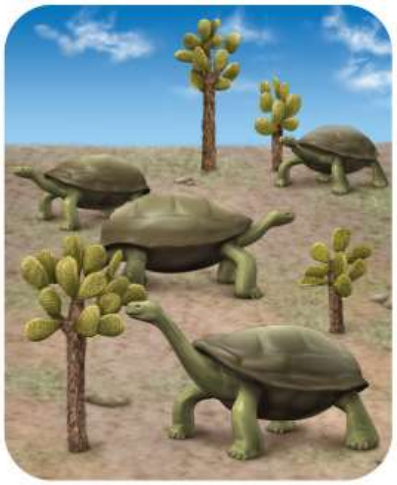
- A **variation** is a slight difference in an inherited trait of individual members of a species.
- Variations arise naturally in populations, occurring in offspring as a result of sexual reproduction.
- Genetic changes to phenotype can be passed on to future generations.

Darwin's Theory (cont.)

- **Natural selection** is the process by which populations of organisms with variations that help them survive in their environments live longer, compete better, and reproduce more than those that do not have the variations.
- Natural selection explains how populations change as their environments change.

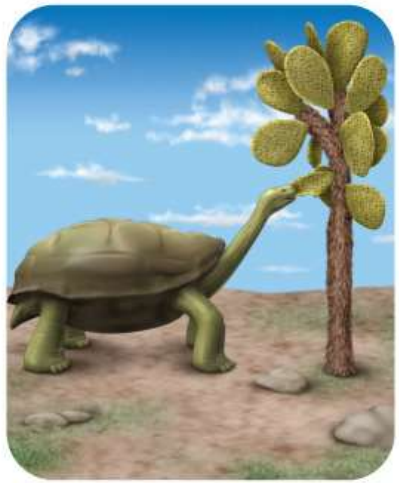
Natural Selection

1 Reproduction
A population of tortoises produces many offspring that inherit its characteristics.



2 Variation
A tortoise is born with a variation that makes its neck slightly longer.

3 Competition
Due to limited resources, not all offspring will survive. An offspring with a longer neck can eat more cacti than other tortoises. It lives longer and produces more offspring.



4 Selection
Over time, the variation is inherited by more and more offspring. Eventually, all tortoises have longer necks.

Darwin's Theory (cont.)

KEY CONCEPT CHECK

What role do variations have in the theory of evolution by natural selection?

Adaptations

- Through natural selection, a helpful variation in one individual can spread to all members of a population.
- An **adaptation** is an inherited trait that increases an organism's chance of surviving and reproducing in its environment.

Adaptations (cont.)

WORD ORIGIN

adaptation

from Latin *adaptare*, means “to fit”

Adaptations (cont.)

KEY CONCEPT CHECK

How do variations lead to adaptations?

Adaptations (cont.)

- Structural adaptations involve color, shape, and other physical characteristics.
- Behavioral adaptations involve the way an organism behaves or acts.
- Functional adaptations involve internal body systems that affect biochemistry.

Adaptations (cont.)

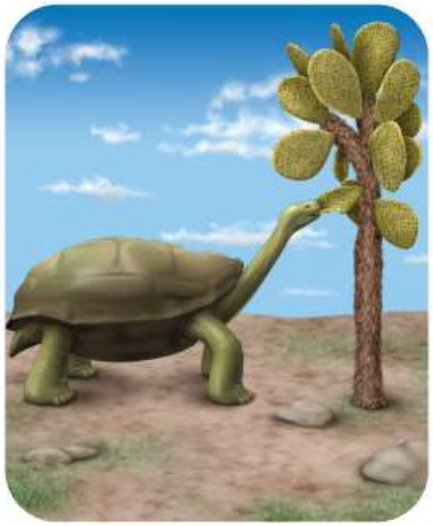
- Camouflage and mimicry are adaptations that help species avoid being eaten.
- **Camouflage** is an adaptation that enables a species to blend in with its environment.
- The resemblance of one species to another species is **mimicry**.

Artificial Selection

- The breeding of organisms for desired characteristics is called **selective breeding**.
- Darwin realized that changes caused by selective breeding were much like changes caused by natural selection.

Summary

- Charles Darwin developed his theory of evolution partly by observing organisms in their natural environment.
- Natural selection occurs when organisms with certain variations live longer, compete better, and reproduce more often than organisms that do not have the variations.



Summary

- Adaptations occur when a beneficial variation is eventually inherited by all members of a population.

Lesson Review

Which refers the process by which populations of organisms with variations that help them survive in their environments live longer, compete better, and reproduce more than those that do not have the variations?

A. adaptation

B. mimicry

C. natural selection

D. selective breeding

Lesson Review

Which is an inherited trait that increases an organism's chance of surviving and reproducing in its environment?

A. adaptation

B. camouflage

C. natural selection

D. variation

Lesson Review

What term refers to the breeding of organisms for desired characteristics?

A. adaptation

B. variation

C. natural selection

D. selective breeding

Lesson Review

What do you think NOW?

Do you agree or disagree?

3. Environmental change causes variations in populations.
4. Variations can lead to adaptations.