



**Cytology:** Study of the structure and function of the cell.

**Cell:** Cell is the basic structural and functional unit of all tissues and organs in the animal body.

**Prokaryotic cells:** - The cells which do not possess any organized nucleus are known as prokaryotic cells. Ex: - Some bacterial and Blue green algae.

**Eukaryotic cells:** - The cells which contain organized nucleus are known as Eukaryotic cells and most of the cells in the animal body are eukaryotic.

**Functionally cells are two types:**

(I) **Somatic cells:** - Somatic cells form various organs of the animal body which contain diploid ( $2n$ ) number of chromosomes.

(II) **Reproductive Cells:** - Reproductive cells take part in the reproduction, which contain haploid ( $n$ ) number of chromosomes.

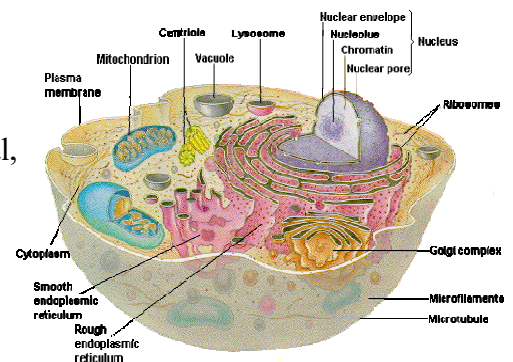
**Reproductive cells are of two types:-**

- Male reproductive cell or male gametes or spermatozoa.
- Female reproductive cells or female gametes or Ova.

## Structure of a Cell

A cell consists of a cell membrane, cytoplasm and a nucleus.

- The cells are in various shapes like flat, cubical, pyramidal, columnar and irregular etc.
- Size of the cells from 5 to 50 microns in most of the somatic cells. However, female reproductive cells and nerve cells are bigger in size.



**Cell membrane:-**

Cells are covered by a thin semipermeable membrane is called cell membrane or plasma membrane, which is composed of three layers, outer and inner layers are formed by protein and intermediate layer is composed of lipid.



- The lipids are mainly phospholipids and arranged in two layers periphery is hydrophilic and middle is hydrophobic in nature.
- The total thickness of the cell membrane is  $70\text{\AA}$

The proteins form the outer and inner layers of cell membrane and also pierce the membrane through and forms water channels, ion channels, different pumps, receptors and enzymes.

### Functions of the cell membrane or plasma membrane:-

- Cell membrane maintains the shape of cell.
- It accommodates various receptors.
- It helps in the selective exchange of inorganic ions.
- It allows selective permeability to lipid.
- It helps in intake of fluid inside the cell cytoplasm by pinocytosis.

### Nucleus: -

The nucleus is the largest cellular organelle, which is composed of nuclear membrane, chromatin, nucleolus and nuclear sap.

- Usually cells contain only one nucleus, but certain cell types such as skeletal muscle cells and osteoclasts normally have several nuclei.
- The shapes of nuclei are commonly spherical to ovoid but they may also be spindle shaped in smooth muscle, bean or kidney shaped in monocytes or multilobulated in neutrophilic leukocytes.
- Nucleus is absent in mammalian RBC.

**Nuclear Membrane:** - Consists of two layers enclosing a narrow perinuclear space and have small circular opening called nuclear pores.

- The outer layer is sometimes blended with rough endoplasmic reticulum and the inner layer is adherent with peripheral chromatin.
- One of the X chromosomes of the females is seen adherent to the nuclear membrane and is known as the **Barr body**.

**Chromatin:** - Chromatin forms the bulk of the nucleus. In interphase period of the cell divisions the chromosomes become uncoiled and extended to form a diffuse network is called chromatin.



# Cytology



**Nucleolus:** - Nucleolus is composed of RNA (ribosome) granules and proteins found within the nucleus and it has no covering. The number of nucleoli varies from one to five in each nucleus.

**Nuclear Sap:** - It is semifluid component of the nucleus, which is rich in protein and serves as a medium for transportation of RNA.

**Cytoplasm:** - The cytoplasm consists of semisolid matrix with organelles and inclusions suspended in it. Organelles are living units while the inclusions are non-living entities.

**Organelles:** Organelles are small structures whose particular organization gives them a specific function in the metabolism of the cell.

**Endoplasmic Reticulum:-** Endoplasmic reticulum is tubular or vesicles like structure which may extend from cell membrane to nuclear membrane.

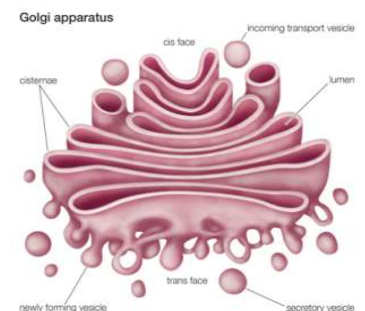
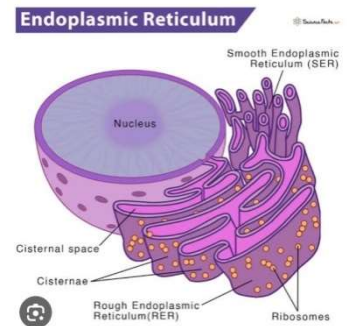
It is two types: rough endoplasmic reticulum and smooth endoplasmic reticulum.

- In rough endoplasmic reticulum ribosome particles are attached to the surface of the tubules and help in protein synthesis.
- The smooth endoplasmic reticulum helps in lipid and steroid synthesis.

## Golgi body / Apparatus:-

It is composed of flat, secretory and micro vesicles and usually present between the nucleus and the apical part of the cell.

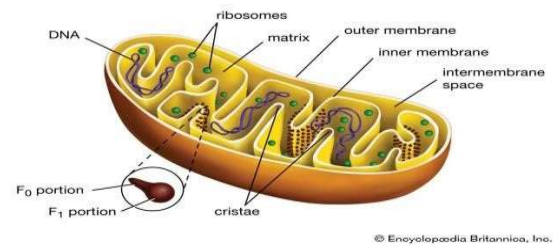
- The protein synthesized by rough endoplasmic reticulum and carried by the micro vesicles to the flat vesicles and from flat vesicles they go to secretory vesicles. The secretory vesicles released as zymogen granules at the cell surface.





## Mitochondria:-

Mitochondria is double membrane structure, the outer membrane is a smooth continuous limiting membrane and the inner membrane is thrown into folds called **cristae**.

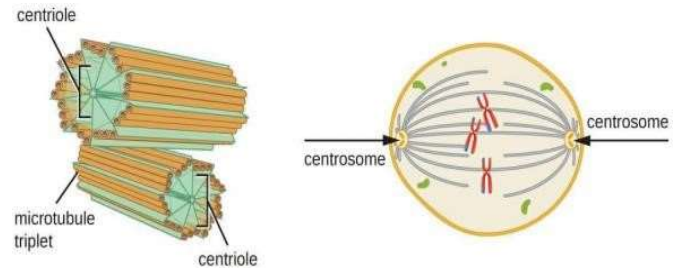


- The mitochondrial fluid is known as matrix. The matrix contains enzymes of kreb's citric acid cycle, respiratory enzymes oxidative phosphorylase etc.
- The number of mitochondria varies in different tissues. Liver, heart and kidney require more energy so more number of mitochondria is found.

**Lysosomes:-** Lysosomes are oval membrane bound bodies and containing number of hydrolytic enzymes like lipase, protease, nuclease, phosphatase etc. They are also called **suicidal bags** because they will destroy the cell itself if their enzymes are released within the cell.

**Ribosomes:-** Ribosomes are granules lying on the surface of endoplasmic reticulum and freely scattered throughout the cytoplasm, which are active sites for the synthesis of proteins.

**Centrioles / Centrosomes:-** It is a dense zone of cytoplasm in the form of short rods and close to the nucleus. It contains two dark particles known as centrioles, each centriole is seen as a cylinder. The wall of the cylinder is made up of nine longitudinal bundles and each of which is made up of three microtubules.



**Fibrils:-** Fibrils are fine filamentous structure form a network to give internal support to the cell e.g. myofibrils in muscle cells, neurofibrils in nerve cells and tonofibrils in epithelial cells.

## Cytoplasmic inclusions:

Cytoplasmic inclusions are non-living entities and do not take part in the metabolism of the cell e.g. Stored food (Glycogen and fat) and Pigments (haemoglobin of blood, melanin of skin, hair and lipofuscin in cardiac muscle, liver and some nerve cells.)