

EUKARYOTIC CELL

(True-nucleus cell)

- Have membrane-bound cell
- Also known as double envelop / double membrane cell.
- Eukaryotic cells are also of two types i.e plant cell and animal cell.

Features of Eukaryotic cell:-

1. Eukaryotic cells have the nucleus enclosed within the nuclear membrane.
2. The cell has mitochondria, endoplasmic reticulum, Golgi apparatus, chloroplasts (in plant cell) and all the membrane bound cell-organelles.
3. Eukaryotic cells have a cytoskeletal structure or elements.
4. They have chromosomes within the nucleus, consisting of a single, linear DNA molecule spiraled around proteins called Histones (Packaging proteins).
5. Eukaryotic cells have cell wall (Plant cells).
6. Cell division is through Mitosis.

Eukaryotic cell

Rough endoplasmic reticulum

Golgi vesicle

cell membrane

Smooth endo-
plasmic reticulum

Ribosomes

Golgi apparatus

Golgi vesicle

nuclear
membrane

Nucleus

Chromatin

Cytoskeleton

mitochondria

Vacuole

mitochondria

Peroxisome

Peroxisome

PLANT CELL

Chloroplast

Vacuole

Glycogen

ANIMAL CELL

COMPARISON B/W PROKARYOTIC AND EUKARYOTIC

CELL

	PROKARYOTIC	EUKARYOTIC
ORGANISM	Bacteria and Cyanobacteria	All the other organisms.
CELL SIZE	1-10µm in linear direction	10-100µm in this
METABOLISM	Anaerobic or aerobic	Only aerobic
ORGANELLE	Only few	All the organelles present.
DNA	Circular in general cytoplasm	Very long containing many non-coding regions. Organized into chromosomes (LINEAR)
RNA & Protein	Synthesized in same compartment	RNA in nucleus and protein in cytoplasm
CYTOSKELETON	No cytoskeleton is present	Cytoskeleton is present and composed of protein filaments
CELL DIVISION	By binary fission	Mitosis & Meiosis

NUCLEUS	Nucleus undefined	Nucleus defined
RIBOSOMES	70S ribosomes	80S ribosomes
NUCLEAR MEMBRANE	Absent	Present

EUKARYOTIC CELL ORGANELLES

- Eukaryotic cell has membrane-bound organelles.
i.e. the organelles are enclosed in a plasma-membrane.

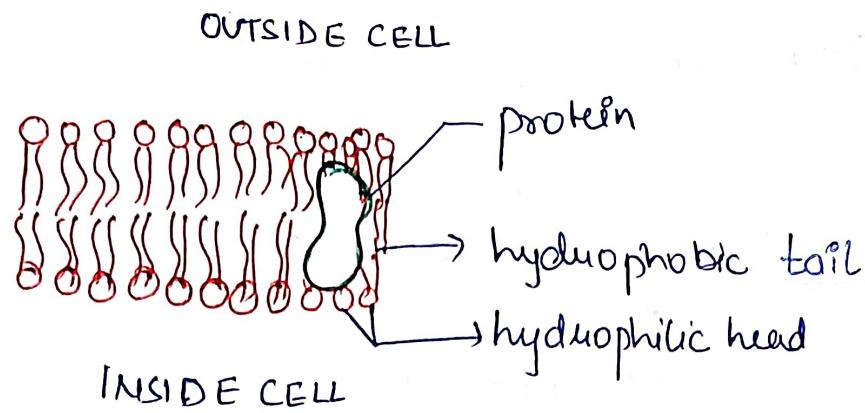
1. CYTOPLASMIC MEMBRANE:-

(CELL MEMBRANE) / PLASMA MEMBRANE)

- The plasma membrane is a semi-permeable membrane that separates the cell from inside to outside.
- The plasma membrane consists of proteins, carbohydrates and two layers of phospholipids (i.e. lipid with a phosphate group).

Structure of cell membrane / plasma membrane:-

- The polar hydrophilic (water-loving) heads face the outside and inside of the cells. These heads interact with the aqueous environment outside and within a cell.
- The non-polar hydrophobic (water-hating) tails are sandwiched between the heads and are protected from the aqueous environments.
- Singer and Nicolson described the structure of the phospholipid bilayer as the "Fluid mosaic model". It is semi-fluid in nature to allow lateral movements of protein within the bilayer.



FUNCTION :-

- The plasma membrane is selectively permeable i.e it allows only selected substances to pass through.
- It protects the cell from shock and injuries.
- The fluid nature of the membrane allows the interaction of molecule within the membrane. It is also important for secretion, cell growth, and division etc.
- It allows transport of molecule across the membrane.

2. CELL WALL :-

The cell wall is a non-living, rigid structure outside the plasma membrane in plant cells and fungi.

(It is absent in eukaryotic cells of animals)

The cell wall is divided into three layers:-

1. Middle lamella :- outermost and made up of calcium pectates.
2. Primary wall :- It is middle layer and made up of cellulose and hemicellulose.

3. Secondary wall :- It is the innermost layer and similar to the primary wall.

FUNCTION :-

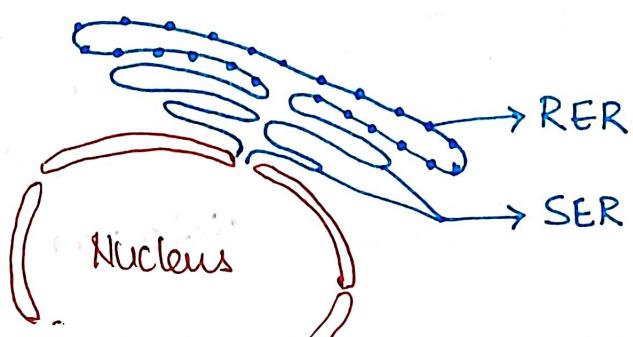
- Provides shape to the cell
- Helps in cell-cell interaction
- Protects the cell from injury, undesirable molecules and pathogens.

3. ENDOPLASMIC RETICULUM (ER) :-

- It is the network of small, tubular structures. It divides the space inside of eukaryotic cells into two parts - luminal (inside) and extra-luminal (cytoplasm)
- ER is of two types :-
 - Rough endoplasmic reticulum
 - Smooth endoplasmic reticulum

FUNCTION :-

- Rough endoplasmic reticulum (RER) helps in protein folding and transports it to the golgi apparatus in vesicles
- Smooth endoplasmic reticulum (SER) is involved in lipid synthesis and RER in protein synthesis.



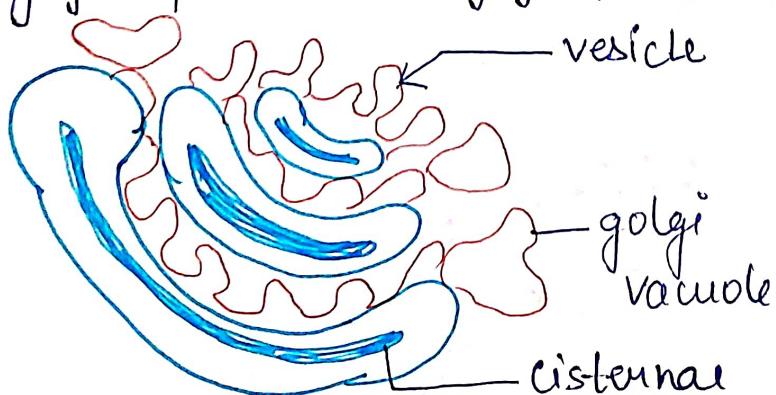
4. GOLGI APPARATUS:-

-Discovered by Camillo Golgi.

- Golgi is made up of many flat, disc-shaped structures called **cisternae**. It is present in all eukaryotic cells except human red blood cells and sieve cells of plants.
- The cisternae are arranged in parallel and concentrically near the nucleus as follows:-
 - Cis face (forming face): It faces the plasma membrane and secretes material in vesicles.
 - Trans face (maturing face): It faces the nucleus and releases the received material into the cell.

FUNCTION :-

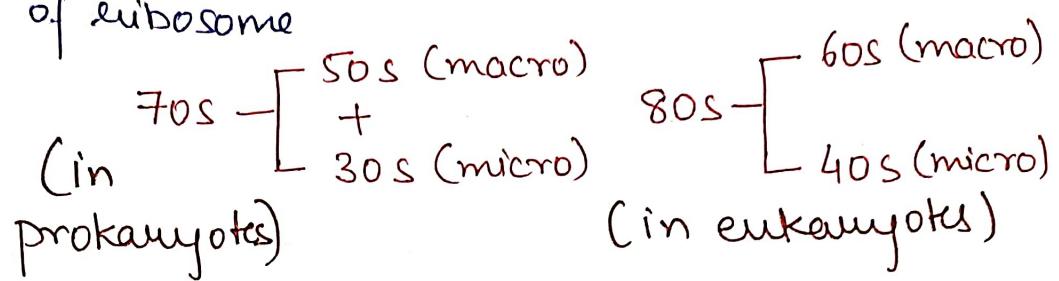
- Important site for packaging material within the cell.
- Proteins are modified in the Golgi.
- An important site for the formation of glycolipids and glycoproteins.



5. RIBOSOMES :-

(Smallest cell organelle)

- It is made up of two subunit i.e large and small unit (macro and micro).
- Two types of ribosome



- They are made up of ribonucleic acids and proteins.

FUNCTION :-

- Major site for protein synthesis and poly peptides (chain of amino acid)

6. MITOCHONDRIA :-

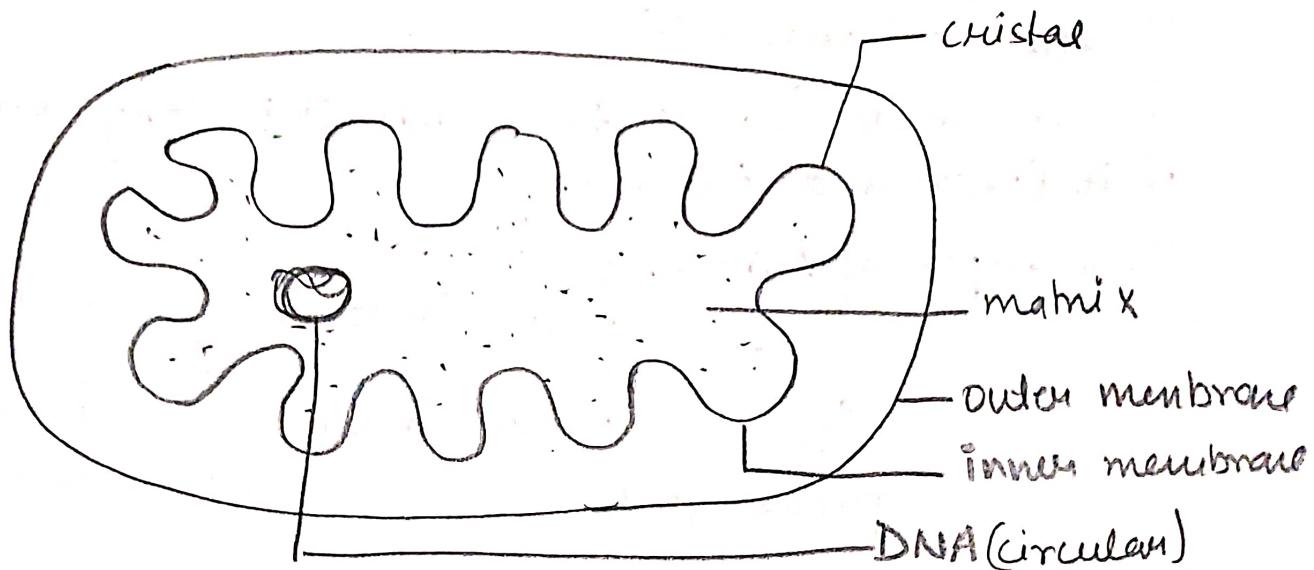
(largest cell organelle in animal cell)

- They are membrane-bound organelles, also known as "Powerhouse of the cell".

STRUCTURE :-

It has two membranes : outer and inner.

- The outer membrane forms a continuous boundary around the mitochondria.
- The inner membrane is semi-permeable and divided into folds called "crista".



— The membranes divide the lumen of the mitochondria into an inner and outer compartment. The inner compartment is called matrix and outer compartment forms the intermembrane space.

FUNCTION:-

- They produce energy (ATP) and thus called powerhouse of the cell.
- Helps in regulating cell metabolism.
- Mitochondria possess their own DNA, RNA and components required for protein synthesis.

7. LYSOMES :-

- These are membrane-bound vesicles which are formed in the Golgi apparatus.
- These are called as "Suicidal bags".
- These are rich in hydrolytic enzymes such as lipases, proteases, peroxidases, nucleases etc.

FUNCTIONS:-

1. Digestion of Lipids, proteins, carbohydrates and nucleic acids.
2. Peroxidase enzyme promotes autophagy/Apoptosis i.e. self destruction of body organ. e.g. tail of lizard. hence known as "SUICIDAL BAGS".

8. NUCLEUS :-

- Nucleus is a double-membrane organelle with all the genetic material. Therefore, it is called "the brain of a cell".
- Nucleus is found in all the cells except human RBCs and sieve cells in plants.
- A nucleus has the following parts :-
- Nuclear envelope - It is a double membrane structure that surrounds the nucleus. The outer membrane is continuous with the endoplasmic reticulum.

- The inner membrane has small pores called "nuclear pores".

- Nucleoplasm :-

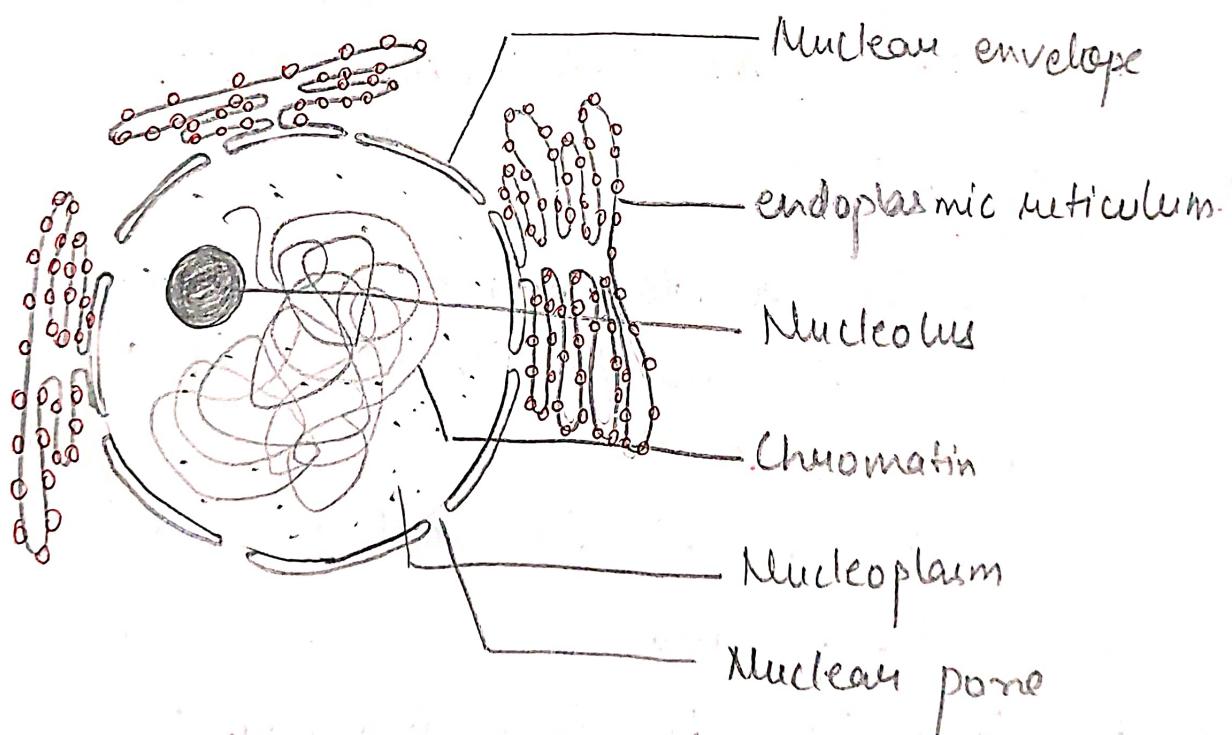
- It is fluid material in the nucleus that contains the nucleolus and chromatin.

- Nucleolus :-

- Nucleoli are not membrane-bound and are active sites for ribosomal RNA synthesis.

- Chromatin :-

- It consists of DNA and proteins called "histones". The DNA is organised into chromosomes.



FUNCTION :-

- It stores genetic information necessary for development and reproduction.
- Contains all information necessary for protein synthesis and cellular functions.

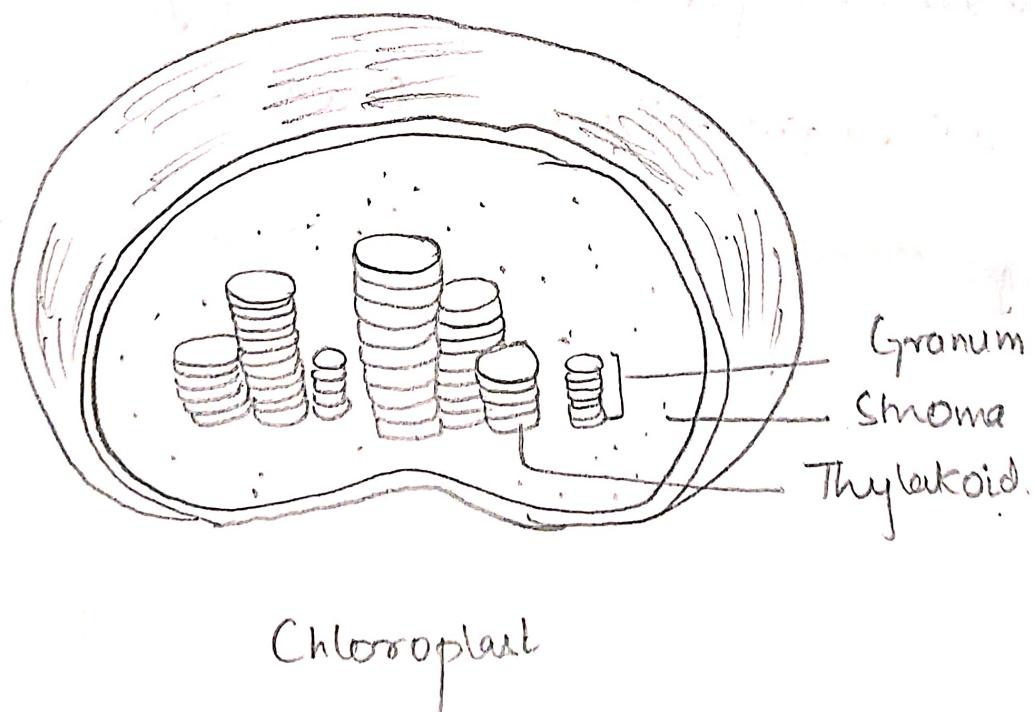
9. CYTOSKELETON :-

- It is the filamentous network present in the cytoplasm of a cell.

FUNCTION:-

- Provide mechanical support and maintains the shape of the cell and helps in motility.

10. PLASTIDS :-

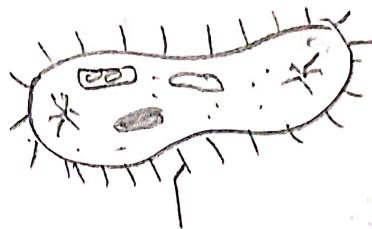


11. CILIA AND FLAGELLA :-

- Cilia are hair-like structure.
- Flagella are whip-like structure.



flagellum



Cilia

- Responsible for movement.

CILIA

Short hair-like
structures

Numerous cilia per cell

Cover cell surface fully

Rowing movement

FLAGELLA

long whip-like
structures

Fewer flagella per cell

Occurs at one end

Up and down movement.

12. VACUOLE:-

- It is structure having non-living materia.
- It is numerous in animal cell single, large and single in plant cell.
- Covered by single membranous covering called tonoplast which is selectively permeable.
- It is of many types like sap vacuole, contractile vacuole, food vacuole and air vacuole.

FUNCTION:-

- Elimination of unwanted material and maintain the osmoregulation (in case of contractile vacuole)

13. PEROXISOMES:-

- These are small vesicles, single membrane-bound organelles found in eukaryotic cells.
- They contain digestive enzymes for breaking down tonic materials in the cell and oxidative enzymes for metabolic activities.

FUNCTION:-

- They take part in various oxidative processes.
- Lipid metabolism
- The reactive oxygen species (such as H_2O_2) produced is converted to water by enzymes like peroxidase & catalase.