

# 20-1 The Kingdom Protista

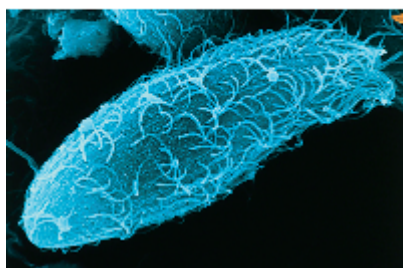
On a dark, quiet night you sit at the stern of a tiny sailboat as it glides through the calm waters of a coastal inlet. Suddenly, the boat's wake sparkles with its own light. As the stern cuts through the water, glimmering points of light leave a ghostly trail into the darkness. What's responsible for this eerie display? You've just had a close encounter with one group of some of the most remarkable organisms in the world—the protists.

## What Is a Protist?

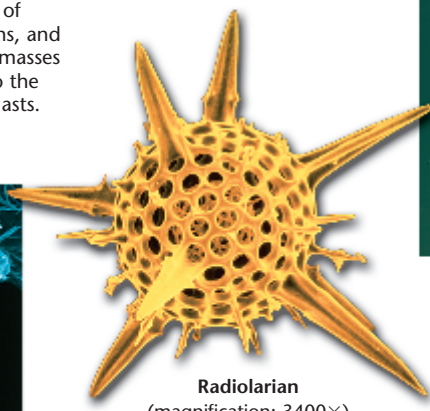
The kingdom Protista is a diverse group that may include more than 200,000 species. Biologists have argued for years over the best way to classify protists, and the issue may never be settled. In fact, protists are defined less by what they are and more by what they are not: A **protist** is any organism that is not a plant, an animal, a fungus, or a prokaryote. **Protists are eukaryotes that are not members of the kingdoms Plantae, Animalia, or Fungi.** Recall that a eukaryote has a nucleus and other membrane-bound organelles. Although most protists are unicellular, quite a few are not, as you can see in **Figure 20-1**. A few protists actually consist of hundreds or even thousands of cells but are still considered protists because they are so similar to other protists that are truly unicellular.

**CHECKPOINT** What is the classification of an organism that is not a plant, an animal, a fungus, or a prokaryote?

**Figure 20-1** Protists are a diverse group of mainly unicellular eukaryotes. Examples of protists include freshwater ciliates, radiolarians, and *Spirogyra*. *Spirogyra* may form slimy floating masses in fresh water. The organism's name refers to the helical arrangement of its ribbonlike chloroplasts.



*Euplotes* (a freshwater ciliate)  
(magnification: about 140×)



Radiolarian  
(magnification: 3400×)



*Spirogyra*  
(magnification: 400×)

## Guide for Reading

**Key Concept**  
• What are protists?

**Vocabulary**  
protist

**Reading Strategy: Summarizing** As you read, find the main ideas for each blue heading. Write down a few key words from each main idea. Then, use the key words in your summary. Reread and revise your summary, keeping only the most important ideas.

## Section 20-1

### 1 FOCUS

#### Objective

20.1.1 **Explain** what a protist is.

### Guide for Reading

#### Vocabulary Preview

Before students read the section, call on volunteers to propose a definition for the word *protist*.

#### Reading Strategy

Ask students to find evidence in the section for this statement: The kingdom Protista is a catchall grouping for organisms that don't fit into other kingdoms.

### 2 INSTRUCT

## What Is a Protist?

### Build Science Skills

**Observing** Collect samples of pond water in several jars. In each jar, include some mud from the pond's bottom. Have students make slides of samples from the water and observe the slides through a microscope. Ask students to make drawings of at least two of the organisms and to pay special attention to how they move. **L2 L3**

## Evolution of Protists

### Make Connections

**Earth Science** Explain that nearly 1.5 billion years ago, when the first protists appeared, the world was much different than it is today. Point out that the ocean covered much of Earth. Explain that Earth itself formed about 4.6 billion years ago, so eukaryotic organisms appeared about 3 billion years after the planet formed and more than a billion years after the first prokaryotes. **L2**



## SECTION RESOURCES

### Print:

- **Teaching Resources**, Lesson Plan 20-1, Adapted Section Summary 20-1, Adapted Worksheets 20-1, Section Summary 20-1, Worksheets 20-1, Section Review 20-1
- **Reading and Study Workbook A**, Section 20-1

### Technology:

- **iText**, Section 20-1
- **Transparencies Plus**, Section 20-1

### Answer to . . .

**CHECKPOINT** A protist

## 20-1 (continued)

# Classification of Protists

## Build Science Skills

**Classifying** Display photographs of protists. Include some images of animal-like, plantlike, and funguslike protists. Use a microprojector to show slides of various organisms, such as an amoeba, a euglena, and a paramecium. Have students brainstorm for lists of similarities and differences that exist among the protists they observe. Ask students to create a classification system. **L2**

### Go Online

Download a worksheet on protists for students to complete, and find additional teacher support from NSTA SciLinks.

## 3 ASSESS

### Evaluate Understanding

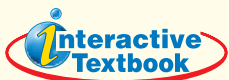
Call on students to explain the classification of protists based on nutrition. Students should describe animal-like protists, plantlike protists, and funguslike protists.

### Reteach

Have students look at the organisms shown in Figure 20-1 and explain why none of the three could be classified as a fungus or an animal.

### Writing in Science

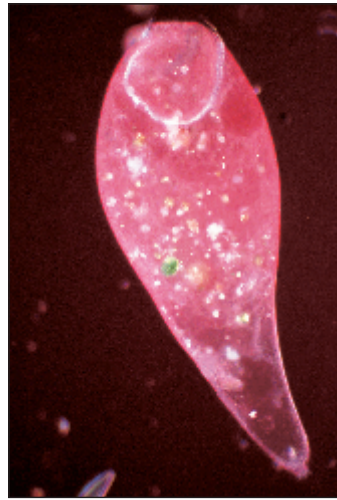
Students' newspaper stories should explain that early in Earth's history, different kinds of prokaryotic cells, including photosynthetic prokaryotes, probably began to live inside larger cells. This relationship began as a parasitic one, but over time the different cells came to be mutually dependent.



If your class subscribes to the iText, use it to review the Key Concepts in Section 20-1.

### Answer to . . .

**Figure 20-2** Chloroplast



*Stentor* (magnification: 350 $\times$ )

**▲ Figure 20-2** According to one hypothesis, some organelles in eukaryotic cells were once symbiotic prokaryotes that lived inside other cells. For example, the mitochondria found in this *Stentor* may be descended from early prokaryotes. **Applying Concepts** What other organelle may originally have been symbiotic cells?

### Go Online

For: Links on protists  
Visit: [www.SciLinks.org](http://www.SciLinks.org)  
Web Code: cbn-6201

## Evolution of Protists

Protists are members of a kingdom whose formal name, *Protista*, comes from Greek words meaning “the very first.” The name is appropriate. The first eukaryotic organisms on Earth, which appeared nearly 1.5 billion years ago, were protists.

Where did the first protists come from? Biologist Lynn Margulis has hypothesized that the first eukaryotes evolved from a symbiosis of several cells. Mitochondria and chloroplasts found in eukaryotic cells may be descended from aerobic and photosynthetic prokaryotes that began to live inside larger cells. **Figure 20-2** shows a representative protist.

## Classification of Protists

Protists are so diverse that many biologists suggest that they should be broken up into several kingdoms. This idea is supported by recent studies of protist DNA indicating that different groups of protists evolved independently from archaeobacteria. Unfortunately, at present, biologists don't agree on how to classify the protists. Therefore, we will take the traditional approach of considering the protists as a single kingdom.

One way to classify protists is according to the way they obtain nutrition. Thus, many protists that are heterotrophs are called animal-like protists. Those that produce their own food by photosynthesis are called plantlike protists. Finally, those that obtain their food by external digestion—either as decomposers or parasites—are called funguslike protists. This is the way in which we will organize our investigation of the protists.

It is important to understand that these categories are an artificial way to organize a very diverse group of organisms. Categories based on the way protists obtain food do not reflect the evolutionary history of these organisms. For example, all animal-like protists did not necessarily share a relatively recent ancestor. The protistan family tree is likely to be redrawn many times as the genes of the many species of protists are analyzed and compared using the powerful tools of molecular biology.

## 20-1 Section Assessment

- Key Concept** What is a protist?
- Describe Margulis's theory about the evolution of protists.
- Are most protists unicellular or multicellular?
- What are the three methods that protists use to obtain food?
- Identify the characteristics of organisms belonging to the kingdom Protista.
- Critical Thinking Using Analogies** In what way is the kingdom Protista similar to a group of people who do not belong to a political party?

## Writing in Science

### Creative Writing

Write and illustrate a brief newspaper story explaining the hypothesis that eukaryotic cells evolved from a symbiosis of several prokaryotes with larger cells. *Hint:* Begin with a draft and then revise that draft, looking at organization and word choice.

## 20-1 Section Assessment

- A protist is a eukaryote that is not a member of the kingdoms Plantae, Animalia, or Fungi.
- The first eukaryotic cells may have evolved from a symbiosis of several prokaryotes with larger cells.
- Most are unicellular.
- Animal-like protists ingest or absorb food; plantlike protists produce food by photosynthesis; and funguslike protists obtain their food by external digestion either as decomposers or as parasites.
- Protists are eukaryotic organisms, and most are unicellular.
- Like people who do not belong to a political party, protists are defined less by what they are and more by what they are not.