

5.1 What Are Cells?

Look closely at the skin on your arm. Can you see that it is made of cells? Of course not! Your skin cells are much too small to see with your eyes. Now look at one square centimeter of your arm. That square centimeter contains about 100,000 skin cells. Cells are so small that they weren't even discovered until the invention of the microscope. What are cells and how were they discovered?

You are made of cells

A cell is the smallest unit of a living thing

A cell is the basic unit of structure and function in a living thing. Your body is composed of billions of cells. You have skin cells, muscle cells, nerve cells, blood cells, and many other types as well. Each type of cell has a unique structure and function, but they all share similarities. Figure 5.1 shows pictures of different types of cells found in your body.

A cell is the basic unit of structure and function in a living thing.

Each cell carries out the living functions

Each cell in your body shares the characteristics of all living things. Each cell can respond, grow, reproduce, and use energy. Like larger organisms, cells respond to changes in their surroundings in ways that keep them alive. In Chapter 2 we learned that this process is called *homeostasis*.

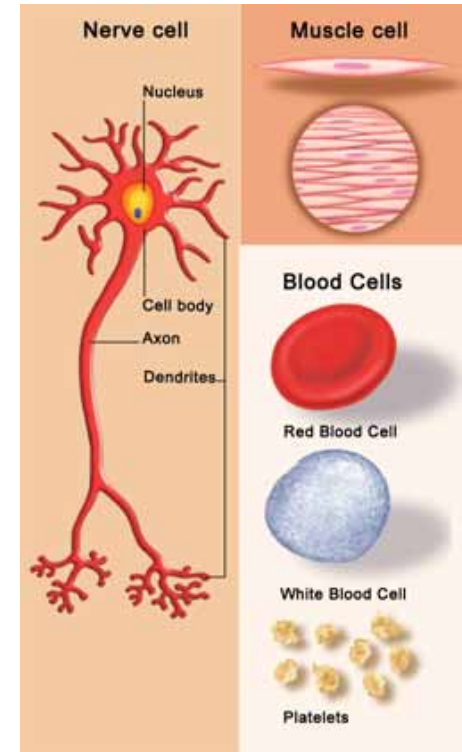
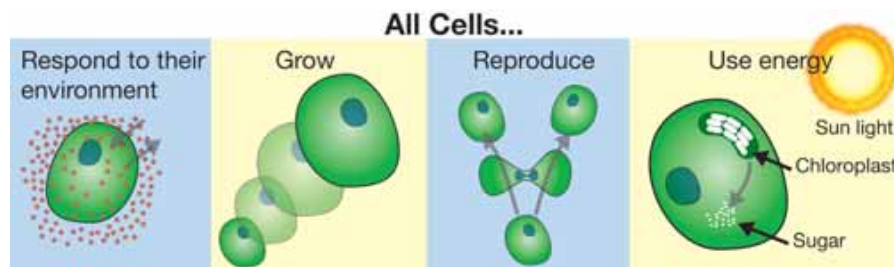
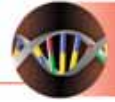


Figure 5.1: Different types of cells found in your body. Platelets are found in your blood but are particles, not cells.



Finding out about cells

Robert Hooke discovered cells How did we learn about cells? It all started with the invention of the microscope in the late 1500s. English scientist Robert Hooke (1635–1703) was the first to record his observations of cells. In 1663, he took a thin slice of cork and placed it under a microscope that he built. *Cork* is made from the bark of the cork oak tree, but its cells are no longer alive. Hooke made detailed sketches of his observations. An artist's version of one of his sketches is shown in Figure 5.2. Hooke called each of the square structures a *cell* because they reminded him of tiny rooms.

Some organisms are made of a single cell Anton van Leeuwenhoek (1632–1723) was not a scientist. He was a Dutch craftsman who made lenses. Yet with skill and curiosity, Leeuwenhoek made some of the most important discoveries in biology. He used his lenses to build a simple microscope. With his microscope, he looked at pond water, blood, and scrapings from his teeth. He was the first to observe single-celled protists, blood cells, and bacteria.

All living things are made from cells As microscopes improved, scientists made more discoveries. In 1839, two German scientists, Matthias Schleiden and Theodore Schwann, viewed plant and animal tissues under a microscope. They concluded that all plants and animals were made up of cells.

Fluorescent microscopy A new technique is called a fluorescent microscope. Cells usually do not glow. Scientists use fluorescent proteins to make cells glow. The cells absorb these proteins like stains. The fluorescent microscope uses filters that only let in light that matches the fluorescing material being studied. All other types of light are blocked out. The fluorescing areas shine out against a dark background, making certain cell structures glow. The mouse egg cells in Figure 5.3 have been treated to show DNA as a glowing blue.



Figure 5.2: Robert Hooke's sketch of cork cells looked like this.



Figure 5.3: Mouse egg cells. The DNA is the glowing blue.

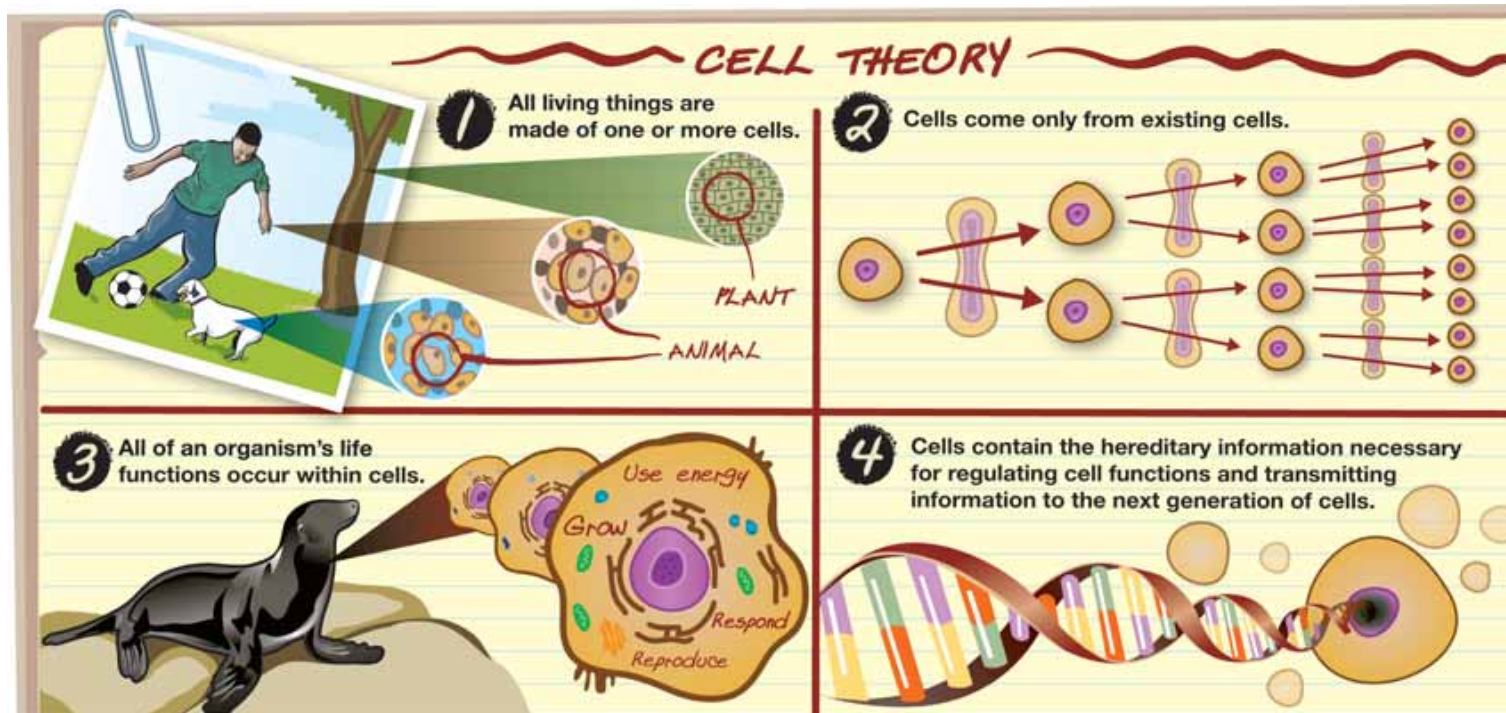
The cell theory

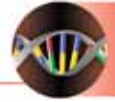
Cells only come from other cells Schleiden and Schwann's theory was widely accepted by other scientists. But where did cells come from? In the 1800s it was believed that living things came from nonliving objects. Did cells come from some tiny, nonliving objects? In 1855, a German physician named Rudolf Virchow (1821–1902) proposed that cells can only come from other cells.

Statements of the cell theory The work of Hooke, Leeuwenhoek, Schleiden, Schwann, Virchow, and others led to an important theory in life science. The **cell theory** explains the relationship between cells and living things.

VOCABULARY

cell theory - a theory that explains the relationship between cells and living things.





Similarities among cells

There are many different types of cells Some organisms are made of only a single cell. You are made of billions of cells. In multicellular organisms like you, there are many different types of *specialized* cells. For example, the cells that line the retina of your eye have a structure and function that is very different from your skin cells. About 200 different types of specialized cells make up the tissues and organs of your body.

There are different types of cells but all cells share similar characteristics.

All cells share some similarities Even though there are many different types of cells, they all share similar characteristics (Figure 5.4). These include:

1. **All cells are surrounded by a cell membrane.** The **cell membrane** is a barrier between the inside of the cell and its environment. It also controls the movement of materials into and out of the cell.
2. **All cells contain organelles.** An **organelle** is a structure inside of a cell that helps the cell perform its functions. Although all cells contain organelles, they don't all contain the same kinds. You'll learn more about the organelles in the next section.
3. **All cells contain cytoplasm.** The **cytoplasm** is a fluid mixture that contains the organelles. It also contains the compounds cells need to survive such as water, salts, enzymes, and other carbon compounds.
4. **All cells contain DNA.** The cell theory states that all cells come from other cells. When cells reproduce, they make copies of their DNA and pass it on to the new cells. DNA contains the instructions for making new cells and controls all cell functions.

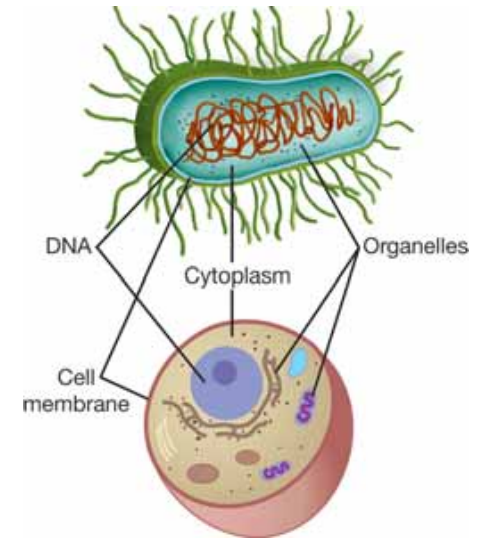


Figure 5.4: All cells have a cell membrane, organelles, cytoplasm, and DNA.

VOCABULARY

cell membrane - a separating barrier that controls movement of materials into and out of the cell.

organelle - a structure inside of a cell that helps it perform its functions.

cytoplasm - a fluid mixture that contains the organelles and the compounds the cell needs.