Activity 1

Adaptations

GOALS
In this activity you will:
• Explain the meaning of adaptation.
• Speculate how adaptations help an organism survive in their environment.
• Distinguish between structural and behavioral adaptations.

What Do You Think?
Imagine surviving a temperature of −50°C and a blinding snowstorm. Imagine surviving a temperature of 50°C in an extremely dry landscape.
• How are plants and animals that live daily in these environments adapted for survival?
Write your answer to this question in your Active Biology log. Be prepared to discuss your ideas with your small group and other members of your class.

For You To Do
Part A: Observing Adaptations
An adaptation is an inherited trait or set of traits that improve the chances of survival and reproduction of organisms. In this part of the activity you will look at photographs of animals to
observe and speculate about how the different types of adaptations help the organism survive.

1. Look closely at the following photographs. There is a living organism in each picture.
   a) Which organisms are exhibiting camouflage?
   b) How could this adaptation help an organism in capturing prey?
   c) How could this adaptation help protect the organism from predators?
   d) What other animals can you think of that use this type of adaptation for protection?

2. Some animals are not adapted to disappear into the background, but rather stand out.

Alligator.

Praying Mantis.

Snowshoe hare.

Chameleon.
A Highway Through the Past

Look at the photographs of the hawk moth and caterpillar.

a) At first glance, of what animal does each remind you?

b) Why would birds avoid an animal with large eyes at the front?

c) What advantage does this adaptation present for the moth and caterpillar?

3. A monarch butterfly stores bad-tasting chemicals in its body that birds hate. The viceroy butterfly also has a bitter taste.

a) The monarch butterfly is brightly colored. Why do you think that this would be an advantage for the monarch butterfly?

b) Would the bright colors and bitter taste protect all monarch butterflies? Explain your answer.

c) Compare the appearance of the monarch and viceroy butterflies. Can you distinguish between them?

d) How would the viceroy butterfly’s coloration be an advantage for its survival?

4. Adaptations are not limited to animals. Look closely at the plants or plant parts shown on the next page for their adaptations to the environment.
Activity 1 Adaptations

a) For each plant shown above, explain the adaptation(s) that you can see. Consider the environment in which the plants live, how they reproduce, and how they get their nutrients when identifying adaptations.

5. Not all adaptations need to be structural. Some adaptations can be behavioral.

a) How is each animal in the photographs adapted to a change in the environmental conditions from summer to winter?

b) How do other animals adapt to an environmental change? Give at least two examples.

c) What type of behavioral adaptation is the plant at right exhibiting?
A Highway Through the Past

6. Invent an organism with specific adaptations. Consider one of the following:
   • camouflage
   • mimicry
   • warning coloration

Part B: How Well Adapted Are You?
In this part of the activity you will have an opportunity to examine one of your own adaptations that you probably take for granted.

1. Using masking tape, have your partner tape your thumb to your index finger on each hand. After your thumbs are securely taped, try each of the following activities. Rank the difficulty of each activity on a scale of 1 to 5.
   • picking up and carrying your textbook;
   • writing your name and address on a piece of paper;
   • picking up five coins from the floor and placing them in your pocket;
   • unbuttoning and buttoning a button;
   • tying up a shoe.

a) Did you find any of the activities impossible?
b) How did your ratings compare with others in your group and in your class?
c) Why do you think that an opposable thumb is an important adaptation for humans? (An opposable thumb is an arrangement in which the fleshy tip of the thumb can touch the fleshy tip of all the fingers.)
d) Do any other animals have opposable thumbs?

Bio Words

**Species**
A group of organisms that can interbreed under natural conditions and produce fertile offspring.

**Adaptation**
An inherited trait or set of traits that improve the chance of survival and reproduction of an organism.

Adaptation
Diversity is a striking feature of living organisms. There are countless types of organisms on Earth. They are the result of repeated formation of new species and adaptation. There is a type of organism that can live in almost every type of environment on Earth. Living organisms are unique in their ability to adapt. The accumulation of characteristics that improve a species’ ability to survive and reproduce is called adaptation. Adaptation occurs over long time periods. It is the environment that “selects” the best and most useful inherited variations. In this activity you observed just a few of the large number of adaptations that exist.
Animals Adapt to the Demands of Their Environments

Animals cannot make their own food. Therefore, they must usually seek food. As a result, adaptations that allow animals to move are favorable. Movement is easier if the organism is elongated in the direction of movement. Fish, for example, are streamlined. This reduces water resistance as they swim. It is also easier to move if the sensory organs are concentrated in the head. The organs that detect food, light, and other stimuli should be in a position to meet the environment first. An organism can move more easily if it has a balanced body.

Animals have the type of body plan that is best suited to their lifestyle. The symmetry of an organism gives clues to its complexity and evolutionary development. Higher animals, including humans, are symmetrical along the mid-sagittal plane. This body plan is referred to as bilateral symmetry, in which the right and left halves of the organism are mirror images of each other. Some animals, however, are radially symmetric, or symmetric about a central axis.

How is body symmetry related to the speed at which an animal moves and to brain development? In general, animals that display radial symmetry are not highly adapted for movement. One explanation for the slower movement can be traced to the fact that no one region always leads. Only bilaterally symmetrical animals have a true head region. Because the head, or anterior region, always enters a new environment first, nerve cells tend to concentrate in this area. The concentration of

**Bio Words**

**bilateral symmetry:** a body plan that divides the body into symmetrical left and right halves

**radial symmetry:** a body plan that is symmetrical about a central axis
nerve tissue at the anterior end of an animal’s body, is an adaptation that enables the rapid processing of stimuli such as food or danger. Not surprisingly, the faster the animal moves, the more important is the immediate processing of environmental information. Every environment places special demands on the organisms living there. Seawater is fairly uniform. It poses the least stress for animal life. Oxygen is usually adequate. The temperatures and salt content are fairly constant. There is little danger that the organism will dry up. In contrast, the salt and oxygen contents of fresh water vary greatly.

Organisms that live in water have special adaptations. Gills, for example, allow the organisms to use the oxygen found in water. On land, oxygen is plentiful. However, the organisms that live there must protect themselves from the dangers of drying up. These dangers increase greatly because air temperatures change daily and seasonally. Air does not provide the same buoyancy as water. Therefore, large terrestrial, or land-dwelling, animals require good supportive structures. On the other hand, there is less resistance to movement in air than in water. Arms and legs, which would hinder an animal’s movement in water, may help on land. Thus, long appendages specialized for locomotion have evolved in terrestrial animals.

Plant Adaptations

Plants lack the ability to move and must survive in the environment in which they are living. A plant must do more than simply survive and grow bigger. It must grow in such a way that it can take the best advantage of the light, water, and other conditions available to it.
Desert plants are an excellent example of adaptation to an environment. Some have a thick waxy coating to prevent them from drying out. Some have long vertical roots enabling a plant to reach water sources beneath the soil. Others develop shallow roots that extend horizontally. This maximizes water absorption at the surface. Many desert plants have small and narrow leaves. This decreases the heating from the Sun.

Even though plants are not able to move, they are still able to disperse. They produce seeds and fruits or other reproductive structures that may be distributed far from the parent plant.

Some plant adaptations are also behavioral. A vine spreads its leaves outward and receives as much light energy as possible. It sends its roots downward and receives more water. Tendrils of a vine touch an object and quickly coil it. This secures the vine in its upward growth. A vine would not live very long if it did not send its roots downward and its stem upward. The manner of plant growth is believed to be governed chiefly by hormones that are produced within the plant. The hormones are produced in response to conditions around the plant such as sunlight and gravity. Thus, the plant can fit itself to the environment in which it lives.

Some plants have even become adapted to feeding on animals. In this activity you looked at the Venus flytrap. Its leaves have been adapted to capture prey. These plants do photosynthesize. However, these plants live in bogs where there is very little nitrogen available. Therefore, they require the nutrients they receive from digesting their prey. Of course, the plant must therefore also be adapted to digest its prey with the secretion of chemicals.

Tendrils are modified stems or leaves that wrap around a support. They enable the plant to achieve fairly extensive horizontal and vertical spread without the use of much energy, since they don’t have to support their own weight. Tendrils seem to respond to touch so if the stem or tendril touches an object, it wraps around it. This response is known as thigmotropism.
Reflecting on the Activity and the Challenge

In this activity you had an opportunity to look at adaptations of different organisms. You learned that every environment places various demands on the organisms living there. Organisms have developed special adaptations for living in any given environment. The animals and plants in the area of the highway construction have also adapted to their environment. In an environmental study scientists would have assessed the impact the highway would have had on the animals and plants. You may need to address this issue in the town-hall meeting if you are representing a government employee.

1. Explain the term adaptation.
2. Distinguish between a structural and a behavioral adaptation.
3. a) How can an animal’s structure help it survive in different environments? Give three examples.
   b) How can an animal’s behavior help it survive in different environments? Give three examples.
4. Do all animals living in the same environment have similar adaptations? Explain your answer.
5. A cross section represents a cut through the middle of an animal’s body. Below are cross sections through an earthworm, sand worm, and a primitive insect.

   ![Cross sections of an earthworm, sand worm, and an insect]

   a) The jointed appendages of the insect lift the body from the ground. How does this help the insect move?
   b) What advantages might the fleshy projections of the sand worm have over the bristle-like projections of the earthworm?
   c) Predict which animal would be the fastest and give your reasons.
Inquiring Further

1. Animal adaptations to the arctic
Keeping warm is no easy task in the arctic where frigid weather lasts almost nine months of the year and where temperatures can plunge to −55°C. Even during the brief summer, when the land thaws and the Sun never sets, a sudden snowstorm can freeze everything. What adaptation have animals that live in this region developed?

2. Animal adaptations to the desert
Lack of water creates a survival problem for all desert organisms. However, animals have an additional problem. The biological processes of animal tissue can function only within a relatively narrow temperature range. Fortunately, most desert animals have evolved both behavioral and structural adaptations. Research the adaptations of animals living in desert regions.

Seals are well adapted to a cold environment. Their slick fur sheds water, and a thick layer of blubber beneath the skin keeps them warm in frigid temperatures.

The desert tortoise retreats to its burrow during the hottest times of the summer days. In the cold of winter it hibernates in its underground burrow.