

✓ A **microscope** is a high precision optical instrument that uses a lens or a combination of lenses to produce highly magnified images of small specimens or objects.

✓ **Microscopy** is the use of a microscope or investigation by a microscope.

• **What specific categories are microscopes used for or by ?**

- **Hobbyists** – gems, coins, stamps, collectibles, learning and discovery, etc.
- **Education** – chemistry, biology, botany, zoology
- **Medical** – microbiology, hematology, pathology, entomology, dermatology, dental usage, veterinary use, everyday analysis to advanced research. From medical schools to labs to hospitals
- **Industry** – inspection of electronic assembly components and many different materials such as metals, textiles, plastics, etc. Used in agriculture, wineries, breweries, and for fine engravings and mining inspection. Used by jewelers and geologists
- **Teachers and students** – in the educational process starting in elementary school through graduate school
- **Science** – for the study of archeology, oceanography, geology, metallurgy, and numerous other fields
- **Government** – many areas for public health and safety such as water quality, pharmaceuticals, forensics, asbestos, lab work, military applications, etc.

✓ **Rules of using a microscope**

- Always carry with 2 hands
- Only use lens paper for cleaning
- Do not force knobs
- Always store covered
- Be careful of the cords

♣ **BIOLOGY** is the science that studies living organisms and how they interact with one another and their environment.

All living organisms share five basic characteristics:

**1. Order.** All organisms consist of one or more cells with highly ordered structures: atoms make up molecules, which construct cellular organelles, which are contained within cells. This hierarchical organization continues at higher levels in multicellular organisms and among organisms.

**2. Sensitivity.** All organisms respond to stimuli. Plants grow toward a source of light, and your pupils dilate when you walk into a dark room.

**3. Growth, development, and reproduction.** All organisms are capable of growing and reproducing, and they all possess hereditary molecules that are passed to their offspring, ensuring that the offspring are of the same species. Although crystals also “grow,” their growth does not involve hereditary molecules.

**4. Regulation.** All organisms have regulatory mechanisms that coordinate the organism’s internal functions.

Once upon a time, all living things were lumped together into two kingdoms, namely plants and animals (at least, that's how I learned it). Animals included every living thing that moved, ate, and grew to a certain size and stopped growing. Plants included every living thing that did not move or eat and that continued to grow throughout life. It became very difficult to group some living things into one or the other, so early in the past century the two kingdoms were expanded into five kingdoms: Protista (the single-celled eukaryotes); Fungi (fungus and related organisms); Plantae (the plants); Animalia (the animals); Monera (the prokaryotes). Many biologists now recognize six distinct kingdoms, dividing Monera into the Eubacteria and Archeobacteria.

○ **Monera (includes Eubacteria and Archeobacteria)**

Individuals are single-celled, may or may not move, have a cell wall, have no chloroplasts or other organelles, and have no nucleus. Monera are usually very tiny, although one type, namely the blue-green bacteria, look like algae. They are filamentous

and quite long, green, but have no visible structure inside the cells. No visible feeding mechanism. They absorb nutrients through the cell wall or produce their own by photosynthesis.

- **Protista**

Protists are single-celled and usually move by cilia, flagella, or by amoeboid mechanisms. There is usually no cell wall, although some forms may have a cell wall. They have organelles including a nucleus and may have chloroplasts, so some will be green and others won't be. They are small, although many are big enough to be recognized in a dissecting microscope or even with a magnifying glass. Nutrients are acquired by photosynthesis, ingestion of other organisms, or both.

- **Fungi**

Fungi are multicellular, with a cell wall, organelles including a nucleus, but no chloroplasts. They have no mechanisms for locomotion. Fungi range in size from microscopic to very large ( such as mushrooms). Nutrients are acquired by absorption. For the most part, fungi acquire nutrients from decaying material.

- **Plantae**

Plants are multicellular and most don't move, although gametes of some plants move using cilia or flagella. Organelles including nucleus, chloroplasts are present, and cell walls are present. Nutrients are acquired by photosynthesis (they all require sunlight).

- **Animalia**

Animals are multicellular, and move with the aid of cilia, flagella, or muscular organs based on contractile proteins. They have organelles including a nucleus, but no chloroplasts or cell walls. Animals acquire nutrients by ingestion.

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Table 25.2 Characteristics of the Six Kingdoms

	Archaeobacteria and Bacteria	Protista	Plantae	Fungi	Animalia
					
Cell Wall	Noncellulose (polysaccharide plus amino acids)	Present in some forms, various types	Cellulose and other polysaccharides	Chitin and other noncellulose polysaccharides	Absent
Means of Genetic Recombination, If Present	Conjugation, transduction, transformation	Fertilization and meiosis	Fertilization and meiosis	Fertilization and meiosis	Fertilization and meiosis
Mode of Nutrition	Autotrophic (chemosynthetic, photosynthetic) or heterotrophic	Photosynthetic or heterotrophic, or combination of both	Photosynthetic, chlorophylls <i>a</i> and <i>b</i>	Absorption	Ingestion
Motility	Bacterial flagella, gliding or nonmotile	9 + 2 cilia and flagella; amoeboid, contractile fibrils	None in most forms; 9 + 2 cilia and flagella in gametes of some forms	Both motile and nonmotile	9 + 2 cilia and flagella, contractile fibrils
Multicellularity	Absent	Absent in most forms	Present in all forms	Present in most forms	Present in all forms
Nervous System	None	Primitive mechanisms for conducting stimuli in some forms	A few have primitive mechanisms for conducting stimuli	None	Present (except sponges), often complex

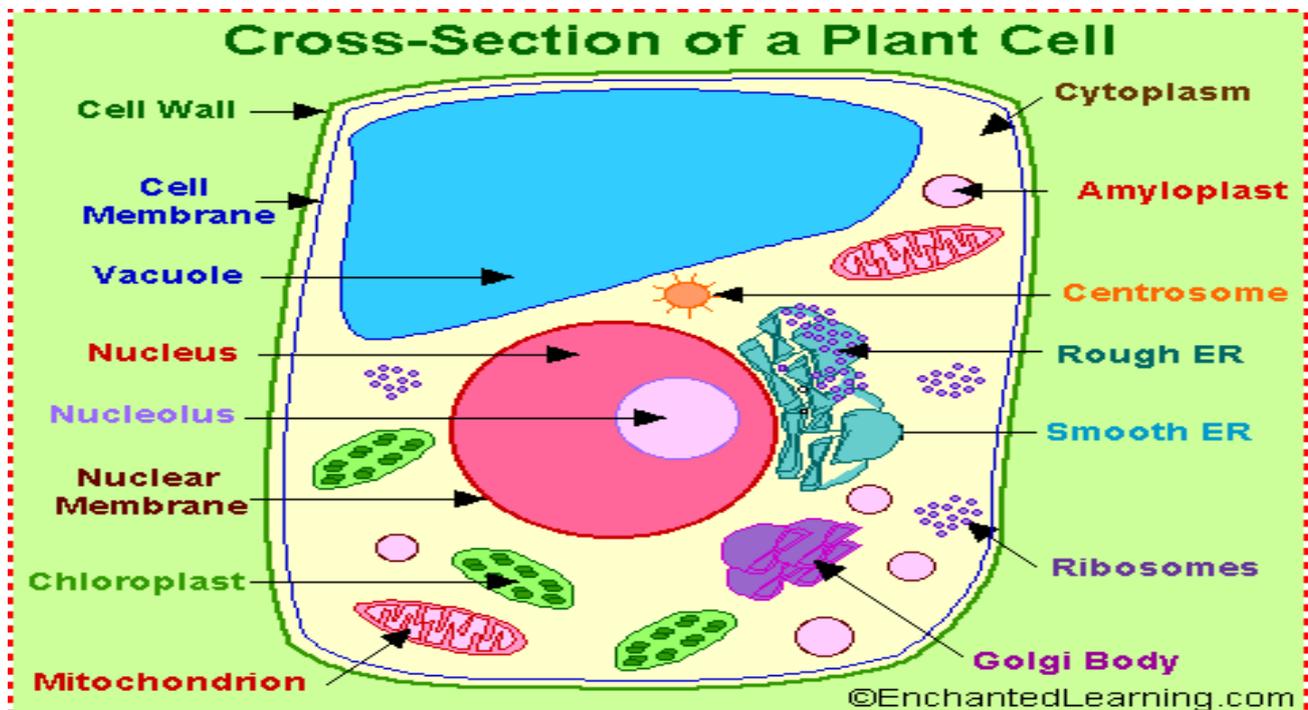
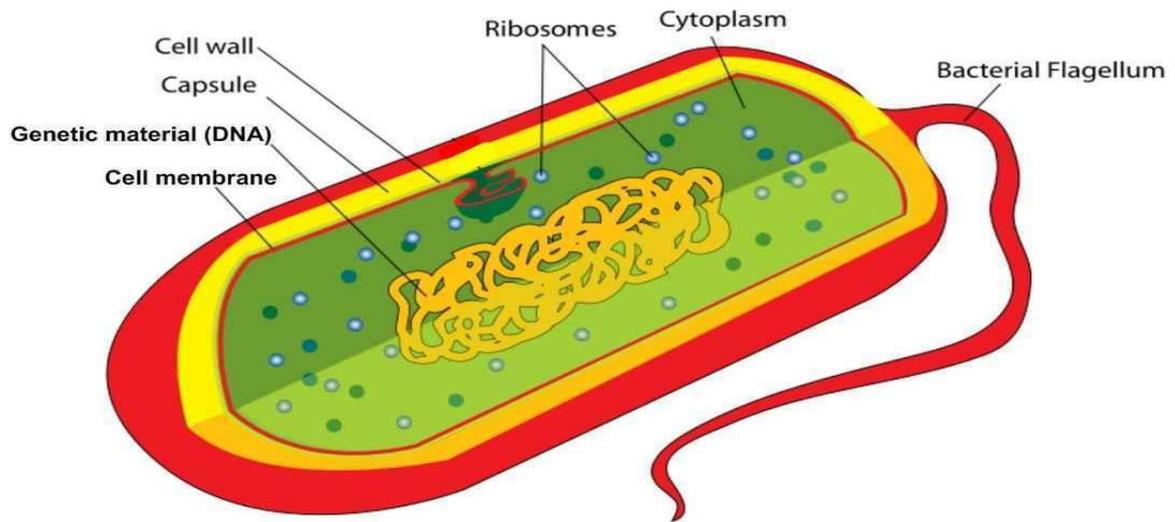
### ❖ The Biological Cell:

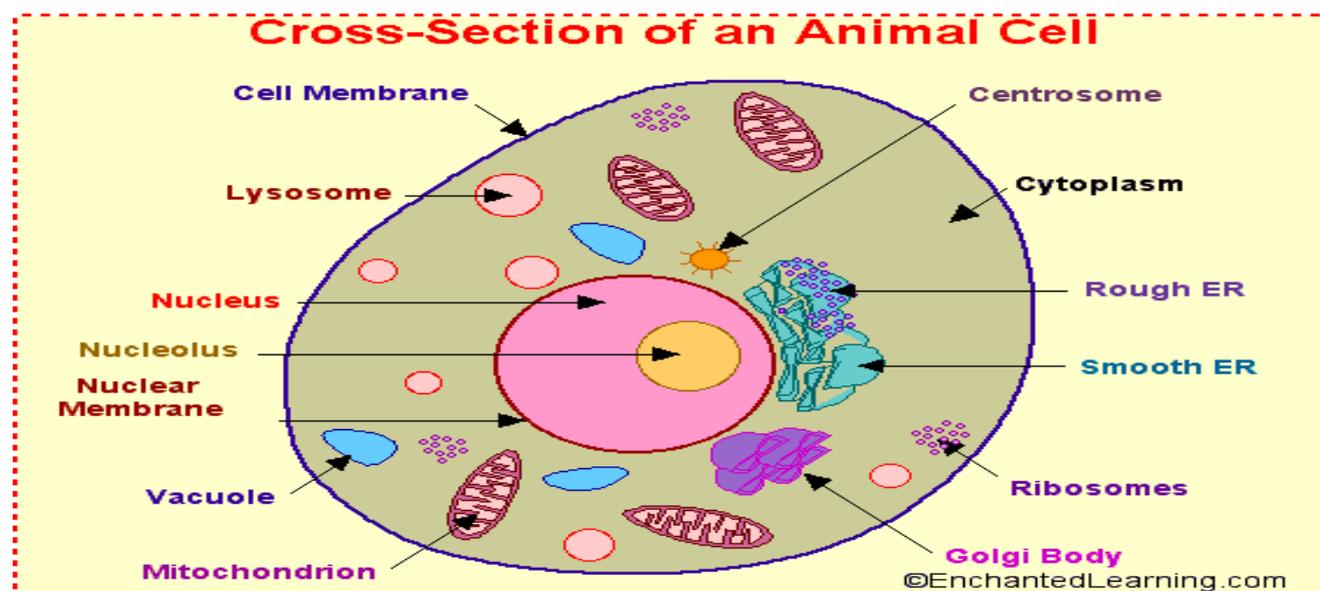
The **cell** (from Latin *cella*, meaning "small room") is the basic structural, functional, and biological unit of all known living organisms. A cell is the smallest unit of life that can replicate independently, and cells are often called the "building blocks of life". The study of cells is called cell biology

- ✓ In biology, **cell theory** is a scientific theory which describes the properties of cells. .
- ✓ **The three tenets** to the cell theory are as described below:

1. All living organisms are composed of one or more cells.
2. The cell is the basic unit of structure and organization in organisms.
3. Cells arise from pre-existing cells.

## Bacterial cell





### Comparison of features of prokaryotic and eukaryotic cells

	Prokaryotes	Eukaryotes
<b>Typical organisms</b>	bacteria, archaea	protists, fungi, plants, animals
<b>Typical size</b>	~ 1–5 $\mu\text{m}^{[1]}$	~ 10–100 $\mu\text{m}^{[1]}$
<b>Type of nucleus</b>	nucleoid region; no true nucleus	true nucleus with double membrane
<b>DNA</b>	circular (usually)	linear molecules (chromosomes) with histone proteins
<b>RNA/protein synthesis</b>	coupled in the cytoplasm	RNA synthesis in the nucleus protein synthesis in the cytoplasm
<b>Ribosomes</b>	50S and 30S	60S and 40S

<b>Cytoplasmic structure</b>	very few structures	highly structured by endomembranes and a cytoskeleton
<b>Cell movement</b>	flagella made of flagellin	flagella and cilia containing microtubules; lamellipodia and filopodia containing actin
<b>Mitochondria</b>	none	one to several thousand
<b>Chloroplasts</b>	none	in algae and plants
<b>Organization</b>	usually single cells	single cells, colonies, higher multicellular organisms with specialized cells
<b>Cell division</b>	binary fission (simple division)	mitosis (fission or budding) meiosis
<b>Chromosomes</b>	single chromosome	more than one chromosome
<b>Membranes</b>	cell membrane	Cell membrane and membrane-bound organelles