ADAPTING TO CHANGE

BENCHMARKS and TASKS

SC.G.1.2.2 The student knows that living things compete in a climatic region with other living things and that structural adaptations make them fit for an environment.

SC.G.2.2.1 The student knows that all living things must compete for Earth's limited resources; organisms best adapted to compete for the available resources will be successful and pass their adaptations (traits) to their offspring.

SC.G.2.2.3 The student understands that changes in the habitat of an organism may be beneficial or harmful.

- The student compares individuals of the same kind to see how they differ in their characteristics, and that sometimes the differences give individuals an advantage in surviving and reproducing.
- The student describes characteristics resulting from an organism's interactions with the environment (e.g., flamingos eat a certain crustacean that causes their feathers to be pink).
- The student discovers, through simulations, how changes in the environment affect organisms (e.g., some organisms move in, others move out; some organisms survive and reproduce, others die).

KEY QUESTION

How can changes in an organism help it adapt and survive in its environment?

BACKGROUND INFORMATION

Adaptations are special body parts or behaviors that allow an animal to survive in its **environment.** When an environment changes, the **organism** that is best adapted to the change will be the one that survives. A classic example of this can be seen in the story of the peppered moth. A long time ago two types of peppered moths could be found in England. One was light gray with dark gray speckles. The other was black all over. Before the Industrial Revolution, there were more light gray moths than black ones. The peppered moths usually rested on the bark of birch trees. Since a birch tree has light colored bark, the light gray moths were harder to find while resting on a birch tree than the dark gray moths, so birds quickly ate the dark colored moths since they were easier to see.

During the Industrial Revolution, many factories were built that pumped tons of black smoke and soot into the air. This soot began to accumulate on the bark of the birch trees. During this time, scientists began to notice that almost all of the light colored moths had disappeared. The dark black moth became the most common moth in England. The lighter colored moth was now the easiest to see on the bark of the birch tree and was more readily eaten by the birds. Fewer and fewer light moths lived long enough to have light colored babies. At the same time, more dark colored moths survived and had dark colored babies. In less than 50 years, the number of dark moths became greater than the number of light moths.

After many years, laws were passed to clean up the air in England. Factories were required to filter waste materials so that smoke no longer filled the air. Gradually the rains washed the dark soot from the birch trees. Once again the peppered moth adapted to its new environment. Light moths began to survive since birds could not easily find them. Today the light colored moths once again outnumber their darker relatives.

MATERIALS

Teacher

The Peppered Moth story
poster board (optional)
prepared moth environment
(glue, classified section of the newspaper, scissors, extra newspaper, colored paper: brown, green, white)
1 piece of chart paper
clock
Hidden Animals, Rigby Informazing Books

Per group

1 copy of the *Moth Patterns* sheet
scissors
crayons or markers
tape

TEACHING TIPS

1. Prepare the moth environment ahead of time:
   - Choose a double page from the classified section of the newspaper. (Any newspaper pages will do as long as they are covered with small print.)
   - Use the *Moth Patterns* sheet to cut out brown, green, white, and newspaper (cut from the classified section) moths. The number of each color of moth should vary.
     (Note: You may want to cut the newspaper moths out of another identical page from the classified section and glue them in the exact position from which they were cut to make them hard to see. The other moths should be glued randomly around on the double page of want ads.)
   - Cover the moth environment with a piece of chart paper before students enter the room.
2. Laminating the newspaper moth environment will make it last for many years, but the lamination will also make the moths easier to see.

ENGAGE

Share the book *Hidden Animals*. Students will be able to see examples of animals in nature that are greatly camouflaged.

EXPLORE and EXPLAIN (Part 1)

1. Tell students that you have a page of paper moths under the chart paper. Their task is to look at the page and estimate the number of moths that are on it.
2. Remove the paper for ten seconds and then replace it quickly.
3. Have students jot down their estimates for the total number of moths they saw.
4. Ask: *What was the total number of moths you saw?*
   What colors of moths did you see? Record this data.
5. Remove the chart paper again and ask: *What is the total number of moths you see now?*
   How many different colors of moths do you see? Record this data.

6. Ask: *How many moths of each color do you see?* Have several students come up and count the different colors of moths. (The moths that were made of newspaper were hard to see and probably were not counted. If no one sees the newspaper moths, you will need to eventually point them out.)
7. Have students record the actual number of each color of moth. Have students compare their estimates to the actual count.
8. Ask:
   Which moths were the easiest to see?
   Which moths were the most difficult to see?
   Why were the newspaper moths hard to see? (The newspaper moths blended into the environment of the surrounding newsprint.)
   If you were a moth living in a newspaper environment, which moth would you rather be? (Students should realize that moths that are harder to see are more likely to survive being eaten by birds and other animals that prey on moths.)
9. Tell students that in this activity they will be creating models of creatures to learn about survival adaptations.

EXPLORE (Part 2)

1. Distribute the materials.
2. Tell students to cut out a moth pattern and color it so it will blend in with something in the classroom. Explain that they will be hiding it by placing it somewhere in the room, but it will have to remain in plain sight. It cannot be placed behind or underneath anything.
3. Explain to students that half of the class will hide their moths first. Their moths will be the prey. The other half of the class will close their eyes as the moths are hidden. These students will represent the predators. Tell the predators to place their heads down while the prey hide their moths. Remind the students who are hiding moths that they must be hidden so that they are still in plain view.
4. Give predators 30 seconds to find as many moths as possible. Tell them to gently remove any moth that they find. When the time is up, have predators tape all of the moths they found on the board or on a piece of poster paper. Label these moths *Eaten.*
5. Next, tell all of the prey students to look around and see if the moth they hid was "eaten." Have them retrieve one moth at a time to show the location and then place the moth on the other side of the board or on another piece of poster paper. Label these moths *Survived.*
6. Now have students switch roles. The predators will become the prey and hide their moths. The prey will become the new predators that have 30 seconds to hunt for moths. Moths that are found are taped on the *Eaten* poster and moths that are not are taped on the *Survived* poster as before.

EXPLAIN (Part 2)

1. Tell students to look at the moths that survived and think about where each one was located. Lead a class discussion about the characteristics of the moths that survived and the characteristics of the environment in which these moths lived. Compare the characteristics of the moths that survived to the characteristics of the moths that did not survive.
   Ask: *What did the moths that survived have in common?* (The moths were able to blend into their environment due to colors, patterns, etc. and were harder to find.)

Explain to students that organisms have adaptations that enable them to survive in their environment. Camouflage is one such adaptation in which an animal's color or shape blends in with its environment.

2. Ask: *What do you think will happen if an environment changes?* (If an environment changes, many of the adaptations that once were an advantage to the animal may no longer be an advantage. The animal must be able to develop new adaptations in order to survive.)

EXTEND/APPLY

Read the story of the *Peppered Moth* to students or make copies and have students read the story. After reading the story ask these questions:
Why were there more light colored moths in the beginning?
How did the factories change the moths' environment?
Why were there more dark colored moths after factories were built?
Why are more light gray moths surviving now?

EXTENSIONS

1. Students can summarize and illustrate the story of *The Peppered Moth* in book form.
2. Scatter colored toothpicks in a grassy area. Let students become hungry birds that have 15 seconds to hunt for the toothpick worms. After they have collected the worms, have them sort them by color. Make a bar graph showing how many of each color were found on grass. Repeat the experiment on pavement or dirt. Ask students to compare the graphs. Relate the results to survival adaptations.
3. Have students design a creature with an adaptation that could help it survive in the classroom. Allow students to hide and hunt for the creatures. Afterwards discuss which creatures survived the best and what adaptations helped those creatures survive.
4. Read *Why Polar Bears Like Snow. . .and Flamingos Don't,* Nancy White, Benchmark Education Co.

ASSESSMENT

Ask students to sketch a picture of a creature that could survive in their bedroom at home and write about how its adaptations would help it to survive.

The Peppered Moth

One of the most dramatic cases of an animal's response to a changing environment began a long time ago in England. Two types of peppered moths lived there. One was light gray with dark specks and the other was very dark gray (almost back).

Peppered moths love to rest on the light colored bark of birch trees. The color of the light gray moths blended into the birch bark almost perfectly. Predators such as birds had a hard time finding the light gray moths. Instead, the birds ate the dark gray moths, which showed up against the bark of the birch tree and were easier to see. The majority of peppered moths that survived during this time were light gray.

During the last half of the 19th century, the Industrial Revolution began. Factories were built which pumped tons of black smoke and soot into the air. The bark of the birch trees began to change. The trees became coated with this pollution and turned darker in color. During this time, scientists began to notice that almost all of the light gray moths disappeared. The majority of peppered moths that survived were the dark colored moths. What do you think caused this change?

Scientists realized that the light gray moths no longer blended into the birch tree bark and were easily seen by hungry birds. Now the dark gray moths blended into the birch bark and were able to escape the birds.

Over time, fewer and fewer light gray moths were able to survive and have light gray babies. At the same time, more dark gray moths survived and had dark baby moths. By 1900, the number of dark colored peppered moths outnumbered the light colored moths.

The story does not end here! After many years of pollution, laws were passed which made factories use cleaner fuels and better technology so that the factories did not pollute the environment so much. Slowly rains washed the dark soot from the bark of the birch trees. What do you think happened to the numbers of dark and light moths?

As England became less polluted, the peppered moth again adapted to its new environment. Light moths began to survive since hungry birds could not easily find them. The dark moths were easily seen and were eaten by the birds. Now the light colored moths once again outnumber their darker relatives.

Moth Patterns