The Fundamental unit of life

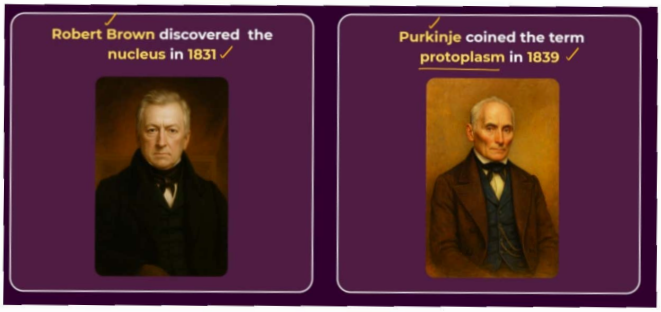
What is a Cell?

A Cell is the fundamental structural and functional unit of life.

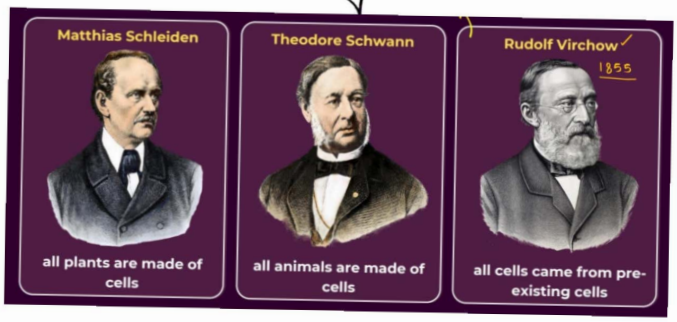
Structural Organisation Of Living -

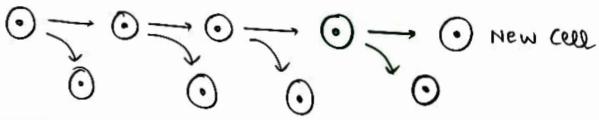
Cell → Tissue → Organ → Organ system → Organism

Discoveries related to Cell:



Cell Theory -





Organism Show Variety in Cell Numbers, Shape and Size:

Cell Number -

Classification of organism based on cell composition.

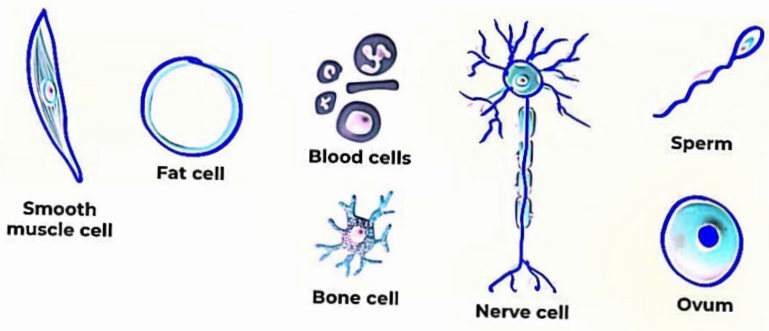
Unicellular Organisms

Organisms made up of only one cell E.g., Bacteria, Chlamydomonas and Paramecium

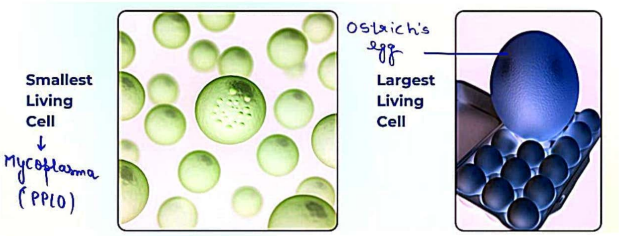
Multicellular Organism

Organisms made up of more than one cells E.g., Plants & Animals.

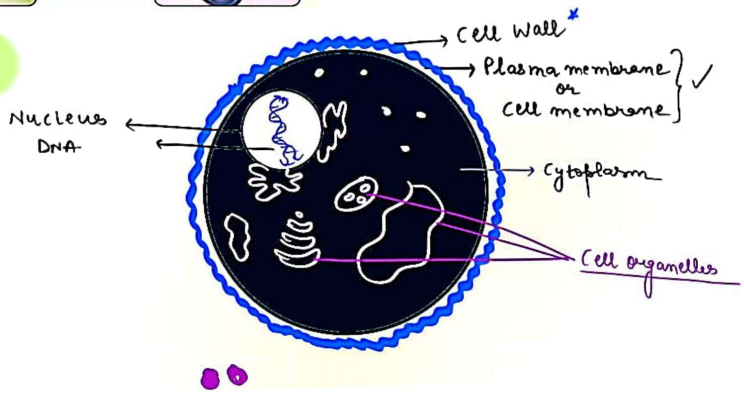
Cell Shape -



cell size :



Basic Structure of Cell



What is a cell made up of?

What is the Structural Organisation of a Cell?

Cell Components

Plasma Membrane / Cell Membrane
- Outermost covering of cell
- Permits the entry and exist of some material (Selectively Permeable)

Cell Wall
- Rigid outer covering lying outside the Plasma Membrane
- Present in Plants only.

Nucleus
- Has double Layered nuclear Membrane having nuclear Pores for transfer of Material and chromosomes.

Cytoplasm
- Fluid content inside the Plasma Membrane and outside the nucleus

Cell Organelles.
- These are specialised Membrane bound Parts of cell Present in Cytoplasm

Cell Wall and its Composition :

- Non-living (dead) and rigid.
- Forms outer covering of Plasma Membrane.
- Provides shape to Cell.

Plants → Present → Cellulose
Bacteria → Present → Peptidoglycan
Fungi → Present → Chitin
Animals → Absent → ✗
Virus → Absent → ✗

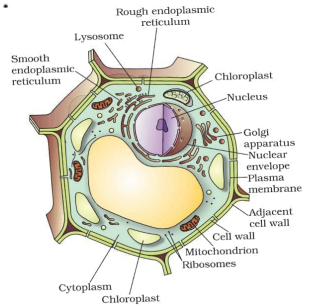


Fig. 5.6: Plant cell

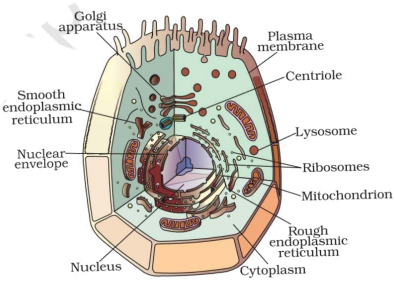
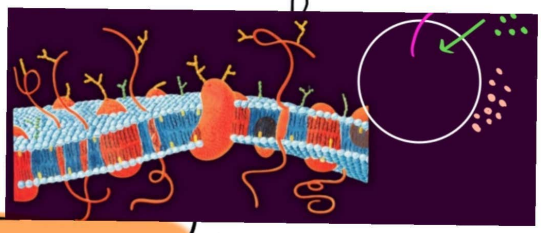


Fig. 5.5: Animal cell

Plasma Membrane / Cell Membrane:

- The Plasma Membrane is a flexible and is made up of lipids [Phospholipid] and Proteins.
- In 1972, Singer and Nicolson
- The Plasma Membrane is a Selectively Permeable Membrane
- The Plasma Membrane allows or permits the entry and exit of some materials in and out of the cell



Passive and Active Transport:

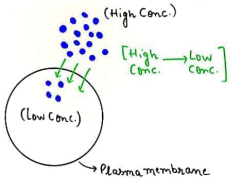
Passive Transport

Substances move from their higher to lower concentration.

No energy is required

It is a slow movement

Only small molecules or water molecules are transported passively



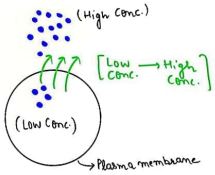
Active Transport

Substances move from their lower to higher concentration

It requires energy in the form of ATP molecules.

It is a rapid movement.

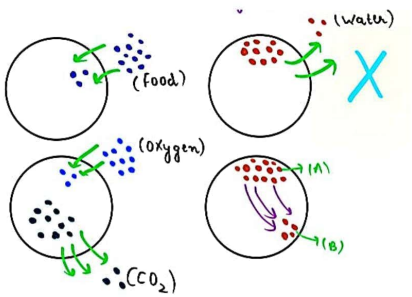
Movement of Large molecules occur by active transport.



Passive Transport: High conc ⟶ Low conc.

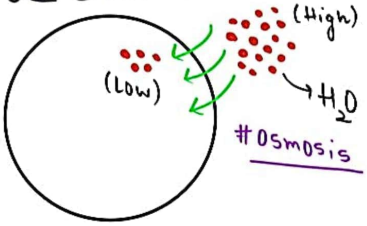
Diffusion

- It is the spontaneous movement of substances (solid, liquid and gases) from a region of high concentration to low concentration.
- Substances like CO_2 & O_2 can move membrane by diffusion.



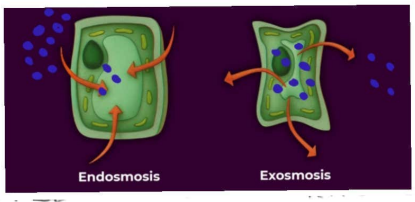
Osmosis

- Osmosis is defined as the Spontaneous movement of solvent or Water molecules from the regi of higher concentration to a region of lower concentration. through a Selectively Permeable Membrane.
- It could be endosmosis or exosmosi

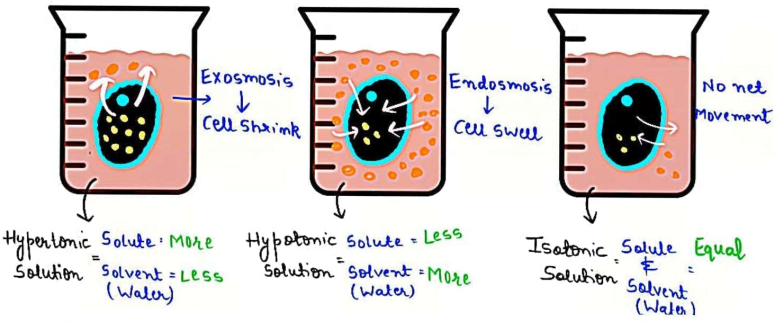


#Movement of Water / Solvent ✓
#High Conc. ⟶ Low Conc. ✓
#Water "Must" cross P.M

- **Endosmosis** : Endosmosis is the movement of solvent into the cell
- **Exosmosis** : Exosmosis is the movement of solvent outside the cell.



Hypertonic, Hypotonic and Isotonic Solution :



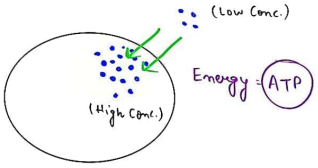
Hype**R**tonic ⟶ Sh**R**imk

Hyp**O**tonic ⟶ Swell

= gola-Mola

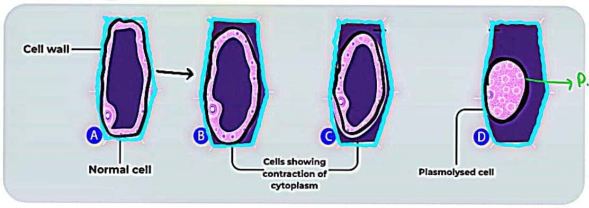
Active Transport :

- The Movement of materials is from their lower to higher concentration.
- Energy is required.



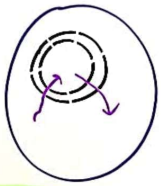
Plasmolysis :

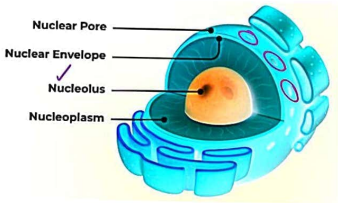
- Shrinkage of Protoplasm (Living content of the cell) away from the cell wall when, placed in a hypertonic solution.
- Observed only in Plants.



Nucleus :

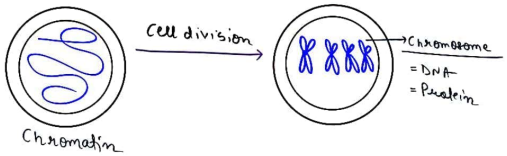
- Controlling Centre of the cell.
- Double Membraned nuclear envelope with Pores.
- Contains DNA.





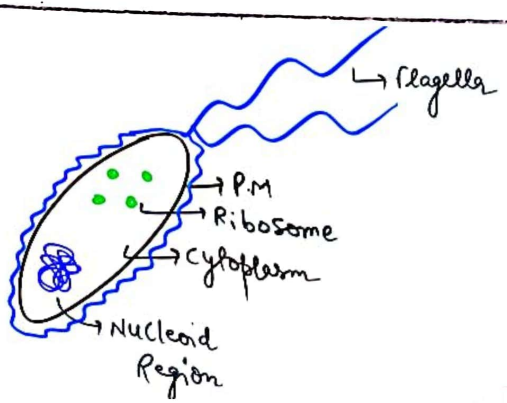
Chromatin & Chromosome :

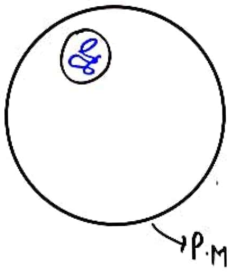
- **Chromatin** – Scattered form of DNA dispersed throughout nucleus.
- **Chromosome** – Highly coiled and condensed form of DNA and are visible only during cell division.



Types of Cell on the basis of Nucleus:

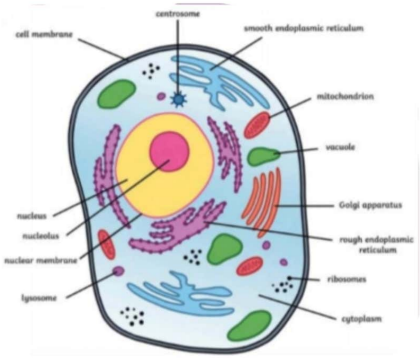
Prokaryotic Cell	Eukaryotic Cell
Prokaryotic cells are generally small in size (1-10 μm).	Eukaryotic cells are comparatively larger in size (5-100 μm)
The nuclear material is undefined having no nuclear Membrane and is called nucleoid	A True nucleus having a nuclear membrane is Present.
A Single chromosome is Present.	More than one chromosome is Present.
It does not contain membrane-bound cell Organelles	It contains membrane-bound cell organelle like Mitochondria, Plastids etc.





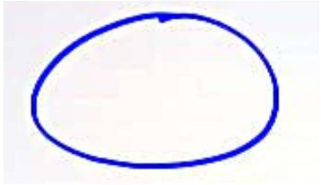
Cell Organelles:

- Cell organelles mean little components or organized structures within a cell.
- Cell organelles have unique characteristic shapes & fuctions



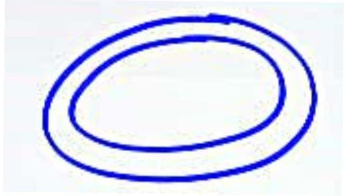
Single Membrane

- Vacuole
- Lysosome
- Golgi Apparatus
- Endoplasmic reticulum



Double Membrane

- Nucleus
- Mitochondria
- Plastids



Membrane-less

- Ribosome
- Centrosome (centriole)

Cell Organelles

Endoplasmic Reticulum (ER)

- A network of interconnecting membranous tube like structures.
- Gives mechanical support to the cell.
- It is an intracellular transport system for various substances.

Golgi Apparatus

- Membranous flattened sacs (cisterns), tubules, vesicles and large vacuoles.
- Secretory cell organelle and transports substances.
- Synthesises cell wall, Plasma membrane & Peroxisomes along with various substances.

Vacuoles

- Sap filled vesicles bound with single membrane.
- Stores water, minerals and reserve foods.
- Maintains turgidity of cell.

Lysosomes

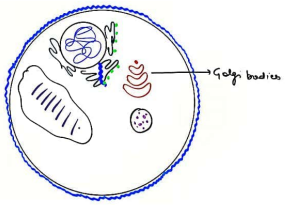
- Tiny spherical sac-like structures.
- Also called suicidal bags or digestive bags.
- Digest dead or damaged cells and organic substances.

Mitochondria

- A double walled structure; inner membrane folds over many times (Cristae)
- Also called Powerhouse of the cell.
- Oxidise food to release energy in form of ATP.

Plastids

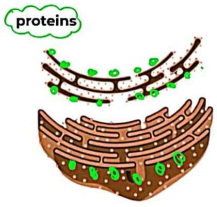
- Largest cytoplasmic double membrane structure found mostly in Plant cell



Endoplasmic Reticulum:

Rough Endoplasmic Reticulum

- Has ribosomes attached to outer surface which synthesise Protein

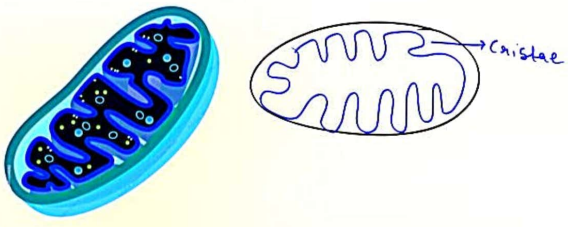


Smooth Endoplasmic Reticulum

- Has smooth surface, devoid of ribosomes and synthesise lipids.

Mitochondria:

- Double Membranous.
- Inner Membrane show deep infoldings called 'Cristae'
- Mitochondria is site of aerobic respiration. Called Power House of the cell
- DNA molecules, few RNA molecules and ribosomes Present.



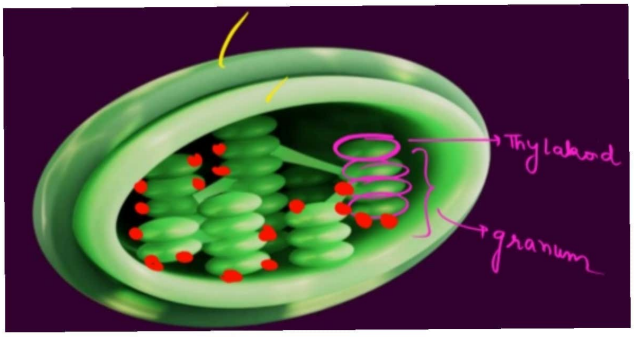
Plastids

Chromoplast
- Coloured plastids (in flowers).

Leucoplast
- Colourless plastids, synthesise and store food.

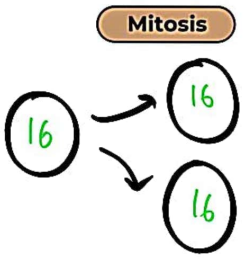
Chloroplast
- Plastids containing chlorophyll pigment.
- Photosynthesis takes place in chloroplasts.

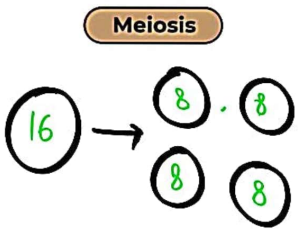
Chloroplast:
- These are green coloured plastid.
- Chloroplast is involved in Photosynthesis thereby help in synthesis of food.
- Imparts green colour to various parts of the plants
- Maintains O_2 concentration in atmosphere.
- DNA molecules, few RNA molecules and ribosomes are present.

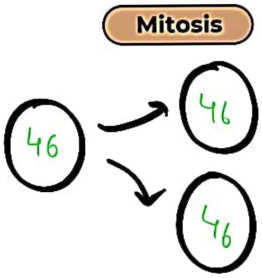


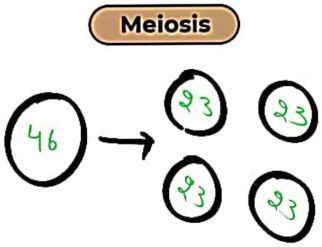
Ribosomes:
- Membrane less cell organelles
- Involved in the Synthesis of Proteins.
- Present in both Prokaryotic and Eukaryotic cell

Cell Division:
- The Process by which new cells are made is called cell division.









Mitosis	Meiosis
• It is an equational division.	• It is reductional division.
• Two daughter cells are formed	• Four daughter cells are formed.
• Daughter cells have same number of chromosomes as the Parent cell	• Daughter cells have half the number of chromosome as the Parent cell.
It helps in growth and repair of injured tissues.	It is responsible for production of gametes.