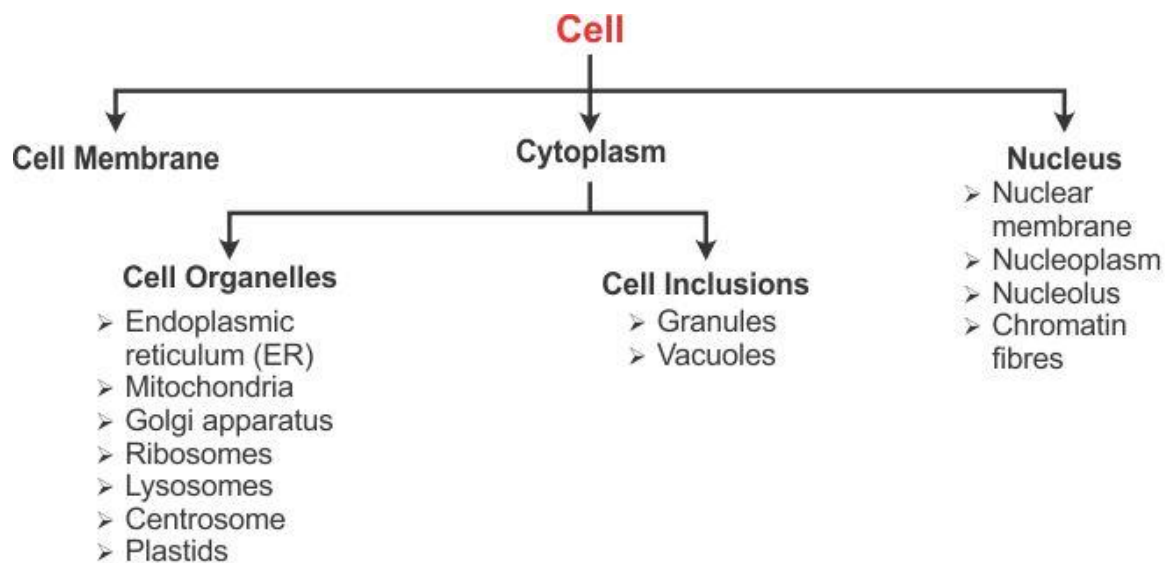


Cell: The Unit of Life

- The **cell** is the basic structural and functional unit of all living organisms. It is the smallest part of the body of an organism, capable of independent existence and able to perform all the essential functions of life.
- The history of cell science began in **1665**, with the observation of a thin section of a bottle cork by the English scientist **Robert Hooke**.
- In 1838, Matthias Schleiden and Theodor Schwann proposed a basic **cell theory**.
- The postulates of the modern cell theory are
 1. The cell is the smallest unit of structure of all living things.
 2. The cell is the unit of function of all living things.
 3. All cells arise from pre-existing cells.
- Cells vary in number (single-celled: *Amoeba*; few-celled: *Spirogyra*, multi-celled: Man), size (smallest: Bacteria, longest: Nerve cell, largest: Ostrich egg) and shape (columnar: Epithelial cells).



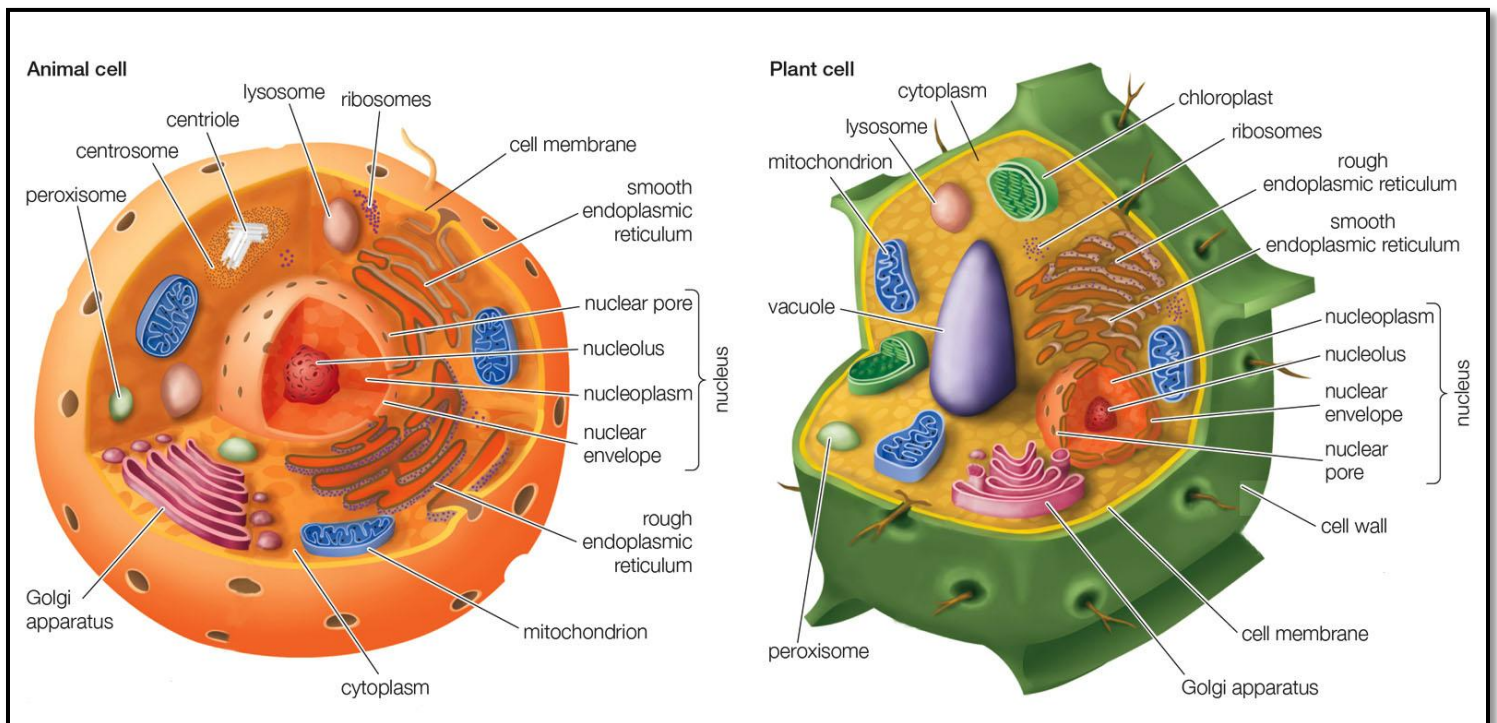
STRUCTURAL ORGANISATION OF A CELL		
NATURE AND OCCURRENCE	MAIN CHARACTERISTICS	MAIN FUNCTIONS
Plasma membrane/Cell membrane		
1. Forms the outermost covering in animal cells.	1. Very thin, flexible and delicate living membrane. 2. Semi-permeable.	1. Acts as an effective barrier and regulates the entry of certain solutes and ions.
Cell wall (in plant cells only)		
1. Non-living rigid protective covering situated just outside the plasma membrane.	1. Mainly composed of cellulose. 2. Freely permeable.	1. Gives rigidity and shape to the plant cells. 2. Provides protection.

STRUCTURAL ORGANISATION OF A CELL		
NATURE AND OCCURRENCE	MAIN CHARACTERISTICS	MAIN FUNCTIONS
Cytoplasm		
1. Content inside the plasma membrane, excluding the nucleus.	1. Contains a mixture of water and soluble organic and inorganic compounds and various cell organelles.	1. Centre of all metabolic activities. 2. Seat of occurrence of glycolysis (production of pyruvic acid).
Endoplasmic reticulum (ER)		
1. Irregular network of tubular double membrane.	1. May be smooth (SER) or rough (RER).	1. Supportive framework of the cell. 2. RER synthesises proteins, while SER secretes lipids.
Mitochondria		
1. Have varied shapes, but usually are sausage-like.	1. Double-walled, inner wall thrown into folds, called cristae. 2. Contain their own ribosomes and DNA, with several genes.	1. Seat of aerobic respiration. 2. Synthesis of respiratory enzymes and energy-rich compounds.
Golgi Apparatus (In animal cells) Dictyosomes (In plant cells)		
1. Stacks of flattened membrane sacs.	1. Consists of a set of membrane-bounded, fluid-filled vesicles and vacuoles.	1. Synthesis and secretion of enzymes, hormones etc. 2. Involved in the synthesis of plasma membrane, cell wall etc.
Ribosomes		
1. Dense, spherical, small granules, either scattered in the cytoplasm or attached to the outside of ER.	1. Single-walled, dense, spherical bodies composed mainly of RNA and proteins. 2. Not bounded by a membrane. 3. Two types: 70S and 80S	1. Synthesis of proteins.
Lysosomes		
1. Simple, tiny, single membrane bound sacs.	1. Contains 40 different types of enzymes.	1. Intracellular digestion. 2. Destroy foreign substances.
Centrosome (In animal cells only)		
1. Region surrounding the centrioles, located near nucleus.	1. Contains one or two centrioles that are surrounded by radiating microtubules to form an aster shape.	1. Initiates and regulates cell division.

STRUCTURAL ORGANISATION OF A CELL		
NATURE AND OCCURRENCE	MAIN CHARACTERISTICS	MAIN FUNCTIONS
Plastids (In plant cells only)		
1. Have their own genome. 2. Self-replicating organelles.	1. Double membrane, proteinaceous matrix containing DNA. 2. Possess disc-like structures called thylakoids, containing chlorophyll.	1. Chromoplasts: Impart colour to flowers and fruits. 2. Chloroplasts: Trap solar energy for photosynthesis. 3. Leucoplasts: Store starch.
Nucleus		
1. Centrally located spherical cellular component.	1. Mostly spherical and dense. 2. Surrounded by nuclear membrane with pores.	1. Regulates cell functions. 2. Regulates cell cycle.
Nucleolus		
1. Embedded within the nucleus of the cell.	1. One or more in number. 2. Round-shaped.	1. Produces ribosomes. 2. Participates in proteins synthesis by forming and storing RNA.
Chromatin fibres		
1. Embedded within the nucleus of the cell.	1. Network of thread-like structures, made up of DNA.	1. Chromosomes carry hereditary information or genes.
Vacuoles		
1. Fluid-filled or solid-filled and membrane-bounded spaces.	1. Non-living structures. 2. Larger in plant cells and fewer and smaller in animal cells.	1. Storage of water and other substances, food, pigments and waste products. 2. Gives turgidity to the cells. 3. Helps to maintain an osmotic pressure in a cell.
Granules		
1. Non-living structures.	1. Small particles, crystals or droplets.	1. Starch (in plant cells), glycogen (in animal cells) and fat-containing granules serve as food for the cell.

- Differences between plant and animal cell**

FEATURE	PLANT CELL	ANIMAL CELL
Structural differences		
Cell wall	Presence of a definite cell wall, made up of cellulose	Absence of a cell wall
Cell membrane	Present internal to the cell wall	Forms the boundary of the cell
Centrosome	Absence of centrosome	Presence of centrosome
Centriole	Absence of centriole	Presence of centriole
Vacuole	Presence of one or more prominent vacuoles	Presence of small and temporary vacuoles
Plastid	Presence of plastids	Absence of plastids
Functional differences		
Size	Usually larger with distinct outlines	Usually smaller with less distinct boundaries
Cytoplasm	Not so dense	Denser and more granular
Arrangement of cytoplasm	Only a thin lining of cytoplasm which is mostly pushed to the periphery	Cytoplasm fills up almost the entire cell
Other differences		
Shape	Rectangular	Spherical
Storage material	Starch	Glycogen



- **Differences between prokaryotic and eukaryotic cell**

FEATURE	PROKARYOTIC CELL	EUKARYOTIC CELL
Nucleus	Absence of a well-defined nucleus	Presence of a well-defined nucleus with a nuclear membrane
Nucleolus	Absent	Present
Genetic material	Presence of a single length of only DNA	Presence of several lengths of DNA, wound around certain proteins
Ribosomes	Presence of smaller ribosomes	Presence of larger ribosomes
Cell organelles	Absence of other cell organelles	Presence of several other cell organelles such as mitochondria, ER, chloroplasts etc.
Cell division	Cell division takes place by fission or budding, but not by mitosis	Cell division takes place by mitosis or meiosis
Examples	Bacteria, blue green algae	<i>Euglena</i> , <i>Amoeba</i> , plants, animals

- All organisms grow due to the **growth** in size and increase in the number of cells. This growth is because of the production of more body substance and cell substance.
- **Repair** of an injury or regeneration of a lost part is because of cell division.
- **Movement** of the body is because of contractility of the cells or cellular parts.
- **Feeding** and **nutrition** have many steps, and each step is a result of cellular activities.
- **Circulation** of blood as well as the movement of other fluids in the body takes place through various forces that are set up due to the contraction of muscle cells of the heart and other parts of the body.
- **Respiratory gases** are transported from the lungs to different parts of the body by blood cells such as RBCs.
- **Protection** of the body from different germs and diseases occurs through cells called white blood cells (WBCs). These cells either devour the germs or give out antibodies or antitoxins, which destroy the germs and neutralise their effect.
- The **sensation** of touch, pain, heat, cold etc. occurs due to sensory cells. The brain orders the muscles to contract or glands to secrete through their cells.
- **Thermoregulation** or maintenance of our body heat also takes place through cellular activity.
- All living organisms **reproduce** through cellular activity.
- In plants, **transportation** takes place due to cellular activity.

- In plants, **food is produced** due to cellular activity.
- In plants, **pollination** takes place due to cellular activity.
- **Inheritance** in an organism depends on the type of its germ cells.