Exercise 37

EXERCISE 37

Protozoa

Objectives

After completing this exercise, you should be able to:

1. List three characteristics of protozoa.
2. Explain how protozoa are classified.

Background

Protozoa are unicellular eukaryotic organisms. Many protozoa live in soil and water, and some are normal microbiota in animals. A few species of protozoa are parasites.

Protozoa are heterotrophs, and most are aerobic. They feed on other microorganisms and on small particulate matter. Protozoa lack cell walls; in some, the outer covering is a thick, elastic membrane called a **pellicle.** Cells with a pellicle require specialized structures to take in food. The **contractile vacuole** may be visible in some specimens (Figure 37.1). This organelle fills with freshwater and then contracts to eliminate excess freshwater from the cell, allowing the organism to live in low-solute environments. Would you expect more contractile vacuoles in freshwater or marine protozoa?

_____

In this exercise, we will examine live, free-living protozoa, as well as prepared slides of three parasitic protozoa. The **Rhizopoda** phylum consists of protozoa that move by using pseudopods. The **amoebas** (Figure 37.1a) move by extending lobelike projections of cytoplasm called **pseudopods.** As pseudopods flow from one end of the cell, the rest of the cell flows toward the pseudopods.

The **Euglenozoa** (Figure 37.1b) have one or more flagella. Although many euglenozoa are heterotrophs, the organism used in this exercise is a facultative heterotroph. It grows photosynthetically in the presence of light and heterotrophically in the dark.

Members of the phylum **Ciliophora** (Figure 37.1c) have many cilia extending from the cell. In some ciliates, the cilia occur in rows over the entire surface of the cell. In ciliates that live attached to solid surfaces, the cilia occur only around the oral groove. Why only around the oral groove? _____

Food is taken into the **oral groove** through the cytostome (mouth) and into the cytopharynx, where a **food vacuole** forms.

Archaezoa generally have multiple flagella and they lack mitochondria. Many archaezoa live in the digestive tracts of animals. The absence of mitochondria is

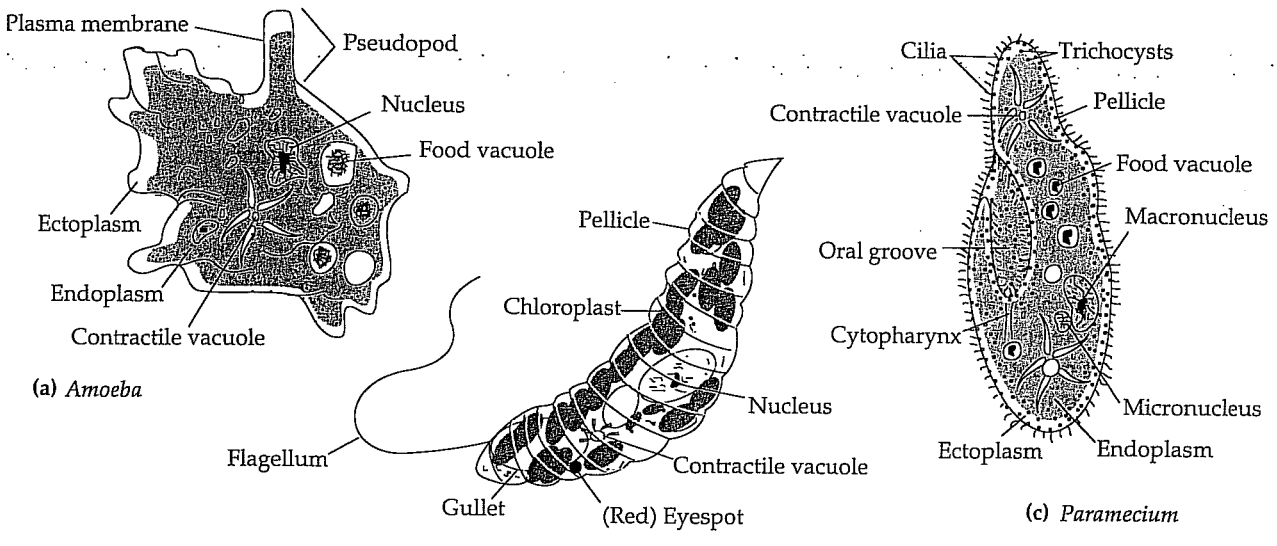


Figure 37.1

Protozoa. (a) An amoeba moves by extending pseudopods. (b) A euglena has a whiplike flagellum. (c) A paramecium has cilia over its surface.

probably not a disadvantage in this anoxic (without oxygen) environment. **Apicomplexa** are nonmotile, obligate intracellular parasites. They have complex life cycles that ensure their transmission to new hosts.

Materials

Methylcellulose, 1.5%

Acetic acid, 5%

Pasteur pipettes

Coverslips

Cultures

Amoeba

Paramecium

Paramecium feeding on Congo red-yeast suspension

Euglena

Prepared Slides

Giardia

Plasmodium

Trypanosoma

Techniques Required

Compound light microscopy, Exercise 1

Wet-mount technique, Exercise 2

Procedure

1. Prepare a wet mount of *Amoeba*. Place a drop from the bottom of the *Amoeba* culture on a slide. Place one edge of the coverslip into the drop, and let the fluid run along the coverslip (Figure 37.2). Gently lay the coverslip over the drop. Observe the amoeboid movement, and diagram it. Which region of the cytoplasm has more granules: the ectoplasm or the endoplasm? (Refer to Figure 37.1a.) _____
2. Prepare a wet mount of *Euglena*. Follow one individual and diagram its movement. Can you see *Euglena's* red "eyespot"? _____
   Why do you suppose it is present in photosynthetic strains and not in nonphotosynthetic strains? _____

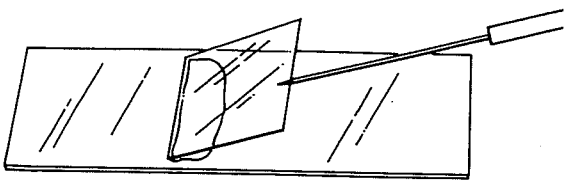


Figure 37.2
Gently lower the coverslip.

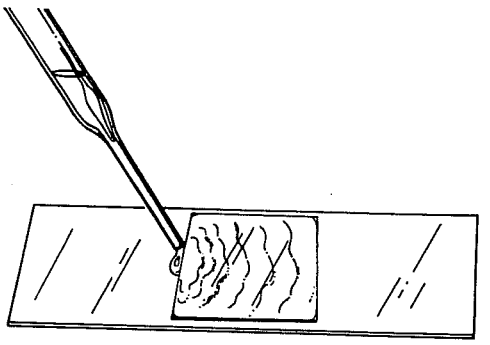


Figure 37.3
Add a drop of acetic acid at one edge of the coverslip. Allow it to diffuse into the wet mount.

   Allow a drop of acetic acid to seep under the coverslip (Figure 37.3). How does *Euglena* respond?

3. Prepare a wet mount of *Paramecium* and observe its movement. (See Color Plate IV.6.) Why do you suppose it rolls and *Amoeba* does not? _____
4. Place a drop of methylcellulose on a slide. Make a wet mount of the *Paramecium* culture that has been feeding on a Congo red-yeast suspension in this mixture. The *Paramecium* will move more slowly in the viscous methylcellulose. Observe the ingestion of the red-stained yeast cells by *Paramecium*. Congo red is a pH indicator. As the contents of food vacuoles are digested, the indicator will turn blue (pH 3). What metabolic products would produce acidic conditions in the vacuoles? _____

   Count the number of red and blue food vacuoles in a *Paramecium*. Sketch a *Paramecium* and identify the locations of the food vacuoles.

Exercise 37

Protozoa

LABORATORY REPORT

NAME _____

DATE _____

LAB SECTION _____

Purpose

_____

_____

_____

Observations

Use a series of diagrams to illustrate the following:

The movement of *Amoeba* across the field of vision. ___ ×

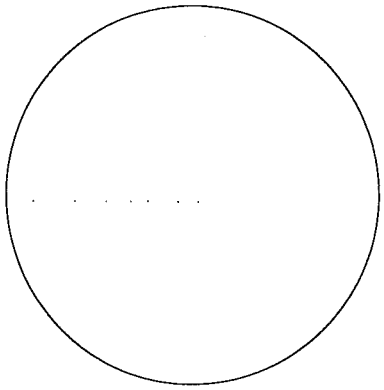
The movement of *Euglena* and its flagellum. ___ ×

The movement of *Paramecium* and its cilia. ___ ×

The ingestion of food, formation of a food vacuole, and movement of food vacuoles in *Paramecium*. Note any color changes in the food vacuoles. ___ ×

Prepared Slides

Sketch a field with each parasite.

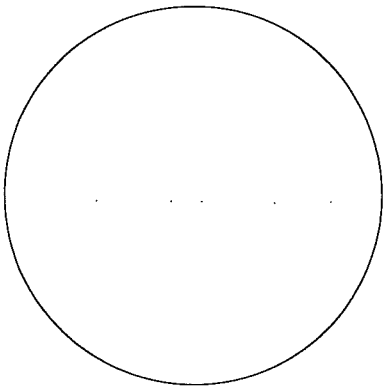


Trypanosoma ___ ×

Label the flagellum.

Disease caused: _____

Phylum: _____

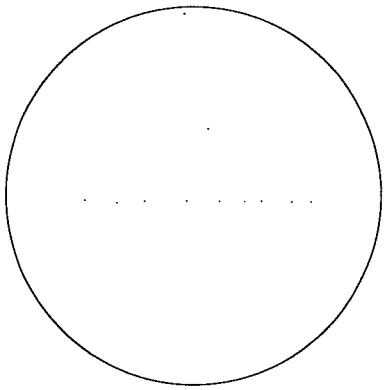


Giardia ___ ×

Label the flagella.

Disease caused: _____

Phylum: _____



Plasmodium ___ ×

Label the nucleus and cytoplasm.

Disease caused: _____

Phylum: _____

Questions

1. How did *Euglena* respond to the acetic acid? _____

2. Which of the live organisms observed in this exercise would you bet on in a race? _____

3. Describe the arrangement of cilia on *Paramecium*. _____

4. *Trypanosoma* and *Plasmodium* are both found in blood. How do they differ in their locations relative to red blood cells? _____

5. What advantage does *Trypanosoma*'s shape provide? _____

6. Match the characteristics (a–g) to the phyla listed. Name one genus from each phylum.

Phylum	Characteristics	Example Genus
Archaezoa		
Apicomplexa		
Dinoflagellates		
Ciliophora		
Euglenozoa		

Characteristics
a. Apical enzymes
b. Cilia
c. Flagella
d. Have cellulose
e. No mitochondria
f. Photosynthetic
g. Pseudopods

Critical Thinking

1. Why is *Euglena* often used to study algae and protozoa?

2. Why are *Giardia* and *Trypanosoma* not classified into the same phylum? Which two genera in this exercise are most closely related?

3. *Pneumocystis* was classified as a protozoan since its discovery in 1908. However, rRNA sequencing now shows that it is a fungus. Why might it be important to have an accurate classification of this organism?

4. Laboratory eyewashes should be flushed once a month to remove *Acanthamoeba* accumulations from the pipes. Why is this removal necessary for eyewashes but not other water outlets?