Using pillbugs and barriers to explore the scientific method in the first introductory laboratory period

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Present activities and associated problems

Students now work with protists, monitoring for two weeks the effects of one species on the other.

This is the first course students take as Biology or related Life Science majors and treats ecology, evolution and diversity. This laboratory than precedes others which focus on trophic levels, parasitism and co-evolution.

This laboratory has always been plagued by problems

- It has proved difficult to maintain these cultures for two weeks.
- Inexperienced, students have had too much trouble using micro pipettes and the microscope to obtain good samples of protist densities.

For two years in a row, we have had to provide simulated data for most student groups as cultures have failed.

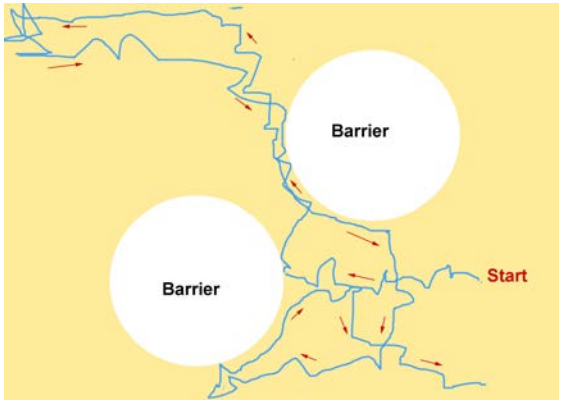
The new activities:

On observation and the scientific method

Students will design their own experiments with pillbugs (sowbugs, isopods) attempting to gain an appreciation for "decision making "in these organisms.

Students will have access to barriers of various shapes, sizes and consistencies and so will have essentially an unlimited number of hypotheses that they can test.

In this activity, students will monitor the innate behaviors used by these organisms to navigate around barriers.



A path (blue) of a pillbug encountering two barriers on wet sand (tan).

This exercise should be a more successful introduction to the course for several reasons.

- Materials used are relatively inexpensive: sowbugs, pans (baking or dissecting). sand, plastic blocks or cut PC piping, markers, and paper.
- Given the ample availability and ease with maintaining sowbugs, there should be no problem providing students with enough specimens for numerous trials.
- The exercise spans one laboratory period not two as the design of the experiment can be assigned as homework.
- The activity stresses the importance of observation, and encourages students to work in groups to become careful observers as they must record not only the direction of movement, but direction and number of turns, and position of the animal at various times in the arena. Our student testers have filmed the behavior of animals with their cell phones to analyze later.

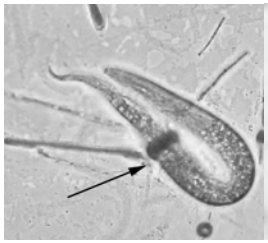
As individual instructors can vary the barriers available, this activity discourages any temptation for students to use data, if not the "report", produced by past students or fellow classmates not registered in that particular section.

The new activities:

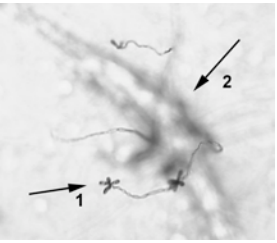
On observation and the scientific method

We will also add a short exercise involving population sampling that monitors the effects of nematodes on fungi to a later laboratory that treats species relationships.

Certain carnivorous fungi in the presence of nematodes produce traps. Fruiting bodies are produced by the fungi later often in the vicinity of the "ghosts" or digested remains of captured nematodes.

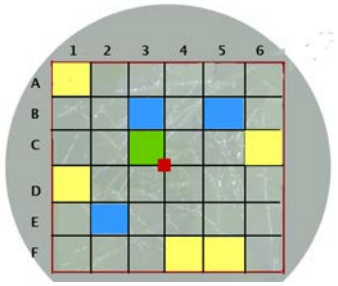


Nematode in trap (arrow) produced by fungus.



Fruiting bodies (1) and can be found in the vicinity of what remains (2) of the digested nematode.

We have devise a non destructive method of sampling that involves dividing the growing chambers (petri dishes) into quadrats. Since the fungi grows from an inoculating square placed in the center of the dish, the chamber is also divided into three sectors which will contain different densities of fungi after two weeks of growth. Nematodes are added in a liquid inoculate at the same density throughout the plate.



Sampling grid: Red square indicate inoculate of fungus. Other color denote sampling quadrats in areas of various fungal densities.

Non destructive sampling enables students to check their counts. It enables several groups to use the same plate. Nematodes and fruiting bodies within an entire quadrat can be easily viewed under a stereoscope. Students can correlate fungal (hyphal) density with captured nematode density (week 1) and nematode density with fruiting body density (week 2)

Nematodes and carnivorous fungi are available from various biological supply companies and fungal growth (and so nematode capture) can be regulated by refrigerating plates for periods of time.