

Probing into Protozoa Activity

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Introduction

Protozoa are so varied that it is difficult to describe the group as a whole. They are single-celled (some prefer the term **acellular**) or colonial eukaryotes. They, along with most algae (another catchall group) comprise the kingdom Protista. Scoop up a sample of water from almost any pond, lake, stream, or ocean shore and you are likely to find protozoa. Other protozoa live in soil or plants. And some live in or on animals as harmless, beneficial symbionts or harmful parasites. Protozoa are partitioned into phyla based mainly on their primary means of locomotion. The following activity focuses on the phylum Sarcodina. It is designed for students in grades 7–12 and addresses the following National Science Education Standards Content Standard C for life science:

Grades 5–8

- Structure and function in living systems
- Reproduction and heredity
- Regulation and behavior
- Populations and ecosystems
- Diversity and adaptations of organisms

Grades 9–12

- The cell
- Molecular basis of heredity
- Biological evolution
- Interdependence of organisms
- Matter, energy, and organization in living systems
- Behavior of organisms

Investigation: Kingdom Protista, phylum Sarcodina

Objectives

- To become familiar with the characteristics of organisms belonging to the phylum Sarcodina
- To study *Amoeba proteus* as a typical representative of the phylum
- To compare and contrast *Amoeba proteus* with other members of the phylum

Materials

Cultures of *Amoeba proteus* and *Chaos (Pelomyxa) carolinensis* (for optional activities, cultures of *Arcella*, *Centropyxis*, *Diffugia*, and *Paramecium caudatum*)

Microscope Slides or Depression Slides (or watch glasses for Optional Activity 2)

Coverslips

Clock or Timer (for Optional Activity 2)

Dropping Pipettes (one or 2 for each culture to help avoid cross-contamination)

Compound Microscopes (stereomicroscopes for use with Optional Activity 2)

Vocabulary

Contractile Vacuole

Ectoplasm

Endoplasm

Food Vacuole

Nucleus

Plasmagel

Plasmalemma

Plasmasol

Pseudopodia

Amoeba proteus

Procedure

Using a dropping pipette, place a small drop of the *Amoeba proteus* culture on a slide and gently cover it with a coverslip. Examine the slide under a microscope using the low-power objective.

Once you have located an amoeba, center it in the microscopic field, and switch to the high-power objective to continue your observation.

1. Observe an amoeba's movement for 15 seconds or longer. Now describe in detail how it moves.

2. Make a **detailed** drawing of the amoeba in the space below. Then use a textbook or lab book illustration to help you label the food vacuole, hyaline cap, ectoplasm, pseudopodium, endoplasm, plasmalemma, nucleus, and contractile vacuole.

3. Make detailed observations of the structures listed below.

- Pseudopodia (false feet)

These are projections from the main mass of the cell. *Amoeba proteus* has large, conspicuous pseudopodia called **lobopodia**. These are used in food capture and locomotion. Is the pseudopodium you are observing a constant (permanent) feature of the amoeba? Give evidence to support your answer.

- Cell membrane (plasmalemma)

The cell membrane is much too thin to be seen as a distinct structure under a light microscope; however, you can see the boundary between the cell and its environment. How does an amoeba breathe? _____

- Ectoplasm or hyaline cap (a clear layer of cytoplasm just beneath the cell membrane)

Do other pseudopodia have a hyaline cap? _____

- Endoplasm (granular and makes up most of the cytoplasm)

If you observe carefully, you may be able to see that granules are moving more rapidly in some areas of the endoplasm than in others. These areas of flowing endoplasm are called **plasmal**. If you observe near the tip of a pseudopodium that is moving forward, you may see an area of endoplasm where the granules are hardly moving with respect to each other. This less-fluid area is called **plasmagel**. The endoplasm's ability to change from plasmal to plasmagel is thought to be involved in cellular movement.

Make a **basic** outline drawing of an amoeba in the space below. Using arrows, show how the cytoplasm flows during locomotion (sol-to-gel conversion).

- Food vacuoles (spherical structures of various sizes containing food being digested)

What breaks down food within the vacuoles? _____

- Contractile vacuole (a clear “bubble” in the endoplasm)

Observe one for several seconds and record your observations.

- The plasmalemma is a selectively permeable membrane, and the concentration of water inside the amoeba is lower than the concentration of water outside the amoeba. Use these facts to state a hypothesis about the contractile vacuole’s function. (This question and the next assume you have studied osmosis.)

- On a separate sheet of paper, describe an experiment you could perform to test your hypothesis on the contractile vacuole’s function. List needed materials; briefly give the procedures and expected results if your hypothesis is correct.

- The nucleus (a disc-shaped, relatively large granular body)

Once you have located the nucleus, observe it for several seconds. What can you say about the nucleus’s position within the amoeba?

Chaos carolinensis

Prepare and examine a slide from the *Chaos carolinensis* culture. Compare and contrast this protozoan to *Amoeba proteus* for the following:

Size _____

Contractile vacuole _____

Nucleus or nuclei _____

Food vacuoles _____

Movement _____

Other (specify) _____

Summary

Assume that *Amoeba proteus* and *Chaos carolinensis* are typical members of phylum Sarcodina. Using your observations recorded above, give at least 3 characteristics of organisms that belong to Sarcodina.

1. _____
2. _____
3. _____

Optional activity 1

Some members of Sarcodina produce a protective **test** (shell). Examples include *Arcella*, *Centropyxis*, and *Diffugia*. Make slides of these organisms and observe them under high-power magnification. What is their method of locomotion? Compare and contrast these organisms to *Amoeba* and *Chaos*. What, if any, changes or additions would you now make to your summary characteristics above? Make drawings of these organisms to help you compare them to *Amoeba* and/or *Chaos*.

Optional activity 2

Try feeding your amoebas. **Note:** *Do not use Protoslo® during this activity.* Isolate an amoeba on a depression slide (without coverslip) if using a microscope, or in a shallow watch glass if using a stereomicroscope. With a pipet, gently draw up a paramecium and “place” it as close to the amoeba as possible without pushing it or the amoeba off of the slide or watch glass. To diminish the amoeba and paramecium’s movement, use the pipet to gently remove excess water. Record the time. **Note:** *This process could take a while; it may be helpful to have one or 2 students observe while part of the group continues on with another activity.* Be patient, it might take a moment to evoke a response. What is the amoeba’s response? What is the paramecium’s response? Record the time. How long did it take each organism to respond? Record the elapsed times and your observations. Experiment with other food sources like diatoms or algae cells.