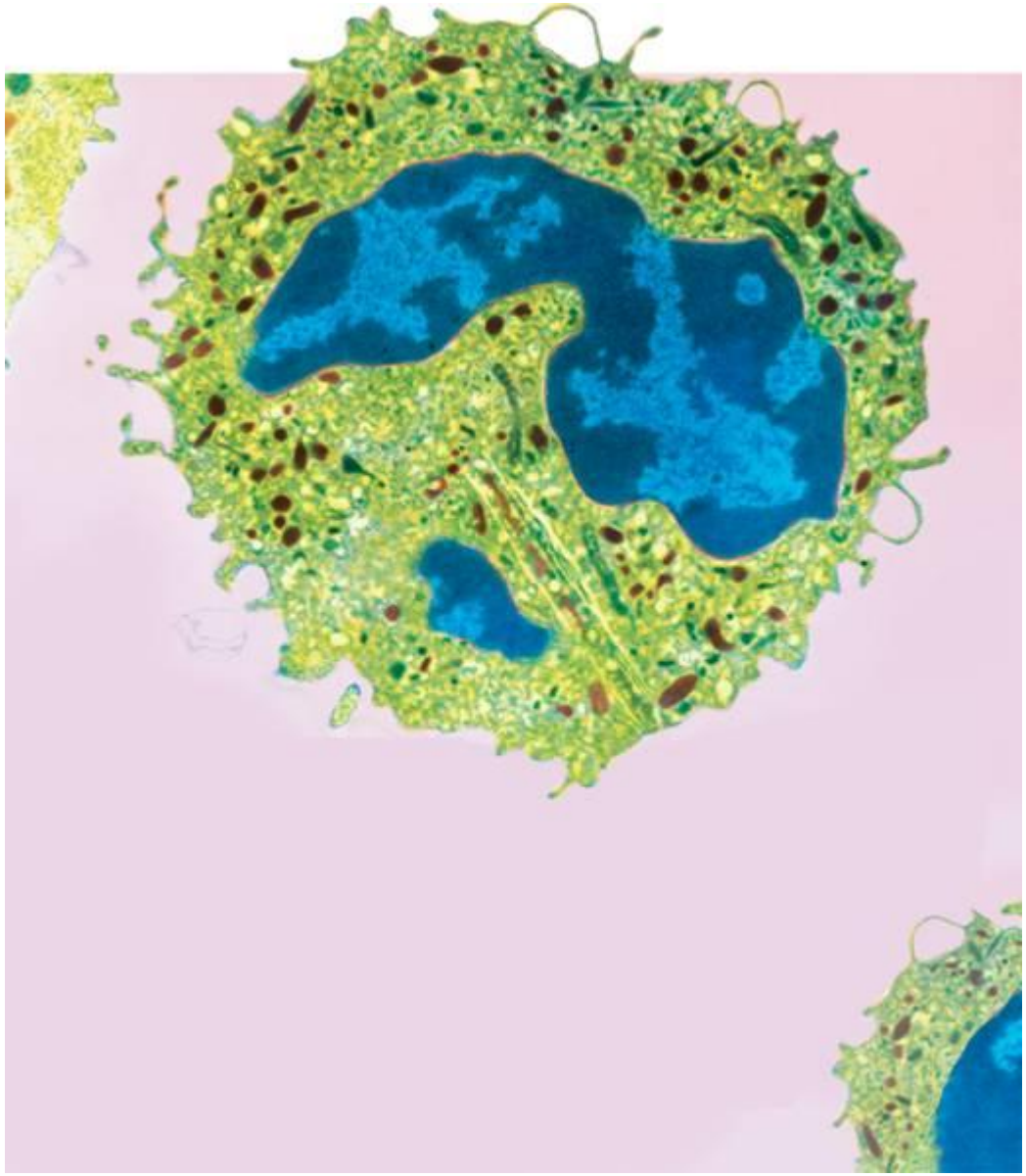
7-1 Life Is Cellular



The Discovery of the Cell

Because there were no instruments to make cells visible, the existence of cells was unknown for most of human history.

This changed with the invention of the microscope.

Early Microscopes

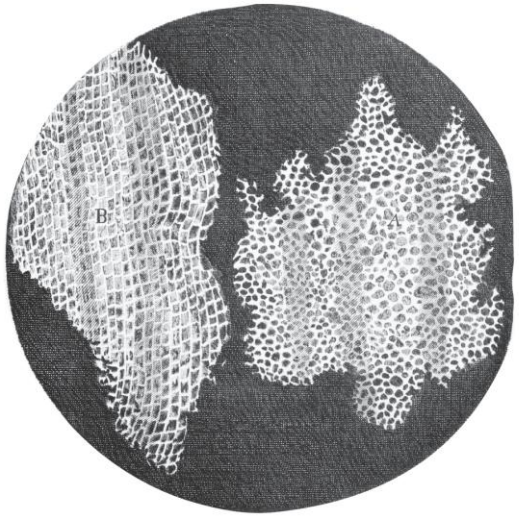
In 1665, Robert Hooke used an early compound microscope to look at a thin slice of cork, a plant material.

Cork looked like thousands of tiny, empty chambers.

Hooke called these chambers “cells.”

Cells are the basic units of life.

Hooke's Drawing of Cork Cells



At the same time, Anton van Leeuwenhoek used a single-lens microscope to observe pond water and other things.

The microscope revealed a world of tiny living organisms.

The Cell Theory

In 1838, Matthias Schleiden concluded that all plants were made of cells.

In 1839, Theodor Schwann stated that all animals were made of cells.

In 1855, Rudolph Virchow concluded that new cells were created only from division of existing cells.

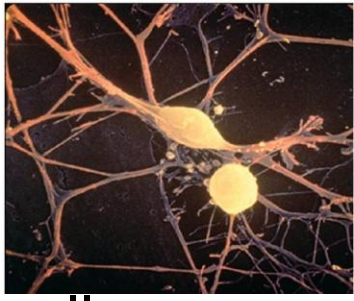
These discoveries led to the cell theory.

The cell theory states:

- **All living things are composed of cells.**
- **Cells are the basic units of structure and function in living things.**
- **New cells are produced from existing cells.**

Exploring the Cell

New technologies allow researchers to study the structure and movement of living cells in great detail.



Electron Microscopes

Electron microscopes reveal details 1000 times smaller than those visible in light microscopes.

Electron microscopy can be used to visualize only nonliving, preserved cells and tissues.

Transmission electron microscopes (TEMs)

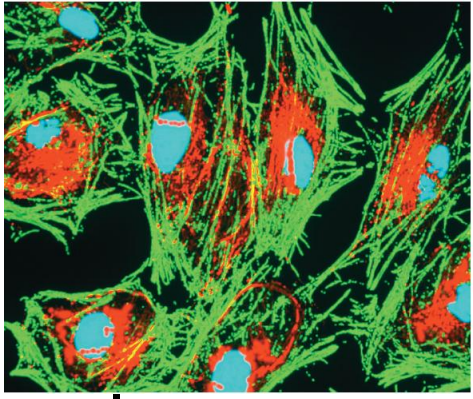
Used to study cell structures and large protein molecules

Specimens must be cut into ultra-thin slices

Scanning electron microscopes (SEMs)

Produce three-dimensional images of cells

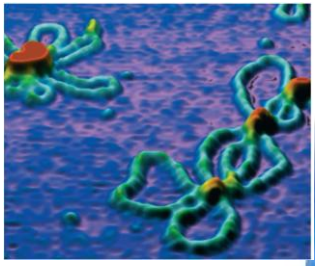
Specimens do not have to be cut into thin slices



Confocal Light Microscopes

Confocal light microscopes scan cells with a laser beam.

This makes it possible to build three-dimensional images of cells and their parts.



Scanning Probe Microscopes

- Scanning probe microscopes allow us to observe single atoms.
- Images are produced by tracing surfaces of samples with a fine probe.

Prokaryotes and Eukaryotes

Cells come in a variety of shapes and sizes.

All cells:

- are surrounded by a barrier called a cell membrane.
- at some point contain DNA.

Cells are classified into two categories, depending on whether they contain a nucleus.

The **nucleus** is a large membrane-enclosed structure that contains the cell's genetic material in the form of DNA.

The nucleus controls many of the cell's activities.

Eukaryotes are cells that contain nuclei.

Prokaryotes are cells that do not contain nuclei.

Prokaryotes

Prokaryotic cells have genetic material that is not contained in a nucleus.

Prokaryotes do not have membrane-bound organelles.

Prokaryotic cells are generally smaller and simpler than eukaryotic cells.

Bacteria are prokaryotes.

Eukaryotes

Eukaryotic cells contain a nucleus in which their genetic material is separated from the rest of the cell.

Eukaryotic cells are generally larger and more complex than prokaryotic cells.

Eukaryotic cells generally contain dozens of structures and internal membranes.

Many eukaryotic cells are highly specialized.

Plants, animals, fungi, and protists are eukaryotes.

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7-1 Section QUIZ

1. The cell theory states that new cells are produced from

   a. nonliving material.

   b. existing cells.

   c. cytoplasm.

   d. animals.

2 The person who first used the term *cell* was

a. Matthias Schleiden.

b. Lynn Margulis.

c. Anton van Leeuwenhoek.

d. Robert Hooke.

3 Electron microscopes are capable of revealing more details than light microscopes because

a. electron microscopes can be used with live organisms.

b. light microscopes cannot be used to examine thin tissues.

c. the wavelengths of electrons are longer than those of light.

d. the wavelengths of electrons are shorter than those of light.

4 Which organism listed is a prokaryote?

a. protist

b. bacterium

c. fungus

d. plant

5 One way prokaryotes differ from eukaryotes is that they

a. contain DNA, which carries biological information.

b. have a surrounding barrier called a cell membrane.

c. do not have a membrane separating DNA from the rest of the cell.

d. are usually larger and more complex.