TIME FOR SLIME

A microscope connected to a digital projector helps students make connections between the microscopic and macroscopic world.

By Michael Tessmer and Richard Cowlishaw

An introduction to microscopy is common in the elementary curriculum, but microscope work with elementary school children can be a challenge. There is equipment maintenance to consider, as well as the difficulty of using the microscope for many children. We have found that using a digital microscope connected to a projector breaks down these barriers. Although the initial costs of a digital microscope may seem prohibitive, there are several advantages. These include only needing to purchase and maintain one quality piece of equipment, guaranteeing that each student will see what you want them to see, and the ability to reach a relatively large audience. The wonder and thrill of seeing microscopic organisms on a large screen captivates young children and engages their natural curiosity.

In this article, we describe an inquiry-based activity designed primarily for the K–2 classroom in which students look at the microscopic parts of an aquatic food chain. Students will ask questions and make observations about the world around them, and then see the differences at the microscopic level. We also provide information on how to adapt the activity for older elementary age children.

This single class period activity on aquatic food chains was developed as an outreach opportunity between a college and local elementary schools and libraries, but can be transferred directly to the classroom.

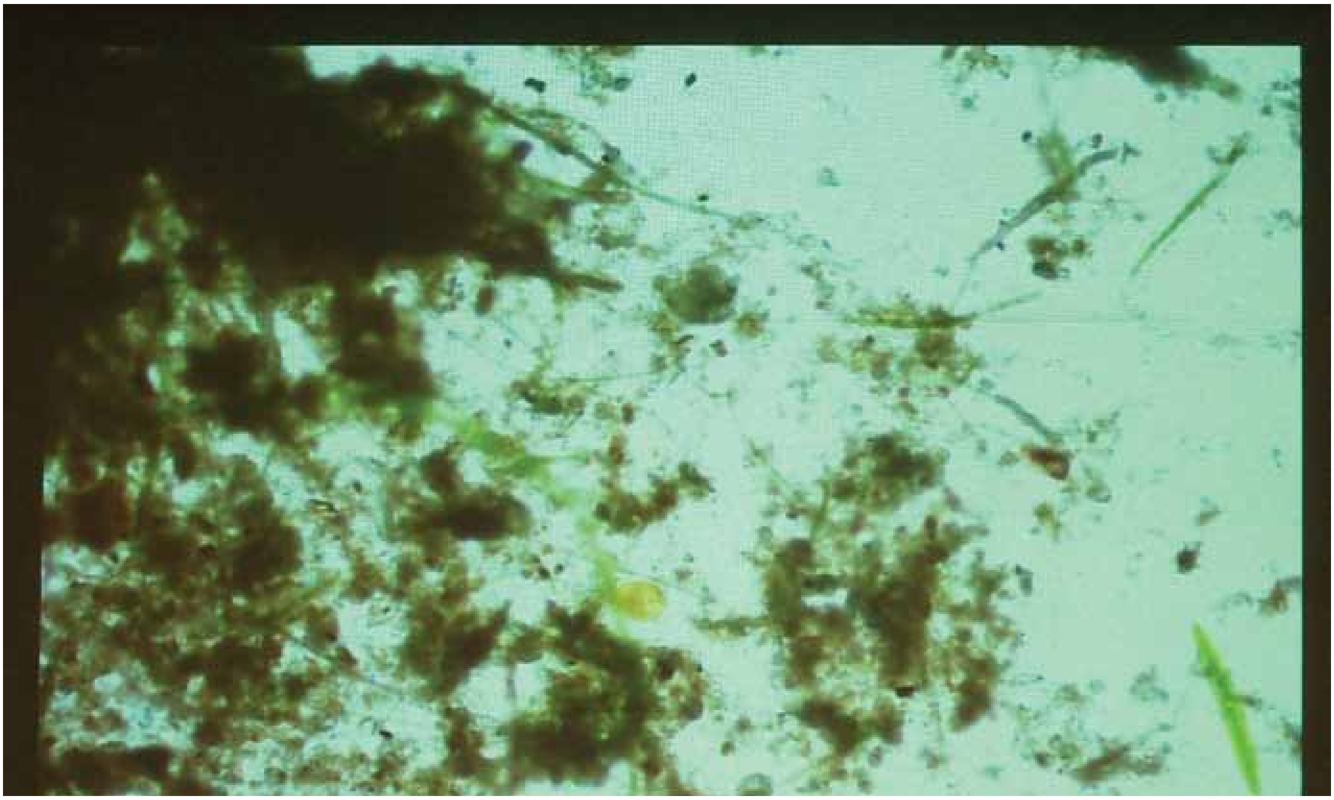
Food Chain Connections

Activities involving pond and stream samples fit nicely into a unit on food chains or food webs, and several examples can be found in the literature (Cook, Hildreth, and Matthews 2004; Lawson 2001; Simms-Smith and Sterling 2008). This activity, developed to wrap up a food chain unit, is unique because it involves using only one microscope projection system to engage many students. The major objectives are to connect the microscopic world with macroscopic observations, show the diversity of microscopic life, and illustrate the importance of algae in food chains. The activity can be readily adapted for older elementary students by adding more information about photosynthesis, the importance of bacteria in decomposition and regeneration of essential nutrients, and the biology of the organisms viewed. An examination of rocks collected from still water (i.e., ponds) versus flowing water (i.e., streams) habitats could also offer an interesting extension for older students.

CAUTION The activity requires the collection of a few algae-coated rocks (~20 cm across), *by an adult*, from a nearby stream or pond. We have had poor success using rocks from large aquariums as they often contain predominantly one organism. Ideally, the instructor could also gather larger organisms such as snails, small fish, and crawdads (crayfish). We are in an area with good biodiversity and are able to gather larger organisms that we return to their native habitat after the activity. However, the activity can work without the larger organisms as described below. If you do collect organisms you should also consult your state fish and wildlife agency regarding collection permits for educational use, possible release restrictions, and any invasive species concerns.

Observing the "Mud"

We start the activity by showing the students one of the collected rocks. Students are then asked to touch the rock and make an observation about how it feels or smells. CAUTION Lining the students up single file in the direction of a hand sanitizer station or a sink with soap and water works well. After the students are seated again, they are asked to describe some of their observations. Students typically say that it smells terrible, is slimy, and is



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40x magnification of scrapings found on a muddy rock from a stream projected onto a large screen.

muddy. We then ask whether students think that anything is living on the rock or in the mud on it. Some students have known that microscopic organisms are present, but most have thought of it as only a muddy rock.

After this initial setup and discussion, we prep a slide containing some mud from the rock. The teacher (not students) scrapes the rock with a razor blade or butter knife, smears the scrapings on a slide, adds a drop of water, and then adds a coverslip. It can take a little practice to prep a good slide, and it often pays to have one prepared in advance.

The initial magnification displayed on the screen will vary with the microscope available, but we start at a total magnification of 40×. The students can instantly see that the "mud" is actually made up of smaller items. This is another time to ask for observations. Answers will vary, but students have usually mentioned that it looks "chunky" or it has a green color. They can usually see objects moving, testifying with loud "oohs" and "ahhs." Overall, it begins to look like something other than the mud they first observed.

A Closer Look

At a total magnification of 100×, more detail and individual organisms, such as microalgae (i.e., diatoms), protozoa, and small invertebrates (i.e., nematodes, rotifers) are often seen. We invite students to approach the screen one or two at a time to get an even closer look. Although magnification of 200× is sufficient, the ability to view organisms at 400× has elicited the best response from students. Students really enjoy going up to the screen and getting close to the projected organisms that are often half a meter across at 400×. Some have even said that they feel they can almost "touch" the organisms that are being projected.

You can add varying amounts of detail at this point, depending on the age group (see Internet Resources for an online supplement on food webs and slide prep). In the simplest terms, students could be asked about where many of the organisms get their energy. A common answer from early elementary age children is the water. If this activity follows a unit on food webs, we quiz students about the two main ways organisms get their food: they either make their own food with sunlight and chemicals from the environment (producers) or they depend on the consumption of other organisms (consumers). Teachers can facilitate this discussion by focusing students' attention on the color of many of the organisms seen and the color of plants. This normally gets students thinking about how the Sun provides the energy input at the base of a food chain. Older elementary school children will likely be familiar with photosynthesis.

Higher Food Web Connections

After examining the microscopic world, we then ask students about what types of organisms consume the organisms seen on the screen. The answers from students have included everything from crawdads (crayfish) to sharks. When we hear an organism such as a shark, we try to get students to think locally and what types of organisms they are aware of from their area. This steers the discussion back to more realistic answers. If larger organisms have been collected, these can be shown to demonstrate food web connections. For example, algae and other protists

100x magnification of scrapings found on a muddy rock from a stream projected onto a large screen.

are consumed by microcrustacea such as *Daphnia*, which are then eaten by small fish. If larger specimens are not available, pictures of various organisms can be projected onto the screen. Another possible extension for older students is to compare aquatic and terrestrial food webs. The similarities will be easy to see, but teachers can lead a discussion that focuses on the differences, mainly on the sizes of organisms that photosynthesize. On land, photosynthesis is done by large, multicellular plants, whereas in aquatic habitats microscopic algae are responsible for most of it. For this microscopic production to support macroscopic aquatic organisms (i.e., fish), it must first pass through a food chain of increasingly larger consumers before it can be consumed by the largest of aquatic organisms.

Conclusion

An examination of the microscopic world can be an important part of any science curriculum. The initial cost of a microscope with the capability of digital projection is worth the investment when considering what can be accomplished. The teacher-facilitated activity described here provides an excellent starting point for incorporating a microscope into the curriculum and getting students excited about science. ■

400x magnification showing a large diatom.

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References

Cook, H.M., D.P. Hildreth, and C.E. Matthews. 2004. Hooked on science. *Science and Children* 41 (8): 42–47.

Lawson, J. 2001. *Diversity of living things:* A *hands-on science module*. Winnipeg: Portage & Main Press.

Simms-Smith, A., and D. Sterling. 2008. Wade in the water: School, parent, and community collaboration. *Science Scope* 31: 73–75.

Internet Resources

Microscopy UK
www.microscopy-uk.org.uk/pond/index.html

Teacher's Supplement for *Time for Slime*
www.sckans.edu/foodwebs

NSTA Connection

For data sheets, tips, and information on organisms, visit *www.nsta.org/SC1112.*

Connecting to the Standards

This article relates to the following *National Science Education Standards* (NRC 1996):

Grades K–4

Content Standards

Standard A: Science as Inquiry

- Abilities necessary to do scientific inquiry

Standard C: Life Science

- Characteristics of organisms
- Organisms and their environment

Standard E: Science and Technology

- Understanding about science and technology

National Research Council (NRC). 1996. *National science education standards.* Washington, DC: National Academies Press.