Snails, Limpets and Chitons: Moving On

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Key Concepts

1. Snails, limpets and chitons each crawl on rocks with a muscular foot to find food and more favorable conditions.

2. These mobile animals also adhere tightly to rocks to survive low tide and to deter predators.

Background

Some of the most common animals in rocky shore habitats are the snails, limpets and chitons. Unlike barnacles, these animals are mobile. They each have a muscular foot that moves in contractions which appear as waves. The wave movement propels the animal forward a minute step at a time. The wave of contraction push-pulls the animal along.

The slime trail snails, limpets and chitons leave has unique chemical properties that alternately act as a glue then as a lubricant depending on the pressure placed on the slime by the animal. The stationary portion is held in place by the glue as the moving portion is easily moved over the lubricated surface.

Materials

For each student or pair of students:

- 1 snail, limpet or chiton
- 1 glass jar with a lid
- sea water
- washable felt marker such as an overhead transparency pen
- 30 cm or so string
- millimeter ruler
- "Snails, Limpets and Chitons: Moving On" student pages

Teaching Hints

"Snails, Limpets and Chitons: Moving On" gives your students a chance to observe movement in a living marine gastropod or the similar chitons. You can readily obtain periwinkles (*Littorina* species) or other snails, limpets or chitons from the intertidal zone or from biological supply houses. Be sure to follow all

collecting regulations for your area. If possible, have one or two extra animals available in case students have an animal that doesn't crawl in the time allotted for the lab. The students still can complete much of the exercise, but it will hold their interest longer if they have an animal that spends at least a little time moving.

Key Words

gastropod - any member of a group of animals (class Gastropoda) comprising snails, whelks, sea slugs, etc.

midline - the median plane of the body of an animal

mollusc - any invertebrate of the phylum Mollusca typically having a calcareous shell that encloses a soft, unsegmented body including chitons, snails, bivalves, squid, and octopods

mucus - a viscous, slimy mixture secreted by glands and serving to protect and lubricate surfaces

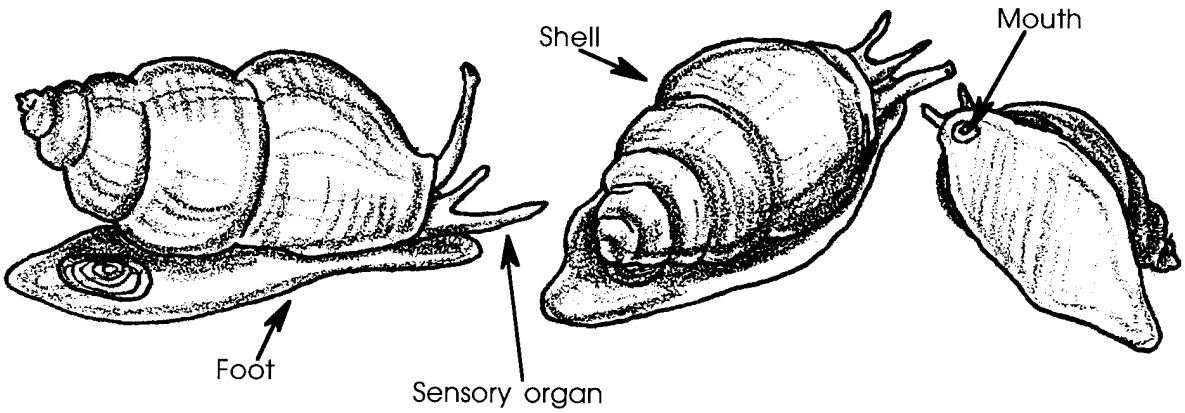
Extensions

1. Flime (fake slime)

   Create a crude model of the mucus snails, limpets and chitons use by creating a corn starch and water colloid. Mix enough water with corn starch to moisten the corn starch. Allow students to handle the mixture. They will find that, when they apply pressure, the mixture becomes more solid and when they release pressure, the mixture flows. Students are more likely to believe that the animals' mucus can both glue and lubricate if they experience this mixture and its very different properties depending on the amount of pressure applied.

Answer Key

4.



5a., b., c., d. The animals' speeds will depend on experimental results.

e. No, the slow rate of speed of the animals seems to indicate that they do not rely upon speed for protection. The most obvious means of protection is the shell.

6. & 7. Student drawings of their animal when it is still, crawling and turning will vary. Most gastropods and chitons move using contractions that look like waves traveling along the foot, so many student drawings and descriptions, if carefully done, will show the waves passing along the foot.

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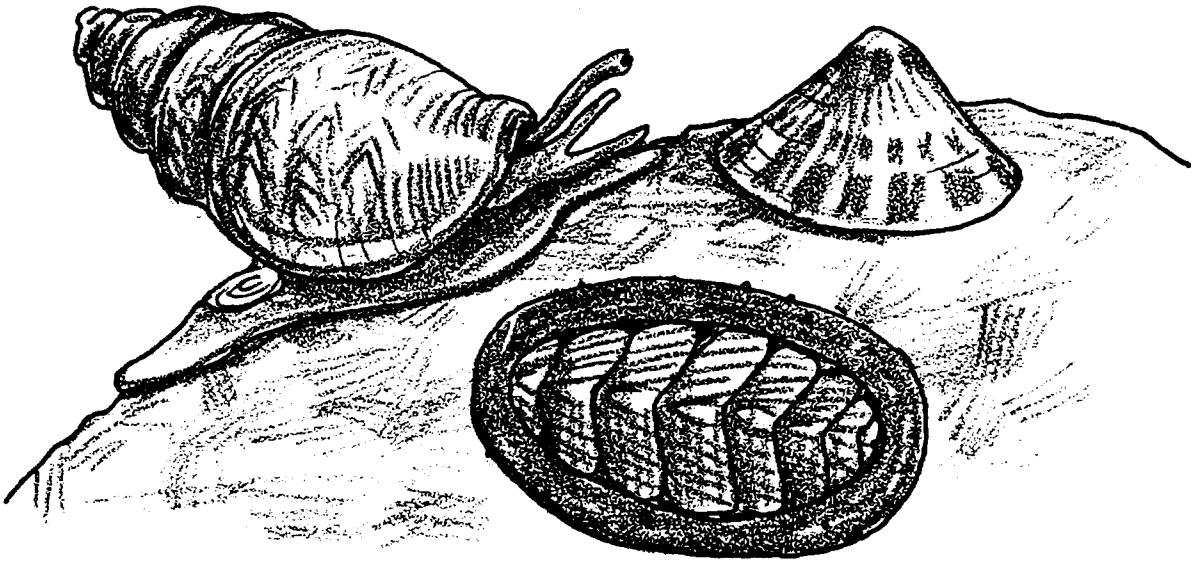


While barnacles sit, attached to rocks, their neighbors on the rocky shore, the snails, limpets and chitons, are mobile. These three animals all have shells and a strong, muscular foot. They can move to find food and move to find more favorable conditions. Most intertidal snails, limpets and chitons also use their muscular foot to clamp down tightly on a rock if they need to wait for the tide to return or need to discourage a predator.

"Moving On" takes a look at the structures and behaviors of these mobile intertidal animals.

Materials

- snail, limpet or chiton
- glass jar with a lid
- sea water
- washable felt marker, such as overhead transparency pens
- string
- millimeter rule

Procedure:

1. Obtain a glass jar, fill it with sea water and place your animal in the jar. What kind of animal do you have? _____

   Use the washable marker pen to outline the animal's foot on the outside of the jar to show the animal's location.

2. When the animal begins to crawl, record the time:_____

3. Watch the animal. As it moves, mark its path on the jar with the marker pen.

4. In the space below sketch top, bottom and side views of the animal. Label the foot and any cilia you may be able to see on the surface of the foot. Label the shell(s) and any sensory organs you see.

   As you draw, remember to mark your animal's location in the jar from time to time.

Top view	Bottom view	Side view

The ability to move gives these intertidal animals many advantages, but can they move fast enough to avoid predators? How fast are they?

5 a. Make a final mark showing your animal's location in the jar. Record the time:_____

How much time elapsed since you first marked the animal's position?

b. Place the string along the path the animal took. How many centimeters did it travel? _____ cm

c. So, how fast was your animal in cm/hour?

$$\frac{\text{\_\_\_\_\_ cm (distance traveled)}}{\text{\_\_\_\_\_ min (total time)}} \times 60 \text{ min/hour} = \text{\_\_\_\_\_ cm/hr}$$

d. Record your rate (in centimeters per hour) on the blackboard. Use the pooled results to calculate the class average. Record the average.

_____cm/hr.

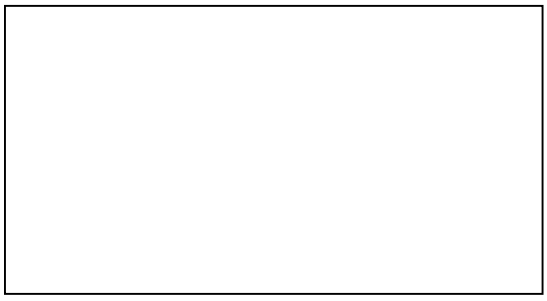
How does the speed of your snail compare with the class average?

e. Is it reasonable to assume that your snail, limpet or chiton relies heavily upon speed to escape from enemies?

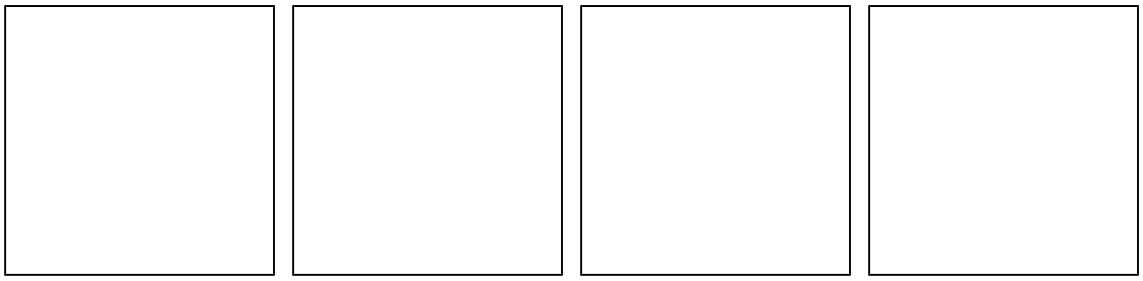
Let's look more closely at snail, limpet and chiton's locomotion. How do these animal accomplish this movement with just one rather amorphous (shapeless) looking foot?

6. Sketch the animal's foot when the animal is still, moving in a straight line, and turning. As you draw, imagine that you are taking snapshots of the animal's foot, capturing how the foot looks at one instant.

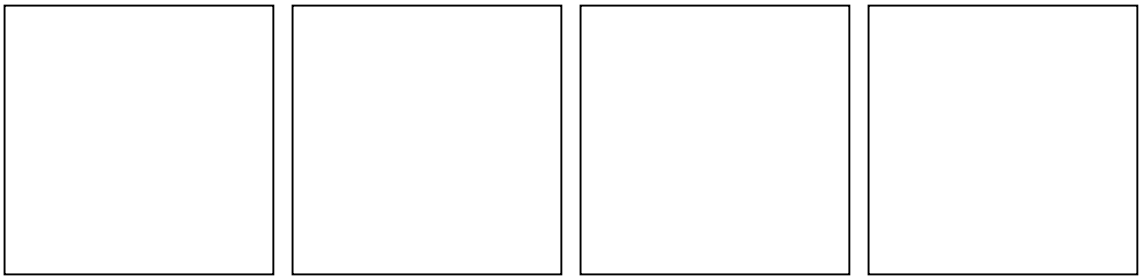
a. Draw the shape of the foot when the animal is still:



b. Draw a series of pictures of the animal's foot as it travels straight ahead. Each drawing will show the shape of the foot at an instant in the snail's movement.



c. Draw a series of pictures of the animal's foot as it turns. Each drawing will show the shape of the foot at an instant in the snail's movement.



7. How does the animal's foot change as it moves?

The animal's foot is a large muscle that can extend and contract, moving the animal forward. Snails, limpets, chitons (slugs, too) also have a special mucus that helps them move. It smooths their path so they can glide easily, yet it also adheres to surfaces so they can stick tightly to rocks.

8. Finally, reach in your jar and remove or try to remove your animal from the glass.

   a. Were you able to remove your animal?

   b. If so, set your animal upside down in the jar. IF IT STICKS VERY TIGHTLY, STOP PULLING ON IT SO YOU WILL NOT BREAK ITS SHELL.

   c. Watch the animal for a few minutes.

   d. Describe what your animal did when it was upside down.

Snails, limpets and chitons defend themselves by clamping tightly to rocks. Limpets are especially strong and not only deter predators with this behavior, but also seal their soft tissues from the air at low tide. If a chiton is loosened from its rock, it typically curls up like a pillbug to hide its soft underside. A snail pulls its soft body inside and seals its shell with a shell plate called an operculum.

9. How does your animal probably protect itself from enemies?

10. Return your animal, wash your jar and return all materials.