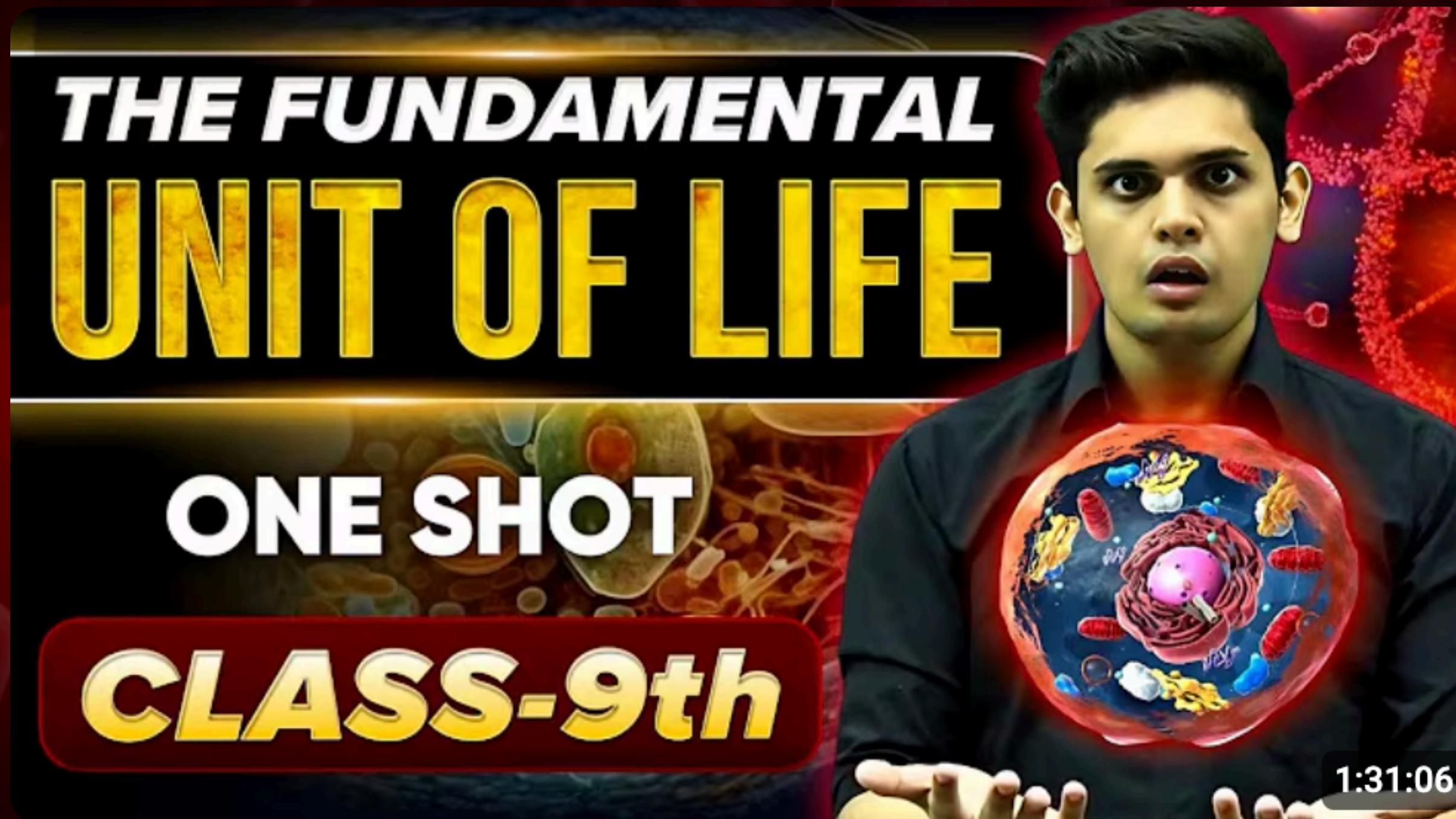


# FUNDAMENTAL UNIT OF LIFE

Class-9th Science

- Rapid Revision -





**RAPID**  
*Revision*

First watch One Shot

A cell is the basic structural and functional unit of life, capable of performing all essential life processes. Hence, it is called the fundamental unit of life.

**Cell - Robert Hooke (1665)**

**Discovered protozoa and bacteria, living cell - Antonie van Leeuwenhoek (1674)**

**Protoplasm - Purkinje (1839)**

**Cell nucleus - Robert Brown (1831)**

**Cell is the building block of life**

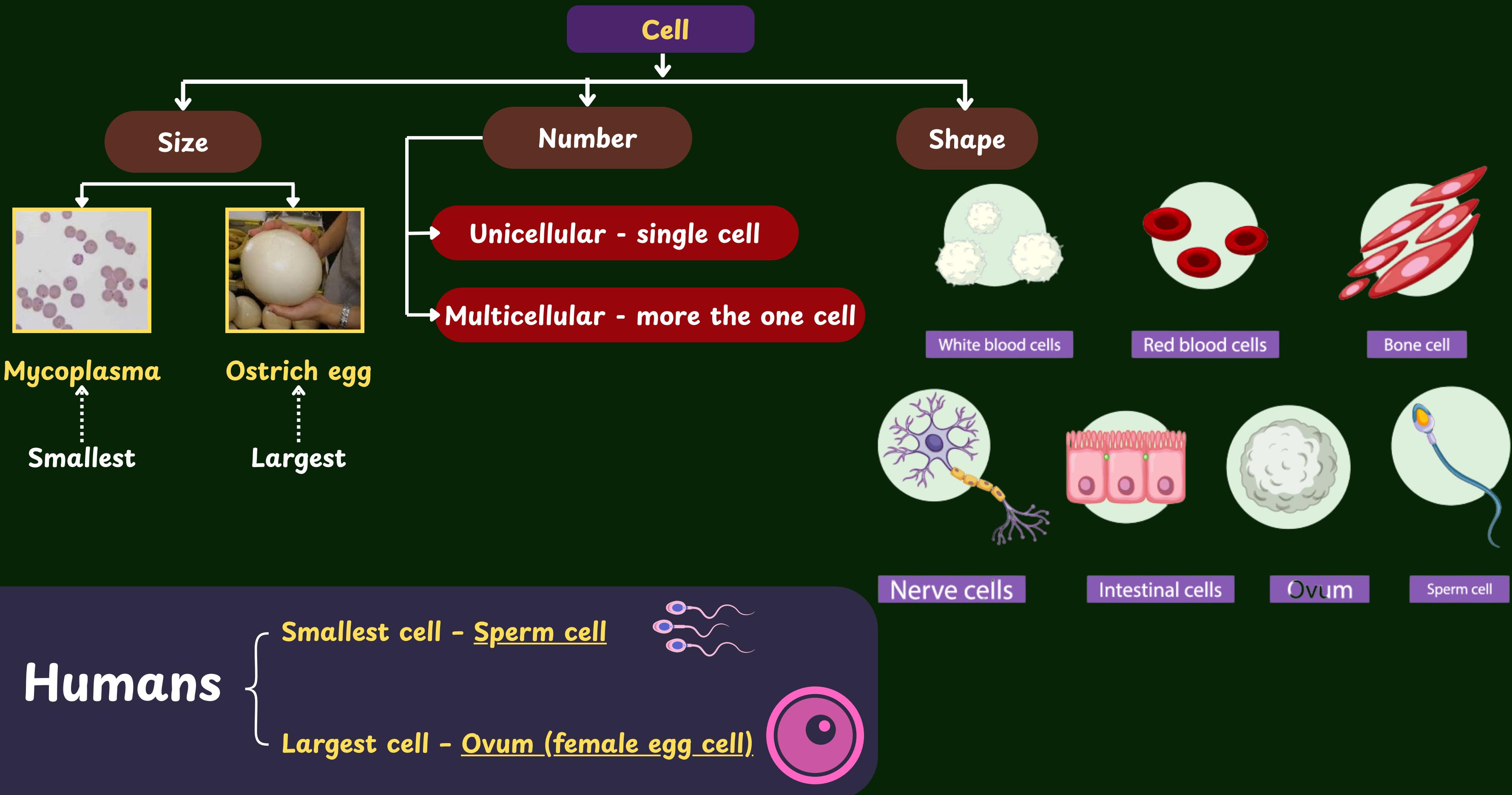
**Cell → Tissue → Organ → Organ System → Organism**

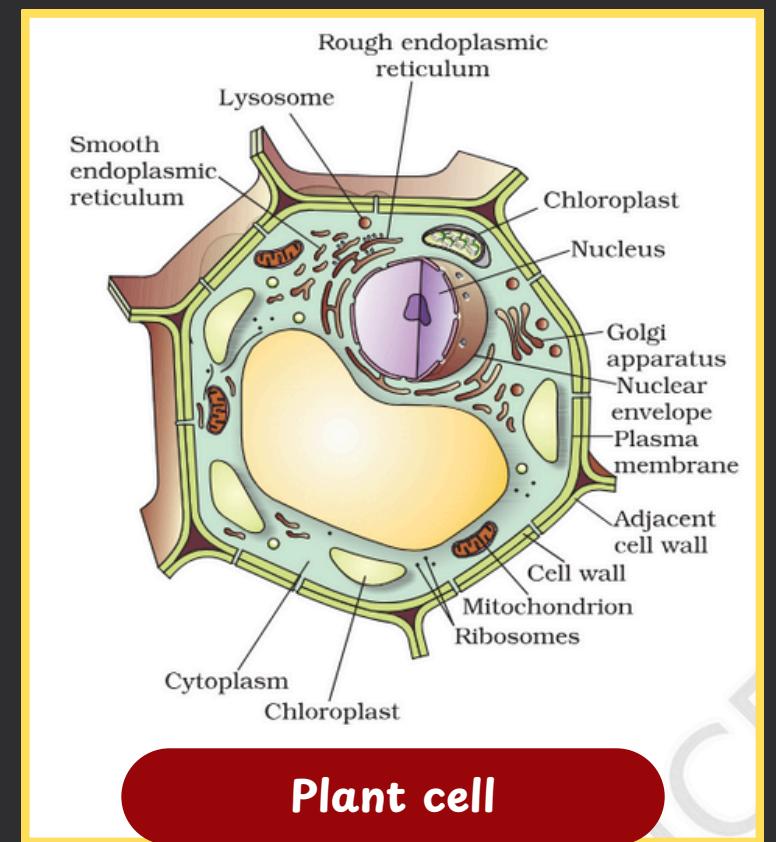
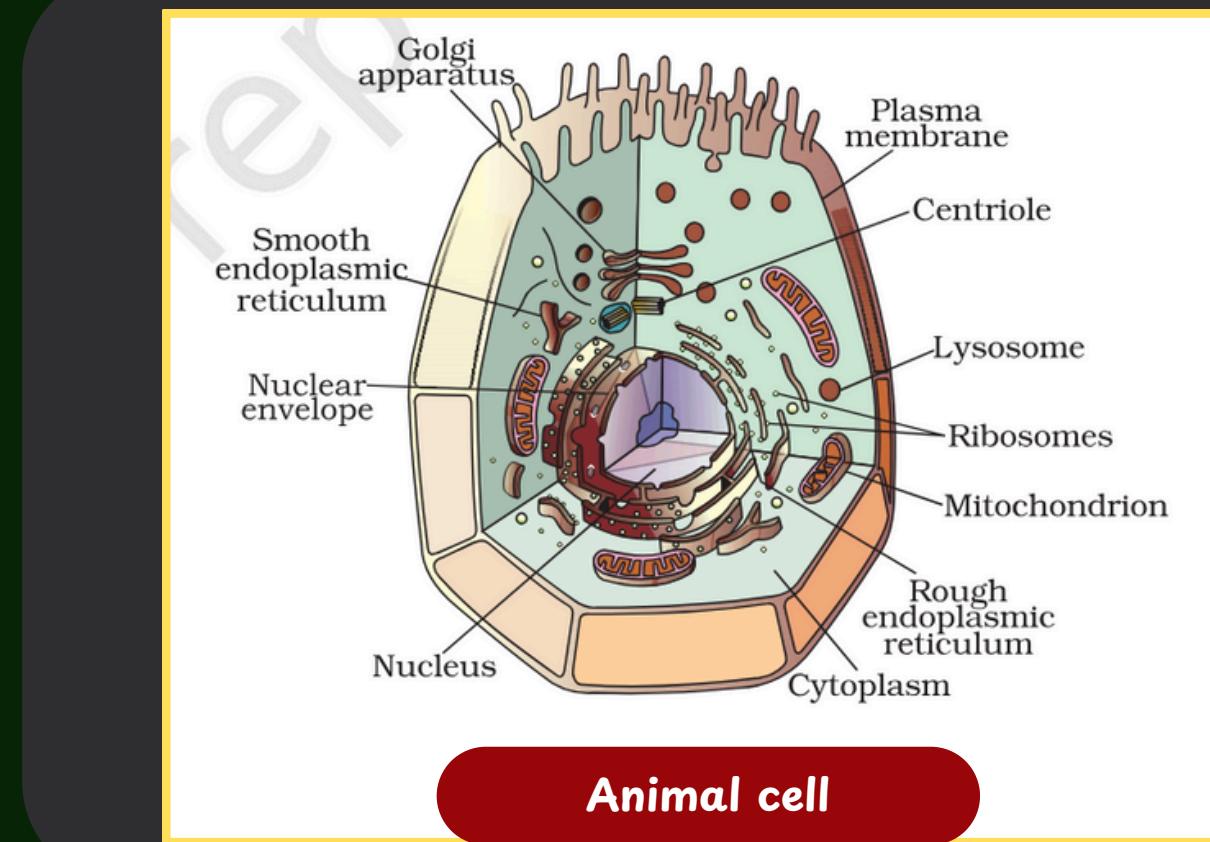
## **Cell Theory**

- **Schleiden (1838)** - Said plants are made of cells
- **Schwann (1839)** - Said animals are made of cells
- **Rudolf Virchow (1855)** - Said new cells come from old cells

- All living things are made of cells
- Cell is the basic unit of life
- New cells come from pre-existing cells







## Plasma Membrane (Cell Membrane)

- Outermost covering of the cell and it **separates cell contents from external environment**.
- Selectively permeable membrane**: regulating material movement and allowing diffusion of O<sub>2</sub> and CO<sub>2</sub> .
- It is made up of **lipids & proteins**.

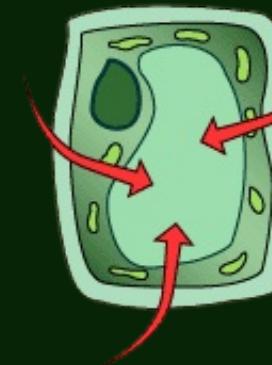
### Active Transport

- Movement against the concentration gradient
- Energy is required** (ATP used)
- Example: Movement of ions into root cells

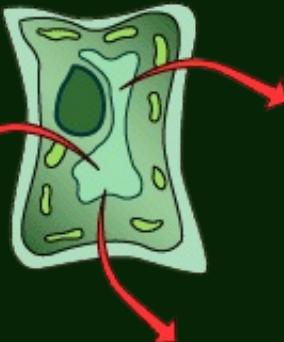
### Passive Transport

- Movement along the concentration gradient
- No energy is required**
- Example: Diffusion of oxygen and carbon dioxide

**Osmosis** is the movement of water molecules through a selectively permeable membrane from a region of higher water concentration to a region of lower water concentration.



**Endosmosis** - Movement of water into a cell or system.

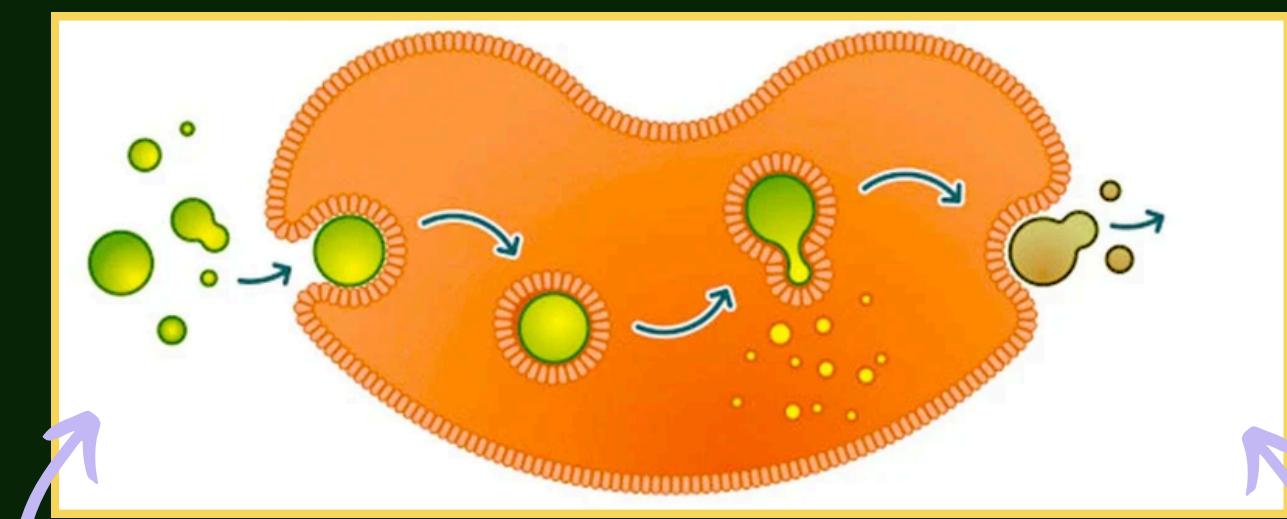


**Exosmosis** - Movement of water out of a cell or system.

**Diffusion:** movement of a substance (solid, liquid, or gas) from the region of higher concentration to the region of lower concentration so as to spread uniformly.

## TYPES OF SOLUTIONS

Hypertonic	Isotonic	Hypotonic
Higher solute OUTSIDE	Equal solute	Higher solute INSIDE
Higher water INSIDE	Equal water	Higher water OUTSIDE
Water moves OUT	No net movement	Water moves IN
Cell SHRINKS	Normal	Cell SWELLS



**Endocytosis**

**Exocytosis**

Diffusion	Osmosis
<ul style="list-style-type: none"> <li>Movement of particles from higher to lower concentration in liquids and gases, without a semi-permeable membrane.</li> <li>Water is not necessary, and movement occurs in all directions.</li> <li>It cannot be stopped and allows all substances to move freely.</li> <li>Example: Ink spreading in water.</li> </ul>	<ul style="list-style-type: none"> <li>Movement of solvent molecules from low to high solute concentration across a semi-permeable membrane, occurring only in liquids.</li> <li>Water is the main solvent, and movement happens in one direction.</li> <li>It can be stopped or reversed by applying external force, and only solvent molecules move.</li> <li>Example: Red blood cells swell in water.</li> </ul>

**Cell Wall:** Non-living, rigid outer covering of plant cells, made of cellulose, providing structural strength and lying outside the plasma membrane.

**Plasmolysis:** Water loss by osmosis causes cell contents to shrink away from the cell wall.

**Plant cell wall → Cellulose**

**Bacterial cell wall → Peptidoglycan**

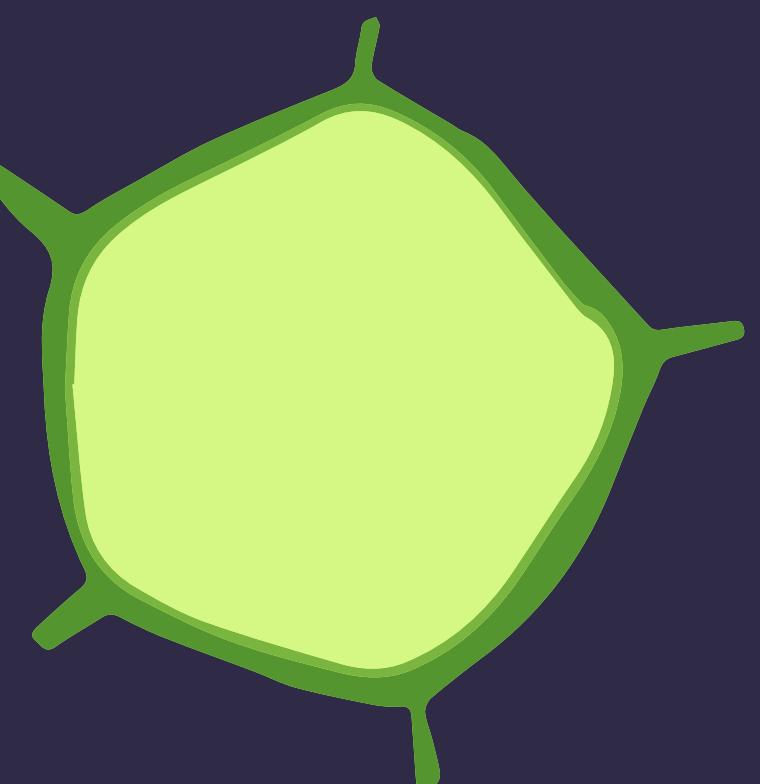
**Fungal cell wall → Chitin**

**Virus → No cell wall, has protein coat (capsid)**

**Animal cells → No cell wall**

### Functions:

- Prevents bursting in hypotonic environments.
- Absorbs water, creating pressure balance between the wall and swollen cell.
- Enables plant, fungi, and bacterial cells to withstand environmental changes better than animal cells.



## Nucleus (Brain of Cell):

- Control center of the cell and its surrounded by double-layered nuclear membrane with pores

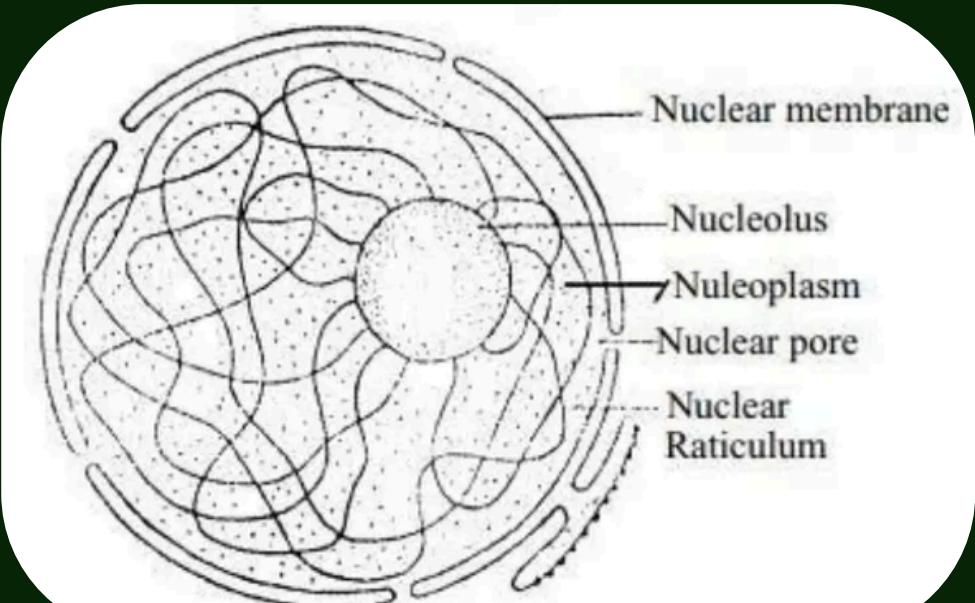
**Chromatin** - thread-like structure made of DNA and protein, found in the nucleus of a non-dividing cell.

condensation (during cell division)

**Chromosomes (rod-shaped structures)** - carry genetic information.

**Genes:** - control traits and cell functions

- **Nucleoplasm** fills the nucleus.
- Controls all **cell activities, reproduction, and inheritance**



Prokaryotic Cell	Eukaryotic Cell	Animal Cell	Plant Cell
<ul style="list-style-type: none"> <li>- Small size (<math>1-10\mu\text{m}</math>).</li> <li>- Nuclear region not well-defined (Nucleoid).</li> <li>- Single chromosome.</li> <li>- No membrane-bound organelles.</li> </ul>	<ul style="list-style-type: none"> <li>- Large size (<math>5-10\mu\text{m}</math>).</li> <li>- Well-defined nucleus with nuclear membrane.</li> <li>- More than one chromosome.</li> <li>- Membrane-bound organelles present.</li> </ul>		

**Cytoplasm:** Semi-fluid substance enclosed by the cell membrane that holds organelles and is the site of metabolic activities.

**Cell Organelles:** Membrane-bound structures in eukaryotic cells (e.g., nucleus, ER, Golgi body, lysosomes) that perform specialized functions.

**Ribosomes:** Membrane less cell organelle.

- Involved in synthesis of protein.
- Present in both Prokaryotic and Eukaryotic cell.



**Endoplasmic Reticulum (ER):** is a network of membranes within a cell that is involved in protein and lipid synthesis, transport, and modification.

<b>Rough Endoplasmic Reticulum (RER)</b>	<b>Smooth Endoplasmic Reticulum (SER)</b>
<ul style="list-style-type: none"> <li>- Rough due to ribosomes; site of protein synthesis.</li> <li>- Ribosomes synthesize proteins.</li> <li>- No role in lipid, enzyme, or hormone synthesis.</li> <li>- Not involved in detoxification.</li> </ul>	<ul style="list-style-type: none"> <li>- Smooth appearance; facilitates lipid, enzyme, and hormone production.</li> <li>- No protein synthesis; functions in lipid synthesis.</li> <li>- Crucial in detoxification, especially in liver cells.</li> </ul>

**Golgi apparatus:** Discovered by Camillo Golgi.

- Membrane-bound vesicles arranged in stacks (cisterns).
- Packages, stores, modifies, and transports proteins and helps in lysosome formation.
- Known as the '**traffic police**' of the cell.



**Lysosomes:**

- Small sac-like structures filled with digestive enzymes
- Break down worn-out cell parts, waste, and foreign material
- Help to keep the cell clean
- Called "**suicide bags**" because they can burst and digest the cell itself

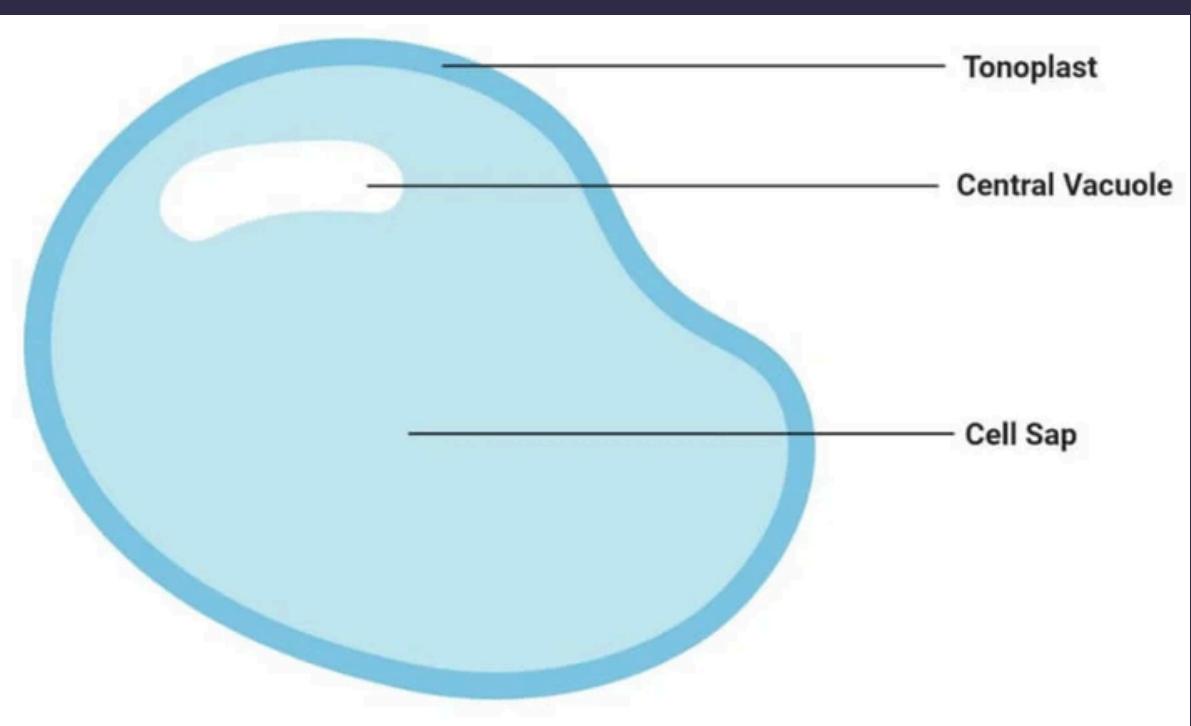


**Vacuoles (storage sacs):**

- They are large and central in plant cells, occupying 50-90% of the cell's volume, and are small or absent in animal cells.
- Filled with cell sap that contains sugars, amino acids, and proteins.
- Surrounded by a membrane called the tonoplast.
- Provide turgidity and rigidity to plant cells.

In unicellular organisms, vacuoles:

- Store consumed food
- Help expel excess water and waste



## Mitochondria (Powerhouse of cell):

- Double membrane: porous outer & folded inner for ATP (**Adenosine Triphosphate**) generation.
- Inner folds increase surface area for energy production.
- Produce ATP, fueling cellular activities & mechanical work.
- Have their own DNA & ribosomes, enabling protein synthesis.



**Plastids** are found only in plant cells.

### Chloroplasts

- Green plastids (contain chlorophyll)
- Do photosynthesis
- Found in green parts of plants

### Chromoplasts

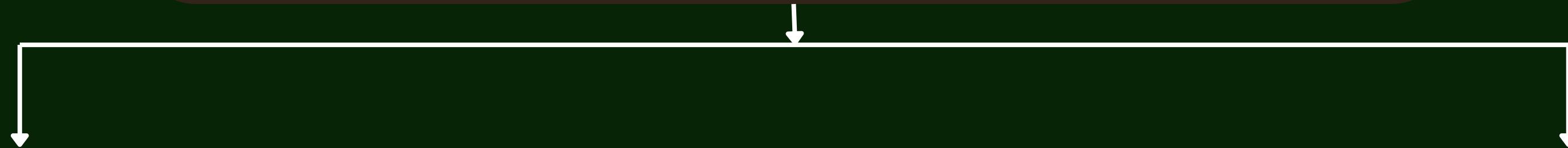
- Colored plastids (red, yellow, orange pigments)
- Give color to fruits and flowers

### Leucoplasts

- Colorless plastids
- Store starch, oils, proteins
- Found in roots, tubers, seeds

- **Double membrane-bound:** Nucleus, Mitochondria, Plastids
- **Single membrane-bound:** vacuole, lysosome, Golgi apparatus, endoplasmic reticulum
- **Membrane-less:** Ribosome, Centrosome (Centriole)

**Cell Division:** Process of forming new cells in organisms.  
Needed for growth, cell replacement, and reproduction.

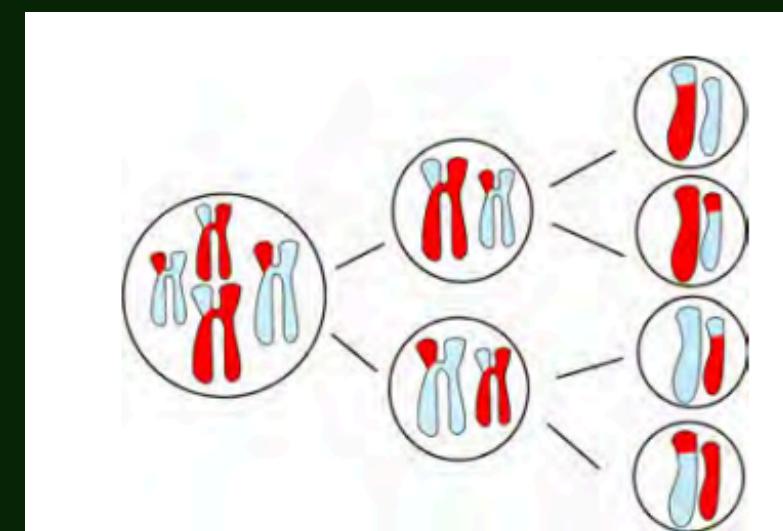
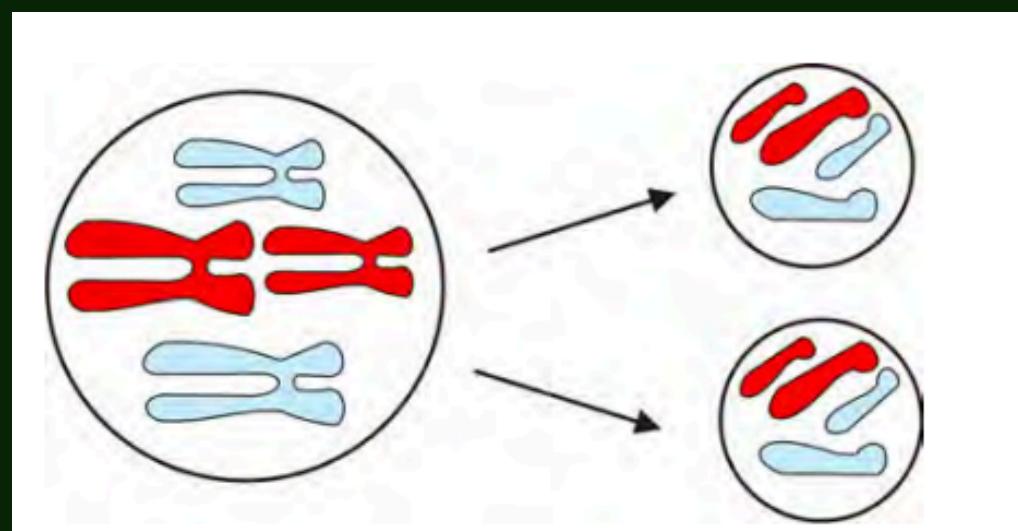


## Mitosis

- Occurs in body cells (somatic cells)
- Results in two daughter cells
- Daughter cells are identical to parent cell
- Chromosome number remains the same
- Helps in growth and repair

## Meiosis

- Occurs in reproductive cells (testes/ovaries)
- Results in four daughter cells
- Daughter cells are not identical to parent cell
- Chromosome number becomes half
- Helps in formation of gametes (sperm/egg)



<b>Feature</b>	<b>Plant Cell</b>	<b>Animal Cell</b>
<b>Cell Shape</b>	Regular shape	Irregular shape
<b>Cell Wall</b>	Present	Absent
<b>Plasma/Cell Membrane</b>	Present	Present
<b>Endoplasmic Reticulum</b>	Present	Present
<b>Lysosomes</b>	Rare	Present
<b>Golgi Apparatus</b>	Present	Present
<b>Cytoplasm</b>	Present	Present
<b>Ribosomes</b>	Present	Present
<b>Plastids</b>	Present	Absent
<b>Vacuoles</b>	Large central vacuole	Small and many
<b>Mode of Nutrition</b>	Primarily autotrophic	Heterotrophic

**Q. Which of the following is found only in plant cells?**

- A) Mitochondria**
- B) Ribosomes**
- C) Chloroplasts**
- D) Nucleus**

**Q. What will happen if a plant cell is placed in a sugar solution that is more concentrated than the cell sap?**

- A) Cell will gain water**
- B) Cell will swell**
- C) Cell will burst**
- D) Cell will lose water and shrink**