ST. ANDREWS SCOTS SR. SEC. SCHOOL

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CLASS- IX

SUBJECT- BIOLOGY

Lesson: 5 (The Fundamental Unit of Life- PART 2)

Structure of Cell

Cell is generally composed of three basic components:

(i) Cell wall and cell membrane

(ii) Nucleus

(iii) Cytoplasm

(i) Cell membrane or Plasma membrane:

Plasma membrane is the covering of the cell that separates the contents of the cell from its external environment.
It is a living part of the cell and is present in cells of plants, animals and microorganisms.
It is very thin, delicate, elastic and selectively permeable membrane.
It is composed of lipid and protein.

Function:

As it is selectively permeable membrane, it allows the flow of limited substances in and out of the cell.

Cell wall:

cell wall is non-living, thick and freely permeable covering made up of cellulose.
It is present in eukaryotic plant cells and in prokaryotic cells.

Functions:

→ It determines the shape and rigidity to the plant cell.

→ It protects the plasma membrane.

→ It prevents desiccation or dryness in cell.

→ It helps in the transport of various substances in and out of the cell.

Substances can pass across a membrane by two processes- diffusion and osmosis.

Diffusion: Some substances like carbon dioxide or oxygen can move across the cell membrane by a process called diffusion.
"Diffusion is the spontaneous movement of molecules from a region of its higher concentration to a region of its lower concentration."
Example: movement of carbon dioxide and oxygen during respiration in organisms.

Osmosis:
The movement of water molecules through a selectively permeable membrane from a region of higher water concentration to a region of lower water concentration is called osmosis.

Let us see what will happen if you put an animal cell or plant cells into solution of sugar or salt prepared in water?

1- If the medium surrounding the cell has a higher water concentration than the cell, i.e., if solution is a very diluted solution, the cell will gain water by osmosis. Such a dilute solution is called **hypotonic solution.**
Water molecule will pass across the plasma membrane in both directions, but more water molecules will enter the cell than will leave. The cell will therefore, swell up and increase in volume. This process is called **endosmosis.**

2- If the medium surrounding the cell is exactly the same water concentration as the cell, there will be no net movement of water across the plasma membrane resulting in no change in the size of the cell. Such a solution is called **isotonic solution.**

3- If the medium has a lower concentration of water than the cell, i.e., if it is very concentrated solution, the cell will lose water by osmosis. Such a concentrated solution is called **hypertonic solution.**
In this case too, water crosses the plasma membrane in both the directions, but this time more water leaves the cell than enter it. The cell will therefore, shrink and reduce in volume. This process is known as **exosmosis.**

(ii) Nucleus:

- The nucleus is a major, centrally located spherical cellular component. It is the centre from where all cellular activities are controlled. It is the carrier of hereditary material in the cell.
- It is bounded by two membranes, both forming a **nuclear envelope**. The nuclear envelope contains many pores known as **nuclear pores** and encloses the liquid ground substance, the **nucleoplasm**.
- The nucleopores allow transfer of materials between the nucleoplasm and the cytoplasm. Within nucleoplasm are embedded two types of nuclear structures- nucleolus and chromatin material.

Nucleolus:

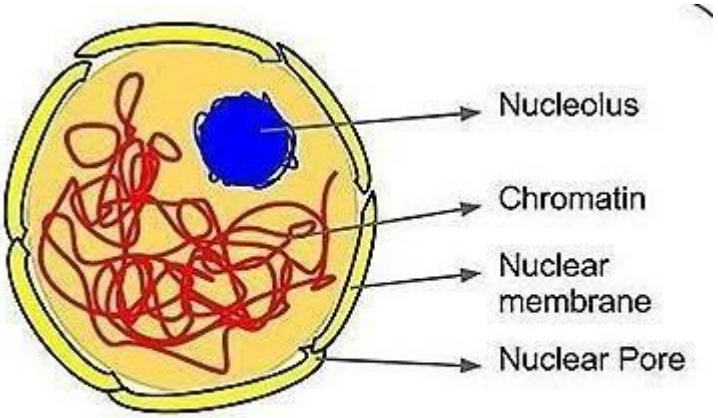
- The nucleolus may be one or more in number and is not bounded by any membrane.
- Nucleolus consists of DNA, RNA and proteins.
- It is the site of ribosome formation. Nucleolus is known as **factory of ribosomes**.

Chromatin material:

- The chromatin is a thin, thread-like intermingled mass of chromosome material and composed of the genetic substance DNA (deoxyribonucleic acid) and proteins.
- DNA stores all the information necessary for the cell to function (metabolism), to grow and to reproduce further cells of the next generation.
- The chromatin is condensed into two or more thick ribbon-like chromosomes during the division of cell.
- Functional segments of DNA are called **genes**.

Functions of nucleus:

1. The nucleus controls all metabolic activities of the cell. If the nucleus is removed from the cell, the protoplasm ultimately dries up and dies.
2. It regulates the cell cycle.
3. It is the **storehouse of genes** which are concerned with the development and manifestation of all the body characters.
4. Nucleus helps in the formation of ribosomes and RNA.
5. It helps in the transmission of characters from one generation to the next.



A Nucleus

(iii) Cytoplasm:

It is a jelly-like, viscous, colourless semi-fluid substance that occurs between the plasma membrane and the nuclear membrane.
The aqueous ground substance of cytoplasm is called cytosol that contains a variety of cell organelles and other insoluble waste products and storage products, like starch, glycogen, lipid, etc.

Functions:

→ Protoplasm acts as a store of vital chemicals like amino acids, proteins, sugars, vitamins,iron etc.
→ It is the site of certain metabOlic reactions, like glycOlysis, synthesis Of fatty acids etc.

Cell organelles:

Inside the cell there are different parts performing different activities to keep the cell alive and functionable. These part are called Cell organelles. They are explained below:

. Endoplasmic Reticulum:

It is a membranous network of tube like structures extending from nuclear membrane to plasma membrane.
It is absent in prokaryotic cells.
There are two types of endoplasmic reticulum:

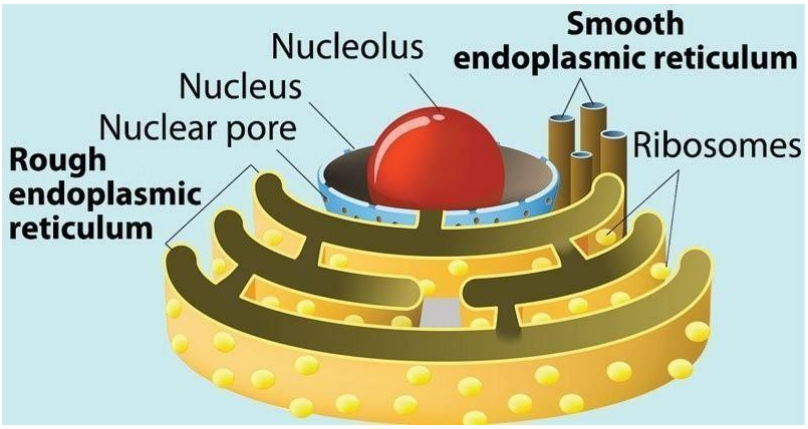
Functions:

→ It gives internal support to cell.

→ It helps in transport of various substances from nuclear membrane to plasma membrane or vice versa.

→ RER helps in synthesis and transportation of proteins.

→ SER helps in synthesis and transportation of lipids.



2. Ribosomes:

These are extremely small, dense and spherical bodies which occur freely in the matrix (cytosol) or remain attached to the endoplasmic reticulum.

These are made up of ribonucleic acid (RNA) and proteins.
They are of two types:
(i) 70s
(ii) 80s

Function:

They play a major role in the synthesis of proteins so they are also called protein factory of the cell.

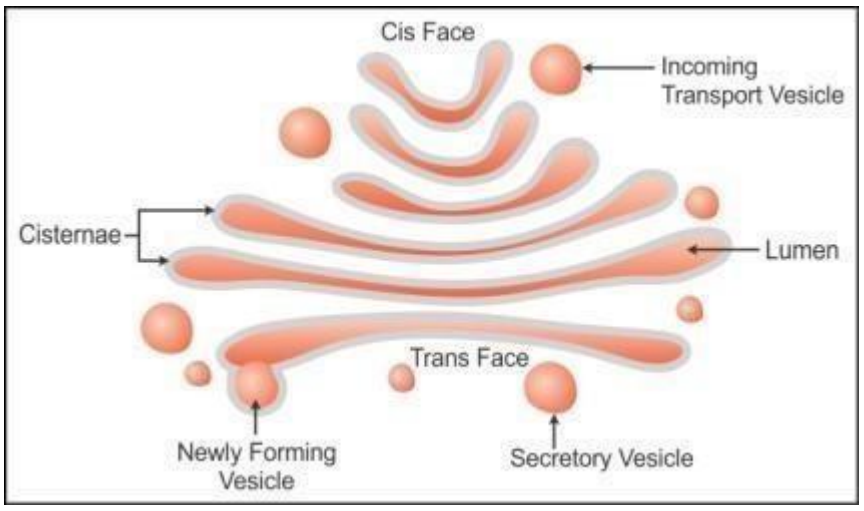
3. Golgi Apparatus:

Golgi apparatus consists of a set of membrane bound, fluid filled vesicles, vacuoles and flattened cisternae (closed sacks).
Cisternae are usually arranged parallel to each other called stacks.

Functions:

→ Its main function is to store, modify, package and dispatch the substances.

→ It is also involved in the synthesis of cell wall, plasma membrane and lysosomes.



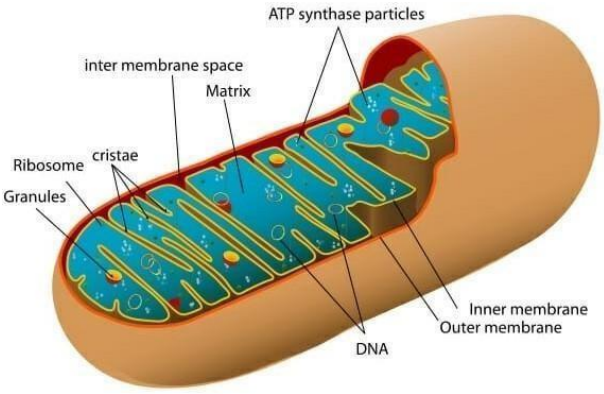
4. Mitochondria:

They are small rod-shaped organelles.
It is a double membrane structure with outer membrane being smooth and porous whereas inner membrane being thrown into a number of folds called cristae.
They contain their own DNA and ribosomes.
It is also known as power house of the cell. It releases all the energy in the form of ATP (Adenosine-tri-phosphate).

Functions:

→ They are the sites of cellular respiration, hence provide energy for the vital activities of living cells.

→ They store energy releases during reactions, in the form of ATP (Energy currency of the cell). Therefore, they are also called **‘power house’ of the cell.**



5. Plastids:

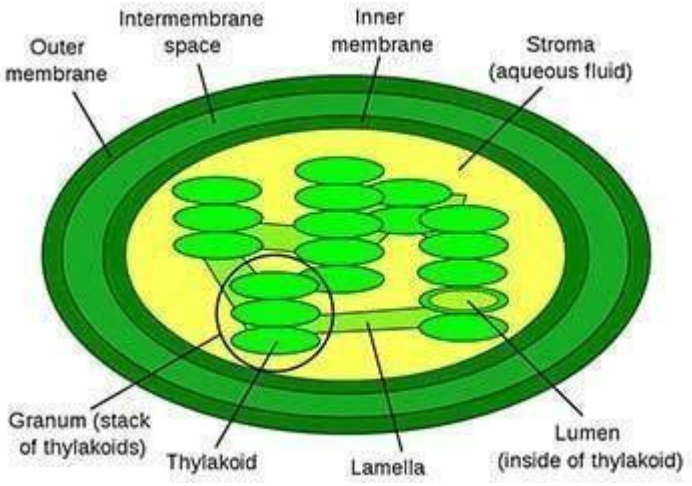
Plastids are present in most of the plant cells and absent in animal cells.
They are usually spherical in shaped and double membrane bound organelles. Plastids contains various membrane layered structure embedded in a material called the stroma. In stroma, different enzymes are present which help in photosynthetic reactions.
They also have their own DNA and ribosomes.
Plastids are of three types: **(a) Chloroplasts:** These are the green coloured plastids containing chlorophyll. Chloroplasts aid in the manufacture food by the process of photosynthesis. **(b) Chromoplasts:** These are the colourful plastids (except green colour). **(c) Leucoplasts:** These are the colourless plastids.

Function:

→ Chloroplasts trap solar energy and utilise it to manufacture food for the plant.

→ Chromoplasts impart various colours to flowers to attract insects for pollination.

→ Lecuoplasts help in the storage of food in the form of starch, proteins and fats.



7. Lysosomes:

Lysosomes are small, spherical, sac like structures which contain several digestive enzymes enclosed in a membrane.
They are found in eukaryotic cells mostly in animals.

Functions:

→ Lysosomes help in digestion of foreign substances and worn-out cell organelles.

→ They prOvide prOtection against bacteria and virus.

→ They help tO keep the cell clean.

→ During the disturbance in cellular metabOlism, fOr example when the cell gets damaged, lysOsOmes may burst and the enzymes digest their Own cell. TherefOre, lysOsOmes are alsO known as **<u>suicide bags</u>** of a cell

8. Vacuoles:

Vacuoles are liquid/solid filled and membrane bound organelles.
In plant cells, vacuoles are large and permanent.
In mature plant cell, It occupies 90% space of cell volume.
Due to its size, other organelles, including nucleus shift towards plasma membrane.

Function:

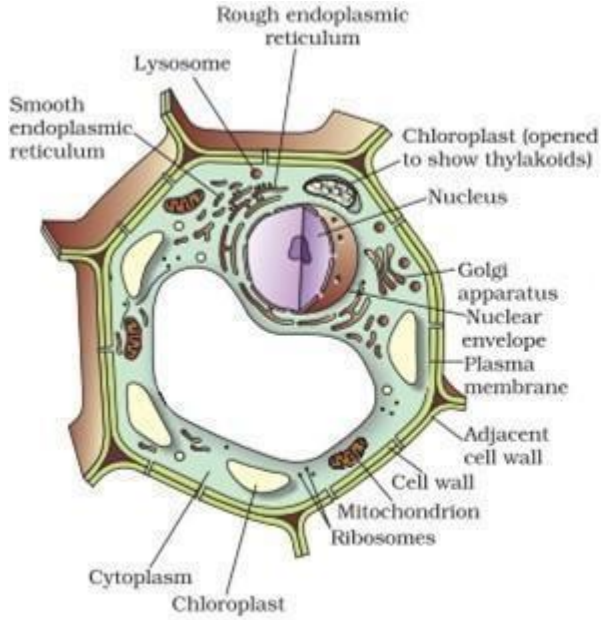
→ They help to maintain the osmotic pressure in a cell.

→ They provide turgidity and rigidity to the plant cell.

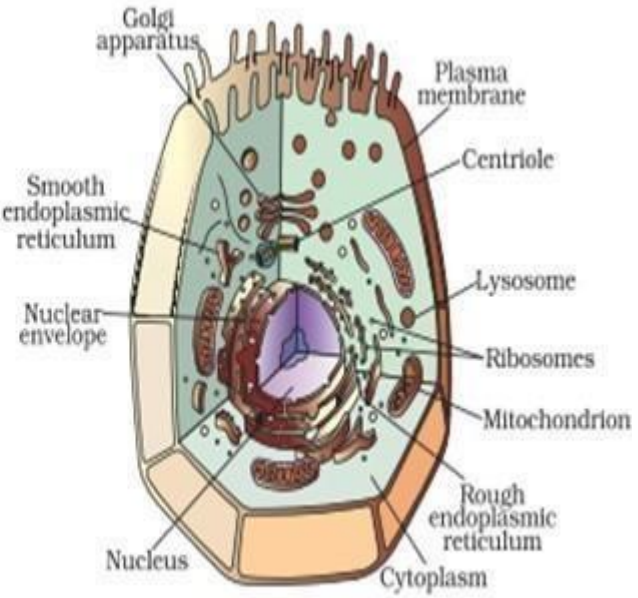
Difference Between Animal Cell and Plant Cell:

S. No.	Animal cell	Plant cell
1.	Animal cells are generally small in size.	Plant cells are larger than animal cells.
2.	Cell wall is absent.	Plasma membrane of plant cell is surrounded by a rigid cell wall of cellulose.
3	Plastids are absent except in case of protozoan Euglena.	Plastids are present.
4.	Here vacuoles are many, small and temporary.	They have a permanent and large central sap vacuole.

Structure of Plant cell and Animal cell:



Plant Cell



Animal cell