પુ.ના International School
Shree Swaminarayan Gurukul, Zundal

SCIENCE IX

(Biology)

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Chapter 5 " The Fundamental Unit of Life"

TERMS

Diffusion

The movement of molecules from a region of their high concentration to a region of their lower concentration is known as diffusion.

Osmosis in selectively permeable membrane

Osmosis is the movement of water across a semi-permeable membrane. Osmosis is a selective process since the membrane does not allow all molecules to pass through it. Water is usually the only free flowing molecule across this membrane.

To know more about Diffusion and Osmosis, visit here.

Isotonic, hypotonic solutions, hypertonic solutions

- Isotonic solutions are those which have the same solute and pH concentration as the surrounding body fluid or the cytoplasm.
- Hypotonic solutions contain lesser amount of solute concentration compared to the surrounding fluid and can force the cell to rupture due to excess input of water into the cell.
- Hypertonic solutions contain higher concentration of solute compared to the surrounding fluid and thus push water out of cell, shrinking it.

Cell walls in plants

Plant cells are different from animals cells due to the presence of a cell wall. The cell wall is made of cellulose and gives a rigid structure to the plant cell.

Cell Organelles

Endocytosis

Endocytosis is the invagination of cell membrane, followed by pinching off forming a membrane bound vesicle. This is commonly seen in Amoeba.

Nucleus in cells

Nucleus is the processing unit of the cell. It is a double membrane bound organelle which contains the genetic material for inheritance.

Chromosomes

During the growth phase of the cell, the chromatin condenses into a much thicker structure called chromosome.

Chromatin

Chromatin is a thread like structure which serves as the genetic material present inside the nucleus of the cell. It is made up of DNA and protein molecules. The DNA contains the hereditary information needed for the structure and function of the organism.

Cytoplasm

Cytoplasm is the fluid found inside the cell. It gives the structure to the cell and houses different organelles of the cell.

Organelles

Organelles are structures present in the cytoplasm of the cell that help in several functions of the cell.

Endoplasmic Reticulum

Endoplasmic reticulum is a membrane like cell organelle that plays an integral role in the interpretation of the genetic information present in the nucleus.

Rough ER

Rough ER are the ones that have ribosomes on it. The ribosome is made up of nucleic acids and proteins. They are the site of protein synthesis. The Rough ER is also involved in the modification and folding of protein.

Smooth ER

Smooth ER do not have ribosomes and thus are not involved in protein synthesis. They are however, involved in the lipid metabolism and detoxifying poisonous molecules.

Golgi Apparatus

Golgi Apparatus is also called the post office of the cell. They package and transport the proteins across the cytoplasm.

Lysosomes

They are referred to as suicide bags of the cell as they contain potent enzymes that can digest a cell. Lysosome also help in defense by attacking a foreign object.

Mitochondria

Mitochondria are also called power plant of the cell. They generate ATP via the electron transport chain. They also have a DNA called mtDNA, which makes them semi-autonomous organelle.

Plastids

There are various types of plastids in different cells based on the pigment they contain. The chloroplast is the plastid where the photosynthesis occurs. Some of the other plastids are leucoplast and chromoplast.

Vacuoles

Vacuoles are large vesicles that hold water or air in them and give structural rigidity to the cell. Vacuoles are common in plant cells. In animals the vacuoles are either very small or absent.

1. Who discovered cells, and how?

Answer

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?

Answer

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.

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

Answer

CO_2 moves by diffusion – These 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 out 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?

Answer

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

5. 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 μm = 10^{-6}m 2. Nuclear region: _____ _____ and known as _____ 3. Chromosome: single 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. More than one chromosome. 4. _____ _____ _____

Answer

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 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 are more than one chromosomes. 4. Membrane-bound cell organelles present.

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

Answer

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?

Answer

In the event of any damage to cells and when 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?

Answer

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?

Answer

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.

10. 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	Distinct edges, shape is either rectangular or square shaped.	Round and irregular shape
Nucleus	Present. Lies on one side of the cell	Present. Lies in the center of the cell
Lysosomes	Rarely present	Always present
Plastids	Present	Absent
Structure of Vacuoles	Single or a few large vacuole that is centrally located	Presence of numerous and small vacuoles

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

Answer

The following are the differences between prokaryotic and eukaryotic cells.

Prokaryotic Cell	**Eukaryotic Cell**
1. Size: Generally small (1-10 μm) 1 μm = 10^{-6}m	1. Size: Generally large (5-100 μm) 2. Nuclear region: well defined and girdled by a nuclear membrane.

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.	3. There are more than one chromosomes. 4. Membrane-bound cell organelles present.

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

Answer:

If plasma membrane ruptures or breaks down then molecules of some substances will freely move in and out of the cells. As plasma membrane acts as a mechanical barrier, 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.

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

Answer

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

- storage of substances
- packaging of substances
- manufacture of substances

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 golgi apparatus, cells will not be produced.

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

Answer

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 'energy currency of the cell'.

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

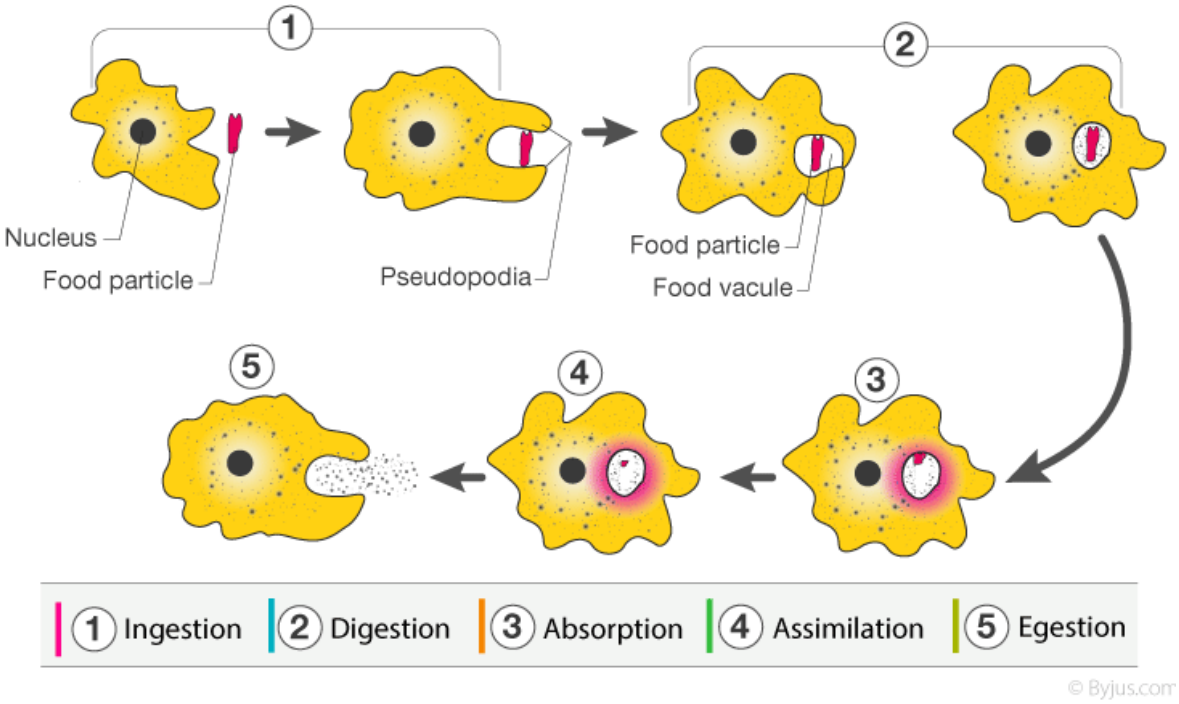
Answer:

Lipids and proteins are synthesised in the ER [Endoplasmic Reticulum].

16 How does an Amoeba obtain its food?

Answer:

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 food is trapped.



17. What is osmosis?

What is osmosis?

Answer:

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.

18. 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

(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. The 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 the 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.

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

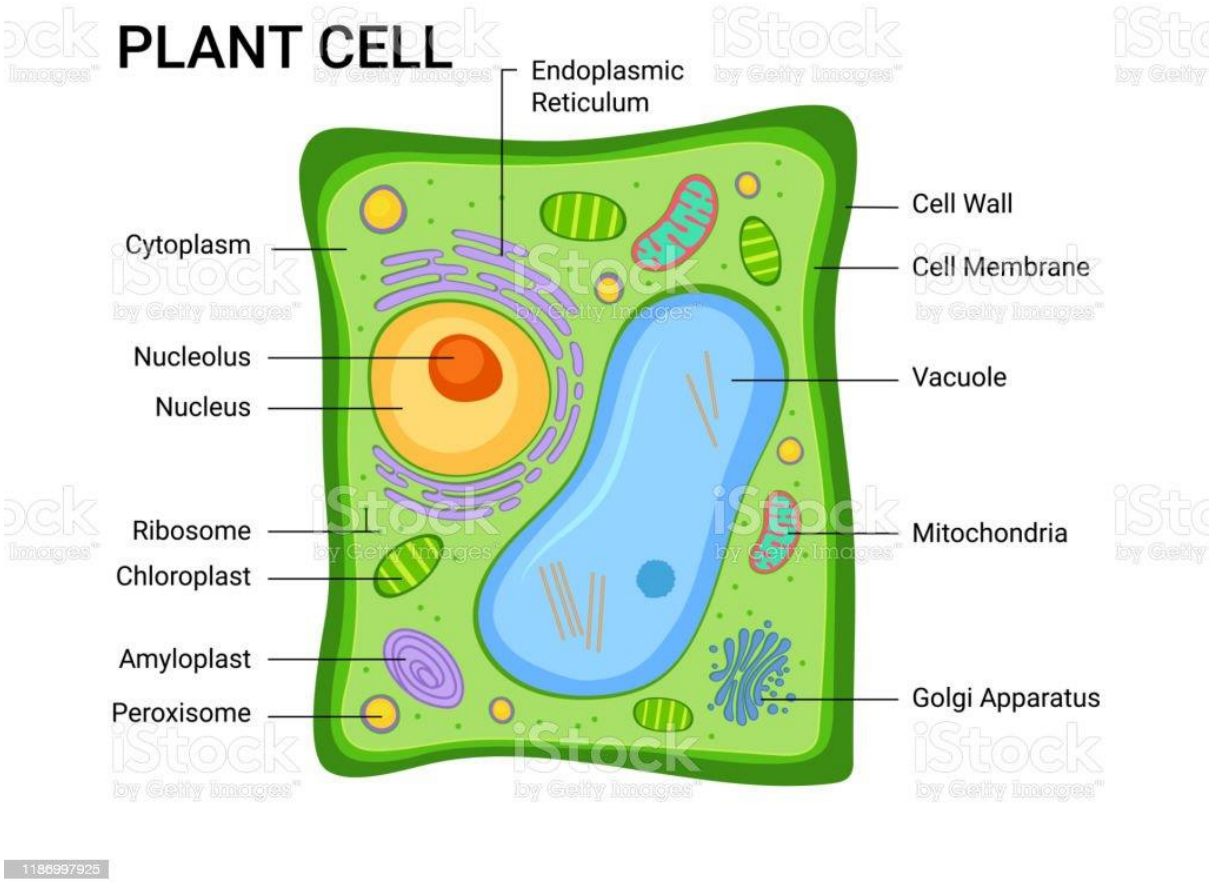
Answer:

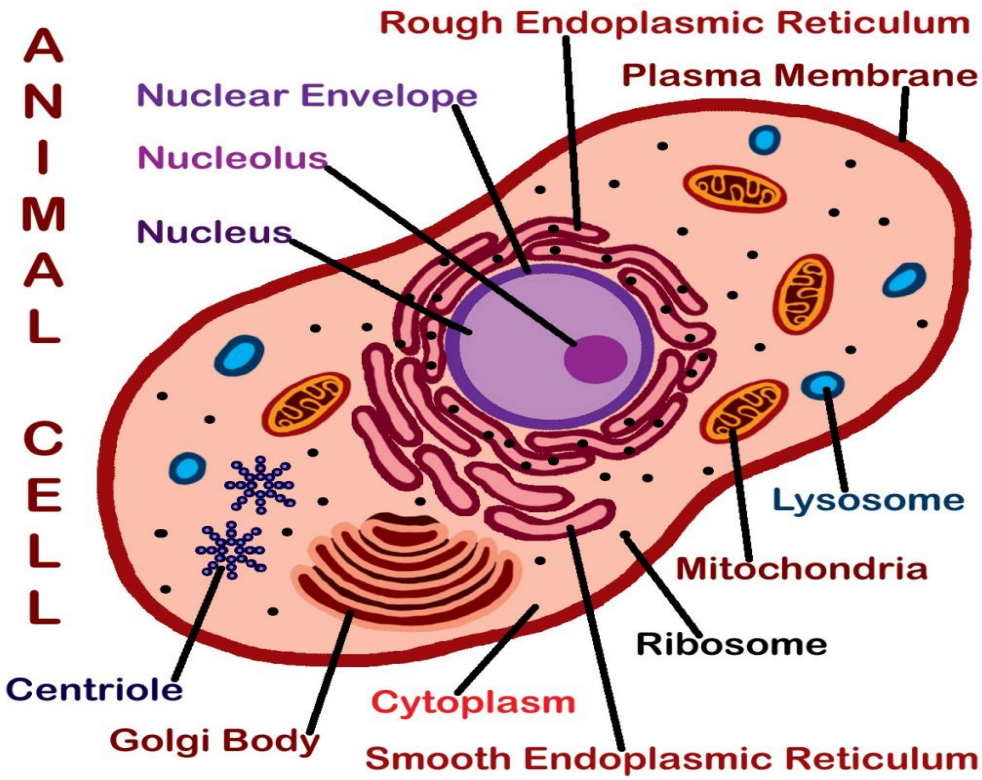
There are two ways in which a cell divides:

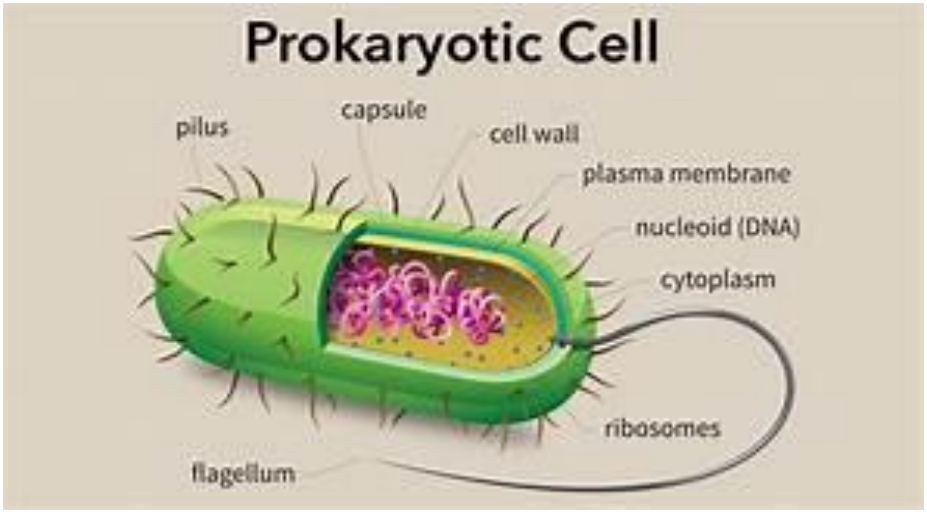
- Mitosis
- Meiosis

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

- **Draw and label the diagrams**
  Plant cell
  Animal




ANIMAL CELL
Rough Endoplasmic Reticulum
Plasma Membrane
Nuclear Envelope
Nucleolus
Nucleus
Lysosome
Mitochondria
Ribosome
Centriole
Cytoplasm
Golgi Body
Smooth Endoplasmic Reticulum


Prokaryotic Cell
pilus
capsule
cell wall
plasma membrane
nucleoid (DNA)
cytoplasm
ribosomes
flagellum

The Compound light Microscope