

Structure of Eukaryotic cell

A typical plant cell consists of the following components:

- (I) Cell wall and plasma membrane
- (II) Cytoplasm and
- (III) Nucleus

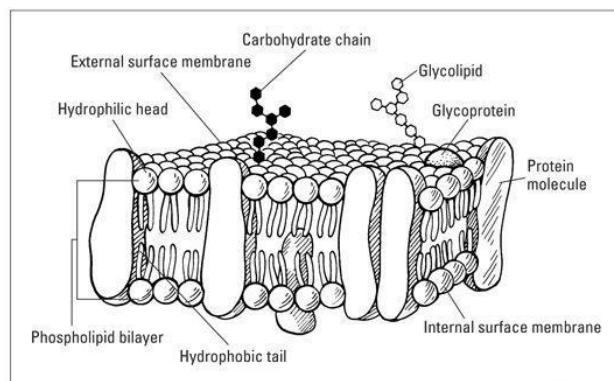
I Cell wall and plasma membrane:-

1. Cell wall:

- The outermost structure of most plant cells is a dead and rigid layer called cell wall.
- The cell wall is a secretion of protoplasm and is mainly composed of cellulose, hemicellulose and pectin.
- The mature cell wall shows differentiation into three layers namely: middle lamella, primary cell wall and secondary cell wall.
- In many plant cells, fine protoplasmic strands pass through the pits and establish organic connection between neighbouring cells these strands are called plasmodesmata.
- The cell wall constitutes a kind of exoskeleton that provides protection and mechanical support to the plant cell. It determines the shape of plant cell and prevents it from desiccation.

2. Plasma membrane:

- The protoplast of a cell is delimited by a living, thin and delicate membrane called plasma membrane, cell membrane or plasma lemma.
- In plant cells, plasma membrane occurs just inner to cell wall, bounding the cytoplasm.
- The plasma membrane exhibits a trilaminar (i.e. three-layered) structure with a translucent layer sandwiched between two dark layers. At molecular level, it consists of a continuous bilayer of lipid molecules with protein molecules embedded in it (intrinsic proteins) or adherent to its both surfaces (extrinsic proteins). The plasma membrane is a selectively permeable membrane. Its main function is to control selectively the entrance and exit of materials.



II Cytoplasm:

- The space between the plasma membrane and the nucleus is filled by an amorphous, translucent, homogeneous colloidal liquid known as hyaloplasm or cytoplasm.
- The cytoplasm is the most essential part of the cell because it is the seat of all biosynthetic and bioenergetic functions.
- It is composed of two distinct types of structures, the matrix (L. matrix-womb) and the organelles (Gr. Organon-instrument).

1. Cytosol or matrix:

- The aqueous portion of the cytoplasm is called cytosol. It serves to dissolve or suspend the great variety of small molecules, concerned with cellular metabolism e.g. glucose, amino acids, nucleotides, vitamins, minerals, oxygen and ions. In many types of cells, the cytosol is differentiated into two parts:
- **(i) Ectoplasm or cell cortex:** It is the peripheral layer of the cytoplasm which is relatively non-granular, viscous, clear and rigid.
- **(ii) Endoplasm:** It is the inner portion of cytosol which is granular, and less viscous.

2. Cytoplasmic structures:

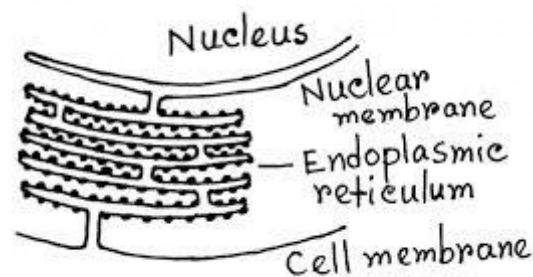
- In the cytoplasmic matrix, certain non-living and living structures remain suspended. The non-living structures are called paraplasm or inclusions; while the living structures are membrane bounded and are called organelles.
- (a) Cytoplasmic inclusions:** The cytoplasmic inclusions include oil droplets, yolk granules, pigments, secretory granules, starch granules in plants and glycogen granules in animal cells.

(b) Cytoplasmic organelles: The cytoplasm is coursed by a multitude of internal membranous structures, the organelles. They perform various important biosynthetic and metabolic activities such as respiration, photosynthesis, transportation, storage and reproduction.

- The most important cytoplasmic organelles are microtubules, endoplasmic reticulum, Golgi complex, lysosomes, cytoplasmic vacuoles, microbodies, mitochondria and plastids.

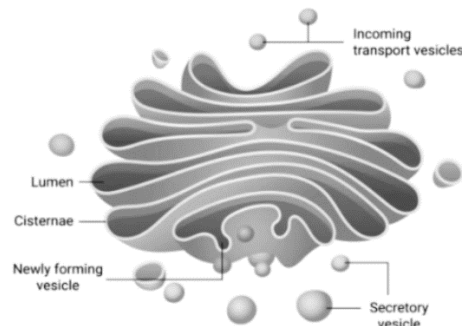
Endoplasmic reticulum:

- The cytoplasmic matrix is traversed by a vast reticulum or network of inter-connecting tubules and vesicles, which is known as endoplasmic reticulum or ER.
- The ER is bounded by a single unit membrane.
- ER remains continuous with the plasma membrane and the nuclear envelope.
- The outer surface of Rough ER has attached ribosomes, whereas smooth ER is without attached ribosomes.
- Functions of smooth ER include lipid metabolism and drug detoxification. Rough ER is found in cells which are active in protein synthesis.



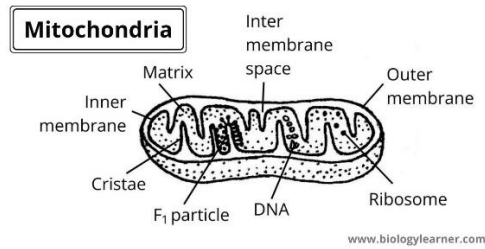
Golgi complex:

- It is a cup shaped organelle which is located near the nucleus in many types of cells.
- Golgi apparatus consists of cisternae, vesicles and vacuoles.
- The function of the Golgi complex is storage of proteins and enzymes which are secreted by ribosomes and transported by ER to them.
- In plant cells, the complex consists of many freely distributed sub-units, called dictyosomes. They secrete cellulose and pectin for cell wall formation during the cell division.



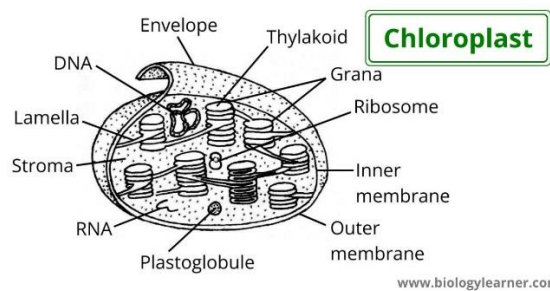
Mitochondria:

- Mitochondria are oxygen - consuming ribbon - shaped cellular organelles of immense importance.
- Each mitochondria is bounded by two unit membranes.
- The outer membrane forms a bag - like structure around the inner membrane which gives out many finger - like folds in to the lumen of the mitochondria.
- The folds of inner mitochondrial membrane are known as cristae.
- The space between outer and inner mitochondrial membrane as well as the central space is filled by a viscous mitochondrial matrix.
- The functions of mitochondria are respiration, oxidation of food, and metabolism of energy. The mitochondria also contain a circular DNA molecule and ribosomes.



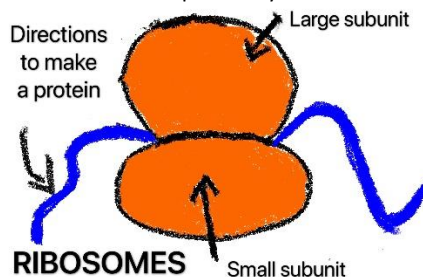
Plastids:

- The plastids occur commonly in plant cells and their diameter varies from 4 μm to 6 μm .
- They may be colourless or coloured.
- The colourless plastids are known as leucoplasts and coloured plastids as chromoplasts.
- The leucoplasts usually have storage function and store starch and lipids. The green coloured plastids are known as chloroplasts which help in the biosynthesis of food stuffs by the process of photosynthesis.



Ribosomes:

- These are small organelles of about 140-230 $\text{\AA}$ in size.
- They are composed of r RNA and proteins.
- They may be present free in the cytoplasm or be attached to the membranes of rough type of ER.
- Each ribosome is composed of two structural units, a smaller subunit known as 40S subunit and a larger subunit known as 60S subunit. Ribosomes are the sites of protein synthesis.



Microtubules:

- The cytoplasm of plant and animal cells is traversed by numerous ultrafine tubules of tubulin protein, called microtubules.
- The function of microtubules is the formation of spindle fibres during cell division. Moreover, they form the structural units of the centrioles, basal granules, cilia and flagella.

Cytoplasmic Vacuoles:

- The cytoplasm of many plant and some animal cells (i.e. ciliate protozoans) contains numerous small or large, sized, hollow, liquid filled structures, the vacuoles.
- The vacuoles are bounded by a single, semi permeable membrane known as tonoplast.
- They are filled with a fluid called cell sap.

III Nucleus:

- The nucleus is the controlling centre of the cell, which governs the growth and development.
- The nucleus was first observed by Robert Brown in 1831.
- The nucleus consists of three structures: (i) Nuclear membrane (ii) Nucleoplasm and Chromosomes, and (iii) the Nucleolus.
- The nucleus is bounded by two membranes of lipoproteins which are known as nuclear membranes.
- They form a kind of envelope around the nucleus and this envelope is known as nuclear envelope.

- The nuclear envelope is interrupted by a number of pores. The outer membrane of nuclear envelope remains continuous with the membranes of ER and plasma membrane.
- The nucleus is filled with a watery substance known as nucleoplasm or karyolymph.
- The nucleoplasm contains certain thread like structures known as chromosomes.
- The nucleoplasm contains a conspicuous, darkly stained spherical body known as the nucleolus.
- Chemically nucleolus is composed of ribosomal proteins and ribosomal RNA.
- Nucleolus is the site for biogenesis of ribosomes.

