



Hydra Mania

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Hydra Mania

Suggestions for Teachers

Grade levels:

9-12

Purpose:

Students will use the Level 4 inquiry approach (teacher/student proposes problem, student plans and carries out the procedure and supplies conclusion) to design and conduct an experiment using the invertebrate, *Hydra*.

Objectives:

The student will be able to:

Maintain a *Hydra* culture.

Design, in a cooperative group, a controlled experiment using *Hydra* organisms.

Conduct the student-designed experiment.

Present the experimental design and results to their peers, via a PowerPoint or poster presentation.

Prior Knowledge Required:

Students should be familiar with the scientific method, with an emphasis on experiment design. They should be able to generate the problem, hypothesis, control and experimental groups, and conclusions. My students carried out the APS Summer Program Bead Experiment to practice experimental design.

Materials:

For Culturing the *Hydra* populations:

1. *Hydra culture* (*Carolina Biological Supply* - 1-800-334-5551)
D8-13-2800.....\$5.10 Brown Hydra
D8-13-2810.....\$7.83 (Green Hydra showing symbiotic relationship with green algae)
2. Spring Water
(That found at your local grocery store or Wal-Mart works just fine. I found that after a week or so in any spring water, they start to scrunch up. When I put them in Evian spring water, they extend their bodies and tentacles and are much "happier". It is the most expensive. It also seems to make them bud more)
3. Shallow containers for large stock culture
(4 ½ - 8-inch glass culture dishes from Carolina work nicely.)
D8-74-1004.....\$4.15, Carolina Biological Supply
Most any hard plastic or glass container will do.
4. Pipettes for transferring *Hydra*
Plastic pipettes work well (Carolina – D8-73-6898, \$6.85/100)

5. Sieve for straining *Hydra* for cleaning and for separating from brine shrimp after feeding (I made sieves from 4-inch plastic embroidery hoops and 400 μm (micrometer) sieve material from Aquaculture Supply), 108 Industrial Boulevard, New Orleans, LA 70121, Tel: 352-567-8540, info@aquaculture-supply.com
BB-H4 – Plastic Hoop 4-inch diameter - \$2.50
B-PES250 – Poly Sieve Fabric 250 μm 40 inches - \$17.25/yd
6. Brine Shrimp for feeding *Hydra* - Carolina BS D8-L610 1 oz., \$5.49
7. Magnifier for working with *Hydra*.
I use 5x magnifying glasses that I ordered from <http://homestead.com/MagnifyingGlass/hand1.html>
For less than \$4.00 each or dissecting scope (Don't use light from scope – heat will kill the *Hydra*!)

For Student Experimentation:

1. Plastic Petri Dishes (100 x 15 mm) for student cultures of *Hydra*
D8-74-1350...\$4.45/20 from Carolina
2. Plastic pipettes
D8-73-6898...\$6.85/100 from Carolina
3. Other materials requested by student experimenters (water from local bodies of water, air pumps, cooled area, etc.)
4. Brine shrimp for feeding *Hydra*
5. Dissecting microscopes, magnifying glasses, 5x, or other magnifying lenses, 1/group

For Culturing Brine Shrimp:

1. 1% NaCl solution (Box salt from the grocery store works fine)
2. 500 ml beaker or other fairly large container for hatching brine shrimp
3. Air pump with tubing (no air stone)
4. Piece of white t-shirt for straining brine shrimp and rinsing
5. Beaker for straining
6. Spring water
7. Plastic pipettes
8. Lamp

Culture Techniques:

Brine Shrimp for *Hydra* feeding:

1. Make up a 1% NaCl solution (1 gram of salt for about every 100 ml spring water).
2. Add about $\frac{3}{4}$ teaspoon brine shrimp eggs (actually cysts) to about 400 ml water in a container, such as a 500ml beaker or quart jar.
3. Aerate with an aquarium pump with just tubing attached – no air stone.
4. Brine shrimp will hatch in about 24 hours.
5. To collect brine shrimp for feeding, pour into a flat container and shine a light on one edge of the container. The brine shrimp will swim toward the light and collect in one corner in 15-30 minutes. You also may just shine the light on the upper surface of the beaker, after turning off the air pump.
6. Prepare a container for rinsing the brine shrimp by placing a square of old white t-shirt over a small beaker.
7. Collect the brine shrimp with a plastic pipette and deposit on the t-shirt square.
8. As the salt water runs through, rinse the salt off the brine shrimp by squirting spring or distilled water over the brine shrimp 3 or 4 times. After they are rinsed, add a squirt of water over them, and then suck up the brine shrimp and small amount of water with another pipette.

I have also experimented with freezing brine shrimp for feeding. I hatched them, rinsed them, and put “blops” of the brine shrimp onto a piece of waxed paper in a pan. Each “blop” contained about 3 drops of thick brine shrimp solution. I put the pan in the freezer until the “blops” were frozen and then raked them into a freezer bag. I keep these in the freezer and thaw them for feeding. I have not read of this anywhere in the culture direction for *Hydra*, but it saves the bother of having to hatch the shrimp so frequently. The *Hydra* don't seem to mind non-swimming brine shrimp, so long as they are squished about with the pipette, to encounter the *Hydra* tentacles. I also have found that the ones that are not rinsed may be kept a day or 2 in the refrigerator.

To maintain *Hydra* Culture:

1. Place *Hydra* in 4-½ inch glass culture dish or other shallow glass or hard plastic container.
2. Add about an inch of spring water.
3. Feed every other day or so with brine shrimp. (*See directions for growing brine shrimp.*)

To feed:

Squirt rinsed brine shrimp, in the plastic pipette, over the *Hydra*, attempting to hit the tentacles of most of the animals. Put the pipette under the surface of the water and squirt the water in and out to move the brine shrimp to encounter all the *Hydra* tentacles.

After 30 minutes to an hour, pour off the water, unattached *Hydra* and uneaten brine shrimp onto the sieve. Squirt spring water over the *Hydra* and brine shrimp to rinse the shrimp on through.

Turn the sieve over, atop the *Hydra* culture dish and squirt spring water through to get the *Hydra* back into the culture dish. Add fresh spring water to about an inch.

3. The next day, clean the *Hydra* culture dish thoroughly. Run your finger over the bottom and sides of the dish to remove the accumulated bacteria and “scum.” Pour the solution and *Hydra* over the sieve. Rinse the *Hydra* using the pipette and spring water. Invert the sieve over a clean culture dish and squirt spring water through to get the *Hydra* into the clean dish.
4. Add fresh spring water to about an inch.
5. If the *Hydra* are fed every day, they will begin to bud and the population will increase rapidly. According to the literature, twice-a-day feeding may increase the speed of budding.

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Student Activity Sheet

Day 1:

Materials:

Plastic Petri dish containing 5 *Hydra* in 40 ml spring water
Dissecting scopes, 5x magnifying glass, or other magnifier

1. Give each group a Petri dish containing 40ml of spring water and 5 *Hydra*.
2. Have them observe the *Hydra* using dissecting microscopes or lenses with at least 5x magnification. (If they use the dissecting microscopes with the built in lights, they must not use the light coming from the bottom or the *Hydra* will get overheated and die.)
3. Conduct a whole group discussion and record student observations of the animal's structure and behavior. Discuss the organism's radial symmetry and slow movement. Lead students to a hypothesis as to how the *Hydra* might get food.

Day 2:

Materials:

Group *Hydra* culture

Spring water

Pipette containing washed brine shrimp, 1/group cultures (Set up the brine shrimp hatching the day before. Rinse them and have ready, in a pipette, for student feeding.)

Hydra sieve for removing uneaten brine shrimp

Beral pipette

Small container for collecting water and uneaten shrimp

1. Give each student group a pipette containing brine shrimp for feeding the *Hydra*. Demonstrate feeding the brine shrimp to the *Hydra* and have the students feed the 5 organisms in their dish. Have students observe with dissecting scope (no hot lights!) or lens and describe feeding method.
2. Whole group discussion of *Hydra* feeding observation.
3. Instruct students in method for removing uneaten brine shrimp after 30 minutes and have them carry out activity.
4. Pass out sheet with *Hydra* background information and information on accepted *Hydra* care. Discuss accepted optimum conditions for *Hydra*, but note that these conditions are not for any particular species; nor do they take into consideration the adaptations for different climates. Also, give students the option of using the Green *Hydra* (green algae) symbiont. Give them the problem scenario:

A mania for Hydra is sweeping the nation! People everywhere are paying premium prices for Hydra as pets and suppliers are not able to keep up with the demand. HYDRA, Inc., the most popular supplier of healthy, pedigreed Hydra, is offering contracts + bonuses to Many High School students for culturing Hydra. All student groups will be paid with points and the group in each class that has the largest population of healthy Hydra at the end of two weeks will receive 20 bonus points. Any chicanery or unethical actions will negate any bonus points and result in a 3-day prison sentence (Student Adjustment Center).

Day 3:

Materials:

Group *Hydra* cultures
Spring water
Plastic Beral pipettes
Magnifiers
1 clean plastic Petri dish/group

1. Instruct students in proper removal of regurgitated brine shrimp skeletons and cleaning of *Hydra* dish. Have groups carry out cleaning procedure.
2. Have groups confer and decide, as a class, on culture methods that will be used by the entire class. Each student group is then to vary only one environmental factor and carry out a controlled experiment for optimum growth of their population.
3. Have student groups turn in a list of materials and/or equipment that they will need for carrying out their experiment.

Day 4-5, 6-10:

(Time of experiment may be varied, depending on the speed at which the *Hydra* begin to bud.)

1. Have groups carry out the experiments, record population numbers daily, and post on a class chart.
2. Each group will plan and present a report of their work one week after the experiment has ended.

Day 11-15:

1. Students groups will prepare a presentation of their experiment for peer review. On the last day, each group will present their experimentation and results, with each group member taking part in the presentation.
2. Students may make posters for their presentation or, if equipment is available, make a PowerPoint or other multimedia presentation. My students use laptop computers to prepare their PowerPoint, the digital camera to illustrate their research, and Excel to graph their data. This is all put into a PowerPoint presentation, using the 32 inch classroom monitor.
3. A grading rubric will be used to grade the presentation. Bonus points will be awarded for the group in each class with the largest *Hydra* population.

References and Resources:

Johnson, E.M, B.E.G Gabel, L. M. Newman, and R. Giacobbe. (1992) *The Hydra Assay Manual*. Department of Anatomy, Jefferson Medical College, Philadelphia, PA.

Loomis, F.W. (1955) Glutathione control of the specific feeding reactions of hydra. *Annals of the New York Academy of Science* 62:209-228.

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