

## 7.1 Life is cellular

## Early Microscopes

In 1665, Englishman Robert Hooke used a microscope to look at a slice of cork.

Cork was made of tiny, empty chambers that Hooke called “cells”.

Anton van Leeuwenhoek examined pond water and other things, including a sample taken from a human mouth. He called the tiny organisms he saw “animacules”.

# The Cell Theory

Other scientists' contributions confirmed that **cells** were the basic units of life.

In 1838, German botanist Matthias Schleiden concluded that all plants are made of cells.

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

In 1855, German physician Rudolf Virchow concluded that new cells could be produced only from the division of living cells.

# The Cell Theory

These discoveries are summarized in the **cell theory**.

The cell theory states:

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

# Light Microscopes and Cell Stains

A light microscope allows light to pass through a specimen and uses two lenses to form an image.

Light microscopes can produce clear images of objects only to a magnification of about 1000 times.

Chemical stains are used to view transparent substances.

Fluorescent dyes can be attached to specific molecules and tracked under a microscope.

# Electron Microscopes

Electron microscopes use beams of electrons focused by magnetic fields.

Electron microscopes offer much higher resolution.

two major types of electron microscopes:

1. transmission
2. scanning

# Electron Microscopes

Transmission electron microscopes make it possible to explore cell structures and large protein molecules.

Transmission electron microscopes produce flat, 2D images.

# Electron Microscopes

In scanning electron microscopes, a beam of electrons is scanned over the surface of a specimen.

Scanning electron microscopes produce 3D images of the specimen's surface.



# Electron Microscopes

Samples examined in electron microscopes must be placed in a vacuum.

Samples are chemically preserved and then all water is removed before placing them in the microscope.

This means that electron microscopy can be used to examine only nonliving cells and tissues.

# Prokaryotes and Eukaryotes

All cells contain DNA.

All cells are surrounded by a thin, flexible barrier called a **cell membrane**.

# Prokaryotes and Eukaryotes

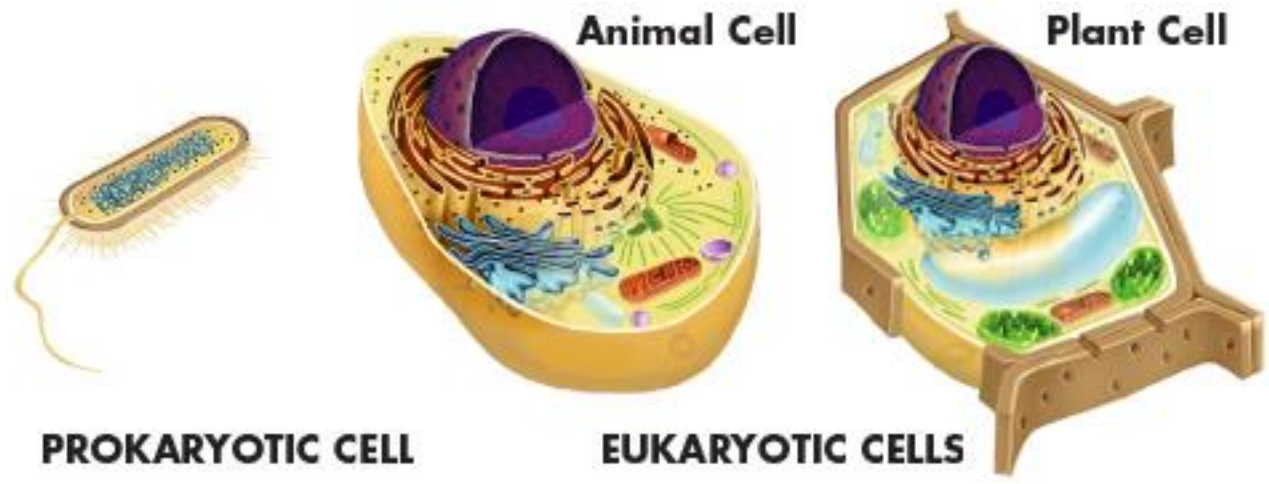
Cells are classified based on the presence of a nucleus.

The **nucleus** is a large membrane-enclosed structure that contains the cell's DNA. It controls many of the cell's activities.

# Prokaryotes and Eukaryotes

**Eukaryotes** are cells that enclose their DNA in nuclei.

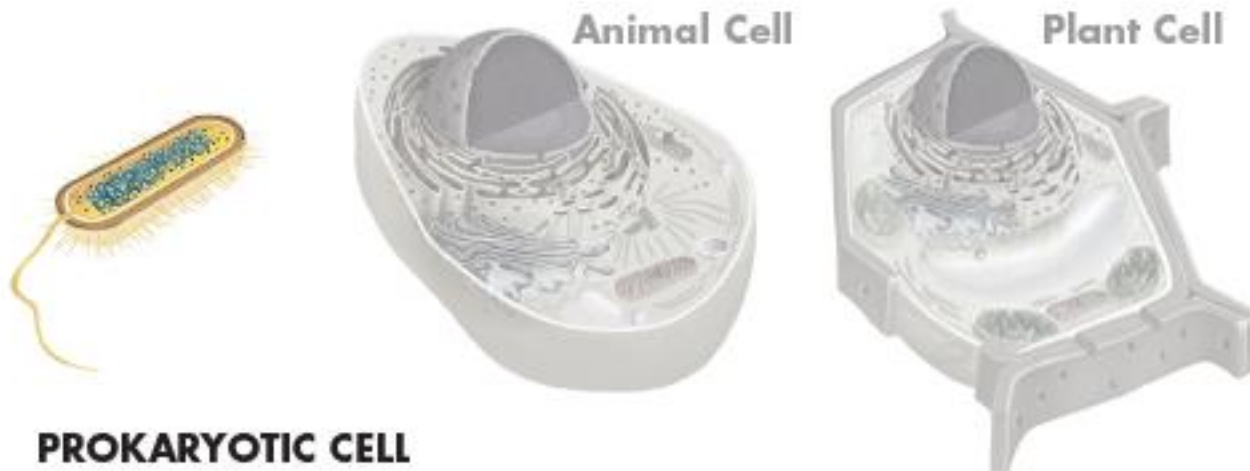
**Prokaryotes** are cells that do *not* enclose DNA in nuclei.



# Prokaryotes

generally smaller and simpler than eukaryotic cells.

Bacteria are prokaryotes.



# Eukaryotes

generally larger and more complex than prokaryotic cells.

Most eukaryotic cells contain dozens of structures and internal membranes. Many eukaryotes are highly specialized.

types of eukaryotes: plants, animals, fungi, and protists.

