

KEY CONCEPT



Protists are a diverse group of organisms.

◀ BEFORE, you learned

- Organisms are grouped into six kingdoms
- Bacteria are single-celled organisms without a nucleus
- Viruses are not living things

▶ NOW, you will learn

- About characteristics of protists
- About the cell structure of protists
- How protists get their energy

VOCABULARY

algae p. 31
plankton p. 33
protozoa p. 34

THINK ABOUT

Where can protists be found?

Protists include the most complex single-celled organisms found on Earth. Fifty million years ago, a spiral-shelled protist called a nummulitid was common in some oceans. Even though its shell was the size of a coin, the organism inside was microscopic and single celled. When the organism died, the shells accumulated on the ocean floor. Over millions of years, the shells were changed into the rock called limestone. This limestone was used to build the great pyramids of Egypt. Some of the most monumental structures on Earth would not exist without organisms made of just a single cell.



Most protists are single-celled.

When Anton van Leeuwenhoek began using one of the world's first microscopes, he looked at pond water, among other things. He described, in his words, many "very little animalcules." Some of the organisms he saw probably were animals, microscopic but multicellular animals. However, many of the organisms Leeuwenhoek saw moving through the pond water had only a single cell. Today, more than 300 years later, scientists call these single-celled organisms protists.

Protists include all organisms with cells having nuclei and not belonging to the animal, plant, or fungi kingdoms. In other words, protists may be considered a collection of leftover organisms. As a result, protists are the most diverse of all the kingdoms.

INVESTIGATE Protists

What lives in pond water?

PROCEDURE

- 1 Using a dropper, place one small drop of pond water in the center of a slide. Try to include some of the material from the bottom of the container.
- 2 Gently place a cover slip on the drop of water.
- 3 Observe the slide with a hand lens first.
- 4 Starting with low power, observe the slide with a microscope. Be sure to follow microscope safety procedures as outlined by your teacher. Carefully focus up and down on the water. If you see moving organisms, try to follow them by gently moving the slide.

WHAT DO YOU THINK?

- Describe and draw what you could see with the hand lens.
- Describe and draw what you could see with the microscope.
- Compare your observations with those of other students.

CHALLENGE Choose one organism that moves and observe it for some time. Describe its behavior.

SKILL FOCUS
Observing

MATERIALS

- dropper
- pond water
- slide
- hand lenses
- microscope

TIME
40 minutes



Most protists are single-celled, microscopic organisms that live in water. However, protists also include some organisms with many cells. These many-celled organisms have simpler structures than animals, plants, or fungi. They also have fewer types of cells in their bodies.

CHECK YOUR READING

Why are protists considered the most diverse group of organisms?

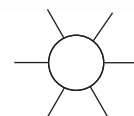
The group of protists you're probably most familiar with is seaweeds. At first glance, seaweed looks like a plant. On closer inspection scientists see that it has a simpler structure. Some seaweeds called kelp can grow 100 meters long.

The name **algae** applies to both multicellular protists and single-celled protists that use sunlight as an energy source. Both seaweed and diatoms are types of algae. Slime molds are another type of multicellular protist.

Given the many different types of organisms grouped together as protists, it is no surprise that protists play many roles in their environments. Algae are producers. They obtain energy from sunlight. Their cells provide food for many other organisms. These protists also produce oxygen, which is beneficial to many other organisms. Both of these roles are similar to those played by plants. Other protists act as parasites and can cause disease in many organisms, including humans.

VOCABULARY

Be sure to make a description wheel for *algae* and add to it as you read this section.



Diversity of Protists

Protists come in a variety of shapes and sizes.

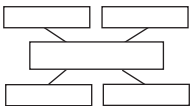


Protists live in any moist environment, including both freshwater and saltwater, and on the forest floor. Some protists move around in the water, some simply float in place, and some stick to surfaces. The photographs above show a small sample of the large variety of organisms that are called protists.

Seaweed is a multicellular protist that floats in the water and can be found washed up on beaches. Slime molds are organisms that attach to surfaces, absorbing nutrients from them. Diatoms are single-celled algae that float in water and are covered by hard shells. Euglena are single-celled organisms that can move like animals but also get energy from sunlight.

MAIN IDEA WEB

Remember to make a web of the important terms and details about the main idea: *Protists obtain their energy in three ways.* Include examples of each method of obtaining energy.



Protists obtain their energy in three ways.

Protists can be classified by their way of getting energy. Some protists capture sunlight and convert it to usable energy. Another group of protists gets its energy from other organisms. A third group absorbs materials that contain stored energy.

Some protists, such as the euglena in the upper left photograph, can even switch from one mode of life to another. They swim rapidly through pond water like animals. If they receive enough sunlight, they look green and make their own food like plants. But if they are left in the dark long enough, they absorb nutrients from their environment like fungi.



CHECK YOUR READING

Explain how the organisms in the photographs above get their energy.

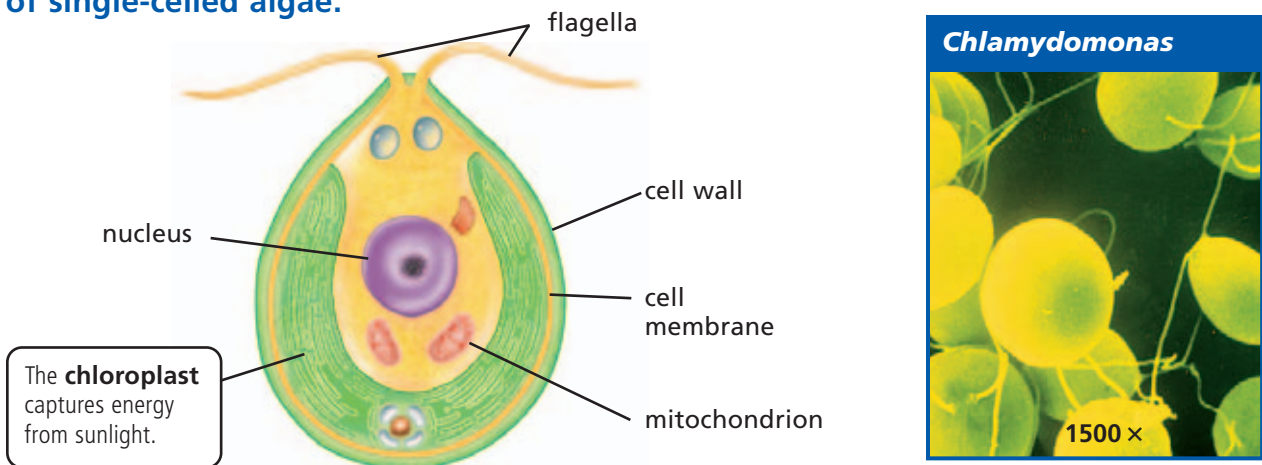
Algae

Plantlike protists, called algae, get energy from sunlight. Like plants, they use the Sun's energy, water, and carbon dioxide from the air or water. Algae contain chlorophyll, a green pigment that is necessary to capture the Sun's energy. In the process of transforming energy from sunlight, algae release oxygen gas into the air. This important process, which is called photosynthesis, also takes place in plants and some bacteria. Organisms that perform photosynthesis also supply much of the food for other organisms.

Diatoms are examples of single-celled algae. Like all algae, a diatom contains a nucleus in which to store its genetic material. Diatoms also have chloroplasts, which are the energy-producing centers that contain chlorophyll.

Algae

Algae are plantlike protists. *Chlamydomonas* is an example of single-celled algae.

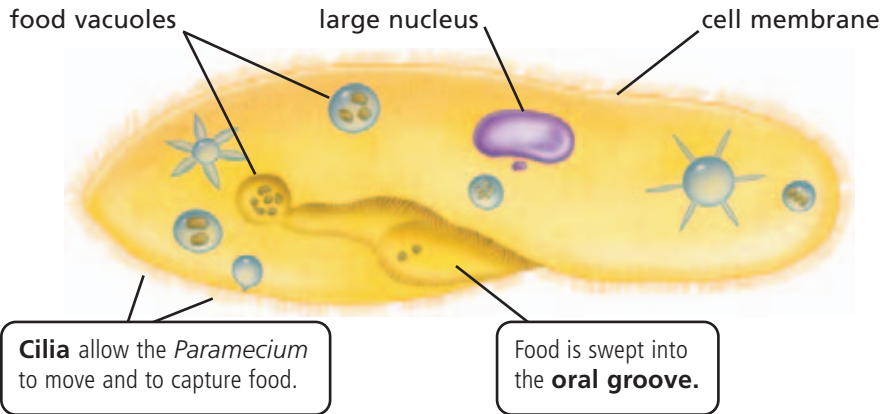


Another type of algae are microscopic colonies of nearly identical cells called volvox. These cells, arranged in a hollow ball, look like some single-celled algae. Sometimes cells break off from the hollow ball to form new colonies. The new colonies will eventually escape the parent colony. Colonial organisms such as volvox are the simplest kind of multicellular organisms. Seaweed is another example of multicellular algae.

All organisms that drift in water are called **plankton**. Plankton includes the young of many animals and some adult animals, as well as protists. Plankton that perform photosynthesis are called phytoplankton (plantlike plankton). Phytoplankton include algae and the cyanobacteria you learned about earlier. Phytoplankton live in all of the world's oceans and produce most of the oxygen animals breathe.

Protozoa

Protozoa, such as this *Paramecium*, are animallike protists.



Protozoa

Protists that eat other organisms, or decaying parts of other organisms, are animal-like protists, or **protozoa**. They include many forms, all single-celled. Protozoa cannot use sunlight as a source of energy and they must move around to obtain the energy they need to survive. Certain chemicals in protozoa can recognize when a particle of food is nearby. The food particle is usually another organism or a part of one. The protozoan ingests the food and breaks it down to obtain energy.

Some animal-like protists swim rapidly, sweeping bacteria or other protists into a groove that looks like a mouth. One example, called a paramecium, is shown above. A paramecium moves about using thousands of short wavy strands called cilia.

Another group of protozoa swim with one or more long whiplike structures called flagella. A third group of protozoa has very flexible cells. Organisms such as the amoeba ooze along surfaces. When it encounters prey, the amoeba spreads out and wraps around its food.

A number of protists live as parasites, some of which cause disease in animals and humans. One of the world's most significant human diseases, malaria, is caused by a protist. A single species of mosquito carries the parasite from human to human. When the mosquito bites an infected human, it sucks up some of the parasite along with the blood. When that same mosquito bites another human, it passes on some of the parasite. In the human blood stream, the parasite goes through a complex life cycle, eventually destroying red blood cells.

REMINDER

A parasite is an organism that lives inside or on another organism and causes the organism harm.

CHECK YOUR READING

How do protozoa and algae differ in the way they obtain energy?

Other Protists

Protists that absorb food from their environment can be called funguslike protists. These protists take in materials from the soil or from other organisms and break materials down in order to obtain energy. They are called decomposers.

The term *mold* refers to many organisms that produce a fuzzy-looking growth. Most of the molds you might be familiar with, like bread mold, are fungi. But three groups of protists are also called molds. These molds have structures that are too simple to be called fungi, and they are single celled for a portion of their lives. One example of a funguslike protist is water mold, which forms a fuzzy growth on food. This food may be decaying animal or plant tissue or living organisms. Water molds live mainly in fresh water.

Slime molds live on decaying plants on the forest floor. One kind of slime mold consists of microscopic single cells that ooze around, eating bacteria. When their food is scarce, however, many of the cells group together to produce a multicellular colony. The colony eventually produces a reproductive structure to release spores. Wind can carry spores about, and they sprout where they land.

A walk in a moist forest might give you a chance to see a third kind of mold. This organism looks like a fine net, like lace, several centimeters across, on rotting logs. These slime molds are not multicellular, but instead one giant cell with many nuclei. They are the plasmodial slime molds.



Plasmodial slime mold may grow on decaying wood after a period of rainy weather.



CHECK YOUR READING

How do funguslike protists get energy?

1.4 Review

KEY CONCEPTS

1. What are two characteristics of protists?
2. What feature do all protists have in common?
3. What are the three different types of protists?

CRITICAL THINKING

4. **Provide Examples** Some protists are dependent on other organisms and cannot live independently. Other protists are independent and have organisms that depend on them. Give an example of each.

CHALLENGE

5. **Hypothesize** Scientists are considering reclassifying protists into many kingdoms. How might they decide how many kingdoms to use and how to place organisms in these kingdoms?