

PUC 1ST YEAR –SEMESTER-2

UNIT I: Cell Biology

Module No –2: Eukaryotic cell - structure and function

Plants, animals, fungi and protista have eukaryotic cells. The eukaryotic cell is more complex in structure when compared to the prokaryotic cell. These cells are about 10 – 100 μm and have different shapes, sizes and functions.

A typical eukaryotic cell contains the following parts

1. Outer envelope (cell wall/ plasma membrane)
2. Cytoplasm and
3. Nucleus

Outer envelope:

The outermost covering in certain protists, fungi and in all plants is the cell wall, while in animals it is the cell membrane or plasma membrane. Cell wall is thick, rigid, non elastic and non – living and it is absent in animal cells. Cell wall is made up of cellulose. The cell wall gives protection and support to the plasma membrane and the cytoplasm which lies beneath it.

In animal cells, the external covering is cell membrane or plasma membrane. It is living, thin, elastic, porous and semi permeable. It gives mechanical support and definite shape to the cell. It checks the entry or exit of undesirable substances and it allows the transmission of necessary materials to and from the cells.

Cytoplasm (hyaloplasm):

It is the colloidal, transparent, colourless, homogeneous fluid present between plasma membrane and nucleus. The cytoplasm consists of various inorganic compounds (water, salts of Na, K etc and other metals) and various organic compounds such as carbohydrates, proteins, lipids, nucleoproteins, nucleic acids and enzymes. Cytoplasm also contains non – living and living structures. The non – living structures are known as deutoplasm, paraplast or inclusions and the living structures are called organelles which are membrane bound.

The peripheral layer of cytoplasmic matrix is called ectoplasm or plasma gel. It is a clear, non – granular viscous fluid. The inner part is called endoplasm or plasma sol which is granular, less viscous and semitransparent. The plasma gel and plasma sol are inter convertible. The cytoplasmic structures are found in the plasma sol. The plasma sol is always in motion and this movement is called cytoplasmic streaming or cyclosis.

Cytoplasmic inclusions:

These includes oil drops, yolk granules, pigments, secretory granules, glycogen granules etc. and these are found suspended in the cytoplasm. The cytoplasmic inclusions are devoid of any membrane.

Cytoplasmic organelles:

The living structures are called organelles or organoids. Most of them are membrane bounded. They perform several biosynthetic and metabolic activities such as secretion, storage, transport, respiration and reproduction etc. the cytoplasmic organelles includes ribosomes, mitochondria, golgi complex, endoplasmic reticulum, centrioles, lysosomes, microtubules, basal granules , plastids, cilia and flagella. Of these golgi complex and mitochondria are double unit membranes. While endoplasmic reticulum and lysosomes are single unit membranes. Ribosomes do not follow the membrane concept. Centrioles are without any limiting membrane (**All the cytoplasmic organelles are covered in detail in module nos 11 to 14**)

As eukaryotic cells can be either animal or plant, both these types of cell contain some common organelles:

- Nucleus
- Mitochondria
- Endoplasmic reticulum
- Golgi apparatus
- Lysosomes
- Peroxisomes

- Cytoskeleton

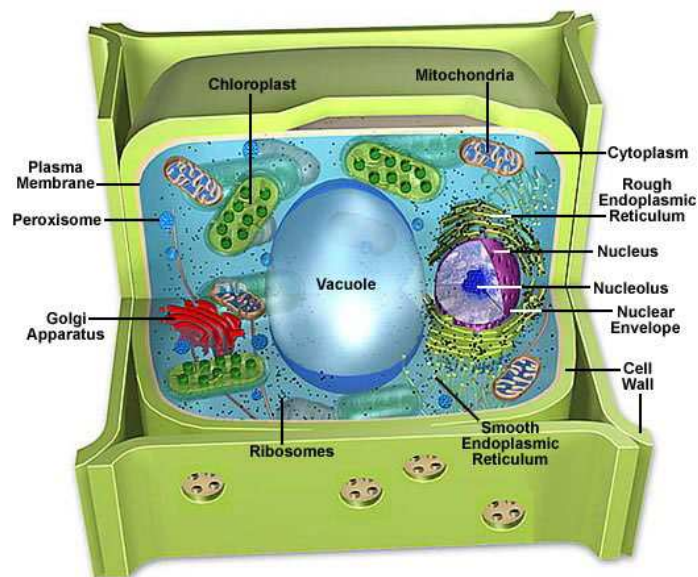
The plant cell contains in addition

- Cell wall
- Plastids
- Vacuoles
- Flagella

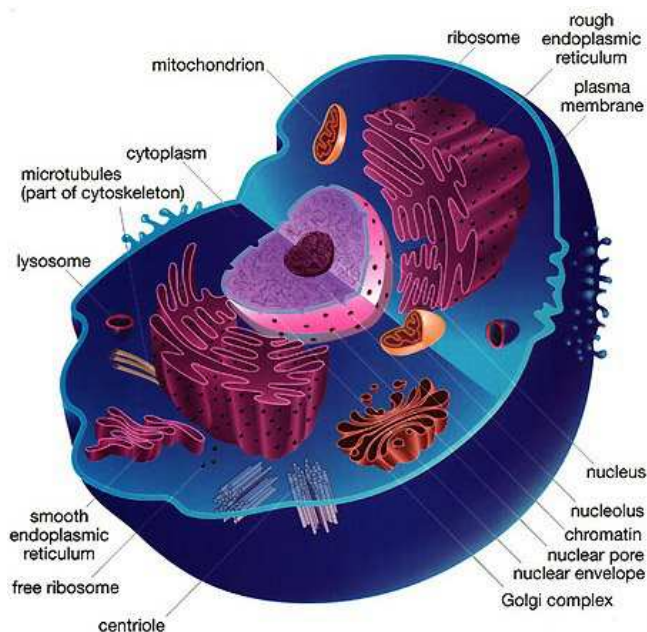
The animal cell contains in addition to the common organelles

- Centrioles
- Cilia or Flagella

STRUCTURE



Ultra Cell structure of Plant cell



Ultra cell structure of animal cell

Nucleus:

Most conspicuous and lying usually in the centre of the cell is a rounded or ovoid body, called nucleus. It is found in all eukaryotic cells of both plants and animals except mammalian erythrocytes. It is delimited from the cytoplasm by its extremely thin nuclear membrane. The membrane has several pores which control transport of substances into and out of the nucleus. Embedded in the nucleoplasm of nucleus are chromatin, nucleolus, endosomes etc. Chromatin is the suspended network present in nucleoplasm and form chromosomes during cell division. Chromosomes contain hereditary material DNA and nucleoproteins. The number of chromosomes remain constant in a given species. Within the nucleoplasm also occurs a conspicuous spherical body, the nucleolus. It is concerned with protein synthesis and origin of ribosomes. Nucleus controls all the vital activities of the cytoplasm and it carries the hereditary material, the DNA.

PLANT CELLS COMPARED WITH ANIMAL CELLS

Animal cells do not have a cell wall. Instead of a cell wall, the plasma membrane (usually called cell membrane) is the outer boundary of animal cells.

Frameworks of rigid cellulose fibrils thicken and strengthen the cell walls of higher plants. Plasmodesmata, the cytoplasmic bridges between adjacent cells of higher plant cells do not have a counterpart in the animal cell model. During telophase of mitosis, a cell plate is formed as the plant cell begins its division. In animal cells, the cell pinches in the center to form two cells; no cell plate is laid down. Centrioles are generally not found in higher plant cells, while they are found in animal cells. Animal cells do not have plastids, which are common in plant cells (chloroplasts). Both cell types have vacuoles, however, in animal cells vacuoles are very tiny or absent, while in plant cells vacuoles are generally quite large.

The cytoplasm consists of cell organelles and also vacuoles and ergastic substances. The details of cell organelles are given in subsequent modules.

COMPARISON OF PLANT AND ANIMAL CELL

Character	Plant cell	Animal cell
Cell wall	Present	Absent
Plastids	Present	Absent
Flagella	Present	Present
Centrioles	Absent	Present
Centrosomes	Absent	Present
Cilia	Absent	Present
Ergastic substances	Present	Eliminated from cell

Check points:

1. Eukaryotic cells are found in organisms belonging to kingdom protista, fungi, plantae and animalia
2. Eukaryotic cells have different shapes, sizes and functions
3. Eukaryotic cells are typically made of outer envelope, cytoplasm and nucleus
4. All eukaryotic cells are covered by a cell membrane or plasma membrane. In plants there is an additional structure called the cell wall made up of cellulose.
5. Cytoplasm exhibits streaming movements, which is called cyclosis.
6. The non – living constituents of the cytoplasm are called paraplast, deutoplast or inclusions
7. The living structures of cytoplasm are called organelles, which are involved in various metabolic activities of the cell.
8. The vital part of the cell that controls all the activities is the nucleus. It is the dynamic centre of the cell.

Object Type Questions:

1. Animal cell differs from plant cell as it possess
 - a) Mitochondria
 - b) Centriole**
 - c) Golgi apparatus
 - d) Endoplasmic reticulum
2. Which of the following found exclusively in animal cell
 - a) Cell wall
 - b) Lysosome
 - c) Centriole**
 - d) Plastids
3. Ergastic substances are
 - a) Organic substances
 - b) Inorganic substances
 - c) Products of metabolism
 - d) All**
4. Cyclosis means
 - a) Streaming movements of the cytoplasm**
 - b) Movement of the vacuoles
 - c) Both
 - d) None

5. Cytoskeleton is composed of
a) Microtubules b) Microfilaments c) Chromatin network **d) a & b**
6. Movement of cytoplasm within the cell is called _____ (cyclosis)
7. In higher plants, the organelle responsible for photosynthesis is _____ (chloroplasts)
8. Nuclear membrane separates nucleus from _____ (cytoplasm)
9. Which of the following orgonells is not bound by two membrances
A. Mitochondria
B. Plastids
C. Nucleus
D. Ribosomes
10. The activities of all the living cells are controlled by
A. Nucleus
B. Hormones
C. Chloroplasts
D. Mitochondria

Short Answer Questions:

1. What are the common characters found in plant and animal cell?
2. What are the characters present only in plant cell?
3. How animal cell is different from the plant cell?
4. Give any 5 differences between a plant and animal cell.
5. How the plant cell is different from animal cell in its outer bounded structure?
6. What are the double membrane organelles?
7. Write about the cytoplasmic movements of the cell?

8. What is the cell organelle which helps in cell divisions that is present in animal cell? Describe it?

Long Answer Questions

1. Describe briefly the ultra structure of Eukaryotic cell.
2. Discuss the major difference between plant and animal cells?
3. Draw and label the animal cell. Mention one important function of each part?