BIOLOGY

Chapter 5: The Fundamental Unit of Life

The Fundamental Unit of Life

Cells are the basic structural and functional unit of life. Cell was discovered by Robert Hooke. A number of cells can work together to form tissues and organs.

History of Cell

- The **cell** is the basic structural and functional unit of all living organisms. It is the smallest part of the body of an organism which is capable of independent existence and is able to perform all the essential functions of life.
- The history of cell science began in **1665**, with the observation of a thin section of bottle cork by the English scientist **Robert Hooke**.
- In **1838**, **Matthias Schleiden** and **Theodor Schwann** proposed a basic cell theory. In 1858, another scientist, Virchow, made an addition to the existing cell theory.
- The **postulates of the modern cell theory** are
  - The cell is the smallest unit of structure of all living things.
  - The cell is the unit of function of all living things.
  - All cells arise from pre-existing cells.
- Cells vary in **number**. Examples: Single-celled *Amoeba,* few-celled *Spirogyra* and multi-celled human being. They vary in **size**. Examples: Bacteria are the smallest, nerve cells are the longest and the ostrich egg is the largest. They vary in **shape**. Example: Columnar epithelial cells.

Cellular respiration

Cellular respiration is the process by which the food releases energy in the mitochondria. Cells absorb glucose from the food and burn it to produce energy.

Structural Organization of Cells

Prokaryotic & Eukaryotic cells

Two types of cells Prokaryotic and Eukaryotic cells. Prokaryotic cells are primitive and lack well defined nucleus. Eukaryotic cells are more advanced and have well defined nucleus.

Cell structure in Eukaryotic cells

Eukaryotic cells have the most well-defined structure. These cells have cell membrane, membrane bound cell organelles and a well-defined nucleus. The nucleus has its own membrane called nuclear membrane.

Cell membrane

- Cell membrane is the outer covering of a cell.
- It is made up of phospho-lipid bilayer membrane.
- It is selectively permeable in nature.
- The structure of a cell membrane is best described by the fluid mosaic model.

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.

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.

Types of Organisms

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.

UNICELLULAR ORGANISMS	MULTICELLULAR ORGANISMS
1. Made of one cell.	1. Made of many cells.
2. There is no division of labour.	2. Cells are specialised to perform specific functions.
3. A single cell participates in reproduction.	3. Only some cells (germ cells) participate in reproduction.
4. Lifespan is short.	4. Lifespan is long.
5. Examples: *Amoeba*, *Paramoecium*	5. Examples: Fungi, plants, animals

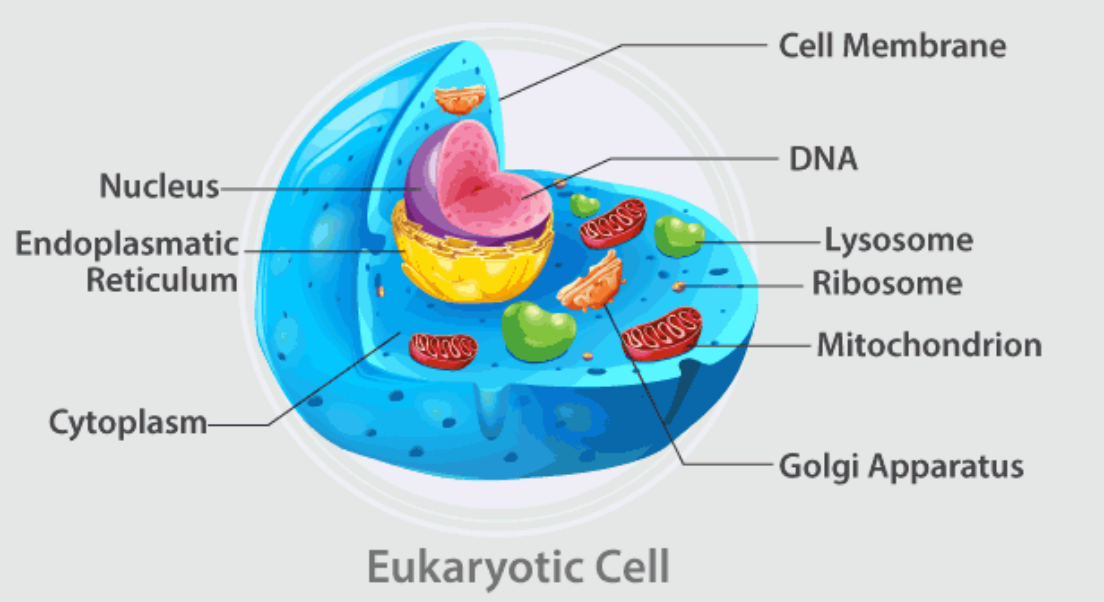
Differences between Prokaryotic and Eukaryotic Cells

PROKARYOTIC CELL	EUKARYOTIC CELL
1. Absence of a well-defined nucleus.	1. Presence of a well-defined nucleus with a nuclear membrane.
2. Nucleolus is absent.	2. Nucleolus is present.
3. Presence of a single length of only DNA.	3. Presence of several lengths of DNA, wound around certain proteins.
4. Presence of smaller ribosomes.	4. Presence of larger ribosomes.
5. Examples: Bacteria, blue-green algae	5. Examples: *Amoeba*, plants, animals

Eukaryotic Cell

The term "Eukaryotes" is derived from the Greek word "eu", (meaning: good) and "karyon" (meaning: kernel), therefore, translating to "good or true nuclei." Eukaryotes are more complex and much larger than the prokaryotes. They include almost all the major kingdoms except kingdom monera.

Structurally, eukaryotes possess a cell wall, which supports and protects the plasma membrane. The cell is surrounded by the plasma membrane and it controls the entry and exit of certain substances.



The nucleus contains DNA, which is responsible for storing all genetic information. The nucleus is surrounded by the nuclear membrane. Within the nucleus exists the nucleolus, and it plays a crucial role in synthesising proteins. Eukaryotic cells also contain mitochondria, which are responsible for the creation of energy, which is then utilized by the cell.

Present in only plant cells, chloroplasts are the subcellular sites of photosynthesis. Endoplasmic reticulum helps in the transportation of materials. Besides these, there are also other cell organelles that perform various other functions and these include ribosomes, lysosomes, Golgi bodies, cytoplasm, chromosomes, vacuoles and centrosomes.

Examples of eukaryotes include almost every unicellular organism with a nucleus and all multicellular organisms.

Prokaryotic Cell

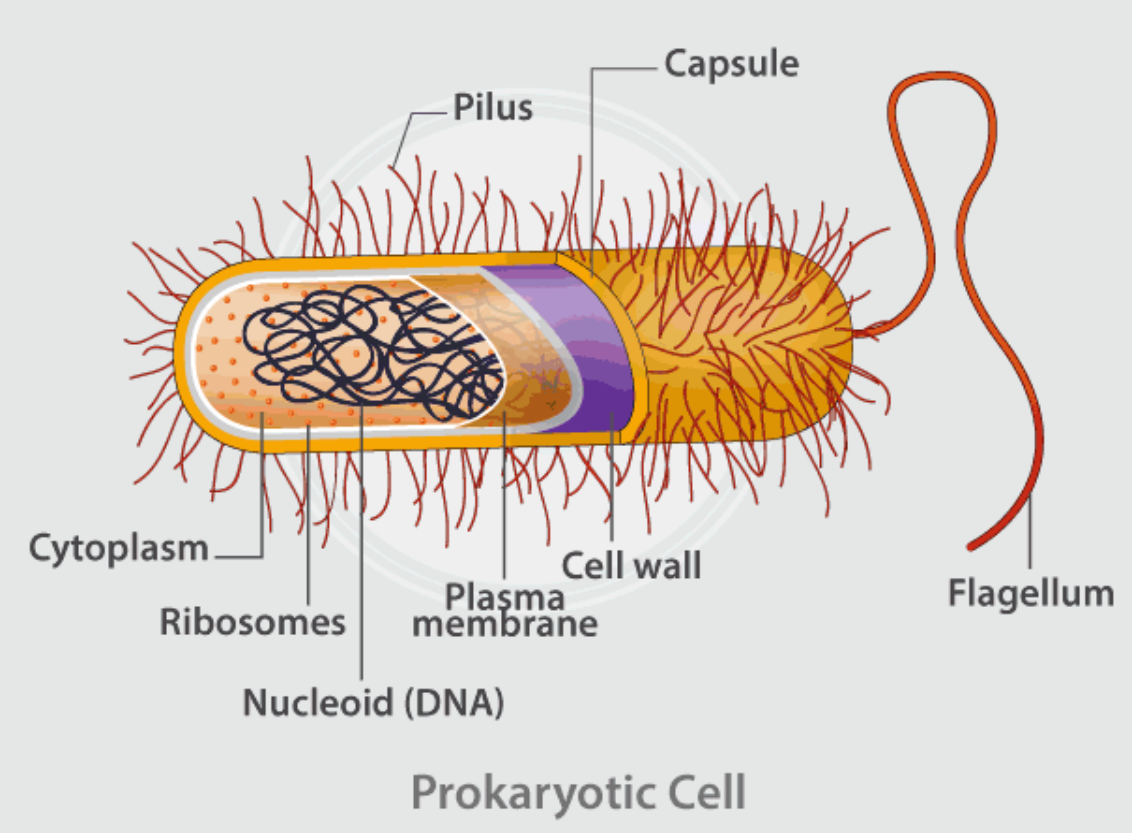
The term “prokaryote” is derived from the Greek word “pro“, (meaning: before) and “karyon” (meaning: kernel). It translates to “before nuclei. “

Prokaryotes are one of the most ancient groups of living organisms on earth, with fossil records dating back to almost 3.5 billion years ago.

These prokaryotes thrived in the earth’s ancient environment, some using up chemical energy and others using the sun’s energy. These extremophiles thrived for millions of years, evolving and adapting. Scientists speculate that these organisms gave rise to the eukaryotes.

Prokaryotic cells are comparatively smaller and much simpler than eukaryotic cells. The other defining characteristic of prokaryotic cells is that it does not possess membrane-bound cell organelles such as a nucleus. Reproduction happens through the process of binary fission.

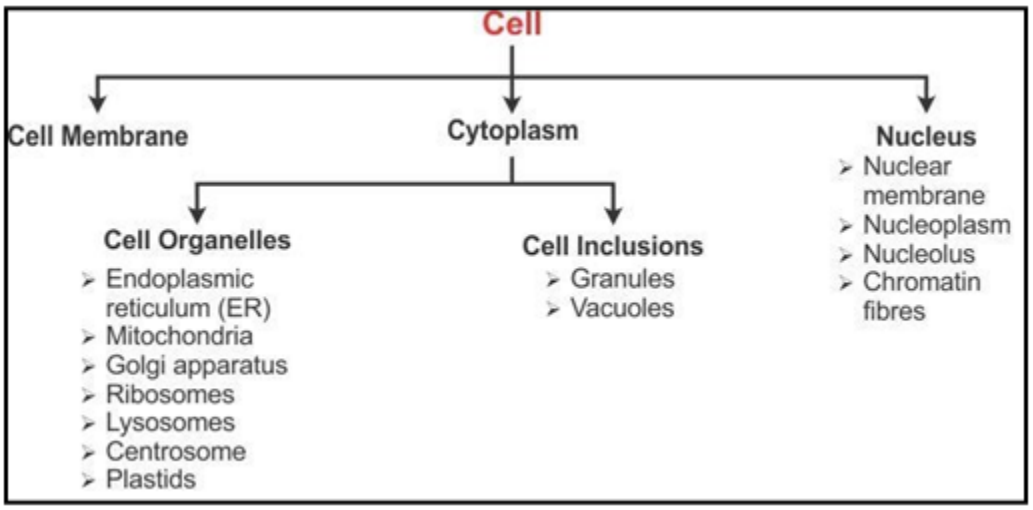
Structurally, prokaryotes have a capsule enveloping its entire body, and it functions as a protective coat. This is crucial for preventing the process of phagocytosis (where the bacteria gets engulfed by other eukaryotic cells, such as macrophages) The pilus is a hair-like appendage found on the external surface of most prokaryotes and it helps the organism to attach itself to various environments. The pilus essentially resists being flushed, hence, it is also called attachment pili. It is commonly observed in bacteria.



Right below the protective coating lies the cell wall, which provides strength and rigidity to the cell. Further down lies the cytoplasm that helps in cellular growth, and this is contained within the plasma membrane, which separates the interior contents of the cell from the outside environment. Within the cytoplasm, ribosomes exist and it plays an important role in protein synthesis. It is also one of the smallest components within the cell.

Some prokaryotic cells contain special structures called mesosomes which assist in cellular respiration. Most prokaryotes also contain plasmids, which contains small, circular pieces of DNA. To help with locomotion, flagella are present, though, pilus can also serve as an aid for locomotion. Common examples of Prokaryotic organisms are bacteria and archaea. Also, all members of Kingdom Monera are prokaryotes.

Structural Organisation of a Cell



CHARACTERISTICS	FUNCTIONS
Plasma membrane	
Very thin, flexible and delicate living semi- permeable membrane	Acts as an effective barrier and regulates the entry of certain solutes and ions
Cell wall	
Freely permeable, mainly composed of cellulose	Gives rigidity and shape to the plant cells and provides protection
Cytoplasm	
Contains a mixture of water and soluble organic and inorganic compounds and various cell organelles	Seat of occurrence of glycolysis (production of pyruvic acid)
Endoplasmic reticulum	
May be smooth (SER) or rough (RER)	Acts as a supportive framework of the cell
Mitochondria	

Double-walled, inner wall thrown into folds called cristae	Seat of aerobic respiration and synthesises respiratory enzymes and energy-rich compounds
Golgi apparatus (in animal cells) Dictyosomes (in plant cells)	
Consists of a set of membrane-bounded, fluid-filled vesicles and vacuoles	Synthesis of the plasma membrane, cell wall etc. and synthesis and secretion of enzymes and hormones
Ribosomes	
Single-walled, dense, spherical bodies composed mainly of RNA and proteins	Synthesis of proteins
Lysosomes	
Contains 40 different types of enzymes	Intracellular digestion

CHARACTERISTICS	FUNCTIONS
Centrosomes	
Contains one or two centrioles which are surrounded by radiating microtubules to form an aster shape	Initiates and regulates cell division
Plastids	
Double membrane, proteinaceous matrix containing DNA and disc-like structures called thylakoids containing chlorophyll	Chromoplasts: Impart colour to flowers and fruits Chloroplasts: Trap solar energy for photosynthesis Leucoplasts: Store starch
Nucleus	
Mostly spherical and dense, surrounded by nuclear membrane with pores	Regulates cell cycle and cell functions
Nucleolus	
Round, one or more in number	Participates in protein synthesis by forming and storing RNA
Chromatin fibres	
Network of thread-like structures which are made of DNA	Chromosomes carry hereditary information or genes
Vacuoles	

Non-living structures	Storage of water and other substances, food, pigments and waste products
Granules	
Small particles, crystals or droplets	Starch (in plant cells), glycogen (in animal cells) and fat-containing granules serve as food for the cell

Differences between Plant and Animal Cells

PLANT CELL	ANIMAL CELL
1. Presence of a definite cell wall made of cellulose	1. Absence of a cell wall
2. Cell membrane present internal to the cell wall	2. Cell membrane forms the boundary of the cell
3. Absence of centrosome	3. Presence of centrosome
4. Absence of centriole	4. Presence of centriole
5. Presence of plastids	5. Absence of plastids

Difference Between Plant cell and Animal cell

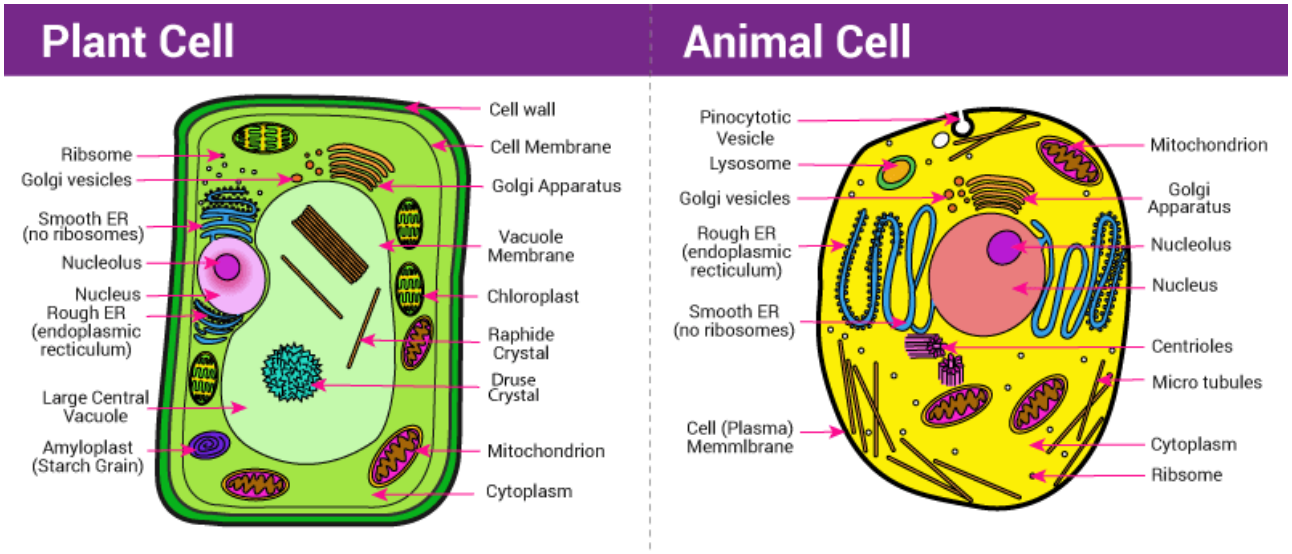
The cell is the fundamental unit of life. All the life activities are carried out by cells. The organisms are classified based on the number of cells present in them. Unicellular organisms are single-celled, while multicellular organisms have a large number of cells.

Unicellular organisms are believed to be one of the earliest forms of life on earth. Eventually, more complex multicellular organisms evolved from these unicellular life forms over the aeons. Multicellular organisms have specialized cells with complicated cell organelles, which unicellular organisms typically lack.

In an ecosystem, plants have the role of producers while animals have taken the role of consumers. Hence, their daily activities and functions vary, so do their cell structure. Cell structure and organelles vary in plants and animals, and they are primarily classified based on their function. The difference in their cell composition is the reason behind the difference between plants and animals, their structure and functions.

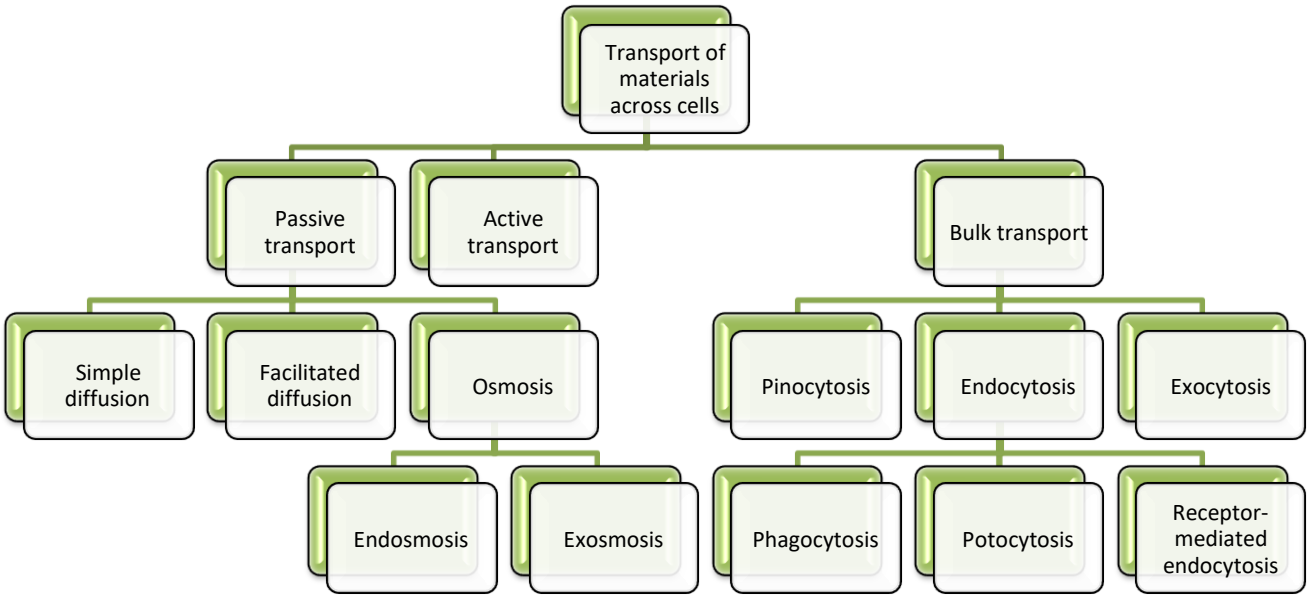
Each cell organelle has a particular function to perform. Some of the cell organelles are present in both plant cell and the animal cell, while others are unique to just one. Most of the earth's higher organisms are eukaryotes, including all plant and animals. Hence, these cells share some similarities typically associated with eukaryotes.

For example, all eukaryotic cells consist of a nucleus, plasma membrane, cytoplasm, peroxisomes, mitochondria, ribosomes and other cell organelles.



As stated above, both plant and animal cells share a few common cell organelles, as both are eukaryotes. The function of all these organelles is said to be very much similar. However, the major differences between the plant and animal cells, which significantly reflect the difference in the functions of each cell.

Transport of Materials across Cells



- **Passive transport** is a kind of diffusion in which an ion or a molecule crossing the cell membrane moves against its electrochemical or concentration gradient.
- In **simple diffusion**, molecules of gases such as oxygen and carbon dioxide enter the cell without the help of transport proteins such as permeases.
- In **facilitated diffusion**, ions or molecules cross the membrane rapidly by using specific proteins called transport proteins or permeases which are present in the membrane.
- The spontaneous passage of water molecules from a region of high water concentration to a region of low water concentration through a selectively permeable membrane is

called **osmosis**.

- The process by which water molecules enter a cell is called **endosmosis**.
- The process by which water molecules move out of the cell is called **exosmosis**.
- In plant cells, when excess of exosmosis occurs, the cytoplasm and plasma membrane shrink away from the cell wall. This is known as **plasmolysis**.
- **Active transport** is the movement or transport of substances through a biological membrane such as the cell membrane. This process requires energy.
- Large molecules are continuously imported or exported into the cells across the plasma membrane. The process where the cells either release or absorb fluids and particles through their outer membrane is called **bulk transport**.
- Materials enter a cell by invagination and formation of vesicles. As the materials leave the cell, the membrane of a vesicle fuses with the plasma membrane and extrudes its contents to the surrounding medium. This outward transport of materials by using carrier molecules is called **exocytosis**.
- **Endocytosis** is the intake or ingestion of materials by cells through the plasma membrane.
- **Phagocytosis**, also known as **cell eating**, is a common method in which substances are taken up in the solid form.
- In **potocytosis**, small molecules or ions are specifically internalised into the cell.
- **Receptor-mediated endocytosis** is a pathway for selective uptake of large molecules such as ligands in clathrin-coated pits.
- In **pinocytosis**, also known as **cell drinking**, substances are taken up by the cell in the fluid form.

Cellulose In Digestion

Cellulose is a complex organic compound that occurs abundantly in nature. It is a polymeric carbohydrate molecule consisting of a linear chain having thousands of glycosidic linkages.

It consists of unbranched chains of glucose (linked D-Glucopyranose). They are straight chains linked by hydrogen bonds producing a substance that is inert and insoluble in water, in their pure form.

Modified cellulose and pure cellulose are different in their chemical compositions. They are components of the plant cell wall and have no odour or taste. It is crystalline in nature and does not dissolve water and other solvents. Termites and herbivorous animals lack the enzyme for cellulose digestion.

Digestion of Cellulose in Termites

Termites have mastigophorans (microbes) in their gut which brings about digestion of cellulose. Herbivorous animals, on the other hand, are ruminants. They have different compartments in

their stomach to carry out digestion.

The rumen is the first compartment where ingested food containing cellulose is stored temporarily and later regurgitated to chew their cud. They are able to digest cellulose because of the presence of bacteria and enzymes in the rumen where anaerobic bacterial digestion occurs. A by-product of this type of digestion releases methane which is foul-smelling and causes the destruction of the ozone layer of the Earth.

Digestion of Cellulose in Humans

Cellulose is a fibre which is not digestible by the human digestive system. It, however, helps in the smooth functioning of the intestinal tract.

The presence of beta acetal linkages in cellulose makes it different from starch and is a deciding factor in its digestibility. Humans lack the enzyme required to breakdown the linkages. Furthermore, it forms a major part of the human diet from plant foods.

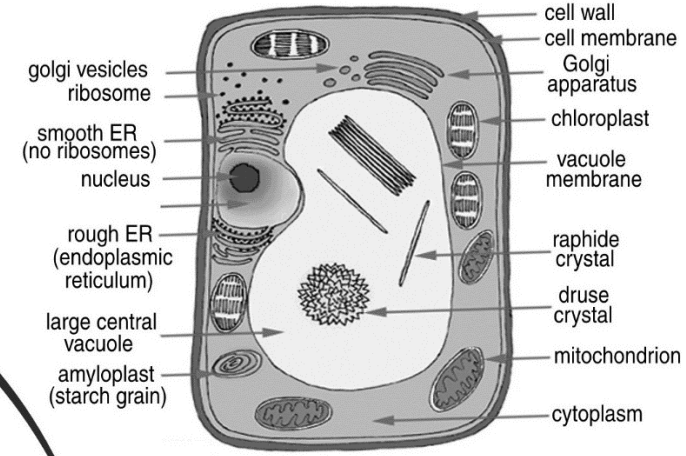
Fruits and vegetables contain cellulose in small amounts which are easily digestible. Fibres contain cellulose which acts as roughage, adding bulk to consumed food and helps in the smooth passage of the food efficiently and at a much faster pace. High fibre diet reduces the risk of colon cancer as fibre in the diet helps reduce the time the faeces stay in the colon wall.

Since it is insoluble in water it binds with other components adding bulk helping to move through the intestines by aiding bowel movements. Consuming food that does not contain cellulose over a period of time results in the bowel becoming weak leading to constipation.

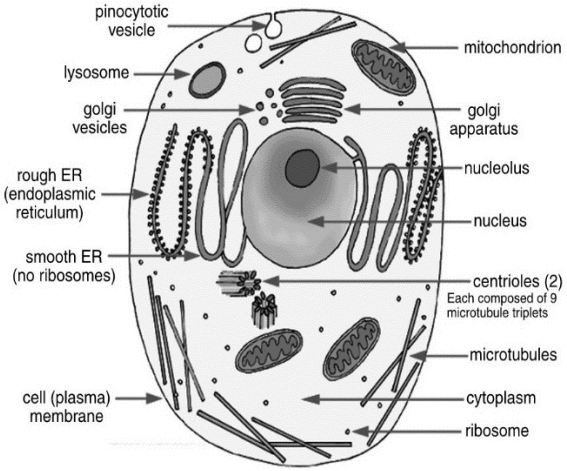
These fibres aid in the growth of bacteria in the gut which feeds on sugars and fibres. They maintain the health of the gut and checks for bacteria causing illness. Fibres also prevent weight gain and aids in weight loss.

Cel - A Basic Unit of Life

- Cell Theories
  - Virchow
    - expended cell theory by suggestion that cell arise from pre-existing cell
  - Leeuwen hoek
    - observed the cells in cork - slice with the help of primitive microscope
  - Robert Hooke
    - discovered and named the cells
  - Robert Brown
    - discovered nucleus in cell
  - schleiden and schwann
    - Gave cell theory and stated that all plants and animals are composed of cells
- Types of cell
  - Prokaryotic cell
  - Eukaryotic cell
- Nucleus
  - Nuclear Membrane
  - Nucleolus
  - Chromatin network
- Plasma membrane or cell membrane
  - Lies outside the plasma membrane
  - Cell wall
- Plant Cell



- Animal Cell



- Cell Organelles
  - Endoplasmic reticulum
  - Golgi Apparatus
  - Lysosomes
  - Mitochondria
  - Plastids

Important Question

➢ Multiple Choice Questions:

1. The basic unit of life is:

(a) tissue

(b) cell

(c) both

(d) none of them

2. Who discovered the cell?

(a) Robert Hooke

(b) Leeuwenhoek

(c) Robert Brown

(d) T. Schwann

3. The cell wall of a plant cell is made up of:

(a) glucose

(b) fructose

(c) protein

(d) cellulose

4. Which of the following controls all biological activities of a cell?

(a) Protoplasm

(b) Cell wall

(c) Nucleus

(d) All of these

5. Which of the following is known as the 'Power House' of a cell?

(a) Nucleus

(b) Golgi Bodies

(c) Ribosome

(d) Mitochondria

6. Digestive Enzymes are found in:

(a) Protoplasm

(b) Cell wall

(c) Lysosomes

(d) Mitochondria

7. Which is the longest cell of the human body?

(a) Nerve cell

(b) Liver cell

(c) Kidney cell

(d) Cardiac cell

8. Which of the following cell organelles functions both as an intracellular transport system and as a manufacturing surface?

(a) Nucleus

(b) Mitochondria

(c) ER

(d) None of these

9. Which of the following cell organelles help in the storage, modification, and packaging of substances manufactured in the cell?

(a) Golgi apparatus

(b) Nucleus

(c) Mitochondria

(d) Chloroplasts

10. Who proposed the “Black Reaction”?

(a) Benda

(b) Camillo Golgi

(c) Schleiden

(d) None of them

11. Who discovered the nucleus in the cell?

(a) Leeuwenhoek

(b) Robert Brown

(c) Schleiden

(d) Robert Hooke

12. Which of the following are formed in bone marrow?

(a) RBC

(b) Cartilage cell

(c) Blood platelets

(d) Fibres

13. Which of the following can be made into crystal?

(a) A bacterium

(b) An amoeba

(c) A virus

(d) A sperm

14. Chromosomes are made up of:

(a) DNA

(b) Protein

(c) DNA and protein

(d) RNA

15. Which of the following are covered by a single membrane?

(a) Mitochondria

(b) Vacuole

(c) Ribosome

(d) Plastid

➢ Very Short Question:

1. What are plastids? Name the different types of plastids found in plant cell.
2. What is plasma membrane made up of?
3. What did Robert Hooke observed first in cork cell?
4. Name the autonomous organelles in the cell.
5. What does protoplasm refer to?
6. Name two cells which keep changing their shape.
7. Name the smallest cell and the longest cell in human body.
8. Name 3 features seen/ present in almost every cell.
9. What is diffusion?
10. What is osmosis? This takes place from high water concentration to low water concentration.

➢ Short Questions:

1. State two conditions required for osmosis.
2. What is plasmolysis?

3. How does fungi and bacteria can withstand much greater changes in the surrounding medium than animal cells?

4. Give the function of nuclear membrane.

5. Name the cell-organelles that have their own DNA and ribosomes.

6. State the difference between smooth endoplasmic reticulum and rough endoplasmic reticulum.

7. What is endocytosis?

8. What is the function of vacuoles?

➢ Long Questions:

1. Give five points of differences between plant cell and animal cell.

2. Give five points of differences between prokaryotic cell and eukaryotic cell.

3. Draw a neat labelled diagram of plant cell and label its parts.

4. Draw a neat labelled diagram of animal cell.

➢ Assertion Reason Questions:

1. For two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

   a. Both Assertion and Reason are correct, and reason is the correct explanation for assertion.

   b. Both Assertion and Reason are correct, and Reason is not the correct explanation for Assertion.

   c. Assertion is true but Reason is false.

   d. Both Assertion and Reason are false.

   Assertion: All plants and animals are composed of cells.

   Reason: Plants and animals made up of DNA.

2. For two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

   a. Both Assertion and Reason are correct, and reason is the correct explanation for assertion.

   b. Both Assertion and Reason are correct, and Reason is not the correct explanation for Assertion.

   c. Assertion is true but Reason is false.

d. Both Assertion and Reason are false.

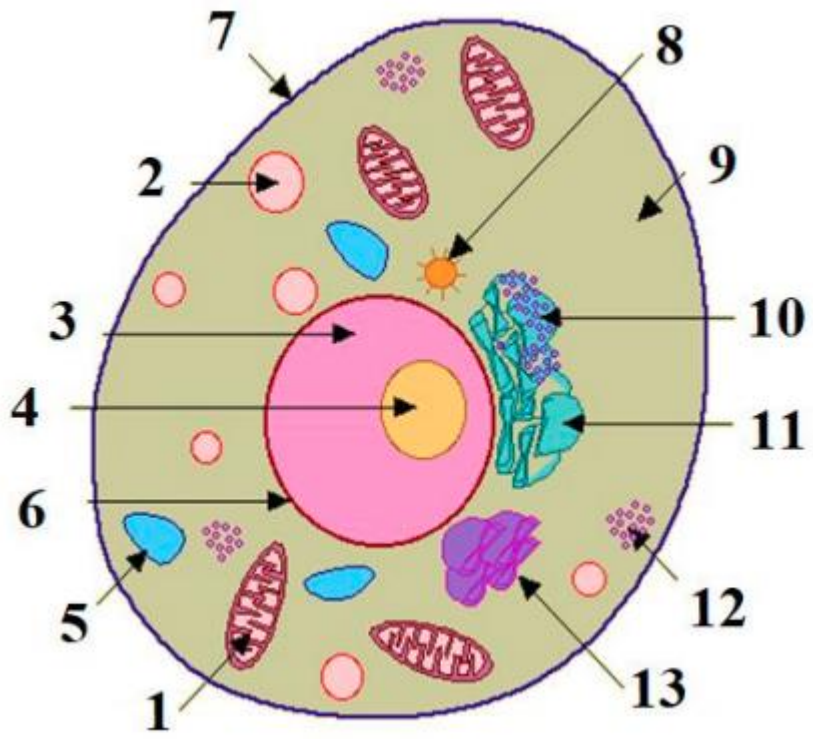
Assertion: All plants and animals are composed of cells.

Reason: All plants and animals are composed of cells.

➢ Case Study Question:

1. Read the following and answer any four questions from (i) to (v)

Study the given diagram and answer the following questions.



(i) Identify the given diagram.

(a) Structure of animal cell

(b) Structure of plant cell

(c) Bacterial cell

(d) Prokaryotic cell

(ii) The function of part labelled as 1 is

(a) Release of energy

(b) Protein synthesis

(c) Transmission of heredity characters

(d) Storage

(iii) Mention any two structures which are not found in above cell.

(a) Cell wall and ribosomes

(b) Cell wall and golgi apparatus

(c) Cell membrane and Golgi apparatus

(d) Plastids and cell wall

(iv) Chromosomes are present in

(a) Cell membrane

(b) Golgi apparatus

(c) Endoplasmic reticulum

(d) Nucleus

(v) Lysosomes are also called

(a) suicide bags

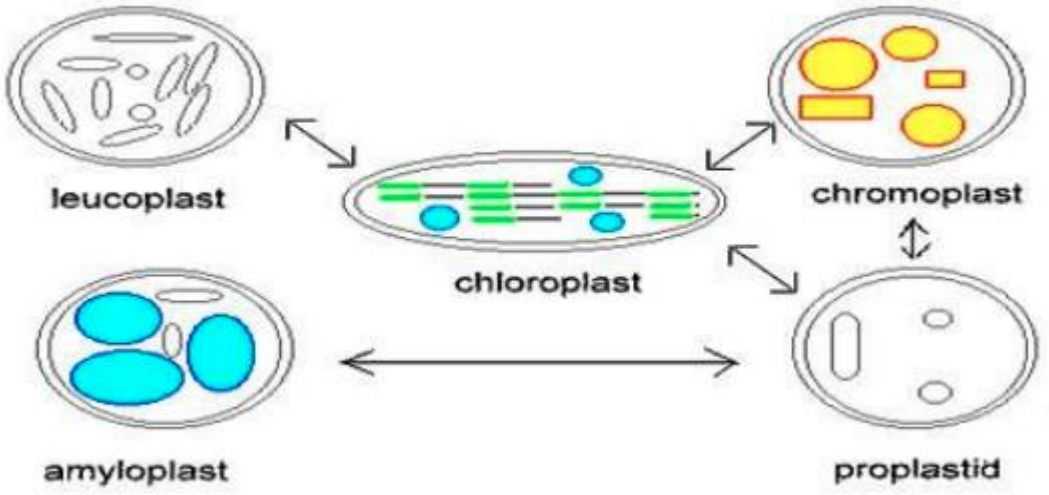
(b) digestive bags

(c) demolition squads

(d) all the above

2. Read the following and answer any four questions from (i) to (v)

Leucoplasts are colourless plastids. They store starch, oil, proteins. Chromoplasts are coloured plastids. They contain pigments. e.g. Chloroplasts contain green pigment present in the plant cell. Chromoplasts provide colour to various flowers and fruits.



(i) What is the function of leucoplasts?

(a) They store starch, oil, proteins.

(b) They provide colour various flowers and fruits.

(c) They help in photosynthesis.

(d) They give support to the plants.

(ii) Which plastids provide colour to fruits and flowers?

(a) Leucoplasts

(b) Chromoplasts

(c) Chloroplasts

(d) Proteinoplast

(iii) Which of the following statement is true?

(a) Plastids are present in both plant and animal cell.

(b) Plastids are absent in plant as well as animal cell.

(c) Plastids are present only in plant cell.

(d) Plastids are present only in animal cell.

(iv) Which plastids contain green pigment?

(a) Leucoplasts contain green pigment.

(b) Chloroplasts contain green pigment.

(c) Chromoplasts mainly contain green pigment.

(d) None of the plastids contain green pigment.

(v) Which plastids bring about the process of photosynthesis?

(a) Leucoplasts

(b) Chromoplasts mainly

(c) Chloroplasts

(d) None of the plastids bring about photosynthesis.

✓ Answer Key-

➢ Multiple Choice Answers:

1. (b) cell
2. (a) Robert Hooke
3. (d) cellulose
4. (c) Nucleus
5. (d) Mitochondria
6. (c) Lysosomes
7. (a) Nerve cell
8. (c) ER
9. (a) Golgi apparatus
10. (b) Camillo Golgi

11. (b) Robert Brown
12. (a) RBC
13. (c) A virus
14. (c) DNA and protein
15. (b) Vacuole

➢ Very Short Answers:

1. Answer: Plastids are organelles found only in plants. They are:

   (a) Chloroplast-Containing chlorophyll

   (b) Chromoplast-Containing carotenoids and xanthophyll (coloured plastids)

   (c) Leucoplast-Wllite or colourless plastids
2. Answer: Plasma membrane is made up of proteins and lipids.
3. Answer: Robert Hooke observed that cork consists of box like compartments which formed a honeycomb structure.
4. Answer. Chloroplasts and mitochondria are the autonomous organelles in the cells.
5. Answer: Protoplasm refer to cytoplasm and nucleus.
6. Answer: Amoeba and white blood cells.
7. Answer: The smallest cell is the red blood cell or sperm cell in male. Longest cell is the nerve cell.
8. Answer: Plasma membrane, nucleus and cytoplasm.
9. Answer: When gases like CO_2, O_2, move across the cell membrane, this process is called diffusion.
10. Answer: The movement of water molecules through a selectively permeable membrane is called osmosis. This takes place from high water concentration to low water concentration.

➢ Short Answer:

1. Answer:

   (i) The difference in the concentration of water, one should have higher concentration than the other.

   (ii) Semi-permeable membrane is also required through which water will flow.
2. Answer: When a living plant cell loses water through osmosis there is shrinkage or contraction of the contents of the cell away from the cell wall. This phenomenon is known as plasmolysis.
3. Answer: The cell wall present in fungi and bacteria permits these cells to withstand very dilute external medium without bursting.

The cells take up water by osmosis, swells, and builds the pressure against the cell wall. The wall exerts an equal pressure against the swollen cell. It is because of the cell wall, such cells can withstand much greater changes in the surrounding medium than animal cells.

4. Answer: The nuclear membrane present as outer covering in the nucleus allows the transfer of material inside and out of the nucleus to cytoplasm.
5. Answer: The cell organelles with their own DNA and ribosomes are mitochondria and plastids.
6. Answer:

Smooth Endoplasmic Reticulum	*Rough Endoplasmic Reticulum*
1. It looks smooth. 2. SER helps in the manufacture of fat molecules or lipids.	1. It looks rough. 2. Ribosomes are attached to RER which synthesise proteins.

7. Answer: The cell membranes flexibility allows the cell engulf in food and other material from its external environment. This process is known as endocytosis. E.g., Amoeba acquires its food through such processes.
8. Answer: Vacuoles are storage sacs for solid or liquid content. In plant cells it provides turgidity and rigidity to the cell. In single-celled organisms vacuoles store food, e.g., Amoeba.

➢ Long Answer:

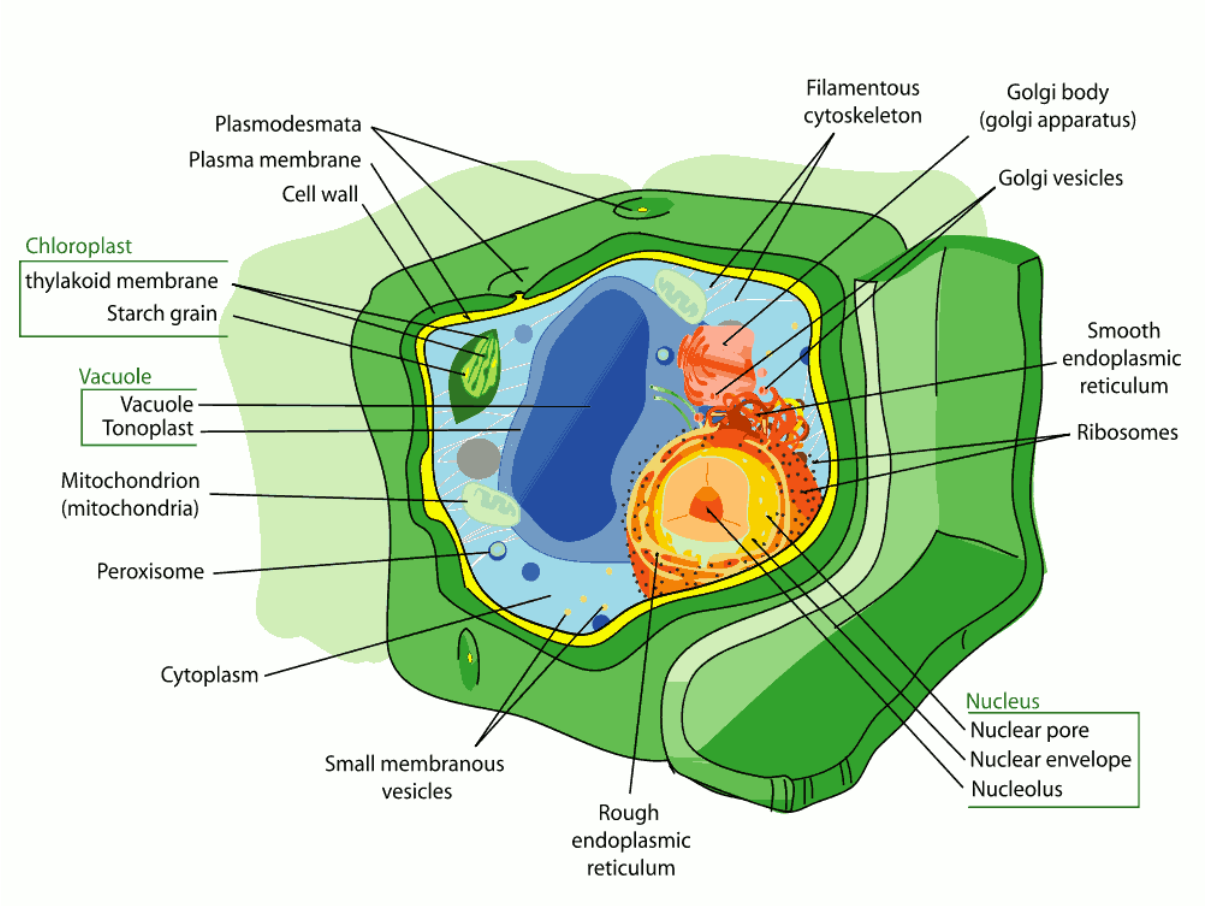
1. Answer:

Plant Cell	*Animal Cell*
1. Size is usually larger than animal cell. 2. Cell wall present. 3. Plastids are present. 4. Vacuoles are large in number and bigger in size. 5. Centriole absent.	1. Size is usually smaller than plant cell. 2. Cell wall absent. 3. Plastids are absent. 4. Vacuoles are small in size and less in number. 5. Centriole present.

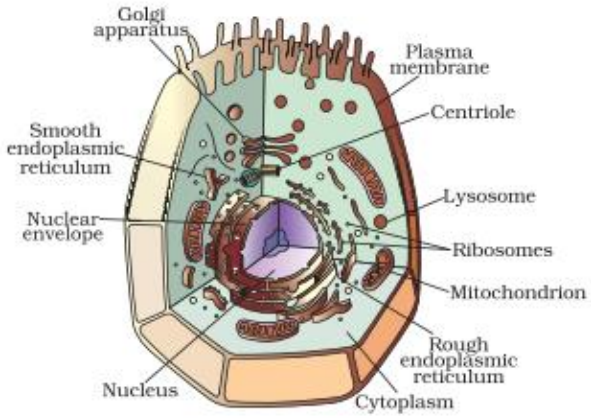
2. Answer:

Characters	*Prokaryotic Cell*	*Eukaryotic Cell*
1. **Size**	0.5–5 µm diameter.	Diameter 1 µm–40 µm.
2. **Nucleus**	No true nucleus, single chromosome, nuclear membrane absent.	True nucleus, nuclear membrane is present, more than one chromosome is present.
3. **Organelles**	Membrane-bound organelles are absent.	Membrane-bound organelles are present.
4. **Ribosomes**	Ribosomes are 70s and randomly scattered.	Ribosomes are 80s, can be free or attached to ER.
5. **Cell division**	Cell divides by simple fission.	Cell divides by mitosis or by meosis.

3. Answer:



4. Answer:



➢ Assertion Reason Answer:

1. (b) Both Assertion and Reason are correct, and Reason is not the correct explanation for Assertion.
2. (a) Both Assertion and Reason are correct, and reason is the correct explanation for assertion.

➢ Case Study Answer:

1. **Answer:**

(i) (a) Structure of animal cell

(ii) (a) Release of energy

Mitochondria are sites of cellular respiration. They use molecular oxygen from air to oxidise the carbohydrates and fats (lipids) present in the cell to carbon dioxide and water vapour. Oxidation releases energy, a portion of which is used to form ATP (adenosine triphosphate). Since the mitochondria synthesize, energy-rich compounds (ATP), they are known as 'power house' of the cell. The energy stored in ATP is used by the cell.

(iii) (d) Plastids and cell wall

(iv) (d) Nucleus

(v) (a) suicide bags

Lysosomes serve as intracellular digestive system, hence, called digestive bags. They destroy any foreign material which enter the cell such as bacteria and virus. In this way they protect the cells from bacterial infection.

Lysosomes also remove the worn out and poorly working cellular organelles by digesting them to make way for their new replacements. In this way, they remove the cell debris and are also known as demolition squads, scavengers and cellular housekeepers. Thus, lysosomes form a kind of garbage disposal system of the cell

2. Answer:

(i) (a) They store starch, oil, proteins.

(ii) (b) Chromoplasts

(iii) (c) Plastids are present only in plant cell.

(iv) (b) Chloroplasts contain green pigment.

(v) (c) Chloroplasts