

## THE FUNDAMENTAL UNIT OF LIFE

## IMPORTANT SCIENTISTS

Robert Hooke: Discovered *cell* in 1665 in a cork slice with the help of a primitive microscope.

Robert Brown: Discovered *nucleus* in the cell in 1831.

M. Schleiden and T. Schwann: They proposed *cell theory* according to which all plants and animals are composed of cells and that the 'cell' is the basic unit of life.

Virchow: He stated that all cells arise from pre-existing cells.

J. E. Purkinje: Gave the term *protoplasm* for the living fluid substance of the cell in 1839.

## EXTRASCORE IMPORTANT NOTES-CUM-QUESTIONS

Q.1: Distinguish between Diffusion and Osmosis.

Ans: Diffusion and Osmosis are the two different processes which can be distinguished by the following points:

DIFFUSION	OSMOSIS
<ul style="list-style-type: none"> <li>&gt;&gt; Diffusion can occur in any medium.</li> <li>&gt;&gt; The diffusing molecules may be solids, liquids or gases.</li> <li>&gt;&gt; Semi-permeable is not required.</li> <li>&gt;&gt; It is dependent upon the free energy of the molecules of the diffusing substance only; presence of other substances in the system is of no importance.</li> <li>&gt;&gt; An equilibrium in the free energy of diffusion molecules is achieved in the system.</li> </ul>	<ul style="list-style-type: none"> <li>&gt;&gt; It occurs only in liquid medium.</li> <li>&gt;&gt; It involves movement of solvent molecules only.</li> <li>&gt;&gt; Semi-permeable membrane is required.</li> <li>&gt;&gt; Though it is the diffusion of solvent molecules only, yet influenced by the presence of the other substances in the system.</li> <li>&gt;&gt; Equilibrium in the free energy of solvent molecules is never achieved.</li> </ul>

Q.2: Write short notes on –

- |                         |                       |
|-------------------------|-----------------------|
| (a) Hypotonic solution  | (b) Isotonic solution |
| (c) Hypertonic solution | (d) Gene              |
| (e) Chromatin Material  | (f) Chromosome        |

Ans:

(a) Hypotonic solution :

If the medium surrounding the cell has a higher water concentration than the cell, i.e. if solution is a very dilute solution, the cell will gain water by osmosis. Such a dilute solution is called **hypertonic solution**.

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In this case, water molecules are free to pass across the plasma membrane in both directions but more water will be entering the cell than leaving. The net result is that the cell will swell up or become inflated or turgid.

**(b) Isotonic solution :**

If the medium surrounding the cell has exactly the same water concentration as that of the cell, there will be no net movement of water across the plasma membrane. Such solution is called **isotonic solution**.

In this case, water crosses the plasma membrane in both directions but the amount of water entering the cell is same as that leaving, so there is no overall movement of water. There will be no change in the size of the cell.

**(c) Hypertonic solution :**

If the medium has a lower concentration of water than the cell i.e. if it is a very concentrated solution, the cell will lose water by osmosis. Such a concentrated solution is called **hypertonic solution**.

In this case, water crosses the plasma membrane in both directions, but more water leaves than cell than enter it. Therefore the cell will shrink.

**(d) Gene:**

It is a distinct unit of hereditary information. Gene is inherited from one generation to next and determines an observable characteristic or trait of an organism. They carry coded information of the parents to their children or progeny, so that the children remain exactly like their parents.

Generally a gene is made of DNA molecules or segments of very long DNA molecule. But sometimes, it is made of RNA molecule such as in Tobacco mosaic virus. Genes are arranged in a single linear order along the chromosome. A gene is a functional unit of DNA / Chromosome which perform one or many function of an organism.

**(e) Chromatin Material –**

It is found in the nucleus in the form of an intertwined mass of thread-like structures. It mainly consists of DNA molecules. Whenever the cell is about to divide, the chromatin material gets organized into chromosomes.

**(f) Chromosome –**

These are compact rod-like bodies, which are formed at the time of cell division from chromatin material (mainly DNA). DNA (*deoxyribonucleic acid*) is responsible for storing and transmitting the hereditary information from one generation to another.

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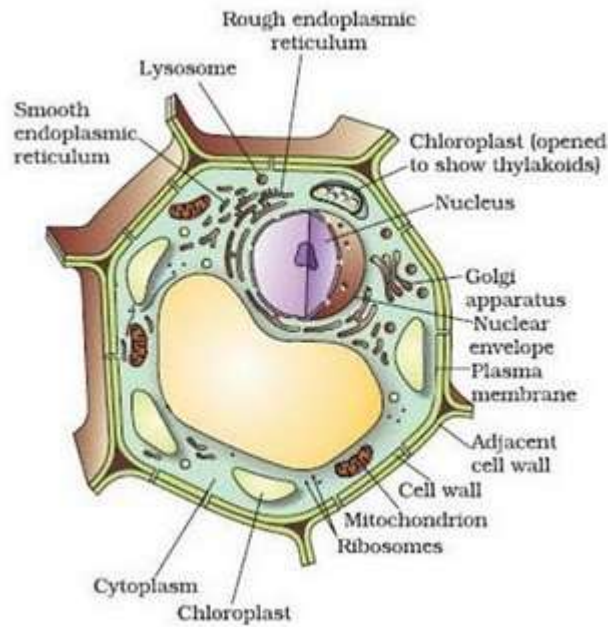


Fig - Plant Cell

Q.3: What is the function of Cell Wall and Plasma membrane?

Ans: Cell wall gives rigidity, shape and protection to plant cell. Cell membrane allows only selected materials to move in and out of the cell.

Q.4: What is cell organelle?

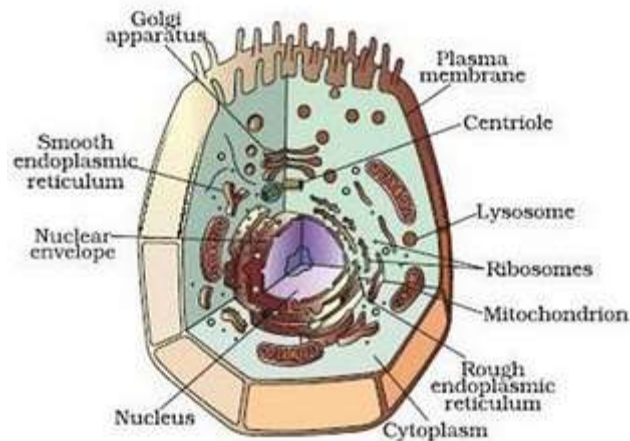


Fig - Animal Cell

Ans: It is the functional unit of cell.

Q.5: Name the largest animal cell.

Ans: An ostrich egg.

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Q.6: Name the smallest cell.

Ans: *Pleuro Pneumonia* like organisms (PPLO).

Q.7: Name the longest plant cell.

Ans: The fiber.

Q.8: Is cell wall living or dead?

Ans: Dead.

Q.9: Is plasma membrane living or dead?

Ans: Living.

Q.10: Who discovered cells and how?

Ans: Robert Hooke discovered cell. He by chance observed a slice of cork through a self-designed primitive microscope. He observed that it contained many little compartments which he named cells.

Q.11: How do substances like  $\text{CO}_2$  and water move in and out of the cell? Discuss.

Ans: Carbon dioxide ( $\text{CO}_2$ ) moves in and out of the cells by the process of diffusion. Diffusion involves movement of molecules from higher concentration to lower concentration across the plasma membrane.

Water moves in and out of the cells by osmosis. Osmosis is the movement of water or solvent through a semi-permeable membrane from a region of high water concentration to a region of low water concentration. Both diffusion and osmosis are physical or mechanical processes and do not require spending of energy for their performance by cells.

Q.12: Why is the plasma membrane is called a selectively permeable membrane?

Ans: Plasma membrane is called selectively permeable membrane because it allows the movement of only selected molecules across it and not all of them.

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Q.13: Describe Cell Wall and its Functions.

Ans:

**Cell wall:**

In plant cells there occurs a rigid cell wall which lies outside the plasma membrane. Cell wall is non-living and freely permeable and is secreted by the cell itself for the protection of its plasma membrane and cytoplasm. It determines the shape of a plant cell and prevents dissection of cells. It is made up of cellulose. The plant cell wall thus, consists of tiny cellulose fibers called **Microfibrils**.

**Functions of cell wall:**

Cell wall of plants has perform the following functions -

- >> It permits the plant cell to become turgid. As water enters the vacuole by osmosis, the plant cell expands. The cell wall has to be strong enough to resist this expansion and so enable the cell to become turgid.
- >> The cellulose Microfibrils is very strong which provide mechanical strength to support the cell.
- >> It is freely permeable to water and substances to solution.
- >> It has narrow pores, called pits, through which fine strands of cytoplasm, called *Plasmodesmata*, are able to pass. These intercellular connections allow exchange of materials between the living cell contents.
- >> The cell walls of adjacent cells are glued together by the *middle lamella*.

Q.14: Why is cell called structural and functional unit of life?

Ans: In Biology, the basic unit of which all living things are composed is known as 'cell'. The 'cell' is the smallest structural unit of living matter that is capable of functioning independently.

A single cell can be a complete organism in itself, as in bacteria and protozoans. A unicellular organism performs all the life processes similar to a multicellular organism. Each living cell has the capacity to perform certain basic functions that are characteristic of all living forms.

Each cell acquires its structure and ability to function because of the organization of its membrane and organelles in specific ways. This helps the cells to perform functions like respiration, obtaining nutrition, clearing of waste materials and forming new proteins etc. Hence, 'cell' is called as the structural and functional unit of life.

Q.15: Distinguish between Plasma membrane (or Cell membrane) and Cell wall.

Ans:

PLASMA MEMBRANE	CELL WALL
>> It consists of plasma proteins and it is living.	>> Made of cellulose and is dead or non-living.
>> Present in both plant and animal cells.	>> Found in plant cells only.
>> It is semipermeable.	>> Permeable.
>> It is soft and elastic.	>> Hard and rigid.

Q.16: Explain the structure of Nucleus.

Ans:

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The nucleus is a major, centrally located spherical cellular component. It is the control center of the cell which is bounded by two nuclear membranes, both forming a nuclear envelope (see Figure). Nuclear envelope encloses a space between two nuclear membranes and is connected to a system of membranes called ER (Endoplasmic Reticulum).

The nuclear envelope separates the nucleus from cytoplasm. The nuclear envelope contains nuclear pores and encloses a liquid ground substance, known as **nucleoplasm**. Nucleopores allow transfer of materials between the nucleoplasm and the cytoplasm. Within nucleoplasm are embedded two types of nuclear structures - the **nucleolus** and **chromatin material**.

The nucleolus, not bounded by any membrane, is rich in protein and RNA molecules and is the site of Ribosome formation. So, nucleolus is known as **factory of ribosomes**. Ribosomes are helpful in protein synthesis in the cytoplasm.

The chromatin material is thin, thread-like intertwined mass of chromosome material and composed of the genetic substance DNA and proteins. The chromatin is condensed into two or more thick ribbon-like chromosomes during cell-division.

*Q.17: Write three main features (points) of Cell Theory as expressed by Schleiden, Schwann and Virchow.*

Ans: Three main features (points) of Cell Theory are as follows:

- i. all plants and animals are composed of cells
- ii. the cell is the basic unit of life
- iii. all cells arise from pre-existing cells.

*Q.18: List some major functions of cell.*

Ans: Below given are some major functions of cell -

- 1) Synthesis of substances
- 2) Digestion of substances
- 3) Generation of energy for vital functions
- 4) Secretion, etc.

*Q.19: What is Endoplasmic Reticulum? Write its main functions.*

Ans:

**Endoplasmic Reticulum:**

Inside the cell there exists a membranous network enclosing a fluid-filled lumen which almost fills up the intracellular cavity. It is called Endoplasmic Reticulum (ER). It occurs in three forms:

- (i) Cisternae
- (ii) Vesicles
- (iii) Tubules.

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ER is of two types:

- (i) Rough Endoplasmic Reticulum (RER) with ribosomes attached on its surface for synthesizing proteins.
- (ii) Smooth Endoplasmic Reticulum (SER) without ribosomes and is meant for secreting lipids (fats).

Functions of ER:

- >> It forms supporting skeletal framework of the cell.
- >> ER provides a pathway for distribution of nuclear material from one cell to other.
- >> Certain enzymes present in SER synthesize fats (lipids), steroids and cholesterol.
- >> RER performs the transport proteins which are synthesized by ribosomes on their surface.
- >> SER plays an important role in the bio-synthesis of cholesterol.
- >> SER is also involved in the process of detoxification.

Q.20: Write a short note about *Ribosomes* and their functions.

Ans: **Ribosomes:**

These are the dense, spherical and granular particles which occur freely in the matrix or remain attached to the RER. Chemically they are composed of *ribonucleic acid and proteins*.

**Functions:**

Ribosomes play an important role of protein synthesis in the cytoplasm.

Q.21: Write a short note on *Golgi apparatus* and its functions.

Ans: **Golgi apparatus:**

Also known as Golgi body or Golgi complex consists of a set of smooth, flattened membranous sac like structures called *Cisternae*. These are placed one above the other in parallel rows. Golgi apparatus may consist of stacks of membrane i.e. Cisternae, tubules, vesicles and Golgian vacuoles.

In plant cells, Golgi apparatus consists of many unconnected units called *dictyosomes*. Golgi apparatus is absent in bacteria, blue green algae, mature sperms and RBCs of mammals and other animals.

**Functions of Golgi apparatus:**

- >> The main function of Golgi body is secretory.
- >> Acts as a station or assembly area for the storage, processing and packaging of various cellular secretions. It packages materials synthesized in the cell and dispatches them either to intracellular targets such as plasma membrane and Lysosomes or extracellular targets.
- >> It produces vacuoles or secretory vesicles which contain cellular secretions e.g. enzymes, proteins, melanin pigment, etc.
- >> Golgi apparatus is also involved in synthesis of cell wall, plasma membrane and Lysosomes.

Q.22: Write a short note on *Lysosomes* and their functions?

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Ans:

**Lysosomes** are tiny spherical sac-like structures evenly distributed in cytoplasm. Each Lysosome is a small vesicle surrounded by single membrane and contains powerful digestive enzymes capable of breaking down all organic materials.

**Functions of Lysosomes:**

>> They serve as intracellular digestive system, hence called *digestive bags*. They destroy any foreign material which enter the cell and thus, protect the cell from bacterial infection.

>> Lysosomes also remove the worn-out and poorly working cell organelles by digesting them to give yield to their new replacements.

>> When cell gets damaged, Lysosomes may burst and the enzymes eat up their own cells.

Q.23: Lysosomes are often called 'suicide bags'. Why?

Ans:

Lysosomes are tiny vesicles, each of which are surrounded by single membrane and contain powerful digestive enzymes capable of breaking down all organic materials. If Lysosome burst, its enzyme eats up (digest) other organelles of its own cell. Therefore, these are known as 'suicide bags'.

Q.24: If the organization of cell is destroyed due to some physical or chemical influence, what will happen?

Ans:

A well organized cell maintains homeostasis, i.e. constant internal chemical composition. It is, therefore, able to perform basic functions such as, respiration, obtaining nutrition, clearing of waste, forming new proteins, etc.

If the organization of cell is destroyed, it will not be able to maintain homeostasis and so will not be able to perform all these functions and such a cell will ultimately die.