

Faculty Science

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B.Sc II Paper-II(Cytology, Genetics, Evolution& Ecology)

Unit-I Topic- Plant Cell Structure

The cell is the basic structural and functional unit of all organisms. All cells whether they exist as one celled organism or as a part of multicellular organism are capable of carrying out certain basic functions such as nutrition, respiration, growth and reproduction. These functions are essential for survival of the cells. The word cell was first used by Robert Hooke in his description (1665) of the fine structure of cork and other plant materials.

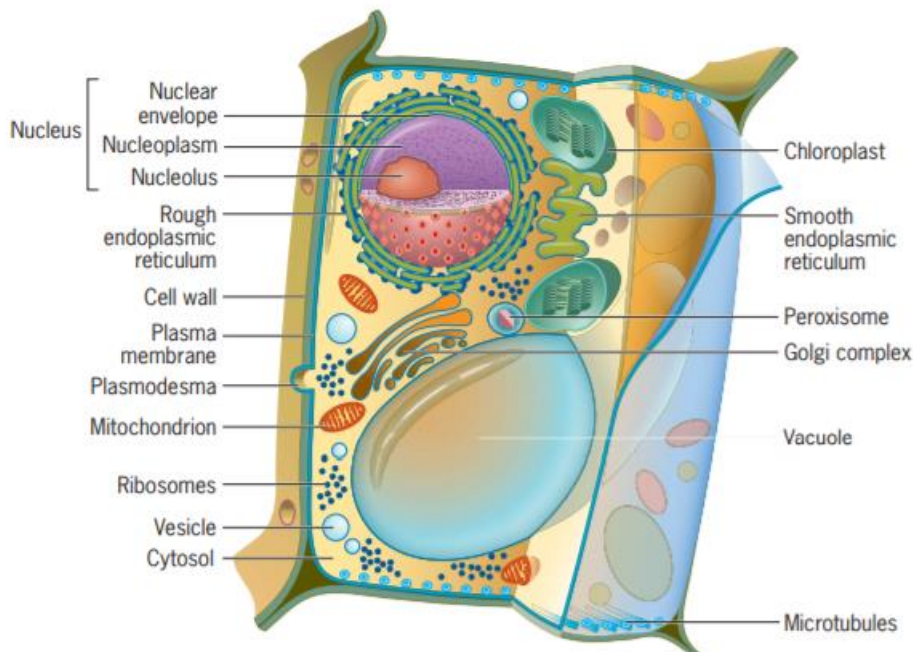
On the basis of cellular organisation all organisms are divided into two main groups:

1. Prokaryotes- These organisms contain prokaryotic cell. A prokaryotic cell does not contain a membrane bound nucleus. They lack the membranous subcellular organelles, their plasma membrane may be infolded to form mesosomes. The mesosomes may be the site of DNA replication and other specialised enzymatic reactions. A prokaryotic cell has a single chromosome in its cytosol. The chromosome consists of a single circular molecule of DNA which is condensed to form a nucleoid. In prokaryotic cell ribosomes are present. Cell division takes place by fission or budding. The prokaryotes include bacteria and cyanobacteria or blue green algae.

2. Eukaryotes -The eukaryotes contain membrane bound nuclei and other cell organelles. Genetic material is surrounded by nuclear membrane. It contains more than one chromosome. Cell division takes place by mitotic or meiotic cell division. The eukaryotes include plants and animals.

Structure of Plant cell -They are eukaryotic cells. The plant cell has following main parts:

- A. Cell wall
- B. Cell membrane
- C. Cytoplasm
- D. Nucleus
- E. Vacuole



The Structure of The Plant Cell

A. Cell wall- The cell wall is a rigid layer which lies outside the plasma membrane. It is non- living, freely permeable and determines the shape of a plant cell. The plant cell wall consists of mainly cellulose along with other polysaccharides like hemicellulose, pectin, and lignin. The cell wall of fungi is made up of chitin. Plant cells have a primary cell wall, which is a flexible layer formed on the outside of a growing plant cell. Plants can also have a secondary cell wall, a tough, thick layer formed inside the primary plant cell wall when the cell is mature.

B. Cell membrane- The cell membrane occurs just beneath the cell wall, bounding the cytoplasm. It consists of lipid bilayers with proteins embedded in it or adherent to its both surfaces. It is living and selectively permeable membrane. Its main function is to control selectively the entrance and exit of molecules.

C. Cytoplasm- The cytoplasm consists of an aqueous ground substance or the cytosol and all the organelles except nucleus. The cytosol contains the soluble proteins and enzymes which forms 20 to 25% of the total protein content of the cell. The cytosol also contains a system of protein fibres called cytoskeleton and cytoplasmic inclusions. The cytoplasmic inclusions store food and secretory

substances such as starch grains. The cytoplasmic organelles include ribosome, mitochondria, plastids, Golgi bodies, lysosomes, endoplasmic reticulum etc.

i) Ribosome-These are the site of protein synthesis. They occur free in the cytoplasm and remain attached to endoplasmic reticulum.

ii) Mitochondria- Mitochondria are distributed uniformly throughout the cytoplasm. They produce ATP through cellular respiration.

iii) Plastids- Plastids are small, variously shaped subcellular organelles present in cytoplasm of plant cells. Their number varies in different plants. They are classified as chromoplast or non-green and non-photosynthetic pigments plastid, leucoplast or colourless plastid, amyloplast or starch accumulating plastid, proteinoplast or protein storing plastid, elaioplast or fat accumulating plastid and the chloroplast or green plastids. The chloroplast contains chlorophyll and other photosynthetic pigments. These are the site of photosynthesis, the process by which CO₂ and light energy from sun are converted into chemical energy, production of oxygen and energy rich organic compounds.

iv) Golgi bodies or Dictyosomes- They are usually found scattered throughout the cytoplasm. The major function of Golgi complex is secretion. They also involve in folding, sorting and packaging of proteins.

v) Lysosome-They are single membrane bounded particle. They contain hydrolytic enzymes to hydrolyze protein and carbohydrate.

vi) Endoplasmic reticulum-They contain a network of tubules and flattened sacs. They play major role in the production, processing and transport of proteins and lipids.

D. Nucleus- It is universally present in all plant cells except mature sieve tubes. The nucleus is the major site of DNA, so that it is responsible for the replication, expression and preservation of genetic information. It also regulates cell division, growth and differentiation. The hereditary characters are transmitted through nucleus

E. Vacuole- Plant cells have a large central vacuole. A vacuole is a small sphere of plasma membrane within the cell .It contains fluid, ions, and other molecules. The central vacuole of a plant cell helps to maintain its turgor pressure, which is the pressure of the contents of the cell pushing against the cell wall. A plant thrives best when its cells have high turgidity, and this occurs when the central vacuole is full of water. If turgor pressure in the plants decreases, the plants begin to wilt.

Differences between the plant cell and the animal cell

The Plant cell	The Animal cell
1.It is usually large in size.	It is smaller in size.
2.It has a rectangular, fixed shape because of the cell wall that surrounds the cell.	It has round, irregular shape. The cell wall is absent.
3.It has chloroplasts. The plants are autotrophs.	It has no chloroplast except Euglena. The animals are heterotrophs.
4.The mature plant cells have a large central vacuole.	The animal cells have many small vacuoles.
5.It lacks centrosome and centrioles.	Centrosome helps in cell division. During cell division centrioles are involved in the spindle formation.
6.Plasmodesmata are present. They facilitate communication and transport of materials across plant cells.	It lacks plasmodesmata.
7.In plant cell during cytokinesis cell plate forms in cytoplasm and grows a new doubled cell wall between daughter cells.	In animal cell a cleavage furrow is formed between daughter cells.

References-

1. <https://biologydictionary.net>
2. "Karp's Cell and Molecular Biology Concepts and Experiments", 8th edition (2016). John Wiley & Sons, Inc., USA.
3. Bios Instant Notes Biochemistry, 3rd edition (2007). Garland Science, USA.

