Chapter – 5

The Fundamental Unit Of Life

What are Living Organisms Made Up of?

⇒ Cells were discovered by Robert Hooke in 1665. He studied a piece of cork under the microscope and term as *Cell*. In Latin cell means ''little room''.

⇒ Schleiden and Schwann proposed the cell theory in 1839 which states that the basic structural and functional unit of all plants and animals is the cell.

⇒Later Rudolf Virchow, a German physiologist proposed a theory in 1855 ''Omnis cellula e cellula'' which means that all living cells arise from pre-existing cells.

Plasma Membrane or Cell Membrane

⇒ Plasma membrane is the outer boundary of the cell and it is composed of lipids and proteins.

⇒ Plasma membrane is a selectively permeable membrane that allows the entry and exit of some material in the cells.

⇒ The movement of a substance across the plasma membrane occurs through a number of mechanisms like diffusion, osmosis, active transport, and endocytosis, etc.

♦ *Diffusion*:

The process of movement of molecules of a substance from the area of higher concentration to the area of lower concentration is called diffusion. Ex: Oxygen enters into the cell through diffusion and carbon dioxide moves out of the cell through diffusion. Diffusion helps in the uniform distribution of materials in the cytoplasm.

♦ *Osmosis*:

Osmosis is the movement of water or any other solvent from a region of higher water concentration to a region of lower water concentration. The cell membrane is a semi-permeable membrane that allows the movement of water molecules in both directions.

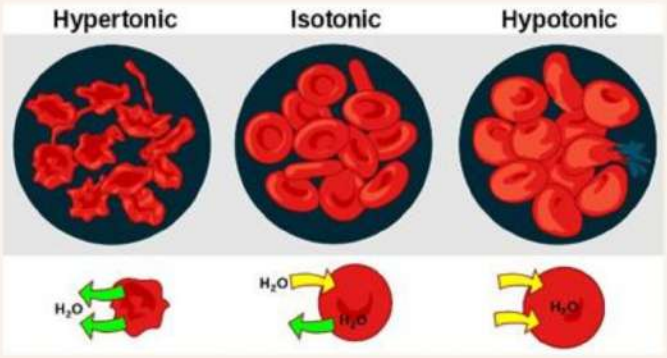
♦ *Endosmosis*:

When a cell is placed in hypotonic solution (lower solute concentration than the solution in the cell. Which means it has more water concentration as compared to the cell), the water enters into the cell and the cell swells up. This process is called endosmosis.

♦ *Exosmosis*:

When a cell is placed in hypertonic solution (high solute concentration than the solution in the cell. Which means it has less water concentration as compared to the cell), the water leaves the cell and move outside and the cell shrinks. This process is called exosmosis.

When a cell is placed in **isotonic solution** (equal solute concentration in and outside the cell), the cell remains un effected as the amount of water enters into the cell is same as the amount of water moves outside the cell so there is no net movement of water.



♦ *Endocytosis*:

The process of ingestion of food and other material by cells through the plasma membrane is called endocytosis. Amoeba gets its food through this process.

Cell Wall and Nucleus

♦ *Cell Wall*:

⇒ In plants in addition to the plasma membrane, have another outer covering called the cell wall.

⇒ The plant cell wall is composed of cellulose. It provides mechanical strength to support cells.

⇒ The process of shrinking of protoplast from the cell wall due to exosmosis in a plant cell when placed in a hypertonic solution is called plasmolysis.

⇒ Animal cells do not show plasmolysis because they do not have cell walls.

♦ *Nucleus*:

⇒Nucleus is a large, spherical organelle present in all the cells.

⇒ The nucleus is separated from the cytoplasm by a double-layer membrane called a nuclear membrane.

⇒ Like plasma membrane, the nuclear membrane is also porous and allows the movements of substances between the cytoplasm and inside the nucleus.

⇒ Inside the nucleus, there is a thread like structure called chromatin fibres.

⇒ During cell division (mitosis and meiosis) chromatin material condenses to form a rod-like structure called chromosomes.

⇒ Chromosomes are made up of DNA (deoxyribonucleic acid) and Proteins (histones and acidic proteins).

- DNA stores all the information for the cell to grow, function, and divide. These segments of DNA are called genes.
- Genes are the hereditary unit of life.

♦ *Nucleoid*:

Prokaryotic organisms lack a nuclear membrane around their genetic material. The nuclear region is poorly defined and contains only nucleic acid. Such undefined nuclear material is called the nucleoid.

Prokaryotic and Eukaryotic Cell

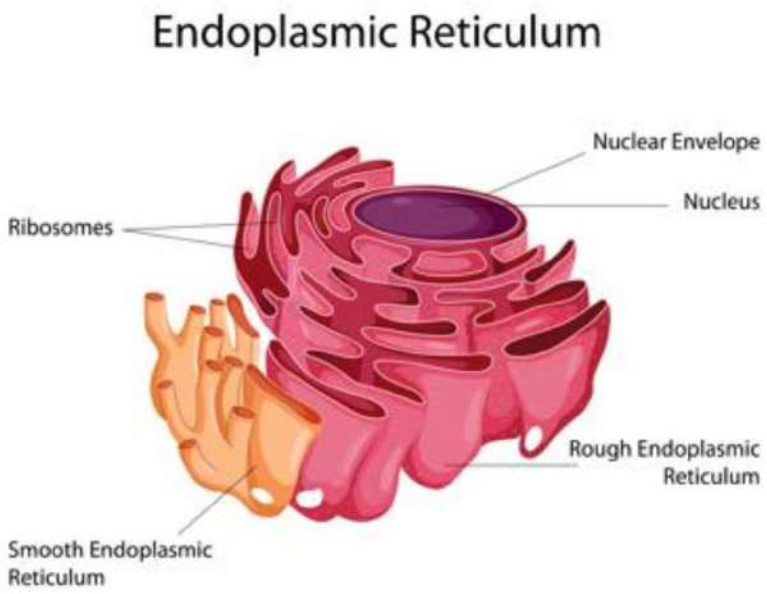
Prokaryotic cell	Eukaryotic cell
Size of a cell is generally small (1 – 10 µm).	Size of a cell is generally large (5 – 100 µm).
Nucleus is absent. Nucleoid is present which is not surrounded by the nuclear membrane.	Nucleus is absent. Nucleoid is present which is not surrounded by the nuclear membrane.
It contains a single chromosome.	It contains more than one chromosome.
Membrane bound cell organelles are absent.	Membrane bound cell organelles (mitochondria, endoplasmic reticulum, Golgi bodies, lysosomes, etc.) are present.
Cell division takes place by the process of fission or budding.	Cell division takes place by mitosis and meiosis.

Cell Organelles

♦ *Endoplasmic Reticulum*:

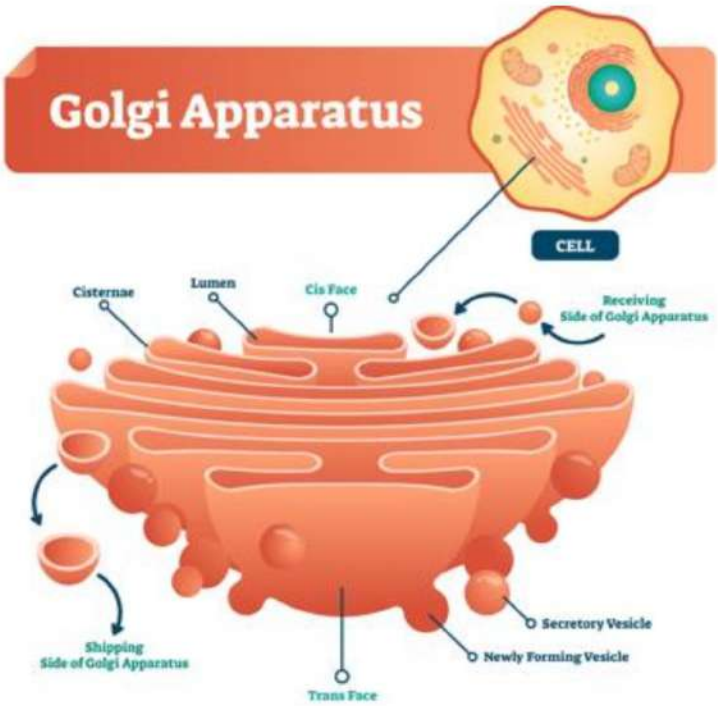
The endoplasmic reticulum is series of membranous network in the cytoplasm of eukaryotic cells. One end of endoplasmic reticulum is connected to nuclear membrane and the other end is connected to plasma membrane. Most eukaryotic cells have two types of endoplasmic reticulum-

- Rough endoplasmic reticulum (RER) with ribosomes attached to its surface is responsible for protein synthesis.
- Smooth endoplasmic reticulum (SER) plays an important role in the synthesis of lipids and fats.



♦ *Golgi apparatus*:

Golgi apparatus is involved in the synthesis of the plasma membrane and lysosomes.



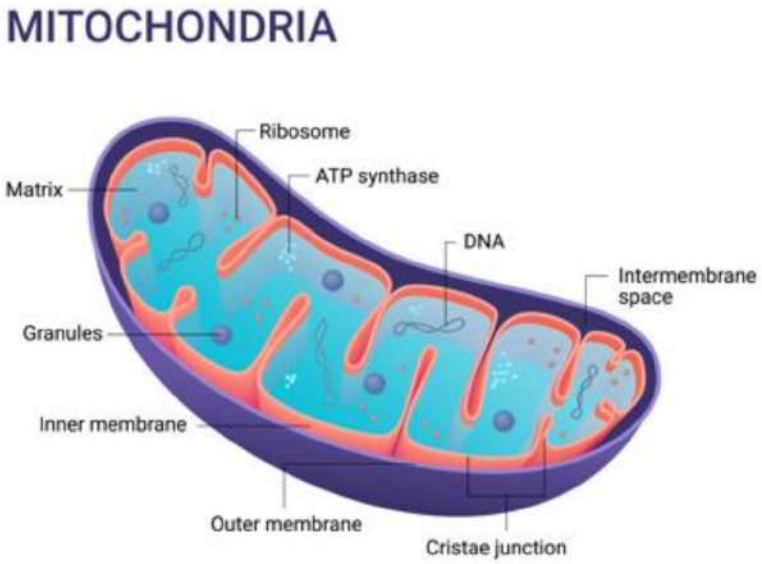
♦ *Lysosomes*:

Lysosomes contain many digestive enzymes and all these enzymes are synthesized in the rough endoplasmic reticulum. They are brought to the lysosomes through the Golgi apparatus. These enzymes are capable of breaking down all types of organic substances.

*Tip: Lysosomes are also called 'suicidal bags'' of the cell because when the cell gets damaged during the breakdown of cell structure, lysosomes bursts, and the enzymes eat up their own cells.

♦ *Mitochondria*:

Mitochondria use oxygen to produce carbon dioxide and water. This is called cellular respiration. The energy released in this process is used to form ATP (Adenosine triphosphate).



*Note: Mitochondria are capable of self-duplication because it has DNA, RNA, and ribosomes. So, mitochondria are able to make their own proteins.

♦ *Plastids*:

Plastids are present in most of the plant cells and absent in animal cells. Plastids have their own DNA and ribosomes, so they are capable of self-replicating. There are three types of plastids:

- Chromoplasts are colored plastids except for the green color.
- Chloroplasts are green-colored plastids that contain chlorophyll.
- Leucoplast is colorless plastids.

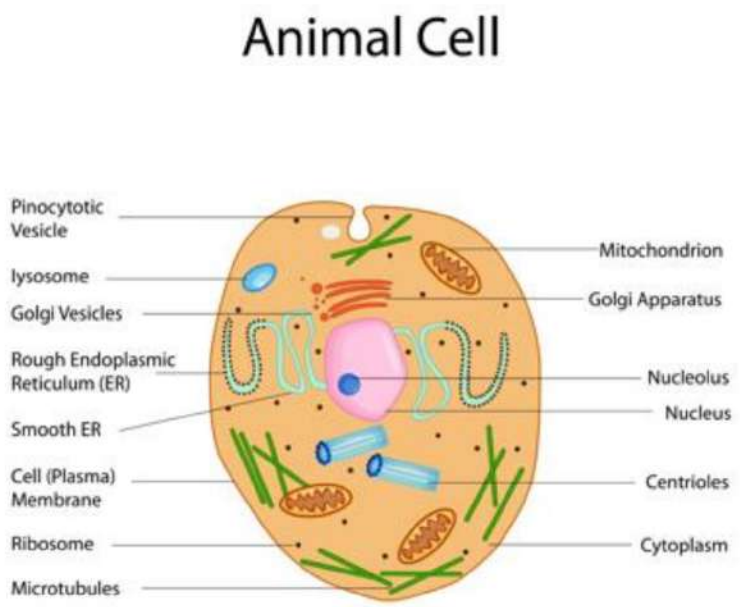
♦ *Vacuoles*:

Plant cells possess large vacuoles. The functions of vacuoles are as follows:

- They store water and minerals.
- Metabolic wastes of the cell are dumped in the vacuole.
- They help to maintain the osmotic pressure in the cell.
- They provide turgidity and rigidity to the plant cells, as it is filled with cell sap

Animal and Plant Cell

♦ *Animal Cell*:



⇒ Animal cells are small in size.

⇒ Animal cells are enclosed by the plasma membrane. The cell wall is absent.

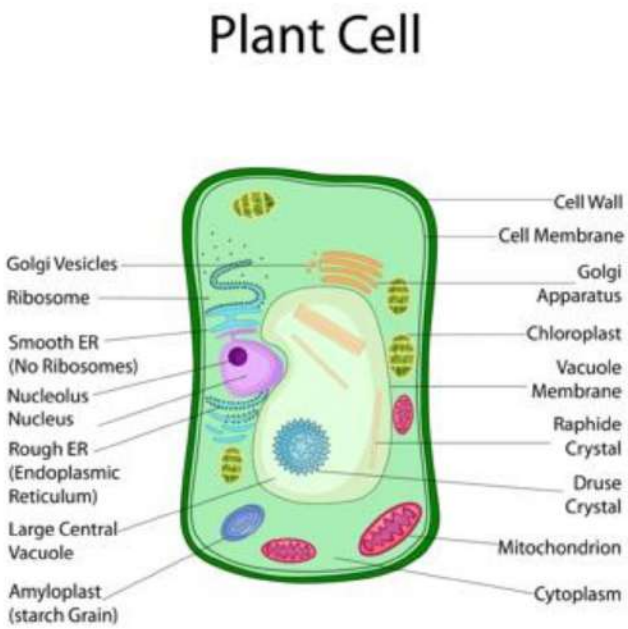
⇒ Plastids are absent in an animal cell.

⇒ In animal cells, vacuoles are small, many, and temporary.

⇒ Animal cells have a single Golgi apparatus near the nuclear envelope.

⇒ Animal cells have centrosomes and centrioles.

♦ *Plant Cell*:



⇒ Plant cells are generally larger than animal cells.

⇒ In addition to the plasma membrane plant cell is surrounded by a rigid cell wall of cellulose.

⇒ Plastids are present in plant cells.

⇒ In plant cells, vacuoles are large, fewer, and permanent.

⇒ Plant cells have many Golgi apparatus scattered in the cytoplasm.

⇒ Plant cells lack centrosomes and centrioles.