

Organizing Life's Diversity

section 17 Domains and Kingdoms

MAIN Idea

The most widely used biological classification system has six kingdoms within three domains.

What You'll Learn

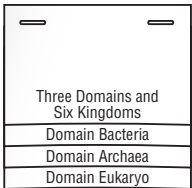
- major characteristics of the three domains
- how to classify organisms at the kingdom level

Study Coach

Make Flash Cards Make a flash card for each kingdom in this section. Write the kingdom on one side of the card. Write the characteristics of the kingdom on the other side. Use the flash cards to review what you have learned.

FOLDABLES™

Take Notes Make a layered Foldable, as shown below. As you read, take notes and organize what you learn about the three domains and six kingdoms of living organisms.



● Before You Read

Kingdom Plantae includes all plants. What kinds of organisms do you think are part of Kingdom Fungi? Write your answer on the lines below. In this section, you will learn characteristics of the domains and the kingdoms.

● Read to Learn

Grouping Species

There are three domains and six kingdoms within those domains. Organisms are classified into domains based on cell type and structure. Organisms are classified into kingdoms based on cell type, structure, and nutrition.

Recall that prokaryotes are unicellular organisms that do not have membrane-bound organelles. At one time, all prokaryotes were classified in Kingdom Monera. Today we know that there are two types of prokaryotes that are as different from each other as they are from eukaryotes. They are classified into two domains—Bacteria and Archaea.

Domain Bacteria

There is no taxonomic difference between Domain Bacteria and Kingdom Bacteria. These organisms are sometimes called eubacteria. They are prokaryotes whose cell walls contain peptidoglycan (pep tih doh GLY kan). Peptidoglycan is a polymer that contains two kinds of sugars. The amino acids on these sugars form a netlike structure that is porous and strong.

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What are the characteristics of bacteria?

Bacteria are unicellular organisms that do not have a nucleus or other membrane-bound organelles. They can survive in many environments. Some bacteria are aerobic organisms, meaning that they need oxygen to live. Others are anaerobic organisms. They cannot live if atmospheric oxygen is present. Some are autotrophic organisms that make their own food. Most are heterotrophic organisms that get their nutrition from other organisms. Bacteria are found in different shapes. Bacteria are more abundant than any other organism.

Domain Archaea

There is no taxonomic difference between Domain Archaea and Kingdom Archaea. These organisms are often called archaea (ar KEE). Most scientists think that archaea are more ancient than bacteria. Archaea are prokaryotes. They are unicellular organisms that do not have a nucleus or other membrane-bound organelles. Their cell walls do not contain peptidoglycan and they have some cytoplasmic similarities to eukaryotes.

What are the characteristics of archaea?

Archaea are found in many shapes. They obtain nutrients in several ways. Some are autotrophic organisms, but most are heterotrophic organisms. Sometimes archaea are called extremophiles because they live in the most extreme environments on Earth. Extreme environments include hot springs, salty lakes, thermal vents on the ocean floor, and the mud of marshes. Little or no oxygen is found in these environments. One type of extremophile lives near thermal vents in deep ocean waters. The water temperatures can reach 98°C, almost boiling. 

Domain Eukarya

All eukaryotes, organisms with membrane-bound organelles, are classified in Domain Eukarya. Domain Eukarya contains Kingdom Protista, Kingdom Fungi, Kingdom Plantae, and Kingdom Animalia.



Think it Over

- 1. Apply** What is a good definition of the term anaerobic?

Reading Check

- 2. Explain** Why are archaea sometimes called extremophiles?

 **Think it Over**

3. Compare How are plantlike protists and animal-like protists different?

What are the characteristics of Kingdom Protista?

Members of Kingdom Protista are called protists. **Protists** are eukaryotes and have membrane-bound organelles. They can be unicellular, a colony of cells, or multicellular. Protists are not similar to one another. However, they do not fit into any other kingdoms either. Protists are classified in three groups: plantlike protists, animal-like protists, and funguslike protists.

What are the characteristics of the three groups of protists?

Plantlike protists are called algae. Algae, such as kelp, are autotrophic organisms. They make their own food by performing photosynthesis.

Animal-like protists are called protozoans. Protozoans, such as amoebas, are heterotrophs. Plantlike protists and animal-like protists do not form organs like species in the plant and animal kingdoms.

Funguslike protists are slime molds and mildews. Euglenoids (yoo GLEE noyds) are protists that have both plantlike and animal-like characteristics. Euglenoids are usually grouped with plantlike protists because they perform photosynthesis.

What are the characteristics of Kingdom Fungi?

A member of Kingdom Fungi is called a fungus. A **fungus** is a eukaryote that absorbs nutrients from organic materials in its environment. Fungi are unable to move. Their cell walls contain chitin, which is a rigid polymer that gives cells structural support. Fungi also have hyphae (HI fee). Hyphae are threadlike strands that enable the fungi to grow, feed, and reproduce. More than 70,000 species of fungi have been identified.

Most fungi, such as mushrooms, are multicellular. A few fungi, such as yeasts, are unicellular. Fungi are heterotrophs. Unlike other heterotrophic organisms that digest food internally, fungi secrete digestive enzymes into their food source and then absorb the nutrients directly into their cells.


Parasitic fungi include saprobes and symbionts. They grow and feed on other organisms. Saprobes get their nourishment from dead or decaying organic matter. Symbionts that live in a mutualistic relationship with algae are lichens. Lichens get their food from algae that live among the fungi's hyphae.

 **Reading Check**

4. Define What are hyphae?

What are the characteristics of Kingdom Plantae?

Members of Kingdom Plantae (PLAN tuh) are called plants. There are more than 250,000 species of plants in Kingdom Plantae. Plants form the base of all land habitats.

All plants are multicellular. The cell walls of all plants contain cellulose. Most plants are autotrophs. Plants convert energy from the Sun through photosynthesis. A few plants also obtain energy from other organisms. For example, the dodder is a parasitic plant. It obtains food through suckers connected to the host plant. 

All plants have cells that are organized into tissues. Most vascular plants have organs such as roots, stems, and leaves. Plants cannot move. However, some plants have reproductive cells that have flagella. The flagella can move the reproductive cells through water.


What are the characteristics of Kingdom Animalia?

Members of Kingdom Animalia are called animals. All animals are heterotrophs and are multicellular. Animals are eukaryotic organisms and have membrane-bound organelles.

Animals do not have cell walls. They have cells that are organized into tissues. Most animals have tissues that are organized into organs such as skin, a stomach, and a brain. Animal organs are often organized into complex organ systems, such as digestive, circulatory, and nervous systems.

Animals range in size from a few millimeters to many meters. Animals live in water, on land, and in the air. Most animals are able to move. A few animals such as coral cannot move in their adult form.

Is there an exception to the classification system?

If you have ever had a cold or the flu, you have had a virus. A virus is a nucleic acid that is surrounded by a protein coat. Viruses do not have cells, and they are not cells. Viruses are not considered to be living. Because they are not living, they are not usually placed in the biological classification system. 

Virologists, scientists who study viruses, have created a special classification system to group viruses. Viral classification is based on a variety of factors.

Reading Check

5. State How many species are in Kingdom Plantae?

Reading Check

6. Explain Why are viruses an exception to the classification system?

Picture This

7. Name What is an example of an animal that cannot move as an adult?

What characteristics define differences in the six kingdoms?

The characteristics of living things are summarized in the table below. The table shows the similarities and differences in cell type and structure, nutrition, habitat, and mobility. As you review the table, think of organisms that fit into each kingdom.

Kingdom Characteristics				
Kingdom	Cell Type and Structure	Nutrition	Habitat	Mobility
Bacteria	prokaryotes with cell walls made of peptidoglycan	most are heterotrophic; some are autotrophic	live in many environments	can move
Archaea	prokaryotes with cell walls that are not made of peptidoglycan	most are heterotrophic; some are autotrophic	live in extreme environments	can move
Protista	unicellular and multicellular eukaryotes	autotrophic and heterotrophic	live in moist environments	can move
Fungi	unicellular and multicellular eukaryotes with cell walls made of chitin	heterotrophic	live in many environments	cannot move
Plantae	multicellular eukaryotes with cell walls made of cellulose	most are autotrophic and perform photosynthesis; some are heterotrophic	live in water and on land	cannot move
Animalia	multicellular eukaryotes without cell walls	heterotrophic	live in water, on land, and in air	most can move; some cannot move, such as adult coral