

# CHAPTER - 5

## THE FUNDAMENTAL UNIT OF LIFE

### Question 1:

Who discovered cells and how?

### Answer 1:

Cells were discovered in 1665 by an English Botanist, Robert Hooke. He used a primitive microscope to observe cells in a cork slice.

### Question 2:

Why is the cell called the structural and functional unit of life?

### Answer 2:

Cells constitute various components of plants and animals. A cell is the smallest unit of life and is capable of all living functions. Cells are the building blocks of life. This is the reason why cells are referred to as the basic structural and functional units of life. All cells vary in their shape, size, and activity they perform. In fact, the shape and size of the cell is related to the specific functions they perform.

### **Question 1:**

How do substances like CO<sub>2</sub> and water move in and out of the cell? Discuss,

### **Answer 1:**

The cell membrane is selectively permeable and regulates the movement of substances in and out of the cell.

#### ***Movement of CO<sub>2</sub>:***

CO<sub>2</sub> is produced during cellular respiration. Therefore, it is present in high concentrations inside the cell. This CO<sub>2</sub> must be excreted out of the cell. In the cell's external environment, the concentration of CO<sub>2</sub> is low as compared to that inside the cell. Therefore, according to the principle of diffusion, CO<sub>2</sub> moves from a region of higher concentration (inside the cell) towards a region of lower concentration (outside the cell). Similarly, O<sub>2</sub> enters the cell by the process of diffusion when the concentration of O<sub>2</sub> inside the cell is low as compared to its surroundings.

#### ***Movement of water:***

Water moves from a region of high concentration to a region of low concentration through the plasma membrane. The plasma membrane acts as a semi-permeable membrane, and this movement of water is known as osmosis. However, the movement of water across the plasma membrane of the cell is affected by the amount of substance dissolved in water.

### **Question 2:**

Why is the plasma membrane called a selectively permeable membrane?

### **Answer 2:**

The cell membrane or the plasma membrane is known as a selectively permeable membrane because **it regulates the movement of substances in and out of the cell**. This means that the plasma membrane allows the entry of only some substances and prevents the movement of some other materials.

**Question 1:**

Fill in the gaps in the following table illustrating differences between prokaryotic and eukaryotic cells.

| Prokaryotic Cell                                                                       | Eukaryotic Cell                                                         |
|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| 1. Size : generally small ( 1-10 $\mu\text{m}$ )<br>$1 \mu\text{m} = 10^{-6} \text{m}$ | 1. Size: generally large ( 5-100 $\mu\text{m}$ )                        |
| 2. Nuclear region:<br>_____<br>_____<br>and known as__                                 | 2. Nuclear region:<br>well defined and surrounded by a nuclear membrane |
| 3. Chromosome:<br>single                                                               | 3. More than one chromosome                                             |
| 4. Membrane-bound cell organelles<br>absent                                            | 4. _____<br>_____<br>_____                                              |

**Answer 1:**

| Prokaryotic Cell                                                                                                   | Eukaryotic Cell                                                                              |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 1. Size : generally small ( 1-10 $\mu\text{m}$ )<br>$1 \mu\text{m} = 10^{-6} \text{m}$                             | 1. Size: generally large ( 5-100 $\mu\text{m}$ )                                             |
| 2. Nuclear region:<br><u>Poorly defined because of absence of nuclear membrane</u><br>and known as <u>Nucleoid</u> | 2. Nuclear region:<br>well defined and surrounded by a nuclear membrane                      |
| 3. Chromosome:<br>single                                                                                           | 3. More than one chromosome                                                                  |
| 4. Membrane-bound cell organelles<br>absent                                                                        | 4. <u>Membrane - bound cell organelles such as Mitochondria, plastids, etc., are present</u> |

**Question 1:**

Can you name the two organelles we have studied that contain their own genetic material?

**Answer 1:**

Mitochondria and plastids are the two organelles that contain their own genetic material. Both these organelles have their own DNA and ribosomes.

**Question 2:**

If the organisation of a cell is destroyed due to some physical or chemical influence, what will happen?

**Answer 2:**

Cell is the smallest unit of life, which is capable of all living functions. If the organisation of a cell is destroyed due to some physical or chemical influence, then the ability of the cell to perform all living functions such as respiration, nutrition, excretion, etc. would be affected.

**Question 3:**

Why are lysosomes known as suicide bags?

**Answer 3:**

Lysosomes are membrane-bound vesicular structures that contain powerful digestive enzymes. These enzymes are capable of breaking down any foreign food particle or microbes entering the cell. Sometimes, lysosomes can cause self-destruction of a cell by releasing these digestive enzymes within the cells. Hence, they are also known as 'suicidal bags'.

**Question 4:**

Where are proteins synthesized inside the cell?

**Answer 4:**

Ribosomes are the site for protein synthesis. Ribosomes are very small structures found either in a free state, suspended in the cytoplasm, or attached to the surface of the endoplasmic reticulum. They are composed of ribonucleic acids and proteins.

## Exercises

### Question 1:

Make a comparison to write down ways in which plant cells are different from animal cells.

### Answer 1:

The cells of animals and plants have the following differences:

| Animal Cell                                                                 | Plant Cell                                                                                     |
|-----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| 1. Animal cells are generally small in size.                                | 1. Plant cells are larger than animal cells.                                                   |
| 2. Cell wall is absent.                                                     | 2. The plasma membrane of plant cells is surrounded by a rigid cell wall of <i>cellulose</i> . |
| 3. Except the protozoan <i>Euglena</i> , no animal cell possesses plastids. | 3. Plastids are present.                                                                       |
| 4. Vacuoles in animal cells are many, small and temporary.                  | 4. Most mature plant cells have a permanent and large central sap vacuole.                     |
| 5. Animal cells have a single highly complex and prominent Golgi apparatus. | 5. Plant cells have many simpler units of Golgi apparatus, called dictyosomes.                 |
| 6. Animal cells have <i>centrosome</i> and <i>centrioles</i> .              | 6. Plant cells lack <i>centrosome</i> and <i>centrioles</i> .                                  |

### Question 2:

How is a prokaryotic cell different from a eukaryotic cell?

### Answer 2:

Difference between prokaryotic cell and eukaryotic cell:

| Prokaryotic Cell                                                                  | Eukaryotic Cell                                          |
|-----------------------------------------------------------------------------------|----------------------------------------------------------|
| 1. Cell size is generally small (1 - 10 $\mu\text{m}$ ).                          | 1. Cell is generally large (5 - 100 $\mu\text{m}$ ).     |
| 2. Nuclear region is called nucleoid and is not surrounded by a nuclear membrane. | 2. Nuclear material is surrounded by a nuclear membrane. |
| 3. Only a single chromosome is present.                                           | 3. More than one chromosome is present.                  |
| 4. Nucleolus is absent.                                                           | 4. Nucleolus is present.                                 |
| 5. Membrane bound cell organelles are absent.                                     | 5. Membrane bound cell organelles.                       |
| 6. Cell division by fission or budding (no mitosis).                              | 6. Cell division mitotic or meiotic.                     |

### Question 3:

What would happen if the plasma membrane ruptures or breaks down?

### Answer 3:

Plasma membrane is a selectively permeable membrane of the cell that maintains its homeostasis, i.e., constant internal composition of the cell. If it ruptures or breaks down the constant internal chemical composition of the cell will be lost and it will not be able to perform its basic functions. Such a cell with ruptured plasma membrane is killed.

### Question 4:

What would happen to the life of a cell if there is no Golgi apparatus?

### Answer 4:

The materials synthesized in the ER are stored, sorted, modified, packaged and dispatched to various targets inside and outside the cell through the Golgi apparatus packs products in vesicles, the secretory vesicles. In some cases complex sugars e.g. cellulose, may be made from simple sugars in Golgi apparatus. The Golgi apparatus is also involved in the formation of the cells which will not be possible if Golgi apparatus is not there.

**Question 5:**

Which organelle is known as the powerhouse of the cell? Why?

**Answer 5:**

*Mitochondria* are known as the powerhouse of the cell because they contain enzymes that are needed for stepwise oxidation of food stuffs (carbohydrate, fats and lipids) present in the cells to CO<sub>2</sub> and water. Oxidation of food releases energy which is used to form high-energy ATP (*adenosine triphosphate*) molecules. ATP is known as Energy Currency of the cell and it is used as cellular fuel. Energy stored in ATP is used to bring about energy requiring activities of the cell such as photosynthesis, protein synthesis and muscle contraction.

**Question 6:**

Where do the lipids and proteins constituting the cell membrane get synthesised?

**Answer 6:**

**Rough Endoplasmic Reticulum (RER)** - synthesizes proteins constituting cell membrane.

**Smooth Endoplasmic Reticulum (SER)** - synthesizes lipids constituting cell membrane.

**Question 7:**

How does *Amoeba* obtain its food?

**Answer 7:**

*Amoeba* has flexible cell membrane. It enables amoeba to engulf in food by the process called *endocytosis*.

**Question 8:**

What is osmosis?

**Answer 8:**

The diffusion of water or solvent through a semi-permeable membrane from a solution of lower concentration of solutes to a solution of higher concentration of solutes, to which the membrane is relatively impermeable, is called osmosis.