Teacher Guide

Caeno-WHAT??

Lesson Summary: Students demonstrate how the nervous system of the worm allows the animal to behave and respond to its environment.

Grade Level 5-8

Lesson Length
1 class period

Standards Alignment

Next Generation Science Standards – Alignment Matrix

- 3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- 4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
- **Framework for K-12 Science Education**: Science & Engineering Practices 3,4,7,8

National Science Standards – Project 2061: Atlas of Science Literacy reference

a) Scientific inquiry: Evidence and reasoning – lines of reasoning and observations and evidence (p. 17, Atlas Vol. 1)
Research on student learning: "When asked to use evidence to judge a theory, students of all ages may make only theory-based responses with no reference made to the presented evidence. Sometimes this appears to be because the available evidence conflicts with the students' beliefs." (p.16, Atlas Vol. 1)

b) Scientific inquiry/Scientific theories – making sense of evidence and alternative explanations (p.21, Atlas Vol. 1)
Research on student learning: "Although most students believe that scientific knowledge changes, they typically think changes occur mainly in facts and mostly through the invention of improved technology for observation and measurement." (p.20, Atlas Vol. 1)

Objectives—Students will

- design and conduct a controlled experiment to test the preference of *C. elegans*.
- analyze their experimental data and present their results.
- use a microscope.

Assessment Options

- Discuss students' design and procedures testing worms for attractants.
- Evaluate lab reports.
- Ask students to present their results and conclusions to the class.

Materials

- light microscopes capable of magnification in 20x-50x range
- adult N2 worms (normal animals)
- *E. coli* growth agar dishes
- pipettes or eyedroppers
- worm pickers (toothpicks)

- different odorants to test: isoamyl alcohol (attracts), 1-nonanol (repels) - best at 10^{-2} strength
- plain, non *E.coli* containing agar plates (as a control)
- bucket or styrofoam container of ice
- ice
- sodium azide

Getting Ready

It would be helpful if your students have had some previous experience using microscopes.

A day or two prior to this activity, have your students bring in a sample of dirt from their homes. Tell them to place the dirt onto half of the 1 *E. coli* plated agar dish and label the dish with the student's name. Leave the plate overnight to see if any nematodes migrate out onto the agar.

Set up stations with a microscope, worm picker, and a dish of worms.

Start the Activity

If the students brought in soil samples, ask each student to look at the plate to see if anything has moved out onto the agar. At least a few kids should have some type of nematode in their sample.

Talk about how this worm lives in the soil all over the world and that it has become a very important model for understanding how our nervous system works as well as for studying the genetics which control behavior.

Project an image of some of the worms moving on a dish or show a videotape of their normal motion. This will give students an idea of what they are looking for. You may also fill out the worksheet together as a class.

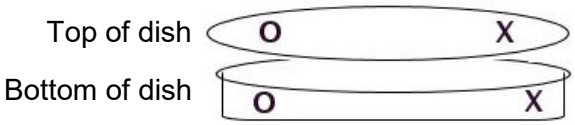
What To Do

1. Remind your students that they'll be pooling data, so it is important for them to take careful notes while they are working.
2. Break students up into groups to use the microscopes to explore the worm's behavior in reaction to different smells and light touches on the body.
3. Assist your students in forming ideas about what they can test with the animals.
4. You may spot the sodium azide on the agar where the students have placed "X"s to stop the worms from moving away.

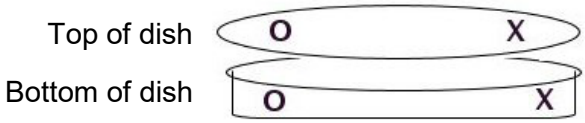
Test a Worm's Sense of Smell

Goal: To see if worms can smell. If they can, what smells do they like and dislike?

1. Get a plain petri dish and make an **X** on the top and the bottom of the dish for the chemical to be tested and an **O** on both sides as a control, as in image below.



2. Put a worm or some worms in the center of the dish. Use an eye dropper to transfer the worms.
3. Take a drop of a chemical and place it on the **top of the dish** where you placed the **X**
4. Line up the **X** and the **O** on the top and bottom of the dish, as in image below.



5. Wait at least 15 minutes to give let the worms move around some.
6. Take a look at your dish . Where did the worms move?
7. Record your results.

Test How the Worm Moves

Goal: To see how the worms move and react to being touched.

1. Take a toothpick and use it GENTLY to touch a worm on the head. How did it react?

2. How does the worm react when touched on the tail?

3. Why might the worm move differently when touched?

4. Come back together as a group and discuss why the worm acts the way it does and what its nervous system needs to have in order to sense and react to the students' investigations.