Cell – The Structural and Functional Unit of Life

- The cell is the structural and functional unit of the body.
- All living beings develop from pre-existing cells.
- Robert Hooke (1665) discovered the cell. He observed cork cells of a tree bark.
- Cell Theory: All organisms start their life with a single cell. Each cell is capable of carrying out various metabolic processes.
- Cell Number:

Unicellular Organisms	Made of a single cell. Example: Amoeba
Multi-cellular Organisms	Consists of many cells adapted to perform different functions. Examples: Plants, human beings

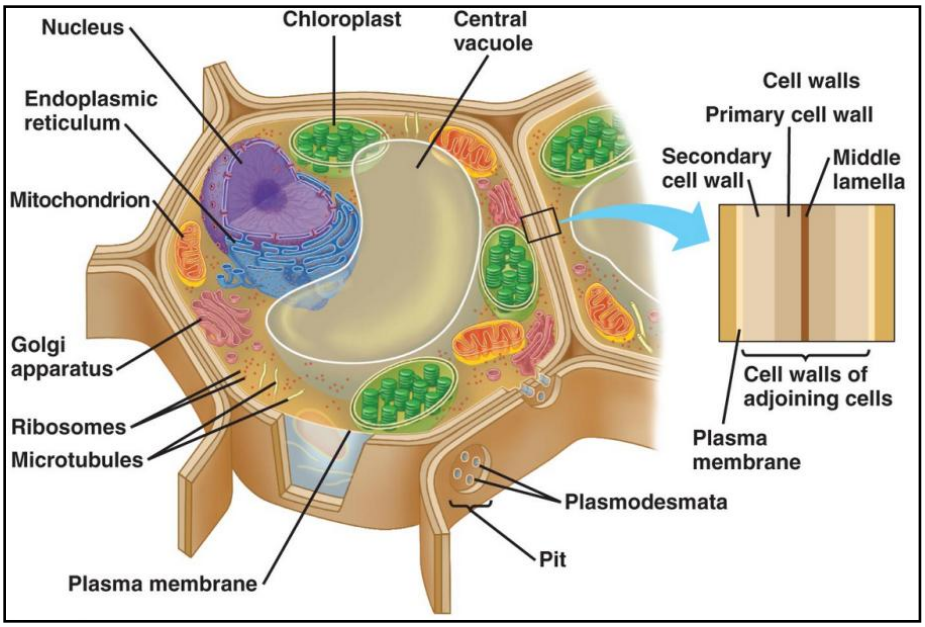
- Cell Size

  The size of cells ranges from 1/10th to 1/1000th mm.

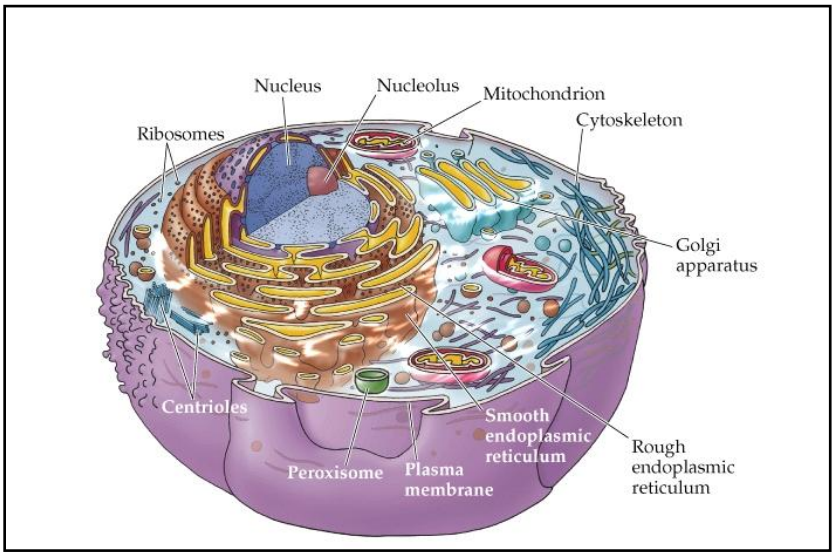
Largest cell in the world	Egg of an ostrich
Smallest cell	*Mycoplasma gallisepticum*
Largest human cell	Female ovum
Smallest human cell	Red blood cell
Longest cell	Nerve cell

- Cell Shape: Shapes of cells are often related to their functions.
  - Human red blood cells are circular and biconcave for easy passage through blood capillaries and to transport oxygen.
  - White blood cells are amoeboid bearing pseudopodia so that they can squeeze through blood capillaries and destroy pathogens.
  - Nerve cells are slender and long to carry impulses.
  - Guard cells are bean-shaped so that they can control the opening and closing of the stoma.

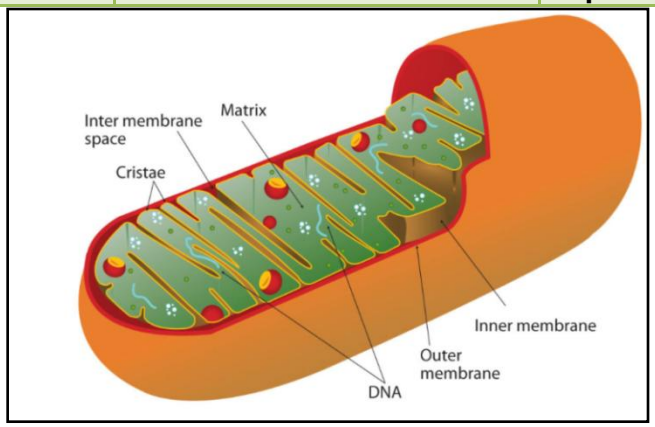
- Microscope: A microscope is an instrument used to magnify objects to be studied.
- Cell Structure:

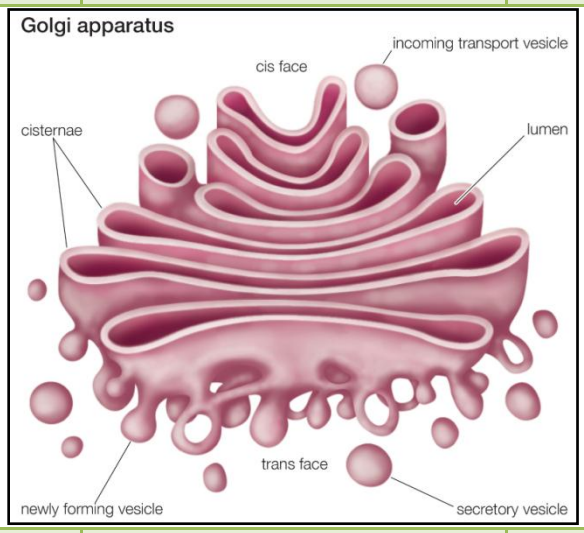
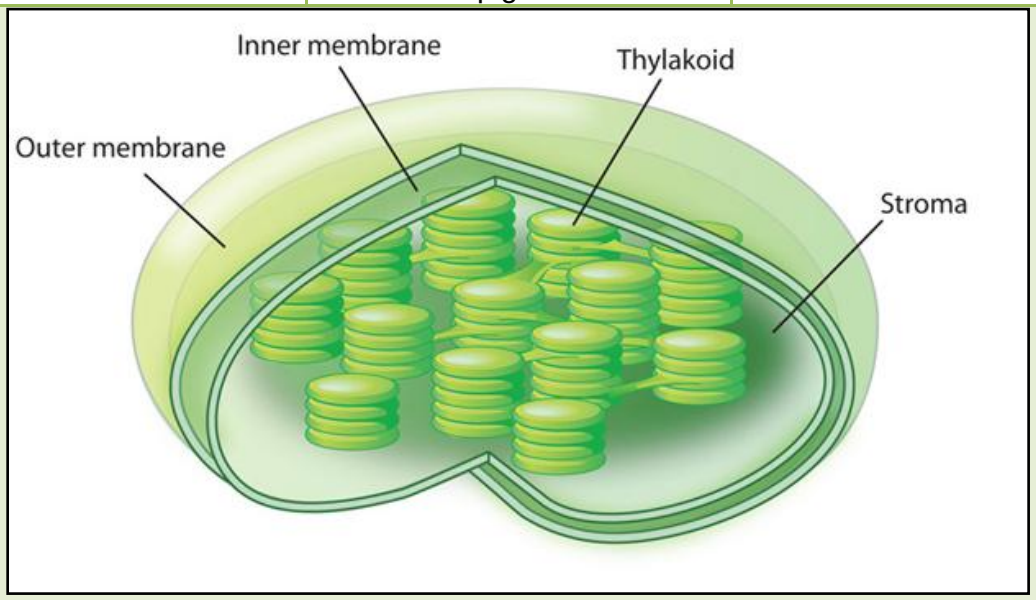


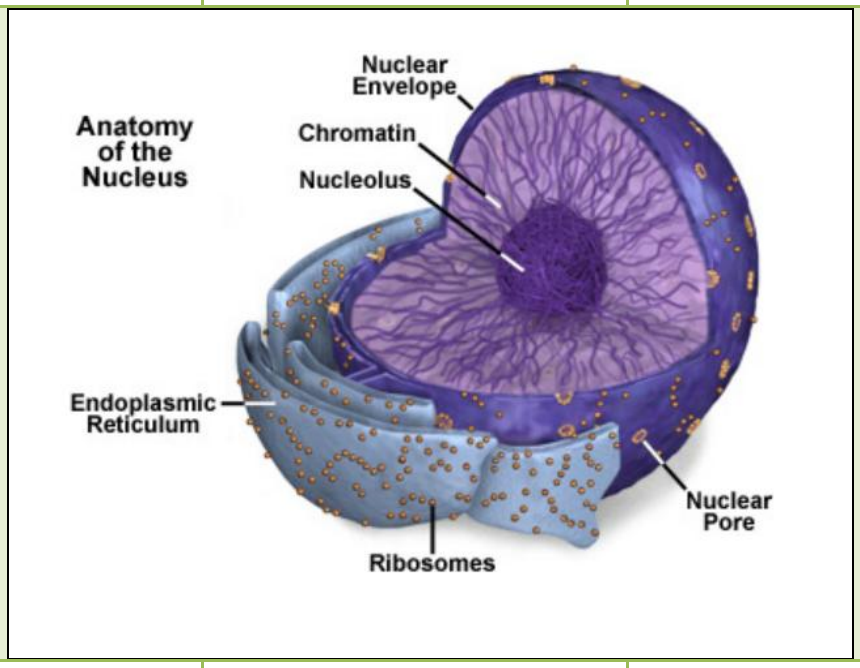
Plant Cell



Animal Cell

Part of Cell	Characteristics	Functions
1. Cell Membrane	• Living membrane • Outermost in animals • Semi-permeable	• Separates cell content from the surroundings • Maintains cell shape in animal cells
2. Cell Wall	• Present only in plant cells • Composed of cellulose	• Gives the plant cell rigidity and shape • Provides protection
3. Cytoplasm	• Semi-liquid substance • Cell organelles lie in the cytoplasm	• Site of enzyme-dependent metabolic reactions
4. Endoplasmic Reticulum	• Two types: Smooth endoplasmic reticulum (SER) and rough endoplasmic reticulum (RER)	• Supportive framework of the cell • Synthesis and transport of proteins and fats
5. Mitochondria	• Lined by a double membrane • Have their own DNA known as **mitochondrial DNA**	• Synthesis of respiratory enzymes • Site for aerobic respiration and energy storage, so also known as the **powerhouse of the cell**
		

6. Golgi Apparatus	• Stacks of flattened membrane sacs	• Synthesis and secretion of enzymes and hormones
		
7. Ribosomes	• Small granular structures • Scattered in cytoplasm, nucleoplasm or on the endoplasmic reticulum	• Site for protein synthesis
8. Lysosomes	• Membranous sacs	• Destroy foreign substances • Destroy old or damaged cells, so also known as **suicidal sacs**
9. Centrosome	• Found only in animal cells • A region surrounding the centrioles	• Initiates and regulates cell division
10. Plastids	• Two kinds: Leucoplasts (colourless plastids) and chromoplasts (coloured plastids) • Chloroplast is a green-coloured pigment	• Leucoplasts store starch • Chloroplasts are sites for photosynthesis
		

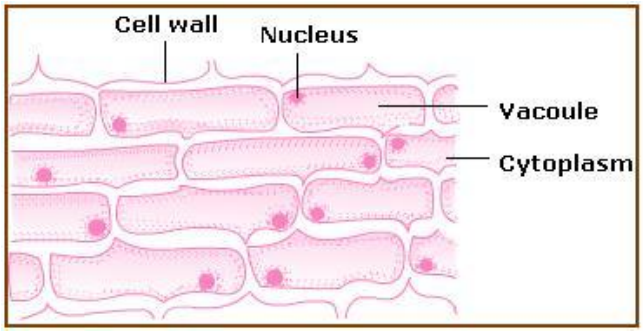
11. Nucleus	• Largest cell organelle • Contains chromatin network	• Regulates cell functions, so also known as control centre of the cell
		
12. Nucleolus	• Present inside the nucleus	• Synthesis of ribosomes
13. Chromatin Fibres	• Contain genetic material, i.e. DNA	• Carry hereditary information
14. Vacuoles	• Sac-like structures which contain cell sap • Large and permanent in plant cells • Small and temporary in animal cells	• Storage of water and substances dissolved in water
15. Granules	• Small particles, crystal or droplets such as fat-containing granules, starch-containing granules in plant cells and glycogen-containing granules in animal cells	• Serve as food for cells

Differences between Plant Cell and Animal Cell

Plant Cell	Animal Cell
• Cell wall is present and is made of cellulose.	• Cell wall is absent.
• Centrosome is absent.	• Centrosome is present.
• Plastids are present.	• Plastids are absent.

Microscopic Examination of Onion Peel:

- The cells are firmly bound together.
- The nucleus is placed towards one side which is usually the case in plant cells.



Nucleus is Essential for Normal Life:

- The nucleus is essential for life.
- Amoeba divides by normal cell division.
- If the nucleus is removed, then amoeba does not survive.
- If the nucleus from another amoeba is transplanted in an enucleated amoeba, then the recipient survives and divides while the donor (enucleated) amoeba dies.

Differences between Eukaryotic Cells and Prokaryotic Cells:

Eukaryotic Cells	Prokaryotic Cells
• Membrane-bound cell organelles are present.	• Membrane-bound cell organelles are absent.
• The contents of nucleus are separated from the cytoplasm.	• Nuclear material lies in the cytoplasm.
• Example: Bacteria	• Examples: Animal cell, plant cell