

Class IX Chapter 5 – The Fundamental Unit of Life Science

Question 1:

Who discovered cells and how?

Answer:

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:

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.

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

Answer:

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

Movement of CO_2 :

CO_2 is produced during cellular respiration. Therefore, it is present in high concentrations inside the cell. This CO_2 must be excreted out of the cell. In the cell's external environment, the concentration of CO_2 is low as compared to that inside the cell. Therefore, according to the principle of diffusion, CO_2 moves from a region of higher concentration (inside the cell) towards a region of lower concentration (outside the cell). Similarly, O_2 enters the cell by the process of diffusion when the concentration of O_2 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:

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.

4.	Membrane-bound cell organelles are absent	4.	
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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 μm) $1 \mu\text{m} = 10^{-6} \text{ m}$	1.	Size: generally large (5-100 μm)

Answer:

	Prokaryotic cell		Eukaryotic cell
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2.	Nuclear region: _____ and is known as _____.	2.	Nuclear region: well-defined and surrounded by a nuclear membrane
3.	Chromosome: single	3.	More than one chromosome

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

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

Answer:

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:

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:

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:

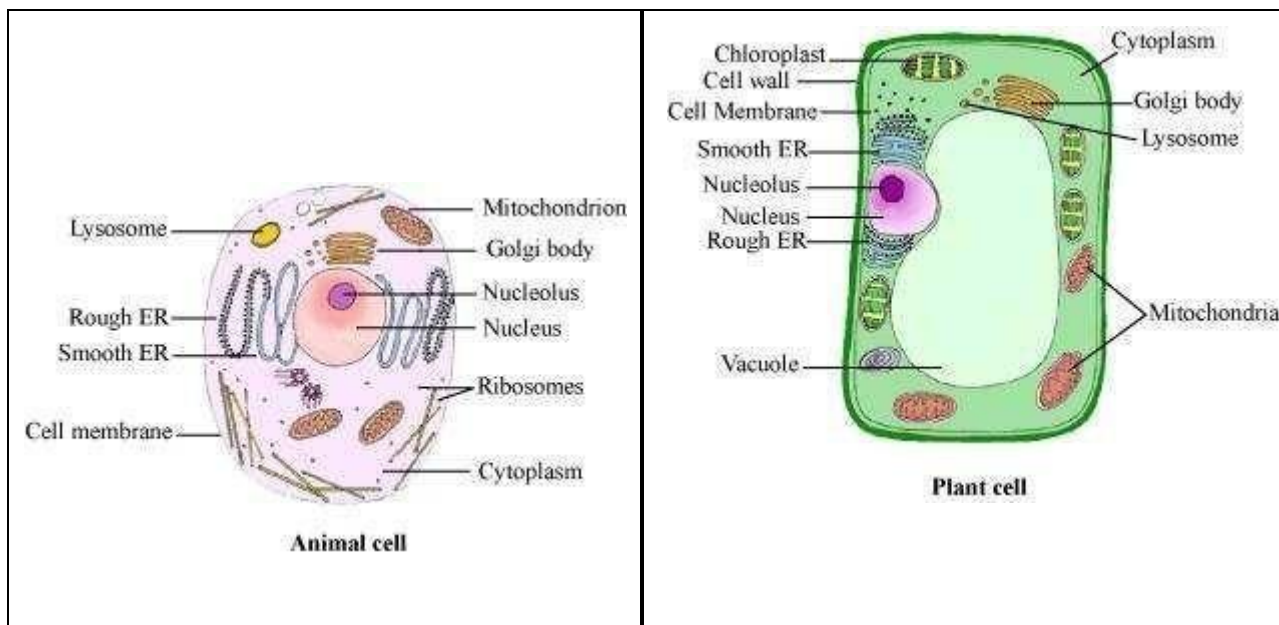
Where are proteins synthesized inside the cell?

Answer:

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

Answer:

Animal cell	Plant cell
Animal cells are generally small in size.	Plants cells are usually larger than animal cells.
Cell wall is absent.	Cell wall is present.
Except the protozoan Euglena, no animal cell possesses plastids.	Plastids (chromoplasts and leucoplasts) are present.
Vacuoles are smaller in size.	Vacuoles are larger in size.



Question 2:

How is a prokaryotic cell different from a eukaryotic cell?

Answer:

Prokaryotic cell	Eukaryotic cell
Most prokaryotic cells are unicellular.	Most eukaryotic cells are multicellular.
Size of the cell is generally small (0.5- 5 μm).	Size of the cell is generally large (50- 100 μm).
Nuclear region is poorly defined due to the absence of a nuclear membrane or the cell lacks true nucleus.	Nuclear region is well-defined and is surrounded by a nuclear membrane, or true nucleus bound by a nuclear membrane is present in the cell.
It contains a single chromosome.	It contains more than one chromosome.
Nucleolus is absent.	Nucleolus is present.
Membrane-bound cell organelles such as plastids, mitochondria, endoplasmic reticulum, Golgi apparatus, etc. are absent.	Cell organelles such as mitochondria, plastids, endoplasmic reticulum, Golgi apparatus, lysosomes, etc. are present.
Cell division occurs only by mitosis.	Cell division occurs by mitosis and meiosis.
Prokaryotic cells are found in bacteria and blue-green algae.	Eukaryotic cells are found in fungi, plants, and animal cells.

Question 3:

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

Answer:

If the plasma membrane of a cell is ruptured, then the cell will die. The plasma membrane regulates the movement of substances in and out of the cell by diffusion or osmosis. Thus, if the plasma membrane is ruptured, then the cell might leak out its contents.

Question 4:

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

Answer:

If there was no Golgi apparatus in the cell, then most activities performed by the Golgi apparatus will not take place.

(i) Membranes of the Golgi apparatus are often connected to ER membranes. It collects simpler molecules and combines them to make more complex molecules. These are then packaged in small vesicles and are either stored in the cell or sent out as per the requirement. Thus, if the Golgi apparatus is absent in the cell, then the above process of storage, modification, and packaging of products will not be possible.

(ii) The formation of complex sugars from simple sugars will not be possible as this takes place with the help of enzymes present in Golgi bodies.

(iii) The Golgi apparatus is involved in the formation of lysosomes or peroxisomes. Thus, if the Golgi body is absent in a cell, the synthesis of lysosomes or peroxisomes will not be possible in the cell.

Question 5:

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

Answer:

Mitochondria are known as the powerhouse of cells. Mitochondria create energy for the cell, and this process of creating energy for the cell is known as cellular respiration. Most chemical reactions involved in cellular respiration occur in the mitochondria. The energy required for various chemical activities needed for life is released by the mitochondria in the form of ATP (Adenosine triphosphate) molecules.

For this reason, mitochondria are known as the powerhouse of cells.

Question 6:

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

Answer:

Lipids and proteins constituting the cell membrane are synthesized in the endoplasmic reticulum.

SER (Smooth endoplasmic reticulum) helps in the manufacturing of lipids.

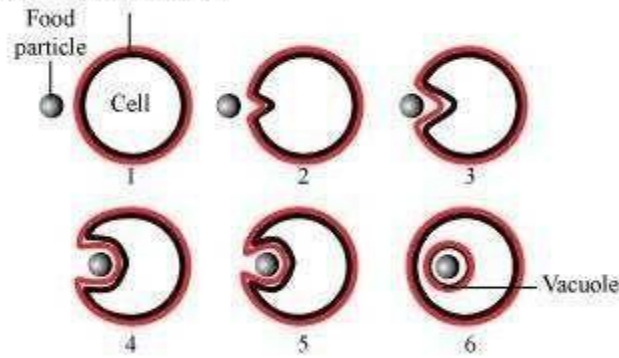
RER (Rough endoplasmic reticulum) has particles attached to its surface, called ribosomes. These ribosomes are the site for protein synthesis.

Question 7:

How does an Amoeba obtain its food?

Answer:

Amoeba obtains its food through the process of endocytosis. The flexibility of the cell membrane enables the cell to engulf the solid particles of food and other materials from its external environment.



Cell engulfing food particle

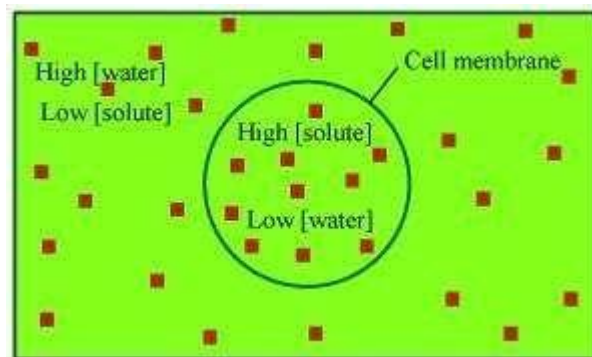
Question 8:

What is osmosis?

Answer:

The movement of water molecules from a region of high concentration to a region of low concentration through a selectively permeable membrane is called osmosis. It is a special case of diffusion, where the medium is water.

For example, if the medium surrounding the cell has a higher water concentration than the cell i.e., if the solution is a dilute solution, then the cell will gain water by osmosis.



Movement of water inside the cell Question 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.

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.

Answer Discussion

Experimental set up

(i) Water gathers in the hollowed portions of set-up B and C because water enters the potato as a result of osmosis. Since the medium surrounding the cell has a higher water concentration than the cell, the water moves inside by osmosis. Hence, water gathers in the hollowed portions of the potato cup.

(ii) Potato A in the experiment acts as a control set-up. No water gathers in the hollowed portions of potato A.

(iii) Water does not gather in the hollowed portions of potato A because potato cup A is empty. It is a control set-up in the experiment.

Water is not able to enter potato D because the potato used here is boiled. Boiling denatures the proteins present in the cell membrane and thus, disrupts the cell membrane. For osmosis, a semi-permeable membrane is required, which is disrupted in this case. Therefore, osmosis will not occur. Hence, water does not enter the boiled potato cup.