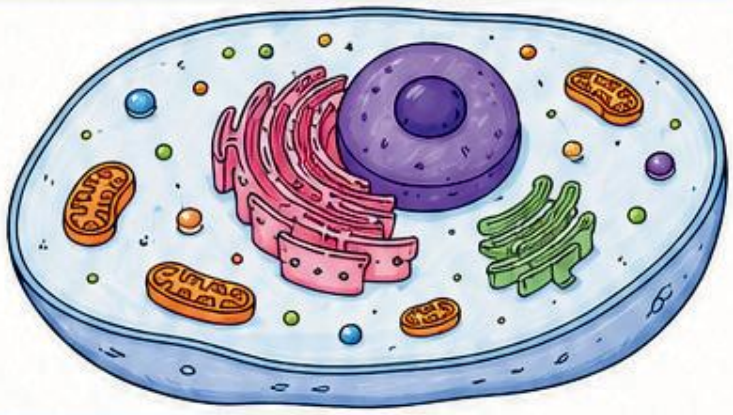
# CELL – THE BASIC UNIT OF LIFE

## Definition

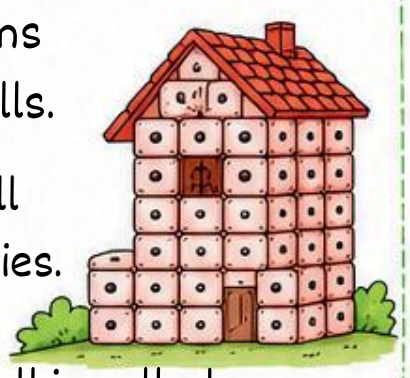
A cell is the smallest structural and functional unit of life capable of performing all life processes.



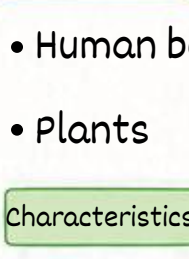
## IMPORTANT POINTS

### 1. Cell is the Building Block of Life

- All living organisms are made up of cells.
- A cell performs all essential life activities.
- Therefore, the cell is called the basic unit of life.



### 2. Levels of Organization



Cell → Tissue → Organ → Organ System → Organism

**Example:**

Cells → Muscle Tissue → Heart → Circulatory System → Human Body

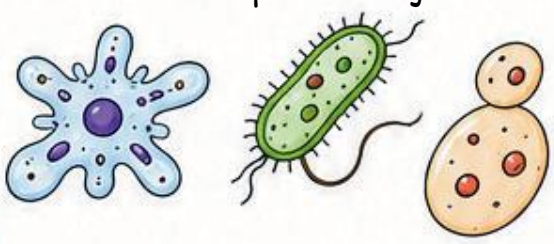
### 3. Types of Organisms Based on Number of Cells

#### Unicellular Organisms

Organisms made up of a single cell.

**Examples:**

- Amoeba
- Bacteria
- Yeast



**Characteristics:**

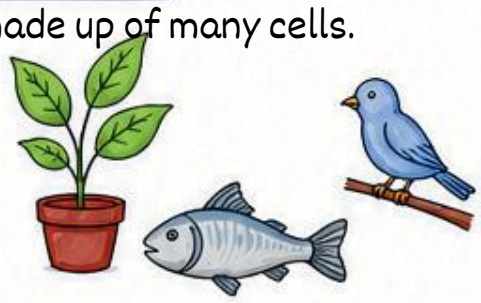
- One cell performs all life functions.

#### Multicellular Organisms

- organisms made up of many cells.

**Examples:**

- Human beings
- Plants
- Fish
- Birds

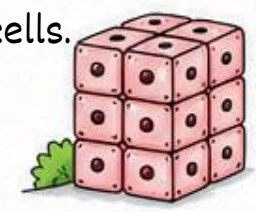


**Characteristics:**

- Different cells perform specialized functions.

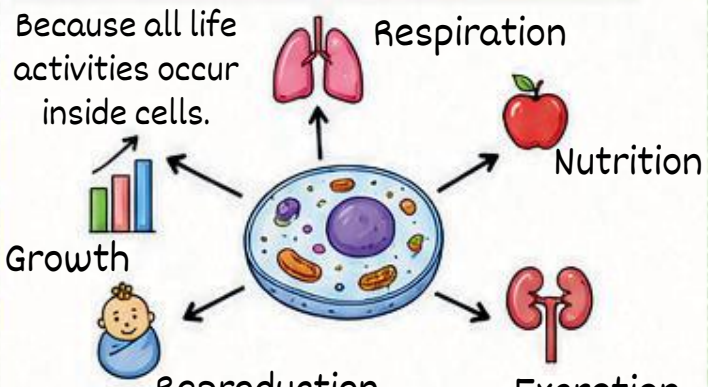
### WHY IS CELL CALLED THE STRUCTURAL UNIT?

Because every living organism is made up of cells.



### WHY IS CELL CALLED THE FUNCTIONAL UNIT?

Because all life activities occur inside cells.

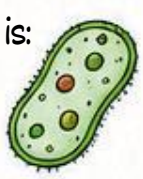



### DIAGRAM TO DRAW

Cell → Tissue → Organ → Organ System → Organism

## MCQ's

**Q1** The basic structural and functional unit of life is:



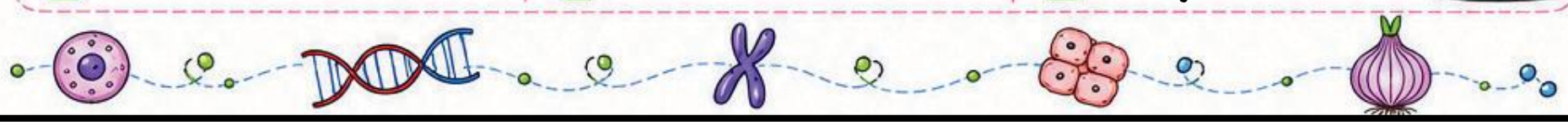
- A. Tissue
- B. Organ
- ✓ C. Cell
- D. Organism

**Q2** Amoeba is:

- A. Multicellular
- ✓ B. Unicellular
- C. Acellular
- D. Colonial

**Q3** A group of similar cells performing a similar function forms:

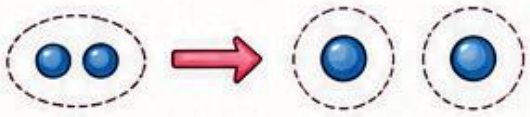
- A. Organ
- B. Organ System
- ✓ C. Tissue
- D. Organism



# HOW DO WE STUDY CELLS?

## Definition of Resolution

Resolution is the ability to distinguish two closely placed objects as separate.



## Limit of Resolution of Human Eye

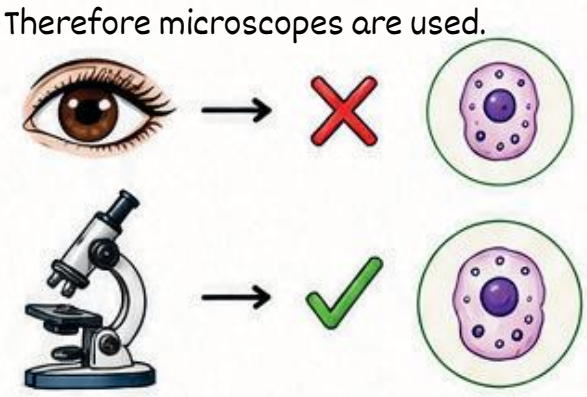
Human eye can distinguish objects separated by approximately:

**0.1 mm**

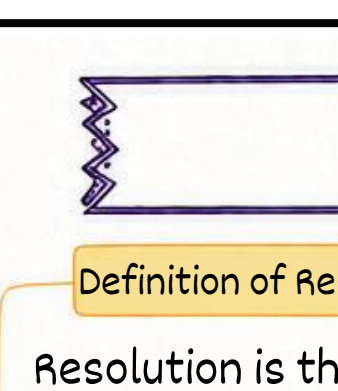
Anything smaller cannot be seen clearly.

## Why are Microscopes Needed?

Most cells are smaller than 0.1 mm and cannot be seen with naked eyes. Therefore microscopes are used.



## ROBERT HOOKE



### Important Fact

- First observed cells in 1665.
- Observed cork under a microscope.
- Named the tiny compartments "Cells".

## Formula

### Total Magnification

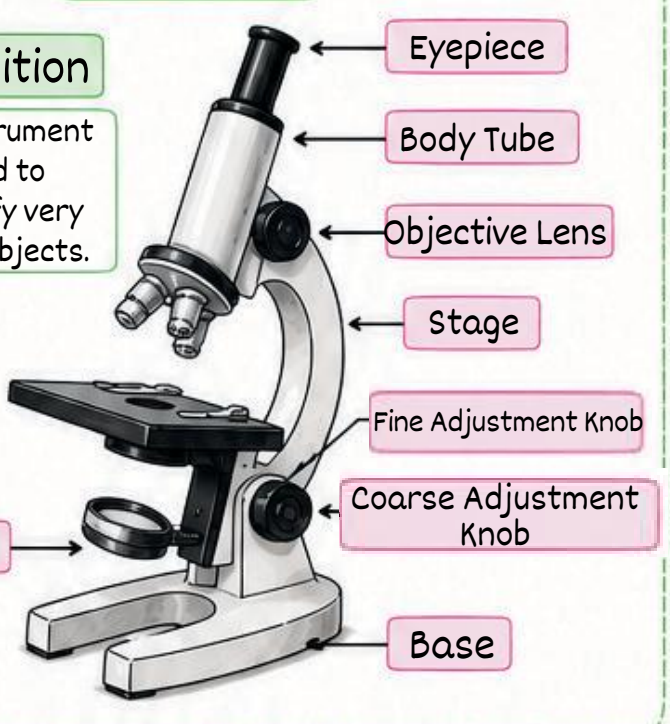
Total Magnification = Eyepiece Magnification × Objective Magnification

Example 10X × 10X = 100X

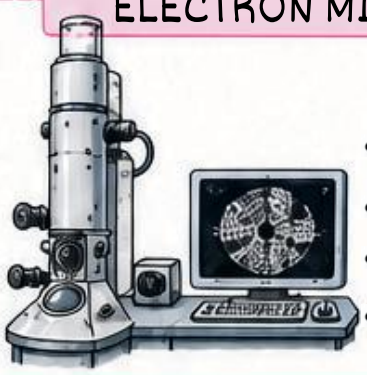
## MICROSCOPE

### Definition

An instrument used to magnify very small objects.

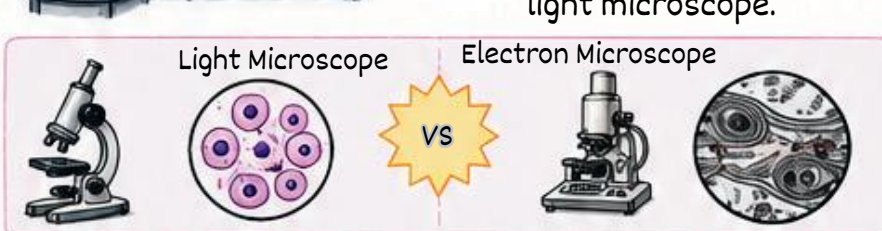



## ELECTRON MICROSCOPE



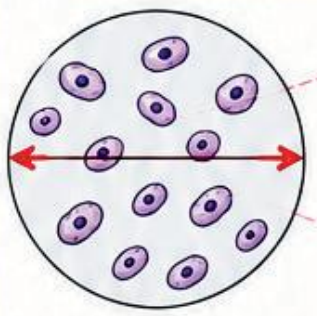
### Features

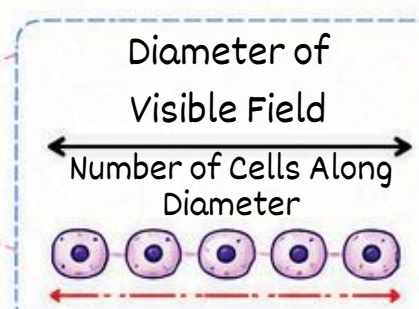
- Uses electrons instead of light.
- Gives very high magnification.
- Can observe organelles clearly.
- Resolution is much higher than a light microscope.




## FORMULA FOR CELL SIZE

$$\text{Estimated Cell Size} = \frac{\text{Diameter of Visible Field}}{\text{Number of Cells Along Diameter}}$$






**Q1** Who discovered cells?

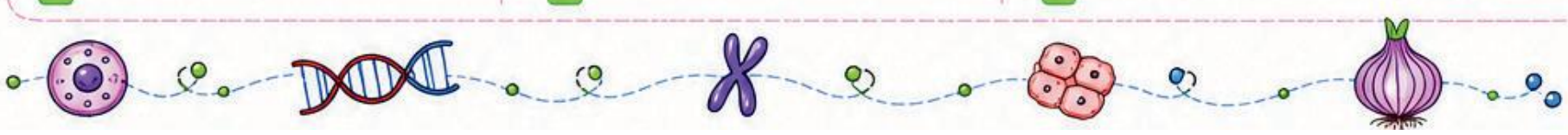
A. Schleiden
B. Schwann
C. Hooke ✓
D. Virchow

**Q2** Human eye resolution is approximately:

A. 1 mm
B. 0.1 mm ✓
C. 10 mm
D. 0.01 mm

**Q3** Electron microscope uses:

A. Light
B. Lens
✓ C. Electrons
D. Water



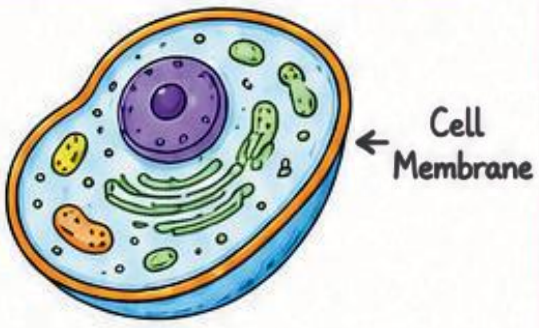
# CELL MEMBRANE (PLASMA MEMBRANE)

## Definition

The cell membrane is a thin, living, selectively permeable membrane that surrounds the cell and protects its contents.

## Other Name

Plasma Membrane




## Functions

**Protection**

Protects cell contents.

**Gives Shape**

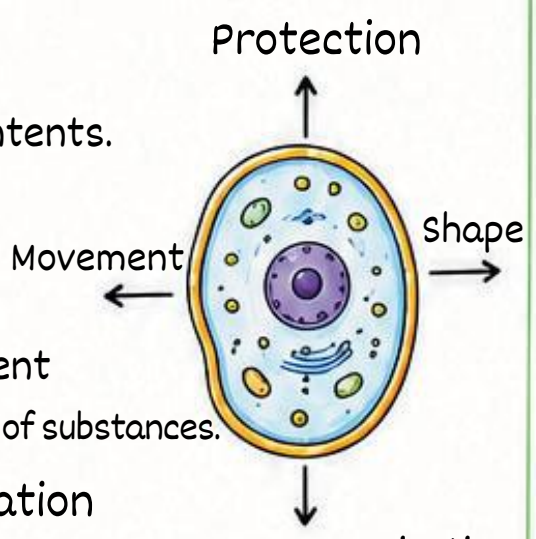
Provides boundary to the cell.

**Controls Movement**

Regulates entry and exit of substances.

**Cell Communication**

Helps cells interact with neighboring cells.




## Structure of Cell Membrane

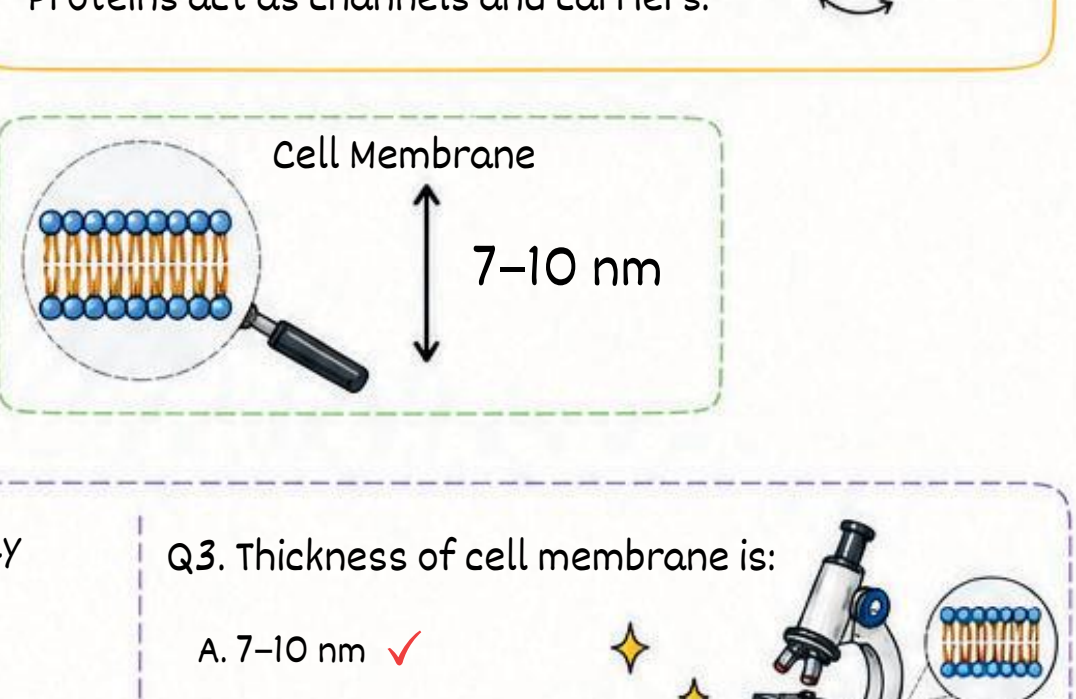
### Fluid Mosaic Model

Cell membrane consists of:

- Lipid bilayer
- Proteins embedded in lipids

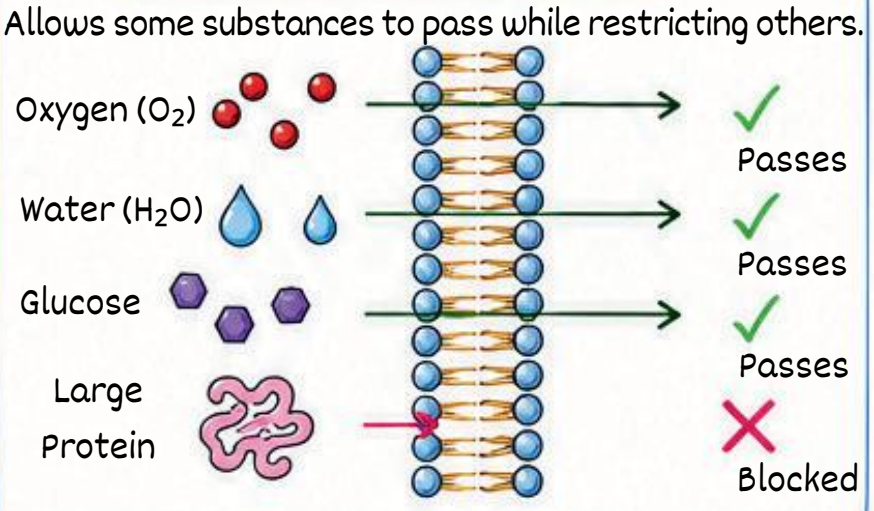
**Thickness:** 7–10 nm

Lipid Bilayer with Protein Channels



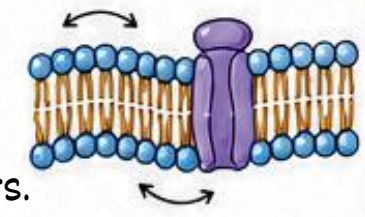

## Selectively Permeable Membrane

Allows some substances to pass while restricting others.




## Important Features

- Lipids move freely.
- Membrane is flexible.
- Proteins act as channels and carriers.






## MCQ's

**Q1.** The cell membrane is:

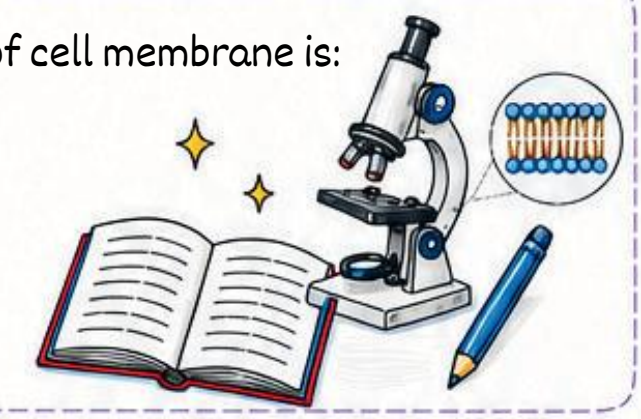
A. Freely permeable
B. Impermeable ✓
C. Selectively permeable
D. Dead

**Q2.** Cell membrane mainly consists of:

A. Protein only
B. Lipids only ✓
C. Lipids and proteins
D. Cellulose

**Q3.** Thickness of cell membrane is:

A. 7–10 nm ✓
B. 7–10 mm
C. 7–10 µm
D. 70 nm



# DIFFUSION AND OSMOSIS

## DIFFUSION

Diffusion is the movement of particles from a region of higher concentration to a region of lower concentration until equilibrium is reached.

### Key Features

✓ Does not require energy.

✓ Occurs in gases, liquids and solid

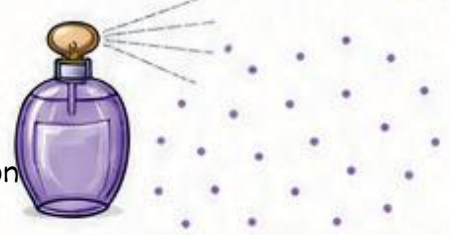
✓ Happens because particles are in constant motion.

✓ No membrane is required.

### Examples

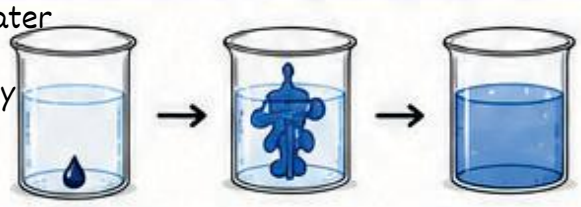
1. Perfume spreading in a room

The fragrance molecules move from a region of high concentration to low concentration.



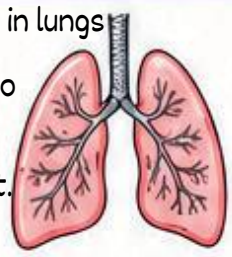
2. Ink spreading in water

Ink particles gradually spread throughout the water.

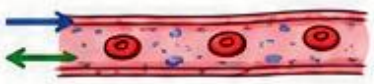


3. Exchange of gases in lungs

Oxygen diffuses into blood and carbon dioxide diffuses out.



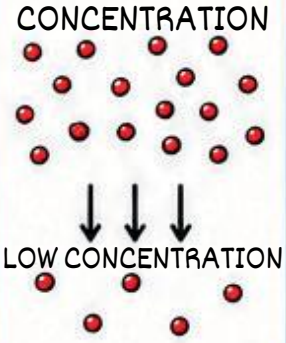
Oxygen → Blood



Carbon Dioxide ← Blood

### Diffusion of Particles

HIGH CONCENTRATION



LOW CONCENTRATION

Particles move from High → Low concentration

## OSMOSIS

Osmosis is the diffusion of water through a selectively permeable membrane from a region of higher water concentration (dilute solution) to a region of lower water concentration (concentrated solution).

### Important Conditions for Osmosis

✓ Presence of water

✓ Concentration difference

✓ Selectively permeable membrane

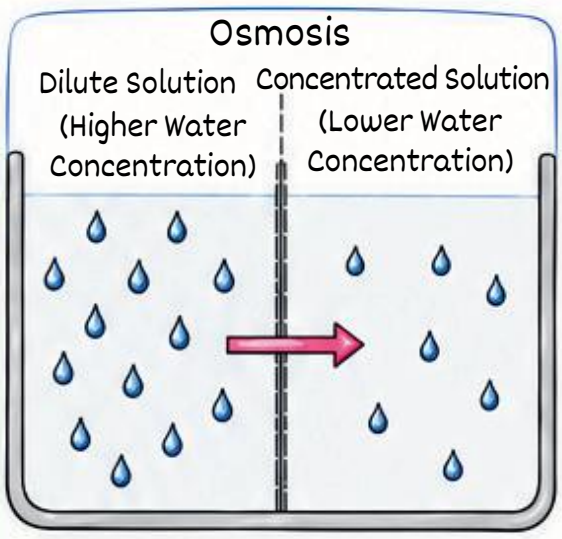
### Key Points

✓ Only water molecules move.

✓ Requires a selectively permeable membrane.

✓ Does not require energy.

### Osmosis



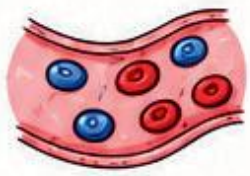

### Importance of Osmosis

#### In Plants

• Absorption of water by root hairs.

• Maintains turgidity of cells.

#### In Animals



• Movement of water between cells and blood.

### TYPES OF SOLUTIONS

#### Isotonic Solution

**Definition**

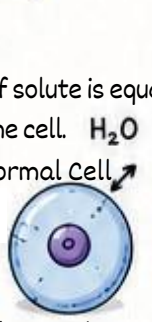
The concentration of solute is equal inside and outside the cell. $H_2O$

**Result**

No net movement of water.

**Cell Condition**

Cell remains unchanged.




#### Hypotonic Solution

**Definition**

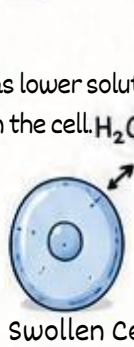
Outside solution has lower solute concentration than the cell. $H_2O$

**Result**

Water enters the cell.

**Cell Condition**

Cell swells.




#### Hypertonic Solution

**Definition**

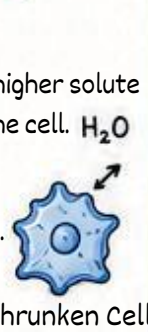
Outside solution has higher solute concentration than the cell. $H_2O$

**Result**

Water leaves the cell.

**Cell Condition**

Cell shrinks.




### Potato Experiment

#### Potato in Water

Observation:

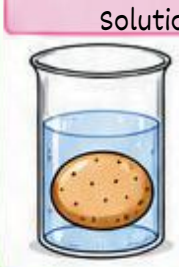
• Potato swells.

• Weight increases.

Reason:

Water enters cells by osmosis.

#### Potato in Salt/Sugar Solution



Observation:

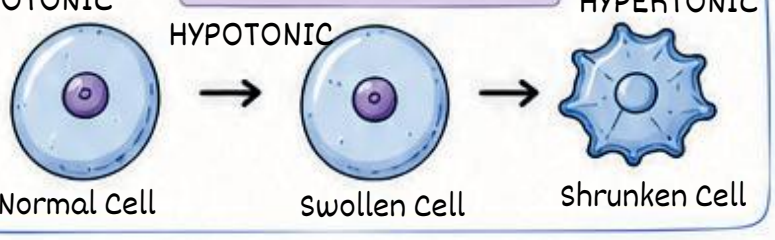
• Potato shrinks.

• Weight decreases.

Reason:

Water moves out of cells by osmosis.

### Effects of Solutions on Cells

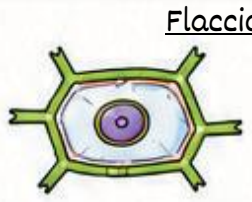



### Keywords

**Turgid Cell**

A cell swollen due to water absorption.

**Flaccid Cell**



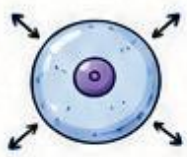
A cell that has lost water and becomes limp.

Q1. Movement of water through a selectively permeable membrane is called:

A. Diffusion
B. Osmosis ✓
C. Respiration
D. Transpiration

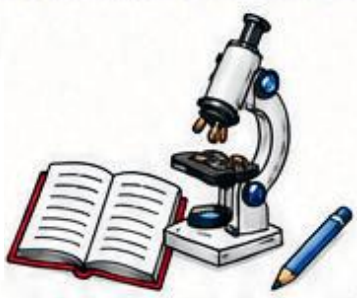
Q2. A cell placed in pure water will:

A. Shrink
B. Burst
C. Swell ✓
D. Die immediately



Q3. Plasmolysis occurs in:

A. Hypotonic solution
B. Isotonic solution
C. Hypertonic solution ✓
D. Distilled water



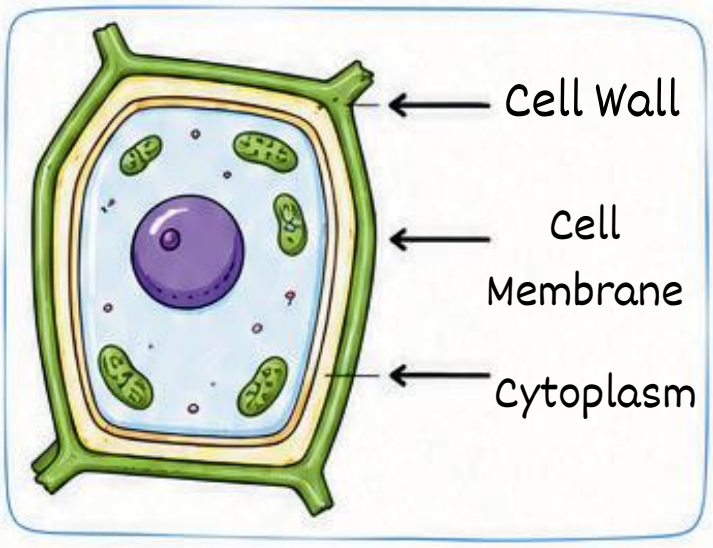
# CELL WALL – THE OUTER PROTECTIVE COVERING

## Definition

The cell wall is a rigid, non-living outer covering present outside the cell membrane in plant cells.

## Characteristics

- ✓ Non-living
- ✓ Rigid
- ✓ Strong
- ✓ Fully permeable

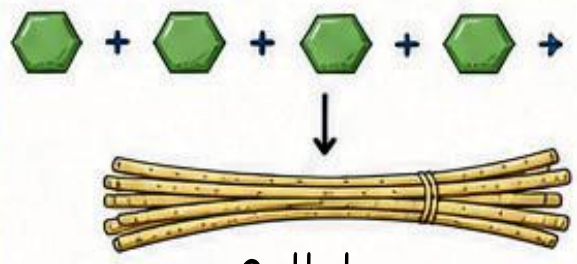



## Composition

Mainly made of:

**Cellulose**

Cellulose is a carbohydrate composed of many glucose molecules.

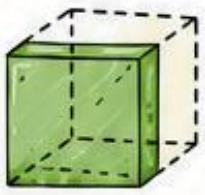



## FUNCTIONS OF CELL WALL

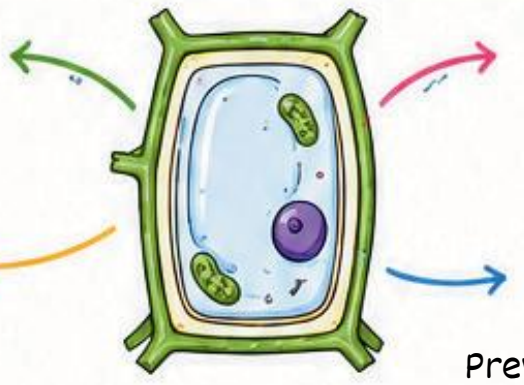
### 1. Protection

Protects the cell from injury.

### 2. Gives Shape

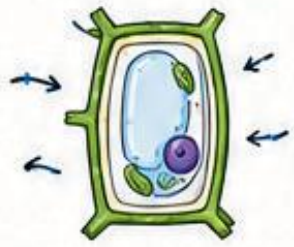


Maintains a fixed shape.



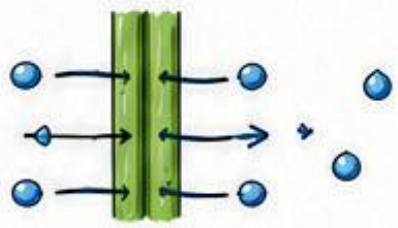
Keeps plants upright.

### 3. Prevents Bursting



Prevents plant cells from bursting when excess water enters.

### 4. Allows Water and Minerals to Pass



Being permeable, it permits movement of water and dissolved substances.

## Why Plant Cells Need Cell Wall?

Plants are fixed in one place.

They face:

- Wind
- Rain
- Gravity
- Mechanical stress

The cell wall provides support and rigidity.

## Why Animal Cells Do Not Have Cell Wall?

Animals need flexibility for:

- Movement
- Changing shape
- Different functions

Therefore animal cells possess only a cell membrane.

Plant Cell → Cell Wall Present

Animal Cell → Cell Wall Absent

## DIFFERENCE BETWEEN CELL WALL AND CELL MEMBRANE

| Cell Wall | Cell Membrane |
|---|---|
| Non-living | Living |
| Present in plants | Present in all cells |
| Fully permeable | Selectively permeable |
| Made of cellulose | Made of lipids and proteins |
| Rigid | Flexible |

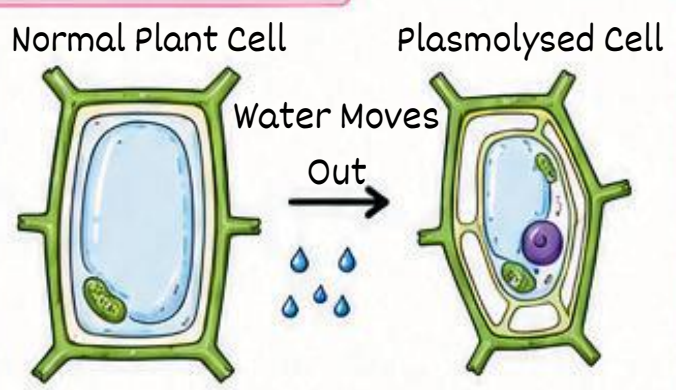
## PLASMOLYSIS IN PLANT CELLS

When plant cells are kept in concentrated sugar solution:

- Water moves out.
- Cytoplasm shrinks.
- Cell membrane pulls away from cell wall.
- Cell wall remains unchanged.

This process is called:

**Plasmolysis**




## MCQ's

Q1. The cell wall of plants is mainly made of:

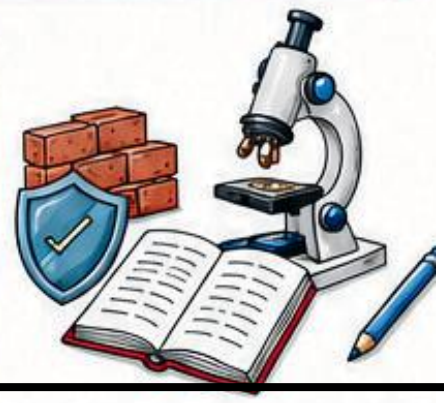
- ○ Chitin
- ○ Protein
- ○ Cellulose ✓
- ○ Lipid

Q2. Cell wall is:

- ○ Selectively permeable
- ○ Impermeable
- ○ Fully permeable ✓
- ○ Semi-permeable

Q3. Which cells lack a cell wall?

- ○ Plant cells
- ○ Bacterial cells
- ○ Animal cells ✓
- ○ Fungal cells

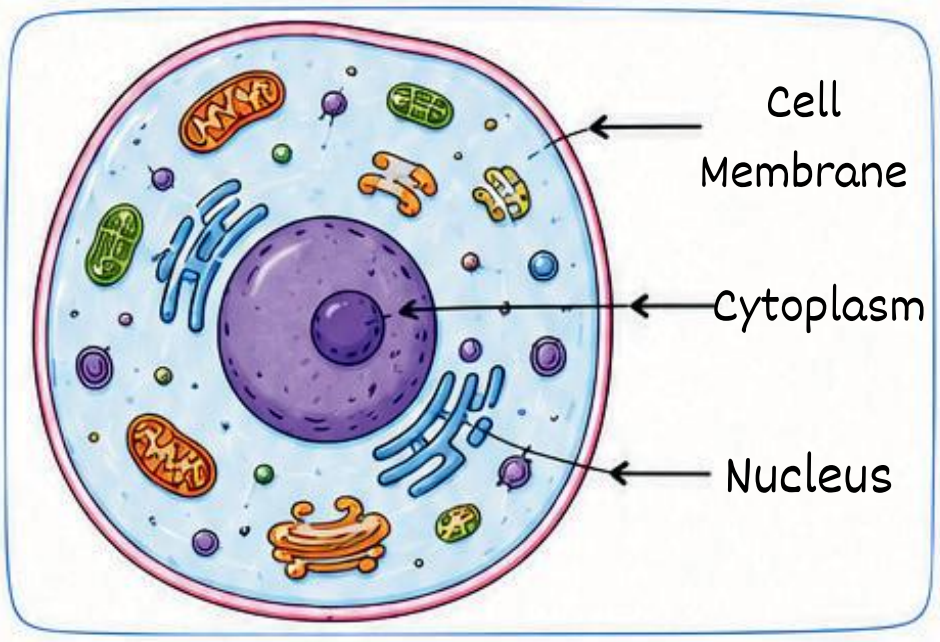


# BASIC STRUCTURE OF A CELL

## Definition

A cell consists of three basic components:

- Cell Membrane
- Cytoplasm
- Nucleus

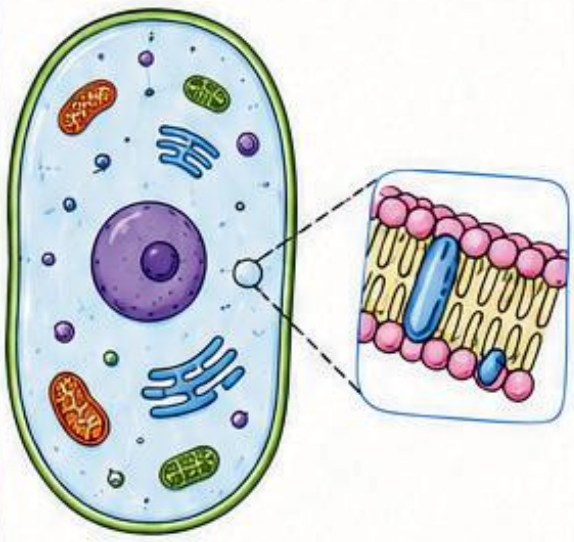



## Diagram to Draw

Cell Membrane
↓
Cytoplasm
↓
Nucleus

## 1. Cell Membrane

- ✓ Outer living boundary.
- ✓ Selectively permeable.



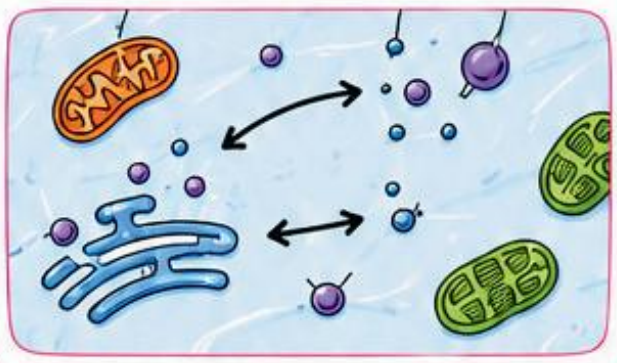
## 2. Cytoplasm

**Definition**

A jelly-like semi-fluid substance present between the cell membrane and nucleus.

**Functions**

- Holds organelles.
- Site of many biochemical reactions.
- Enables transport of materials.



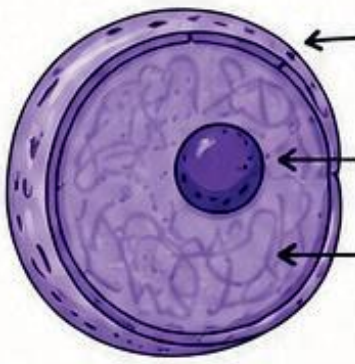
## 3. Nucleus

**Definition**

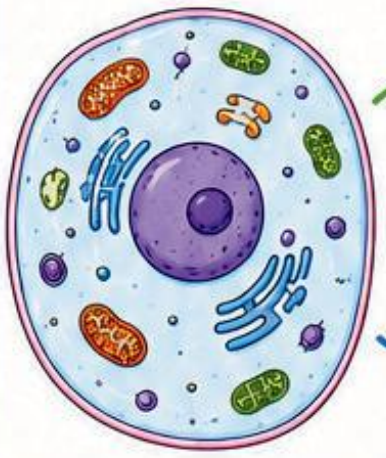
The control centre of the cell containing genetic material.

**Functions**

- Controls cell activities.
- Stores hereditary information.
- Regulates growth and reproduction.




## FUNCTIONAL VIEW OF A CELL



- Cell Membrane — Protection & Selective Transport
- Cytoplasm — Site of Reactions & Transport
- Nucleus — Control Centre of the Cell

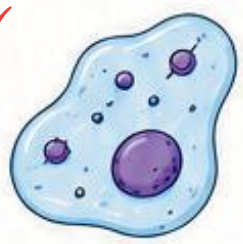
## QUICK COMPARISON

| Component | Main Function |
|---|---|
| Cell Membrane | Boundary & Transport |
| Cytoplasm | Reactions & Transport |
| Nucleus | Control & Heredity |

## MCQ's

Q1. The jelly-like substance inside a cell is:

- ○ Cell Wall
- ○ Cytoplasm ✓
- ○ Nucleus
- ○ DNA



Q2. The control centre of the cell is:

- ○ Ribosome
- ○ Vacuole
- ○ Nucleus ✓
- ○ ER

Q3. The three basic components of a cell are:

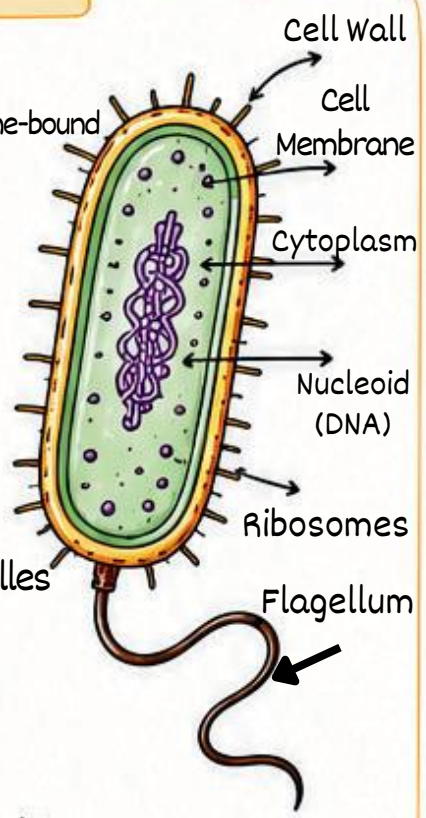
- ○ Cell wall, nucleus, chromosome
- ○ Membrane, cytoplasm, nucleus ✓
- ○ ER, Golgi body, nucleus
- ○ Cytoplasm, ribosome, vacuole

# PROKARYOTIC AND EUKARYOTIC CELLS

## PROKARYOTIC CELL

**Definition**

Cells lacking a true nucleus and membrane-bound organelles are called prokaryotic cells.



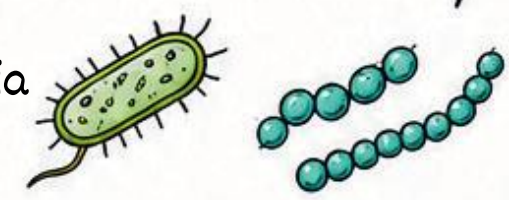

**Meaning**

Pro = Primitive
Karyon = Nucleus

- ✓ Small size (1–10 µm)
- ✓ Usually unicellular
- ✓ No true nucleus
- ✓ No membrane-bound organelles
- ✓ DNA present in nucleoid

**Examples**

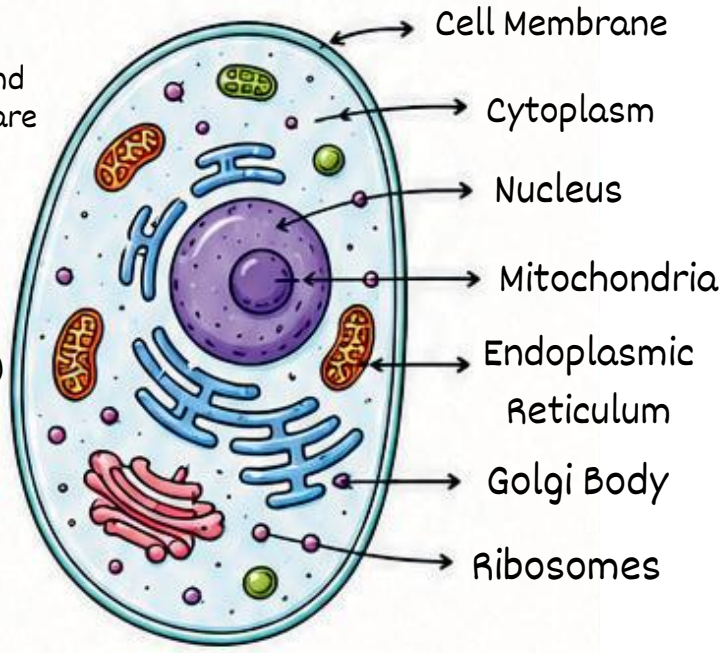
- Bacteria
- Cyanobacteria



## EUKARYOTIC CELL

**Definition**

Cells having a true nucleus and membrane-bound organelles are called eukaryotic cells.




**Meaning**

Eu = True
Karyon = Nucleus

- ✓ Larger size (10–100 µm)
- ✓ True nucleus present
- ✓ Organelles present
- ✓ Can be unicellular or multicellular

**Examples**

- Plants
- Animals
- Fungi
- Protists

## DIFFERENCE BETWEEN PROKARYOTIC AND EUKARYOTIC CELLS

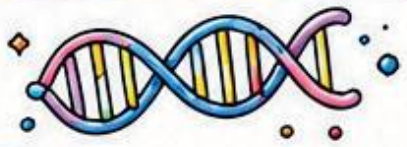
| Prokaryotic | | Eukaryotic |
|---|---|---|
| Primitive nucleus |  | True nucleus |
| No organelles |  | Organelles present |
| 1–10 µm |  | 10–100 µm |
| Usually unicellular |  | Uni- or multicellular |
| Bacteria |  | Plants and Animals |

## MEANING TRICK

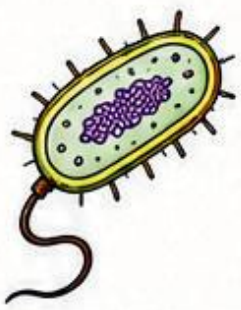
**Pro** = Primitive

**Eu** = True

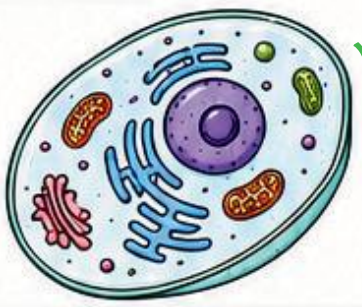
**Karyon** = Nucleus



## PROKARYOTIC VS EUKARYOTIC



- ✗ No true nucleus
- ✗ No membrane-bound organelles
- ✗ Small size (1–10 µm)
- ✗ Usually unicellular



- ✓ True nucleus present
- ✓ Membrane-bound organelles present
- ✓ Larger size (10–100 µm)
- ✓ Can be unicellular or multicellular

## MCQs

**Q1.** Bacteria are:

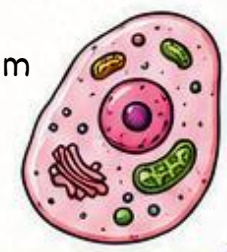
- ○ Eukaryotic
- ○ Prokaryotic ✓
- ○ Acellular
- ○ Multicellular

**Q2.** The genetic material in prokaryotes is present in:

- ○ Nucleus
- ○ Nucleolus
- ○ Nucleoid ✓
- ○ Cytoplasm

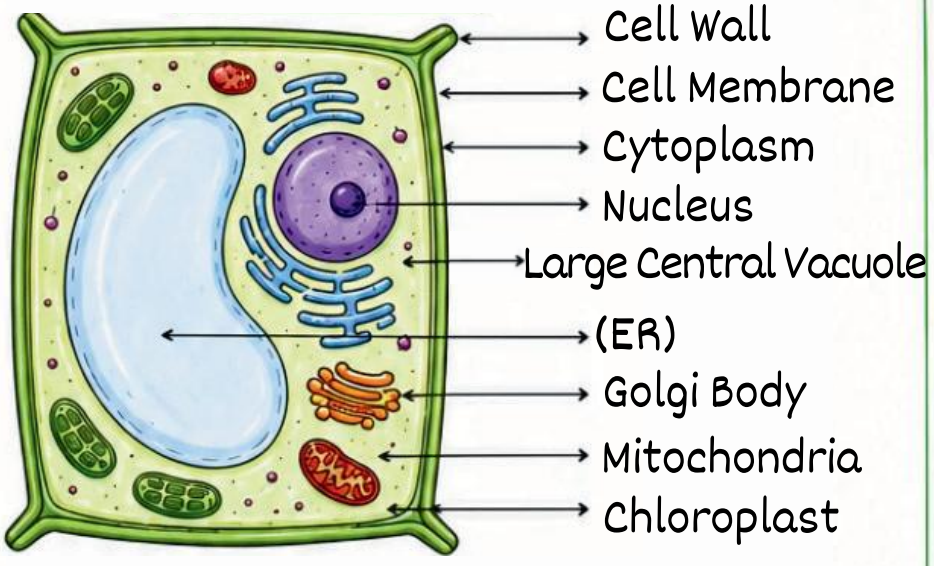
**Q3.** Which is a eukaryotic cell?

- ○ Bacterium
- ○ Cyanobacterium
- ○ Animal cell ✓
- ○ Mycoplasma



# PLANT CELL VS ANIMAL CELL

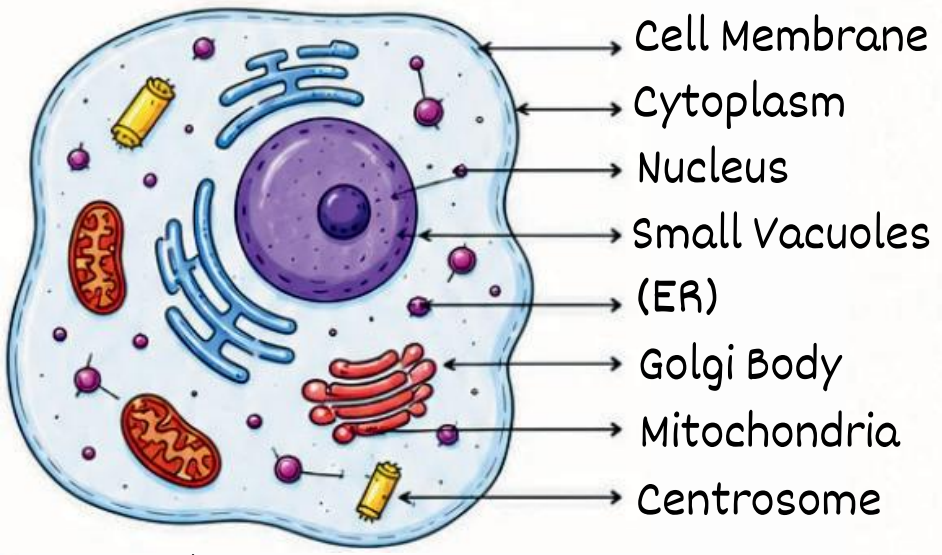
## PLANT CELL




### Key Features

- ✓ Cell Wall Present
- ✓ Chloroplast Present
- ✓ Large Central Vacuole
- ✓ Fixed Shape
- ✓ Can Prepare Food

## ANIMAL CELL



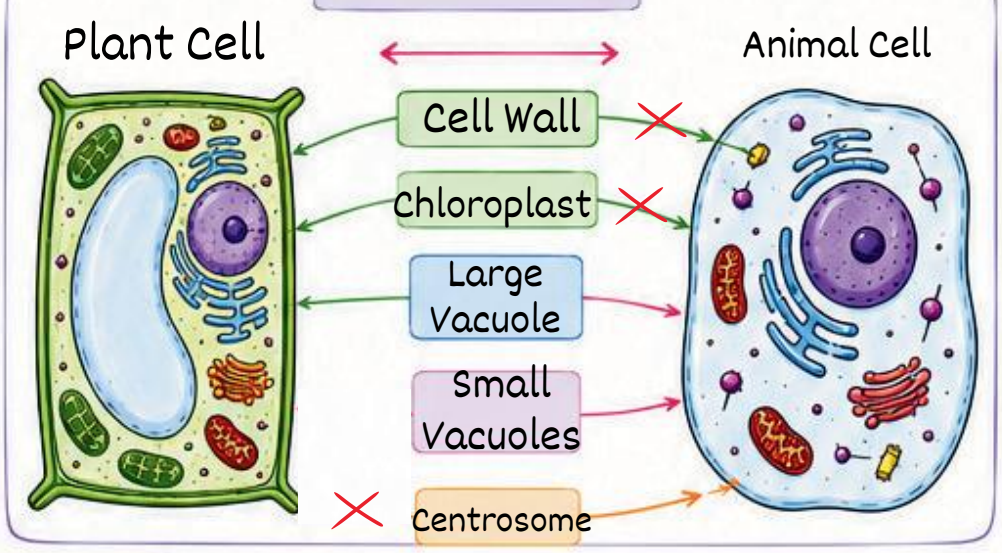

### Key Features

- ✓ Cell Wall Absent
- ✓ Chloroplast Absent
- ✓ Small Vacuoles
- ✓ irregular Shape
- ✓ Cannot Prepare Food

## SIDE-BY-SIDE COMPARISON

| Characterstics | plant cell | Animal cell |
|---|---|---|
| Cell Wall | Present | Absent |
| Shape | Fixed | Irregular |
| Chloroplast | Present | Absent |
| Vacuole | Large Central Vacuole | Small or Temporary |
| Centrosome | Usually absent | Present |

## VISUAL DIFFERENCE




## MEMORY BOX

**Plant Cell**

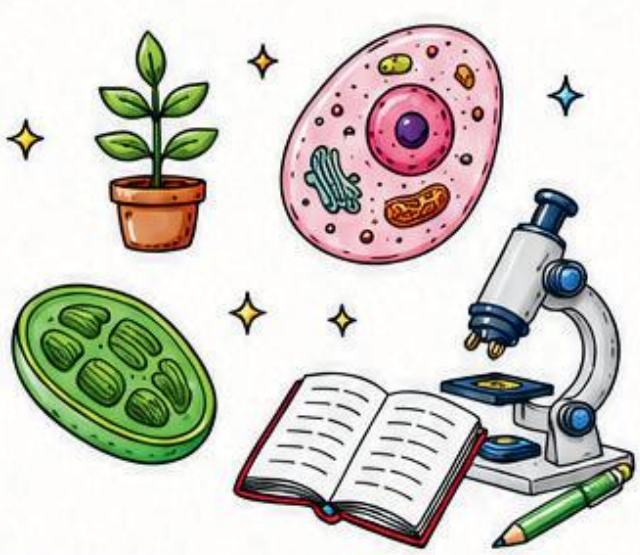
Wall + Chloroplast + Large Vacuole

**Animal Cell**

Centrosome + Small Vacuoles

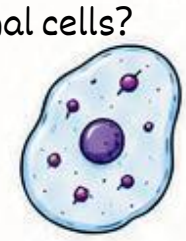
## ORGANELLE COMPARISON

| Organelle | Plant | Animal |
|---|---|---|
| Cell Wall | ✓ | ✗ |
| Chloroplast | ✓ | ✗ |
| Mitochondria | ✓ | ✓ |
| ER | ✓ | ✓ |
| Golgi Body | ✓ | ✓ |
| Nucleus | ✓ | ✓ |



**Q1.** Which structure is absent in animal cells?

- ○ Nucleus
- ○ Cytoplasm
- ○ Cell Wall ✓
- ○ Mitochondria

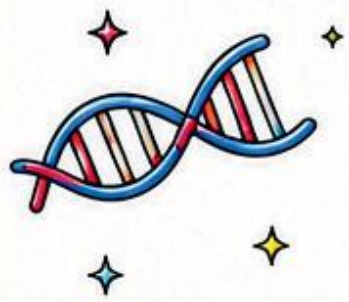


**Q2** Large central vacuole is found in:

- ○ Animal cells
- ○ Plant cells ✓
- ○ Bacteria
- ○ Viruses


**Q3.** Which organelle helps plants prepare food?

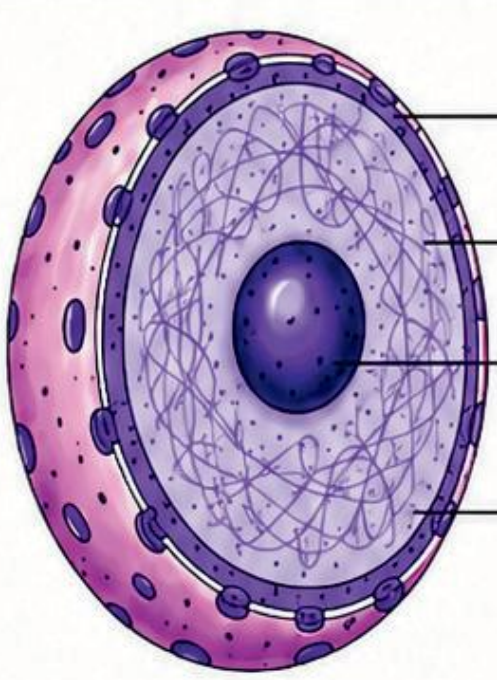
- ○ Mitochondria
- ○ Ribosome
- ✓ ○ Chloroplast
- ○ Lysosome



# NUCLEUS – THE CONTROL CENTRE OF THE CELL

## Definition

The nucleus is a membrane-bound cell organelle that controls all activities of the cell and contains hereditary material (DNA).




## Why is the Nucleus Important?

The nucleus acts as the brain of the cell because it:

- ✔ Controls growth
- ✔ Controls metabolism
- ✔ Controls reproduction
- ✔ Controls protein synthesis
- ✔ Stores hereditary information

## STRUCTURE OF NUCLEUS

### 1. Nuclear Membrane

**Definition**

A double-layered membrane surrounding the nucleus.

**Features**

- ✓ Double membrane
- ✓ Contains nuclear pores
- ✓ Separates nucleus from cytoplasm

**Function**

Controls movement of substances between nucleus and cytoplasm.

### 2. Nuclear Pores

**Definition**

Tiny openings present in the nuclear membrane.

**Function**

Allow exchange of:

- RNA
- Proteins
- Other molecules between nucleus and cytoplasm

### 3. Nucleolus

**Definition**

A dense spherical structure present inside the nucleus.

**Function**

Forms ribosomal subunits. These later combine to form ribosomes.

### 4. Chromatin

**Definition**

A network of thread-like structures present inside the nucleus.

**Function**

Contains DNA and proteins.

### 5. Chromosomes

**Definition**

Rod-shaped structures formed from chromatin during cell division.

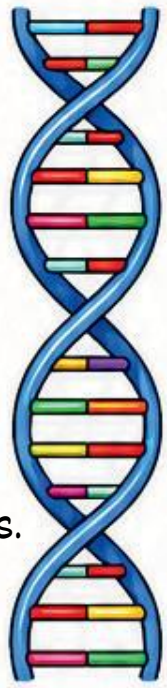
## HIERARCHY OF GENETIC MATERIAL

Nucleus → Chromosomes → DNA → Genes

## DNA (Deoxyribonucleic Acid)

**Definition**

DNA is the hereditary material that carries genetic information.



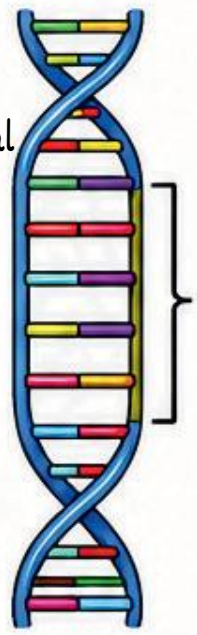
**Functions**

- ✓ Stores biological information.
- ✓ Controls cell activities.
- ✓ Transfers characters from parents to offspring.

## Gene

**Definition**

A gene is the functional unit of heredity present on DNA.

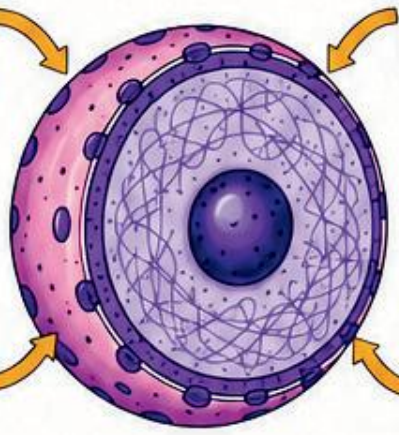


**Functions**

Determines traits such as:

- Eye colour
- Height
- Hair type
- Blood group

## FUNCTIONS OF NUCLEUS



**Controls Cell Activities**
Acts as the control centre.

**Stores Genetic Material**
Contains DNA.

**Controls Cell Division**
Regulates growth and reproduction.

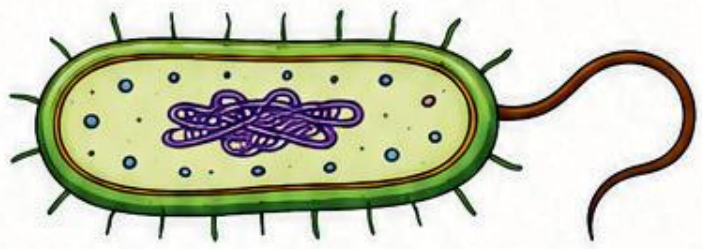
**Transfers Hereditary Characters**
Passes genetic information to offspring.

## NUCLEOID (PROKARYOTIC CELLS)

Prokaryotic cells do not possess a true nucleus.

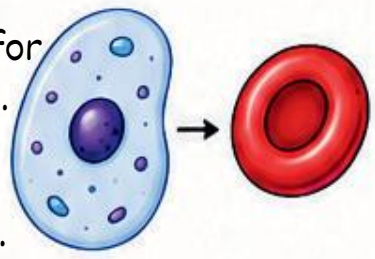
Their DNA is present in a region called:

**NUCLEOID**



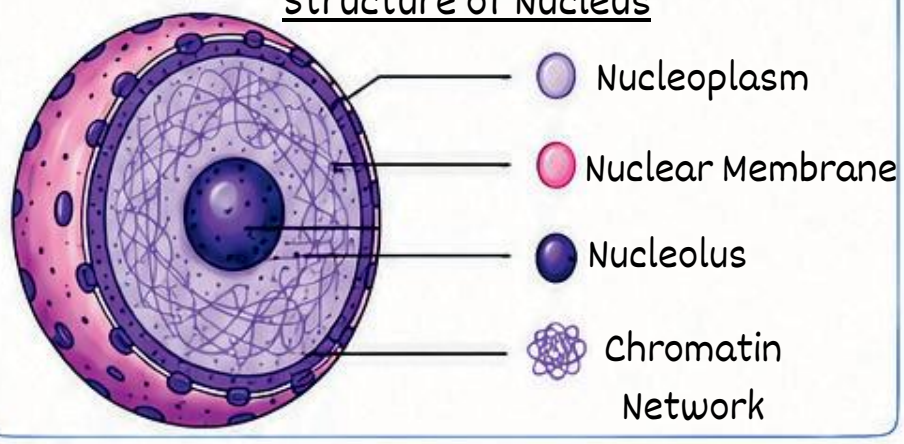
## SPECIAL FACT

| | | |
|---|---|---|
| Human RBCs | → | Mature red blood cells lack a nucleus. |
| Advantage | → | More space for haemoglobin. |
| Result | → | More oxygen can be transported. |
| Life span | → | About 120 days. |



## DIAGRAM TO DRAW

Structure of Nucleus




## MCQs

**Q1.** The control centre of the cell is:

- ○ Ribosome
- ○ Vacuole
- ⊘ Nucleus
- ○ Golgi Body

**Q2.** Genes are located on:

- ○ DNA
- ✓ Ribosomes
- ○ Cell membrane
- ○ Vacuoles

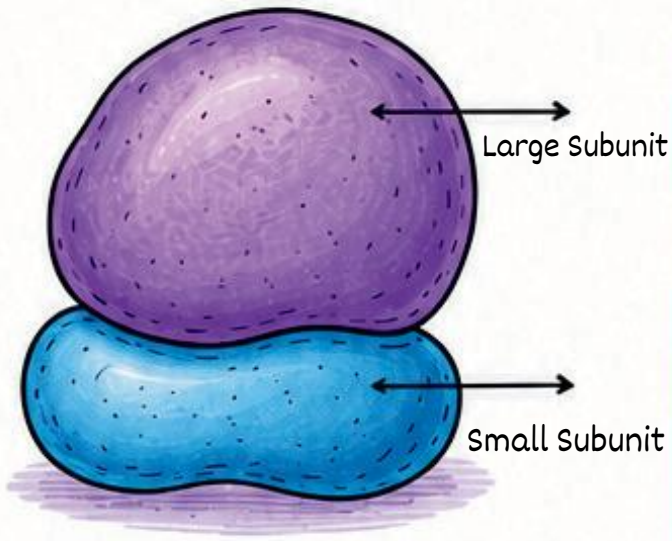
**Q3.** Prokaryotic DNA is present in:

- ○ Nucleus
- ○ Nucleolus
- ✓ Nucleoid
- ○ ER

# RIBOSOMES – THE PROTEIN FACTORIES

## Definition

Ribosomes are tiny cell organelles responsible for protein synthesis.



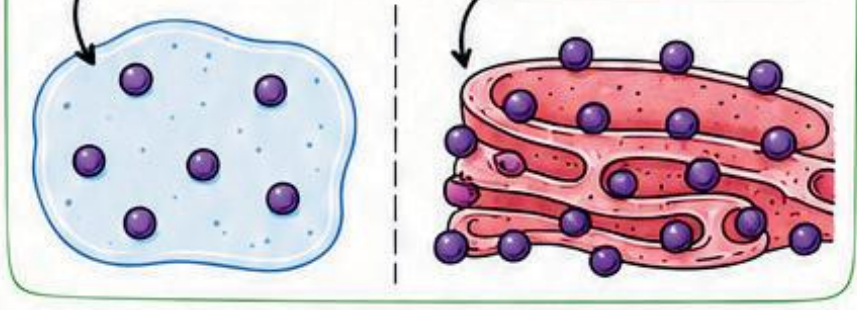

## Location

Ribosomes may be:

- **Free Ribosomes** — Present freely in cytoplasm.

OR

- **Attached Ribosomes** — Attached to Rough Endoplasmic Reticulum.

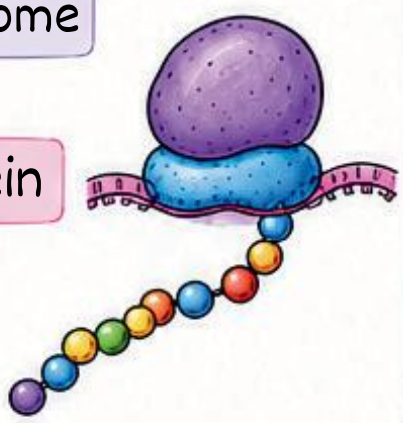


## Functions

**Protein Synthesis**

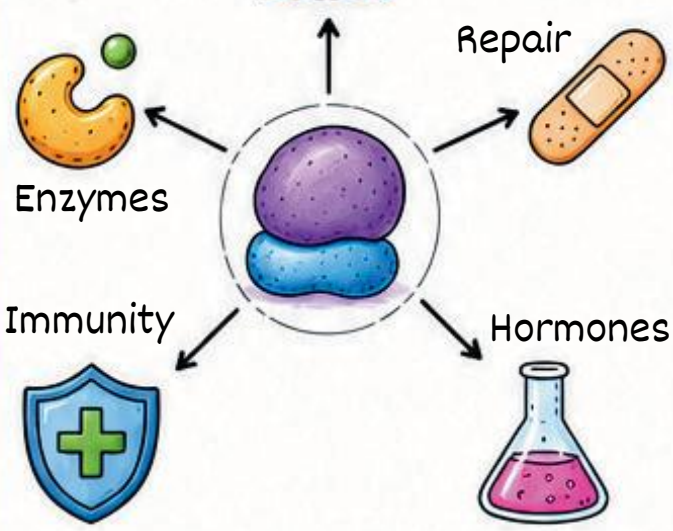
They manufacture proteins required by the cell.

Amino Acids → Ribosome → Protein



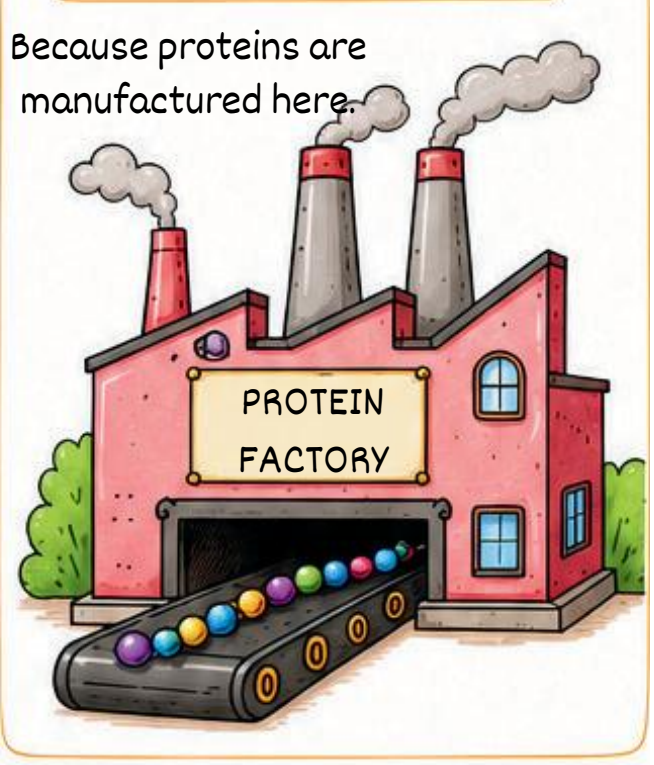
## Importance of Proteins

Proteins are needed for:

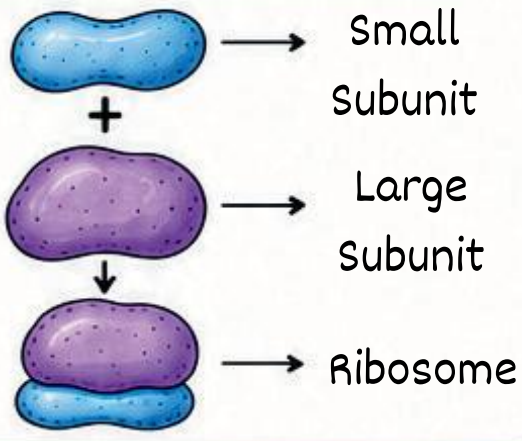



## Why Are Ribosomes Called Protein Factories?

Because proteins are manufactured here.

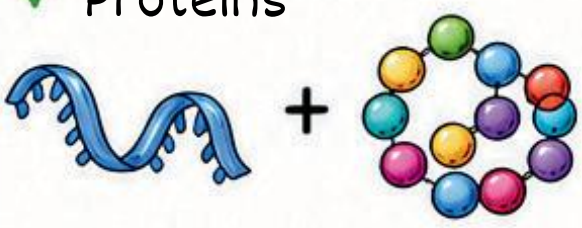



## Structure of Ribosome




## Ribosomes are mainly made of:

- ✓ RNA
- ✓ Proteins

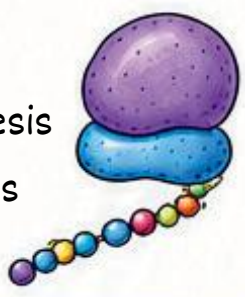


## Quick Comparison

| Type | Location |
|---|---|
| Free Ribosome | Cytoplasm |
| Attached Ribosome | Rough ER |

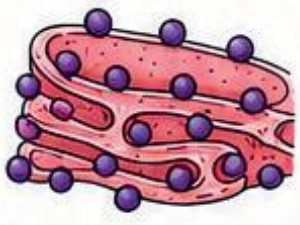
**Q1.** Ribosomes are the site of:

- ○ Respiration
- ✓ ○ Protein synthesis
- ○ Photosynthesis
- ○ Digestion



**Q2.** Ribosomes may be attached to:

- ○ Golgi body
- ○ Vacuole
- ✓ ○ Rough ER
- ○ Nucleus



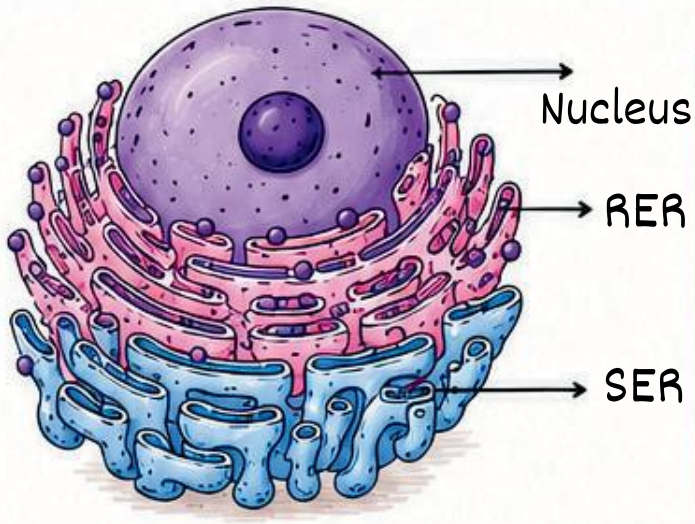
**Q3.** Ribosomes are mainly made of:

- ○ Lipids
- ✓ ○ RNA and proteins
- ○ DNA
- ○ Cellulose

# ENDOPLASMIC RETICULUM (ER)

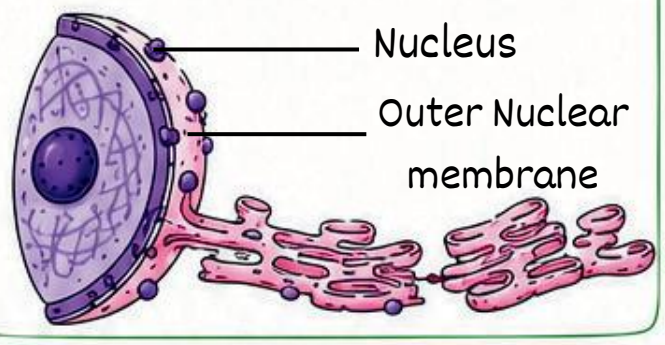
## Definition

The Endoplasmic Reticulum is a network of membrane-bound tubules and sacs spread throughout the cytoplasm



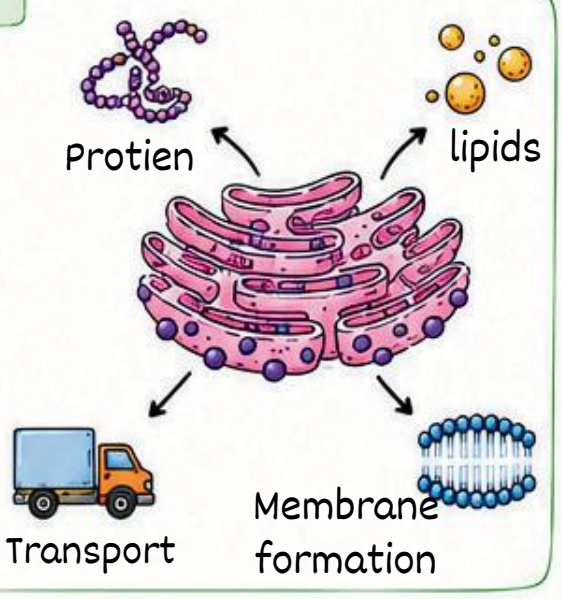

## Important Feature

The ER is continuous with the outer nuclear membrane.




## Functions

- ✓ Synthesis of proteins
- ✓ Synthesis of lipids
- ✓ Intracellular transport
- ✓ Formation of membranes




## Types of ER

### 1. Rough Endoplasmic Reticulum (RER)

**Definition**

ER having ribosomes attached on its surface.

Appearance: Looks rough under microscope.

**Functions**

- ✓ Protein synthesis
- ✓ Protein transport
- ✓ Protein secretion

**Example**

Pancreatic cells (gland cells producing proteins)

### 2. Smooth Endoplasmic Reticulum (SER)

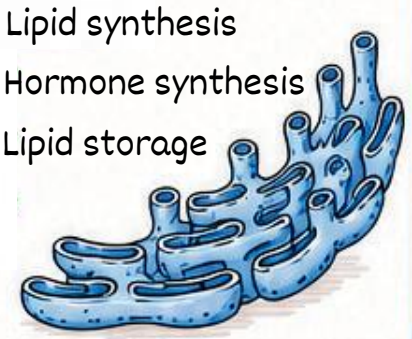
**Definition**

ER without ribosomes.

Appearance: Looks smooth.

**Functions:**

- ✓ Lipid synthesis
- ✓ Hormone synthesis
- ✓ Lipid storage

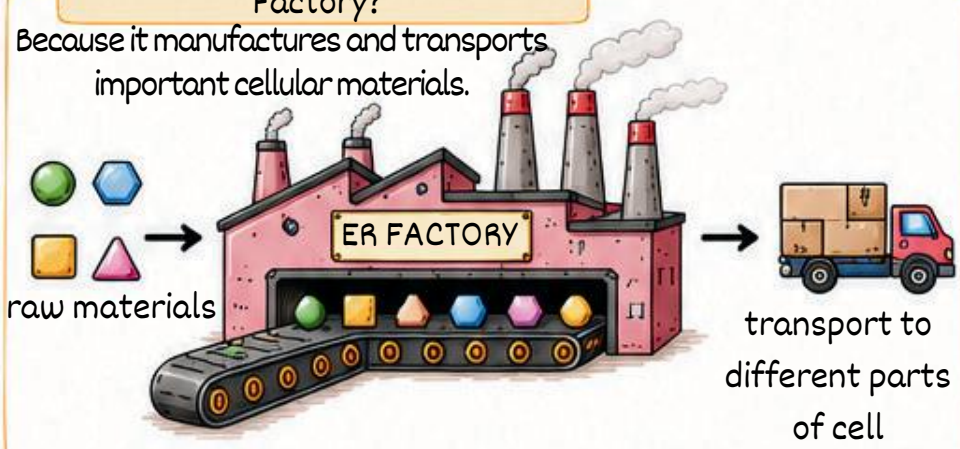


## Difference Between RER and SER

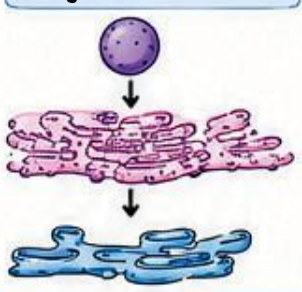
| RER | SER |
|---|---|
| Ribosomes present | Ribosomes absent |
| Rough appearance | Smooth appearance |
| Protein synthesis | Lipid synthesis |
| Common in gland cells | Common in fat-producing cells |

## Why is ER Called the Manufacturing Factory?

Because it manufactures and transports important cellular materials.




## Diagram to Draw



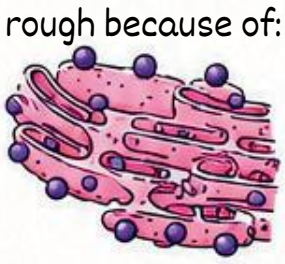
## QUICK MEMORY

**RER**
R = Ribosomes
R = Rough
R = Protein

**SER**
S = Smooth
S = Storage
S = Lipids

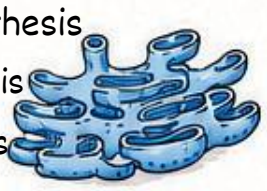
**Q1.** RER appears rough because of:

- ○ DNA
- ✓ ○ Ribosomes
- ○ Lipids
- ○ Enzymes



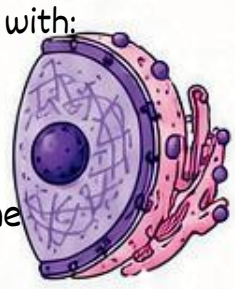
**Q2.** SER is involved in:

- ○ Protein synthesis
- ✓ ○ Lipid synthesis
- ○ Photosynthesis
- ○ Respiration



**Q3.** ER is continuous with:

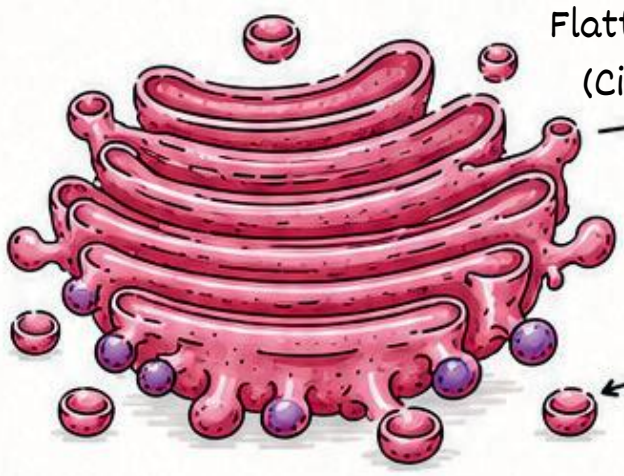
- ○ Golgi body
- ○ Cell wall
- ✓ ○ Nuclear membrane
- ○ Vacuole



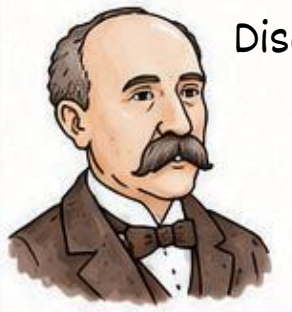
# GOLGI APPARATUS – THE PACKAGING AND SHIPPING CENTRE

## Definition

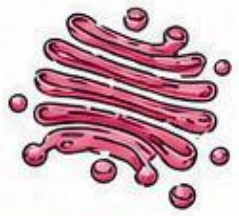
The Golgi apparatus is a stack of flattened membrane-bound sacs that modifies, packages and transports cellular materials.




## Discovery



Discovered by:

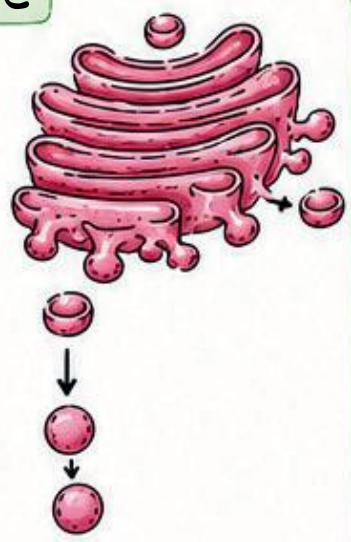


Camillo Golgi (1898)

## Structure

Consists of:

- ✓ Flattened sacs called cisternae
- ✓ Vesicles



## Functions

| Modification | Packaging | Transport | Secretion | Formation of Lysosomes |
|---|---|---|---|---|
| Modifies proteins and lipids received from ER. | Packages materials into vesicles. | Transports substances to different parts of cell. | Helps release substances outside the cell. | Produces lysosomes. |

## Why is Golgi Apparatus Called the Post Office of Cell?

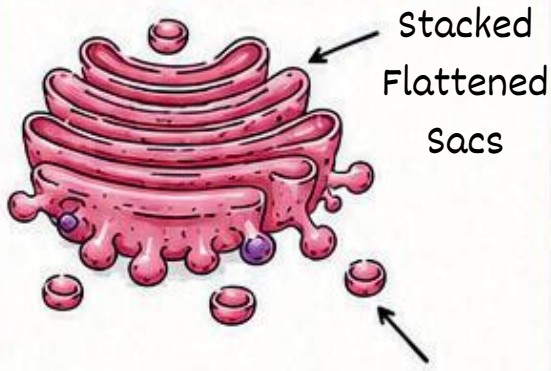
Because it:

- ✓ Packages materials
- ✓ Receives materials
- ✓ Sorts materials
- ✓ Delivers materials

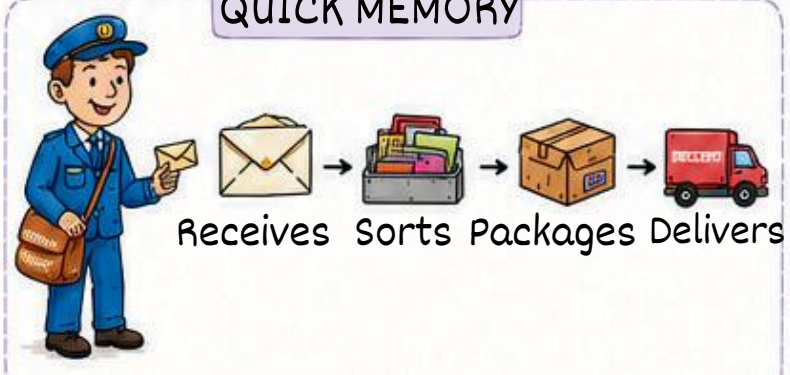

## Flow of Materials

Ribosome → ER → Golgi Apparatus → Vesicles → Destination

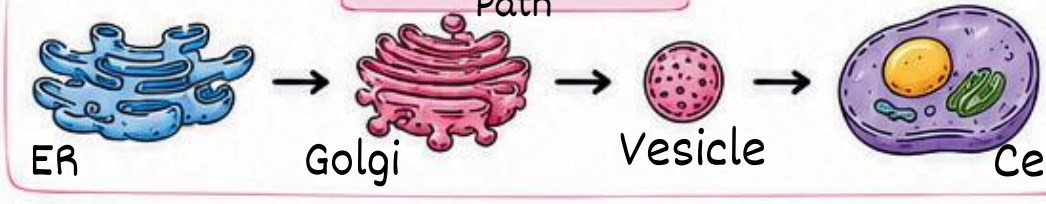
## Diagram to Draw




## QUICK MEMORY




## Material Processing Path




**Q1.** Golgi apparatus was discovered by:

- ○ Hooke
- ✓ ○ Golgi
- ○ Schwann
- ○ Virchow

**Q2.** Golgi apparatus mainly functions in:

- ○ Respiration
- ○ Digestion
- ✓ ○ Packaging and secretion
- ○ Photosynthesis

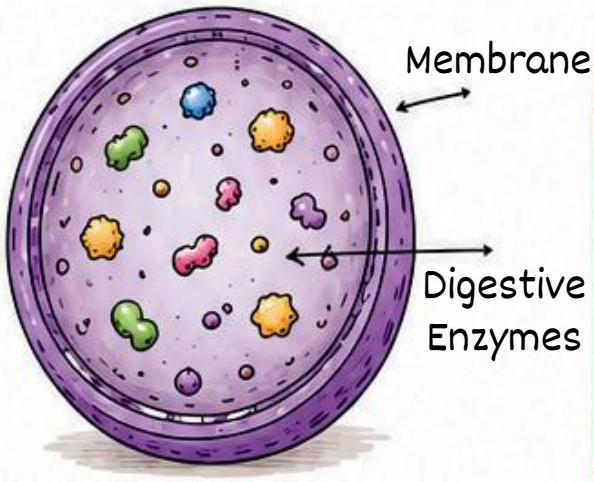
**Q3.** Lysosomes are formed by:

- ○ Mitochondria
- ○ Nucleus
- ✓ ○ Golgi Apparatus
- ○ Vacuoles

# LYSOSOMES – THE CLEAN-UP SYSTEM OF THE CELL

## Definition

Lysosomes are membrane-bound sacs containing digestive enzymes.

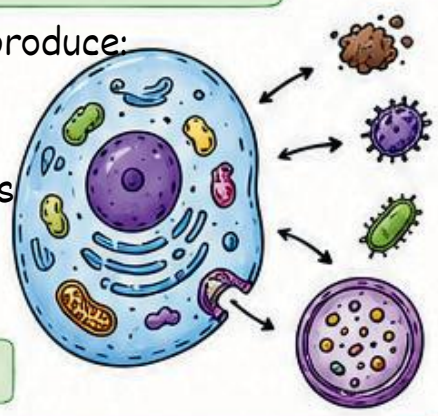



## Why Are Lysosomes Important?

Cells continuously produce:

- Waste materials
- Damaged organelles
- Foreign particles

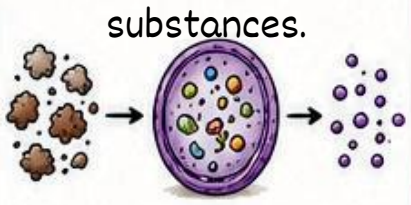
Lysosomes remove them.



## Functions

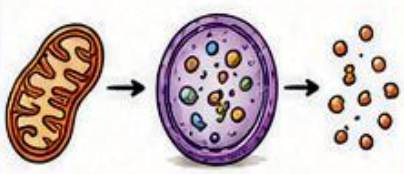
### 1. Digestion of Waste

Break down unwanted substances.



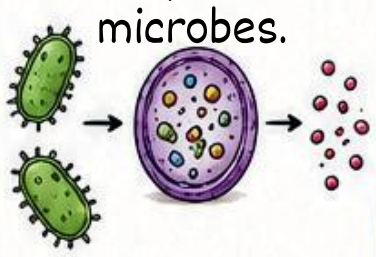
### 2. Destruction of Damaged Organelles

Recycle old organelles.



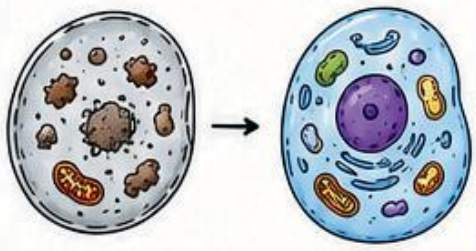
### 3. Defence

Destroy harmful microbes.



### 4. Cellular Cleaning

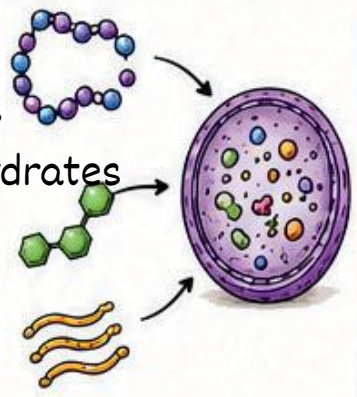
Keep the cell healthy.



## Enzymes Present

Digest:

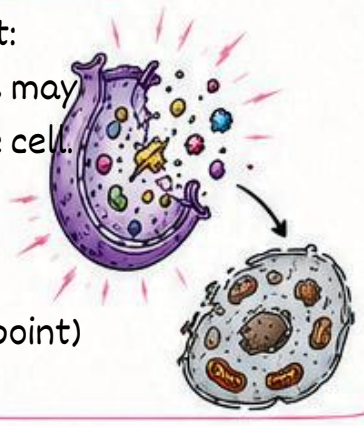
- Proteins
- Carbohydrates
- Lipids



## Why Are Lysosomes Called the Suicide Bags of the Cell?

If lysosomes burst:
Digestive enzymes may destroy the entire cell.
Hence called:
SUICIDE BAGS

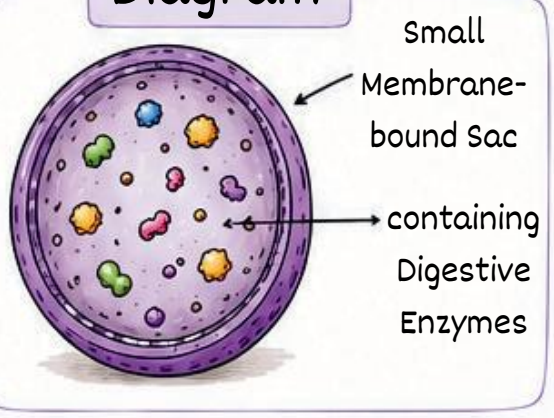
(Important exam point)



## Interesting Fact

Sperm cells contain lysosomal enzymes that help penetrate the egg during fertilization.

## Diagram




## QUICK MEMORY

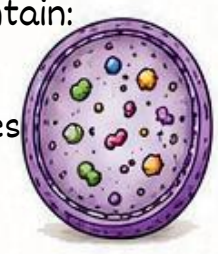
Waste → Digestion → Recycling → Healthy Cell

## CLEAN-UP PROCESS

Waste Material → Lysosome → Digestion → Recycled Materials

**Q1.** Lysosomes contain:

- ○ Chlorophyll
- ✔ ○ Digestive enzymes
- ○ DNA
- ○ Cellulose



**Q2.** Lysosomes are formed by:

- ○ Nucleus
- ✔ ○ Golgi Apparatus
- ○ Vacuole
- ○ Ribosome

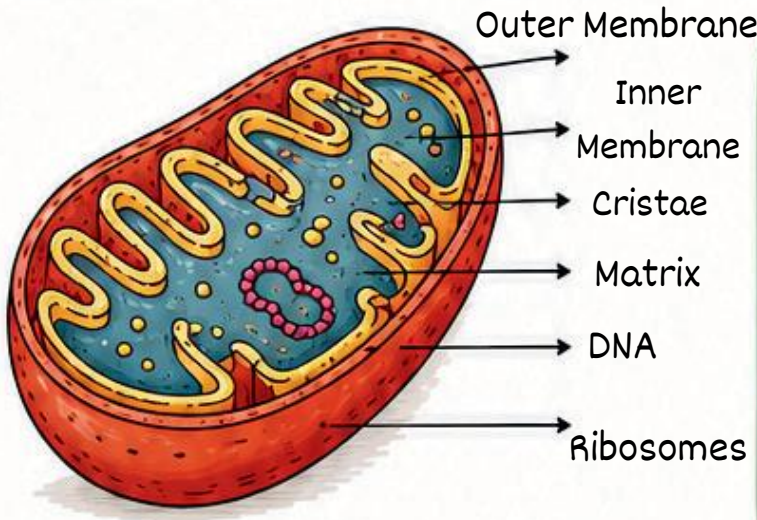
**Q3** Lysosomes are known as:

- ○ Powerhouse
- ○ Protein Factory
- ✔ ○ Suicide Bags
- ○ Control Centre

# MITOCHONDRIA – THE POWERHOUSE OF THE CELL

## Definition

Mitochondria are double membrane-bound cell organelles responsible for producing energy required for all cellular activities.

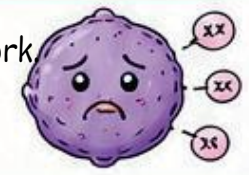



## Why are Mitochondria Called the Powerhouse of the Cell?

Just as a power station supplies electricity to a city, mitochondria supply energy to the cell.

### Without Mitochondria:

- ✗ Cells cannot perform work.
- ✗ Growth stops.
- ✗ Life processes cease.



## Structure of Mitochondrion

### 1. Outer Membrane

- Smooth
- Porous

**Function** Allows substances to enter and leave.

### 2. Inner Membrane

Highly folded membrane.

**Function**

Increases surface area for energy production.

### 3. Cristae

**Definition**

Finger-like folds of the inner membrane.

**Function:**

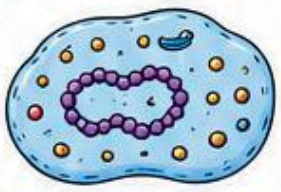
Provide a large surface area for respiration.

### 4. Matrix

Fluid-filled inner region.

Contains

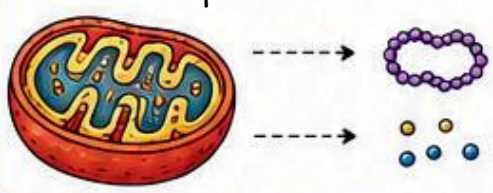
- Enzymes
- DNA
- Ribosomes



### Special Features

Mitochondria possess:

- ✓ Their own DNA
- ✓ Their own Ribosomes
- ✓ Ability to synthesize some proteins



## Function of Mitochondria

### Cellular Respiration

Food molecules (especially glucose) are broken down to release energy.

### ATP Formation

Energy is stored as:

ATP

(Adenosine Triphosphate)

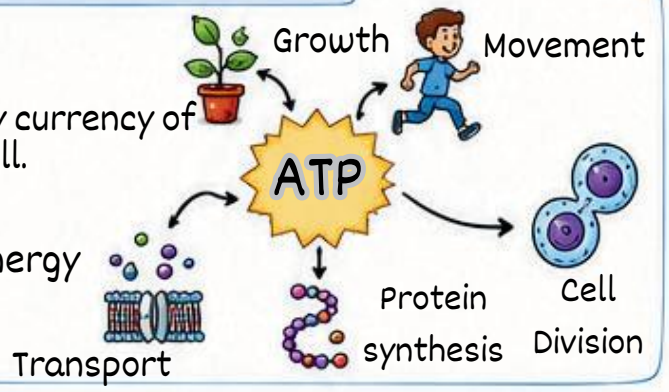
## ATP – ENERGY CURRENCY

**Definition**

ATP is the energy currency of the cell.

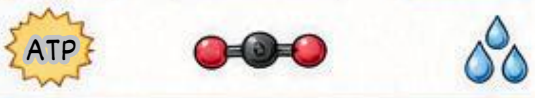
**Importance**

ATP provides energy for:




## Formula to Remember

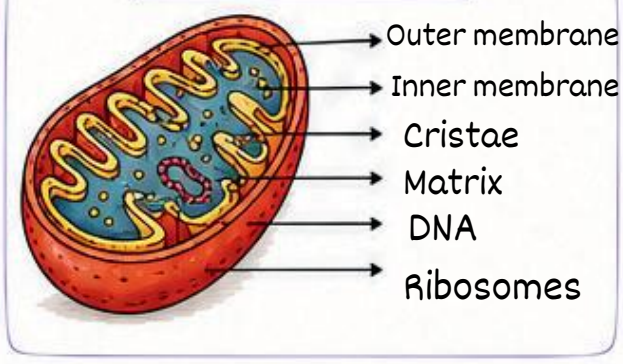
Glucose + Oxygen → Cellular Respiration → ATP + Carbon Dioxide → Water




## Why Are Many Small Mitochondria Better Than One Large Mitochondrion?

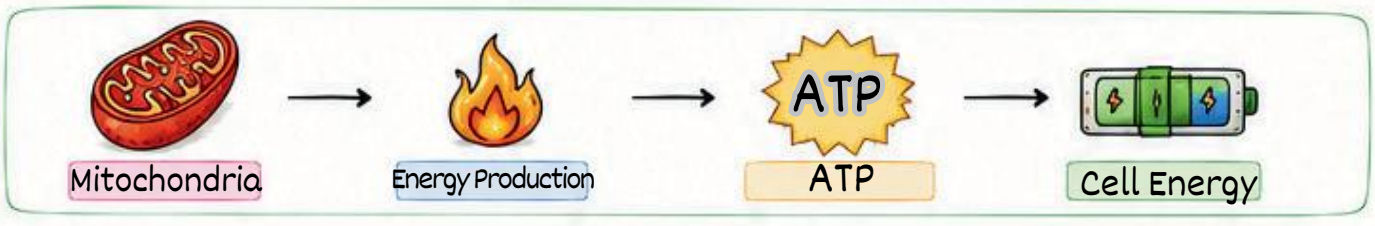
- ✓ Larger surface area
- ✓ Faster energy production
- ✓ Better distribution of energy

## Diagram to Draw




## Exam Point

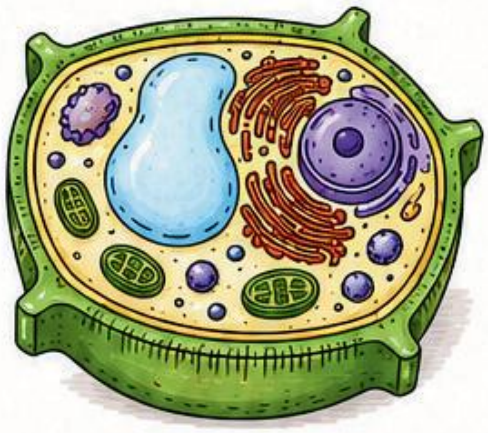
Mitochondria are called: POWERHOUSE OF THE CELL because they produce ATP.



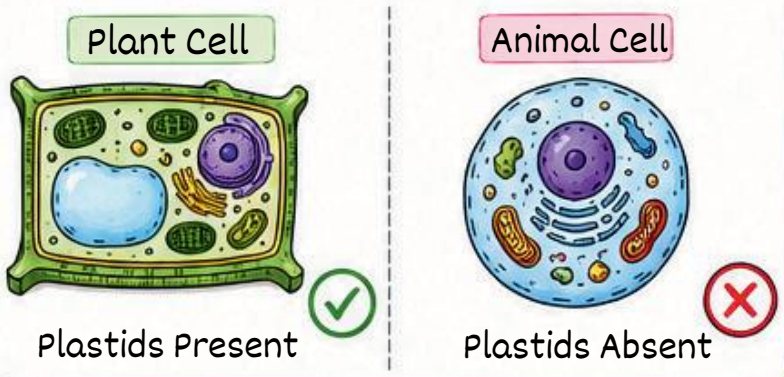
# PLASTIDS – ORGANELLES OF PLANT CELLS

## Definition

Plastids are double membrane-bound organelles found only in plant cells that help in food synthesis, storage and colouring.



## Important Point




## Types of Plastids

### 1. Chloroplasts

Green plastids
Photosynthesis

### 2. Chromoplasts

Colored plastids

Provide colors to fruits and flowers

### 3. Leucoplasts

Colorless plastids
Food storage

## CHLOROPLASTS

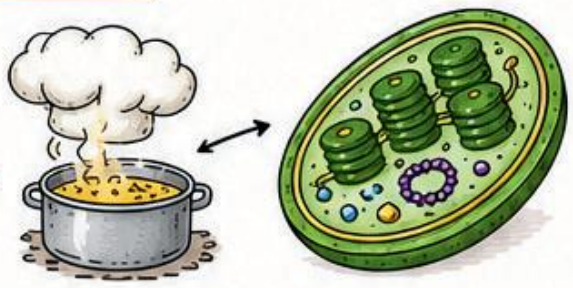
**Definition**

Chloroplasts are green plastids containing chlorophyll and are responsible for photosynthesis.

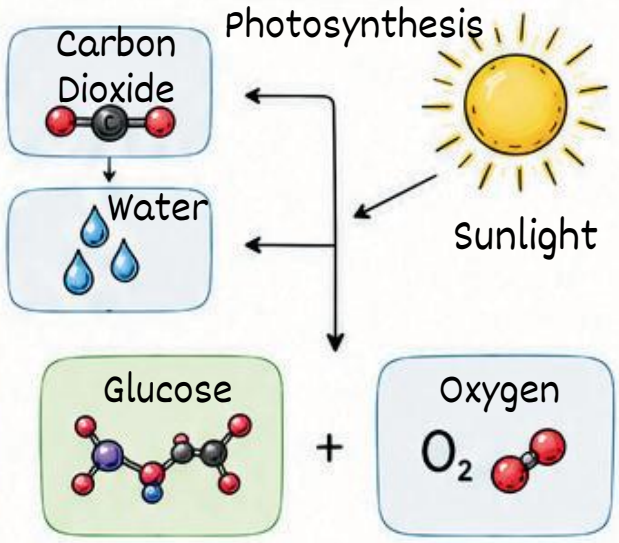
## Why Are Chloroplasts Important?

Plants prepare food inside chloroplasts.

Hence chloroplasts are called:
**KITCHEN OF THE CELL**



## Function




### Outer Membrane

Protective covering.

### Inner Membrane

Controls movement of substances.

### Stroma

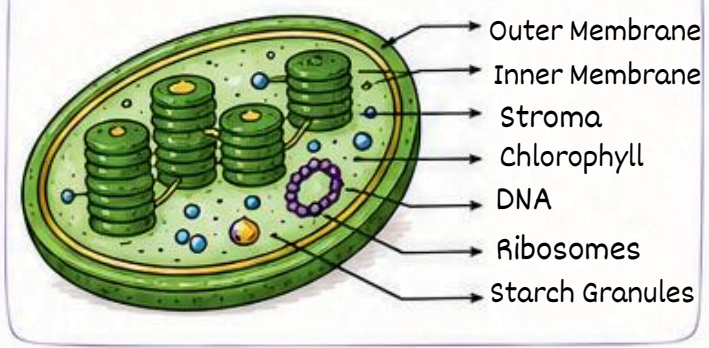
Fluid-filled matrix.

- DNA
- Starch granules
- Enzymes
- Ribosomes

### Chlorophyll

Green pigment responsible for photosynthesis.

## CHLOROPLAST LABELLED DIAGRAM

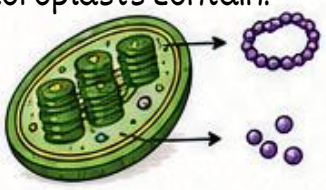



## Special Features

Like mitochondria, chloroplasts contain:

✓ DNA
✓ Ribosomes

Therefore they are:
semi-autonomous



## QUICK MEMORY

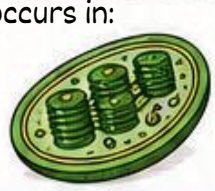
Chloroplast → Photosynthesis → Glucose → Plant Food

## Plastid Comparison

| plastids | | function |
|---|---|---|
| Chloroplast | | Photosynthesis |
| Chromoplast | | Colour |
| Leucoplast | | Storage |

**Q1.** Photosynthesis occurs in:

- Mitochondria
- Ribosome
- ✓ Chloroplast
- Golgi body



**Q2.** Green pigment in plants is:

- Haemoglobin
- Melanin
- ✓ Chlorophyll
- Keratin

**Q3.** Chloroplasts are found in:

- Animals
- Bacteria
- ✓ Plants
- Viruses

# PLASTIDS: CHROMOPLASTS & LEUCOPLASTS

Plastids are specialised plant cell organelles responsible for food synthesis, storage and colouring.

## 1. CHROMOPLASTS

**Definition**

Chromoplasts are coloured plastids containing pigments other than chlorophyll.

**Colours Produced**

- Yellow
- Orange
- Red

**Function**

Provide colour to:

- Flowers
- Fruits
- Vegetables

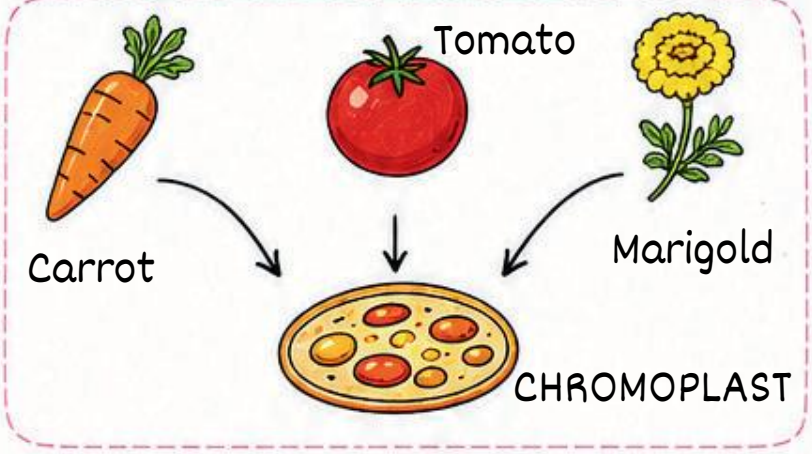
**Importance**

Bright colours attract:

- Pollinators
- Seed dispersers

**Examples**

| plant part | colour |
|---|---|
| Carrot | Orange |
| Tomato | Red |
| Marigold | Yellow |




## 2. LEUCOPLASTS

**Definition**

Leucoplasts are colourless plastids that store food materials.

**Characteristics**

- ✓ Colourless
- ✓ No pigments
- ✓ Storage function

**Function**

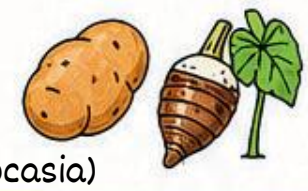
Storage of reserve food.

**Materials Stored**

**Starch**

Example:

- Potato
- Taro (Colocasia)



**Oils**

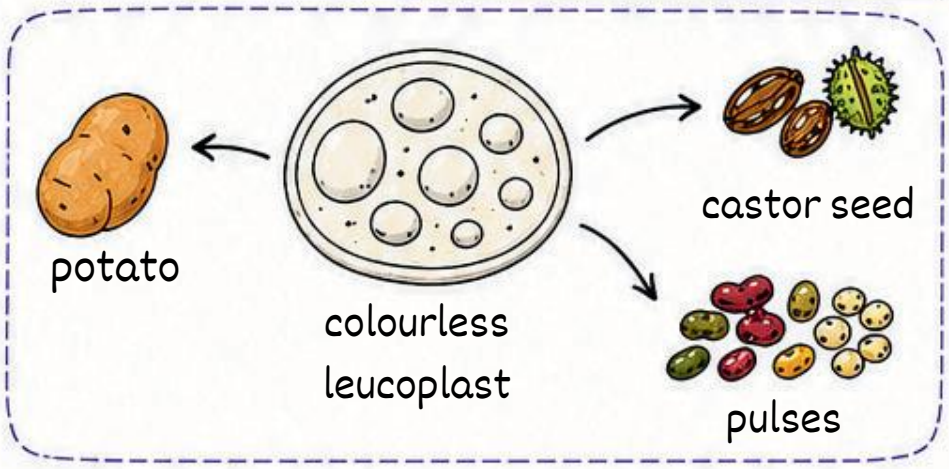
Example:

- Castor seeds

**Proteins**

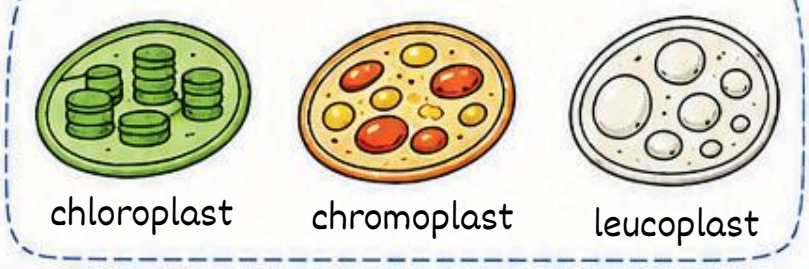
Example:

- Pulses




### Difference Between Plastids

| chloroplast | chromoplast | leucoplast |
|---|---|---|
| Green | Coloured | Colourless |
| Photosynthesis | Colouring | Storage |
| Chlorophyll present | Other pigments present | No pigments |
| Leaf cells | Flowers/Fruits | Roots/Tubers |




**Q1.** Chromoplasts contain:

A. Green pigments
B. Colour pigments ✓
C. ATP
D. DNA only

**Q2.** The red colour of tomato is due to:

A. Leucoplast
B. Chromoplast ✓
C. Ribosome
D. Nucleus

**Q3.** Leucoplasts are:

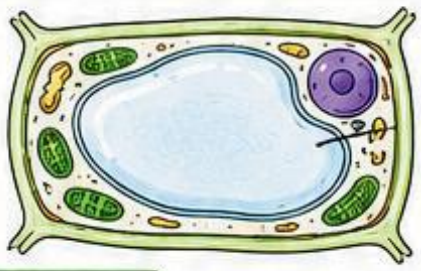
A. Green
B. Red
C. Colourless ✓
D. Blue

**Q4.** Potato stores starch in:

A. Chromoplasts
B. Chloroplasts
C. Leucoplasts ✓
D. Ribosomes

# VACUOLES – STORAGE AND SUPPORT ORGANELLES

Vacuoles are important storage organelles that help maintain water balance and support plant cells.



Central Vacuole

## Definition

Vacuoles are membrane-bound sacs filled with cell sap that store water, food, minerals and waste materials.

## Structure

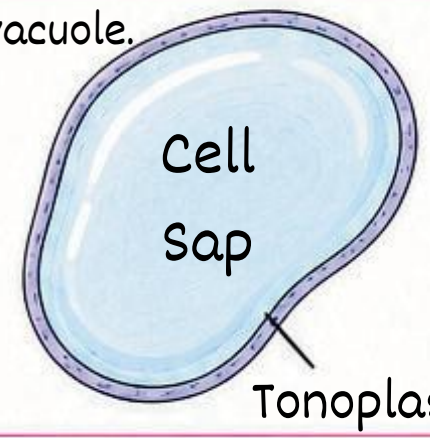
### Tonoplast

The membrane surrounding the vacuole.

### Cell Sap

Fluid present inside vacuole.

- Water
- Sugars
- Minerals
- Pigments
- Waste materials

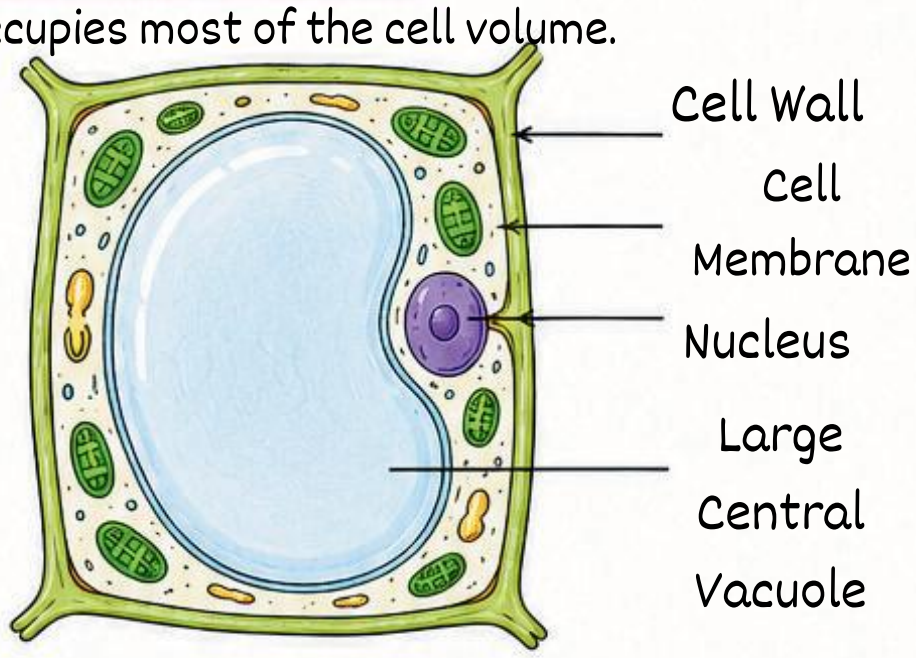



## Vacuoles in Plant Cells

Usually:

### One Large Central Vacuole

Occupies most of the cell volume.




## Functions in Plant Cells

### 1. Storage

- Water
- Minerals
- food
- Waste materials

### 2. Maintains Turgidity

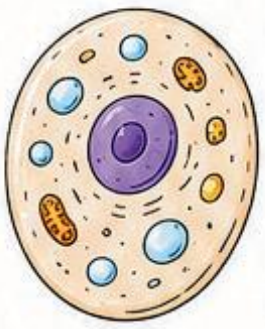
Keeps cells firm.

### 3. Prevents Wilting

Helps plants remain upright.

## Vacuoles in Animal Cells

- Small
- Temporary
- Less prominent



## Why Do Plants Wilt?

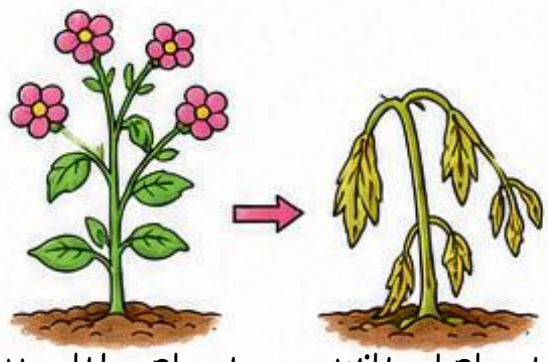
When water is lost:

- Vacuole shrinks.
- Cell loses pressure.
- Plant becomes limp.

This condition is called:

**WILTING**

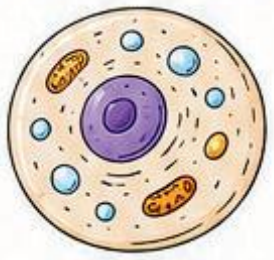
Healthy Plant
↓
Water lost
↓
Vacuole Shrinks
↓
Cell Loses Pressure
↓
Plant Becomes Limp
↓
WILTING



Healthy Plant Wilted Plant

## Plant Vacuole vs Animal Vacuole

| plant cell | Animal cell |
|---|---|
| One large vacuole | Small vacuoles |
| Permanent | Temporary |
| Occupies large volume | Less prominent |
| Maintains turgidity | Storage only |



# HOW DO CELLS GROW AND DIVIDE?

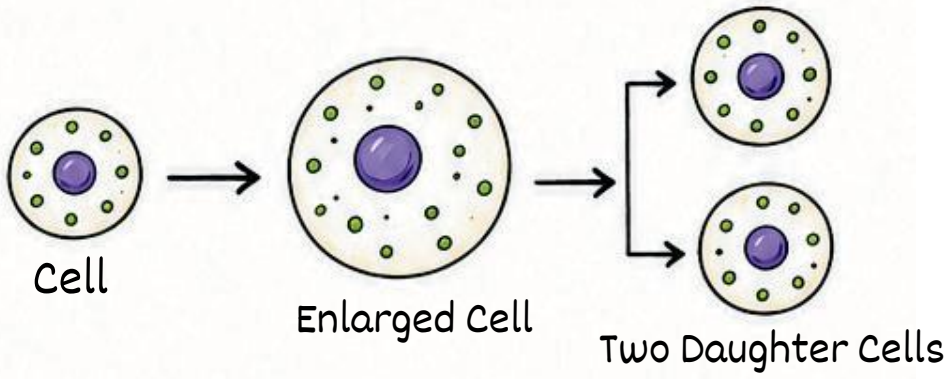
## Introduction

Growth in living organisms does not occur only because cells become bigger.

A cell can grow only up to a certain size.

Further growth occurs because:

➡ Existing cells divide to produce new cells.

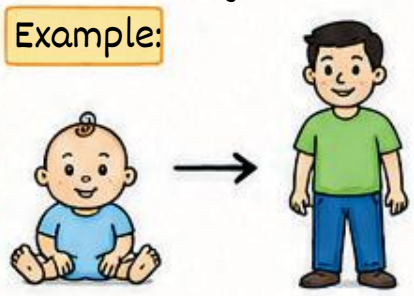



## WHY IS CELL DIVISION NECESSARY?

### 1. Growth

Increase in number of cells causes growth.

Example:

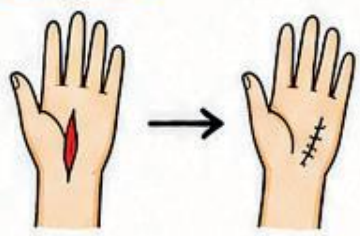


A baby grows into an adult because cells divide repeatedly.

### 2. Repair

Replaces damaged cells.

Example:

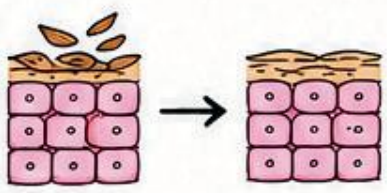


Healing of cuts and wounds.

### 3. Replacement

Replaces old and dead cells.

Example:

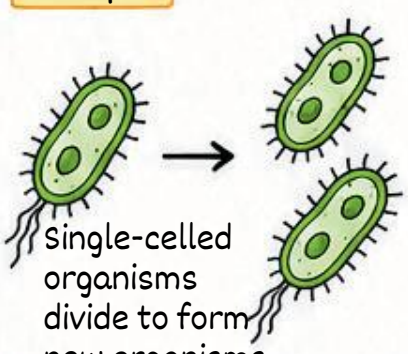


Skin cells are continuously replaced.

### 4. Reproduction

Produces new organisms.

Example:

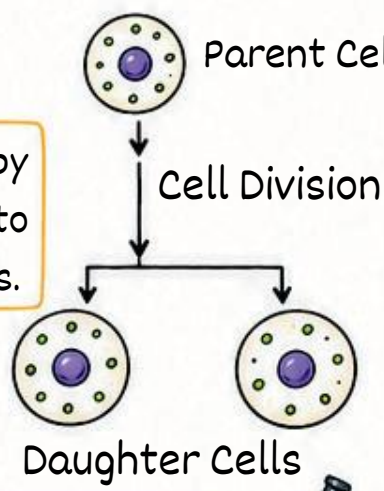


Single-celled organisms divide to form new organisms.

## CELL DIVISION

### Definition

Cell division is the process by which a parent cell divides to produce new daughter cells.




### Important Point

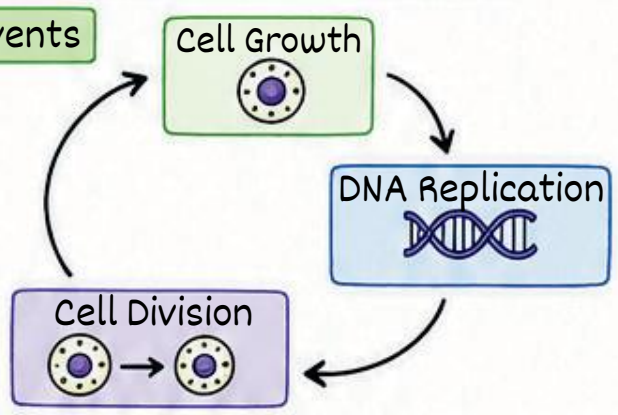
According to Cell Theory:
New cells arise only from pre-existing cells.

## CELL CYCLE

### Definition

The orderly sequence of events through which a cell grows and divides is called the cell cycle.

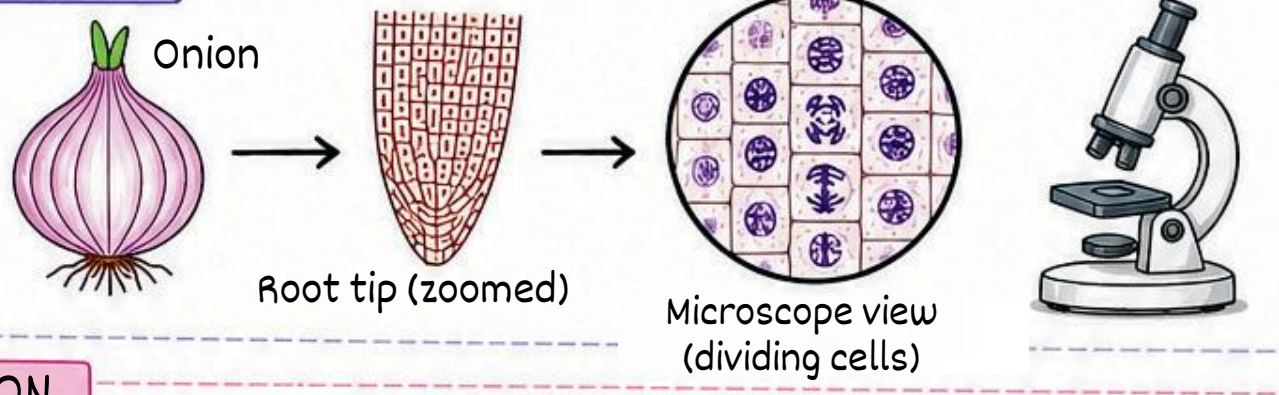
### Major Events




## OBSERVATION OF CELL DIVISION

### Onion Root Tip

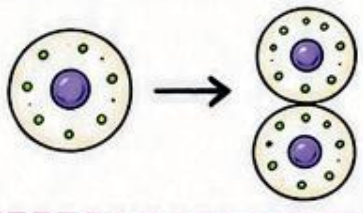
The onion root tip is a region where cells divide continuously. Therefore it is commonly used to study cell division.




## TYPES OF CELL DIVISION

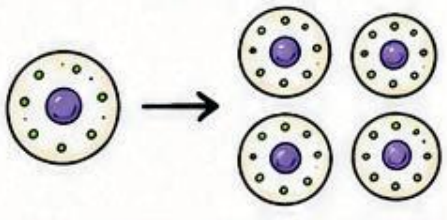
### 1. MITOSIS

Cell dividing into two daughter cells.



### 2. MEIOSIS

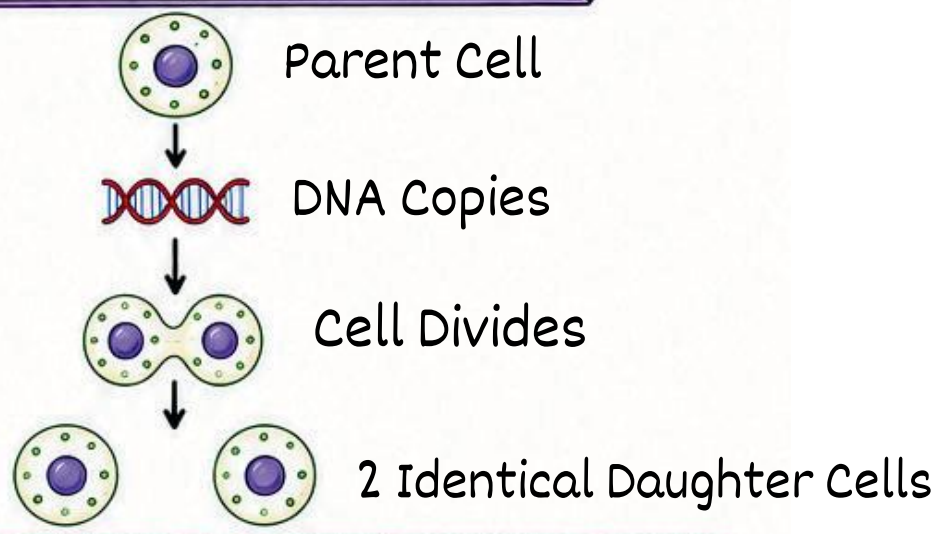
Cell dividing into four daughter cells.



# MITOSIS

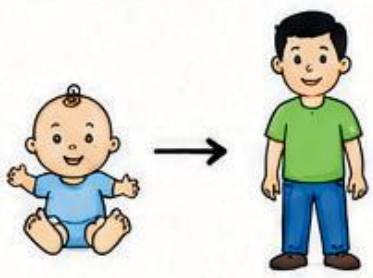
## Definition

Mitosis is a type of cell division in which one parent cell produces two genetically identical daughter cells.

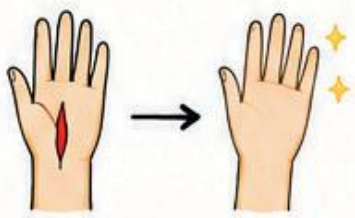



## WHY IS MITOSIS IMPORTANT?

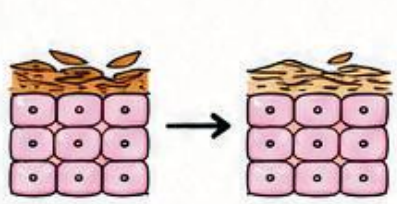
### Growth



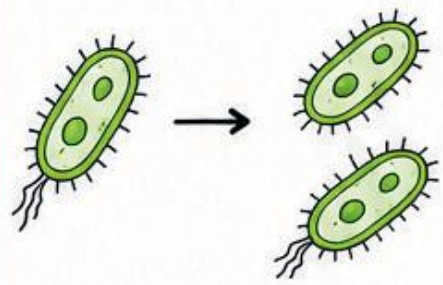
### Repair



### Replacement of old cells

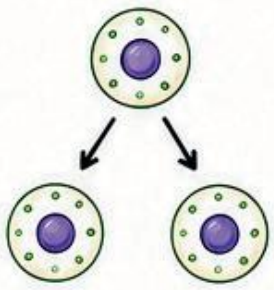


### Asexual reproduction



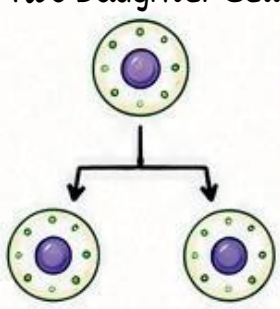
## CHARACTERISTICS OF MITOSIS

1. One Division



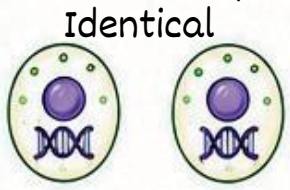
the parent cell divides only once.

2. Two Daughter Cells



Produces: Two daughter cells

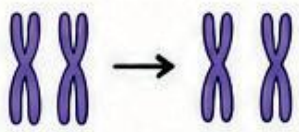
3. Genetically Identical



Daughter cells contain:

- Same DNA
- Same genes
- Same chromosomes as the parent cell.

4. Chromosome Number Remains Same

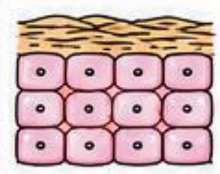


- No reduction in chromosome number.

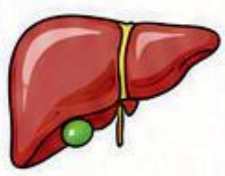
## SIMPLE FLOW

Parent Cell → DNA Copies → Cell Divides → 2 Identical Daughter Cells

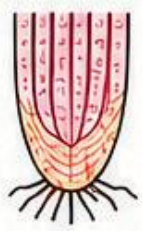
## EXAMPLES



Skin cells



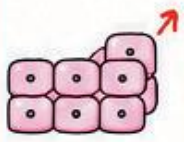
Liver cells



Root tip cells

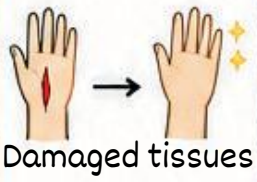
## IMPORTANCE OF MITOSIS

### Growth



Increase in cell number.

### Wound Healing

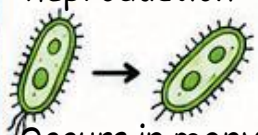


Damaged tissues repaired.

### Cell Replacement

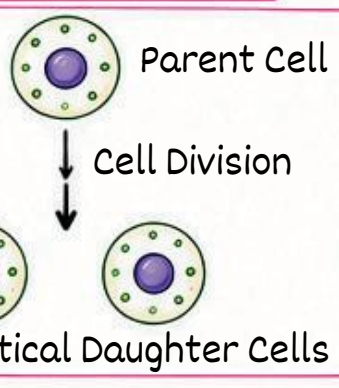
Dead cells replaced.

### Asexual Reproduction



Occurs in many unicellular organisms.

## DIAGRAM TO DRAW




## MCQ's

**Q1. Mitosis produces:**

A. One cell
B. Two identical cells ✓
C. Four cells
D. Eight cells

**Q2. Mitosis helps in:**

A. Sexual reproduction
B. Growth and repair ✓
C. Pollination
D. Fertilization

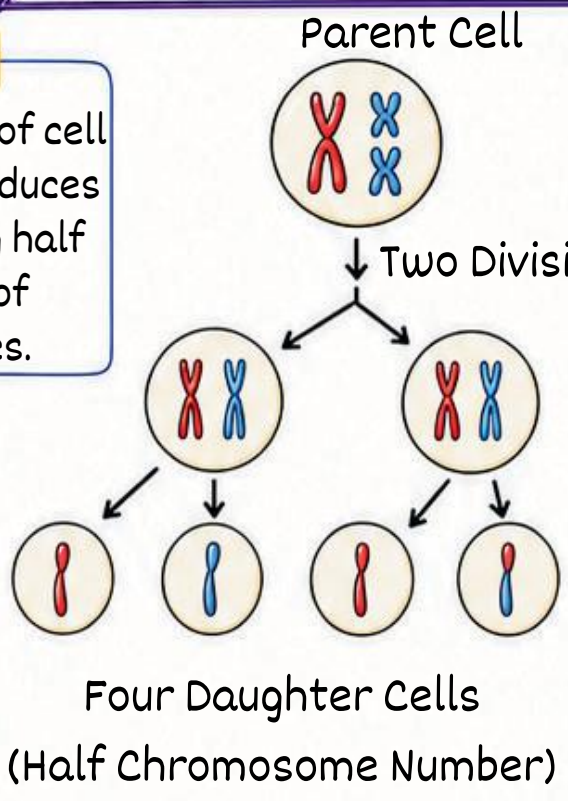
**Q3. Chromosome number after mitosis:**

A. Doubles
B. Halves
C. Remains same ✓
D. Becomes zero

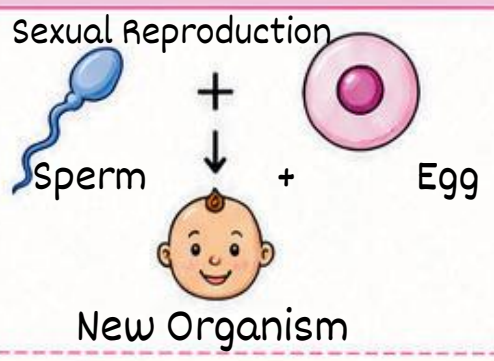
# MEIOSIS

## Definition

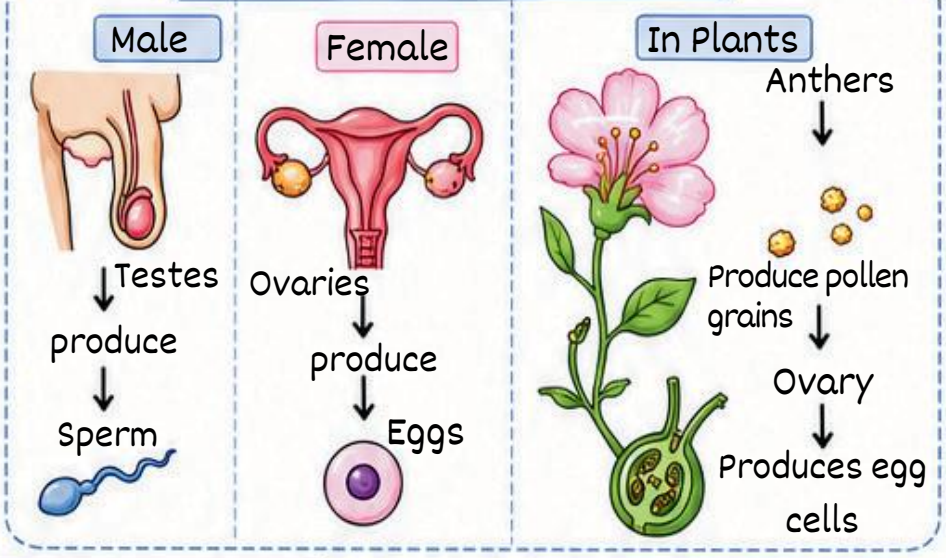
Meiosis is a type of cell division that produces gametes having half the number of chromosomes.




## WHY IS MEIOSIS IMPORTANT?



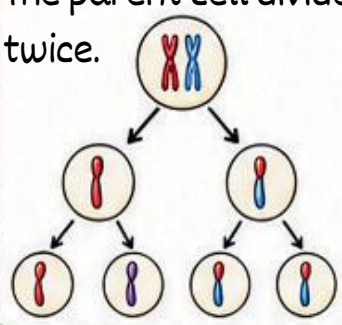

## WHERE DOES MEIOSIS OCCUR?




## CHARACTERISTICS OF MEIOSIS

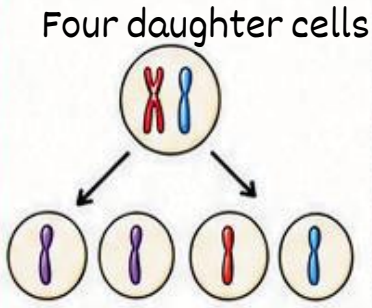
### 1. Two Successive Divisions

The parent cell divides twice.

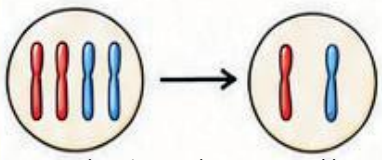


### 2. Four Daughter Cells

Produces:
Four daughter cells

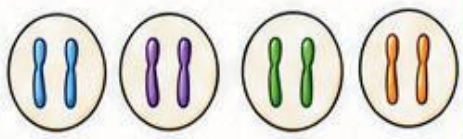


### 3. Chromosome Number Becomes Half



Each daughter cell receives half the chromosomes.

### 4. Genetic Variation Produced

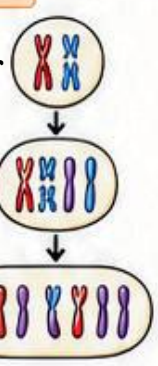


Daughter cells are not identical.

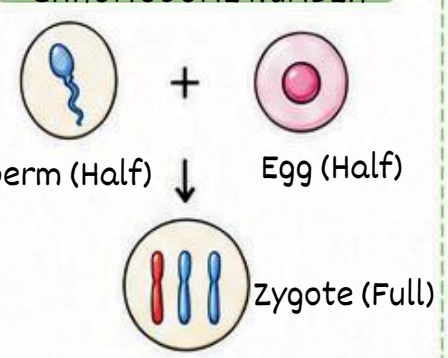
## WHY IS CHROMOSOME NUMBER REDUCED?

If chromosome number remained unchanged:

- It would double in every generation.
- Meiosis prevents this.



## FERTILIZATION RESTORES CHROMOSOME NUMBER

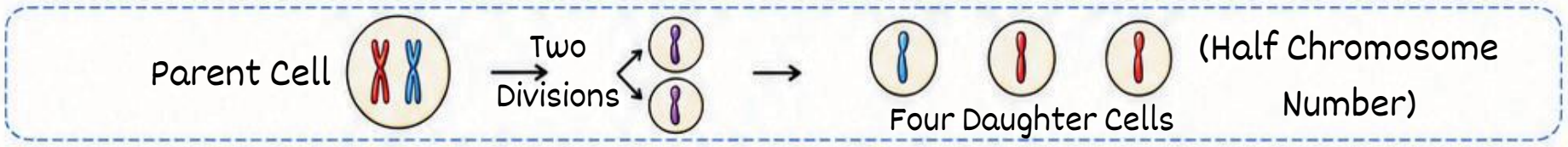



## IMPORTANCE OF MEIOSIS

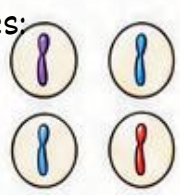
1. Formation of Gametes
Produces sperm and eggs.

2. Maintains Chromosome Number
Across generations.

3. Creates Variations
Responsible for diversity among organisms.

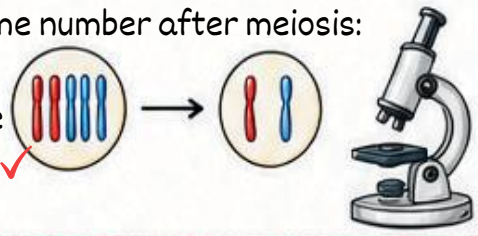



1. Meiosis produces:
A. Two cells
B. Four cells ✓
C. One cell
D. Eight cells

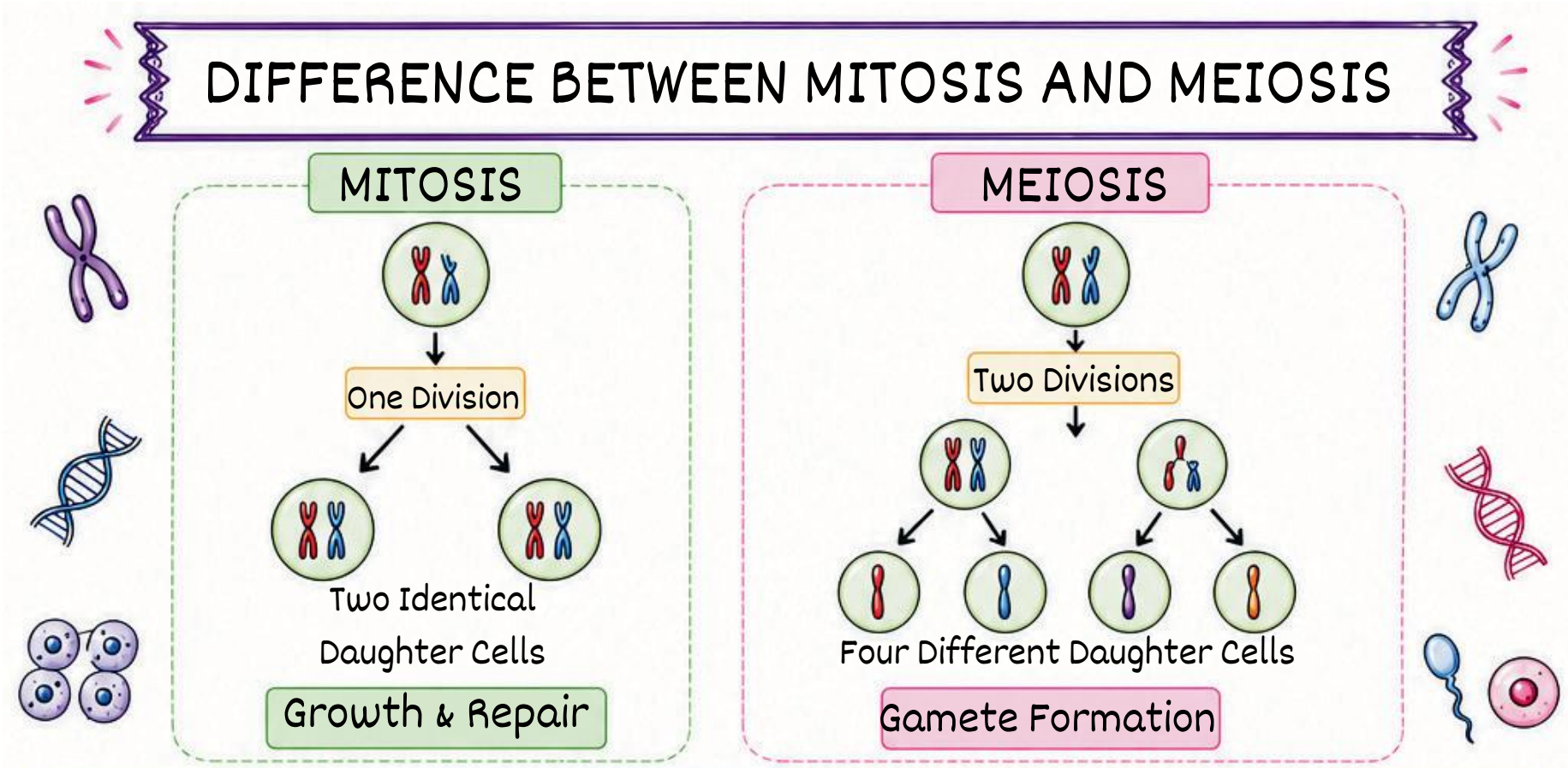


2. Meiosis occurs in:
A. Skin cells
B. Liver cells
✓ C. Reproductive cells
D. Root cells

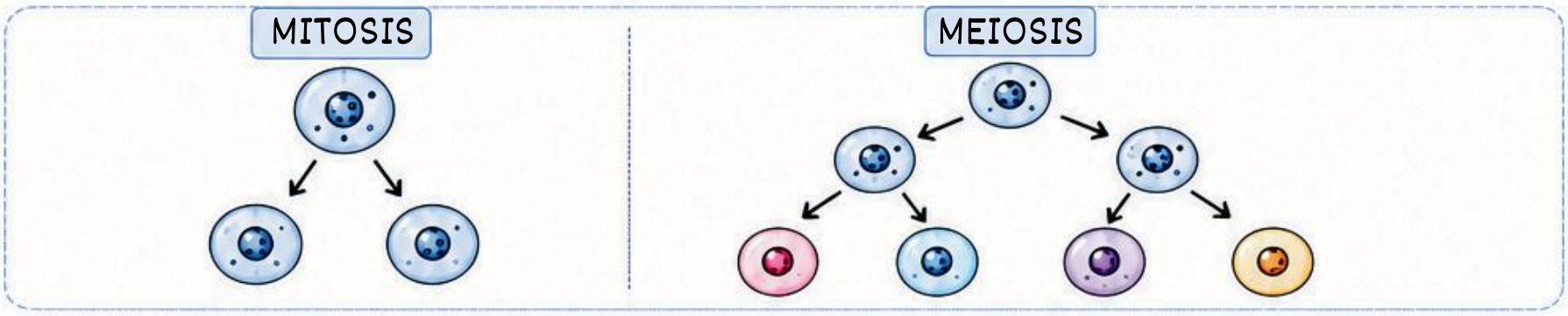
3. Chromosome number after meiosis:
A. Doubles
B. Remains same
C. Becomes half ✓
D. Triples

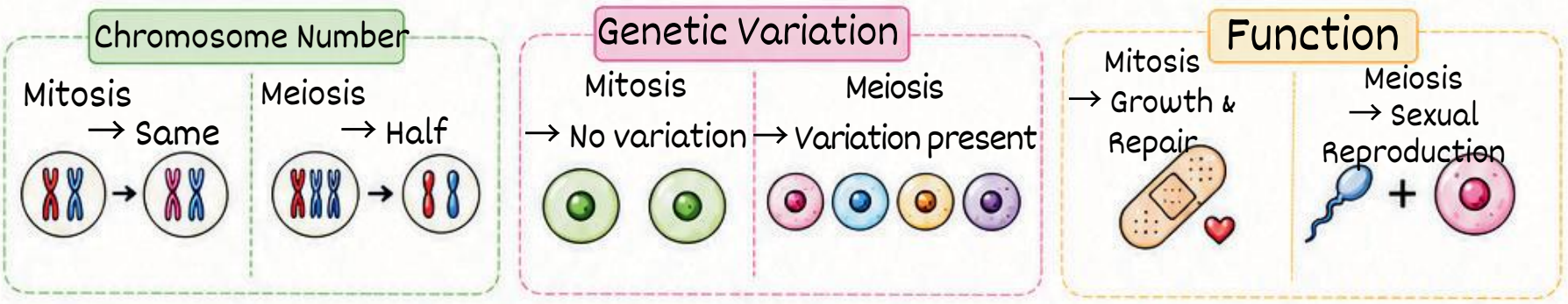


# DIFFERENCE BETWEEN MITOSIS AND MEIOSIS



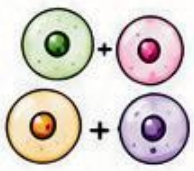

| | MITOSIS | MEISOSIS | |
|---|---|---|---|
| | One division | Two divisions | |
| | Produces 2 cells | Produces 4 cells | |
| | Chromosome number remains same | Chromosome number becomes half | |
| | Daughter cells identical | Daughter cells different | |
| | Growth and repair | Gamete formation | |
| | Body cells | Reproductive cells | |




Q1. Which division produces variation?

A. Mitosis
B. Meiosis ✓
C. Binary Fission
D. Budding



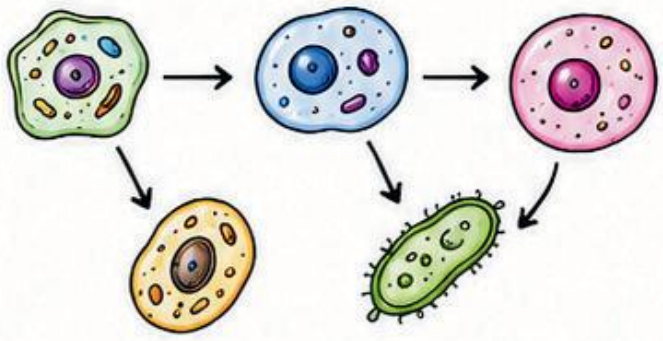
Q2. Which division is responsible for growth?

A. Meiosis
B. Mitosis ✓
C. Fertilization
D. Pollination

# CELL THEORY

## Definition

Cell Theory is the fundamental theory of biology explaining the structure and origin of living organisms.



## SCIENTISTS ASSOCIATED WITH CELL THEORY

### Matthias Schleiden (1838)

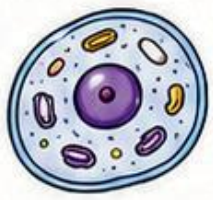
**Proposed:**

All plants are made of cells.

### Theodor Schwann (1839)

**Proposed:**

All animals are made of cells.



### Rudolf Virchow (1855)

**Proposed:**

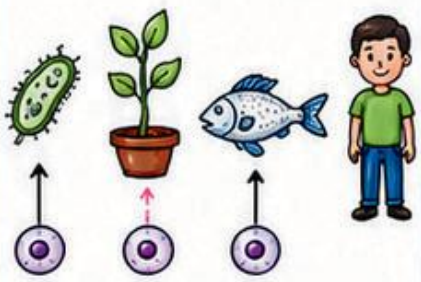
"Omnis Cellula e Cellula"

**Meaning:**

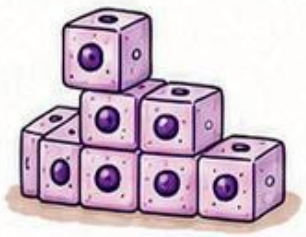
All cells arise from pre-existing cells.

## MAIN POSTULATES OF CELL THEORY

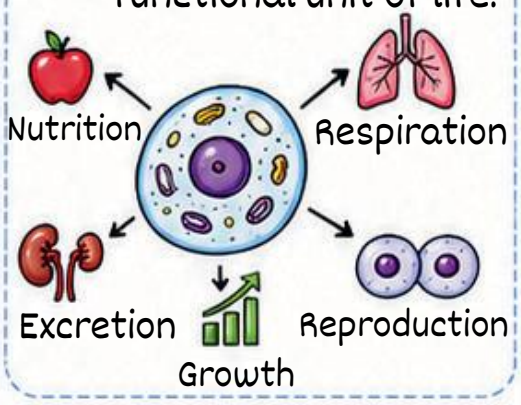
1. All living organisms are made up of one or more cells.



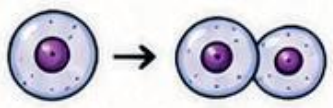
2. Cell is the basic structural unit of life.



3. Cell is the basic functional unit of life.

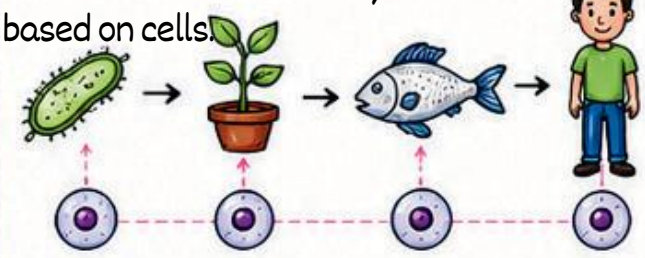



4. All cells arise from pre-existing cells.



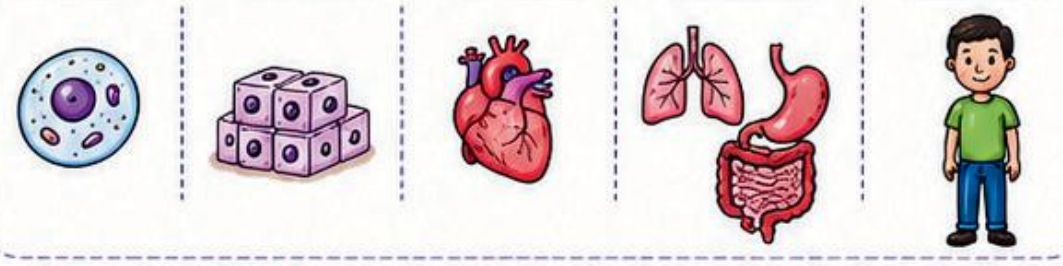
## SIGNIFICANCE

Cell Theory unifies all living organisms. From bacteria to humans, all life is based on cells.



## SUMMARY FLOWCHART

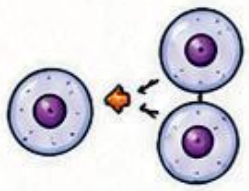
Cells → Tissues → Organs → Organ Systems → Organisms



## MCQ's

1. Who proposed that all cells arise from pre-existing cells?

A. Hooke
B. Virchow ✓
C. Schleiden
D. Schwann



2. Cell Theory was proposed by:

A. Hooke and Virchow
B. Schleiden and Schwann ✓
C. Darwin and Lamarck
D. Mendel and Morgan

3. Cell is the:

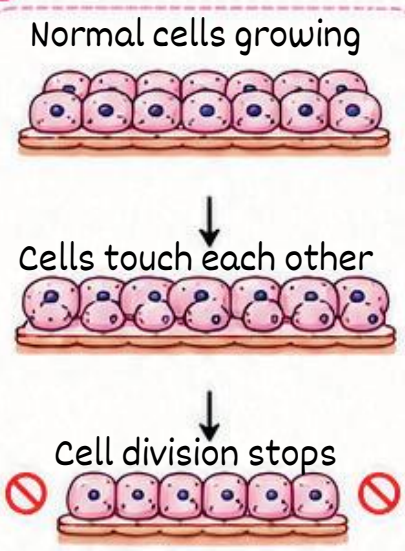
A. Basic structural unit
B. Basic functional unit
C. Both A and B ✓
D. Neither

# CONTACT INHIBITION AND CANCER

## CONTACT INHIBITION

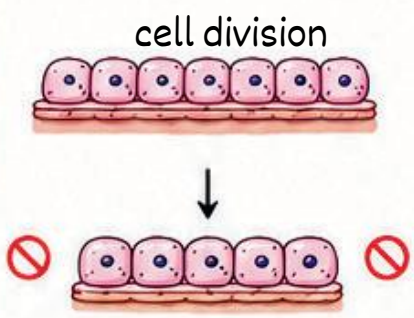
**Definition**

The phenomenon in which normal animal cells stop dividing when they come into contact with neighbouring cells.

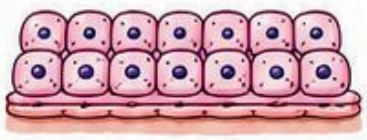



**Importance**

Prevents unnecessary cell division



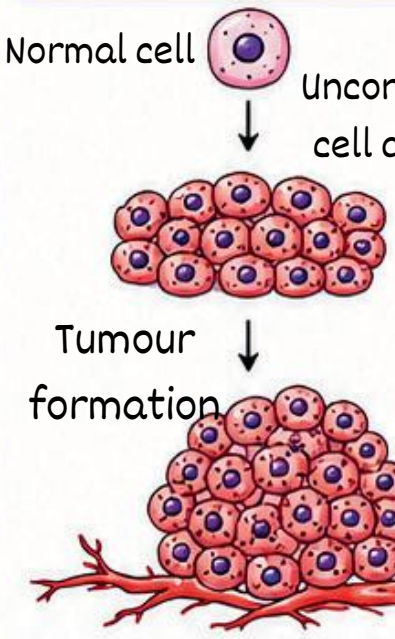
Maintains proper tissue organization



## CANCER

**Definition**

Cancer is a disease in which cells divide uncontrollably and form tumours.



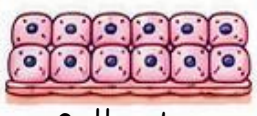

## WHY DOES CANCER OCCUR?

Cancer cells lose:

Contact Inhibition

Loss of Contact Inhibition → Continuous Division → Tumour Development

**Normal cells**



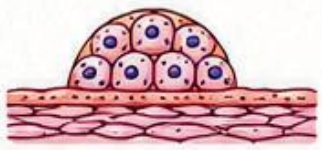
Cells stop dividing when they touch.

**Cancer cells**

Cells keep dividing without stopping.

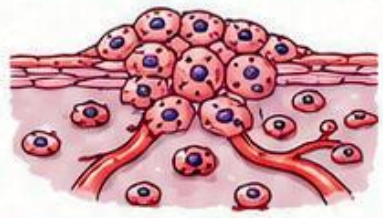
## TYPES OF TUMOURS

**BENIGN TUMOUR**



- Non-cancerous
- Localized
- Slow growth

**MALIGNANT TUMOUR**



- Cancerous
- Spreads to other organs
- Rapid growth

## VISUAL COMPARISON

**Normal Tissue**

Neat, orderly and uniform cells.

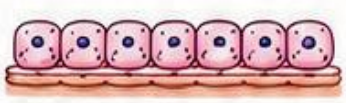
**Cancer Tissue**

Irregular, overcrowded and disorganized cells

## SUMMARY FLOWCHART

**Normal Cells**

Contact Inhibition Present → Controlled Growth → Healthy Tissue



**Cancer Cells**

Contact Inhibition Lost → Uncontrolled Growth → Tumour Formation

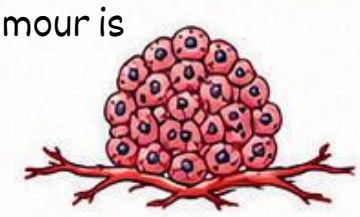
## MCQ's

**Q1** Cancer cells lose:

A. Respiration
B. Contact inhibition ✓
C. ATP
D. Cytoplasm

**Q2** A cancerous tumour is called:

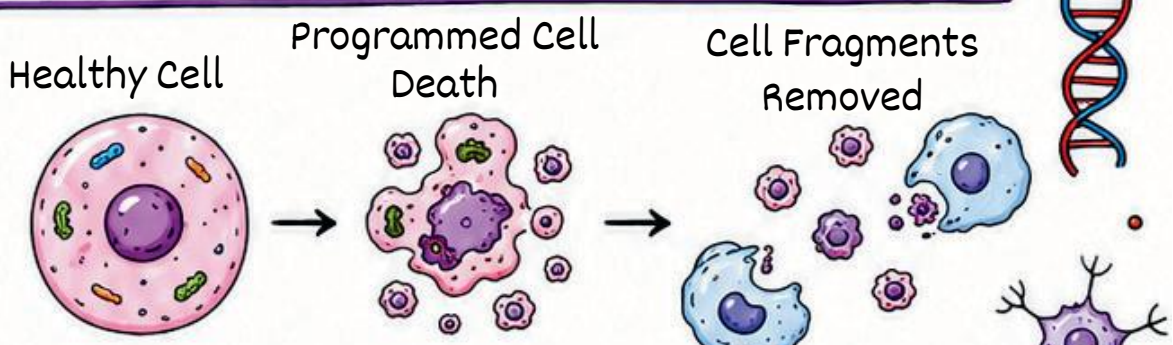
A. Benign
B. Malignant ✓
C. Temporary
D. Permanent



# PROGRAMMED CELL DEATH (PCD)

## Definition

Programmed Cell Death is a genetically controlled process through which cells die in an organized manner.



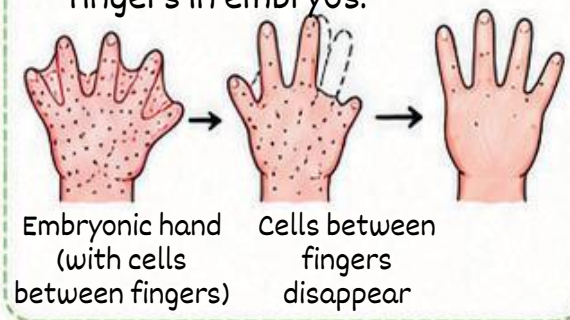

## IMPORTANCE

### 1. Development

Helps shape organs.

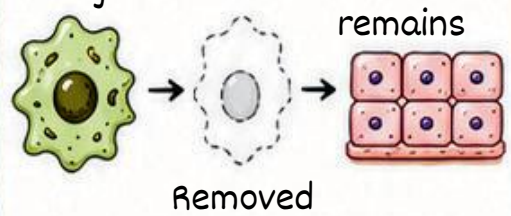
Example:

Removal of cells between fingers in embryos.



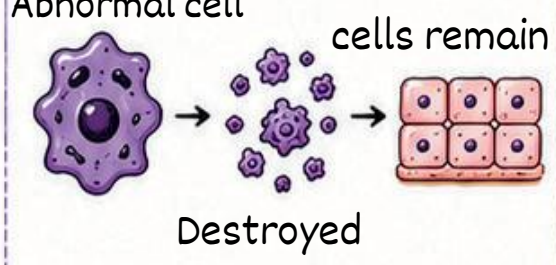

### 2. Removal of Damaged Cells

Maintains healthy tissues.




### 3. Prevents Abnormal Growth

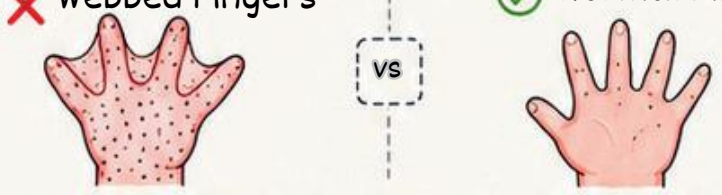
Removes harmful cells.



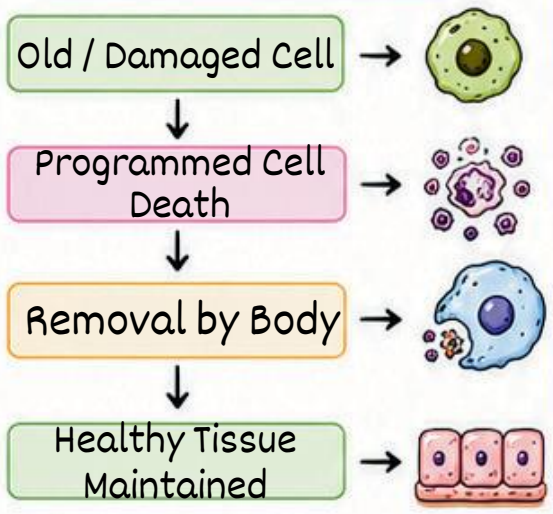

## IMPORTANT FACT

Without PCD:

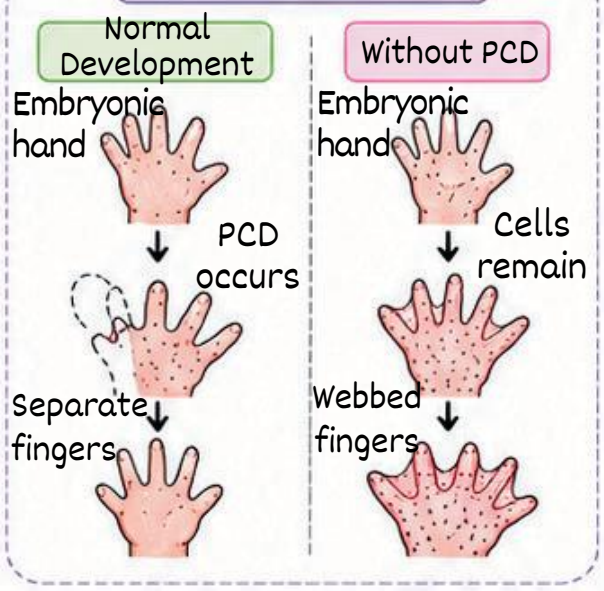
Humans would have webbed fingers.




## HOW PCD HELPS THE BODY




## VISUAL COMPARISON




## SUMMARY

- Shapes organs.
- Removes damaged cells.
- Prevents abnormal growth.
- Maintains healthy tissues.

## IMPORTANT QUESTIONS

Q1 What is Programmed Cell Death?

Q2 Why is PCD important in development?

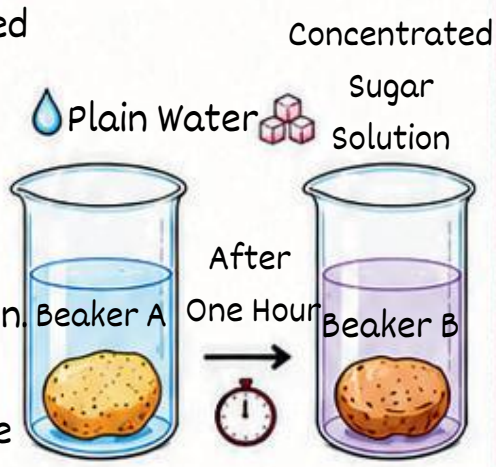
Q3 What would happen if PCD did not occur?

# Add CASE STUDY & APPLICATION QUESTIONS – CELLS AND OSMOSIS

## 1. Case Study – Potato Experiment

A student places two equal-sized potato pieces in two beakers.

- Beaker A contains plain water.
- Beaker B contains concentrated sugar solution.




After one hour, the potato in Beaker A becomes swollen while the potato in Beaker B shrinks.

### Result

Beaker A → Swollen Potato

Beaker B → Shrunken Potato 

## Questions

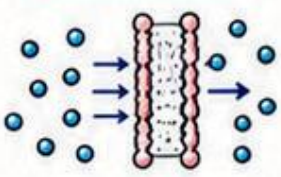
(a) Name the process responsible for these observations.

(b) Why does the potato in Beaker A swell?

(c) Why does the potato in Beaker B shrink?

### Solution

(a) Process: **Osmosis**

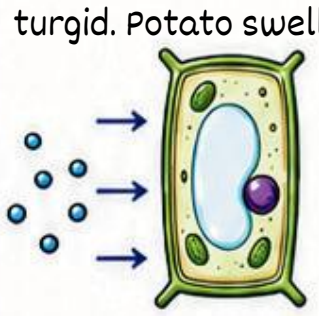


Movement of water through a selectively permeable membrane.

**(b) Why does the potato in Beaker A swell?**

- Water concentration is higher outside the potato.
- Water enters potato cells through the cell membrane.

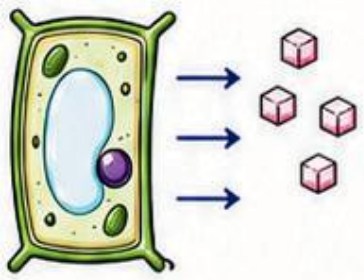
As a result: Cells become turgid. Potato swells.



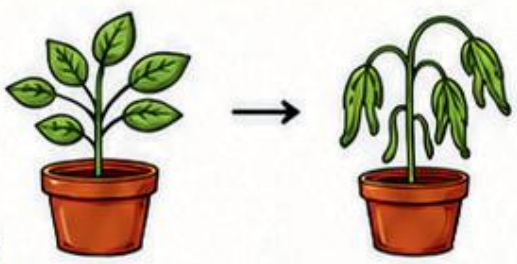
**(c) Why does the potato in Beaker B shrink?**

- The sugar solution is hypertonic.
- Water moves out of potato cells.

As a result:
Cells lose water.
Potato shrinks.



## 2. A plant kept without water for several days becomes wilted. Explain why this happens.



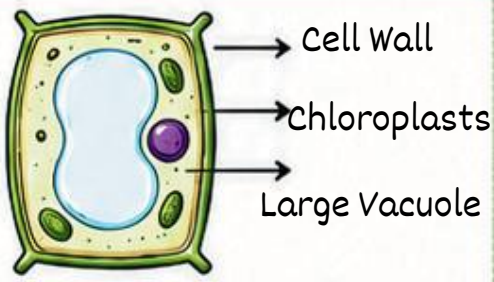
Healthy Plant Wilted Plant

### Solution

- The vacuoles of plant cells lose water.
- Due to loss of water:
  1. Turgor pressure decreases.
  2. Cells become flaccid.
  3. Plant loses firmness.

Hence the plant wilts.

## 3. A scientist observes a cell under a microscope The cell has: Cell wall, Chloroplasts, Large vacuole. Identify the cell and justify your answer..




### Solution

The observed cell is: Plant Cell

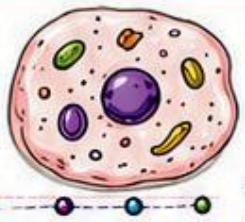
Reason:

- Cell wall, chloroplasts and a large central vacuole are characteristic features of plant cells.
- Animal cells lack these structures.

## 4. A bacterial cell and a human cheek cell are observed. Give any four differences between them.

| Bacterial Cell | Human Cheek Cell |
|---|---|
| Prokaryotic | Eukaryotic |
| No true nucleus | True nucleus present |
| No membrane-bound organelles | Organelles present |
| Smaller size | Larger size |

## 5. A cell contains a nucleus but lacks chloroplasts and cell wall. Which type of cell is it? Give two reasons.



**Solution:** It is an: Animal Cell
Reasons: Cell wall absent.
Chloroplast absent.

# CASE STUDY & APPLICATION QUESTIONS – CELL ORGANELLES

## 6. Assertion–Reason

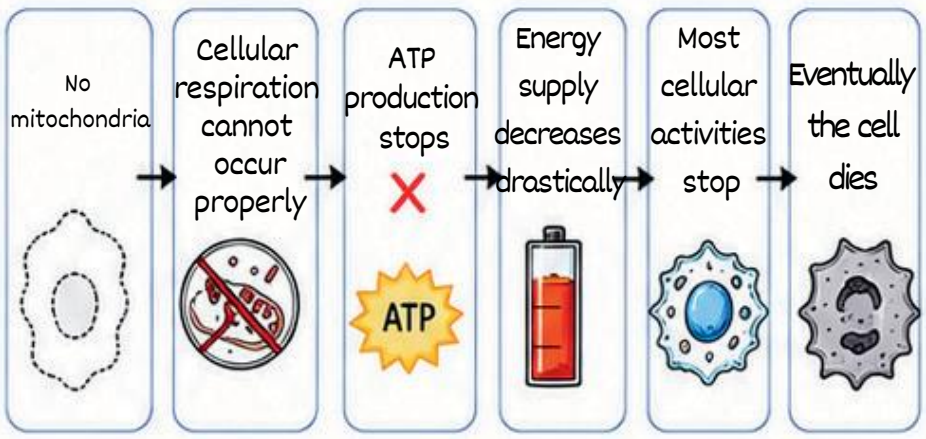
Assertion (A):
Mitochondria are called the powerhouse of the cell.
Reason (R):
Mitochondria produce ATP during cellular respiration.
Choose the correct option:

A. Both A and R are true and R explains A.
B. Both A and R are true but R does not explain A.
C. A is true but R is false.
D. A is false but R is true.

### Solution

Correct Answer: A
Explanation:
ATP is the energy currency of the cell.
Since mitochondria produce ATP, they are called powerhouses.

## 7. A cell loses all its mitochondria. Predict the consequences.




## 8. Why are mitochondria and chloroplasts called semi-autonomous organelles?

Both contain:

- Their own DNA
- Their own ribosomes

Therefore they can synthesize some proteins independently.

Hence they are called semi-autonomous organelles.

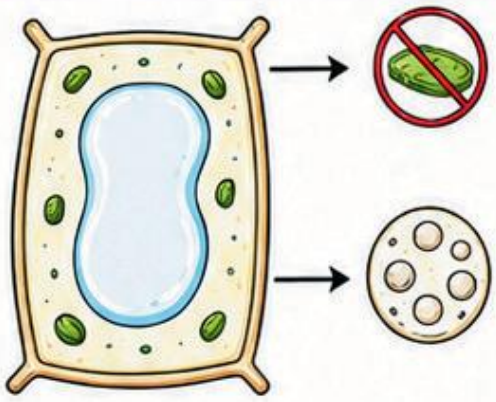
## 9. A flower is brightly coloured but does not perform photosynthesis. Which plastid is mainly responsible for its colour?

Plastid: Chromoplast
Importance:
Bright colours attract:

- Insects
- Birds

Other pollinators
This helps pollination.

## 10. Why do root cells generally lack chloroplasts but may contain leucoplasts?




### Solution

- Roots are underground and receive little or no sunlight.

Therefore:

- Photosynthesis does not occur.
- Chloroplasts are unnecessary.

However food storage is needed.
Hence leucoplasts are present.