

4.1 The Function of the Nucleus within the Cell

The nucleus controls the functions of a living cell. Chromosomes within the nucleus are composed of deoxyribonucleic acid, or DNA. DNA carries the master set of instructions for cell function. Genes are small segments of DNA. Genes contain the information to produce proteins that control a cell's activities.

Words to Know

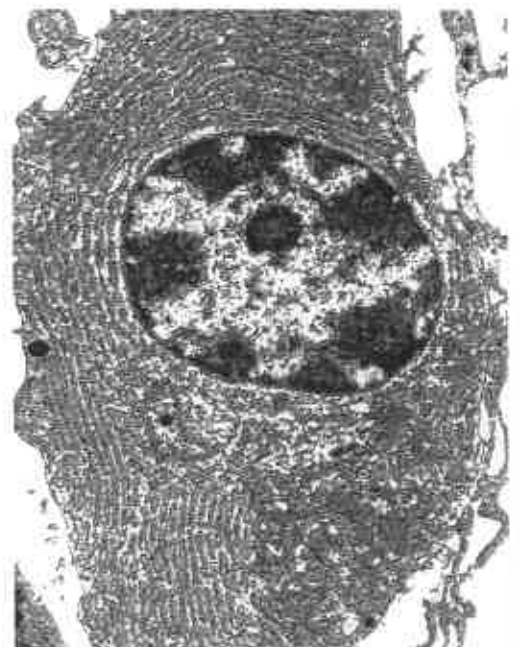
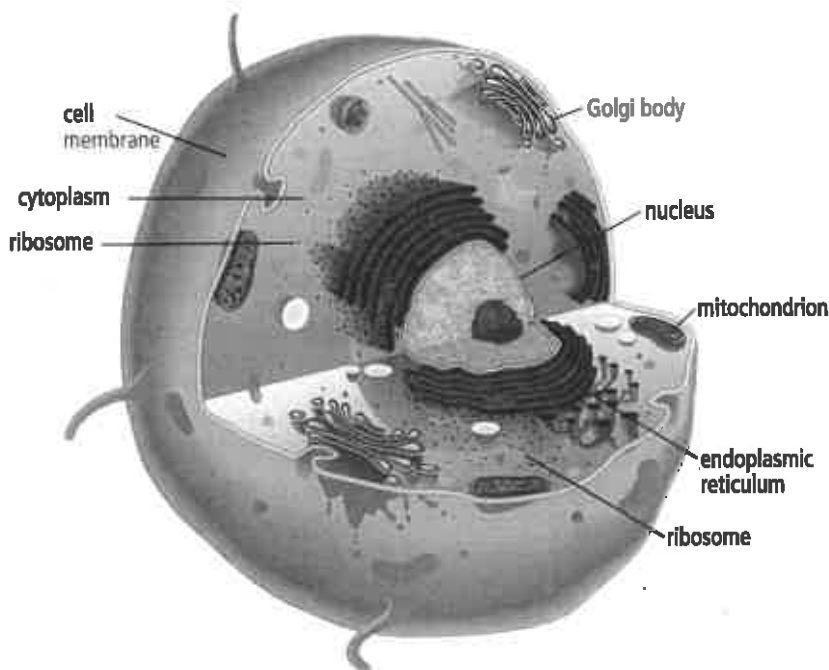
chromosome
DNA
gene
nucleolus
nucleus
protein

Life processes within cells occur very quickly. Using technologies such as nanoprobe, scientists are seeing these processes more clearly and learning more about how cell parts function and transmit messages to the nucleus. So far, the journey into animal and plant cells has helped scientists determine the structure and function of the cell parts shown in Figure 4.1A and Figure 4.1B on the next page.

A Survey of Animal and Plant Cells

All cells are surrounded by a thin covering called the **cell membrane** that separates the inside of a cell from its external environment. The cell membrane controls the flow of materials into and out of the cell. In addition to a cell membrane, plant cells also have a **cell wall**. The cell wall is a tough, rigid structure that surrounds the cell membrane. The cell wall provides support for the plant cell and prevents the cell from bursting when a plant is in a very moist environment.

Figure 4.1A An animal cell



The **cytoplasm** is a jelly-like substance that contains the organelles and other life-supporting materials, such as water and sugar. An **organelle** is a specialized cell part that carries out specific functions to ensure a cell's survival. Remember from previous science courses that in eukaryotic cells, such as animal cells, most organelles are surrounded by a membrane. Prokaryotes, such as bacterial cells, do not have membrane-bound organelles.

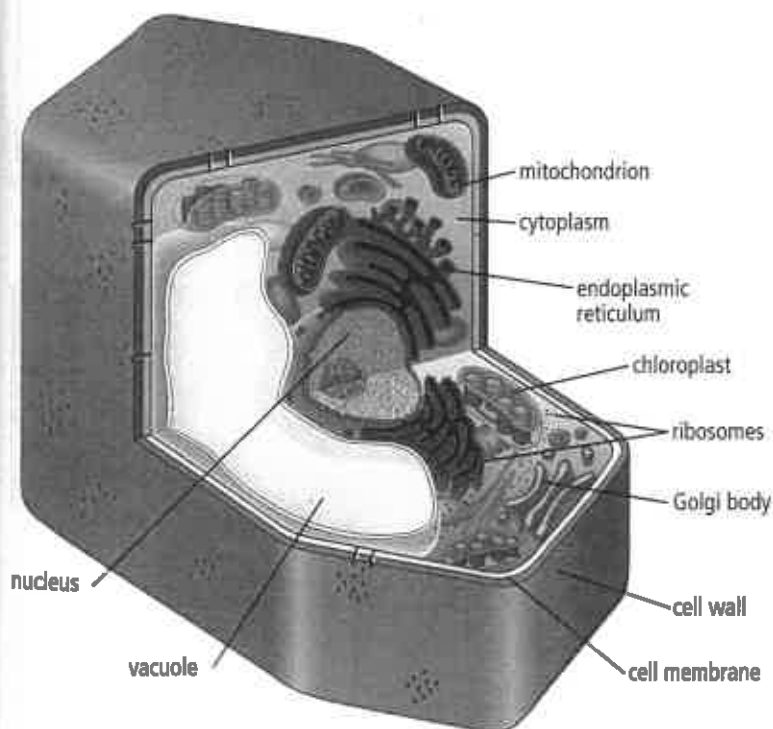
The **mitochondria** (singular: mitochondrion) are organelles that are specialized to provide energy for cells by changing sugar called glucose into usable energy. The chemical reactions that occur on the many folds of the inner membrane of a mitochondrion provide energy for the cell.

Plant cells have specialized organelles called **chloroplasts** that trap the energy from the Sun and make glucose. The production of glucose takes place on the stacks of membranes within a chloroplast.

Ribosomes are small organelles that do not have a membrane. Some ribosomes float in the cytoplasm. Other ribosomes are attached to the endoplasmic reticulum. Each ribosome is like a manufacturing plant that makes proteins. **Proteins** are essential materials required for the cell to carry out the activities necessary for its survival.

The **endoplasmic reticulum** is a network of membrane-covered channels within a cell. This organelle acts as a transport system for materials made in the cell. Proteins made on ribosomes that are attached to the endoplasmic reticulum travel through these channels and are often processed further in the Golgi body.

Figure 4.1B A plant cell



internet connect

To find out more about cell parts and organelles, go to www.bcsience9.ca.

Vesicles are membrane-covered sacs that form off the ends of the endoplasmic reticulum. Vesicles transport new proteins to the Golgi body for further processing and export out of the cell.

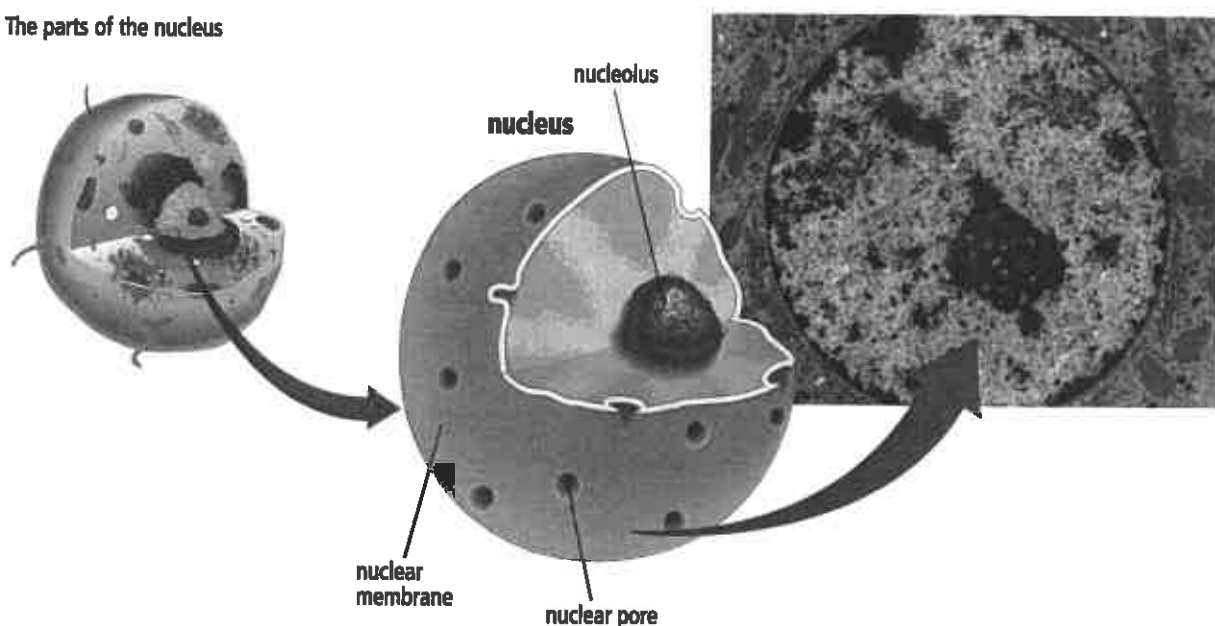
The **Golgi body** is a specialized organelle that sorts and packages proteins for transport. If a protein is to be transported out of the cell, a vesicle will form off the end of the Golgi body. The vesicle is then carried to the cell membrane.

Vacuoles are membrane-covered storage containers within cells. Plant cells often contain small vacuoles to store starch and a large vacuole to store water. Some animal cells have small vacuoles.

The **nucleus** (plural: nuclei) is the organelle that controls all the activities of the cell parts described above. The nucleus is surrounded by the **nuclear membrane**, which is similar in structure to the cell membrane. The nuclear membrane protects the contents of the nucleus (Figure 4.2).

The **nucleolus** is a membrane-free organelle that floats in the interior of the nucleus. The function of the nucleolus is to make ribosomes. **Nuclear pores** are openings in the nuclear membrane that allow only certain materials into and out of the nucleus. Ribosomes made in the nucleolus will leave through the pores and go to the cytoplasm or the endoplasmic reticulum.

Figure 4.2 The parts of the nucleus



Reading Check

1. What is the function of a cell membrane?
2. Describe the structure of a cell wall.
3. What is an organelle?
4. What is the function of mitochondria?
5. What is the function of a ribosome?
6. Where do proteins go after they are made on the endoplasmic reticulum?
7. What is the function of the nucleolus?