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The Fundamental Unit of Life

In the Chapter

- The cell is the fundamental organisational unit of life.
- Cells are enclosed by a plasma membrane composed of proteins and lipids.
- The cell membrane is an active part of the cell. It controls the movement of materials between the ordered interior of the cell and the outer environment.
- In plant cells, a cell wall composed mainly of cellulose is located outside the cell membrane.
- The presence of the cell wall enables the cells of plants, fungi and bacteria to exist in hypotonic media without bursting.
- The nucleus in eukaryotes is separated from the cytoplasm by double-layered membrane and it directs the life processes of the cell.
- The ER functions both as a passageway for intracellular transport and as a manufacturing surface.
- The Golgi apparatus consists of stacks of membrane-bound vesicles that function in the storage, modification and packaging of substances manufactured in the cell.
- Most plant cells have large membranous organelles called plastids, which are of two types – chromoplasts and leucoplasts.
- Chromoplasts that contain chlorophyll are called chloroplasts and they perform photosynthesis.
- The primary function of leucoplasts is storage.
- Most mature plant cells have a large central vacuole that helps to maintain the turgidity of the cell and stores important substances including wastes.
- Prokaryotic cells have no membrane-bound organelles, their chromosomes are composed of only nucleic acid, and they have only very small ribosomes as organelles.

Intext Exercises

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1. Who discovered cells, and how?

Ans. (i) The cell was discovered by Robert Hook, in 1665.

(ii) He discovered cell in a cork slice with the help of a primitive microscope.

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

Ans. (i) In all living organisms whether as large as elephant or as small as bacteria, it is the cell which constitute the body. Hence, it is called structural unit of life.
(ii) In all living organisms, it is the cell which performs different functions. The cells are the smallest units involved in the division of labour. Hence, it is called the functional unit of life.

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

Ans. The substances move from place of higher concentration to the place of lower concentration in a cell.
When the concentration of CO_2 in the external environment of the cell is higher than that inside the cell CO_2 moves inside the cell. When the concentration outside the cell becomes low and it is high inside the cell due to metabolic activities, the CO_2 moves out. In the same way, water also moves outside and inside the cell.

2. Why is plasma membrane called a selectively permeable membrane?

Ans. Plasma membrane allows some substances to go in and out of the cell, but does not allow some other substances to either enter or leave the cell. That is why, it is called as selectively permeable membrane.

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

Ans. Prokaryotic Cell
1. Size : generally small (1^{-10}um) 1 um = 10^{-6} m
2. Nuclear region : not surrounded by a nuclear membrane and known as-nuceoid.
3. Chromosome : single
4. Membrane-bound cell organelles absent

Eukaryotic Cells.
1. Size : generally large (5^{-100} um)
2. Nuclear region : well defined and surrounded by a nuclear membrane
3. More than one chromosome
4. Membrane–bound cell organelles present

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

Ans. (i) Mitochondria, (ii) Plastids

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

Ans. If the structure of a cell is destroyed, the cell will not be able to perform its basic functions, such as respiration and nutrition, and will not be able to synthesise protein. This may stop all the life activities of the organism and may result in its death.

3. Why are lysosomes known as suicide bags?

Ans. When the cell is destroyed, the lysosomes explode and their enzymes eat (digest) their own cell. That is why, they are called suicide bags.

4. Where are proteins synthesized inside the cell?

Ans. The proteins are synthesized in the Ribosome inside the cell.

Exercise

Answer the following questions :

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

Ans. We can differentiate between an animal cell and a plant cell and observe the following differences :

Animal cell

1. They do not have cell wall.
2. They do not have chloroplast.
3. They contain small vacuoles.
4. They have centro-some.

Plant cell

1. They have cell wall made of cellulose.
2. They contain chloroplast.
3. They contain large vacuoles.
4. They do not have centro-some.

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

Ans. Eukaryotic Cell

1. Generally large size (5-100 um).
2. Nuclear material surrounded by a nuclear membrane.
3. More then one chromosome.
4. Nucleolus present.
5. Membrane-bound cell organelles present.
6. Cell division by mitotic or meiotic modes.

Prokaryotic Cell

1. Generally small size (1-10 um).
2. Nuclear region (nucle-oid) not surrounded by a nuclear membrane.
3. Single chromosome.
4. Nucleolus absent.
5. Membrane-bound cell organelles absent.
6. Cell division by fission or budding (no mitosis).

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

Ans. Plasma membrane is the outer covering of the cell that separates its contents from the surrounding medium. It is a selectively permeable membrane. If it ruptures or breaks down the cytoplasm will come in direct contact with the surrounding medium and the act of selection will stop.

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

Ans. If the cell does not have Golgi apparatus, the materials synthesized up the endoplasmic reticulum will not be carried to intracellular and extracellular targets. Lysosomes also will not be formed and, as a result, several enzymes and hormones will not be formed that are responsible for excretion of waste matter. All this will cause the cell's life to be reduced.

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

Ans. Mitochondria are called are powerhouse of the cell. They produce energy, which is stored in the form of ATP molecules. This energy is used in several life processes. That is why mitochondria are called powerhouse.

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

Ans. The lipids and proteins constituting the cell membrane are synthesized in the endoplasmic reticulum.

7. How does an Amoeba obtain its food?

Ans. Amoeba is a unicellular organism. Its cell has several vacuoles. One of these is the food vacuole. The food vacuole is full of food, and from here amoeba gets its food.

8. What is osmosis?

Ans. The movement of water molecules through a selectively permeable membrane from an area of higher concentration to an area of lower concentration is called osmosis. The movement of water depends on the substances dissolved in it.

9. Carry out the following osmosis experiment:

Take four peeled potatoes halves and hollow 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 boiled potato cup D.

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

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

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

(c) Explain why water does not gather in the hollowed out portion of A and D.

Ans. (a) A potato is made up of several cells. The cell membrane of the cells is selectively permeable. Cups B and C are filled with sugar and salt, respectively, while their outer part is in contact with water. Therefore, the concentration of water is higher outside the potato as compared to the inside of potato. Thus, due to osmosis, water moves towards the inside of potato from its outside. As a result, water collects inside cups B and C.

(b) Cup A is important in this experiment because it shows that if two solutions with the same concentration are taken, then there is no movement in the water molecules.

(c) Water does not gather inside cups A and D because cup D is made of boiled potato. Its cells are dead and their cell membranes are no more selectively permeable. Therefore, no osmosis takes place and water does not go inside the potato from outside. Potato cup A has been left empty. Therefore, the concentration of both sides of the cell membrane is equal. As a result, there is no movement in the water molecules. Thus, water does not collect inside cups A and D.

Additional Questions

1. What will happen to a plant cell if it is kept in a:

(i) hypertonic solution

(ii) hypotonic solution

Ans. (i) Water crosses the cell membrane in both directions, but more water leaves the cell than enters it. Therefore, the cell will shrink.

(ii) The overall result is that, water enter the cell. The cell is likely to swell up.

2. Mention any two functions of the endoplasmic membrane.

Ans. (i) Synthesis of lipids and their secretion (SER),

(ii) Synthesis of proteins (Rough E.R.)

3. Which organelle of a cell is known as power house of the cell? Why?

Ans. Mithochondria contains enzymes for catalysing biochemical reactions involved in respiration. Energy is produced in the process, thus it is generally called power house of the cell.

4. How is a prokaryotic cell different from an enukaryotic cell?

Ans. Prokaryotic cells lack well organised nuclear membrane and membrane bound organelles. They have 70 S types of ribosomes.
Eukaryotic cells have proper nucleus and membrane bound organelles. They have 80 S types of ribosomes.

5. Does the same organism can have cells of different kinds?

Ans. Yes, the same organism can also have cells of different kinds.

6. What is the functional unit of life? Define it.

Ans. Cell is called "the functional unit of life". A cell is defined as, "The structural and functional unit of the life."

7. What is plasmolysis? Give its one example.

Ans. When a living plant cell looses water through osmosis, there is shrinkage or contraction of the protoplasm away from the cell wall. The phenomenon is called plasmolysis.

8. Do you agree that a cell is a 'building unit of organism'? If yes, explain why?

Ans. Yes, cell is a building unit of every living organism as every living being is made up of one or more cells. In unicellular organisms, the single cell performs cell functions of life. In multicellular organisms all the cells have a similar basic structure and perform similar basic life activities. However, they become specialised to form components of different structuers that perform different functions. Cells are first orgnised into tissues each with a specific function, e.g., contraction by muscular tissue. Tissues are organised to form organs with each organ performing a specific function, e.g., heart, stomach, kidney, organs are grouped into organ systems, each with a major function, e.g. circulatory system, excretory system, respiratory system. A living being has a number of organ systems. However, in all such organisational complexity, cell remains the basic building unit of the organism.

9. Why are lysosomes known as 'suicide bags' of a cell?

Ans. Lysosomes are known as 'suicide bags' because when cell gets damaged during the disturbance in cellular metabolism, lysosomes may burst and the digestive enzymes thus released digest their own cell.

10. How does amoeba obtain its food?

Ans. Plasma membrane of Amoeba is flexible. With its help, amoeba engulfs food particle. The engulfed food particle passes into the body of amoeba as a phagosome. Phagosome combines with lysosome to produce digestive or food vacuole. Digestion occurs in food vacauole. The digested food passes into surrounding cytolasm. The undigested matter is thrown out of the cell.

11. Which cell organelle controls most of the activities of the cell?

Ans. Nucleus, by controlling metabolism and cell activities. Genes expressed their effect through RNAs. RNAs control synthesis of proteins and enzymes.

12. State the full form of ATP.

Ans. Adenosine Tri-phosphate.

13. What is the function of leucoplasts?

Ans. The function of leucoplasts is to store starch grains, oil drops and protein granules.

14. Mention one function each of Golgi apparatus and smooth endoplasmic reticulum (SER).

Ans. Function of Golgi apparatus: Cell secretion and condensation. Function of smooth endoplasmic reticulum: Detoxification of many poisons and drugs.

15. Why are lysosomes known as suicidal bags?

Ans. Lysosomes are capable of digesting or lysing the entire cell, once the enzymes are liberated, so these are called suicidal bags.

16. Define endocytosis.

Ans. Endocytosis: Here, cellular active intake of material takes place. The intake of droplets of extra cellular fluid along with the sub-microscopic particles is called cell drinking of pinocytosis.

17. What will happen if you put an animal or plant cell into a dilute solution of salt or salt prepared in water?

Ans. The cell will swell by gaining water from sugar or salt solution by osmosis.

18. Which chemical molecule carries heredity from parents to offspring?

Ans. DNA.

19. Give two examples where the cells constantly keep their shapes changing.

Ans. (i) White blood corpuscles (Leukocytes). (ii) Amoeba (Protozoa).

20. What is a eukaryotic cell?

Ans. The cell containing membrane-bound cell organelles is known as a eukaryotic cell.

21. What are the most important structures within a nucleus?

Ans. Chromosomes.

22. Where does protein synthesis occur in a cell?

Ans. In ribosomes of cell.

23. Name the plastid which stores starch, oils and protein granules.

Ans. Leucoplasts.

24. Name the organelle of a cell which is often referred as Power House of the cell.

Ans. Mitochondria.

25. Who discovered cells in living organism? Give an example of unicellular organism.

Ans. Robert Hook discovered cells in living organism.
Example of unicellular organism : Amoeba

26. Name the process in which diffusion takes place through a selective permeable membrane.

Ans. Osmosis.

27. Name the cell organelle which you would associate with elimination of old and worn out cells.

Ans. Lysosomes.

28. List any two single celled (unicellular) organisms.

Ans. Paramecium and Euglena.

29. What is the function of leucoplasts?

Ans. Leucoplasts store the starch, protein or oil in non-photosynthetic stem and roots.

30. Name any two materials stored in leucoplasts.

Ans. Fats and proteins.

31. Name the kind of plastid which is important for photosynthesis in leaves of the plants.

Ans. Chloroplasts.

32. Give three examples of organisms in which a single cell performs all the functions?

Ans. (i) Paramoecium, (ii) Chlamydomonas, (iii) Amoeba.

33. Who coined the word 'cell'?

Ans. Robet Hooke (1665).

Multiple Choice Questions

1. The cell organelles inolved in forming complex sugars from simple sugars are
(a) Endoplasmic reticulum
(b) Ribosomes
(c) Plastids
(d) Golgi apparatus
Ans. (d)

2. Which out of the following is not a function of vacuole?
(a) Storage
(b) Locomotion
(c) Waste excretion
(d) Providing turgidity and rigidity to the cell
Ans. (b)

3. Amoeba acquires its food through a process, termed
(a) Exocytosis
(b) Endocytosis
(c) Plasmolysis
(d) Exocytosis and endocytosis both
Ans. (b)

4. Cell wall of which one of these is not made up of cellulose?
(a) Bacteria
(b) Hydrilla
(c) Mango tree
(d) Cactus
Ans. (a)

5. Silver nitrate solution is used to study
(a) Endoplasmic reticulum
(b) Golgi apparatus
(c) Nucleus
(d) Mitochondria
Ans. (b)

6. Organelle other than nucleus, containing DNA is
(a) Endoplasmic reticulum
(b) Golgi apparatus
(c) Mitochondria
(d) Lysosome
Ans. (c)

7. Kitchen of the cell is
(a) Mitochondria
(b) Endoplasmic reticulum
(c) Chloroplast
(d) Golgi apparatus
Ans. (c)

8. Lipid molecules in the cell are sythesized by
(a) Smooth endoplasmic reticulum
(b) Rough endoplasmic reticulum
(c) Golgi apparatus

(d) Plastids

Ans. (a)

9. Cell arises from pre-existing cell was stated by

(a) Haeckel
(b) Virchow
(c) Hooke
(d) Schleiden

Ans. (b)

10. Cell theory was given by

(a) Schleiden and Schwann
(b) Virchow
(c) Hooke
(d) Haeckel

Ans. (a)

11. The only cell organelle seen in prokaryotic cell is

(a) Mitochondria
(b) Ribosomes
(c) Plastids
(d) Lysosomes

Ans. (b)

12. Organelle without a cell membrane is

(a) Ribosome
(b) Golgi apparatus
(c) Chloroplast
(d) Nucleus

Ans. (a)

13. Lysosome arises from

(a) Endoplasmic reticulum
(b) Ggolgi apparatus
(c) Nucleus
(d) Mitochondria

Ans. (b)

14. Living cells were discovered by

(a) Robert Hooke
(b) Purkinje
(c) Leeuwenhoek
(d) Robert Brown

Ans. (c)

15. Which of the following acts as a garbage disposal system of the cell?

(a) Vacuole
(b) Lysosome
(c) Peroxisome
(d) Golgi body

Ans. (b) Lysosome

16. Power house of the cell is

(a) Mitochondria
(b) Golgi apparatus
(c) Lysosome

(d) Chloroplast

Ans. (a) Mitochondria

17. Lysosomes function in the cell as

(a) Suicide bag
(b) Digestive bag
(c) Kitchen
(d) Protein factory

Ans. (b) Digestive bag

18. Grapes placed in concentrated saline solution will

(a) swell and burst
(b) become more juicy
(c) shrink
(d) remain unchanged

Ans. (c) shrink

19. Well defined nucleus is absent in

(a) Plant cell
(b) Animal cell
(c) Eukaryotic cell
(d) Prokaryotic cell

Ans. (d) Prokaryotic cell

20. Which of the following is absent in plant cell ?

(a) Vacuole
(b) Centriole
(c) Cell membrane
(d) Mitochondria

Ans. (b) Centriole

21. Which of the following is the largest cell organelle present in the plant cell?

(a) Mitochondria
(b) Chloroplast
(c) Nucleus
(d) E.R.

Ans. (a) Mitochondria

22. A colourless plastid is

(a) Amyloplast
(b) Elaioplast
(c) Aleuroplast
(d) All the above

Ans. (d) All the above

23. Root hair absorb water from soil through

(a) Diffusion (b) Imbibition
(c) Osmosis (d) All the above

Ans. (c) Osmosis.

24. Identify the phenomenon by which protoplast of a cell shrinks from the wall.

(a) Plasmolysis
(b) Deplashmolysis
(c) Osmosis
(d) Diffusion

Ans. (a) Plasmolysis.