1.1 Observing Living Things

Living things survive in many different environments. All living things have five main characteristics that demonstrate they are alive. They respond to their environment, they need energy, they grow, they reproduce, and they get rid of wastes. Some living things are very small and can be observed only with a microscope. To study such organisms on prepared or wet mount slides, you must handle a compound light microscope carefully and learn how to operate it correctly.

Key Terms

compound light microscope
electron micrograph
magnification power
resolving power
scanning electron microscope

Living things can survive in almost any type of type of environment on Earth—from very wet and warm to very cold and dry. Scientists have discovered multicellular organisms, such as the red tube worm, in the depths of the ocean. They have also found bacteria, unicellular organisms, and tiny worms called nematodes in the ice and snow of Antarctica.

Amazing Survival Stories

All living things have special features that help them survive. For example, the feathers on a duck are oily so they do not absorb water. This waterproof coat helps keep the duck dry and warm. Other living things have more out-of-the-ordinary features that help them cope with their environments. A single honey mushroom, which lives in the Blue Mountains of eastern Oregon, is thought to be the largest living thing on Earth (see Figure 1.1). It spreads out over 890 hectares. Scientists estimate that this enormous mushroom is about 2400 years old. What makes this living thing such a survivor? It has a huge network of thread-like structures that draw water and food out of the trees it grows around.

Figure 1.1 You will not see a giant organism if you go looking for the honey mushroom. Most of it is growing underground. In the fall, it sends up groups of mushrooms like these.

The strongest living thing on Earth is the rhinoceros beetle (see Figure 1.2 on the next page). As beetles go, the rhinoceros beetle is pretty big, but compared to an elephant, it is tiny. However, this amazing beetle can lift 850 times its own weight. An elephant can lift only up to one quarter of its weight. Although an elephant may be able to lift a heavier object, relative to its weight the rhinoceros beetle is the lifting champion. This strength helps the beetle survive on the jungle floor. Since the jungle floor is covered with dead plants, leaves, and other debris, the beetle uses its strength to clear a path.

To survive on the vast, open plains of southern and eastern Africa, animals like the cheetah must be fast and alert (see Figure 1.3). The cheetah holds the speed record for land animals and has been clocked running at about 100 km/h for short periods of time. These short bursts of speed help the cheetah catch fast-moving prey like the antelope, which it depends on for food.

Regardless of where they live, all living things have needs that must be met if they are to survive in their environment.

Did You Know?

Bacteria have been found to live in water temperatures of 90°C and in water as acidic as vinegar.

Figure 1.2 To match the lifting ability of a rhinoceros beetle, a 100 kg human would have to lift 85 000 kg. That is approximately the mass of an empty space shuttle!

Figure 1.3 The cheetah can reach its top speed in just a few seconds.

1-1 What Do Living Things Need for Survival?

Find Out ACTIVITY

All living things require certain living conditions and have particular needs that must be met if they are to survive. In this activity, you will develop your own list of what living things need for survival.

What to Do

1. Work with a partner or a small group of classmates. On a piece of chart paper, brainstorm a list of what you think a living thing needs for survival.
2. When you are finished, half of your group will join half of another group to see what they have done. The remaining half will explain your work to the classmates who have joined your group.
3. Get back together in your original group. Decide if you will add, change, or remove any of the points on your chart paper.
4. Join another group. Use the ideas from both sheets of chart paper to make a new list that shows what the new group thinks a living thing needs for survival.
5. Post your list on the wall.

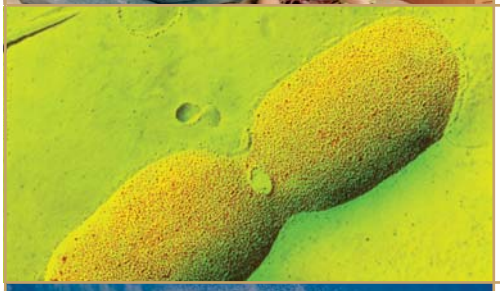
What Did You Find Out?

1. Go around to the different lists. As you are looking at your classmates' work, record your own list of what living things need for survival.
2. As a class, discuss your ideas. List which ideas your class believes all living things need to survive in their environment.

Characteristics of Living Things

Sometimes it is clear whether something is living or non-living. You and your friends are living; a pencil or book is non-living. What about a lighted match? The flame of the match can grow. It can produce more flames and it can move. But is it living or non-living? A living thing must have at least the five characteristics listed in Table 1.1 to be considered alive.

Table 1.1 Five Characteristics of Living Things

	**Living things respond to their environment** A cat may hiss when it feels threatened by something in its external environment. Hissing is the cat's response to a **stimulus**. A stimulus (plural: stimuli) is anything that causes a living thing to respond. Living things also respond to stimuli that occur in their internal environment. Think of the last time you were hungry or thirsty. Hunger and thirst are stimuli that cause you to respond by eating or drinking.
	**Living things need energy** Responding to the environment and carrying out activities necessary for survival require energy. You get your energy from the food you eat. Other living things have different ways of getting energy. Plants, for example, combine carbon dioxide, water, and sunlight to produce sugar or food.
	**Living things grow** As you continue to grow as a teenager, you get taller and your clothes probably do not fit for long. Your growth is the result of the cells in your body increasing in number. Even when you stop growing, your body will continue to replace cells as they wear out and die.
	**Living things reproduce** Reproduction provides a way for living things to replace older individuals that die. Some living things, such as bacteria, reproduce every 20 minutes. Some types of salmon will spend about four years in the ocean before returning to the freshwater stream where they hatched. Once they have returned, they will lay eggs and die.
	**Living things must get rid of wastes** Animals produce wastes such as carbon dioxide, urine, and feces. To survive, they must have ways of getting rid of these wastes. For example, when a whale uses the food it eats to make energy, carbon dioxide gas is produced. Exhaling is the way the whale's body gets rid of this waste gas.