

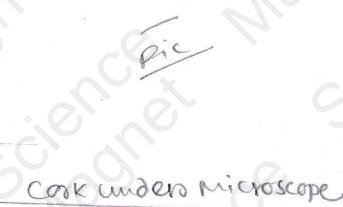
# CELL

## • Definition of cell :

- > Fundamental unit of life.
- > Building blocks of life.
- > Structural & functional unit of life.

## • Discovery of Cell :

- > First discovered by Robert Hooke in 1665 (observed Cork).
- > Cork is obtained from bark of tree.
- > Robert Hooke coined the term cell (from Latin cellula meaning "small room") in his book Micrographia (1665).



Honeycomb pattern.

## • Others discoveries :

>> Antonie Van Leeuwenhoek

His most important discovery was the existence of single-cell organisms (Protozoa : 1674)

>> Robert Brown :

He discovered the cell nucleus which helped in proving the cell theory. (1831)

>> Jan Evangelista Purkinje :

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*pic*

Cork under microscope



Honeycomb pattern

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### • Cell Theory :

Presented by 2 biologists -

1. Schleiden (1838)
2. Schwann (1839)

- All animals and plants are composed of cells.
- Basic unit of life is cell

- Rudolf Virchow (1855) expanded,  
Cells arise from pre-existing cells.

### • Modern Cell Theory :

- > All living organisms are made of cells.
- > Cells are the structural and functional units of all living organisms.
- > These cells have originated from already existing cells.

### ■ Variety in Cells :- Based on Numbers of Cells :

#### • Unicellular Organisms :

Organisms made of a single cell, capable of performing all necessary life functions independently.

Examples : Bacteria, Yeast, Chlamydomonas, Amoeba, Paramecium.

#### • Few-Celled Organisms :

Organisms composed of a few hundred to a few thousand cells, representing an intermediate complexity.

Examples : Spirogyra and Volvox

#### • Multicellular Organisms :

Organisms made of millions to billions of cells, characterized by complex structures and differentiation.

Examples : Human, Bull, Banana tree, Sparrow.

### • Variety in cells :

- The reduced cell count in smaller organisms does not hinders their functionality.
- Regardless of being composed of millions to trillions of cells, every living organism originates from a single fertilized egg cell, known as a zygote.

Pic draw.

### • Variety in Cells :> Based on size of cells :

- Smallest Cell :
  - = Bacteria ( $0.3 - 0.5 \mu\text{m}$ )
  - = Red blood Cells ( $7 \mu\text{m}$ )
- Longest Cell : Nerve cell in the neck of a giraffe.  
( $> 3\text{m}$  long)
- Largest Cell : Ostrich egg ( $170\text{mm} \times 130\text{mm}$ )

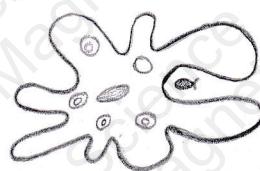
### • Variety in Cells :> Based on Shape of Cells :

- Columnar : Epithelial Cells
- Spherical : Human Ovum
- Oval : Fat Cells
- Biconcave : Red blood cells .
- Spiral : Sperm cell
- Rectangular : Spirogyra
- Rod-Shaped : Bacteria
- C-shaped : Cartilage Cells
- Cylindrical : Striated muscle fibre Cells

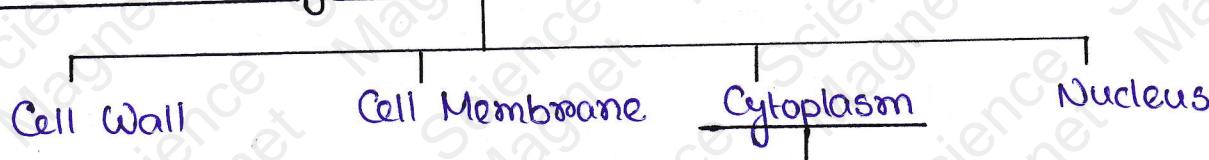
## ① Variety in Cells :- Based on shape of Cells :-

- Branched : Nerve Cells
- Spindle-shaped : Smooth Muscle cells
- Bean-shaped : Guard cell from a plant leaf.
- Irregulars : Amoeba

Amoeba is irregular in shape. It changes its shape continuously due to the presence of pseudopodia. The change in shape helps amoeba in movement and in capturing food.



## ■ Structural Organisation of a Cell :



Endoplasmic Reticulum,  
Mitochondria, Golgi Apparatus, Ribosome,  
Lysome, Plastide.

## ■ Cell Wall [In plant, Bacteria & Fungus cells only]

- > Absent in animal cell.
- > Protects the contents of cell.
- > Made up of cellulose
- > Freely permeable.
- > Provides strength to cell.

### Q) Facts about Cell Wall :

- > Mycoplasma do not contain cell wall.
- > Animal do not contain cell wall.

Organism	Cell Wall Composition
Plant	Cellulose
Bacteria	Pectin
Fungus	Chitin

Q. Who discovered the cell?

[RRB NTPC 30/12/2020 S-II]

- A. Theodorus Schwann
- B. Robert Hooke
- C. Matthias Schleiden
- D. Rudolf Virchow

Q. The cell theory given by Schleiden and Schwann is not applicable to which of the following organisms?

[RRB Group D 02/08/22 S-II]

- A. Fungi
- C. Viruses
- B. Animal
- D. Algae

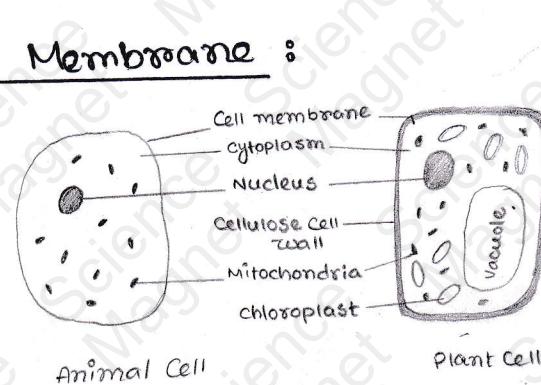
Q. Cell theory does not apply to which of the following?

RRB SSE 21.12.2014

- A. Bacteria
- C. Algae
- B. Fungus
- D. Virus

### Q) Plasma Membrane / Cell Membrane :

Forms the outermost covering in animal cells and lies next to the cell wall in plant cells.



## Plasma Membrane / Cell Membrane :

### Main characteristics :

- > Thin
- > Flexible
- > Delicate
- > living membrane that possesses tiny pores.

Q. What is the jelly like substance and the cell membrane called?

filled between the nucleus

[RRB NTPC 07/03/21 S-I]

A. Protoplasm

c. Nucleus

b. Chloroplast

d. Cytoplasm

### Main functions of Plasma membrane :

- > It permits the entry and exit of some materials in and out of the cell. The cell membrane is called a selectively permeable membrane.
- > It is made up of lipid and protein.

### Endocytosis :

The flexibility of the cell membrane also enables the cell to engulf in food and other material from its external environment. Such processes are known as endocytosis. Amoeba acquires its food through such processes.

### Diffusion and Osmosis :

- > The spontaneous movement of a substance from a region of high concentration to a region of low concentration is called diffusion.

Some substances like carbon dioxide or oxygen can move across the cell membrane by a process called diffusion.

## • Diffusion and Osmosis :

► The movement of water molecules through a semipermeable membrane along the concentration gradient is called osmosis.

Examples : • Unicellular freshwater organisms and most plant cells tend to gain water through osmosis.

• Absorption of water by plant roots is also an example of osmosis.

### ► Hypotonic Solution :

If the medium surrounding the cell has a higher water concentration than the cell, meaning that the outside solution is very dilute, the cell will gain water by osmosis. Such a solution is known as a hypotonic solution.

### ► Hypertonic Solution :

If the medium has a lower concentration of water than the cell, meaning that it is a very concentrated solution, the cell will lose water by osmosis. Such a solution is known as a hypertonic solution.

### ► Isotonic Solution :

If the medium has the same water concentration as the cell, there will be no net movement of water across the cell membrane. Such a solution is known as an isotonic solution.

## • Cytoplasm :

### ► Nature and occurrence :

Content inside the plasma membrane, excluding the nucleus.

### ► Main characteristics :

Transparent jelly-like material that contains a mixture of water, soluble organic and inorganic compounds, and various cell organelles.

### ► Main functions :

- Different organelles contained in it perform different functions.
- Centre of all metabolic activities.

## • Endoplasmic Reticulum (ER) :

### ► Nature and Occurrence :

The endoplasmic reticulum (ER) is a large network of membrane bound tubes and sheets.

### ► Main characteristics :

- Continuous with the plasma membrane on the outside and nuclear membrane on the inside.
- Two parts → Smooth endoplasmic reticulum (SER) & Rough endoplasmic reticulum (RER)

### ► Main Functions :

- Supportive framework of the cell.

► Main functions of ER :

- RER synthesizes proteins, while SER synthesizes lipids.
- Provides a pathway for the distribution of material.

Endoplasmic Reticulum :

- Some of these proteins and lipids help in building the cell membrane. This process is known as membrane biogenesis.
- ER provides a surface for some of the biochemical activities of the cell. In the liver cells of the group of animals called Vertebrates. SER plays a crucial role in detoxifying many poisons and drugs.

Q. Ribosomes make \_\_\_\_\_

[RRB NTPC 09/01/21 S-I]

- A. Fat
- B. Lipid
- C. Protein
- D. Starch

Q. Which of the following organelles is called the protein factory of the cell?

[RRB ALP & TEC. 30/8/18 S-II]

- A. Chloroplast
- B. Lysomes
- C. Mitochondria
- D. Ribosomes

Q. What is the basic unit of life?

[RRB NTPC 28/3/2016 S-III]

- A. Cell
- B. Organ
- C. Tissue
- D. Nucleus

Q. What are the complex carbohydrates that form cell walls in plant called?

- A. Maltose
- B. Cellulose
- C. Sucrose
- D. Lactose

[RRB JE 02/6/2019 S-III]

Q. Which cell organ eliminates the toxic effects of toxins and medicines?

[RRB Group D 25/8/22 S-I]

- A. Endoplasmic reticulum
- B. Ribosome
- C. Golgi body
- D. Mitochondria

## ● Golgi Apparatus (Golgi Body) :

### ► Discovery :

Discovered by Camillo Golgi.

### ► Nature and Occurrence :

➢ Stacks of flattened membrane

sacs.

➢ The Golgi apparatus consists of a system of membrane-bound vesicles arranged approximately parallel to each other in stacks called cisterns.

### ► Main Functions :

Its functions include the storage, modification and packaging of products in vesicles. In some cases, complex sugars may be made from simple sugars in the Golgi apparatus.

Q. Which of the following organelles is responsible for the transport, modification and packaging of proteins and lipids into vesicles.

A. RER

C. Ribosome

[RRB NTPC 26/07/2021 S-II]

B. SER

D. Golgi body.

## ● Lysosomes :

► Discovery : Christian de Duve discovered lysosomes in 1995.

### ► Nature and Occurrence :

Lysosomes are membrane-bound sacs filled with digestive enzymes. These enzymes are made by RER.

► Main functions of Lysosomes:

During the disturbance in cellular metabolism such as when the cell gets damaged, lysosomes may burst and the enzymes digest their own cell. Therefore, lysosomes are also known as the "Suicide bags" of a cell.

• Also known as Cell's —

- Suicidal bag.
- Disposal bag
- Atom Bomb
- Cleaners

Q. Which of the following organelles is also called suicide bag?

- A. Mitochondria      C. Chloroplast  
B. Golgi body      D. Lysosome

[RRB NTPC (Stage-2) 13/6/22 S-II]

● Mitochondria :

► Discovery :

Discovered by Altman (1894).

► Main characteristics :

Double walled, with the inner wall forming folds known as Cristae.

► Main functions :

- Releases and stores energy.
- Mitochondria are strange organelles in the sense that they have their own DNA and ribosomes.

Q. Which of the following is called the "powerhouse of the cell"?

A. Mitochondria.

- b. Red blood Cells.
- c. White blood Cells.
- d. Plasma membrane.

[RRB NTPC stage-2 17/6/22 S-III]

### • Plastids (In plant Cells only) :

Plastids are double membrane organelles found in the cells of plants and algae.

► Types :

#### CHROMOPLASTS

Chromoplasts containing the pigment chlorophyll are known as chloroplasts.

Colored plastids.

### ■ Photosynthesis :

Plants make their food through visible light.

► In what type of colors do plants make their food the most?  
→ white > Red > Blue.

• Green.

#### LEUCOPLASTS

Leucoplasts are primarily organelles in which materials such as starch, oils and protein granules are stored.

## ● Chloroplast :

Its main function is to absorb light.

Chloroplast has 3 pigments :

- > Chlorophyll 'a' : It absorbs red and violet and a little blue.
  - > Chlorophyll 'b' : It absorbs blue and indigo colors.
  - > Carotenoid : It absorbs orange and yellow colours.
- Chlorophyll does not absorb green, yellow and orange.
- » Chloroplast trap solar energy for photosynthesis.

## ● Plastids : (In Plants only)

### ► Structures :

These plastids possess disc-like structures called thylakoids containing chlorophyll.

- » Chromoplasts impart colour to flowers and fruits.
- » Leucoplasts store starch or fat or protein.

Amyloplast  
pic  
if needed

graph

Chloroplast  
pic

plastid's  
pic

pic of  
leucoplasts

Q. Chlorophyll pigment is present in which of the following components of the cell? [RRB Group D 15/8/22 S-I]

- A. Chloroplast
- B. Lysosome
- C. Mitochondria
- D. Ribosome

Q. What are colourless plastid called? [RRB Group D 22/8/22 S-I]

- A. Leucoplastids
- B. Apicoplastid
- C. Chromoplastid
- D. Chloroplastid.

Q. Which of the following plants stores starch, protein and oil granules in the cell? [RRB Group D 25/8/22 S-I]

- A. Chloroplast
- B. Leucoplast
- C. Chromatin
- D. Protoplasm

Q. Name the pigment due to which plants have green colour.

- A. Carotenoids
- B. Chlorophyll
- C. Thiamine
- D. Actin

### Vacuole :

#### ► Nature and Occurrence :

Vacuoles are storage sacs for solid or liquid contents. Vacuoles are small sized in animal cells while plant cells have very large vacuoles.

pic of  
vacuole.

#### ► Function :

In plant cells vacuoles are full of cell sap and provide turgidity and rigidity to the cell. Many substances of importance in

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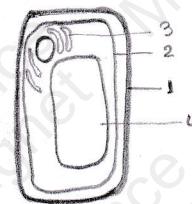
the life of the plant cell are stored in vacuoles. These include amino acids, sugars, various organic acids and some proteins.

- Amoeba : In single-celled organisms like Amoeba, the food vacuole contains the food items that the Amoeba has consumed.

In some unicellular organisms, specialized vacuoles also play important roles in expelling excess water and some wastes from the cell.

Q. Where can we find waste products in the plant cell shown in the following figure? [RRB Group D 17/09/22 S-I]

- A. In the area shown by arrow 1
- B. In the area shown by arrow 2
- C. In the area shown by arrow 4
- D. In the area shown by arrow 3

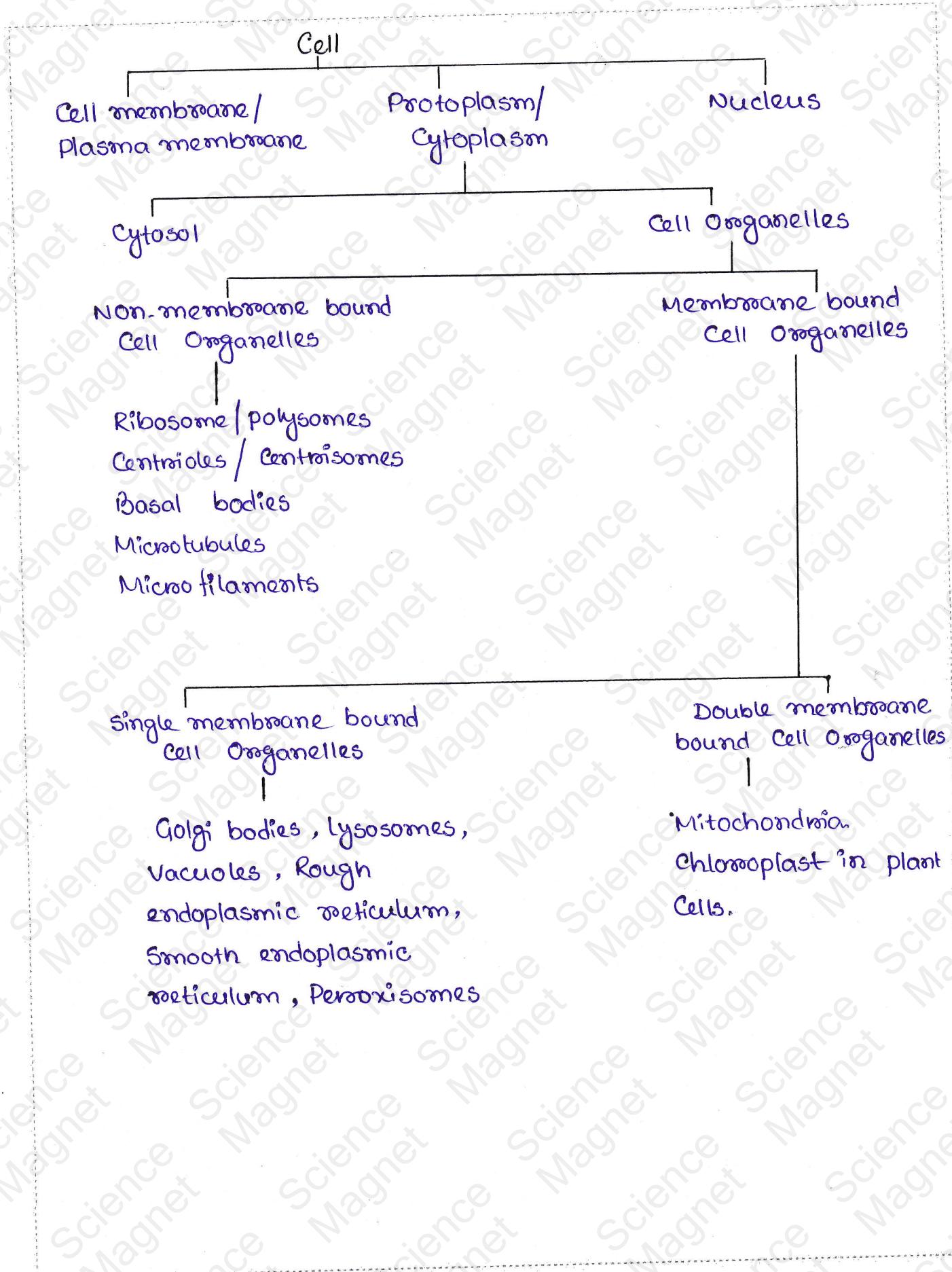


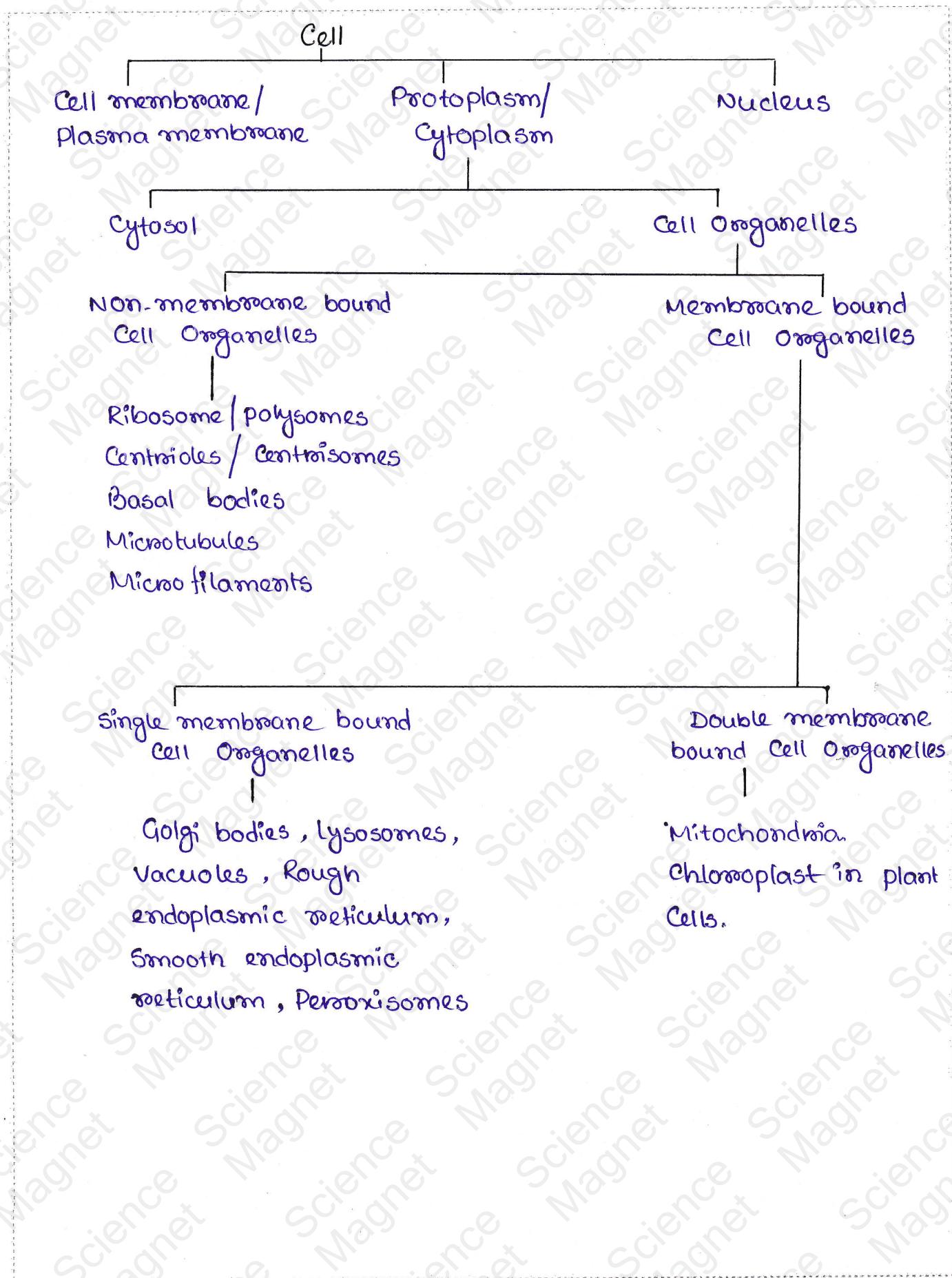
### • Ribosomes :

#### ► Main characteristics :

Discovered by George Emil Palade in 1955 (named Palade's Corpuscles)

The term "ribosome" was proposed by Scientist Richard B. Roberts.





## ● Nucleus :

### ► Nature and occurrence :

The nucleus is usually the most prominent organelles in a eukaryotic cell, positioned centrally. It is called the cell's control center.

### ► Main Characteristics :

The largest cell organelle.

Mostly spherical and dense the nucleus is surrounded by a nuclear membrane with pores that allow substances to enter and leave.

### ► Main functions :

Regulates cell functions.

## ■ Types of Cells :

### 1. Prokaryotic

Only bacteria have prokaryotic cell types.

pic

### 2. Eukaryotic

Animals, plants, fungi, protozoans and algae all possess eukaryotic cell types.

pic

## Prokaryotic Cells Vs Eukaryotic Cells :

Feature	Prokaryotic Cells	Eukaryotic Cells
Organism	Bacteria and Archaea	Animals, plants, fungi, protists.
Nucleus	Absent - DNA exists in a region called the nucleoid.	Present - DNA enclosed within a nuclear membrane.
Size	Generally smaller (0.1 - 5 micrometers)	Generally larger (10 - 100 micrometers)
Ribosomes	Smaller ribosomes	Larger ribosomes
DNA structure	single, circular chromosome	Multiple, linear chromosome

- Q. Which regulates the functional activities of the cell?
- Cytoplasm
  - Nucleus
  - Mitochondria
  - Nucleus
- [RRB JE 14/12/2014]

- Q. Which cell is called "the master of the cell"? [RRB ALP & Tech- 29/8/2018]
- Endoplasmic Reticulum
  - Mitochondria
  - Nucleus
  - Nucleus

Q. Which is the largest organelle present in a cell?

- A. Endoplasmic reticulum
- B. Nucleus
- C. Golgi Body
- D. Mitochondria.

[RRB JE 23.05.2019 S-III]

Q. Which of the following organelles is called the protein factory of the cell?

[RRB NTPC Stage II 26.04.2016 S-II]

- A. Only mitosis
- B. Meiosis only
- C. Both mitosis and meiosis
- D. Neither mitosis nor meiosis

Q. Which of the following cellular components is not present in most prokaryotes?

[RRB Group D 02/09/22 S-II]

- A. Cytoplasm
- B. Nuclear membrane
- C. Cell wall
- D. Ribosome

Q. What is the subunit structure of a prokaryotic ribosome?

[RRB Group D 01/09/22 S-II]

- A. 50S and 40S
- B. 60S and 40S
- C. 50S and 30S
- D. 80S and 30S

Q. Which of the following is called the 'powerhouse of the cell'?

[RRB NTPC Stage II S-III]

- A. Mitochondria
- B. Red Blood Cell
- C. White Blood Cells
- D. Plasma membrane

Q. What is the process of cell shrinking and separating from the cell wall due to lack of water called? [RBG NTPC 14/3/21 S-1]

- A. Di plasmolysis
- B. Cytolysis
- C. Photosynthesis
- D.  Plasmolysis

Q. Some characteristics of Prokaryotic cell are mentioned below.

Select the wrong option from the given options. [RBG Group D 05/9/22 S-1]

- A. Presence of membrane-bound organelles
- B. Extremely small size
- C. Single chromosome
- D. Its nuclear region is called nucleus.

Q. The only cell organelle seen in prokaryotic cell is -

- A. Mitochondria
- B.  Ribosome
- C. Plastids
- D. Lysosomes.

Q. The scientific study of a cell is called : A. Cytology c. Physiology  
B. Histology d. Taxonomy

Q. Lipid molecules in the cell are synthesised by —

- A.  SER
- B. RER
- C. Golgi apparatus
- D. Plastids

Q. Kitchen of cell is — A. Mitochondria

- B. ER

- C.  Chloroplast
- D. Golgi apparatus

Q. Organelle without a membrane is —

- A.  Ribosome
- B. Golgi bodies
- C. Chloroplast
- D. Nucleus

Q. Which cell organelle plays a crucial role in detoxifying many poisons and drugs in a cell?

- A. Golgi apparatus
- B. Lysosomes
- C. SER
- D. Vacuoles.

Q. Which of the following is/are called the "powerhouse of the cell"?

- A. White blood cells
- B. Plasma membrane
- C. Mitochondria
- D. Red blood cells.

Q. Which of the following are the cellular structures responsible for protein synthesis?

- A. Lysosomes
- B. Mitochondria
- C. Golgi apparatus
- D. Ribosomes

Q. Which cell organelle is called "the master of the cell"?

- A. Endoplasmic reticulum
- B. Mitochondria
- C. Nucleolus
- D. Nucleus.

Q. Which of the following cell organelles does not contain DNA?

- A. Nucleus
- B. Lysosomes
- C. Chloroplast
- D. Mitochondria

Q. Why do plants require less energy? [RRB Group D 24/8/22 S-I]

- A. Because they contain excessive dead cells.
- B. Because they grow only in height.
- C. Because they prepare their own food.
- D. Because they produce Oxygen.

Q. Some bacteria are photosynthetic. Where are photosynthetic pigments located in these cells? [RRB Group D 11/09/22 S-III]

- A. On special membranes
- B. chlorophyll
- C. The cytoplasm of the cell.
- D. in infolding of plasma membrane.

Q. Apart from the nucleus in the cell, which two of the following cell organelles have their own DNA and ribosomes?

- A. Plastid and mitochondria
- B. Plastid and Golgi body
- C. Mitochondria and Golgi bodies
- D. Mitochondria and lysosomes.

Q. When you place a plant cell, fungal cell or bacterial cell in a very dilute extracellular medium, the plant cell or fungal cell will absorb water but will not burst, whereas the animal cell will burst. Which part of a plant cell helps it to bear the pressure of incoming water?

- A. Nucleus
- B. Cytoplasm.
- C. Plasma membrane
- D. Cell wall.

[RRB Group D 19/09/22 S-III]

## ● Difference between Animal Cell and Plant Cell :

Animal Cell	Plant Cell
Cell wall is absent.	Cell wall present.
Golgi bodies are present	Golgi bodies are present; called Dictyosome
Vacuoles are absent. If present, they are small.	Vacuoles are present and large in size.

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

- A. Golgi body
- B. Mitochondria
- C. Plastid
- D. Nucleus

[RRB NTPC 22/01/21 S-II]

## ● Nucleus :

### ► Main functions :

Contains chromosomes, made of genes, which control hereditary characteristics.

pic

### ■ Nucleus :

> Some acids are found inside the nucleus which are called "nucleic acids".

> These were discovered by Johannes Friedrich Miescher.

pic of  
DNA

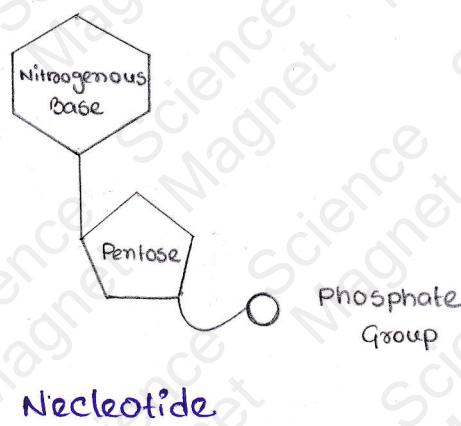
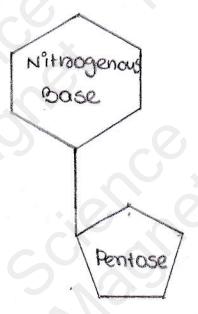
- > It has two types –
- 1. DNA and
- 2. RNA

Species	<i>Parascaris equorum</i>	<i>Oryza sativa</i>	<i>Homo sapiens</i>	<i>Pan troglodytes</i>	<i>Canis familiaris</i>
Chromosome	4	24	46	48	78
Common Name	Round worm	Rice	Human	Chimpanzee	Dog.

- Highest chromosome : (630 pairs)  
*Ophioglossum reticulatum*

- Lowest chromosome : (1 pair)  
*Myrmecia pilosula*.

■ DNA :



- Nucleotide = Nucleoside + Phosphate
- Nucleoside = Sugar + Nitrogenous Base

pic.

- There are five nitrogenous bases in total:

- Nitrogen Base:

- Purine

- A. Adenine
  - B. Guanine

- Pyrimidine

- A. Thymine
  - B. Cytosine
  - C. Uracil

- Nitrogen Base:

- DNA

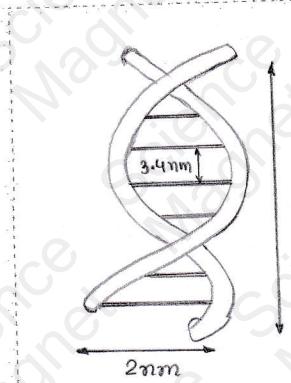
- 1. Adenine
  - 2. Cytosine
  - 3. Guanine
  - 4. Thymine

- RNA

- 1. Adenine
  - 2. Cytosine
  - 3. Guanine
  - 4. Uracil

Adenine = Thymine      (double bond)  
Guanine ≡ Cytosine      (triple bond)

p/c



- Length of one helix of DNA : 3.4 nm ( $34 \text{ \AA}$ )
- No of base pairs in one helix of DNA : 10

- Process of DNA to DNA : Replication
- Process of DNA to RNA : Transcription
- Process of RNA to DNA : Reverse Transcription.
- Process of RNA to Protein : Translation.

- > helping enzyme in process of DNA to DNA : Polymerase.
- > helping enzyme in process of DNA to RNA : Transcriptase.
- > When virus exits the body, it changes from DNA to RNA. (Transcription).
- > When virus enters the body, it changes from RNA to DNA (Reverse Transcription)

### Cell Division :

Mitosis	Meiosis
<ul style="list-style-type: none"> <li><math>46 \rightarrow 46+46</math> : daughter cells</li> <li>held in somatic cells</li> <li>Except Sex cell all are somatic cell</li> <li>Ex- Nose cell, Skin cell, hand cell</li> </ul>	<ul style="list-style-type: none"> <li><math>46 \rightarrow 23 + 23</math></li> <li>held in germ- / Sex cells / gametes</li> <li>Sex Cells which help to develop sexual characters.</li> <li>Ex- Egg cell, Sperm</li> </ul>

Q. Which of the following organelles is called the protein factory of the cell?

[RRB NTPC stage II 26/4/16 S-II]

- A. Only mitosis
- B. Meiosis only
- C. Both mitosis & meiosis
- D. Neither mitosis nor meiosis.

Q. The membrane around the vacuole is known as -

- A. Tonoplast
- B. Elaioplast
- C. Cytoplasm
- D. Amyloplast.

Q. Which scientist said that the structure of DNA is double helical?

- A. Watson and Crick
- B. Newton
- C. Gregor Mendel
- D. Einstein.

Q. The smallest unit of nucleic acid is -

- A. Nucleotide
- B. Nucleoside
- C. Nucleosite
- D. Nitrogen

Q. What is made up of DNA and proteins called histones?

- A. Chromosome
- B. Chronosome
- C. Chronolite
- D. None of the above

Q. How many types of element are found in the structure of DNA?

- A. 5
- B. 3
- C. 4
- D. 1

Q. Which of following is not the nitrogen base of DNA.

- A. Uracil
- B. Adenine
- C. Cytosine
- D. Guanine

- Q. Full form of DNA is -  A. Deoxyribonucleic Acid  
B. Deoxyribose nucleic acid  
C. Dioxysribonucleic acid  
D. None of above

Q. Nucleotide is made up of what?

- A. Sugar + nitrogenous base + phosphate.  
B. Sugar + nitrogenous base + nitrogen.  
C. Sugar + nitrogenous base + phosphorous  
D. Sugar + nitrogenous base + protein

Q. Cytosin is related to Guanine then Adenine.

- A. Thymine      C. Hexamine  
B. Piromine      D. Guanine

Q. Length of one helix of DNA is -  A. 3.4 nm      C. 5.3 nm  
B. 2.4 nm      D. 6.7 nm

Q. Number of base pairs in one helix of DNA is -

- A. 10      C. 16  
B. 13      D. 17.

Q. Some characteristics of prokaryotic cell are mentioned below. Select the wrong option from the given options. [RRB Group D 5/9/22 S-I]

- A. Presence of membrane-bound organelles.  
B. Extremely small size.  
C. Single Chromosome.  
D. Its nuclear region is called nucleus.