1-4 Finding Solutions for Problems in the Newo Colony

Find Out ACTIVITY

In this activity, your task is to work with your classmates to figure out a possible solution for each of the problems facing the management groups of Newo.

What to Do

1. Record each problem the management groups identified.
2. Brainstorm solutions for each problem.
3. Select the best solution for each problem. Each solution must also work with the other solutions you select.
4. Make a drawing of Newo that shows how you solved each problem. Use labels and descriptions to help explain your solutions.

What Did You Find Out?

1. Post your drawing on the wall.
2. Walk around and look at the drawings of other classmates. Make notes on what you observe in these drawings. Find an example of a drawing that:
   (a) Shows a solution different from yours. Record what is different.
   (b) Shows a solution the same as yours. Record what is the same.
3. Return to your drawing. Based on your observations, what would you change about one of your solutions so that it works better? Make this change on your drawing.
4. Share your own drawing with the class and discuss which solutions would probably work best for solving Newo's problems.

Using an Analogy to Understand a Cell

The colony of Newo is an **analogy** for a cell. In science, an analogy is a way to understand new ideas by making a comparison. For example, you have learned that each management group in Newo carries out a specific task. You have also seen how these groups work together to ensure the survival of the colony. You can use this knowledge to help you understand how a cell works by comparing it to what you read in this section. Try to connect what you learn about different cell structures to what you know about the different groups in Newo. You will find some hints in the paragraphs below.

Inside a Cell

As microscope technology has advanced, so has our ability to observe two types of cells in greater detail: animal and plant cells. Figure 1.13 on the next page shows an electron micrograph of an animal cell and a drawing of some of the cell's parts, or structures. Some structures are called organelles. An **organelle** is a cell structure in which functions are carried out to ensure the cell's survival. Organelles take up about 5 to 30 percent of a cell. The rest of the cell consists of water.

Many organelles are surrounded by a thin covering called a membrane. Each cell is also surrounded by a membrane that separates the interior of the cell from its surroundings. This structure is called the **cell membrane**. The Protection Dome that surrounds Newo is like a protective barrier that controls, or regulates, the flow of materials in and out of the colony. The cell membrane surrounding a cell has a similar function. It protects the cell and regulates the movement of particles in and out of the cell.

Within the cell is a jelly-like substance called **cytoplasm**. Cytoplasm contains organelles, water, and other life-supporting materials. A cell's cytoplasm is like the liquid atmosphere inside Newo's Protection Dome.

The Functions of Cell Organelles

Control Central is an essential management group in Newo that controls everything in the colony. Like Control Central, the **nucleus** is the organelle that controls all the activities within a cell (see Figure 1.14). The nucleus contains **deoxyribonucleic acid** or **DNA**. DNA carries the heredity material that is passed on from generation to generation.

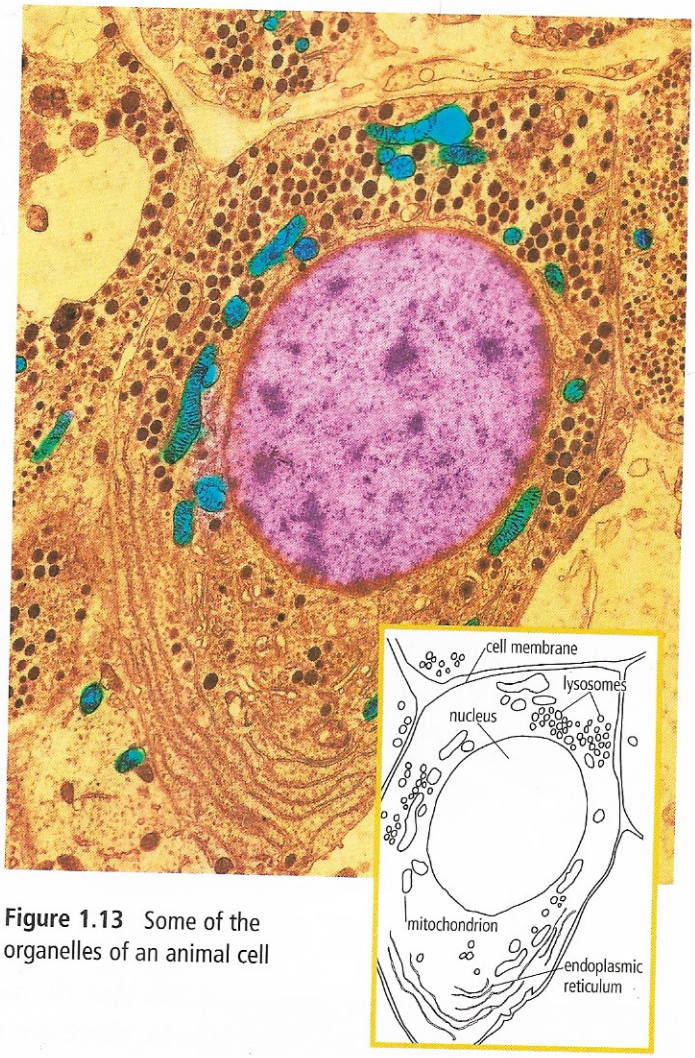


Figure 1.13 Some of the organelles of an animal cell

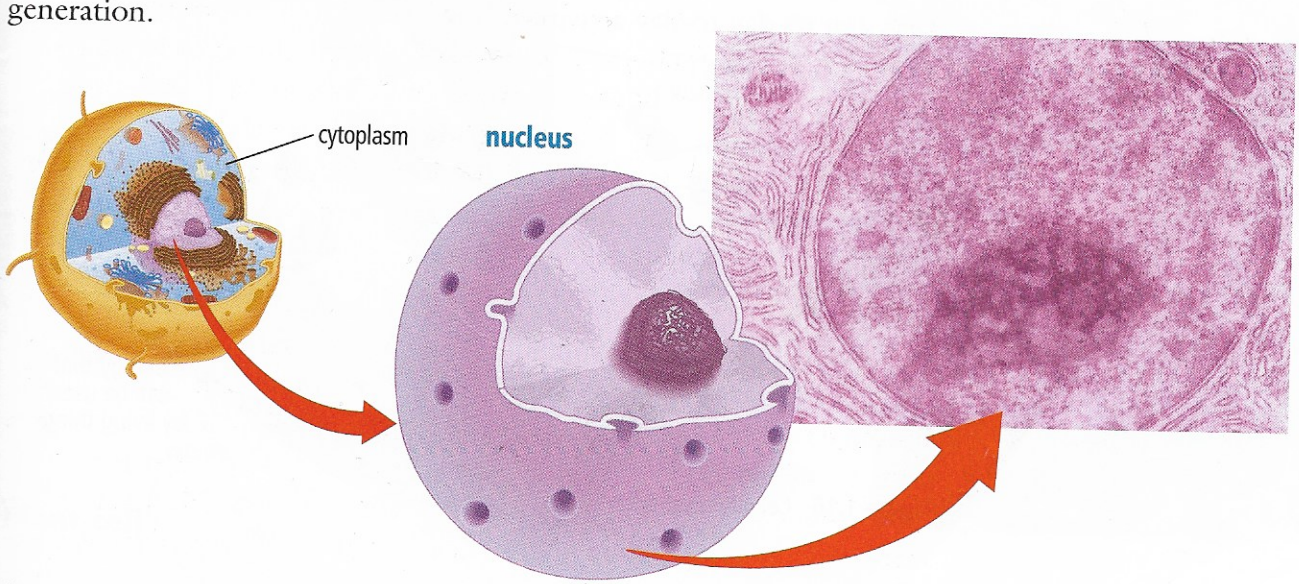


Figure 1.14 The nucleus of an animal cell

The **mitochondria** (singular: mitochondrion) are the energy producers in the cell (see Figure 1.15). Mitochondria carry out **cellular respiration** to produce energy for the cell. Cellular respiration occurs when the chemical energy we take in through the food we eat is changed into energy that our cells use to carry out their activities (see Figure 1.16). The total of all the chemical reactions that take place in our cells is called our **metabolism**.

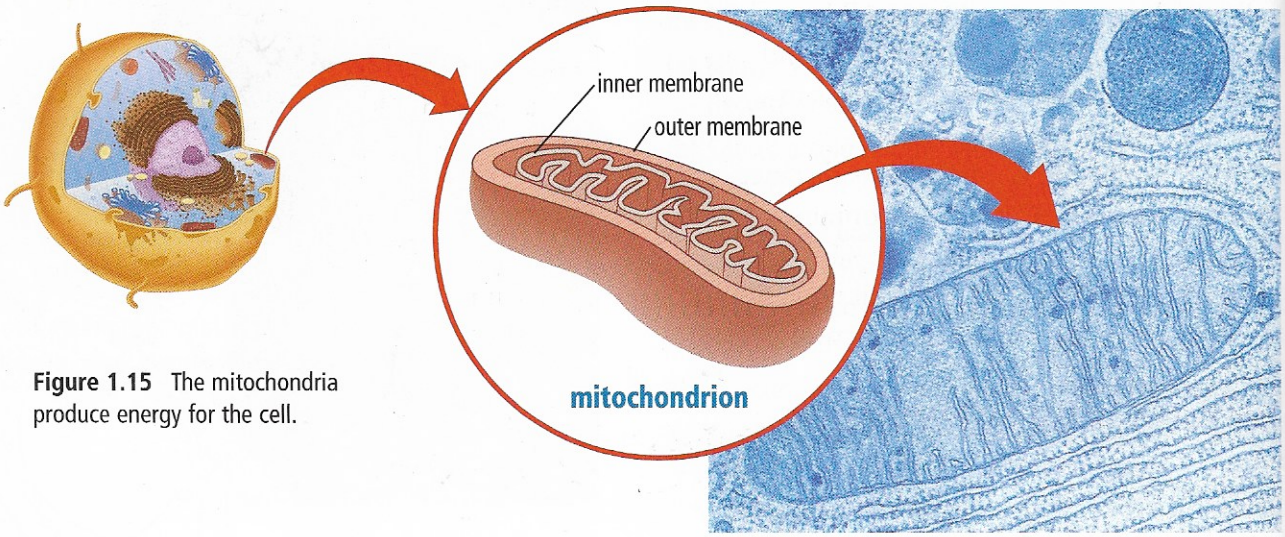


Figure 1.15 The mitochondria produce energy for the cell.

Cells that do more work in the body have more mitochondria. For example, there are more mitochondria in a muscle cell than in a cheek cell. Recall that the Energy Production group in Newo needed an energy source like mitochondria so that the colony could continue to carry out its day-to-day activities.

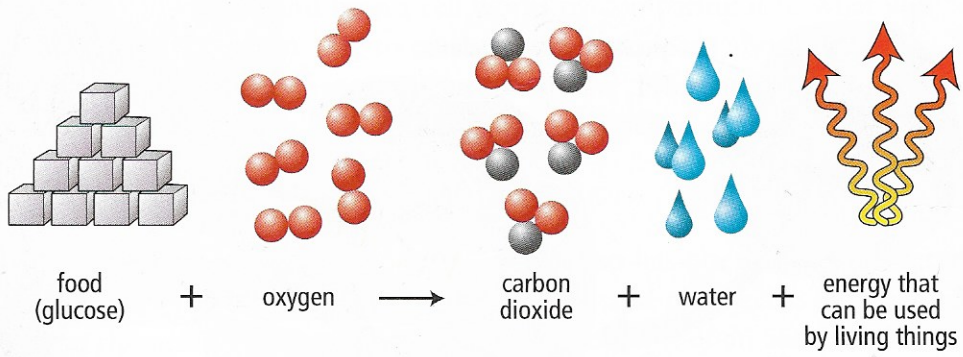
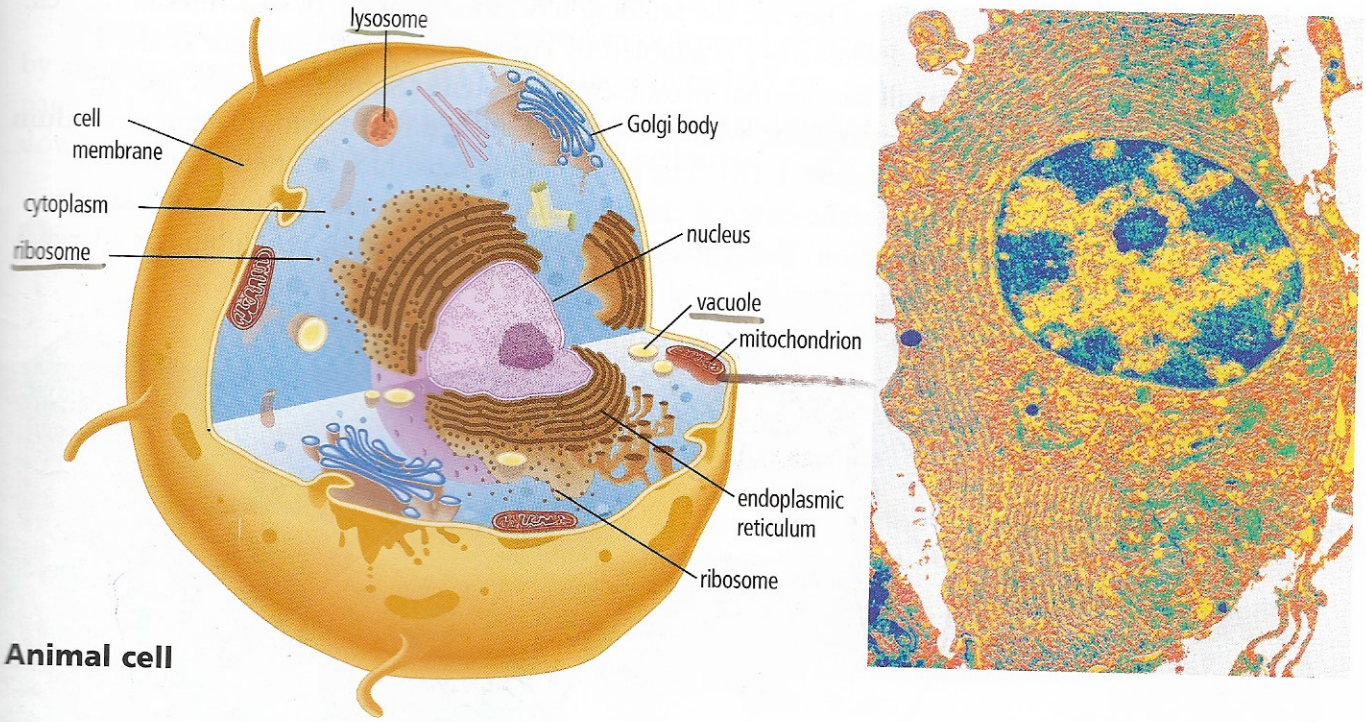


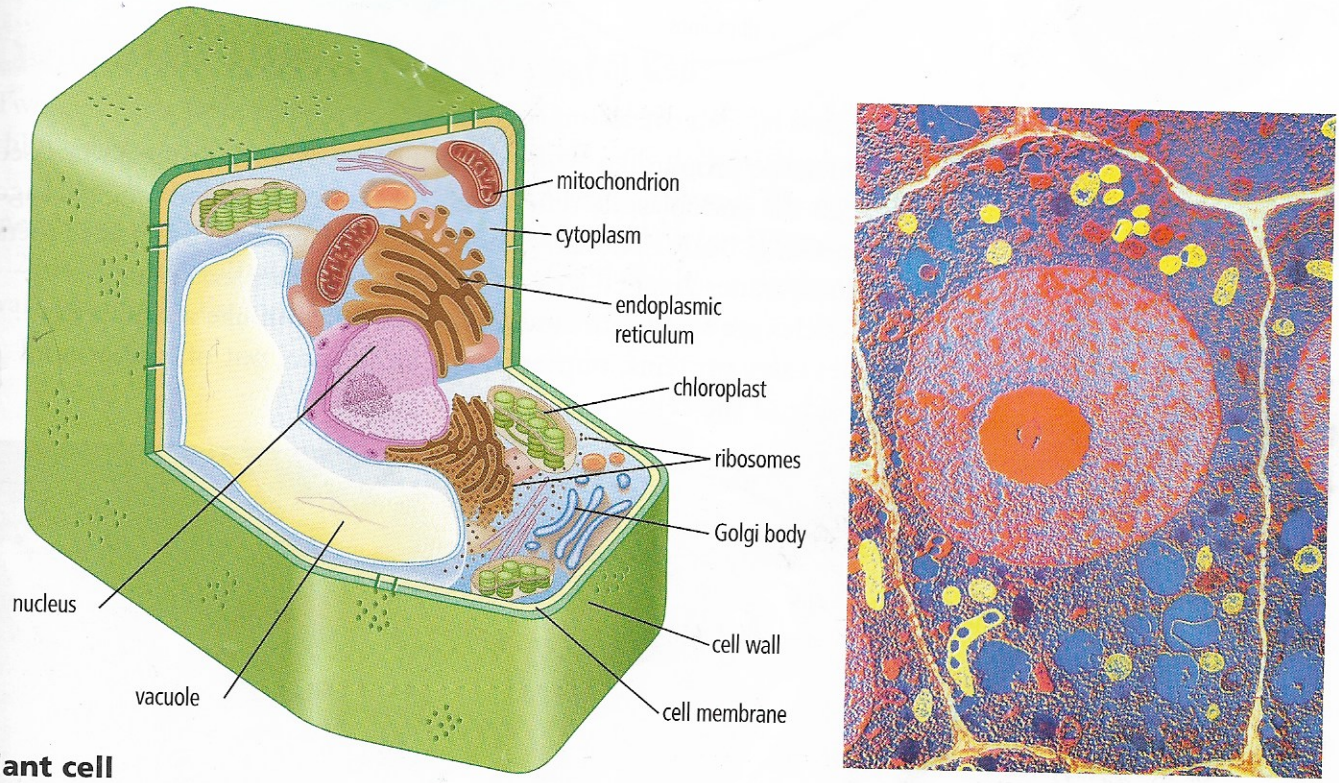
Figure 1.16 Cellular respiration

Typical Animal and Plant Cells

Figure 1.17 shows the organelles in an animal cell and a plant cell.



Animal cell



Plant cell

Figure 1.17 Notice the difference in shape between an animal cell and a plant cell.

Organelles for Assembly, Transport, and Storage

Many cell organelles carry out activities related to assembling (bringing together), transporting, and storing **proteins**. Proteins are essential to all life. They are the building blocks for a variety of structures in the cell.

Proteins are assembled by **ribosomes**. Each ribosome is like a small factory that manufactures proteins. Some ribosomes float in the cytoplasm, while others are attached to the **endoplasmic reticulum** (see Figure 1.18). The endoplasmic reticulum is a network of membrane-covered channels that look a bit like the folds of a fan or accordion. Being folded means the endoplasmic reticulum has a large surface area in a small space.

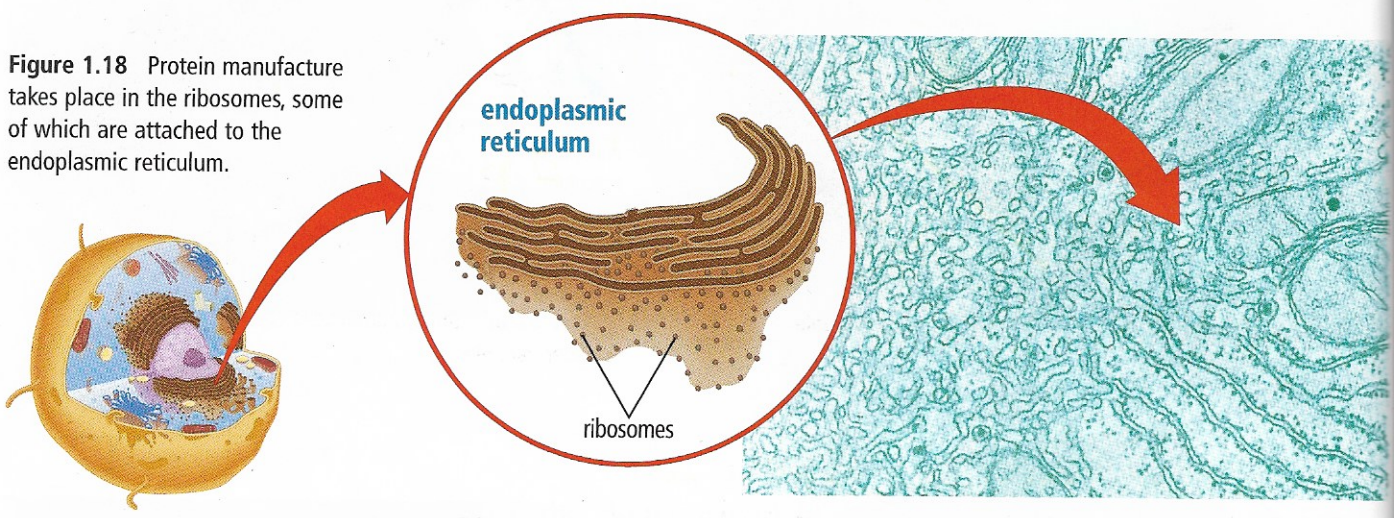


Figure 1.18 Protein manufacture takes place in the ribosomes, some of which are attached to the endoplasmic reticulum.

Once the protein has been manufactured by a ribosome and passed through the endoplasmic reticulum, it is put into a membrane package by the **Golgi body**. The Golgi body sorts the proteins and packs them into membrane-wrapped structures called **vesicles** (see Figure 1.19).

Vesicles are smaller than vacuoles and function like a mail system. Vesicles carry proteins, nutrients, and water into, out of, and around the inside of the cell.

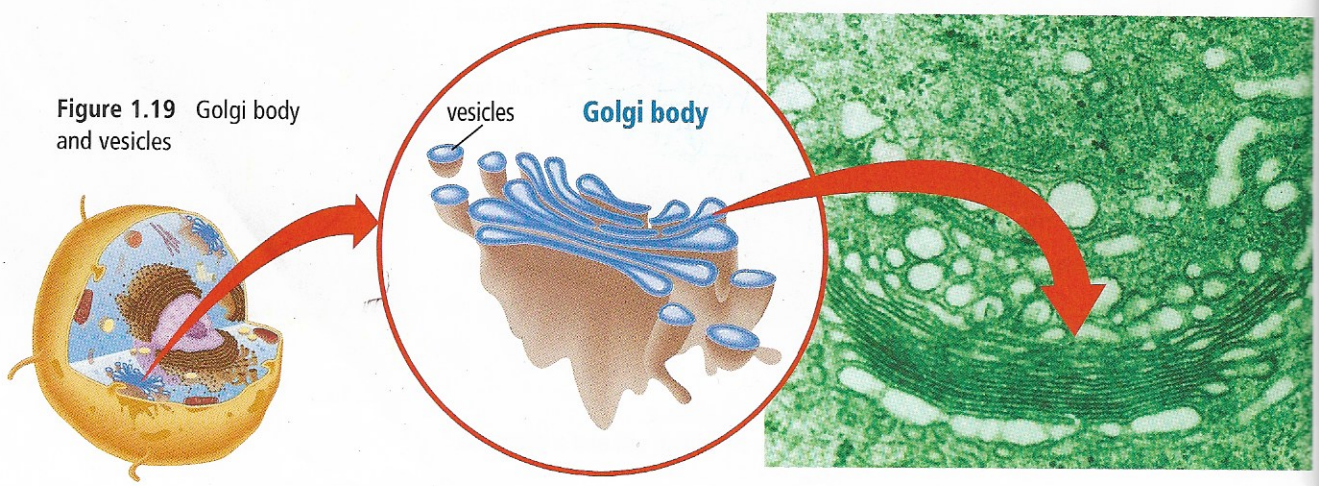


Figure 1.19 Golgi body and vesicles

Vacuoles are temporary storage compartments that sometimes store waste. These organelles tend to be larger in plants and much smaller in animals. If you look at Figure 1.20, you can see the difference in vacuole size between a plant and an animal cell.

When organelles wear out, they are broken down and recycled by another organelle called the **lysosome** (see Figure 1.17 on page 27). The lysosome contains digestive chemicals that break down food particles, cell wastes, and worn-out cell parts.

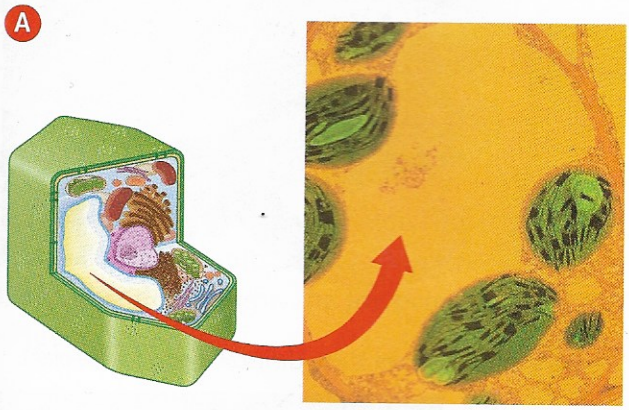


Figure 1.20A Plant cells usually have one large vacuole.

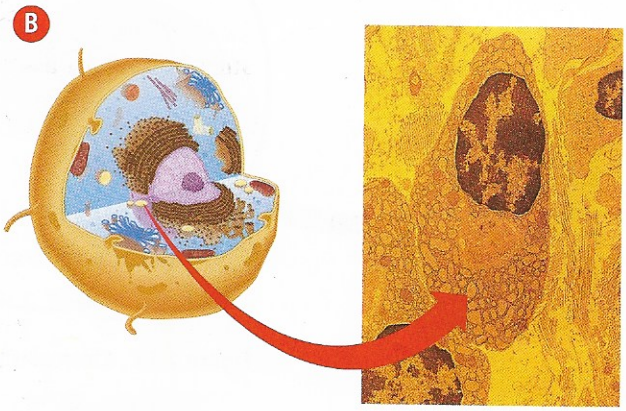


Figure 1.20B Some animal cells contain many smaller vacuoles.

The Difference between Plant and Animal Cells

Two cell parts found in plants but not in animals are the cell wall and chloroplasts, which carry out functions animal cells do not require.

The **cell wall** is a tough, rigid structure that surrounds the cell membrane and gives the cell a regular, box-like shape (see Figure 1.21). The cell wall protects the cell. Since each cell has a rigid outer wall, plant cells also provide support for a growing plant.

Figure 1.21 The cell wall is a rigid structure that protects the plant cell and gives the cell its shape.

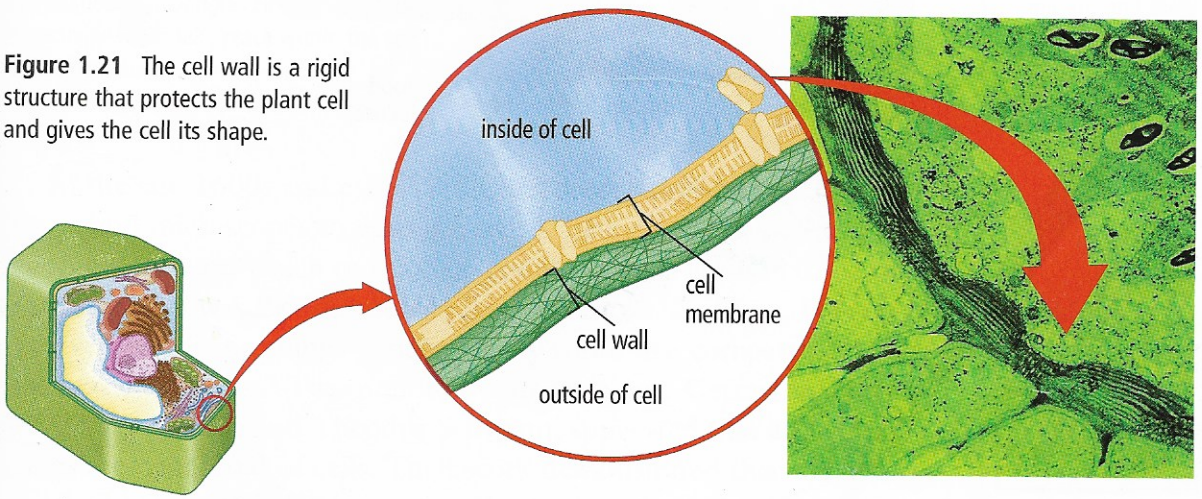


Figure 1.22 shows the **chloroplasts**, which trap the energy from the Sun and change it into chemical energy.

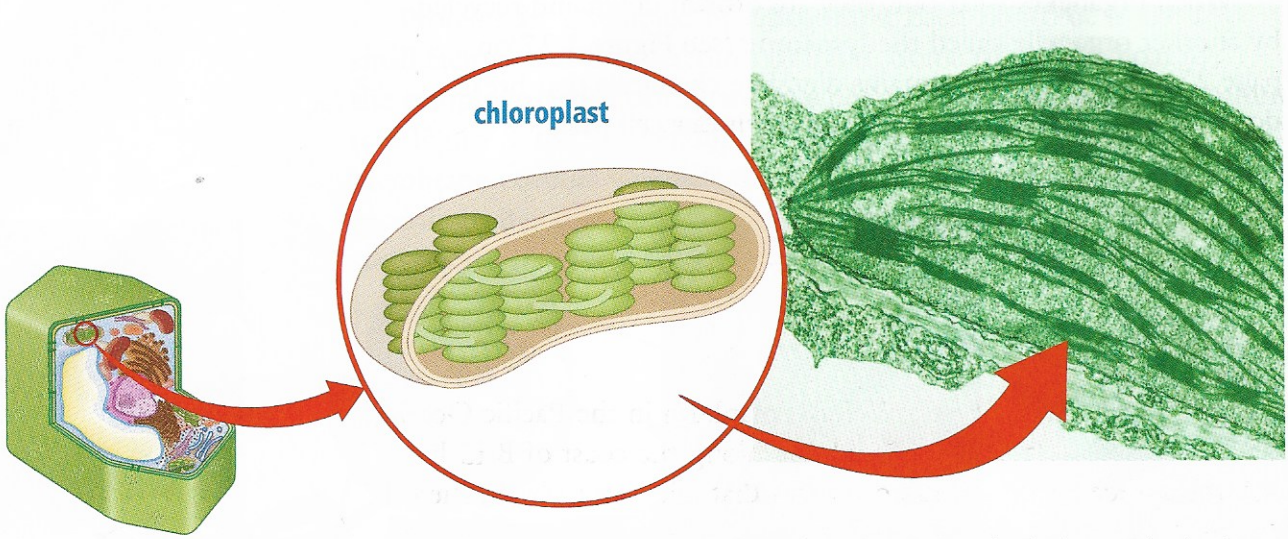


Figure 1.22 Chloroplasts trap the Sun's energy and turn it into chemical energy for the plant.

This process occurs during **photosynthesis**, the chemical reaction that takes place when carbon dioxide and water react in the presence of sunlight to produce glucose and oxygen (see Figure 1.23).

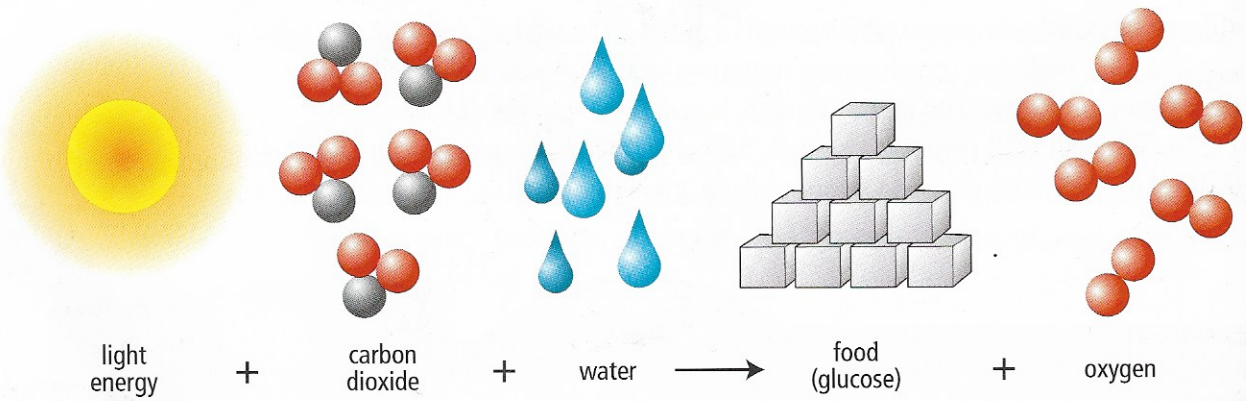


Figure 1.23 Photosynthesis in plants

Suggested Activities

Conduct an Investigation 1-6 on page 35
Conduct an Investigation 1-7 on page 36