

You will learn how scientists have developed a branch of biology known as taxonomy, the goal of which is to organize the great diversity of life. You will also learn why this organization of living things into a scientific framework is important to understanding the great diversity of life.

Taxonomy is the branch of biology that organizes living things based on shared characteristics and evolutionary history.

A **domain** is the largest group into which life is organized. There are three domains: Archaea, Bacteria, and Eukarya.

A **prokaryote** is an organism whose cells do not have a nucleus or membrane-bound organelles.

Eukaryotes are organisms with cells that have a nucleus enclosed by a membrane.



GUIDED INSTRUCTION

DIRECTIONS Read the following information and answer the questions.

Imagine that you walk into your local supermarket to buy a gallon of milk. You probably would know exactly where to go to find the milk. Now imagine that you walk into an unfamiliar supermarket while you are on vacation. In this case, you would know to look for the dairy section to find the milk. Finally, imagine that you walk into a supermarket that has been hit by a tornado. Now you would have to start searching all over the store to find that gallon of milk. Organizing everything into a logical system makes it much easier to find just what you were looking for. The same is true in biology.

The diversity of life can be compared to that supermarket hit by a tornado. Organizing the diversity of life, however, would make it more like your local supermarket. If the diversity of life were somehow organized, a biologist would know exactly where to look when searching for something. People have long recognized the value of organizing the diversity of life. Over 2000 years ago, the Greek philosopher Aristotle organized life. He formed two groups of living things—plants and animals. He then divided animals according to where they lived—land, sea, or water. Aristotle then divided plants according to differences in their stems. However, each group of organisms still contained quite a diversity of life.

Today, biologists have a much better system than Aristotle's. This system organizes life based on the characteristics and evolutionary history that organisms share. The branch of biology that organizes life in such a way is called **taxonomy**. Taxonomy has led to the organization of life based on a hierarchical system.

Guided Questions

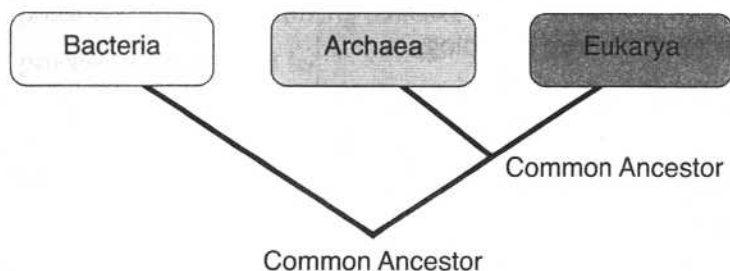
Into what group would Aristotle place a human?

This simply means that the system is organized so that organisms placed in a larger group share only certain characteristics, while organisms placed in a smaller group are much more alike.

The largest groups of living things are called **domains**. There are three domains: Archaea, Bacteria, and Eukarya. The domains Archaea and Bacteria contain **prokaryotes**, which are organisms whose cells do not have a nucleus or membrane-bound organelles. Members in each of the two prokaryotic domains differ in the chemical makeup of their cell membranes and cell walls. They also differ in their response to antibiotics, which are chemical substances that destroy bacteria. The third domain, Eukarya, contains only eukaryotes. **Eukaryotes** are organisms with cells that have a nucleus enclosed by a membrane.

As prokaryotes, members of Archaea and Bacteria have more in common with each other than either one does with members of Eukarya. For example, both Archaea and Bacteria include organisms whose cells lack organelles and whose chromosomes consist only of a loop of a single DNA molecule. In contrast, Eukarya include organisms whose cells contain organelles. In addition, their chromosomes have a more complex structure. However, in terms of evolutionary relationships, Archaea are more closely related to Eukarya than they are to Bacteria.

The illustration below shows how these three domains are organized in terms of their evolutionary relationships. Notice that Archaea and Eukarya share a common ancestor more recently in evolutionary history. This relationship is based on the fact that although Archaea are prokaryotes, their genetic information is more like that of Eukarya.



The members of Archaea are much alike, just as the members of Bacteria are much like each other. However, the domain Eukarya still contains a wide variety of organisms. As a result, this taxonomic group is divided into smaller groups called kingdoms. There are four kingdoms—Protista, Fungi, Plantae, and Animalia.

- *Protista* The kingdom Protista is made up of a great variety of organisms. Some protists are multicellular. Although they resemble plants, these multicellular protists lack the specialized structures, such as roots and stems, that are

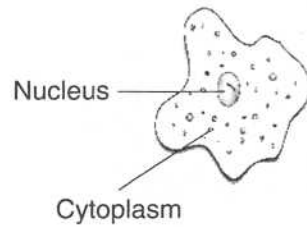
Guided Questions

How are Archaea and Bacteria similar to each other but different from Eukarya?

In what way is Archaea more closely related to Eukarya than to Bacteria?

Why is only the **domain** Eukarya subdivided into kingdoms?

characteristic of plants. However, most protists consist of just a single cell. An example is an amoeba, which is shown in this illustration.



The kingdom Protista points out one difficulty biologists face in developing taxonomic groups. Many species of protists are more unlike each other than plants are to animals. As a result, one criterion used to place an organism in the kingdom Protista is simply that the organism cannot be placed in any of the other three kingdoms. An example is an organism called *Euglena*. This single-celled organism can make its own food, just as plants do. However, *Euglena* can also feed on other organisms, just as animals do. As a result, *Euglena* is grouped or classified in the kingdom Protista.

- **Fungi** The kingdom Fungi contains single-celled and multicellular eukaryotes. All members of this kingdom share one characteristic. This characteristic involves their method of obtaining nutrients. Fungi do not make their own food like plants do. Fungi also do not ingest and then digest food like animals do. Rather fungi release enzymes to digest substances outside their body and then absorb the nutrients. The illustration below shows a fungus that is absorbing nutrients from a tree stump.



- **Plantae** The kingdom Plantae contains multicellular organisms that use photosynthesis as a source of energy. Photosynthesis is important not only as a source of energy for plants but also for all animals that ultimately get their nutrients from plants. Plants exist in a wide variety of sizes and shapes. A plant can be as small as a candy sprinkle, such as the world's smallest flowering plant commonly called watermeal that floats on water. A plant can also be as tall as 85 meters, such as the giant sequoia tree.

Guided Questions

What is unusual about the kingdom Protista?

What is characteristic of all members of the kingdom Fungi?

What is characteristic of all members of the kingdom Plantae?

- *Animalia* The kingdom Animalia contains multicellular organisms that depend on other organisms as their source of energy. To obtain this energy, animals eat either other animals or plants. Like plants, animals exist in a wide variety of sizes and shapes. One of the simplest animals is the sponge. Unlike almost all animals, sponges do not move. Rather, they live in the sea where they obtain nutrients by filtering the seawater. At one time, sponges were placed in kingdom Plantae. However, they were reclassified because of their inability to make their own food.

Sponges provide an important lesson about taxonomy. Classifying organisms, or placing them in groups, is not always easy. Furthermore, once an organism has been placed in a taxonomic group, it may be reclassified as more information about the organism is discovered. The problem gets even more involved when you consider that domains and kingdoms are not the only taxonomic groups. As you will learn in the next lesson, biologists have developed six levels of classification below the kingdom.

Guided Questions

What is characteristic of all members of the kingdom Animalia?



SHORT-ANSWER QUESTIONS

DIRECTIONS Answer the following questions.

1. What are the three domains to which all organisms belong?

2. What are the four kingdoms into which the domain Eukarya is subdivided?

3. What characteristics do members of the four kingdoms in the domain Eukarya share?

4. In the past, the members of the domains Archaea and Bacteria were classified in the same kingdom known as Monera. What might be a reason for classifying these domains into a single kingdom?

5. Which feature do organisms in the kingdoms Plantae and Animalia share?

 APPLY THE TEKS

DIRECTIONS Read the paragraph, study the diagram, and answer the questions.

A student prepared the table below to summarize the characteristics of the four kingdoms that make up the domain Eukarya. An autotroph is an organism that produces its own nutrients to obtain the energy it needs. A heterotroph depends on other organisms for its energy needs.

Kingdom	Cell Type	Body Type	Method of Nutrition
<i>Protista</i>	<i>eukaryotic</i>	<i>unicellular/multicellular</i>	<i>autotrophic/heterotrophic</i>
<i>Fungi</i>			
<i>Plantae</i>			
<i>Animalia</i>			

1. What terms should the student use to complete this table for Fungi?

2. How should the student complete this table for Plantae?

3. How should this student complete this table for Animalia?



STAAR PRACTICE

DIRECTIONS Read each question and choose the best answer.
Then circle the letter for the correct answer.

- 1 Which of the following does not apply to a classification system that biologists have developed?
 - A It can change.
 - B It is hierarchical.
 - C It considers only physical traits.
 - D It can indicate evolutionary relationships.

- 2 An organism is unicellular, contains organelles, and can produce its own nutrients to use as an energy source. Into which kingdom should you place this organism?
 - A Plantae
 - B Animalia
 - C Protista
 - D Fungi

- 3 An organism is unicellular. Which statement about this organism is correct?
 - A This organism may be found in any of the three domains.
 - B This organism must be classified in either the Archaea or Bacteria domain.
 - C This organism can belong to any of the kingdoms in the domain Eukarya.
 - D This organism must be classified as a prokaryote.

- 4 Which branch of biology organizes living things based on their shared characteristics and evolutionary history?
 - A Evolution
 - B Genetics
 - C Ecology
 - D Taxonomy



STAAR PRACTICE: CUMULATIVE

DIRECTIONS Read each question and choose the best answer.
Then circle the letter for the correct answer.

- 1 A scientist named Carl Woese developed the three domain system for classifying life in 1990. He based his system on analyzing the chemical composition of a nucleic acid found in ribosomes. Which biomolecule did Woese study to develop his three domain systems?
- A Proteins
 - B Enzymes
 - C DNA
 - D RNA
- 2 Which of the following would not be found in the Protista, Fungi, Plantae, or Animalia kingdoms?
- A Eukaryotes
 - B Prokaryotes
 - C Single-celled organisms
 - D Multicellular organisms
- 3 Cells carry out various processes. Which of the following cellular processes would be found in an organism belonging to any of the three domains?
- A Replication
 - B Recombination
 - C Digestion
 - D Cell specialization
- 4 Which biomolecule contains the genetic information for an organism that is classified in any of the three domains?
- A Enzymes
 - B Proteins
 - C DNA
 - D RNA