Pond Water

Overview

In this exploratory exercise, students will examine organisms found in pond water. Many of the organisms will be multi-cellular, but a larger sample will contain many one-celled protists. This can be an exciting introduction to these tiny organisms, and therefore a good entry into the more abstract concepts of how they carry out all the necessary life functions in just one cell.

North Carolina Essential Science Standards:

7.L.1.1 Compare the structures and life functions of single-celled organisms that carry out all of the basic functions of life including:

- Euglena
- Amoeba
- Paramecium
- Volvox

Background

Most students will have never seen the amazing world that is visible in a drop of pond water. When they actually get to see the organisms in real life, they often get excited. Students may find some of the common organisms (*Paramecium*, *Euglena*, and water fleas), and that may be enough. Some students may find organisms that are not shown in the textbook.

Prior to doing this exercise, teachers should help students learn to use microscopes effectively. Before preparing wet mounts as described below, students should practice using microscopes with some dry materials. A human hair is easy to work with, and a bit of printed material like the asymmetric letter 'e' on a piece of thin paper (so that light from below will pass through it) can show that the image is reversed. It is important for students to become familiar with manipulating the light source, the diaphragm, the coarse and fine focus knobs, and the various objective lenses with easy material. Students should know that it is easier to get oriented using low magnification and then gradually increase to higher magnifications. It is especially important that they do not smash the slide preparation with the highest power objective lens.

Most of these organisms are single-celled organisms and are often very small. These organisms may be more easily seen on a flat slide, covered with a cover slip. On the other hand, some of the multicellular organisms (water fleas, *Cyclops*, rotifers, and *Hydra*), are relatively large and are best observed three-dimensionally in a depression slide. Students can then adjust the focus knobs to look at the tops, insides, and bottoms of these organisms. They may see limbs twitching or water flowing as it is being pumped around, and they may actually see them feeding.

Students should always use a cover slip when working with compound microscopes, whether they are using flat or depression slides. The cover slips keep the material from drying out and may help to keep the high magnification objective lenses clean and dry.

Also, students should always begin their observation under lower magnification. This helps them get oriented. With the desired object in the center of the field, they can then switch to medium power. At this level of magnification they can use the coarse and fine focus knobs to search for interesting organisms. They may also need to adjust the light diaphragm. Dimmer light may highlight such features as cilia and flagella.

High magnification generally should only be used once an interesting object has been found. It can be quite challenging to 'chase' an organism around the slide at high power. Also, the objective lens will be so close to the slide that students should only use the *fine* focus knob. If they are looking at large

organisms (*Daphnia*, for example), they can focus up and down through its body, seeing different organs at the various depths.

Be prepared for a diversity of organisms. In addition to single-celled protists, there will be multi-celled organisms as well—algae, rotifers, water fleas, etc. And depending on your sample, there may be even larger organisms—insect larvae, worms of various kinds, etc. These may be particularly exciting to students, since they will be LARGE under the microscope. If the culture is active, even the smaller creatures may be seen swimming, bumping into things, eating, and so forth.

The following website, *Pond Life Identification Kit*, bills itself as "a simple guide to small and microscopic pond life." Students could use it to identify organisms they find in their water samples. It is easy to navigate, has many images, and provides links to more information. http://www.microscopy-uk.org.uk/index.html?http://www.microscopy-uk.org.uk/pond/

Here is another, similar website: http://www.microscope-microscope.org/applications/pond-critters/pond-critters.htm

Materials

*Materials to be supplied by the teacher or the students are marked with an asterisk.

Materials for the whole class

- *Pond water teeming with 'wildlife'
- *Compound microscopes

Materials for small groups (2-3 students)

- 1 depression slide
- 1 flat slide
- 2 cover slips
- 2 pipettes
- 1 forceps
- 1 copy of BLM 1 *Pond Water – Directions for Students*

Materials for individual students

- *Science notebook

Preparation

- Collect some pond water in a clean bucket or small aquarium. Be sure to collect some algae and/or bits of vegetation (leaves, small twigs) as well. Some of the organisms like to swim freely, but many prefer to attach to or be close to larger bits of vegetation.
- In warm weather, you can probably collect the water the day before class. In colder weather, get the water 3-5 days ahead of time and bring it inside where it will warm up. This should give the organisms a chance to get active if they have been in a state of torpor because of the cold. They may even start reproducing, thus increasing their numbers.
- If pond water is not available, slow-moving water from a stream will also work. Again, gather bits of algae and other vegetation if possible, including dead leaves that may have collected in quiet areas in the stream.

- Do not add tap water that has been treated with chlorine. This could kill many of the organisms. If your bucket has been washed with detergents, rinse it thoroughly several times to get rid of residues that can be harmful to microorganisms.

Procedure

- Remind students about proper microscopy techniques:
  - Starting on lowest magnification (shortest objective lens)
  - Changing objective lenses
  - Adjusting the coarse and fine focus knobs
  - Adjusting the light diaphragm
  - Preparing wet mount slides (see student handout)
- Have students get pond water samples and make their observations, sketches, and written descriptions/observations in their notebooks. Notebook entries should include the date and the microscope magnification.
- After they have made their observations, students should discard the cover slips, rinse the slides, and lay them out to dry on a paper towel.

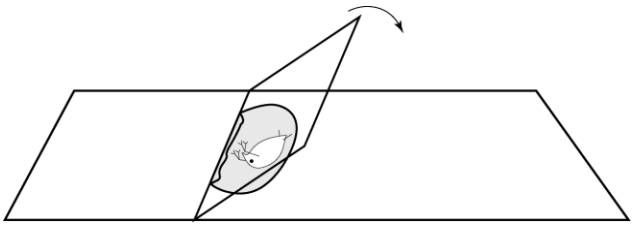
Reflection/Discussion

- When students find something interesting in their samples, encourage them to let others look through their microscopes.
- Students (and teachers) should try to identify everything they see.
- Give students a chance to share their observations with the whole class.
- Use this activity to lead a discussion about the structures and life functions of single-celled organisms that carry out all of the basic functions of life.

BLM 1: Pond Water – Directions for Students

Prepare a microscope slide for viewing

- Place a drop of pond water in the middle of a flat or depression microscope slide. If possible, get a very tiny bit of vegetation along with the water—algae, a piece of a leaf, etc.
- Cover the specimen with a cover slip, starting at an angle as shown in the figure. This should get rid of most of the air bubbles and keep the sample from drying out.



- If liquid seeps out around the cover slip, use a small piece of paper towel to soak it up. Be careful not to press down on the cover slip.

Under the microscope

- Always start with the *lowest* magnification (the shortest objective lens). This will help you get oriented and find interesting things to look at. Use the coarse focus (usually the large focus knob). You may then use the fine focus to get better focusing control. Adjust the light diaphragm so that the whole field is lit up.
- When you have something interesting to look at in the center of the field, switch to medium magnification. Experiment with the light diaphragm. Less light may make some parts of the organisms easier to see (cilia and flagella, for example).
- Move the slide so that you have something interesting in the center of the field. This will make it much easier to find your interesting thing when you switch to high magnification. It can be very difficult and frustrating to 'chase' organisms around when you are using high power.
- Watch carefully from the side as you move the high magnification objective lens into place. If it looks like it will hit the slide before clicking into place, back off the focus a little bit before proceeding.
- Once the lens is in place, use only the fine focus knob. Otherwise you may break the cover slip or the slide and get the lens wet. You will then have to clean the lens and prepare a new slide.
- Try different positions of the light diaphragm.

Viewing and recording

- The organisms you are viewing are alive. In your science notebook, make a full page sketch of what you see. Mark the sketch with the date and the magnification you are using. To calculate the magnification, multiply the power of the eyepiece by the power of the objective lens.
- Write a few sentences:
  - What does the organism look like?
  - What do you see *inside* the organism?
  - What do you think the organism is doing? Swimming? Eating?
  - How big is the organism compared to other organisms in the water?
  - How many different kinds of organisms did you see?