The Fundamental Unit of Life

Exercise-5.1 Page: 59

1. Who discovered cells, and how?

Solution:

In 1665, Robert Hooke discovered cells while examining a thin slice of cork through a self-designed microscope. He observed that the cork resembled the structure of a honeycomb consisting of numerous tiny compartments. The minuscule boxes are referred to as cells.

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

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Solution:

Cells form the structure of an entity. A group of cells form a tissue, further an organ and ultimately an organ system. They perform fundamental functions and life processes such as respiration, digestion, excretion etc., in both unicellular and multicellular entities. They perform all the activities independently. Hence, cells are referred to as structural and fundamental units of life.

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3. How do substances like CO_2 and water move in and out of the cell? Discuss.

Solution:

CO_2 moves by diffusion. The cellular waste accumulates in high concentrations in the cell, whereas the concentration of CO_2 in the external surroundings is comparatively lower. This difference in the

concentration level inside and outside of the cell causes the CO_2 to diffuse from a region of higher (within the cell) to a lower concentration.

H_2O diffuses by osmosis through the cell membrane. It moves from a region of higher concentration to a lower concentrated region through a selectively permeable membrane until equilibrium is reached.

4. Why is the plasma membrane called a selectively permeable membrane?

Solution:

The plasma membrane is called as a selectively permeable membrane as it permits the movement of only certain molecules in and out of the cells. Not all molecules are free to diffuse.

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Exercise-5.2.2-5.2.4 Page: 63

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

Prokaryotic Cell	**Eukaryotic Cell**
1. Size: Generally small (1-10 μm) 1 μm = 10^{-6}m 2. Nuclear region: _____ _ _____ _ and known as _____ 3. Chromosome: single	1. Size: Generally large (5-100 μm) 2. Nuclear region: well-defined and surrounded by a nuclear membrane. 3. More than one chromosome. 4. _____ _ _____ _

4. Membrane-bound cell organelles absent.	_____

Solution:

Prokaryotic Cell	**Eukaryotic Cell**
1. Size: Generally small (1-10 µm) 1 µm = 10^{-6}m 2. The nuclear region is poorly defined due to the absence of a nuclear membrane and is known as the nucleoid. 3. There is a single chromosome. 4. Membrane-bound cell organelles absent.	1. Size: Generally large (5-100 µm) 2. Nuclear region: well-defined and surrounded by a nuclear membrane. 3. There is more than one chromosome. 4. Membrane-bound cell organelles present.

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

Solution:

The two organelles which have their own genetic material are

1. Mitochondria

2. Plastids

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

Solution:

In the event of any damage to cells and when the revival of cells is not possible, Lysosomes burst, and enzymes digest such cells. This is why lysosomes are often referred to as 'suicide bags'.

8. Why are lysosomes known as suicide bags?

Solution:

When there is damage to the cell and when revival is not possible, lysosomes may burst, and the enzymes digest their own cell. Consequently, lysosomes are known as suicide bags.

9. Where are proteins synthesised inside the cell?

Solution:

Protein synthesis in cells takes place in ribosomes. Hence, ribosomes are also referred to as protein factories. Ribosomes are particles that are found attached to the rough endoplasmic reticulum.

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Exercise Page: 67

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

Solution:

The following table depicts the differences between plant cells and animal cells.

Characteristic	Plant Cell	Animal Cell
Cell Wall	Present	Absent
Shape of Cell	With distinct edges, the shape is either rectangular or square-shaped.	Round and irregular shape

Nucleus	Present. It lies on one side of the cell	Present. It lies in the centre of the cell
Lysosomes	Rarely present	Always present
Plastids	Present	Absent
Structure of Vacuoles	Single or a few large vacuoles that are centrally located	Presence of numerous and small vacuoles

2. How is a prokaryotic cell different from a eukaryotic cell?

Solution:

The following are the differences between prokaryotic and eukaryotic cells.

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Prokaryotic Cell	**Eukaryotic Cell**
1. Size: Generally small (1-10 μm) 1 μm = 10^{-6}m 2. The nuclear region is not well defined as the nuclear membrane is absent and is referred to as the nucleoid. 3. There is a single chromosome. 4. Membrane-bound cell organelles absent.	1. Size: Generally large (5-100 μm) 2. Nuclear region: well-defined and girdled by a nuclear membrane. 3. There is more than one chromosome. 4. Membrane-bound cell organelles present.

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

Solution:

If the plasma membrane ruptures or breaks down, then molecules of some substances will freely move in and out of the cells. As the plasma membrane acts as a mechanical barrier, the exchange of material from its surroundings through osmosis or diffusion in a cell won't take place. Consequently, the cell would die due to the disappearance of the protoplasmic material.

4. What would happen to the life of a cell if there was no Golgi apparatus?

Solution:

The Golgi apparatus consists of stacks of membrane-bound vesicles whose functions are as follows:

- Storage of substances
- Packaging of substances
- Manufacture of substances

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Without the Golgi apparatus, the cells will be disabled from packing and dispatching materials that were produced by the cells. The Golgi apparatus is also involved in the formation of cells. Hence, in the absence of the Golgi apparatus, cells will not be produced.

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

Solution:

Mitochondria are known as the powerhouse of the cell. It is because it releases the energy required for different activities of life. Mitochondria releases energy in the form of ATP (Adenosine triphosphate) molecules, essential for numerous chemical activities of life. Hence, ATP is often referred to as the 'energy currency of the cell'.

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

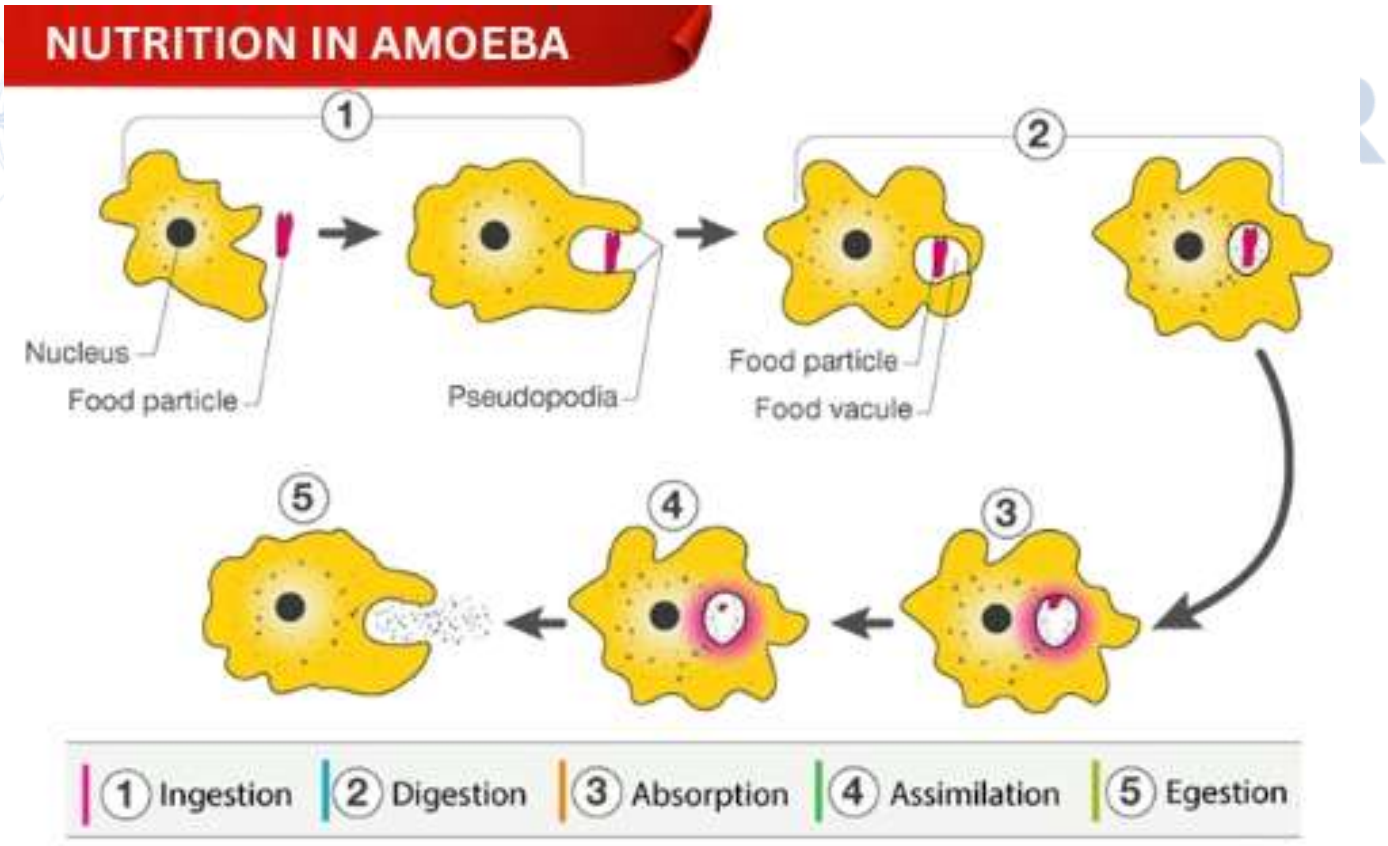
Solution:

Lipids and proteins are synthesised in the ER (Endoplasmic Reticulum).

How does an Amoeba obtain its food?

Solution:

Through the process of endocytosis, an Amoeba obtains its food. As its cell membrane is flexible enough, food particles are engulfed, forming a food vacuole girdling it, which is assisted by the pseudopodia. Amoeba secretes digestive enzymes to bring about digestion of the engulfed particle once the food is trapped.



What is osmosis?

Solution:

The process of movement of a water molecule from a region of higher concentration to a region of lower concentration through a semipermeable membrane is known as osmosis.

9. Carry out the following osmosis experiment:

Take four peeled potato halves and scoop each one out to make potato cups. One of these potato cups should be made from a boiled potato. Put each potato cup in a trough containing water. Now,

(a) Keep cup A empty

(b) Put one teaspoon sugar in cup B

(c) Put one teaspoon salt in cup C

(d) Put one teaspoon sugar in the boiled potato cup D.

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Keep these for two hours. Then observe the four potato cups and answer the following:

(i) Explain why water gathers in the hollowed portion of B and C.

(ii) Why is potato A necessary for this experiment?

(iii) Explain why water does not gather in the hollowed-out portions of A and D.

Solution:

(i) Water accumulates in the hollowed portions of B and C as a difference in the water concentration

is observed. Thereby, endosmosis occurs as the cells act as a semipermeable membrane.

(ii) Potato A is essential in this experiment as it is significant to compare different scenarios seen in

potato cups B, C and D. Potato A in this experiment clearly shows that the potato cavity on its

own cannot bring about water movement.

(iii) Cup in A does not show any change in the water flow concentration for osmosis to occur, which

requires concentration to be higher than the other. Cells in cup D are dead; thus, there is no

existence of a semipermeable membrane for water flow. Consequently, osmosis does not occur.

10. Which type of cell division is required for the growth and repair of the body, and which type is involved in the formation of gametes?

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Solution:

There are two ways in which a cell divides:

- Mitosis
- Meiosis

Mitosis is the type of cell division that is involved in the growth and repair of the body, whereas meiosis is a type of cell division which results in the formation of gametes.