Section 1

Protists

Objectives

After completing the lesson, students will be able to

A.3.1.1 Describe the characteristics of animal-like protists and give examples.

A.3.1.2 Describe the characteristics of plantlike protists and give examples.

A.3.1.3 Describe the characteristics of funguslike protists and give examples.

Target Reading Skill

Outlining Explain that using an outline format helps organize information by main topic, subtopic, and details.

Answers

Protists

I. What is a Protist?
II. Animal-Like Protists
  A. Protozoans With Pseudopods
  B. Protozoans With Cilia
  C. Protozoans With Flagella
  D. Protozoans That Are Parasites
III. Plantlike Protists
  A. Diatoms
  B. Dinoflagellates
  C. Euglenoids
  D. Red Algae
  E. Green Algae
  F. Brown Algae
IV. Funguslike Protists
  A. Slime Molds
  B. Water Molds
  C. Downy Mildews

All in One Teaching Resources

- Transparency A18

Preteach

Build Background Knowledge

L2

Characterizing Living Organisms

Review characteristics of living things. Before class, place several drops of vegetable oil in a small dish of water. Add a few drops of green food coloring to the water. Place the dish on an overhead projector. Ask students: **How can you tell whether the blobs you see are alive?** *(Sample answer: Check for reaction to stimuli, taking in food, breathing, and movement.)*

Section 1

Protists

Reading Preview

Key Concept

- What are the characteristics of animal-like, plantlike, and funguslike protists?

Key Terms

- protist • protozoan
- pseudopod
- contractile vacuole • cilia
- symbiosis • mutualism
- algae • pigment • spore

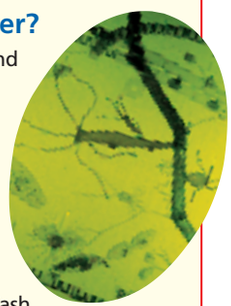
Target Reading Skill

Outlining As you read, make an outline about protists that you can use for review. Use the red section headings for the main topics and the blue headings for the subtopics.

Protists
I. What is a protist?
II. Animal-like protists
A. Protozoans with pseudopods
B.
C.

Lab zone Discover Activity

What Lives in a Drop of Pond Water?



1. Use a plastic dropper to place a drop of pond water on a microscope slide.
2. Put the slide under your microscope's low-power lens. Focus on the objects you see.
3. Find at least three different objects that you think might be organisms. Observe them for a few minutes.
4. Draw the three organisms in your notebook. Below each sketch, describe the movements or behaviors of the organism. Wash your hands thoroughly when you have finished.

Think It Over

Observing What characteristics did you observe that made you think that each organism was alive?

Look at the objects in Figure 1. What do they look like to you? Jewels? Beads? Stained glass ornaments? You might be surprised to learn that these beautiful, delicate structures are the walls of unicellular organisms called diatoms. Diatoms live in both fresh water and salt water and are an important food source for many marine organisms. They have been called the "jewels of the sea."

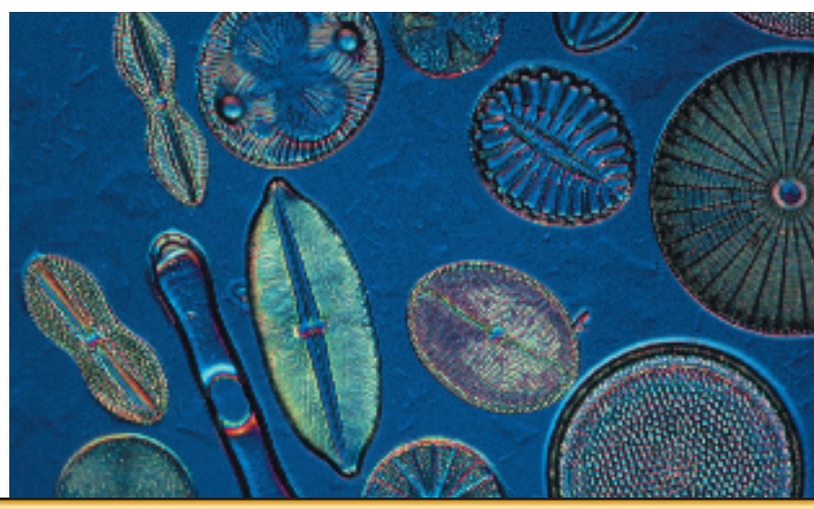


FIGURE 1
Diatoms
These glasslike organisms are classified as protists.

Lab zone Discover Activity

Skills Focus Observing

L1

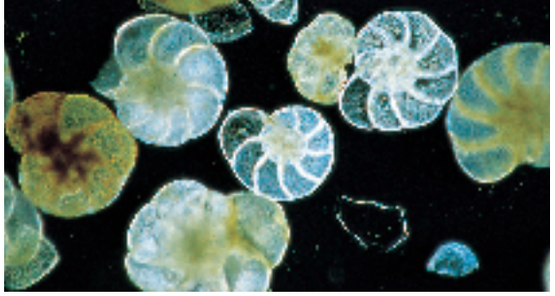
Materials plastic dropper, pond water, microscope slide, cover slip, microscope

Time 25 minutes

Tips Have students predict what they might observe in the water. Suggest students use their high-power objective lenses if they have them.

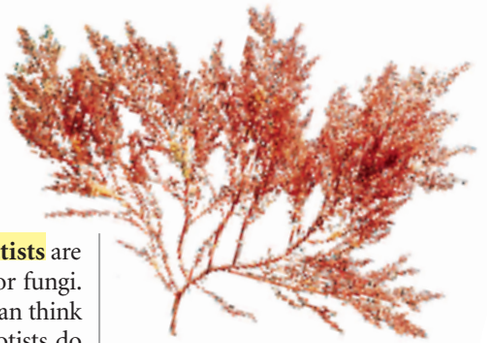
Expected Outcome Both algae and protozoans should be visible. Green algae have a greenish tint, but most organisms appear colorless. Organisms with flagella or pseudopods could be either protozoans or algae.

Think It Over Students will probably associate movement with life.



▲ These shells are the remains of unicellular, animal-like protists called foraminifera.

FIGURE 2
Protists
Protists include animal-like, plantlike, and funguslike organisms.
Comparing and Contrasting *In what ways do protists differ from one another?*



▲ This red alga is a multicellular, plantlike protist found on ocean floors.

▲ The yellow slime mold oozing off the leaf is a funguslike protist.

What Is a Protist?

Diatoms are only one of the vast varieties of protists. **Protists** are eukaryotes that cannot be classified as animals, plants, or fungi. Because protists are so different from one another, you can think of them as the "odds and ends" kingdom. However, protists do share some characteristics. In addition to being eukaryotes, all protists live in moist surroundings.

The word that best describes protists is *diversity*. For example, most protists are unicellular, but some are multicellular. Some are heterotrophs, some are autotrophs, and others are both. Some protists cannot move, while others zoom around their moist surroundings.

Because of the great variety of protists, scientists have proposed several ways of grouping these organisms. One useful way of grouping protists is to divide them into three categories, based on characteristics they share with organisms in other kingdoms: animal-like protists, plantlike protists, and funguslike protists.

Reading Checkpoint **In what kind of environment do all protists live?**

Animal-Like Protists

What image pops into your head when you think of an animal? A tiger chasing its prey? A snake slithering onto a rock? Most people immediately associate animals with movement. In fact, movement is often involved with an important characteristic of animals—obtaining food. All animals are heterotrophs that must obtain food by eating other organisms.

Like animals, animal-like protists are heterotrophs, and most are able to move from place to place to obtain food. But unlike animals, animal-like protists, or **protozoans** (proh tuh ZOH unz), are unicellular. Protozoans can be classified into four groups, based on the way they move and live.

Instruct

What Is a Protist?

Teach Key Concepts L2

Describing Protist Characteristics

Focus Emphasize that protists are highly diverse but do share some traits.

Teach Ask: **Which traits are shared by all protists?** *(They are eukaryotes that live in moist environments.)* **Name the diverse protist categories.** *(Animal-like, plantlike, funguslike)*

Apply Ask: **What characteristic would a plantlike protist have?** *(The ability to make its own food)* **learning modality: verbal**

Independent Practice L2

All in One Teaching Resources

- Guided Reading and Study Worksheet: *Protists*

Student Edition on Audio CD

Animal-Like Protists

Teach Key Concepts

Comparing Protists and Animals

Focus Ask: **What are some animal traits?** *(Sample answers: They are consumers; most can move about to obtain food.)*

Teach Explain that animal-like protists are heterotrophs and that most can move about to obtain food. Ask: **What name is given to animal-like protists?** *(Protozoans)* **How do protozoans differ from animals?** *(Protozoans are unicellular; animals are multicellular.)*

Apply Ask: **What characteristic can be used to classify protozoans?** *(How they move)* **learning modality: verbal**

Differentiated Instruction

English Learners/Beginning Comprehension: Modified Cloze L1

Distribute a simple paragraph about protists, leaving some strategic words blank. For example, "Animal-like protists are called _____. They can be grouped by how they _____ and _____." Provide students a list of the correct answers, and have them fill in each blank with one of those words. **learning modality: verbal**

English Learners/Intermediate Comprehension: Modified Cloze L2

Distribute the cloze paragraph designed for Beginning Level, but add some incorrect answers to the list of correct answers. Students can work in pairs to correct each other's answers, and to collaborate in writing a definition, in English, of the words that they filled in. **learning modality: verbal**

Monitor Progress L2

Answers

Figure 2 Structure, unicellular or multicellular; habitat

Reading Checkpoint Moist environment

Help Students Read

Previewing Visuals Refer to the Content Refresher, which provides guidelines for Previewing Visuals. Before students read the section on protozoans with pseudopods and protozoans with cilia, have them study Figures 3 and 4 and read the labels. Call on student volunteers to name protozoan structures used for locomotion *(Cilia, pseudopods)*, feeding *(Food vacuole, oral groove)*, and reproduction *(Nucleus)*. Have students read the text in this section, then together discuss the functions of the structures observed prior to reading.

Lab zone **Build Inquiry** L1

Observing Pseudopod Movement

Materials plastic dropper, amoeba culture, microscope slide, cover slip, microscope

Time 20 minutes

Focus Review with students the function of an amoeba's pseudopods.

Teach Have students place a drop of the amoeba culture on a slide, carefully add a cover slip, and then observe the organisms under low and high power.

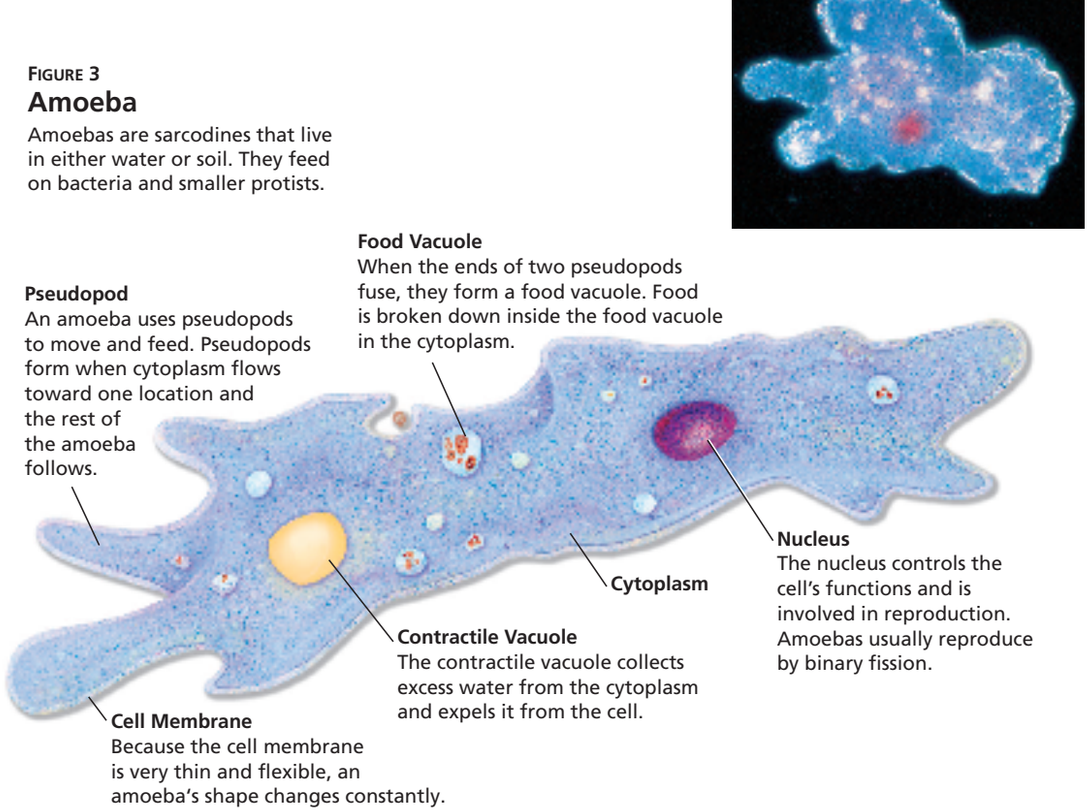
Apply Ask: **Can you tell when the amoeba is using its pseudopods to eat and when it is using them to move?** *(Students may say that when the amoeba is eating, it wraps two pseudopods around the food; when it is moving, it puts out a pseudopod and flows into it.)* Students can sketch what they observe and label the parts of the amoeba. Observations should include the organism's shape, size, and motion. **learning modality: visual**

Go Online active art

For: Amoeba and Paramecium activity
Visit: PHSchool.com
Web Code: cep-1031

Students learn about two types of protozoans, the amoeba and the paramecium.

FIGURE 3
Amoeba
Amoebas are sarcodines that live in either water or soil. They feed on bacteria and smaller protists.



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Protozoans With Pseudopods The amoeba in Figure 3 belongs to the group of protozoans called sarcodines. Sarcodines move and feed by forming **pseudopods** (SOO duh pahdz)—temporary bulges of the cell. The word *pseudopod* means "false foot." Pseudopods form when cytoplasm flows toward one location and the rest of the organism follows. Pseudopods enable sarcodines to move. For example, amoebas use pseudopods to move away from bright light. Sarcodines also use pseudopods to trap food. The organism extends a pseudopod on each side of the food particle. The two pseudopods then join together, trapping the particle inside.

Protozoans that live in fresh water, such as amoebas, have a problem. Small particles, like those of water, pass easily through the cell membrane into the cytoplasm. If excess water were to build up inside the cell, the amoeba would burst. Fortunately, amoebas have a **contractile vacuole** (kun TRAK til VAK yoo ohl), a structure that collects the extra water and then expels it from the cell.

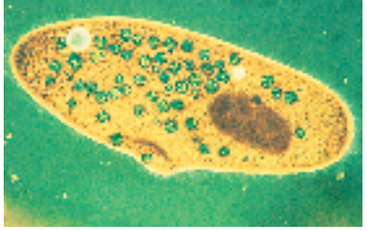
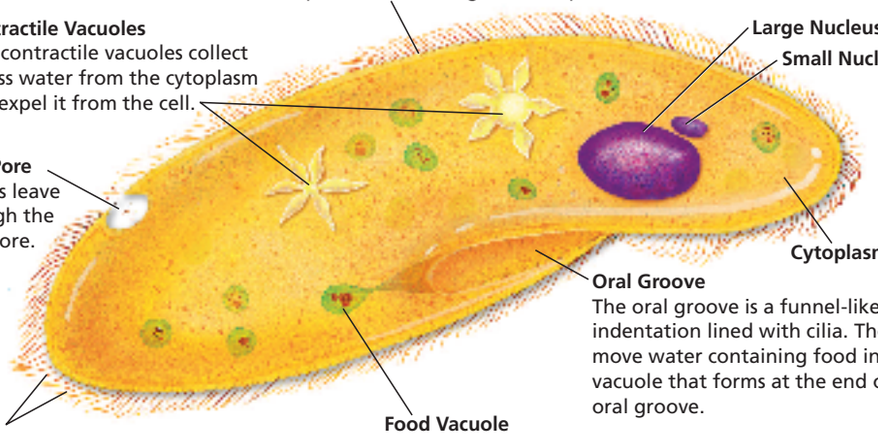


FIGURE 4
Paramecium
Paramecia are ciliates that live mostly in fresh water. Like amoebas, paramecia feed on bacteria and smaller protists.



Pellicle
A stiff but flexible covering, called the pellicle, surrounds a paramecium and gives it shape.

Contractile Vacuoles
Two contractile vacuoles collect excess water from the cytoplasm and expel it from the cell.

Large Nucleus

Small Nucleus

Anal Pore
Wastes leave through the anal pore.

Cytoplasm

Oral Groove
The oral groove is a funnel-like indentation lined with cilia. The cilia move water containing food into the vacuole that forms at the end of the oral groove.

Cilia
Thousands of cilia project through the pellicle. The beating cilia enable a paramecium to move smoothly in one direction.

Food Vacuole
A food vacuole forms and pinches off from the oral groove. It moves into the cytoplasm. Inside the vacuole, the food is broken down and then distributed.

Protozoans With Cilia The second group of animal-like protists are the ciliates. Ciliates have structures called **cilia** (SIL ee uh), which are hairlike projections from cells that move with a wavelike motion. Ciliates use their cilia to move and obtain food. Cilia act something like tiny oars to move a ciliate. Their movement sweeps food into the organism.

The cells of ciliates, like the paramecium in Figure 4, are complex. Notice that the paramecium has two contractile vacuoles that expel water from the cell. It also has more than one nucleus. The large nucleus controls the everyday tasks of the cell. The small nucleus functions in reproduction.

Paramecia usually reproduce asexually by binary fission. Sometimes, however, paramecia reproduce by conjugation. This occurs when two paramecia join together and exchange some of their genetic material.

Reading Checkpoint **What are cilia?**

Use Visuals: Figures 3 and 4 L1

Amoeba and Paramecium

Focus Have students observe the figures.

Teach Ask: **What do these two protists have in common?** *(They eat the same things, and they both have nuclei, cytoplasm, food vacuoles, and contractile vacuoles.)* Ask: **What is different about them?** *(Amoebas live in soil and water, paramecia only in water; paramecia move with cilia, amoebas move with pseudopods; paramecia ingest food into an oral groove, amoebas surround food with pseudopods; amoebas have one nucleus, paramecia have two.)*

Apply Ask: **What characteristics make the amoeba suited to life in either soil or water?** *(Sample answer: It can change its shape and flow easily through different substances. The contractile vacuole allows excess water to be expelled.)* **What characteristics make the paramecium suited to living only in water?** *(Sample answer: Its two contractile vacuoles remove excess water from the cell. Their cilia, which move the paramecium through water and sweep food into the oral groove, may not be as effective in a solid environment such as soil. Their rigid shape may hinder movement through compact soil.)* **learning modality: visual**

All in One Teaching Resources

- Transparencies A19, A20

Differentiated Instruction

Gifted and Talented L3
Investigating Protozoan Groups
Provide books or online sources on ciliate and sarcodine (amoeba) protozoans. Have students prepare and present a visual display that highlights the features of one of the two groups: the variety of protozoans in the group, what they eat, whether any cause disease to humans, and so forth. **learning modality: visual**

Less Proficient Readers L1
Identifying Protozoan Structures
Provide students with a list of amoeba and paramecium structures presented in Figures 3 and 4, and an accompanying list of their descriptions. Have students match structures with descriptions as they observe Figures 3 and 4 or the relevant transparencies. **learning modality: visual**

Monitor Progress L2

Oral Presentation Have students compare and contrast the characteristics of an amoeba and a paramecium.

Answer

Reading Checkpoint Hairlike projections from cells that move with a wavelike motion

Lab zone **Build Inquiry** L2

Modeling Animal-Like Protists

Materials clay, paint, string, pipe cleaners, cardboard, and other materials of students' choice

Time 30 minutes

Focus Challenge small groups to design models of one of the four kinds of animal-like protists.

Teach Have students consult photos in the text or in reference materials. Models should include unique details for each organism, with labels. Have students compare and contrast the models, explaining similarities and differences. They should note the structures, shapes, and methods of movement of the various animal-like protozoans.

Apply Challenge groups to use their models to demonstrate how these organisms move or feed. **learning modality: kinesthetic**

Integrating Health L1

Avoiding Health Threats of Parasites in Water

Ask students to describe ways that hikers can avoid ingesting *Giardia. (Sample answers: Carry enough water, use water purifying treatments, boil water before using.)* Inform students that the safest way to purify water of organisms is to boil it for at least three minutes. This will kill the organisms, but it will not necessarily make the water safe if the water also contains chemical pollutants. **learning modality: verbal**

FIGURE 5
Giardia
When people drink from freshwater streams and lakes, they can get hiker's disease. *Giardia intestinalis* (inset) is the protozoan responsible for this disease.
Inferring *Why is it important for hikers to filter stream water?*

Protozoans With Flagella The third group of protozoans are flagellates (FLAJ uh lits), protists that use long, whiplike flagella to move. A flagellate may have one or more flagella.

Some of these protozoans live inside the bodies of other organisms. For example, one type of flagellate lives in the intestines of termites. There, they digest the wood that the termites eat, producing sugars for themselves and for the termites. In turn, the termites protect the protozoans. The interaction between these two species is an example of **symbiosis** (sim bee OH sis)—a close relationship in which at least one of the species benefits. When both partners benefit from living together, the relationship is a type of symbiosis called **mutualism.**

Sometimes, however, a protozoan harms its host. For example, *Giardia* is a parasite in humans. Wild animals, such as beavers, deposit *Giardia* in freshwater streams, rivers, and lakes. When a person drinks water containing *Giardia*, these protozoans attach to the person's intestine, where they feed and reproduce. The person develops a serious intestinal condition commonly called hiker's disease.

Protozoans That Are Parasites The fourth type of protozoans are characterized more by the way they live than by the way they move. They are all parasites that feed on the cells and body fluids of their hosts. These protozoans move in a variety of ways. Some have flagella, and some depend on hosts for transport. One even produces a layer of slime that allows it to slide from place to place!

Many of these parasites have more than one host. For example, *Plasmodium* is a protozoan that causes malaria, a disease of the blood. Two hosts are involved in *Plasmodium's* life cycle—humans and a species of mosquitoes found in tropical areas. The disease spreads when a healthy mosquito bites a person with malaria, becomes infected, and then bites a healthy person. Symptoms of malaria include high fevers that alternate with severe chills. These symptoms can last for weeks, then disappear, only to reappear a few months later.

Reading Checkpoint **What is symbiosis?**

FIGURE 6
Malaria Mosquito
Anopheles mosquitoes can carry the parasitic protozoan *Plasmodium*, which causes malaria in people.

Plantlike Protists

Plantlike protists, which are commonly called **algae** (AL jee), are extremely diverse. **Like plants, algae are autotrophs.** Most are able to use the sun's energy to make their own food.

Algae play a significant role in many environments. For example, algae that live near the surface of ponds, lakes, and oceans are an important food source for other organisms in the water. In addition, much of the oxygen in Earth's atmosphere is made by these algae.

Algae vary greatly in size. Some algae are unicellular, while others are multicellular. Still others are groups of unicellular organisms that live together in colonies. Colonies can contain from a few cells up to thousands of cells. In a colony, most cells carry out all functions. But, some cells may become specialized to perform certain functions, such as reproduction.

Algae exist in a wide variety of colors because they contain many types of **pigments**—chemicals that produce color. Depending on their pigments, algae can be green, yellow, red, brown, orange, or even black.

Diatoms Diatoms are unicellular protists with beautiful glasslike cell walls. Some float near the surface of lakes or oceans. Others attach to objects such as rocks in shallow water. Diatoms are a food source for heterotrophs in the water. Many diatoms can move by oozing chemicals out of slits in their cell walls. They then glide in the slime.

When diatoms die, their cell walls collect on the bottoms of oceans and lakes. Over time, they form layers of a coarse substance called diatomaceous (dy uh tuh MAY shus) earth. Diatomaceous earth makes a good polishing agent and is used in household scouring products. It is even used as an insecticide—the diatoms' sharp cell walls puncture the bodies of insects.

Dinoflagellates Dinoflagellates (dy noh FLAJ uh lits) are unicellular algae surrounded by stiff plates that look like a suit of armor. Because they have different amounts of green, orange, and other pigments, dinoflagellates exist in a variety of colors.

All dinoflagellates have two flagella held in grooves between their plates. When the flagella beat, the dinoflagellates twirl like toy tops as they move through the water. Many glow in the dark. They light up the ocean's surface when disturbed by a passing boat or swimmer.

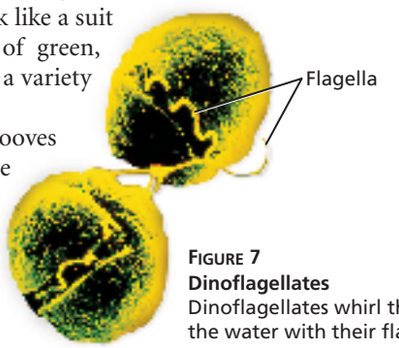


FIGURE 7
Dinoflagellates
Dinoflagellates whirl through the water with their flagella.

Lab zone Try This Activity

Watching Protists

In this activity you will watch the interaction between paramecium, an animal-like protist, and *Chlorella*, a plantlike protist.

1. Use a plastic dropper to place 1 drop of paramecium culture on a microscope slide. Add some cotton fibers to slow down the paramecia.
2. Use the microscope's low-power objective to find some paramecia.
3. Add 1 drop of *Chlorella* to the paramecium culture on your slide.
4. Switch to high power and locate a paramecium. Observe what happens. Then wash your hands.

Inferring What evidence do you have that paramecia are heterotrophs? That *Chlorella* are autotrophs?

Lab zone Try This Activity

Skills Focus Inferring L2

Materials paramecium culture, *Chlorella* culture, plastic dropper, microscope and slide, cotton fibers

Time 15 minutes

Tip Students can also slow down the paramecia by placing a coverslip over the drop of culture and absorbing water from the edge of the coverslip with lens paper, or by adding a drop of 2–3% clear gelatin solution to the drop of culture. Make sure students wash their hands after the activity.

Expected Outcome Green food vacuoles form inside the paramecia as they ingest the *Chlorella*. Students should conclude that paramecia are heterotrophs, while *Chlorella* are autotrophs. **learning modality: visual**

Plantlike Protists

Teach Key Concepts L2

Describing Plantlike Protists

Focus Have students look at the pictures in this section of plantlike protists.

Teach Ask: **What is the name commonly used for plantlike protists?** *(Algae)* **How are algae similar to plants?** *(They are autotrophs—they can make their own food.)* **What traits of algae vary greatly?** *(Size—unicellular to colonies of thousands of cells; colors—green, red, brown, yellow, orange, or black)*

Apply Explain that algae can make their own food. Ask: **What important role do algae, like plants, play in the environment?** *(They produce oxygen and serve as an important food source for other organisms.)* **learning modality: logical/mathematical**

All in One Teaching Resources

- Transparencies A21, A22

Monitor Progress L2

Oral Presentation Ask students to give the other names for animal-like protists and plantlike protists. *(Animal-like—protozoans; plantlike—algae)*

Answers

Figure 5 To remove disease-causing *Giardia* and other harmful organisms from the water

Reading Checkpoint A close relationship between two species in which at least one of the species benefits

Lab zone Build Inquiry

L2

Building Models of Algae

Materials none

Time 15 minutes

Focus Direct students to make a "living" model of how algae of various sizes take in food and eliminate waste.

Teach Divide the class into three groups: unicellular algae, multicellular algae, and a colony of algae. Have each student act out the role of an individual algae cell. Give each group a deck of cards to use as a food source, and encourage the "cells" to act out how each organism accomplishes food intake and waste elimination.

Apply Have students describe food intake and waste elimination in terms of whether they are individual or cooperative processes. *(Sample answers: unicellular: individual students pick up and put down cards without interacting; multicellular: cooperative model—one student picks up a card and passes it on, another puts it down; colony: both individual and cooperative.* **learning modality: kinesthetic**

Help Students Read

Summarizing Summarizing the information presented in the text will help students to focus on main ideas and remember what they read. Have students read the paragraphs describing the types of plantlike protists and summarize them by restating the main ideas in their own words.

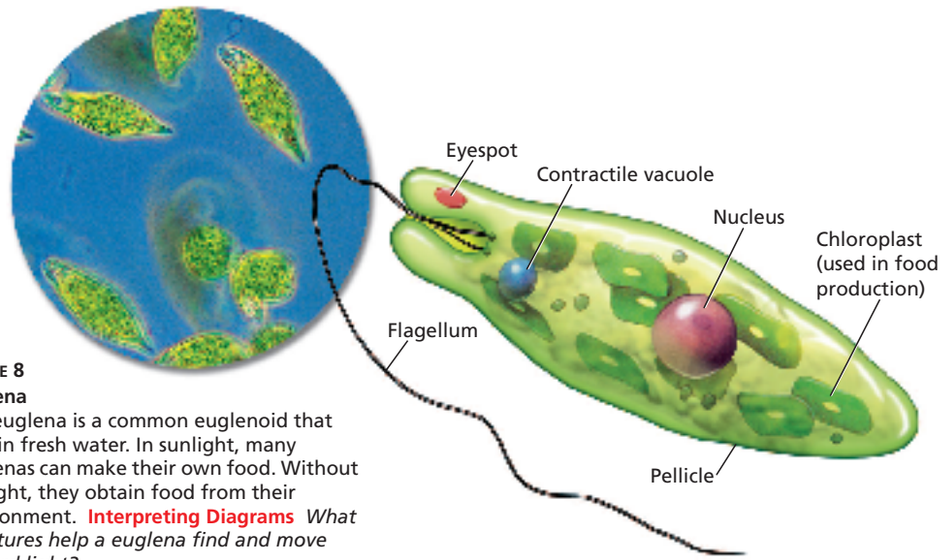


FIGURE 8
Euglena
The euglena is a common euglenoid that lives in fresh water. In sunlight, many euglenas can make their own food. Without sunlight, they obtain food from their environment. **Interpreting Diagrams** *What structures help a euglena find and move toward light?*

Euglenoids

Euglenoids (yoo GLEE noydz) are green, unicellular algae that are found mostly in fresh water. Unlike other algae, euglenoids have one animal-like characteristic—they can be heterotrophs under certain conditions. When sunlight is available, most euglenoids are autotrophs that produce their own food. However, when sunlight is not available, euglenoids will act like heterotrophs by obtaining food from their environment. Some euglenoids live entirely as heterotrophs.

In Figure 8, you see a euglena, which is a common euglenoid. Notice the long, whiplike flagellum that helps the organism move. Locate the eyespot near the flagellum. Although the eyespot is not really an eye, it contains pigments. These pigments are sensitive to light and help the euglena recognize the direction of a light source. You can imagine how important this response is to an organism that needs light to make food.

Red Algae

Almost all red algae are multicellular seaweeds. Divers have found red algae growing more than 260 meters below the ocean's surface. Their red pigments are especially good at absorbing the small amount of light that is able to reach deep ocean waters.

People use red algae in a variety of ways. Carrageenan (ka ruh JEE nun) and agar, substances extracted from red algae, are used in products such as ice cream and hair conditioner. For people in many Asian cultures, red algae is a nutrient-rich food that is eaten fresh, dried, or toasted.

Lab zone Skills Activity

Predicting

Predict what will happen when you pour a culture of euglena into a petri dish, and then cover half the dish with aluminum foil. Give a reason for your prediction.

Then carry out the experiment with a culture of euglena in a plastic petri dish. Cover half the dish with aluminum foil. After 10 minutes, uncover the dish. What do you observe? Was your prediction correct? Explain why euglena behave this way.

Lab zone Skills Activity

L2

Skills Focus Predicting

Materials euglena culture, plastic petri dish, aluminum foil, compound microscope

Time 20 minutes

Tips Tell students to record their predictions and the reasons for them. Make sure students wash their hands after handling the paramecium cultures.

Expected Outcome Students will probably predict that the euglena will move toward the light because it needs light to make food. The result of the experiment will confirm this prediction. The covered area will no longer be green, because the euglena have moved to the uncovered area and the light.

Extend Ask students to identify the source of the green tint of the euglena culture. *(Chloroplasts)* **learning modality: visual**

FIGURE 9
Green Algae
Green algae range in size from unicellular organisms to multicellular seaweeds. This multicellular sea lettuce, *Ulva*, lives in oceans.

Green Algae Green algae, which contain green pigments, are quite diverse. Most green algae are unicellular. Some, however, form colonies, and a few are multicellular. Most green algae live in either fresh water or salt water. The few that live on land are found on rocks, in the crevices of tree bark, or in moist soils.

Green algae are actually very closely related to plants that live on land. Green algae and plants contain the same type of green pigment and share other important similarities. In fact, some scientists think that green algae belong in the plant kingdom.

Brown Algae Many of the organisms that are commonly called seaweeds are brown algae. In addition to their brown pigment, brown algae also contain green, yellow, and orange pigments. As you can see in Figure 10, a typical brown alga has many plantlike structures. Holdfasts anchor the alga to rocks. Stalks support the blades, which are the leaflike structures of the alga. Many brown algae also have gas-filled sacs called bladders that allow the algae to float upright in the water.

Brown algae flourish in cool, rocky waters. Brown algae called rockweed live along the Atlantic coast of North America. Giant kelps, which can grow as long as 100 meters, live in some Pacific coastal waters. The giant kelps form large underwater "forests" where many organisms, including sea otters and abalone, live.

Some people eat brown algae. In addition, substances called algins are extracted from brown algae and used as thickeners in puddings and other foods.

Reading Checkpoint **What color pigments can brown algae contain?**

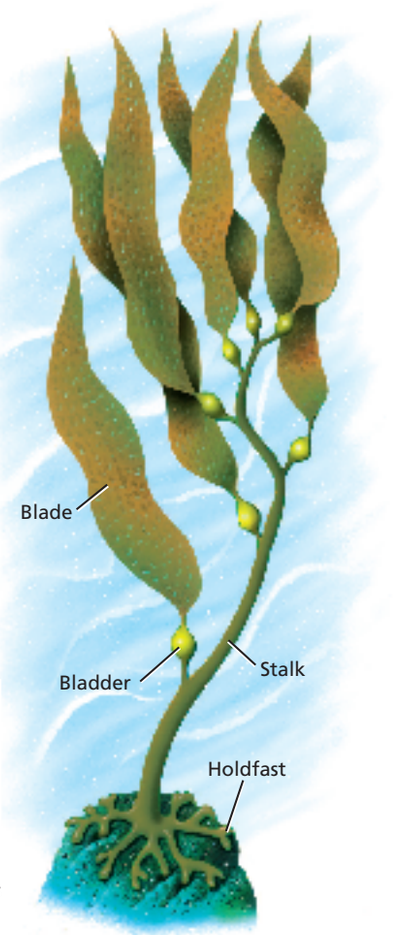


FIGURE 10
Brown Algae
Giant kelps are brown algae that have many plantlike structures.
Interpreting Diagrams *What plant structures do the kelp's holdfasts and blades resemble?*

Use Visuals: Figure 8 L1

Euglena

Focus Emphasize that a unicellular organism can have functional structures.

Teach Ask: **How many cells does a euglena have?** *(One)* Point out that structures such as flagella, the eyespot, and the chloroplast are all part of the same cell. Some students may be confused that a unicellular organism has so many parts. Explain that a cell is the smallest structure capable of performing all the functions required for life.

Apply Ask: **Is the cell shown in the figure specialized to do certain tasks?** *(No, it performs all the functions necessary to maintain the euglena's life.)* **learning modality: visual**

Address Misconceptions

Not All Red Algae Are Red

Focus Explain that algae contain other pigments in addition to the dominant pigment. The combination of pigments creates a great variety of colors.

Teach Students may think that all red algae look red, all green algae look green, and all brown algae look brown. Inform them that although these algae contain the pigment in their names, they also contain other pigments, sometimes in such concentrations that, for example, a red alga may actually look pink or purple.

Apply Remind students that plant leaves also contain pigments. Ask: **What is the function of the pigments in algae and in plant leaves?** *(They absorb light needed for the algae and plants to make food.)* **learning modality: verbal**

Differentiated Instruction

Special Needs L1

Identifying Protists Display in stations around the room pictures of various protists, such as slime molds, paramecia, euglenoids, diatoms, and algae. Have small groups list on index cards the characteristics they observe in the pictures. Next display three headings on the board: animal-like protists, plantlike protists, and funguslike protists. Have students attach under the appropriate headings the index cards containing the protist traits observed in the pictures. Discuss any overlap of traits among the protist groups, and ask students if it is possible to create an operational definition of a protist. **learning modality: visual**

Monitor Progress L2

Writing Ask students to describe the characteristics of diatoms, euglenoids, or red algae. Students can save their descriptions in their portfolios. Portfolio

Answers

Figure 8 The eyespot helps the euglena find light, and the flagellum helps the euglena move toward light.

Figure 10 The holdfasts resemble roots and the blades resemble leaves.

Reading Checkpoint Brown, green, yellow, and orange

Funguslike Protists

Teach Key Concepts L2

Exploring Funguslike Protists

Focus Review with students the characteristics of fungi: heterotrophs, have cell walls, use spores to reproduce.

Teach With students, prepare a chart or start a Venn diagram to show basic characteristics of plants, animals, and fungi. Illustrate your answers: **How are funguslike protists like animals?** *(They are heterotrophs.)* **How are they like plants?** *(Their cells have cell walls; they use spores to reproduce.)* **Which of these traits do fungi also exhibit?** *(They have cell walls, are heterotrophs, and, reproduce with spores)*

Apply Ask: **How have funguslike protists caused human deaths?** *(Water molds destroyed the Irish potato crops in 1845 and 1846, triggering starvation.)* **learning modality: visual**

Lab zone Build Inquiry L3

Observing Slime Mold

Materials compound microscope, slime mold culture, plastic petri dish with cover, oatmeal

Time 15 minutes for setup, 10 minutes for observation after 24 hours

Focus Tell students that individual slime mold cells can join together and respond to stimuli as a giant mass.

Teach Pair students; give each pair a covered petri dish containing slime mold culture to observe under the microscope. Ask students to predict how slime molds will react when oatmeal is placed in the dish. Students can test predictions by uncovering the dish, putting a few flakes about 1 mm from a branch of the slime mold, and putting the cover back on. After 24 hours in a cool, dark place, the slime mold should increase in size, spread across, and engulf the oatmeal.

Apply Ask: **What did you observe that suggests the slime mold is alive?** *(It moved toward the oatmeal and engulfed it.)* **learning modality: visual**

Funguslike Protists

The third group of protists are the funguslike protists. Recall from Chapter 1 that fungi include organisms such as mushrooms and yeast. Until you learn more about fungi in Section 3, you can think of fungi as the "sort of like" organisms. Fungi are "sort of like" animals because they are heterotrophs. They are "sort of like" plants because their cells have cell walls. In addition, most fungi use spores to reproduce. A **spore** is a tiny cell that is able to grow into a new organism.

Like fungi, funguslike protists are heterotrophs, have cell walls, and use spores to reproduce. All funguslike protists are able to move at some point in their lives. The three types of funguslike protists are slime molds, water molds, and downy mildews.

Slime Molds Slime molds are often brilliantly colored. They live on forest floors and other moist, shady places. They ooze along the surfaces of decaying materials, feeding on bacteria and other microorganisms. Some slime molds are so small that you need a microscope to see them. Others may cover an area of several meters!

Slime molds begin their life cycle as tiny, individual amoeba-like cells. The cells use pseudopods to feed and creep around. Later, the cells grow bigger or join together to form a giant, jellylike mass. In some species, the giant mass is multicellular and forms when food is scarce. In others, the giant mass is actually a giant cell with many nuclei.

The mass oozes along as a single unit. When environmental conditions become harsh, spore-producing structures grow out of the mass and release spores. Eventually the spores develop into a new generation of slime molds.

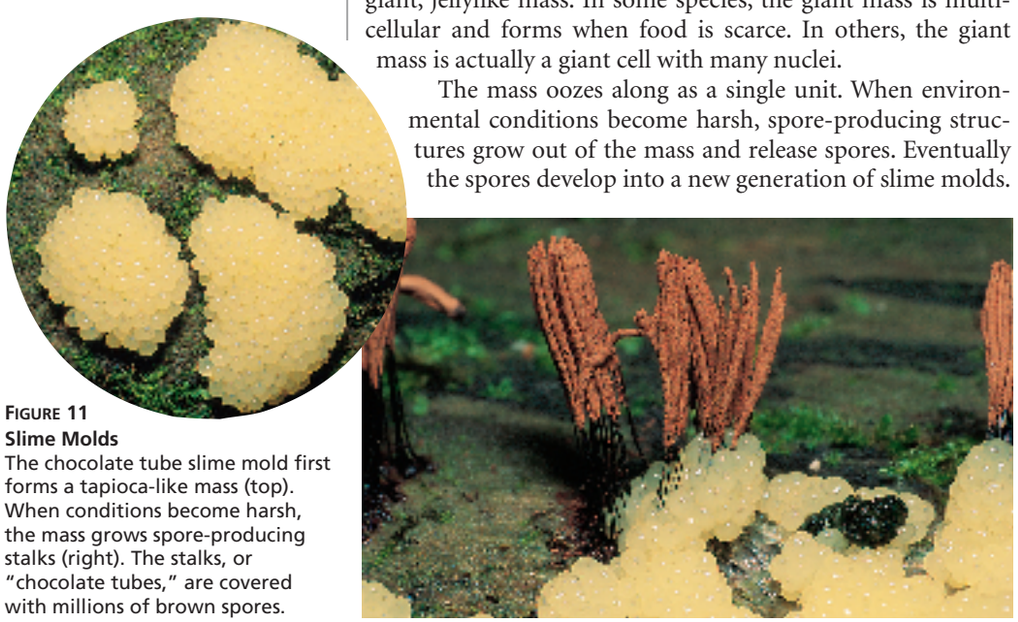
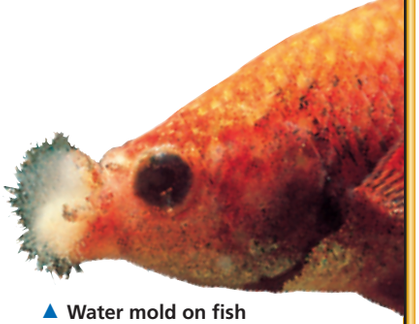


FIGURE 11
Slime Molds
The chocolate tube slime mold first forms a tapioca-like mass (top). When conditions become harsh, the mass grows spore-producing stalks (right). The stalks, or "chocolate tubes," are covered with millions of brown spores.

Water Molds and Downy Mildews Most water molds and downy mildews live in water or moist places. These organisms often grow as tiny threads that look like fuzz. Figure 12 shows a fish attacked by a water mold and a leaf covered by downy mildew.

Water molds and downy mildews attack many food crops, such as potatoes, corn, and grapes. A water mold impacted history when it destroyed the Irish potato crops in 1845 and 1846. The loss of these crops led to a famine. More than one million people in Ireland died, and many others moved to the United States and other countries.

Reading Checkpoint **In what environments are water molds found?**



▲ Water mold on fish

▼ Downy mildew on grape leaf

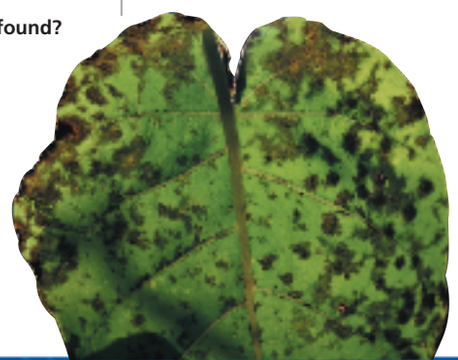


FIGURE 12
Water Molds and Downy Mildews Many water molds are decomposers of dead aquatic organisms. Others are parasites of fish and other animals. Downy mildews are parasites of many food crops.

Section 1 Assessment

Target Reading Skill **Outlining** Use your outline about protists to help you answer the questions below.

Reviewing Key Concepts

1. **a.** **Listing** List the four types of animal-like protists. How does each type move or live?
   b. **Comparing and Contrasting** How are these four types of protists similar to animals? How are they different?
   c. **Classifying** You observe an animal-like protist under the microscope. It has no hairlike or whiplike structures. It moves by forming temporary bulges of cytoplasm. How would you classify this protist?
2. **a.** **Reviewing** In what way are diatoms, dinoflagellates, and other plantlike protists similar to plants?
   b. **Making Generalizations** Why is sunlight important to plantlike protists?
   c. **Making Judgments** Would you classify euglena as an animal-like protist or as a plantlike protist? Explain.
3. **a.** **Listing** What are the three types of funguslike protists?
   b. **Describing** In what ways are funguslike protists similar to fungi?

Lab zone At-Home Activity

Algae Scavenger Hunt Look around your house with a family member to find products that contain substances made from algae. Look at both food and nonfood items. Before you begin, tell your family member that substances such as diatomaceous earth, algin, and carrageenan are products that come from algae. Make a list of the products and the algae-based ingredient they contain. Share your list with the class.

Monitor Progress L2

Answer

Reading Checkpoint In water or moist places

Assess

Reviewing Key Concepts

1. a. Protozoans with pseudopods, protozoans with cilia, protozoans with flagella, protozoans that are parasites **b.** Similar to animals: they are heterotrophs that can move from place to place; different: they are unicellular. **c.** As a protozoan with pseudopods.
2. a. They are autotrophs. **b.** Their pigments absorb the sunlight, which they need to make food. **c.** Possible answer: Although euglena have animal-like and plantlike characteristics, they should probably be classified as plantlike protists because they have the unique ability to make thier own food.
3. a. Slime molds, water molds, downy mildews **b.** They are heterotrophs, have cell walls, and use spores to reproduce.

Reteach L1

Discuss the characteristics shared by all protists, then use a "quiz bowl" format to classify protists by animal-like, plantlike, and funguslike traits.

Performance Assessment L2

Writing Ask students to imagine they are a paramecium. Have them write a short story of their encounters with other microscopic life forms such as amoebas, euglenoids, slime molds, and other protists. Encourage students to describe how these organisms behave and how to identify them.

Students can save their stories in their portfolios. Portfolio

All in One Teaching Resources

- Section Summary: *Protists*
- Review and Reinforce: *Protists*
- Enrich: *Protists*

Lab zone At-Home Activity

Algae Scavenger Hunt L1 Encourage students to explain to family members that algae can be found in many products such as ice cream, hair conditioners, toothpaste, and scouring products. Students may wish to see who can find the most products containing algae.