chapter 6 Evolution—Evidence of Change

lesson 3 Evolution and Plate Tectonics

Grade Seven Science Content Standard. 4.f. Students know how movements of Earth's continental and oceanic plates through time, with associated changes in climate and geographic connections, have affected the past and present distribution of organisms. **Also covers:** 3.c, 3.e.

MAIN Idea

The movement of Earth's plates has caused changes in land formations and in climates, which has resulted in changes in organisms.

What You'll Learn

- how plate tectonics changes land and environments
- the relationship between plate tectonics and biogeography

Before You Read

Have you seen changes in your environment that have occurred too slowly to notice at the moment you were looking? On the lines below, describe changes that occur slowly over time. Then read the lesson to learn about how Earth's plates have slowly moved, resulting in changes in organisms.

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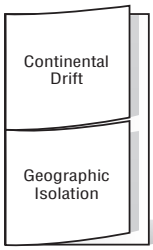
Mark the Text

Identify Main Ideas
Highlight the main ideas in each paragraph as you read the lesson.

FOLDABLES™

C Describe Make a two-tab Foldable. Label the front tabs as illustrated. Describe how continental drift and geographic isolation affect natural selection.



Read to Learn

Continental Drift

Earth's surface slowly changed over time. These changes have occurred so slowly that they are hard to notice. Earthquakes offer evidence that changes to Earth's plates are still occurring.

In 1912, Alfred Wegener suggested that the continents were once connected. This hypothesis was known as continental drift. Wegener's idea came from the similar shape of the shorelines of Africa and South America. The continental drift hypothesis led to the theory of plate tectonics. When plates move, the environment changes. This causes changes for the organisms that live on the plates.

Organisms develop adaptations to their environment. When there are changes to the environment, natural selection occurs. Natural selection means that organisms that are well suited to their environment will survive. The genes of these organisms will be passed on to their offspring. Even though plates move slowly, the resulting changes to the environment can be large. These environmental changes can cause some species to thrive and other to become extinct.

Geographic Isolation

Geographic isolation occurs when a physical barrier separates populations of species. Once separated, the populations might follow different evolutionary paths because they are in different environments. Geographic features, such as mountains, rivers, and large bodies of water can cause geographic isolation of species. Therefore, the geography of a place can effect how organisms evolve.

Does geographic isolation influence evolution?

Geographic isolation affected many of the organisms Darwin described in his journals and was the cause of much of his research. Darwin found that a species of birds on the Galápagos Islands were similar to those on Ecuador's mainland but with significant differences. Those differences were body size, beak shape, and eating habits. These observations led to the idea of evolution by natural selection. Recall that natural selection means that organisms that are well suited to their environment will survive to reproduce, and organisms that cannot adapt will die out.

What is convergent evolution?

Sometimes distant locations with similar environmental conditions have species with similar traits. These species have evolved separately but under similar conditions. This type of evolution is called **convergent evolution** and results in structural and functional similarities. Research in genetics has shown that such species may look similar but may still have different ancestors. Geographic evolution leads to closely related species that look different. Convergent evolution results in distantly related species that look similar.

How are plate tectonics and evolution related?

Earth's moving plates have affected evolution. Changes in the land, such as the formation of mountains, have resulted in the development of new species. Changes in climate have forced organisms to change as well. This has also resulted in new species. Organisms that are found at different locations on Earth may have similar features that help them survive in similar environments. Some related organisms are now separated because of plate movement. Species can become extinct if the environment changes and they do not have traits that help them survive in the new environment.

Academic Vocabulary

physical (FIH zih kul) (adj) having substance, can be touched

Think it Over

1. **Describe** How would change in a bird's body size, beak shape, and eating habits make it better suited to its environment?

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Reading Check

2. **Decide** Are species that have experienced convergent evolution closely or distantly related?

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chapter 6 Evolution—Evidence of Change

lesson 4 Classifying Organisms

Grade Seven Science Content Standard. 3.d. Students know how to construct a simple branching diagram to classify living groups of organisms by shared derived characteristics and how to expand the diagram to include fossil organisms. **Also covers:** 3.c.

MAIN Idea

Scientists use a species' physical structures and evolutionary history to group species.

What You'll Learn

- the classification system developed by Linnaeus
- how the theory of evolution has changed classification of organisms

Before You Read

Scientists organize Earth's organisms much like a librarian organizes books in a library. On the lines below, describe what types of items you organize in your own environment. Read the lesson to learn about the different systems scientists use to organize and classify organisms.

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Study Coach

Create a Quiz For each paragraph you read, think of a question and record it on a card. On the back of each card, write the answer to the question. After you finish reading, use the cards to quiz yourself.

Read to Learn

Historic Classification Systems

The Greek philosopher Aristotle was one of the first people to put organisms into some kind of order. He categorized things as animals, plants, or minerals. He also grouped things by where they lived—in the air, on the land, or in the sea. Aristotle's system was used for hundreds of years. When Europeans began exploring new lands, they found many new plants and animals. European scientists also found that they needed a new classification system to organize all the organisms.

In the mid-eighteenth century, Carolus Linnaeus, a Swedish scientist, developed a classification system that grouped organisms based on similar physical structures. This system of classifying organisms organizes them by levels. The largest group of organisms is called a kingdom and the smallest group is called a species. Species have the greatest number of traits in common. They can also breed and produce offspring that can themselves have offspring. Species can be affected by natural selection and have the ability to evolve.

Reading Check

1. **Describe** How did Linnaeus group organisms?

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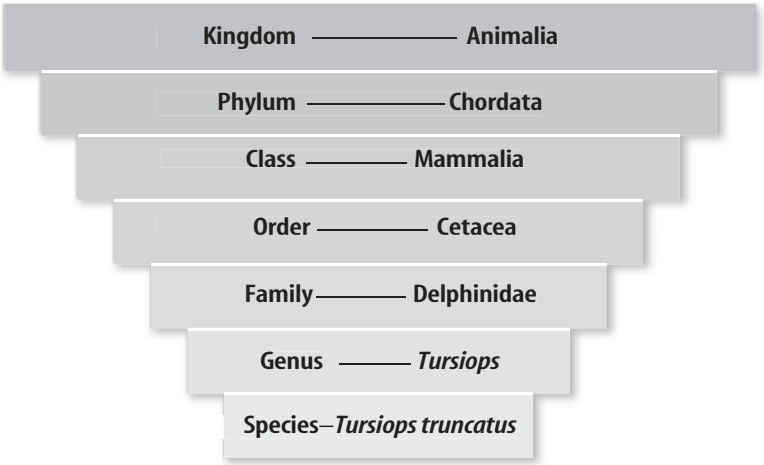
How did Linnaeus name and group species?

Linnaeus developed a system for naming species that is still used today. The species name is a two-word name. For example, the species name for the California black oak is *Quercus kelloggii.*

Groups of species that are similar belong to a genus (JEE nus). The first word of a species name indicates the genus to which the species belongs. All oaks have Quercus as the first word of their species name because they are all from the same genus. Similar genera (plural of genus) belong to the same family. Similar families belong to the same order. Similar orders belong to the same class. Similar classes belong to the same phylum. Similar phyla (plural for phylum) belong to the same kingdom.

How are kingdoms determined?

The features of organisms are used by scientists to define a kingdom. These features include cell type, the presence of a cell wall, or whether the organism is single-celled or multicellular. There are six kingdoms: Kingdom Eubacteria, Kingdom Archeabacteria, Kingdom Protists, Kingdom Fungi, Kingdom Plantae, and Kingdom Animalia. The figure below shows how a bottle-nosed dolphin can be classified.

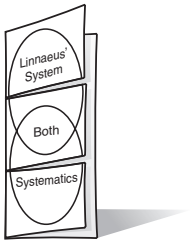


Modern Methods of Classification

Today, classification depends mostly on DNA and molecular biology to identify related organisms. This type of classification is called **systematics**.

FOLDABLES™

D Compare Make a Venn-diagram Foldable and use it to compare Linnaeus' system of classification with modern methods of classification.



Academic Vocabulary
feature (FEE chur) (noun) structure or appearance; how something looks

Picture This

2. Classify Circle the names of the kingdom and species of the bottle-nosed dolphin.

What is systematics?

Systematics is a classification system based on the evolutionary relationships between living organisms. Scientists know that the more shared DNA sequences two species have, the more likely they are to share a recent ancestor. Scientists also know that when DNA sequences show that species that were thought to be related are not related, those scientists must go back to compare the species' fossil records. Scientists must also compare the species' anatomy, or physical characteristics. ☑

Reading Check

3. Explain What is systematics?

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What is DNA hybridization?

Another method scientists use to classify organisms is called DNA hybridization. In this method, the differences in overall DNA between two organisms are measured and percentages are determined.

What is the highest level in new classification systems?

Molecular biology has supported the development of a new level of classification. In new classification systems, domain is the highest level, above kingdom. There are three domains—Bacteria, Archaea, and Eukarya. The domains are based on differences in genetic sequences. The Eukarya are organisms that have cells with a nucleus. In the future, the classification system could be changed again based on new findings in molecular biology. ☑

Reading Check

4. Describe What is a domain?

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How are classification of organisms and evolution related?

Classification involves the idea of common ancestors and the theory of natural selection. Aristotle developed the first classification system. Linnaeus used similar physical structures to place organisms into groups. He also developed the species naming system.

The system used today is based on molecular systematics. Classification involves the following levels: domain, kingdom, phylum, class, order, family, genus, and species. The first word of the name of a species identifies the genus. Classification provides an understanding of evolutionary relationships.