**The cell**

A cell is the basic structural and functional unit of all living things. The human body consists of trillions and trillions of cells. But cells are too small to see with the human eye. The invention of the microscope allowed scientists to discover that cells existed. In 1665, an English scientist named Robert Hooke made a simple microscope. He used the microscope to look at a piece of cork, which is the dead cells of oak bark. Hooke saw small, box shaped structures in the cork, which he called cellulae. Today, we call them cells. In the late 1600s, Anton van Leeuwenhoek (LAY vun hook), a Dutch scientist, made another microscope. He examined pond water, milk, and other substances. He was surprised to find living organisms in these substances.

In 1838, German scientist Matthias Schleiden studied plants under microscopes. He concluded that all plants are composed of cells. Another German scientist, Theodor Schwann, declared that animal tissues were made up of cells.

Scientists continued to learn more about cells. Scientist Rudolf Virchow proposed that cells divide to form new cells. He suggested that every cell came from a cell that already existed. The observations and ideas of the various scientists who studied cells are summarized as the cell theory. The cell theory is a fundamental idea of modern biology and includes the principles listed in the table below.

The development of the microscope made the discovery of cells possible. Improvements made to early microscopes have helped scientists learn much more about cells.

The modern compound light microscope uses a series of glass lenses to magnify, or enlarge, an object. When visible light passes through each lens, it magnifi es the image of the previous lens. For example, two lenses that each magnify an image 10× result in a microscope that magnifi es the object 100×, as shown in the figure below.

The best compound light microscopes only magnify an image about 1000×. Scientists needed more powerful microscopes to learn more about cells. The electron microscope was invented in the1940s. It doesn’t use lenses. Instead, the transmission electron microscope (TEM) uses magnets to aim a beam of electrons at the image to be magnifi ed. Some TEMs can magnify an image500,000×. The scanning electron microscope (SEM) was a further improvement in technology. Itproduces a three-dimensional image of the cell. One problem with the TEM and SEM is that only nonliving cells can be examined. A more recent invention, the scanning tunneling electron microscope (STM), can magnify living cells.

Cells have different sizes, shapes, and functions, but all cells have a plasma membrane. A plasma membrane is a boundary that helps control what enters and leaves the cell. Some basic functions are common to most cells. For example, most cells have some form of genetic material that provides instructions for making substances that the cell needs. In addition, all cells break down molecules to generate energy for metabolism.

Scientists group cells into two broad categories based on their internal structures. These categories are prokaryotic cells and eukaryotic cells. Simple cells that have no specialized structures are known as prokaryotic (pro kar ee AW tik) cells. Cell functions in these simple cells occur in the plasma membrane.