Eukaryotic Cell: Structure and Function

Introduction to eukaryotic cells

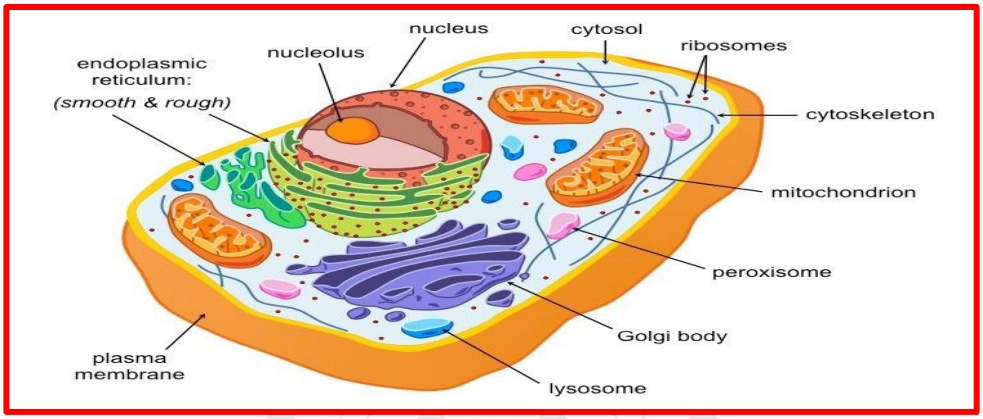
Eukaryotic cells are cells that contain a membrane-bound nucleus, a structural feature that is not present in bacterial or archaeal cells. In addition to the nucleus, *eukaryotic cells* are characterized by numerous membrane-bound *organelles* such as the endoplasmic reticulum, Golgi apparatus, chloroplasts, mitochondria, and others.

Eukaryotic cells have a nucleus enclosed within the nuclear membrane and form large and complex organisms. Protozoa, fungi, plants, and animals all have eukaryotic cells. They are classified under the kingdom Eukaryota.

Characteristics of Eukaryotic Cells

The features of eukaryotic cells are as follows:

1. Eukaryotic cells have the nucleus enclosed within the nuclear membrane.
2. The cell has mitochondria.
3. Flagella and cilia are the locomotory organs in a eukaryotic cell.
4. A cell wall is the outermost layer of the eukaryotic cells.
5. The cells divide by a process called mitosis.
6. The eukaryotic cells contain a cytoskeletal structure.
7. The nucleus contains a single, linear DNA, which carries all the genetic information.



Structure Of Eukaryotic Cell

PLASMA MEMBRANE

Every human cell has a plasma membrane, a nucleus, and cytoplasm. (Some exceptions to this rule exist. A mature erythrocyte, or red blood cell, eliminates its nucleus once development is complete. Thus, erythrocytes are ***a nucleate***. Cells of skeletal muscle, liver, and other tissues may have up to 50 nuclei and are ***multinucleate***.*)*

The Cell Membrane (Plasma Membrane)**,** which surrounds the cell and keeps it intact, regulates what enters and exits a cell. The plasma membrane is a phospholipid bilayer that is said to be *semipermeable* because it allows certain molecules but not others to enter the cell. Proteins present in the plasma membrane play important roles in allowing substances to enter the cell.

MEMBRANE FUNCTIONS:

1. **Compartmentalization.**
2. **Scaffold for biochemical activities.**
3. **Providing a selectively permeable barrier.**
4. **Transporting solutes**
5. **Responding to external signals**
6. **Intercellular interaction.**
7. **Energy transduction**

Small molecules can be transported across the plasma membrane by any one of the following three methods:

(I) Diffusion:

Molecules of substances move from their region of higher concentration to their region of lower concentration. This does not require energy. Example: absorption of glucose in a cell.

(II) Osmosis:

Movement of water molecules from the region of their higher concentration to the region of their lower concentration through a semipermeable membrane. There is no expenditure of energy in osmosis. This kind of movement is along concentration gradient.

(III) Active Transport:

When the direction of movement of a certain molecules is opposite that of diffusion i.e. from region of their lower concentration towards the region of their higher concentration, it would require an "active effort" by the cell for which energy is needed. This energy is provided by ATP (adenosine triphosphate). The active transport may also be through a carrier molecule.

Transport of large molecules (bulk transport)

During bulk transport the membrane changes its form and shape. It occurs in two ways:

(i) ***Endocytosis*** (taking the substance in)
(ii) ***Exocytosis*** (passing the substance out)

Endocytosis is of two types:

Endocytosis		
Phagocytosis	**Pinocytosis**	**Endocytosis**
intake of solid particles	**intake of fluid droplets**	**intake metabolites, hormones, other proteins - and in some cases viruses**
membrane folds out going round the particle, forming a cavity and thus engulfing the particle	**. membrane folds in and forms a cup like structure sucks in the droplets**	**inward budding of plasma membrane vesicles containing proteins with receptor sites specific to the molecules being absorbed**

Note: Cell membrane regulates movement of substance into and out of the cell. If the cell membrane fails to function normally the cell dies.

Plasma membrane structure:

The plasma membrane is made of proteins and lipids and several models were proposed regarding the arrangement of proteins and lipids. The fluid mosaic model proposed by Singer and Nicholson (1972) is widely accepted. The plasma membrane is a phospholipid bilayer with attached (also called peripheral) or embedded (also called integral) proteins. The phospholipid molecule has a polar head and nonpolar tails . Because the polar heads are charged, they are hydrophilic (water loving) and face outward, where they are likely to encounter a watery environment. The nonpolar tails are hydrophobic (water fearing) and face inward, where there is no water.

- Phospholipids
- Peripheral proteins – present on the outer or inner surface of phospholipid bilayer but are not implanted in the hydrophobic core
- Cholesterol – folded between the hydrophobic tails of phospholipid membrane
- Carbohydrates – found to be attached to the lipids or proteins on the extracellular side of the membrane, leading to the formation of glycolipids and glycoproteins
- Integral proteins – found to be implanted in the phospholipid bilayer