Date 4/5/23

The Fundamental unit of life - Cell

Chapter ⇒ 5

Cell :
- The structural and functional unit of life.
- The basic unit of life
- The Fundamental unit of life.
- Study of cell : Cytology.

Unicellular
Multicellular

→ All the living organisms are made up of cells and product of cells.

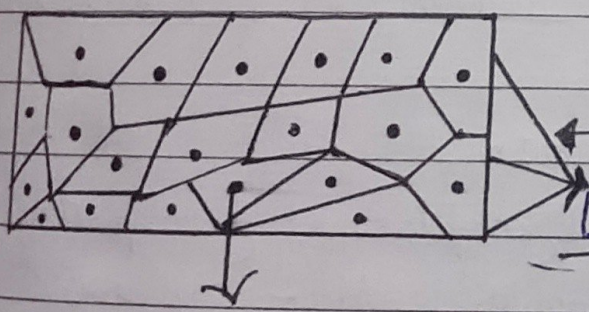
Cell
- Unicellular → Single Cell → Ex ⇒ Bacteria, Paramecium, Amoeba etc.
- Multicellular → Multiple Cell. → Ex ⇒ Plant, Animal → Billion of Cell.

Discovery of cell:

- 1st discovery of dead cell → Robert Hook → 1665

* When Robert Hook saw ← Cork Tissue ← Bark of a tree
Cork from microscope, the cork resembled the structure of a honeycomb consisting of many little compartments → Cell → Latin words → "A little room."

- 1st discovery of living cell → Antonce Leuwenhaurk → 1674 → Peel of onions

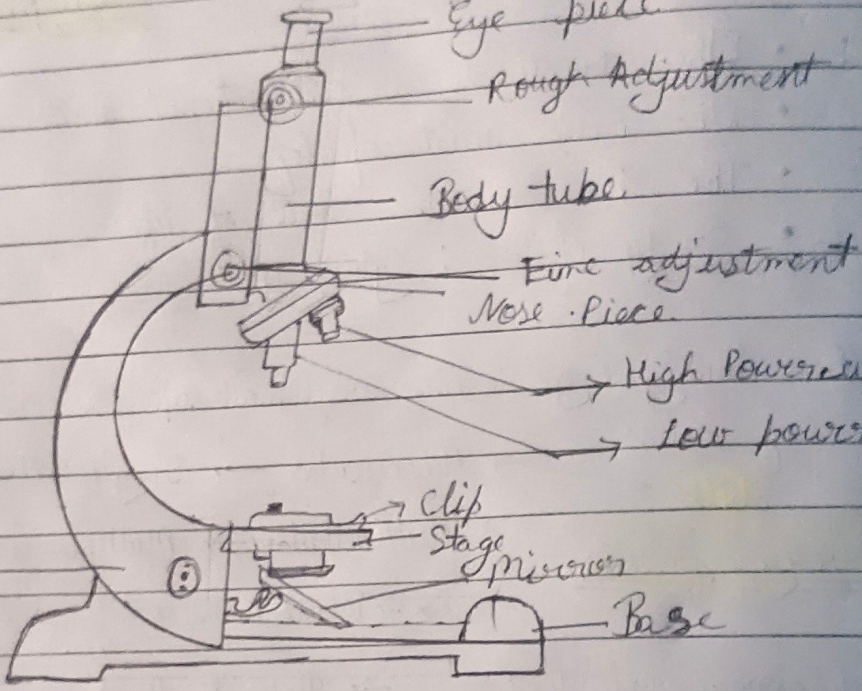


Cells

Nucleus

- Longest cell in our body : Brain cell → Motor Neuron

Compound Microscope



- Smallest cell in our body : RNA
  Smallest gamete cell : Sperm
- Longest cell of our body : Ovum Cell
  ↓
  Egg Cell
- Longest cell in universe : Ostrich egg (18cm)
  [170 - 135 mm - diameter]
- Smallest cell in universe : Bacteria

Cells
↓
Tissues
↓
Organ
↓
Organ System
↓
Body

(0.4 - micron)

- Longest cell → Nerve Cell. - 1m
  0.1 - 0.15 , 101 - 05 um
  "Mycoplasma Gayespectum"
  (PPLO - Pleuro Pneumonia like - organisms).
  Cell measuring in → um (micrometer).
  $1u = \frac{1}{1000}\ mm = 10^{-3}\ mm.$
  $1\ mm = \frac{1}{1000}\ um = 10^{-6}\ mm.$

Cellular Composition in Different Organisms

Unicellular Organism	Multicellular Organism
• A Single Cell Constitute the whole organism.	• Multiple cells are grouped together in a Single body.
• Eg :- Amoeba, Chlamydomonas, Paramecium, Bacteria etc.	• Eg :- Animal, plant, Fungi, humans etc.

Shape and size of Cells

- Fixed Shape
  - Most plant and animal cells
  - Elliptical, Spherical, discoidal, Spindle shape, Knabbed thread, elongated
- Changing their shape
  - WBCs and Amoeba

Components of Cell

- Cell wall
  - It is found in only plant cell.
  - It is made from cellulose
    - Hardest part of plant
    - dead
    - water is 0%
    - Polysaccharide: Carbohydrate

* Not Found in human and animal Cell.

- Cell membrane / Plasma membrane :
  - It is found in Both plant and Animal Cell.
  - It is made from Phospholipids and Proteins
    Phospholipids ↓ Lipid
    Not dissolve in water ←

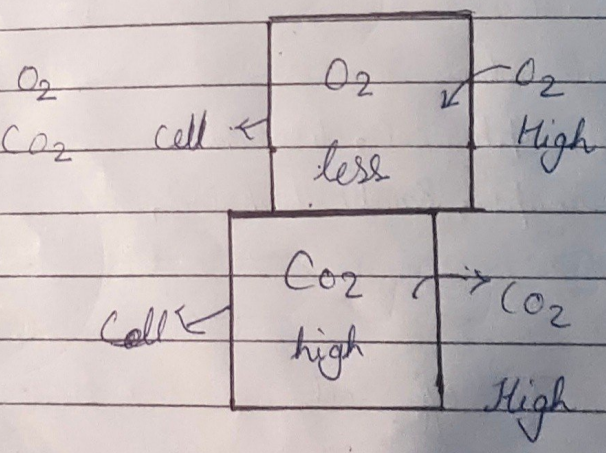
Functions:

- It regulate the movements of molecules inside to inside the cell.
- It helps to maintain the shape of the cell.
- It provides protection against microbes.

Transport through Plasma Membrane

(i) Diffusion

We Inhale O_2 and Excrete CO_2



O_2 go in the Cell of our body (diffusion) then many chemical reaction take place.

In Cell many reactions are take place then CO_2 is produce, cell start diffusion and then CO_2 goes out from the cell.

Diffusion ⇒ Gas from high concentration to lower Concentration

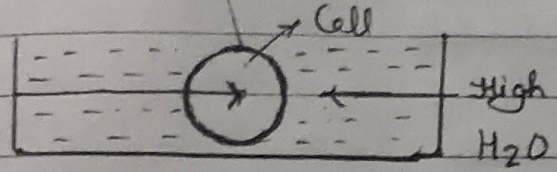
Osmosis ⇒ • Movement of water molecules through a Selectively Permeable membrane.

RO ⇒ Reverse Osmosis.

* Movement of water is always from high concentration of water to low concentration of water.

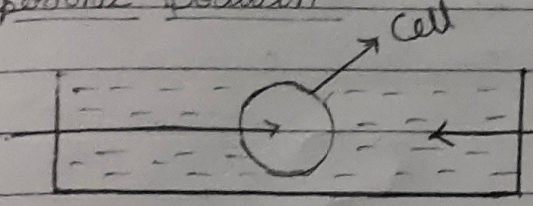
• Isotonic Solution • Hypotonic Solution • Hypertonic Solution

• Hypotonic Solution



H_2O moves into cell.

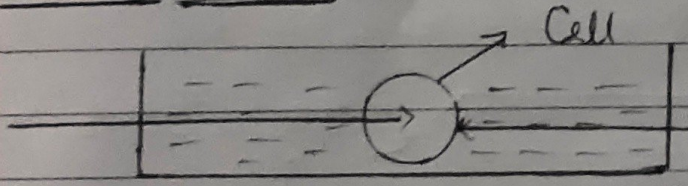
• Hypertonic Solution



Water comes out from cell.

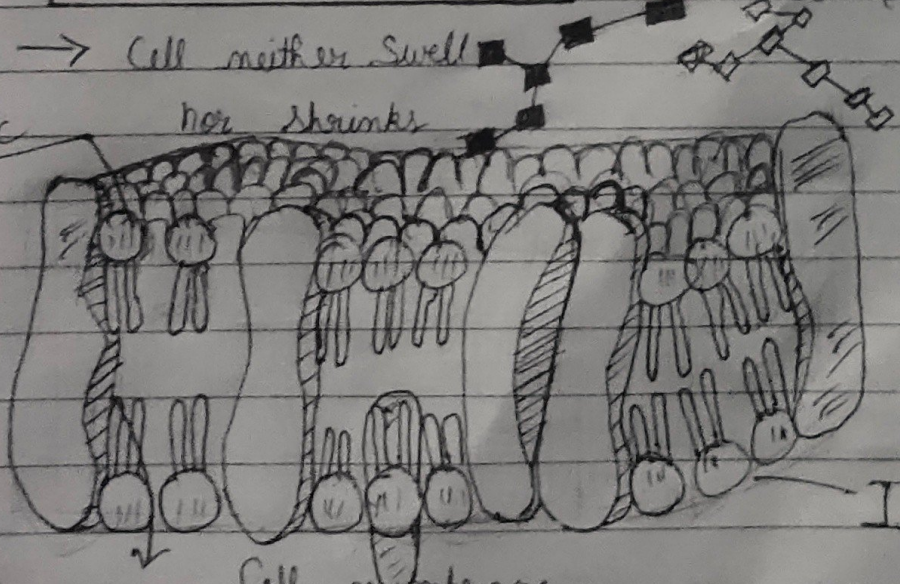
→ More cell shrinks

• Isotonic Solution



H_2O Concentration same in Cell as well as Solution.

→ Cell neither Swell nor shrinks



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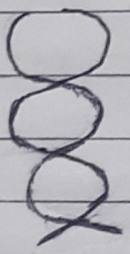
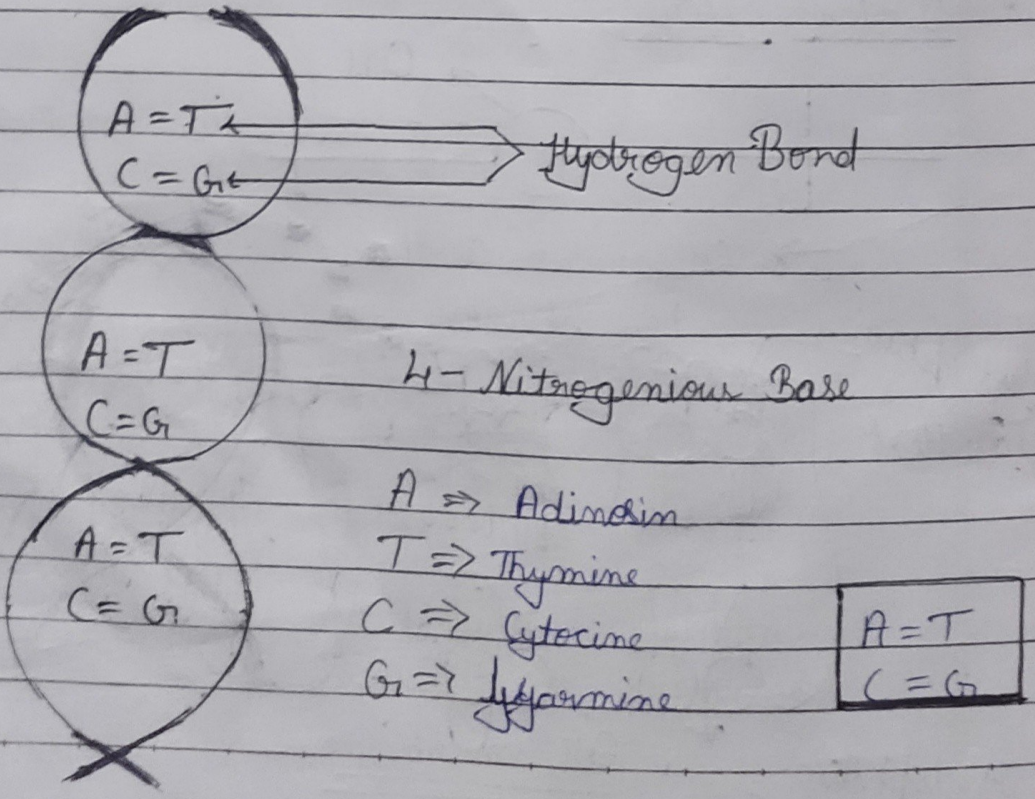
Cell membrane

- **Nucleus:**
  - → Discovered by Robert Brown
  - → Largest part of cell.
  - → Brain of cell.
  - → Manager of cell.
  - → DNA and RNA
    - ↓
    - Form of Nucleric Acid

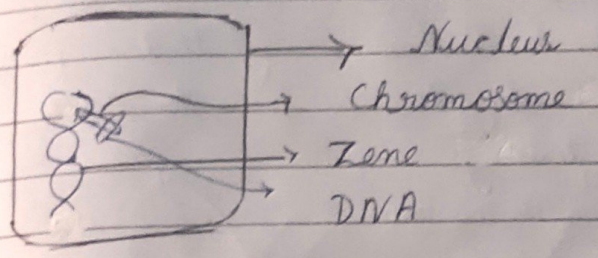
DNA:-
- Full form: Deoxyribose → Nucleric acid
- Model given by: Watson and crick
- Double Helix
- It is genetic material



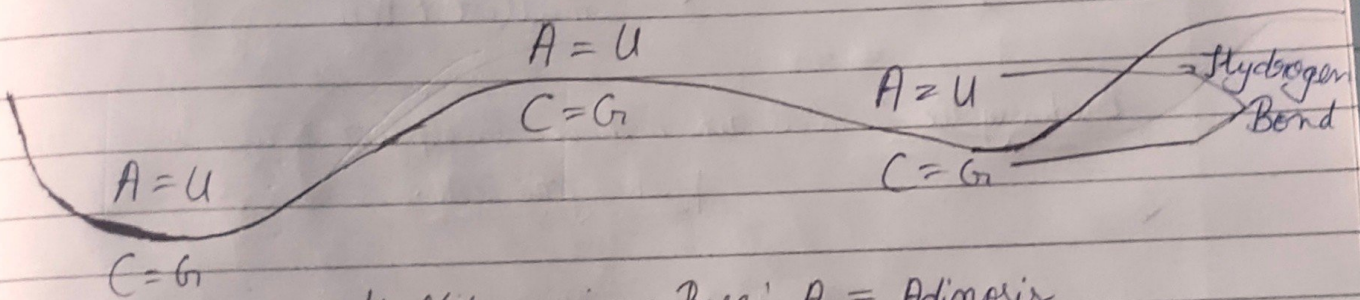
- DNA found in Nucleus and Mitochondria of the cell.



• DNA is Genetic Material



RNA ⇒ • Full Form : Ribose Nucleric Acid
• Model given by : Fredrick Meisne
• Single Helix
• RNA Found in Nucleus and Cytoplasm of the Cell



4 Nitrogenious Base : A = Adinosis
U = Uracil
C = Cytosin
G = Gya

• Ribose
Ribosome
Ribo
} Protein

Required of protein in our body = 22 Protein
↓
RNA = 12
Remain from died = 10

Largest organ
↑
Skin protein

Collagen protein is higest protein in our body

Types of RNA
↓
mRNA . . . . . R-RNA . . . . . T-RNA . . . .

Messenger RNA → It get message that which cell required how many protein → Then he gave message to r-RNA forming protein

Ribose RNA → It make Protein according to message

Transfer RNA → It transfer protein to cells

Then it give protein to t-RNA for transfer of protein

- Main RNA
- Smallest RNA

Prokaryotic : Cell which have incipient Nucleus called prokaryotic cell.

Or

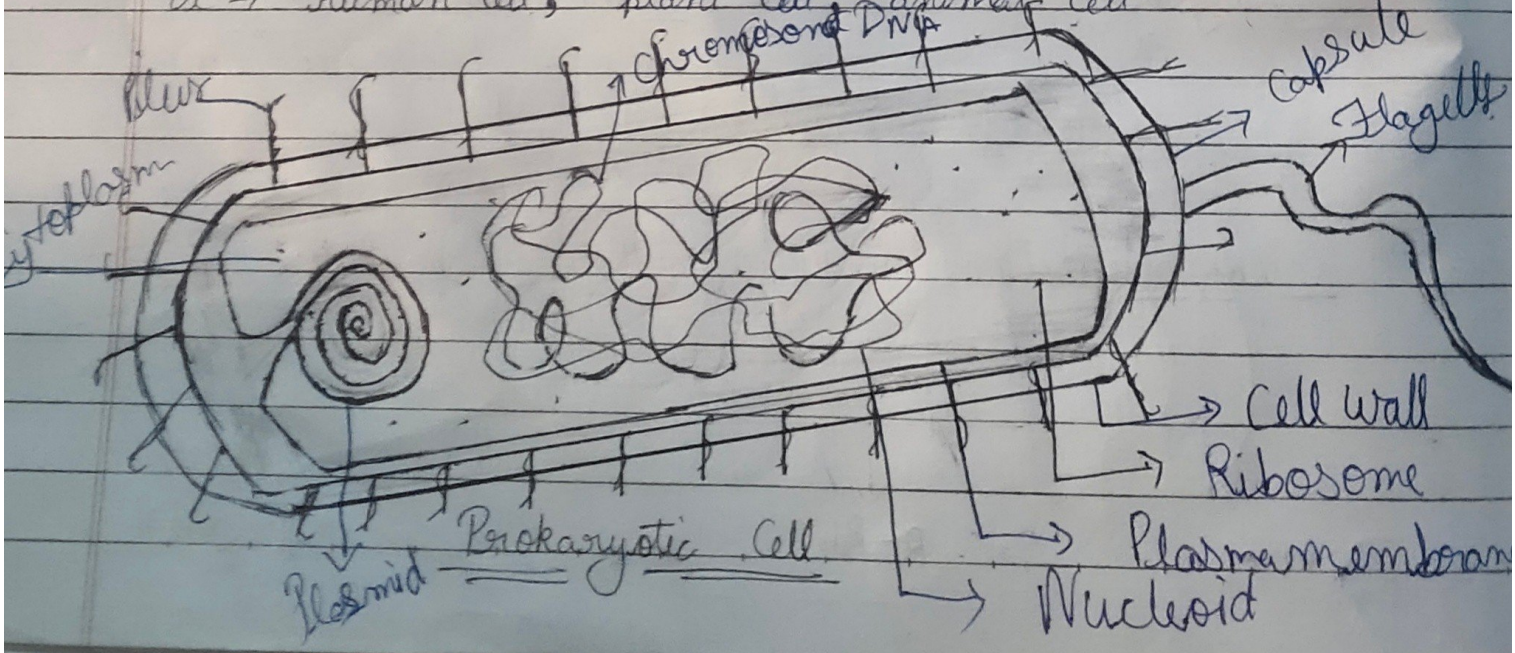
Cell which have not Nucleus is called Prokaryotic cell.

Eg:- Bacteria, Cynobacteria

(Pro = Primitive or Primary.
Karyote = Karyon = Nucleus)

- Eukaryotic : Cell which have nucleus is called eukaryotic cell.

Ex ⇒ Human Cell, plant cell, animal Cell.



Prokaryotic Cell

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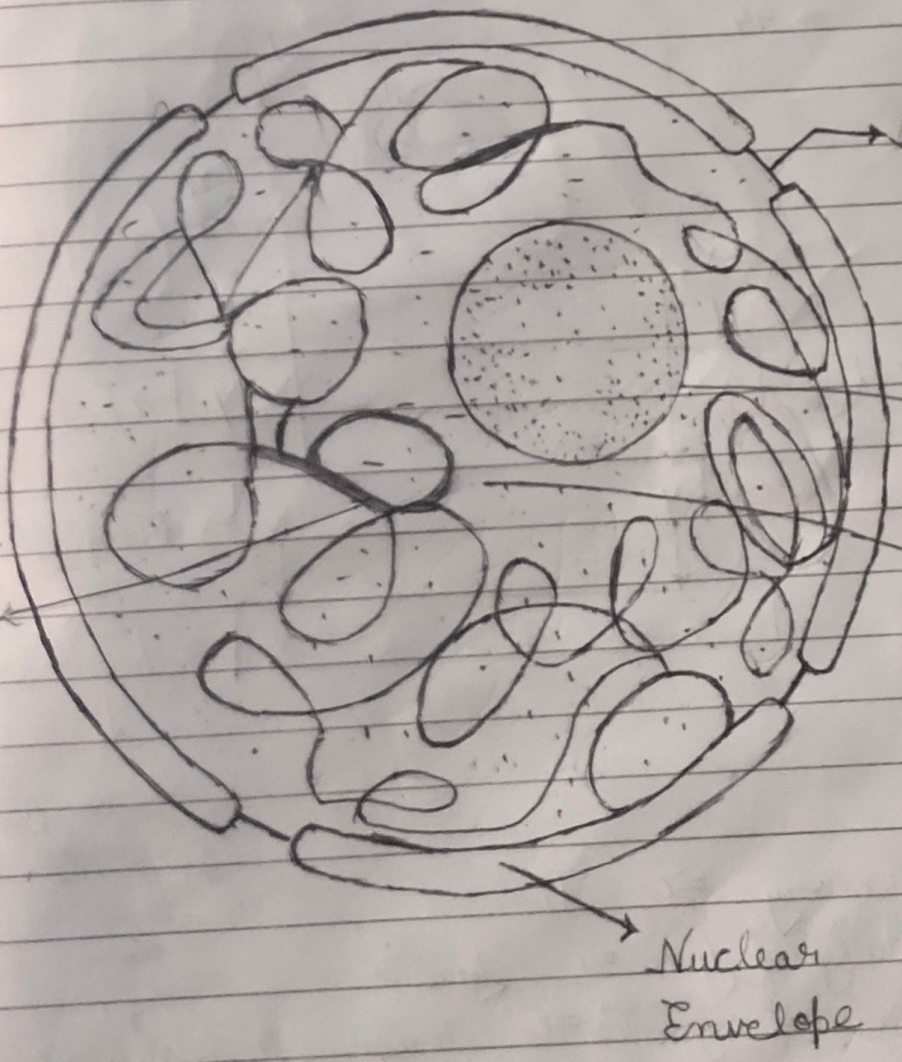
Function of Nucleus

(i) Participate in division of cell.
(ii) It determines the cell development and maturity by directing the Chemical activities of the Cell.
(iii) It helps in the transmission of hereditary traits from parents of offsprings.
(iv) It controls all metabolic activities of Cell. If it is removes, the protoplasma dries up.



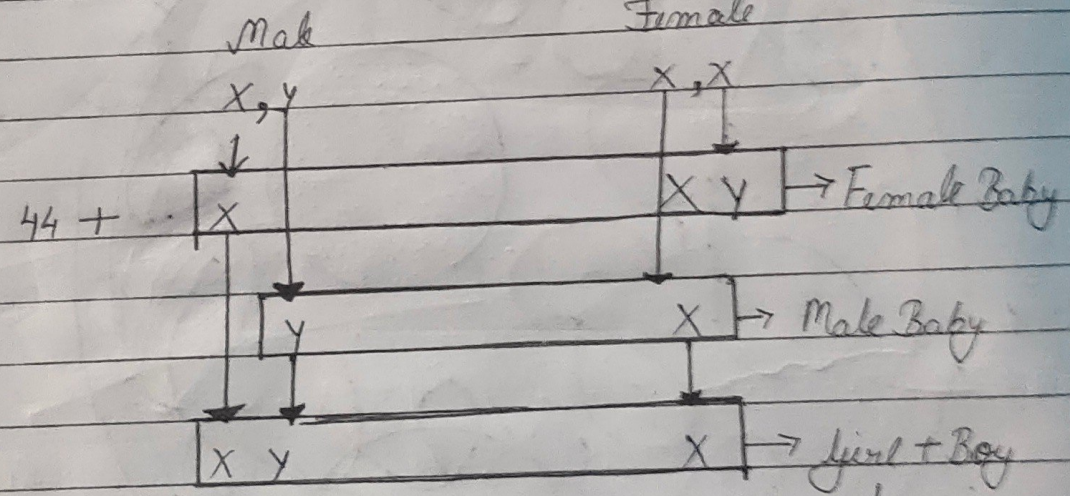
Nucleus

- **Chromosomes:**
  - Attached on DNA
  - Visible - Cell division only
  - always found in pairs
  - Human → 23 Pairs

Types

Autosomes
Chromosomes
↓
22 Pairs = 44

Ailosome
Chromosomes
↓
1 Pair = 2
Male = X, y
Female = X, X

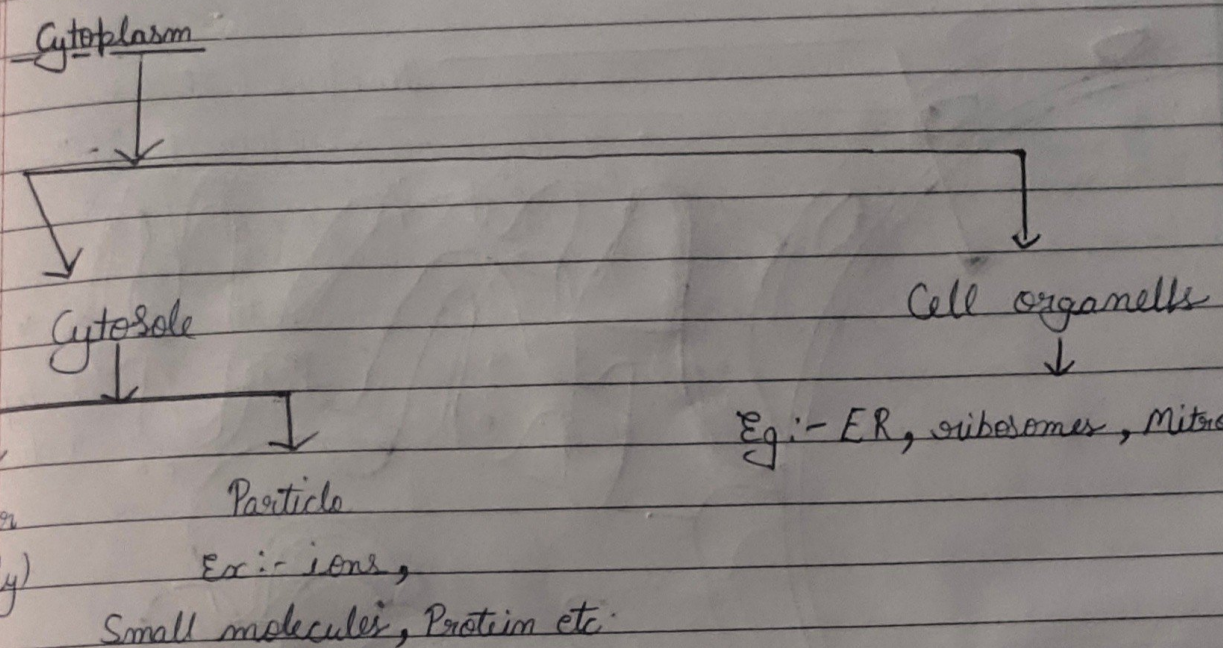


↓
Transgender

- Gene
  - Discovery ⇒ Thonson
  - Study of gene ⇒ Genetic
  - Father of Genetic ⇒ Gregor Mendal
  - Human ⇒ 30K genes

- **Cytoplasm:** Cytoplasm is all of Material within a cell,

Except of the cell called Cytoplasm.



Functions:-

(i) Exchange of materials Between cell organelles.
(ii) Acts as Store house of vital molecules. Such as amino acid, glucose, iron etc.
(iii) Acts as the site for certain metabolic pathways such as glycolysis etc.

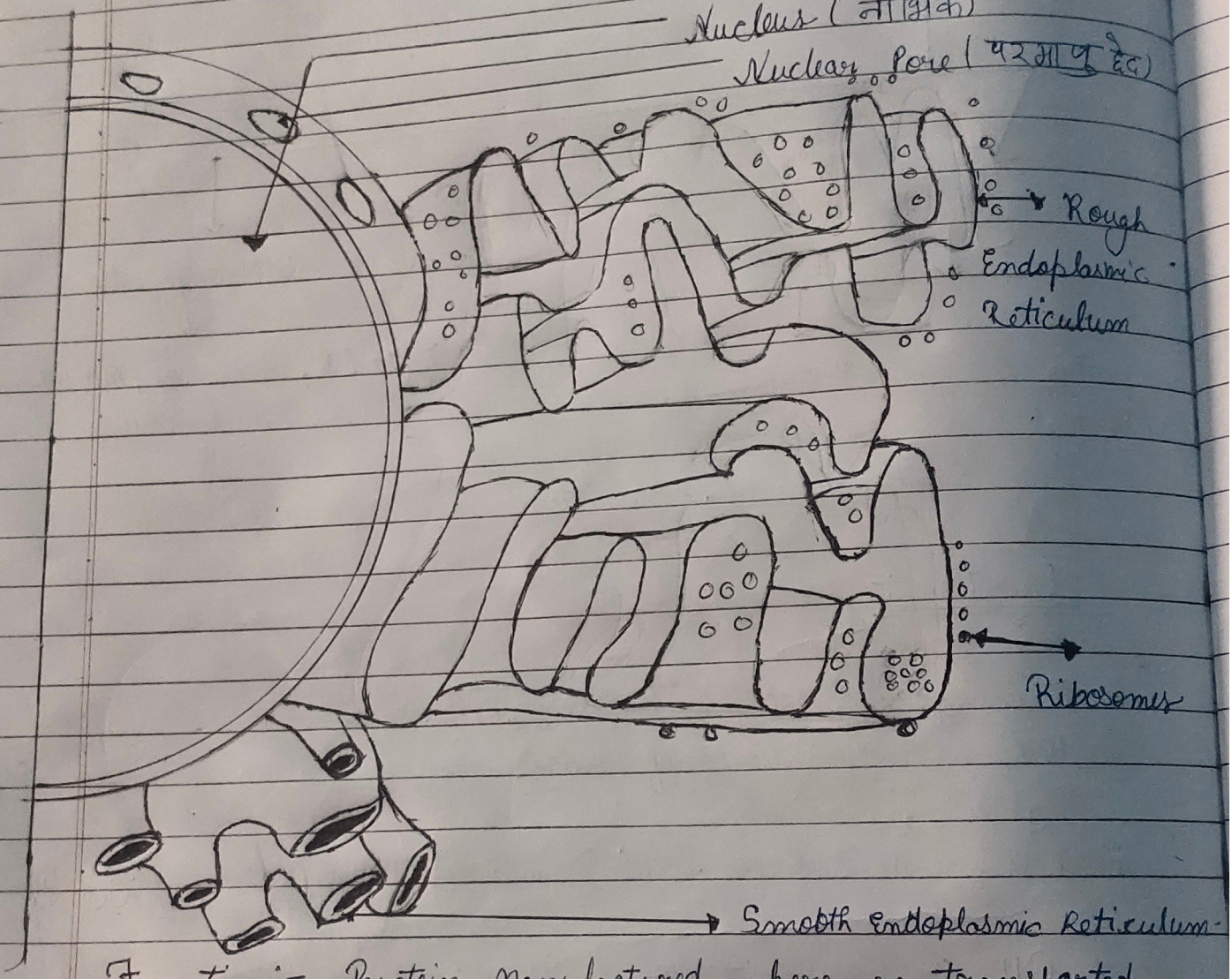
Cell Organelles :- Membrane bound organelles
:- Present to support complex activity of cell
— Different type.

Endoplasmic reticulum :-

Discovered By : "PORTER"

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

Endoplasmic Reticulum (ER)



Function:- Protein manufactured here are transported through out the cell by Endoplasmic reticulum.

(ii) Fat and lipid molecules manufactured by SER, helps in Building cell membrane and other cell components. This process is called **membrane biogenesis**:-

(iii) It Function as cytoplasmic Framework. It provide a Surface for Some of the biochemical activites of the cell.

(iv) It gives mechanical Support to the cell.

(v) Some other protein and lipids Synthesised by E.R. Function as enzymes and hormones.

Endoplasmic Reticulum

Rough Endoplasmic Reticulum

Looks Rough under microscope so, it is called RER

It has ribosomes attached to its wall

- Protein: Synthesis of protein molecules is done by ribosomes which are attached on RER.

Smooth Endoplasmic Reticulum

It looks Smooth

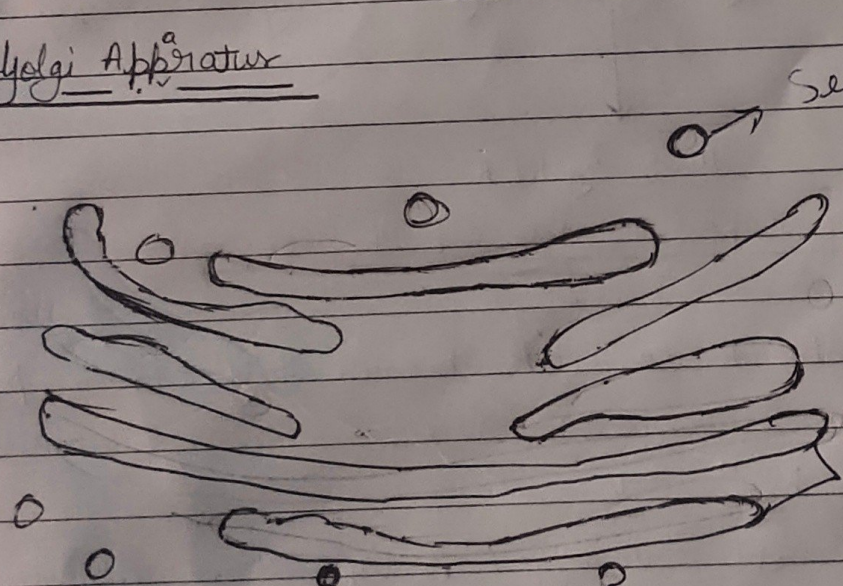
↓

It has no ribosomes

↓

Production of fat and lipid molecules.

Golgi Apparatus



Discovery: "Camellio Golgi"

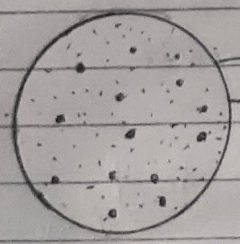
Cisterns: The Golgi apparatus consist of a system of membrane - bound vesicles arrange approximately parallel to each other in stacks called Cisterns.

→ It help T-RNA to delivery of protein

Functions:-

(i) Golgi apparatus stores, modifies and packs products in vesicles.
(ii) It is involved in the formation of lysosomes.
(iii) It forms complex sugar from simple sugars in some cases.
(iv) It is involved in synthesis of cell wall and plasma membrane.

- **Lysosomes**
  - Discovery: "Deduve"



→ Lysosomes
→ Hydrolytic Enzyme (Digestive Enzymes)

Made By RER

- Waste disposal system of the Cell.

Lysomes are able to do this because they contain powerful digestive enzymes.

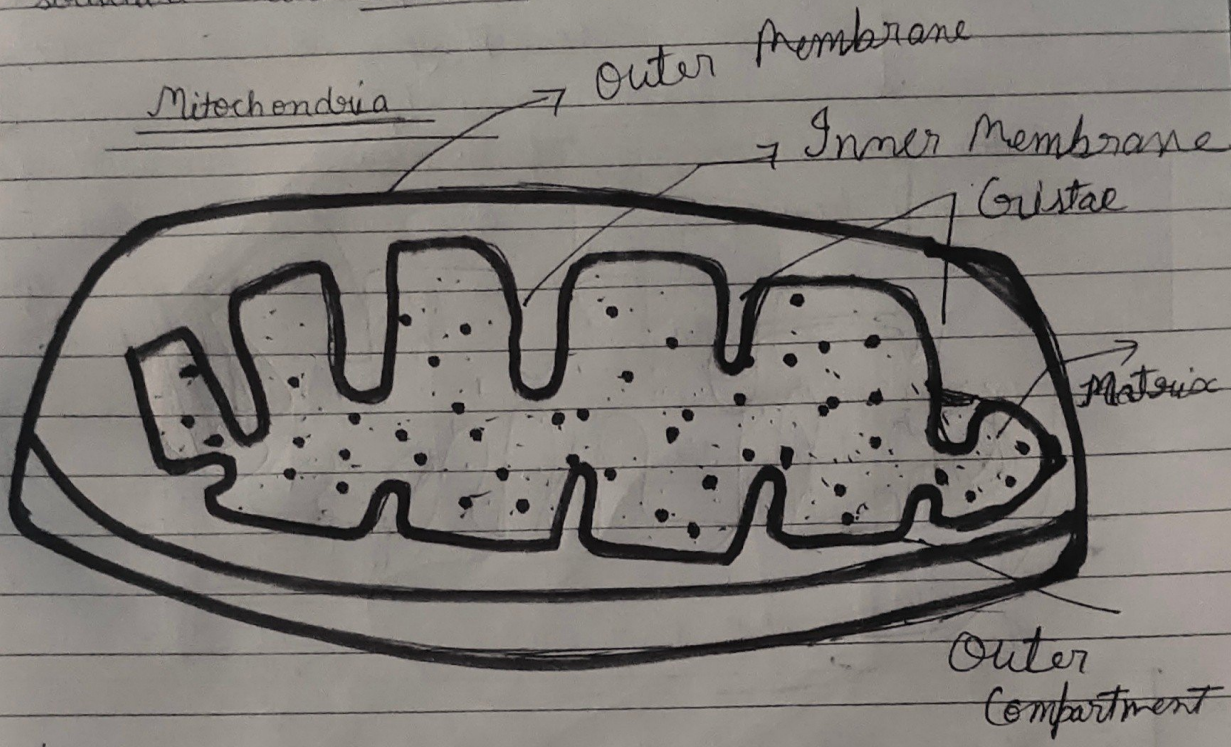
- "Sucidal bag" →

When the cell gets damaged, lysomes may burst and the enzymes digest their own cell.

- **Mitochondria** ↓ Power house of the cell.
  - Discovery: "Altman"
  - term given by "Benda"
  - Second largest part of the cell.
  - It have Double membrane

- 1st observed by : "Kolliker (1880)

The inner membrane is deeply folded into finger like structure called cristate.



Functions:

(i) They release energy required by the cell in the form of ATP (Adinosine Triphosphate)

Energy currency of the Cell.

(ii) mitochondria have their own DNA and ribosomes. Hence, they are able to make some of their own proteins.

(iii) They provide intermediates for the Synthesis of various Chemical;

Like : Fatty acids, Steroids, amino acids etc.

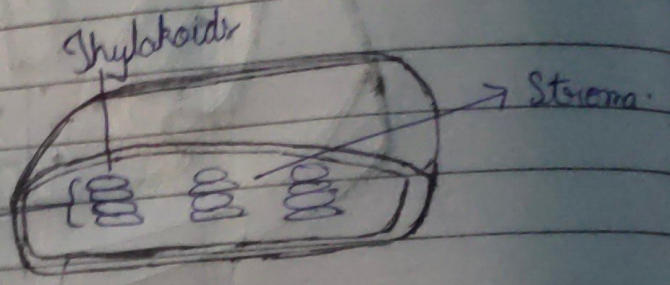
- Plastid :
  - Discovered by : Haeckal
  - It is found in only plant cell.

Chloroplast . . . . . Chromoplast . . . . . Leucoplast.

Chloroplast
↓
- double membrane
↓
The internal organisation of numerous membrane layers embedded in the material is called the Stroma.

Chromoplast
↓
Colored plastids (except green and white)
↓
Colour: Flower and fruits.

Leucoplast
↓
(White colour/ Colourless)
↓
It contain Starch, Oils and protein granules.



- Chloroplast are called the Kitchen of the plant cell.

* Plastids also have their own DNA and ribosomes like mitochondria.
* Plastids are usually spherical or discoidal in shape

- Chloroplast are green in colour + Orange and yellow
- Chloroplast help in photosynthesis.

- Vacuoles:
  - Membrane Bound
  - Solid or liquid filled
  - Storage Sac like.

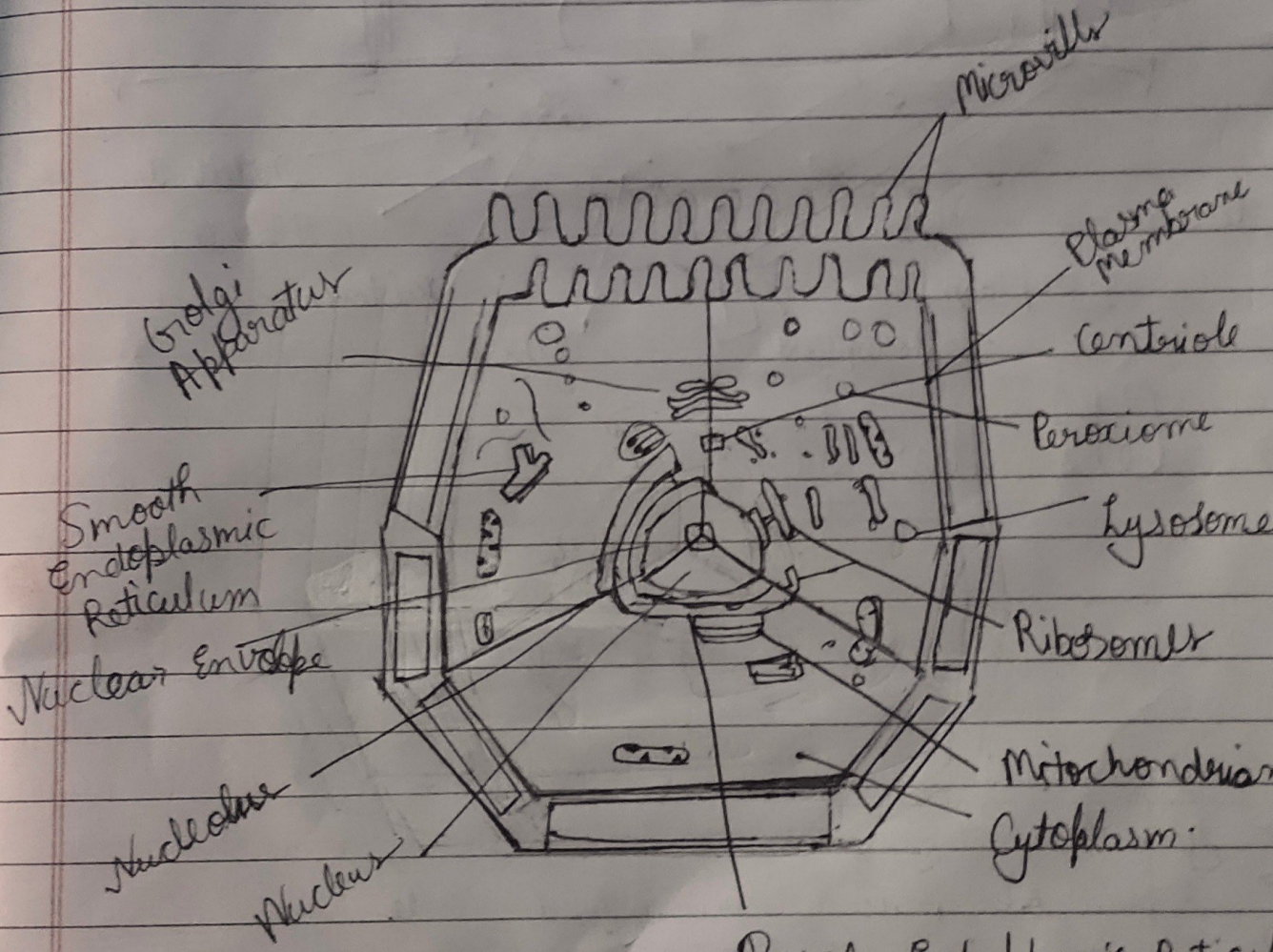
Vacuoles in animal Cell.
(i) Small
(ii) Temporary
(iii) Store glucose, glycogen, protein

Vacuoles in plant Cell.

(i) Large, distinct
(ii) Permanent
(iii) Store cell sap.
(iv) Plant Cell vacuoles provid turgidity and rigidity
(v) Central vacuoles of some plant may occupy 50-90% of Cell volume.

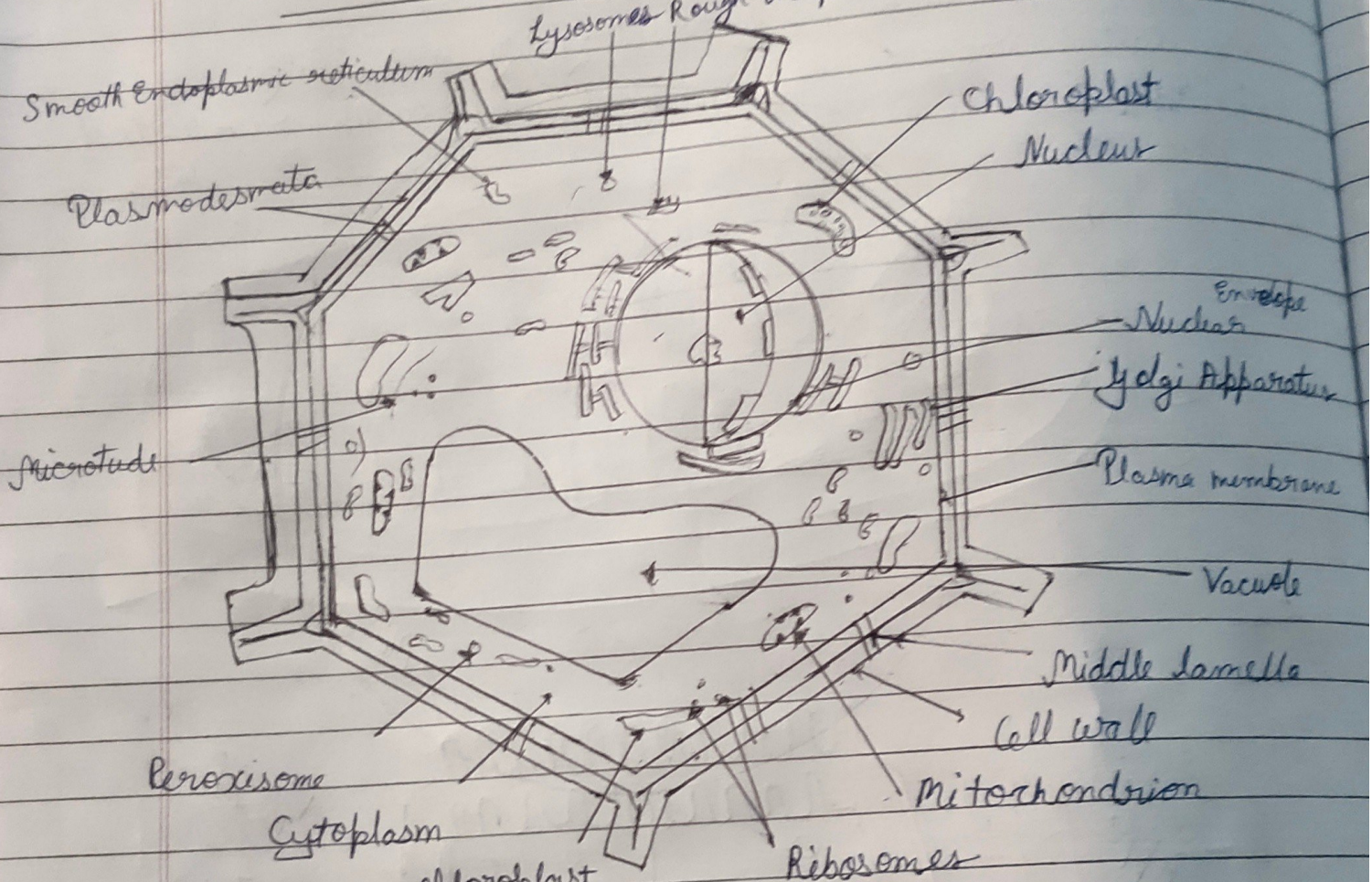
Cell Sap

→ Amino acids
→ Sugars
→ Organic acids



Animal Cell

Plant Cell



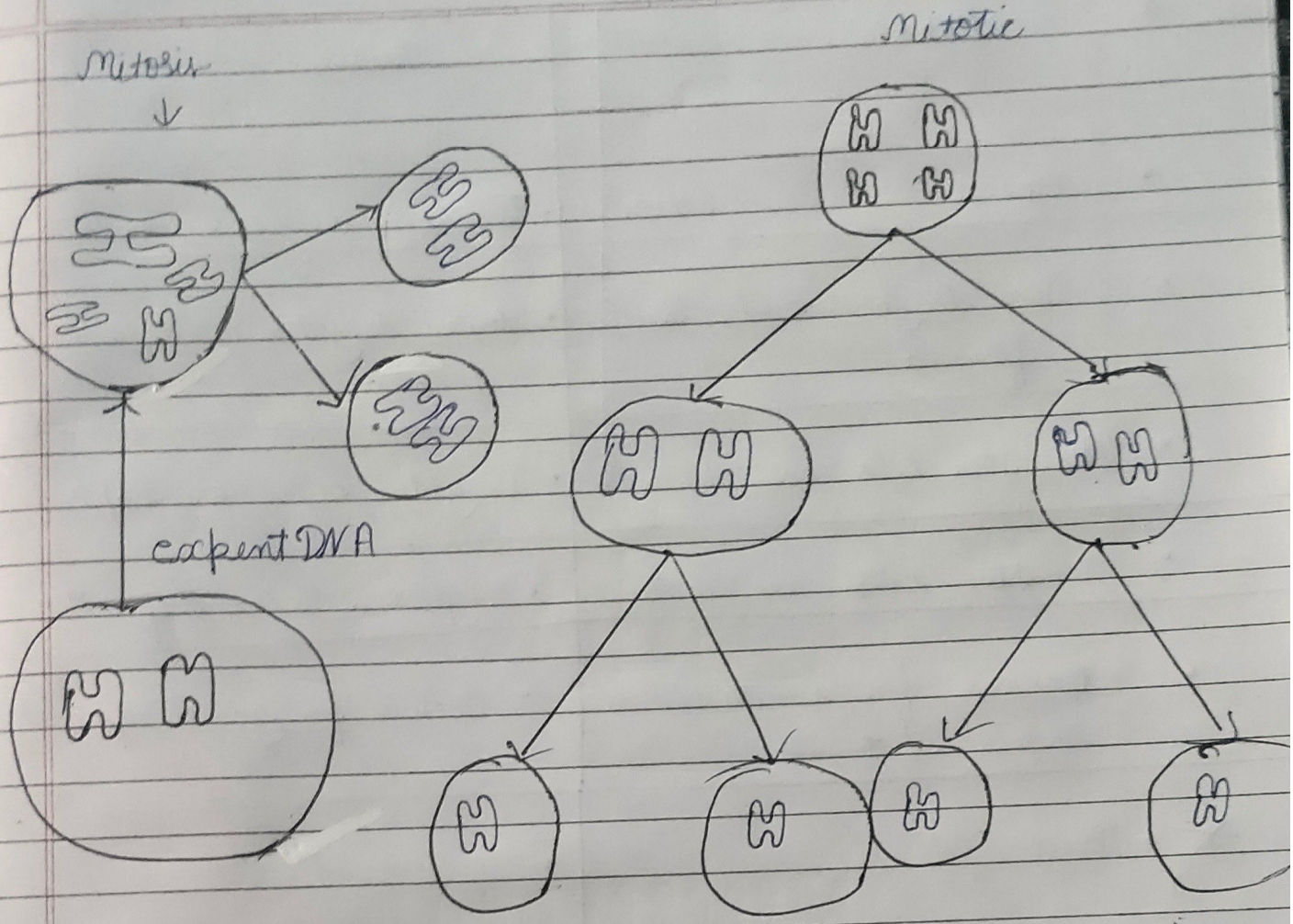
→ Cell division

Division of cell into new cells.

Reasons of division:

→ Growth of organisms
→ Replace old, dead and injured cells
→ For gamete formation

Type of cell division



Difference Between

Prokaryotic Cell	Eukaryotic Cell
• Size : generally small (1-10 um)	• Size : generally large (5-100 um)
1 Um = 10^{-6} m	
• Nucleus is not in this cell	• Nucleus is present
• Chromosome is single	• More than one chromosome
• Membrane-bound cell organelles absent	• Membrane-bound cell organelles present

Mitosis	Meiosis
*	
• One cell division occur	• Two cell divisions occurs
• Two daughter cells are formed.	• Four daughter cells are formed.
• Daughter cells are diploid.	• Daughter cells are haploid.
• Daughter cells are identical.	• Daughter cells are different.
• Occurs for growth and repair of tissues	• Occurs for gamete formation.
* • Plant Cell	• Animal Cell
• Larger in Size	• Smaller in size.
• Nucleus is larger	• Nucleus is Smaller.
• Cell wall is present	• Cell wall is absent.
• Outer membrane Cell wall.	• Outer membrane → Cell membrane
• Plastid Present	• Plastid Absent
• Lysosome are Rare	• Always found
• Reserve food → Starch → Root #	• Reserve food → Glycogen →
• Vacuoles → larger	• Vacuole → Smaller

• Photosynthesis of is done	• Photosynthesis is not done.
• Cellulose is the hardest part of plant cell.	• Enamel → Teeth ↓ Hardest part of the Cell

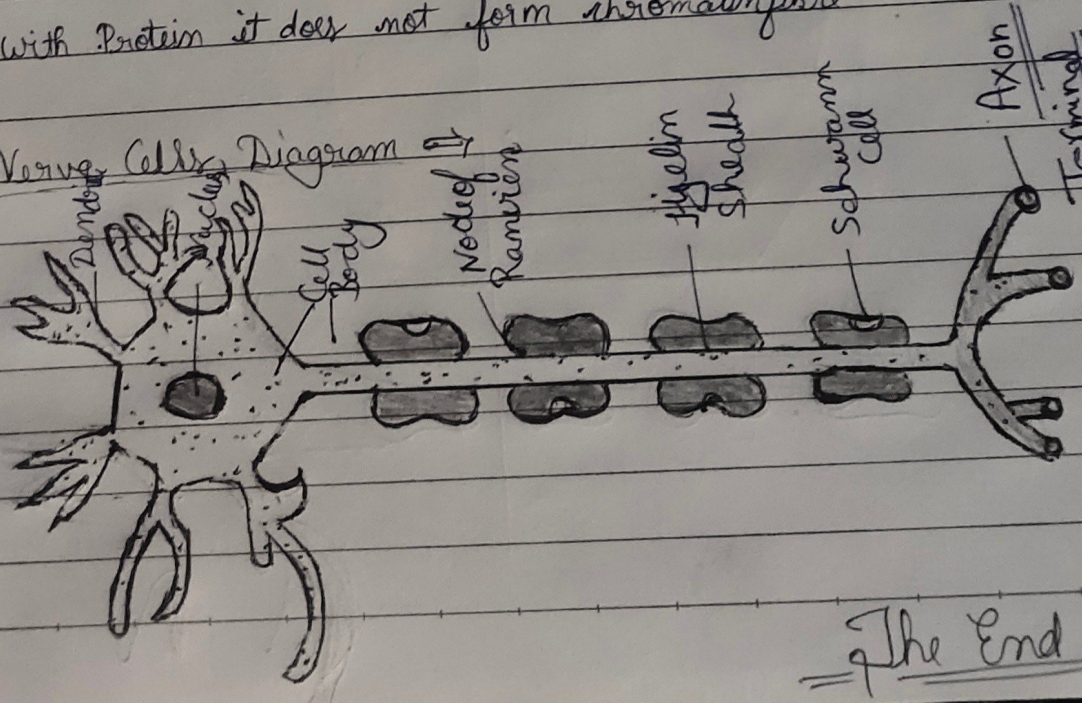
Exception of Cell Theory

* Viruses
  - Viruses that not follow cell theory.
  - Nucleic acid (DNA or RNA) ↓ Excloud in a protein coat
  - Viruses do not have nucleus, cytoplasm and Engy
  - On Non-living surface they can't multiply.
  - On living they can multiply.

* Bacteria and Blue green algae (Cynobacteria) :- Monera ↓
  - Not true cells.
  - They are without cell organisms
  - They are without cell organisms
  - Nuclear material only found in DNA.
  - With Protein it does not form chromatin fibre

Bacteria
- Archabacteria (Ancient)
- Eubacteria (True Bacte

Nerve Cells Diagram →



The End