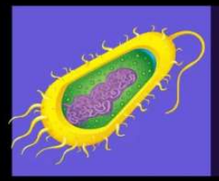
The Fundamental Unit of Life

Class 9

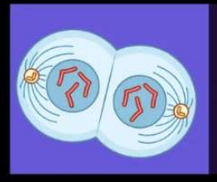
Topics to be covered



Introduction to Cell

Cell - Different Shape , Size , Number

Structrural Organization of Cell- What is Cell Made Up Of ?



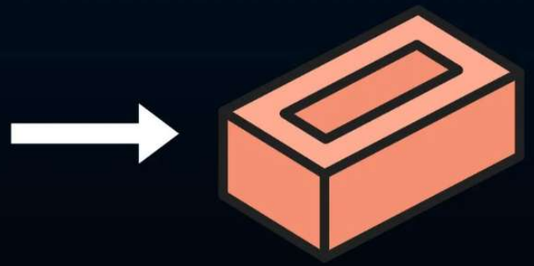
Cell Division

What is a Cell ?

- A cell is the fundamental Structural and Functional Unit of Life (Living Organism)

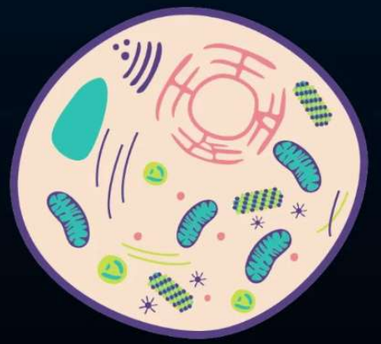
- A cell is the basic building units of Living organisms

House



Bricks

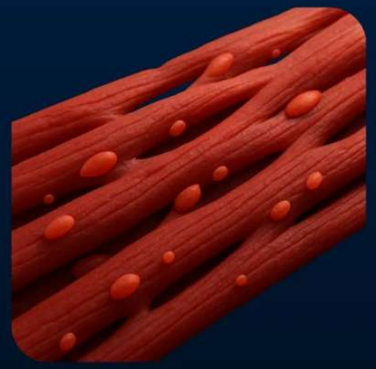
Living Organism



Cell

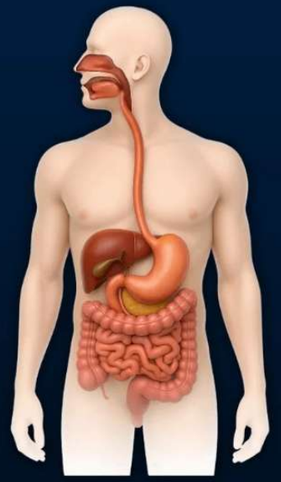
- A cell can replicate (make copy of itself) on its own

Cell



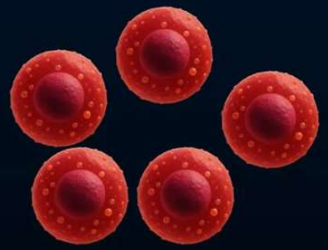
Tissue

Organ



Organ System

Organism



Stomach,food pipe, intestine,etc — Digestive system

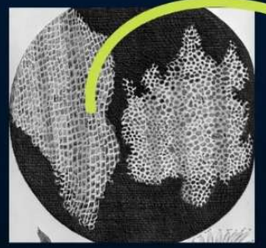
Heart, blood, blood vessel — Ciculatory system

Discovery of Cell

Robert Hooke -> Discovered cell & gave the term “cell” .

In 1665 , Hooke Observed a Cork (made from bark of a tree) under a self designed microscope

These were Dead Cells.

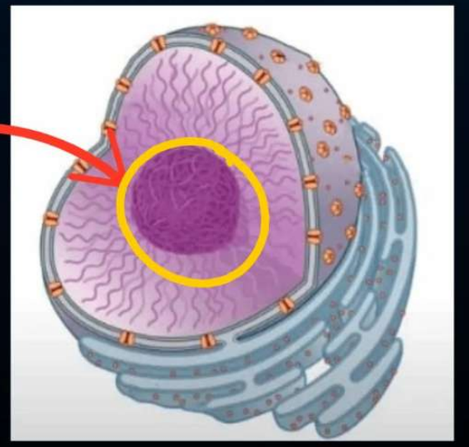


Little Rooms
(cell)

Robert Hooke

Scientist	Year	Discovery / Contribution
Antonie Van Leeuwenhoek	1674	Living cell (in pond water)
Robert Brown	1831	Discovered nucleus in cell
Purkinje	1839	Protoplasm

Controls the cell



Cell Theory

Matthias Schleiden (1838)

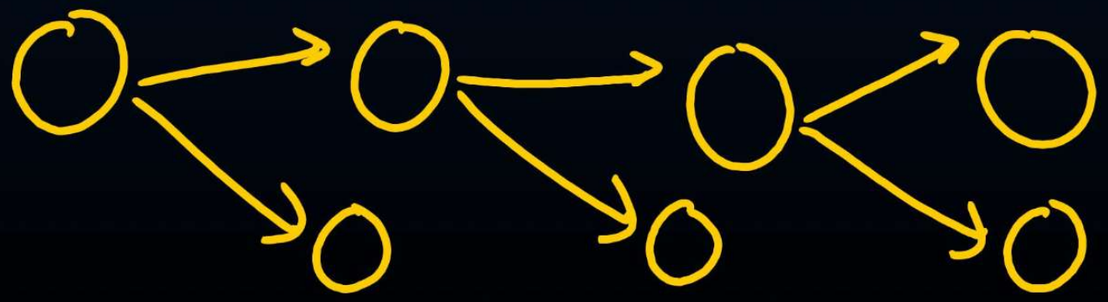
All Plants are made of Cells

Theoder Schwann (1839)

All Animals are made of Cells

Rudolf Virchow (1855)

All cells came from pre-existing cells



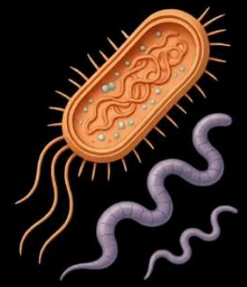
Q1 -Who discovered Cell & Nucleus?

Q2 - Why is cell called the structural and functional unit of life ?

Classification of Organisms Based on number of cells

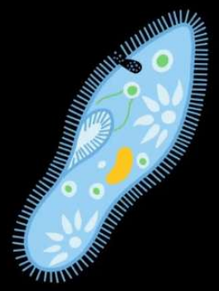
Unicellular Organisms

- Uni = single
- Organism made up of single cell
- Example :- Bacteria ,Amoeba , Paramecium



Bacteria

Amoeba



Paramecium

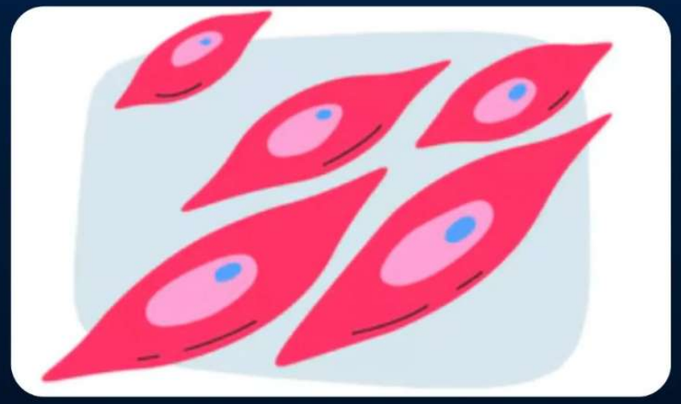
Multicellular Organisms

- Multi = many
- Organism made up of more than one cells
- Example :- Plants ,Animals

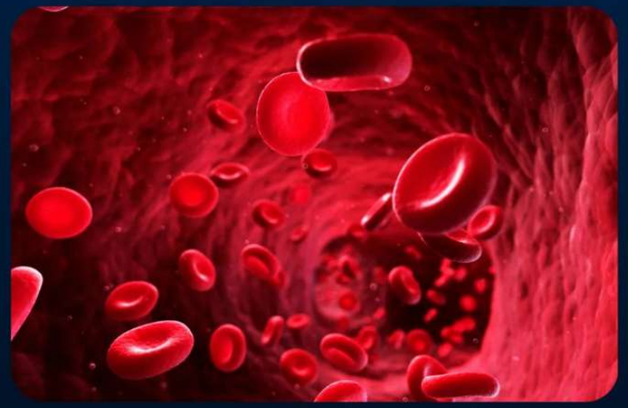
Plants

Animals

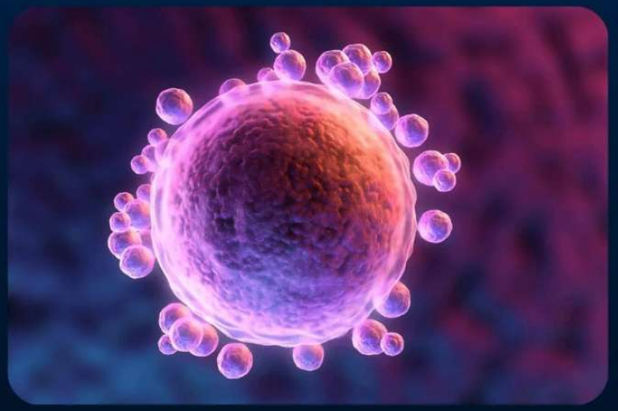
Different Shapes of Cell



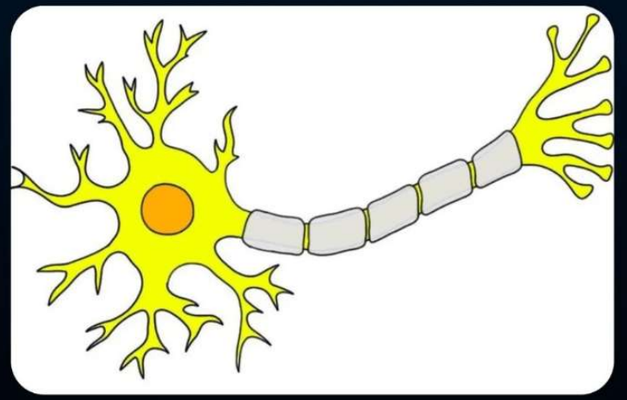
Smooth muscle cell (spindle-shaped)



Red Blood cell (round & biconcave)

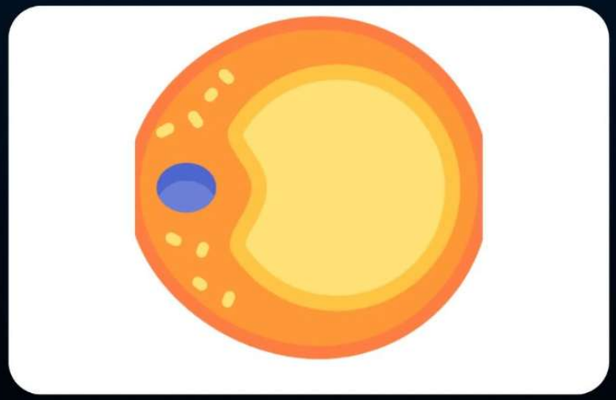


Ovum / Egg cell (spherical)



Neuron (long and branched)

Sperm Cells

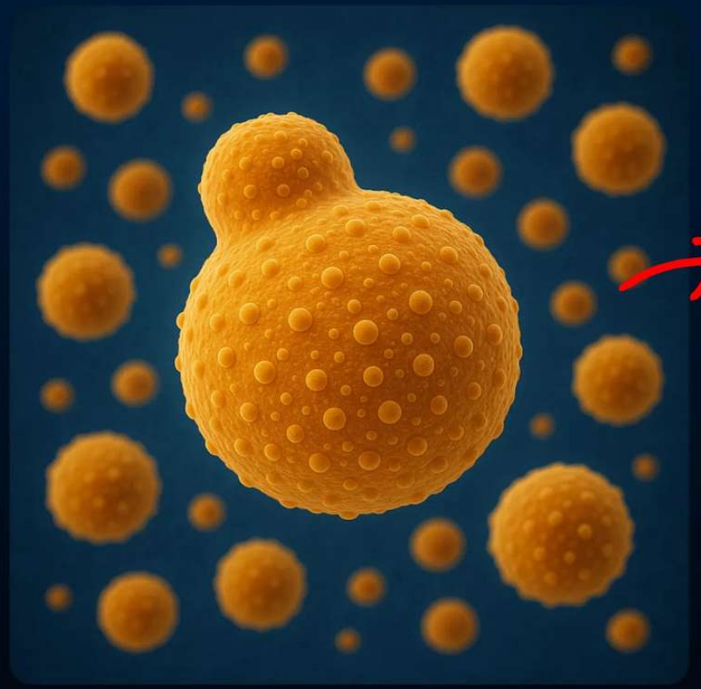


Fat cell

Different Size of Cell

Human body - Largest cell- Ovum/egg cell
Smalles cell - Sperm Cell

Smallest Living Cell

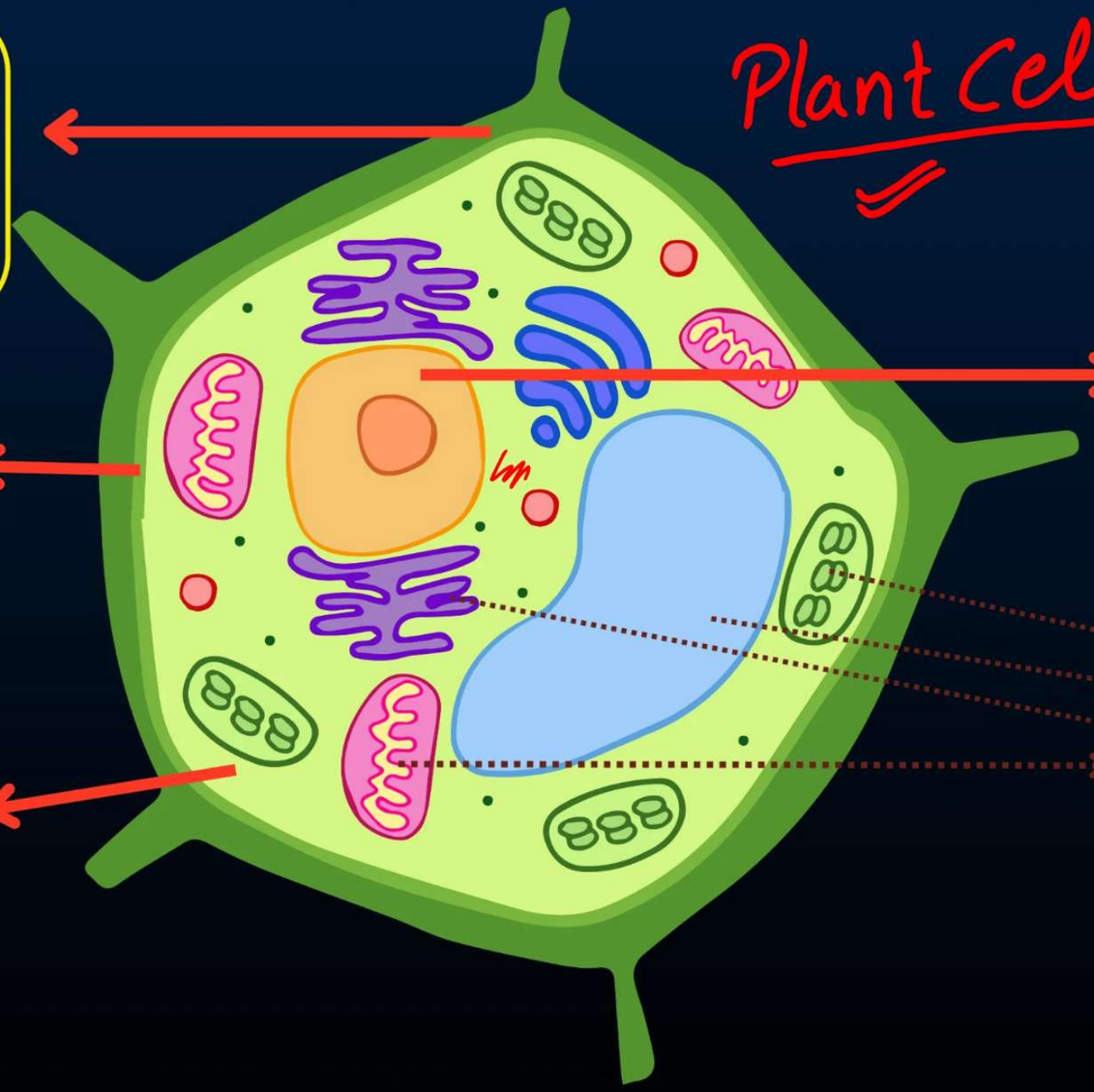


Mycoplasma (PPLO)
(Pleuro pneumonia like Organisms)

Largest Living Cell

Ostrich Egg Cell

Structural components of Cell - What is Cell Made Up Of ?



Cell wall

Rigid Outer Covering outside Plasma Membrane of Plant Cell

Plasma membrane

Outermost Covering of Cell

Cytoplasm

Fluid Content inside Plasma Membrane

gelly

Nucleus

Control centre of cell

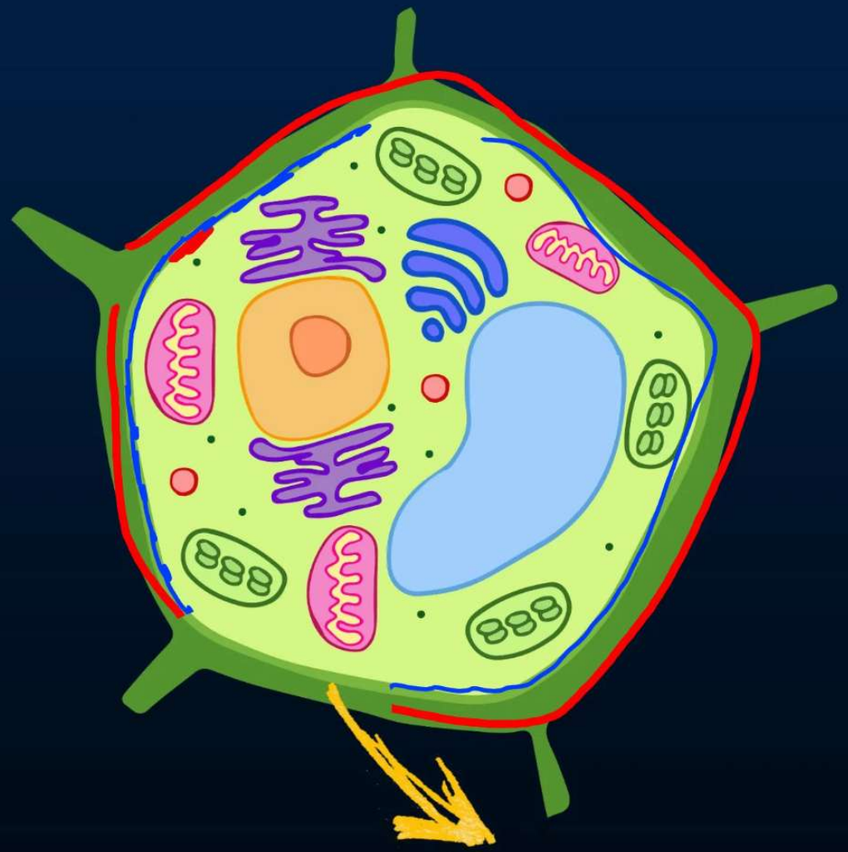
Cell Organelles

performs specific functions

Cell wall

Present in Plants, Bacteria , Fungi
Not Present in Animals

- Rigid (non flexible) outermost covering
- Non-living
- Forms outer covering of Plasma membrane
- Provide Shape & structural strength to plant cells.
- Protects the cell from mechanical damage

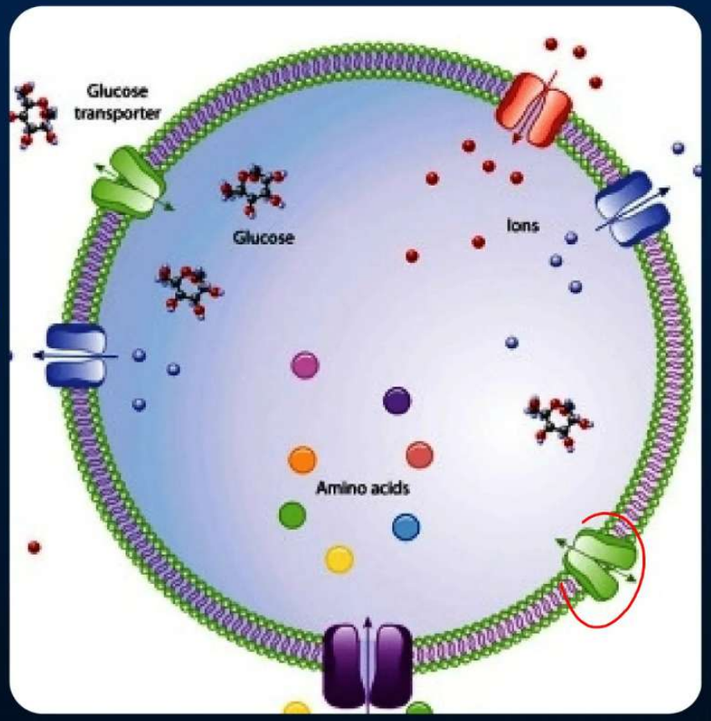


Cell wall is made up of Cellulose (long chains of C,H,O) in plants

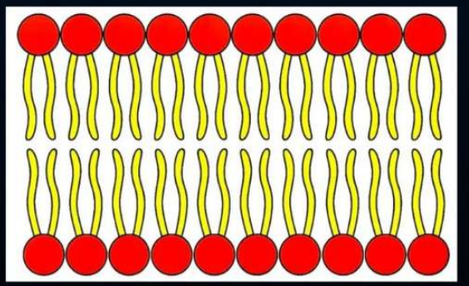
Plasma Membrane / Cell Membrane

↳ All living organism

Lipids & Proteins



- Outermost Living covering of the cell
- Plasma Membrane is Flexible & Living
- Made up of lipids and proteins (bilayer)
- Plasma Membrane is called a selectively permeable membrane.
  because it allows entry & exit (transport) of certain / specific materials through it.
- Movement of materials through plasma membrane is of two types -



Phospholipid Bilayer

Transport Across Membrane

Passive Transport	Active Transport
Movement of molecules from their higher concentration to lower concentration	Movement of molecules from their lower concentration to higher concentration
No energy is required	Energy is required which is in the form of ATP
It is comparatively slow process	It is a rapid process
Not affected by temperature	Affected by temperature
Small molecules or water molecules show passive transport	Large molecules show active transport
Types: Osmosis and Diffusion	Types: Endocytosis, Exocytosis,

Q3 -Why is Cell membrane called a selectively permeable membrane ?

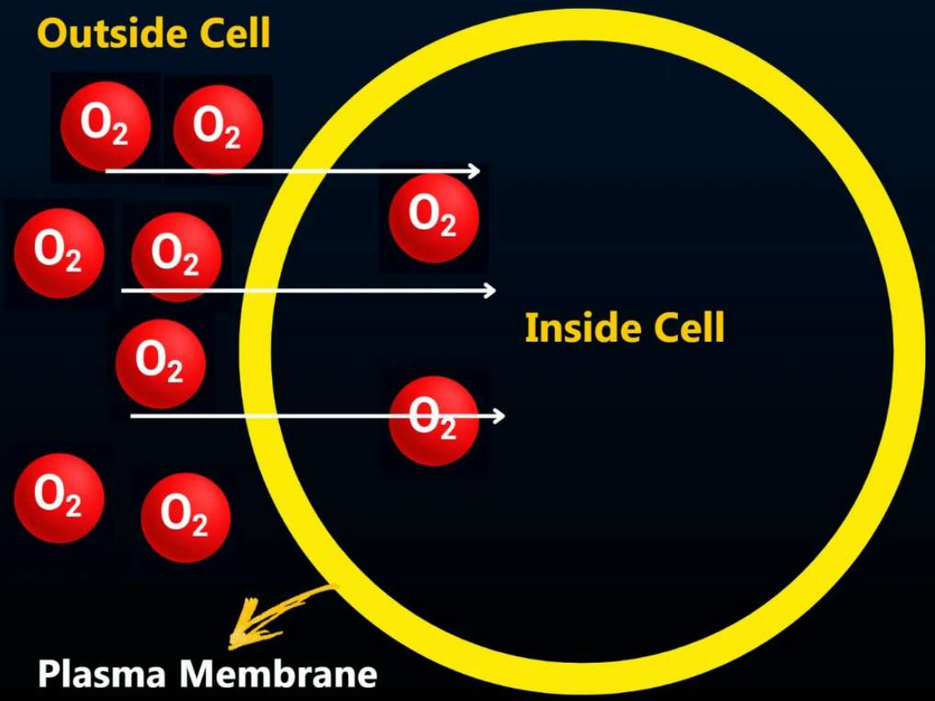
Q4 -Give two examples each of Passive & Active Transport

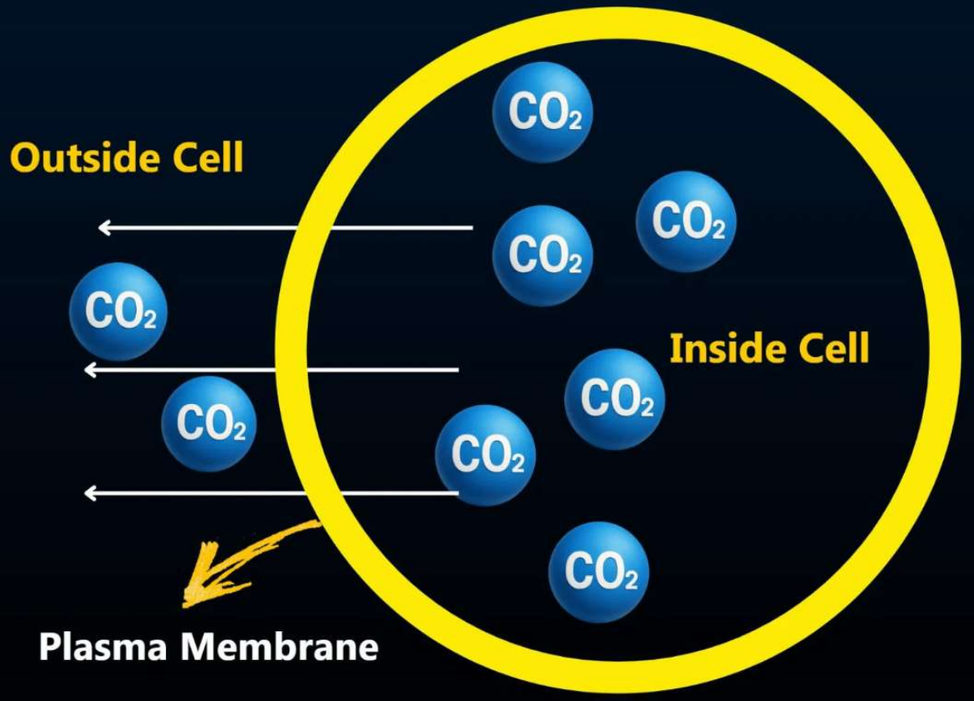
imp

Passive transport

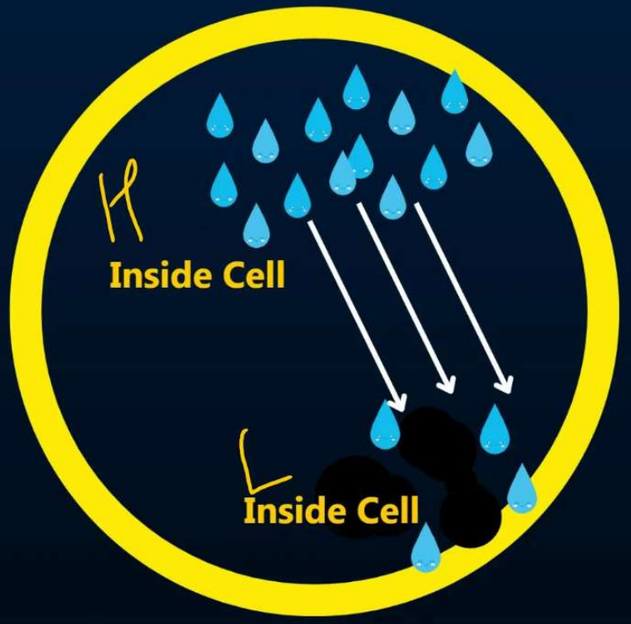
Diffusion

- Spontaneous movement of substances (Solids, Liquids & Gases) from Region of High Concentration to Low Concentration.
  - CO_2 and O_2 move across Plasma Membrane by diffusion

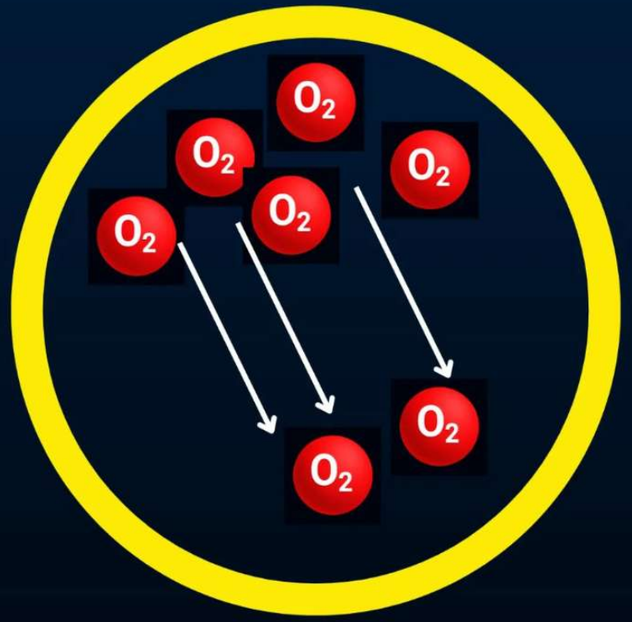




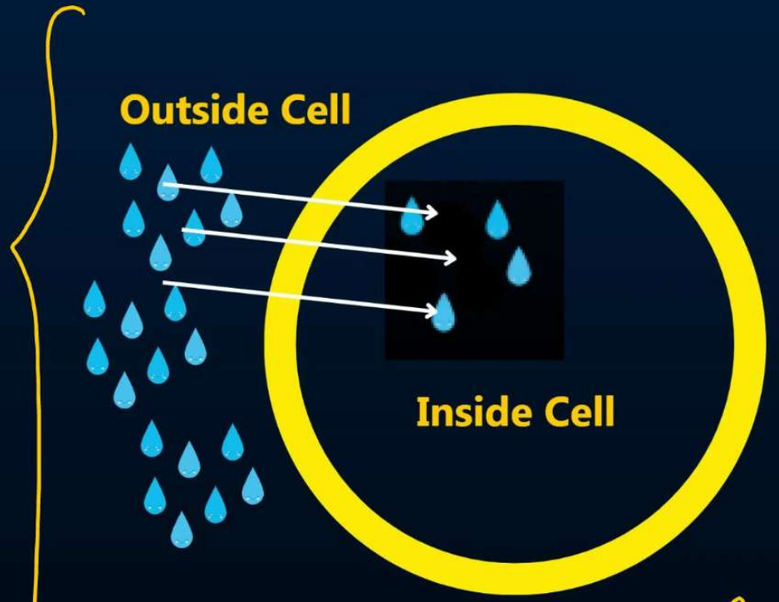
- Water molecules H_2O move within cell from Higher to Lower Concentration through diffusion



- Oxygen molecules O_2 move within cell from Higher to Lower Concentration through diffusion



- Water molecules H_2O move through plasma membrane of cell from Higher to Lower Concentration



→ water Special Diffusion

→ membrane Cross / selective

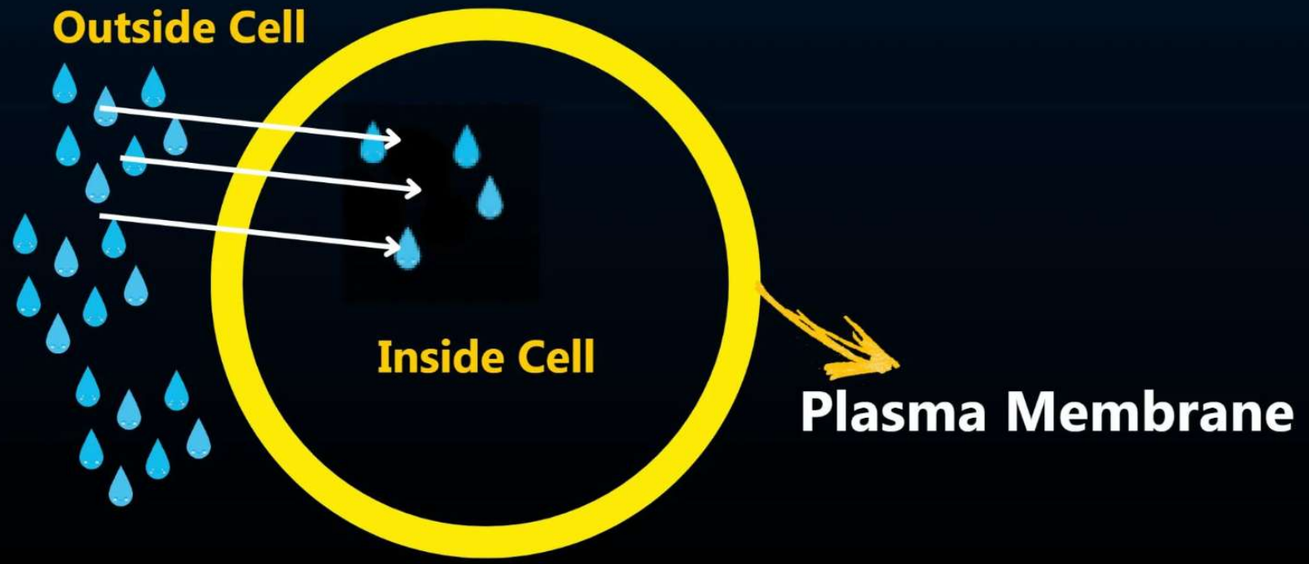
Passive transport

Osmosis

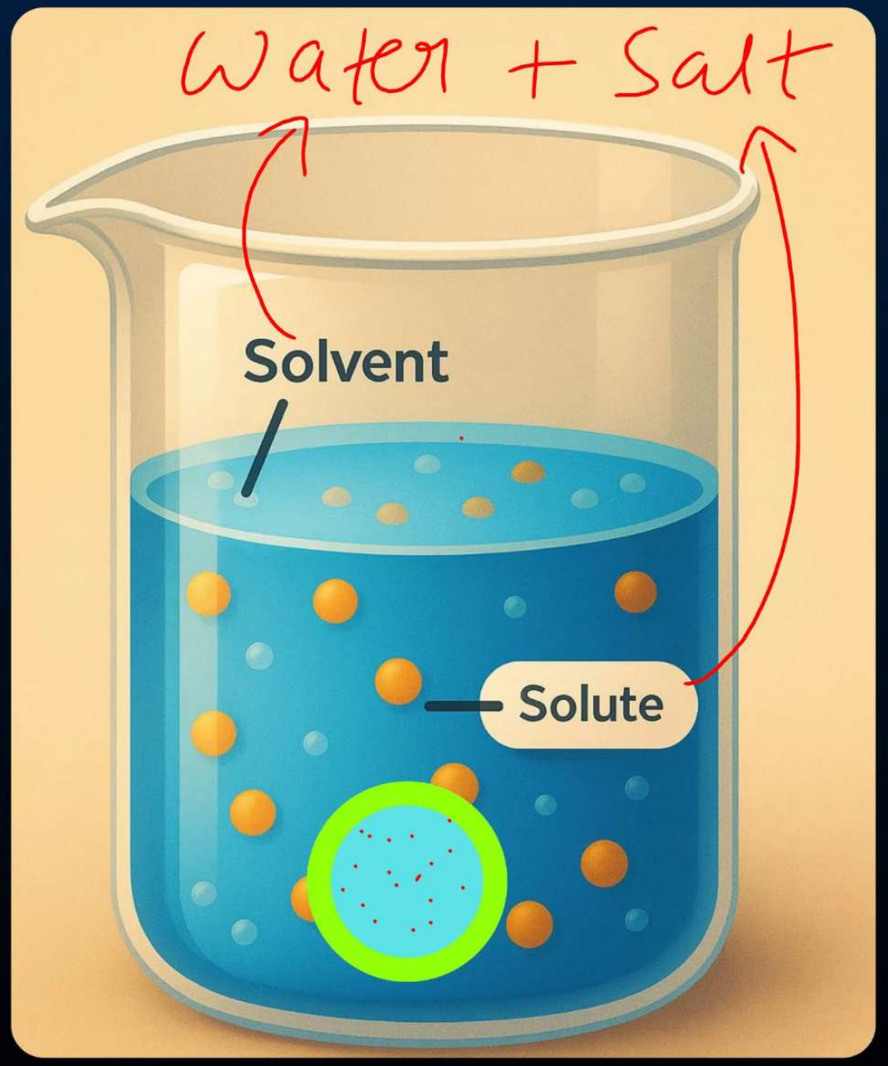
- Spontaneous movement of Solvent or Water molecules from a region of Highiger Concentration to Lower Concentration through a Selectively Permeable Membrane
- Osmosis is a special case of diffusion only , with two conditions -
  1) Movement is of Solvent or Water
  2) Selectively Permeable Membrane is involved

Example:

- Unicellular freshwater organisms gain water through osmosis.
- Absorption of water by plant roots.



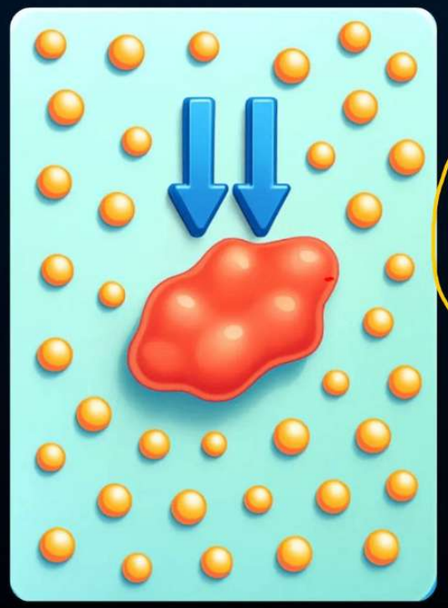
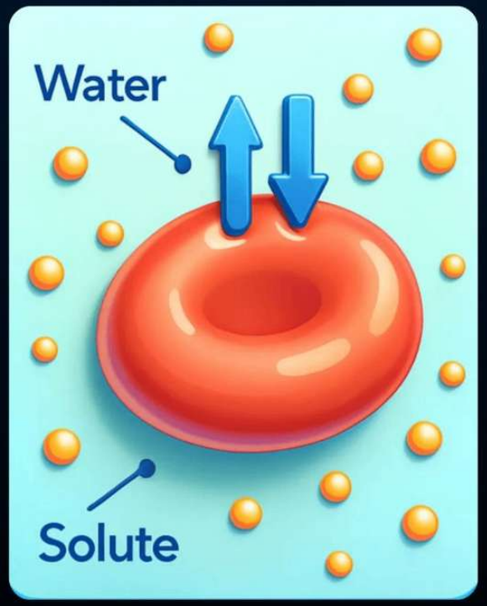
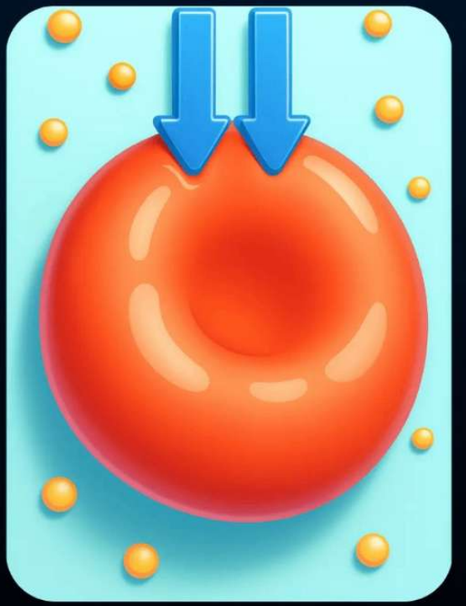
Cell is kept in Hyper / Hypo/ Iso tonic Solution



Hypertonic Solution Solute ↑↑

Hypotonic Solution Solute ↓↓

Isotonic Solution Solute =

Hypertonic Solution	Isotonic Solution	Hypotonic Solution
More Solute Outside	Equal Solute In and Out	Less Solute Outside
Less Water Outside	Equal Water In and Out	More Water Outside
Water moves Inside to Outside	No Net Movement of Water	Water moves Outside to Inside
Cell Shrinks	Remains Same	Cell Swells
 Shrunken cell	 Normal cell	 Swollen cell

Hippo
Hypo
Mota
Swell

Diffusion	Osmosis
Movement of substances from their region of Higher Concentration to lower concentration	Movement of solvent or water molecules from their region of Higher Concentration to lower concentration through a semi permeable membrane
Occurs in solids , liquids and gases.	Occurs only in liquids.
No membrane is needed.	Needs a semi-permeable membrane.
It's a natural process and can't be controlled or stopped.	It can be controlled and reversed

Q5 - How do gases moves across plasma membrane?

Q6 - How does water molecules moves across plasma membrane?

Active transport

Endocytosis & Exocytosis

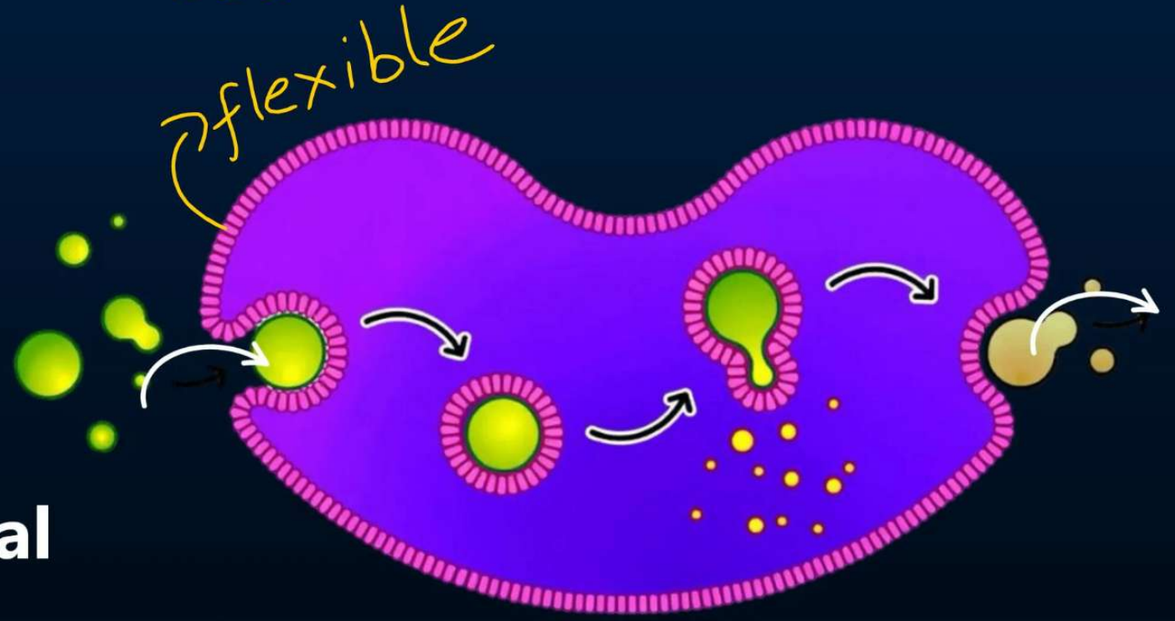
in

out

- The cell engulfs in food and other substances from its external environment called **Endocytosis.**

- The cell expells waste materials or undigested food particles to external environment called **Excocytosis**

- Occurs in **Amoeba**

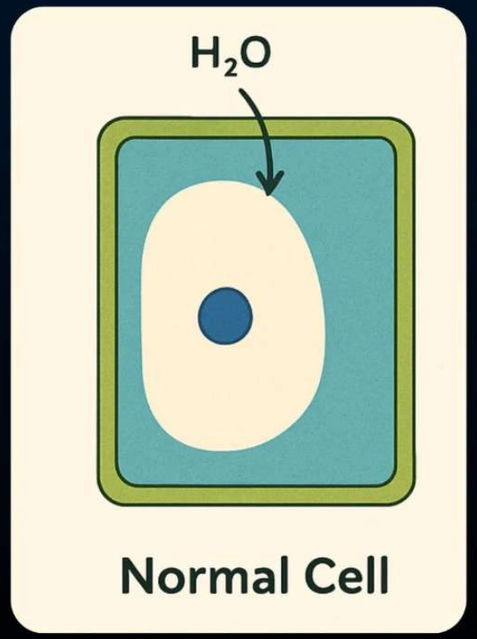


Protoplasm - Living contents of cell. Does not include Cell Wall.

Plasmolysis

In a Hypertonic Solution, the protoplasm of a living plant cell shrinks away from the cell wall. This is called plasmolysis.

Plant cell

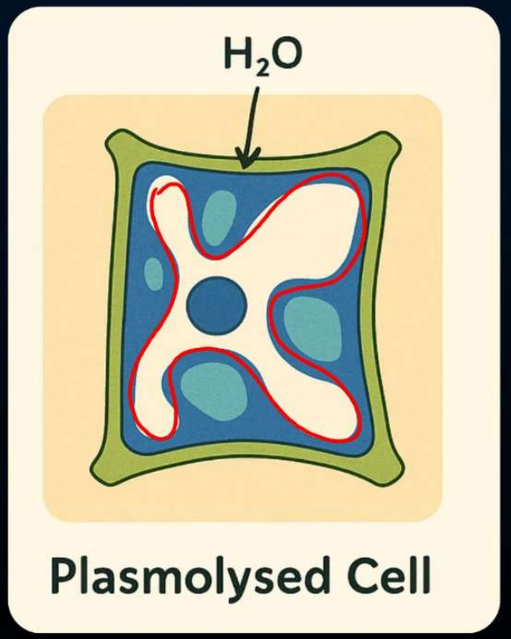


Hypertonic solution

cell loses water

cell shrinks

Protoplasm



- In a Hypertonic solution - living plant cells show plasmolysis

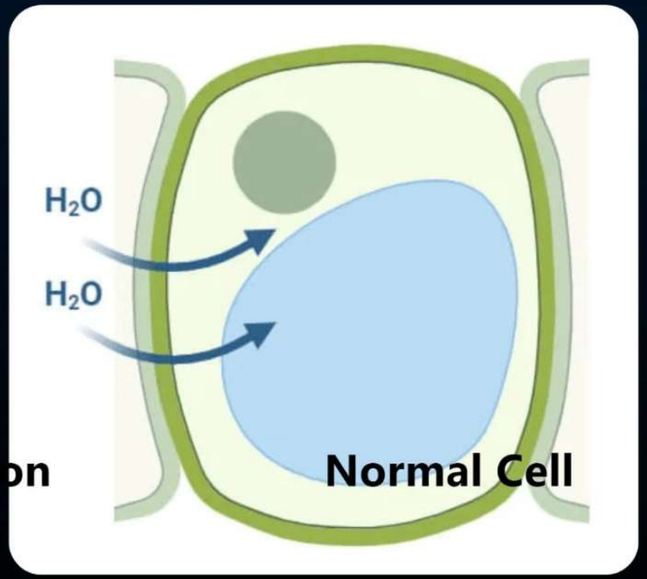
Note - Dead plant cells do not show plasmolysis

Dead Plant Cell
↳ Osmosis X

- In a Hypotonic solution - Protoplasm starts swelling and puts pressure on cell wall. The cell wall puts equal pressure on Protoplasm and prevents bursting of cells of plants.

→ ink

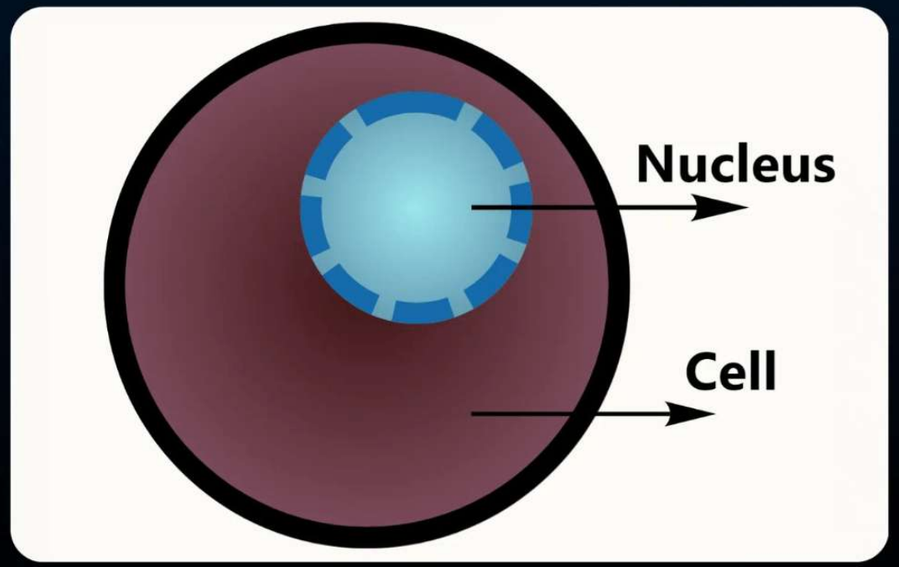
Bail
Dead
Osmosis X

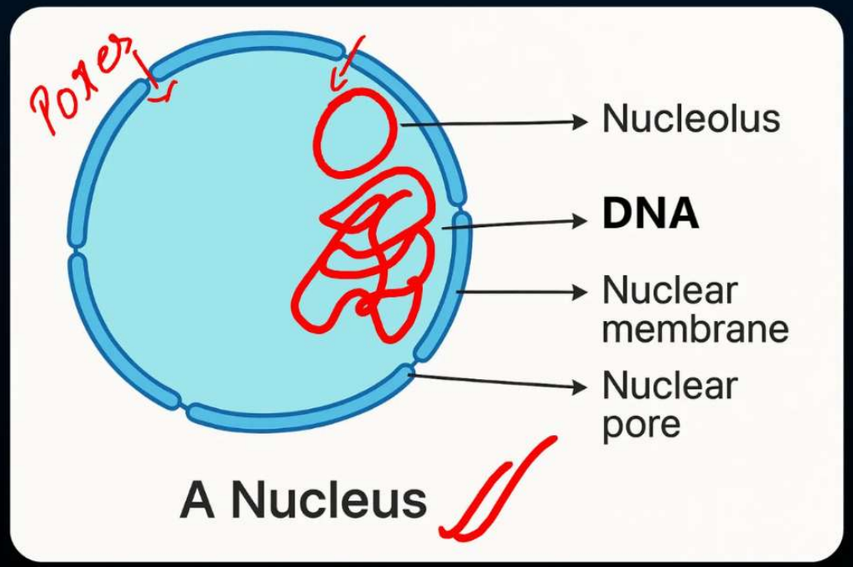


Nucleus

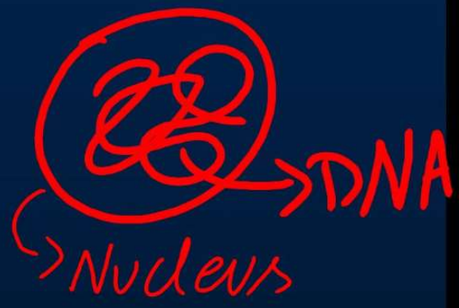
3-D Cell

- Control center of the cell
- Double membrane called nuclear envelope
- Nuclear membrane has pores
  → Allows movement of particles from inside to cytoplasm & vice-versa
- Contains Genetic Material - DNA





DNA – Deoxyribonucleic acid



- Thread-like structure present in nucleus
- Contains information about our characters → All
- Inherits/gives genetic information from one generation to another

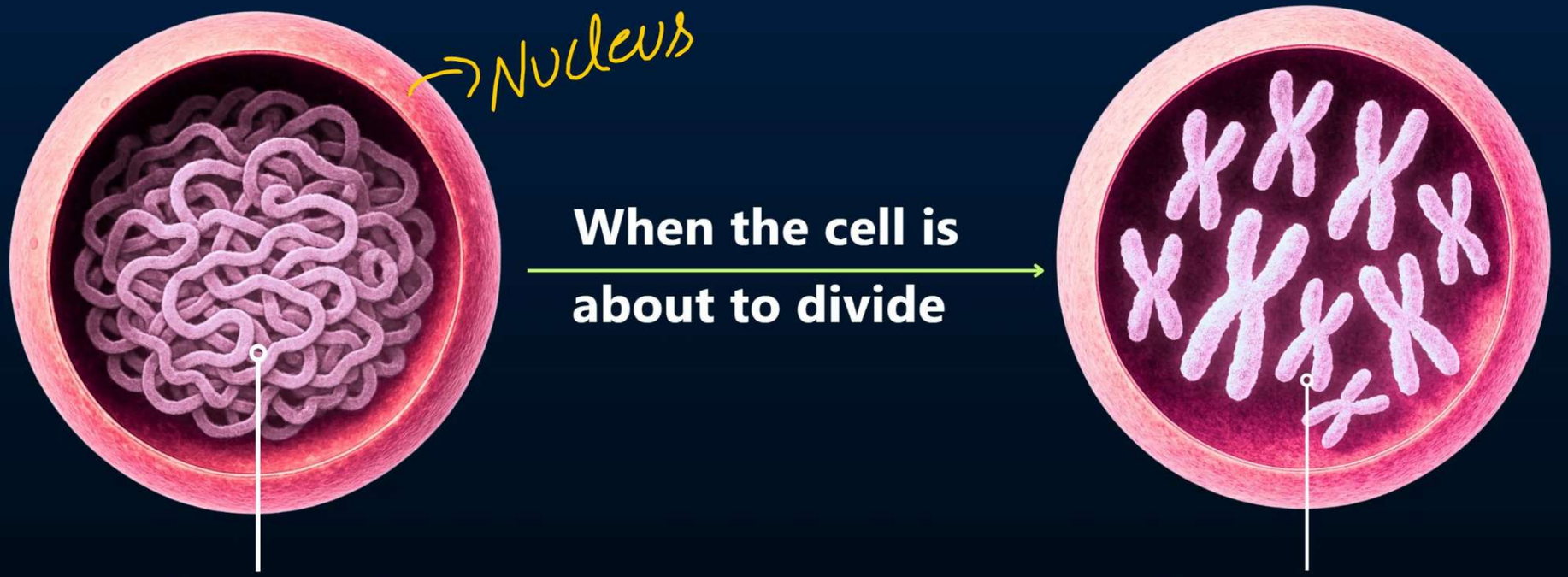
Gene

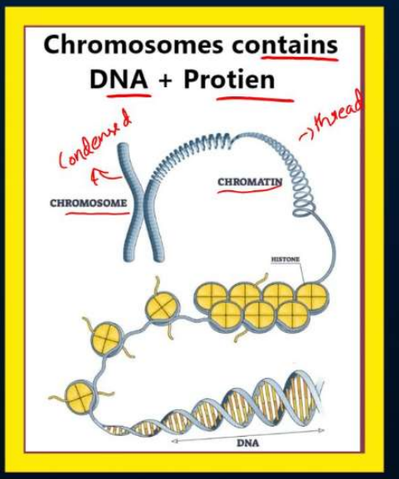
- Gene is a specific segment of DNA that contains the code for a particular character, such as eye color , skin colour , shape of nose or hair type, etc.

Skin Colour

Eye colour

Chromatin & Chromosomes



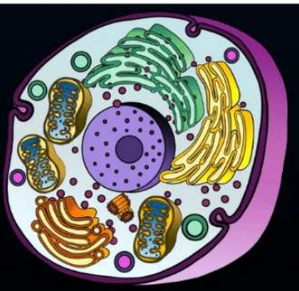


Chromatin

Scattered form of DNA in Nucleus
(Thread like structures)

Chromosomes

Highly condensed and Coiled form
of DNA in Nucleus
(Rod shaped structures)

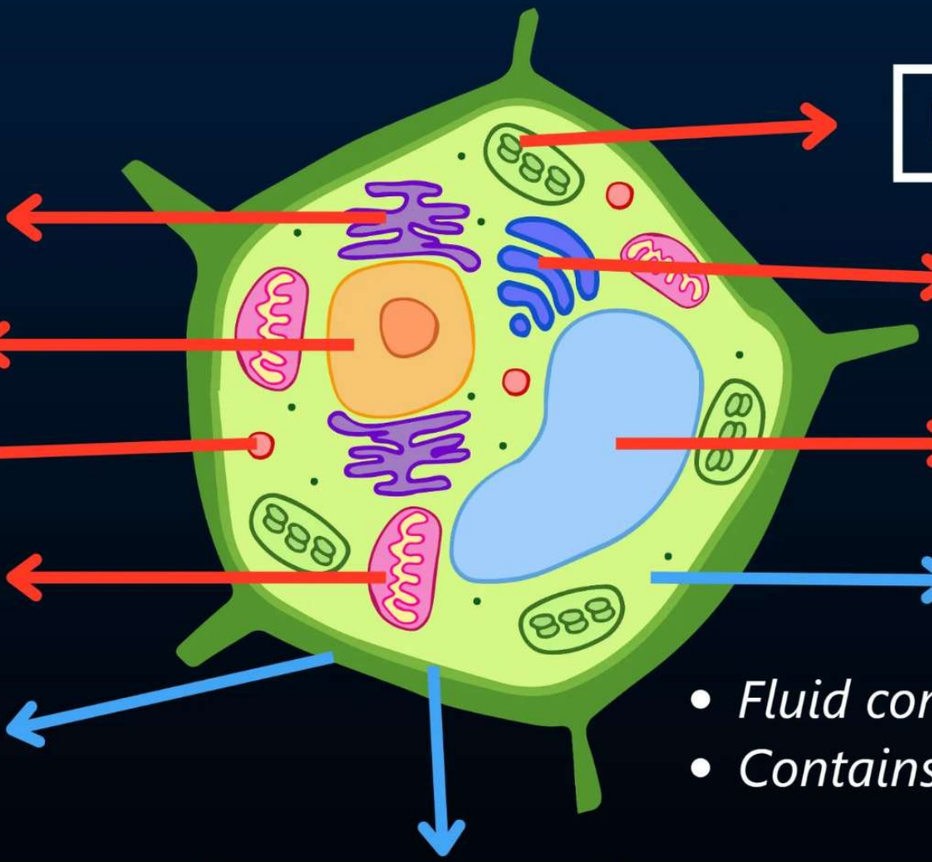
Prokaryotic Cell	Eukaryotic Cell
Nuclear region is not well definded , and it is known as Nucleiod. imp Nucleus✗	Nuclear region well defined Nucleus✓
Do not have Nuclear Membrane	Have Nuclear Membrane
Membrane-bound cell organelles absent, Ribosomes present imp	Membrane-bound cell organelles present Ribosome present
Only one chromosome	More than one chromosome
Size is generally small (1–10 µm)	Size is generally large (5–100 µm)
Flagella is present to help in movement	No Flagella
Bacteria 	Plants, animals, fungi 

Q7 - Define a)Gene b)Chromosomes

Q8 - How is a prokaryotic cell different from eukaryotic cell?
Give one example of each type of cell

Cell Organelles

- **Organelles perform a specific function for the cell**
  Like we have organs for different functions , Cell has organelles



Endoplasmic Reticulum

Nucleus

Lysosomes

Mitochondria

Cell Wall

Plastids

Golgi Bodies

Vacuoles

Cytoplasm

- *Fluid content inside plasma membrane*
- *Contains many specialized cell organelles*

Plasma Membrane

Endoplasmic Reticulum (ER) ➡ *Protien and Lipid Syntheis*

- It is Large network of membrane-bound tubes and sheets
- Helps in transport of materials between nucleus and cytoplasm
- Formation of Plasma membrane - Lipids and Protiens

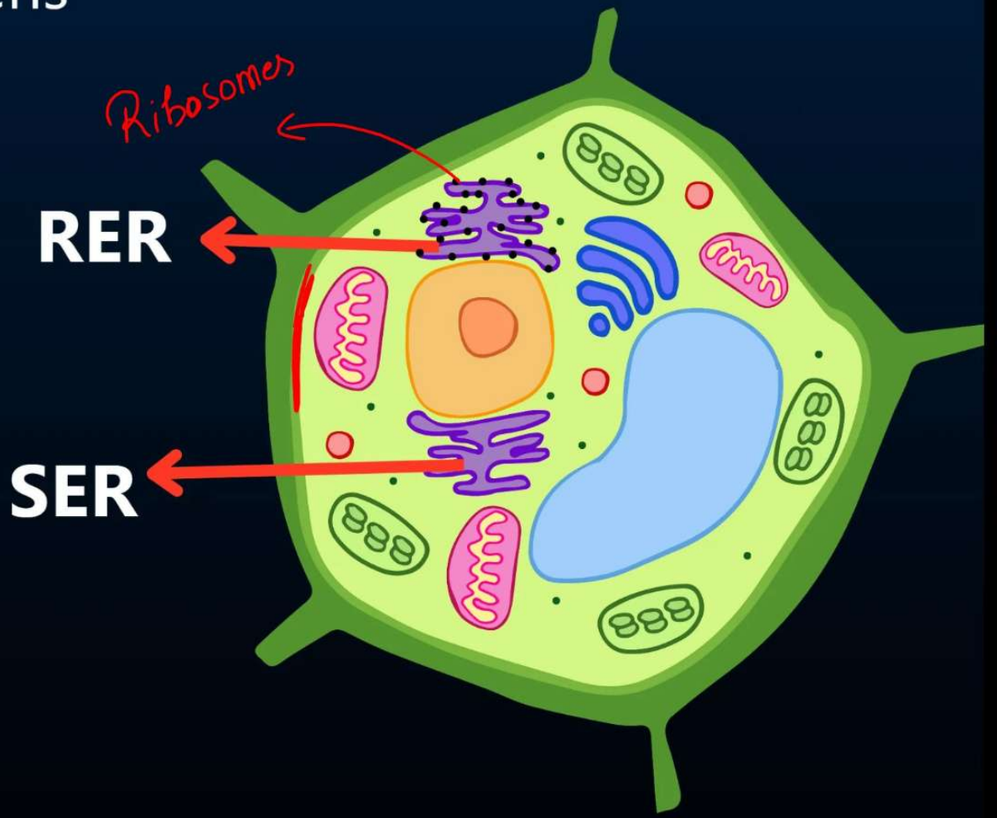
- **Two types of ER - RER & SER**

Rough Endoplasmic Reticulum (RER)

Ribosomes are attached to the surface

Smooth Endoplasmic Reticulum (SER)

Ribosomes are not attached to the surface



ER → Protiens + Lipids

RER SER imp

Rough Endoplasmic Reticulum (RER)	Smooth Endoplasmic Reticulum (SER)
Ribosomes attached to the surface of ER	Ribosomes not attached to the surface of ER
Appears rough under microscope	Appears Smooth under microscope
Protien synthesis (by ribosomes - Protien factories)	Lipids Synthesis
Enzyme synthesis (by protiens)	Harmones synthesis
No role in detoxification	Helps in detoxifyication in liver cells of vertebrates (Animals who have backbone)

Q9- Which of these options are not the functions of ribosomes?

I. It helps in manufacture of protein molecules.

II. It helps in manufacture of enzymes.

III. It helps in manufacture of hormones.

IV. It helps in manufacture of starch molecules.

(a) I and II

(b) I and III

(c) III and IV

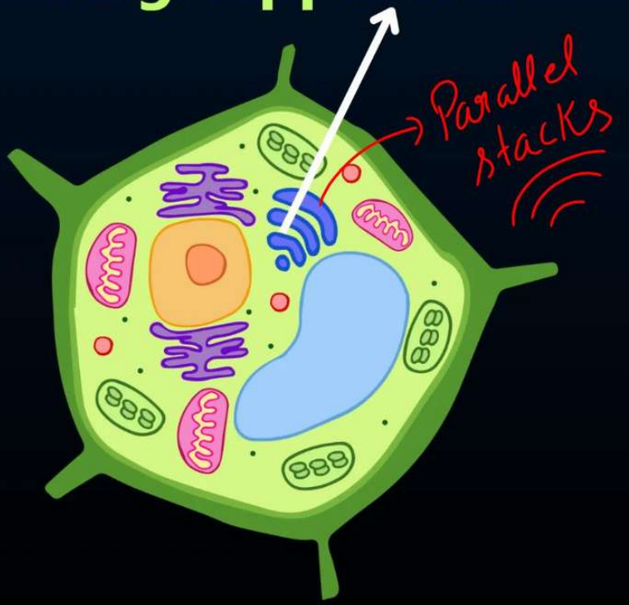
(d) IV and I

Golgi Bodies / Apparatus ➞ *Store,Modify,Pack*

- Membrane bound Vesicles arranged nearly parallel to each other in stacks known as **Cisterns** imp

Golgi Apparatus

- Functions
- **Storage**, **modification**, and **packaging** of products like protiens & lipids synthesised from ER → dispatched to various targets
- Involved in formation of lysosomes imp



Q11- Q. What would happen to the life of a cell if there was no Golgi apparatus?

Answer:
If there were no Golgi apparatus in a cell, the following problems would occur:

1. No proper packaging and transport of proteins and lipids: essential materials would not reach their proper destinations inside or outside the cell.

2. No formation of lysosomes: The Golgi apparatus is responsible for forming lysosomes. Without lysosomes, the cell cannot digest waste materials or worn-out organelles, leading to collection of waste.

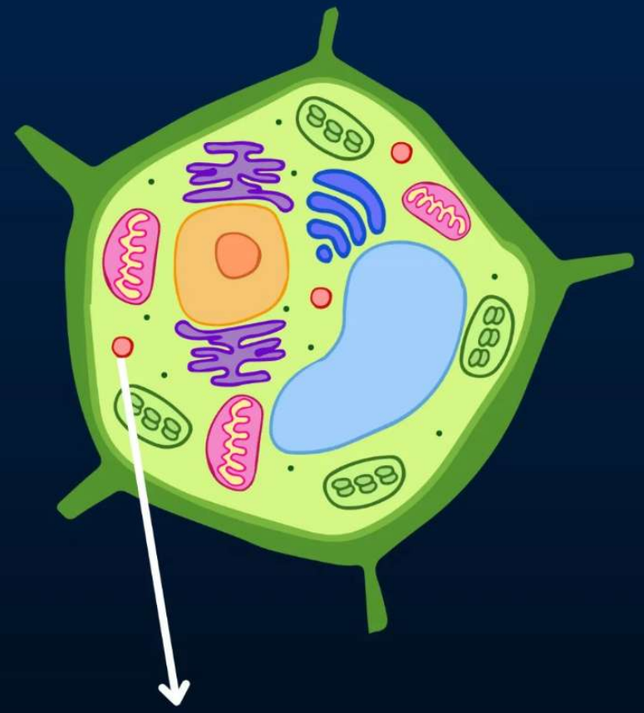
Overall cell function would be disturbed, and the cell might not survive for long.

Lysosomes ➞ *Waste Disposal*

- Sacs filled with **powerful digestive enzymes** ,acts as **Waste disposal system of cell**

- Help in cleaning the cell by digesting foreign material (bacteria) as well as damaged organelles

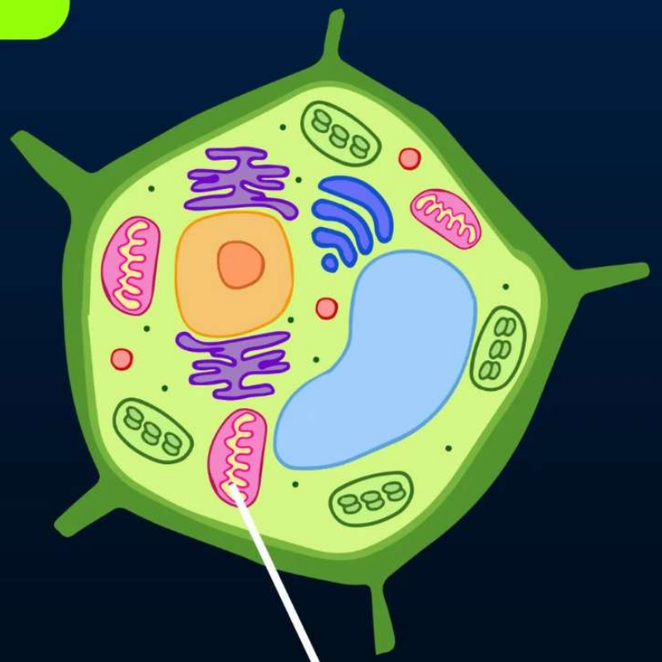
- Known as **suicide bags**
  During cellular disturbances-the cell gets damaged, the lysosomes may burst & digest their own cell

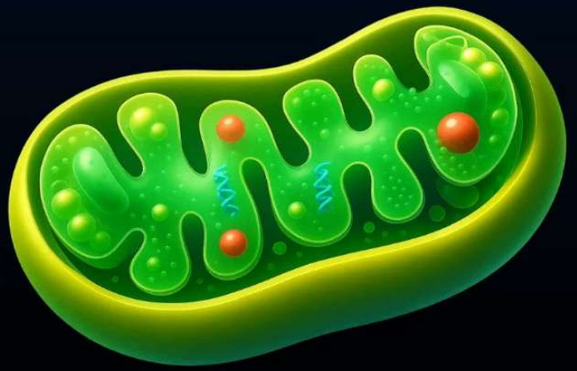


Lysosomes

Mitochondria ➟ *"Powerhouse of the cell"*

- Outer membrane: porous — Pores
- Inner membrane: deeply folded
  Increases Surface area for ATP generation
- **Energy is released by Mitochondria in the form of ATP molecule (Adenosine Triphosphate).**
- **ATP:** energy currency of cell





Mitochondria also have their own DNA and ribosomes.

Plastids ➞ *"Present only in plants."*

Chromoplasts- Colored Plastids

Flower

1

Chromoplast

Chloroplast - Chromoplasts containing pigment chlorophyll. It is required for photosynthesis. Responsible for green colour

2

Chloroplast

Leucoplasts- White colorless plastids
Store starch, oil, and protein granules.

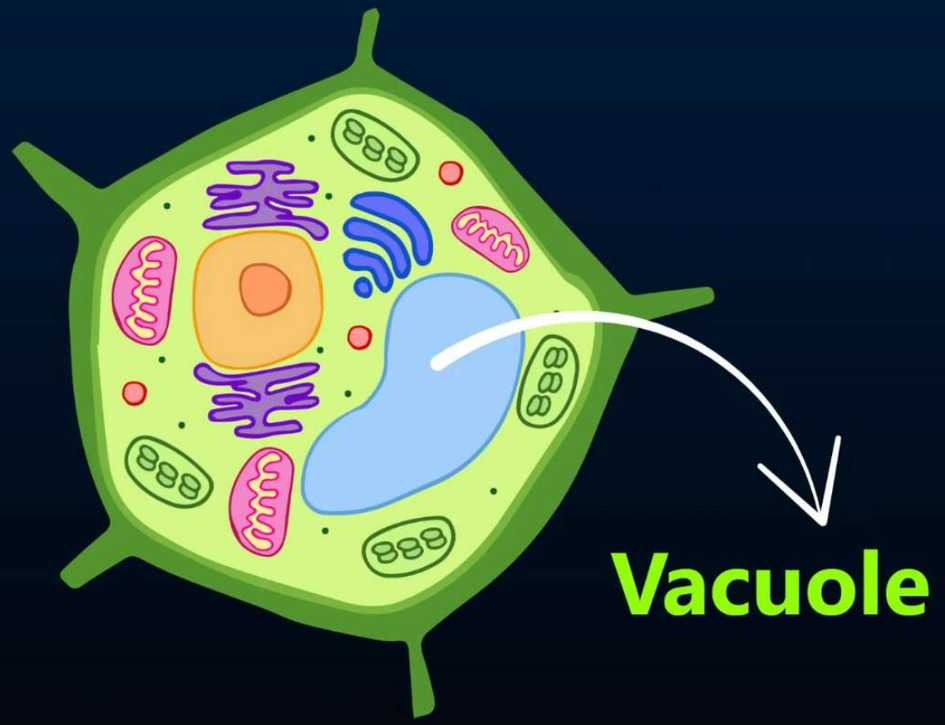
3

Leucoplast

Plastids also have their own DNA and ribosomes.

Vacuoles ➞ *Turgidity , Rigidity , Storage Sac*

- **Storage sac**
- **Large in plants , Small in Animals**



Plants

- May occupy 50-90% of volume
- Provide **turgidity** & **rigidity** to cell
- Stores amino acids, sugars, organic acids, proteins. ***(SOAP)***

Amoeba - Unicellular

- Food vacuole contains food items that amoeba consumes. Expells Waste

Membranes Ka Khel

- Nucleus
- Mitochondria
- Plastids

} Have DNA → Double Membrane

- Endoplasmic Reticulum
- Golgi Apparatus
- Lysosomes
- Vacuoles

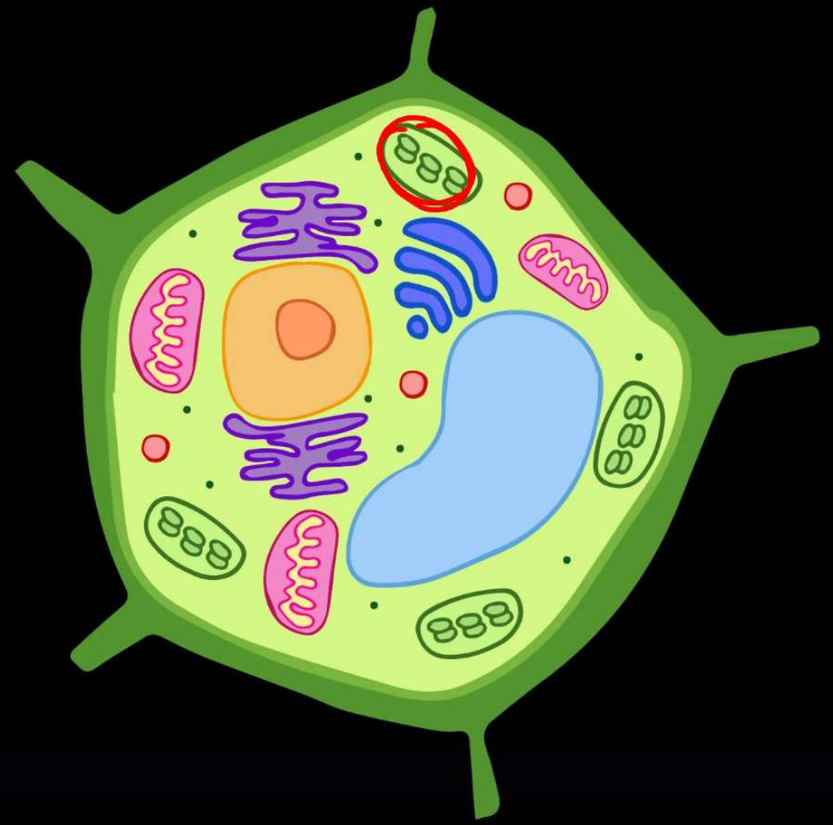
} No DNA → Single Membrane

Ribosomes → No membrane , protien factory , RER
(Only organelle present in prokaryotic & Eukaryotic Cell)

Plant Cell

- Cell wall present
- Plastids present
- Large central vacuole present
- Centrioles absent

imp

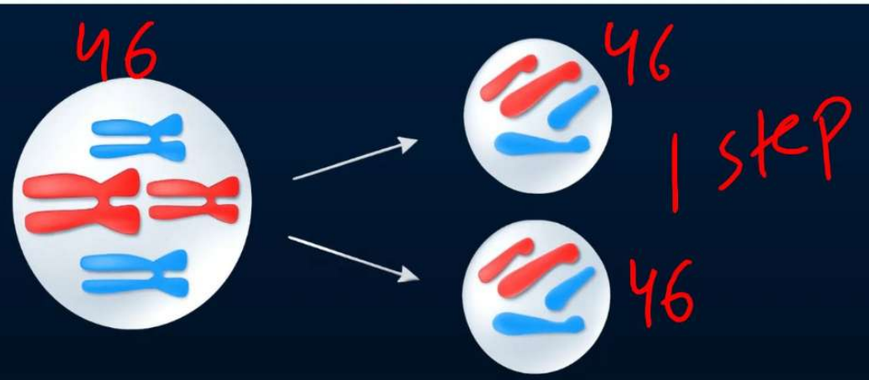
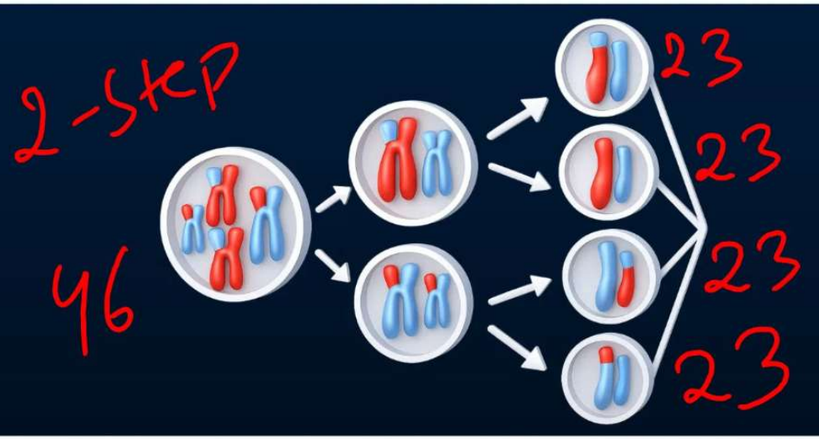


Animal Cell

- Cell wall absent
- Plastids absent
- Large central vacuole absent
- Centrioles present

Cell Division

Process by which new cells are made – Cell Division

Mitosis	Meiosis
	
Produces 2 new daughter cells	Produces 4 new daughter cells
Daughter cell has the same number of chromosomes as the mother cell	Daughter cells have half the number of chromosomes as mother cells
Equational division Equal	Reductional division
Helps in growth and repair of tissues	Required for production of gametes