

Daphnia **Teacher Resource**

Grade Level **5-12**
Objectives

1. The student will identify daphnia as an important link in a food web.
2. The student will identify the anatomy of a daphnia.
3. The student will demonstrate the use of a digital microscope.
4. The student will record findings in a food web through digital images and movies.

National Standards

NS.5-8.1 ; NS.9-12.1	Science as Inquiry
NS.5-8.3 ; NS.9-12.3	Life Science
NS.5-8.4 ; NS.9-12.4	Earth Science
NS.5-8.5 ; NS.9-12.5	Science & Technology
NT.K-12.1	Basic Operations and Concepts
NT.K-12.3	Technology Productivity Tools
NT.K-12.6	Technology Problem-Solving & Decision-Making Tools

MATERIALS

Digital Microscope	Heart Rate Lab Handout (Student Guide)
Personal Computer	Ethanol
Living Algae (chlamydomonas)	Caffeine Tablets, Coffee, or Tea
Living Daphnia	Transfer Pipettes
Depression Slides	
Balanced Aquarium (<i>optional Part C</i>)	
Underwater Digital Camera (<i>optional Part C</i>)	
Interactive White Board/Projector (<i>optional Part C</i>)	

Teacher Background Information

Daphnia are tiny, semi-transparent freshwater crustaceans that predominantly are used for aquarium fish food. Daphnia can be very inexpensive to introduce the interrelationships among living things in an environment; a perfect introduction for food webs. Introduce the anatomy of the Daphnia and note the legs which are not used so much for swimming as for production of water currents around its body to carry oxygen and microscopic food particles to the animal. The teacher must provide algae for the Daphnia to be maintained in the aquarium. Physiologically, the Daphnia can be observed under the digital microscope to see the effect of various chemicals on the heartbeat of an animal and graph the results.

After a few days of just the daphnia and algae in the aquarium, set up a balanced aquarium that will further illustrate what occurs in a food web. Add fish to the aquarium to allow students to observe the fish feeding on the daphnia, the daphnia on the algae, and the algae needing sunlight, correct temperature, and water to survive. Record this with the underwater digital camera.

To setup a balanced aquarium make sure the aquarium is placed in a well-lighted place, and algae added. Only a small amount of algae needs to be added. All fish should be temporarily removed for the first 2 days and the daphnia added to the aquarium.

PROCEDURE

Activity 1

Daphnia Anatomy

1. Observe any changes occurring in the aquarium.
2. Have a Live Feed of the aquarium with the underwater digital camera.
 - a. This can be done by the teacher for each hour and projected on an Interactive White Board (IWB) or projector for students to make observations.
3. Obtain a Daphnia sample from aquarium.
4. Place Daphnia on a clean depression slide WITHOUT a cover slip
5. Place slide under the digital microscope.
6. Observe, record, and label the various parts of the Daphnia.
7. Return Daphnia to aquarium.

8. Answer *Activity 1* Questions

Activity 2 ***Daphnia Heart Beat***

1. Observe any changes occurring in the aquarium.
2. Have a Live Feed of the aquarium with the underwater digital camera.
 - a. This can be done by the teacher for each hour and projected on an interactive white board or projector for students to make observations.
3. Obtain a Daphnia sample from aquarium.
4. Place one Daphnia on a clean depression slide **WITHOUT** a coverslip.
5. Find the various parts of the Daphnia, which you labeled in *Activity 1*.
6. Find the heart.
7. Count the rate of its heartbeat for 10 seconds.
 - a. To do this, record a movie for 10 seconds, then go back and review movie to count how many heartbeats occurred.
8. Multiply this rate by 6 to give the rate of the heartbeat for one minute.
9. Record in Science Notebook.
10. Repeat steps 4-7, with a drop of caffeine solution to the Daphnia.
11. Repeat steps 4-7 with a drop of diluted ethanol (1 drop ethanol to 9 drops water) to the Daphnia.
12. Draw and label the Daphnia for any changes observed in the control solution, the caffeine solution, and the ice water solution.
13. Answer *Activity 2* Questions

Activity 3 **Food Web**

1. Observe any changes occurring in the aquarium.
2. Have a Live Feed of the aquarium with the underwater digital camera.
 - a. This can be done by the teacher for each hour and projected on an interactive white board or projector for all students to make observations.
3. Add the fish back into the aquarium and record what occurs using the underwater digital camera.

- a. You will want to record and save this information, just in case feeding does not occur in each of your science classes.
4. Have the students record what they observe and make inferences in their science notebooks.
5. Inferences being made from observations should be similar to:
 - a. The algae added to the aquarium grew when placed in sunlight.
 - b. Daphnia feed on algae.
 - c. Fish feed on Daphnia.
6. Answer *Activity 3* Questions

DISCUSSION QUESTIONS

Activity 1

1. Why is the Daphnia often green?
2. What is the purpose of the legs on the Daphnia?
3. Draw a diagram of a food web in which organisms such as Daphnia would be involved.
4. Is Daphnia classified as autotrophic or heterotrophic?
5. What type of organism would most likely feed on the Daphnia?

Activity 2

1. How do various chemicals affect the heart rate of a water flea?
 - a. Water
 - b. Caffeine Solution
 - c. Ethanol Solution
2. When you add a drop of caffeine solution is there a change in the heart rate? If yes, why?
3. When you add a drop of ethanol solution is there a change in the heart rate? If yes, why?

Activity 3

1. Construct a food web based on observations of *Day 3*.
2. How would these organisms of algae, daphnia, and fish relate to a mountain lion in the natural environment?
3. How would drought affect their relationships?
4. How would water pollution affect their relationships with you?

PRESENTATION

Have students prepare a lab report including the data, images, and video to give a presentation on the interactive white board or projector for the class.

EXTENSION

- Have all students transfer a large *Daphnia* to a clean depression slide. Examine the *Daphnia* underneath the digital microscope for eggs. When a *Daphnia* with a young is located, project it up on the interactive white board or projector for the whole class to view. Gently probe against the *Daphnia* with a pin. If the young are developed sufficiently, this touch will be stimulus enough to cause the birth of *Daphnia* to expel young, or the eggs.