Hands-On Science with Phenomenal Critters

Phenomenon—Using Planaria as a Model for Interspecies Relationships

Planaria (also known as flatworms) are a group of aquatic animals found throughout the world in both saltwater and freshwater. Planaria have a simple yet unique body structure, showing a distinct head with eyespots that are sensitive to light. Planaria also have a digestive system that includes a mouth, a pharynx, and a gastrovascular cavity. While planarians are typically used in regeneration experiments, in this experiment you will observe their interactions with *Daphnia magna.* Work in pairs.

Materials

2 to 3 Planaria (per group)
4 to 5 *Daphnia magna* (per group)
2 Pipets with Tips Cut Off (per group)
1 Petri Dish, 2-Compartment (per group)
1 Hand Lens (per person)
Springwater
Timer or Watch

Time Requirements

Setup and initial observation: 5 minutes
Final observation: 10 minutes

Procedure

1. Using 1 pipet, place 2 to 3 planaria into 1 side of the petri dish.
2. Fill that side of the dish with springwater to the height of the divider. Take care not to spill water over the divider.
3. Using a fresh pipet, place 4 to 5 *Daphnia magna* into the other side of the petri dish.
4. Fill the second side of the dish with springwater to the height of the divider, taking care not to spill water over the divider.
5. Each group member will observe *either* the planaria or the *Daphnia* for 1 to 2 minutes. Pay attention to how each species moves and if the organisms cluster together or travel independently. Take notes in the provided space.
6. After the observation period, share your findings with the other group members.
7. Using the springwater, add water to the **planaria** side of the petri dish until the water exceeds the low side of the divider. Gently break the surface tension with 1 of the pipets. Take care not to fill the plate so high that the ***Daphnia*** can move from side to side. Only the planaria should be able to travel between the compartments (Fig. 1).

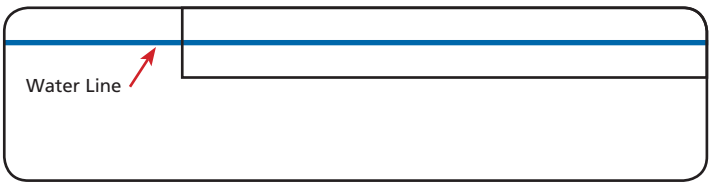

Figure 1: When you add water to the plate to allow the planaria to cross, add water until it crests the low side but does not top the high side.

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Procedure (continued)

8. Observe both sets of organisms for 10 minutes, taking notes in the provided space. Every 2 minutes, draw on the provided templates the approximate locations of each organism and note how many of each organism are still in the petri dish.
9. During your observations, pay special attention to when a planarian and a *Daphnia* interact.
10. What did you observe? What questions do you have (students)?

Observations

Initial observations: _____

_____

Observations during feeding:

2 minutes: _____

4 minutes: _____

6 minutes: _____

8 minutes: _____

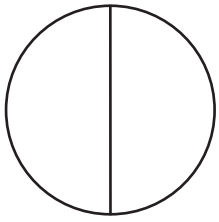
10 minutes: _____

Final observations and conclusions: _____

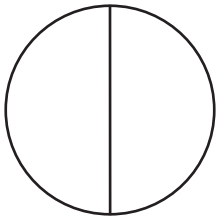
_____

_____

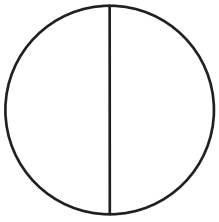
_____



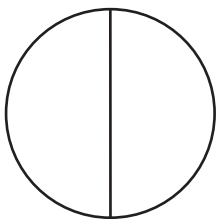
Time: 0 min Planaria:____ Daphnia:____



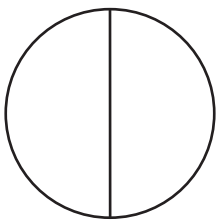
Time: 2 min Planaria:____ Daphnia:____



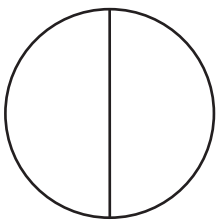
Time: 4 min Planaria:____ Daphnia:____



Time: 6 min Planaria:____ Daphnia:____



Time: 8 min Planaria:____ Daphnia:____



Time: 10 min Planaria:____ Daphnia:____

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Hands-On Science with Phenomenal Critters

Guided Inquiry—Termites: Follow That Trail!

Termites are wood-consuming eusocial insects, meaning the members of the colony are organized into different castes, or groups, that have different responsibilities. Workers are the most numerous members of a colony and perform the important tasks of building the colony, caring for young, and foraging for food. In this experiment, you will form and test a hypothesis about termite trail following. Variables to test include pens, pencils, markers, or depressions left by the handle of a paintbrush.

Time Requirements

Planning and setup: 5 minutes

Testing: 10 minutes

Materials (per person)

5 to 7 Termites
1 Blank Sheet of Paper
1 Paintbrush
Various Writing Implements

Procedure

1. Working alone and using what you know about termites, write down a hypothesis about what may lead to termite trail-following behavior.
2. Select 3 writing implements and/or the handle of a paintbrush to test. Record your selections in the appropriate blanks. (Attempt to have a unique set of 3 implements compared to the other members of your group.)
3. On the blank piece of paper, draw 3 shapes that intersect each other in at least 1 spot (see Fig. 1 for an example of shapes). The shapes should be large; use the entire piece of paper.
4. Using the paintbrush, gently place the termites in the center of 1 shape.
5. Observe as the termites travel the paper for 10 minutes. Make special note if they follow a trail, how many follow each trail, and begin to form conclusions about what trail(s) the termites are following and how the termites are following the trail(s).
6. Gently place the termites back into their containers using the paintbrush.
7. Discuss your results with your group and compare conclusions.

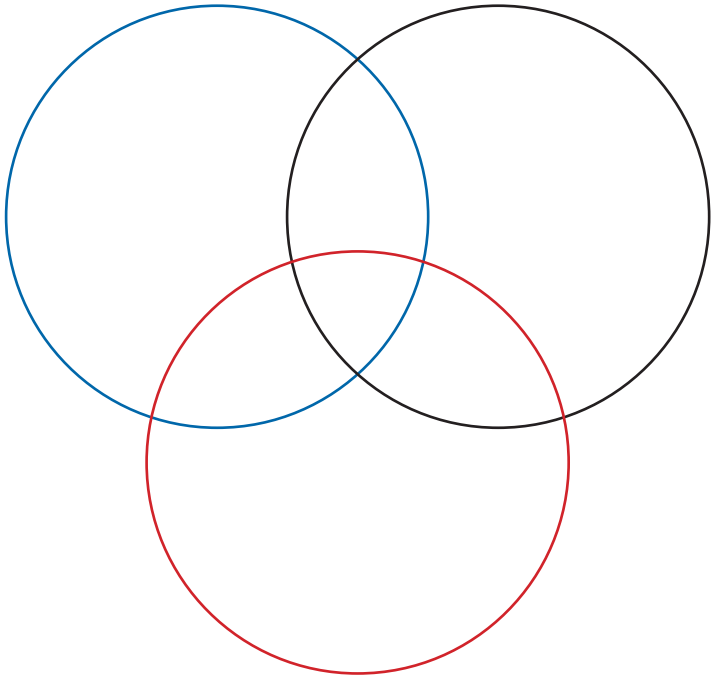

Figure 1: One potential shape for testing.

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Experiment Data

Hypothesis: _____

Data Table

Implement 1	Implement 2	Implement 3
Implement type:	Implement type:	Implement type:
Color:	Color:	Color:
Brand:	Brand:	Brand:
Number of followers:	Number of followers:	Number of followers:

Other implements tested in group: _____
All implements that were followed: _____
Similarities between followed implements: _____
Differences between followed implements: _____
Similarities between non-followed implements: _____
Differences between non-followed implements: _____

Discussion Questions

1. Which implement(s) did the termites follow?_____

2. Why do you think the termites followed certain lines from specific implements?_____
   _____

3. What *similarities* are there between the implements the termites followed?_____
   _____

4. What *differences* are there between the implements the termites followed?_____
   _____

5. Based on what you know about termite workers, what are some advantages of this trail-following behavior for worker termites?_____
   _____

6. Did you accept, reject, or revise your hypothesis?_____

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Hands-On Science with Phenomenal Critters

Open Inquiry—Gaining Traction with Bess Beetles

Bess beetles (or bessbugs) are large wingless—and harmless—wood-eating insects. They use their large mandibles to eat rotten hardwood and are a common sight in rotting logs of hickory, oak, and other hardwoods. Bess beetles also can "sing," which you can hear by holding a beetle up to your ear. Bess beetles are a great model to use when comparing the strength of insects, as they are extremely docile and can be attached easily to a "sled" with floss. Bess beetles can pull more than 30 times their mass. In this experiment, you will explore the role that **friction** and **traction** have on bess beetle pulling power. Each group will devise the best variable combination to maximize the mass the beetles can pull. Work in groups of 2 to 4.

Time Requirements

Planning: 5 minutes

Testing: 15 minutes

Procedure

1. As an introduction, watch the video showing how bess beetles pull a sled full of washers.
2. Then watch the video about how to make a lasso for the bess beetle. See the **appendix** on the next page for instructions.
3. Working in groups of 2 to 4, create a hypothesis and design an experiment to test your hypothesis. The beetle's *traction* and the sled's *friction* coefficient are the variables that should be tested. **(5 minutes)**
4. Engineer the selected designs and attach the bess beetle to the sled.
5. Complete the test and record results. **(15 minutes)**
6. Return the bess beetle to container.
7. Discuss your results with other groups at your table and determine which combination maximized the beetle's pulling power.

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Materials (per group)

1 Bess Beetle
1 Petri Dish
Dental Floss
Metal Washers
Transparent Tape
Sandpaper
Aluminum Foil
Cheesecloth
Wood Dowels
Carpet
Plastic Wrap

Appendix: How to Make a Lasso

1. Cut a piece of dental floss 6 to 8" (15 to 20 cm) long.
2. Using a paintbrush or dowel rod, tie a loop in roughly 1" (2.5 cm) from 1 end. Leave the excess, as this will serve as an easy way to release the beetle.
3. Slide the loop off of the paintbrush or dowel rod.
4. Loosely feed the long end of the floss through the hole, creating a slip knot.
5. Gently slip the loop over the bess beetle's head and thorax; tighten the loop around the junction between the thorax and abdomen. Lay the excess over the beetle's back.
6. Tape the long end of the floss to the ***inside*** of the petri dish.

Experiment Design and Results

Hypothesis: _____

Material used to change traction: _____

Material used to change friction: _____

Space for collecting data:

Conclusions: _____

_____

_____

Best material used to change traction from all group results: _____

Best material used to change friction from all group results: _____

Most washers moved: _____

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