3 CHAPTER

THE CELL

3.1 CELL

LONG ANSWER QUESTIONS

Q.3 What is a cell? (K.B)

Ans:

CELL

Definition:

The cell is the basic unit of life. Just as bricks are the building blocks of a house, cells are the building blocks of living organisms, including plants, animals, and humans.

Discovery:

The basic structure of cell was first discovered by Robert Hooke in 1665.

Importance of Cell:

- Every living thing, from the smallest bacterium to the largest whale, is made of cells.
- Most of the cells are very small, and cannot be seen with the naked eye.
- Despite their size, cells are very complex and carry out many essential functions to keep living things alive and functioning.

Size of Cells:

Some cells are large enough to be seen with naked eye e.g.,

- The egg cell of ostrich
- A unicellular green algae *Acetobularia*
- A unicellular giant Amoeba

3.2 STRUCTURE OF CELL

LONG ANSWER QUESTIONS

Q.1 Make and label the structure of animal cell.

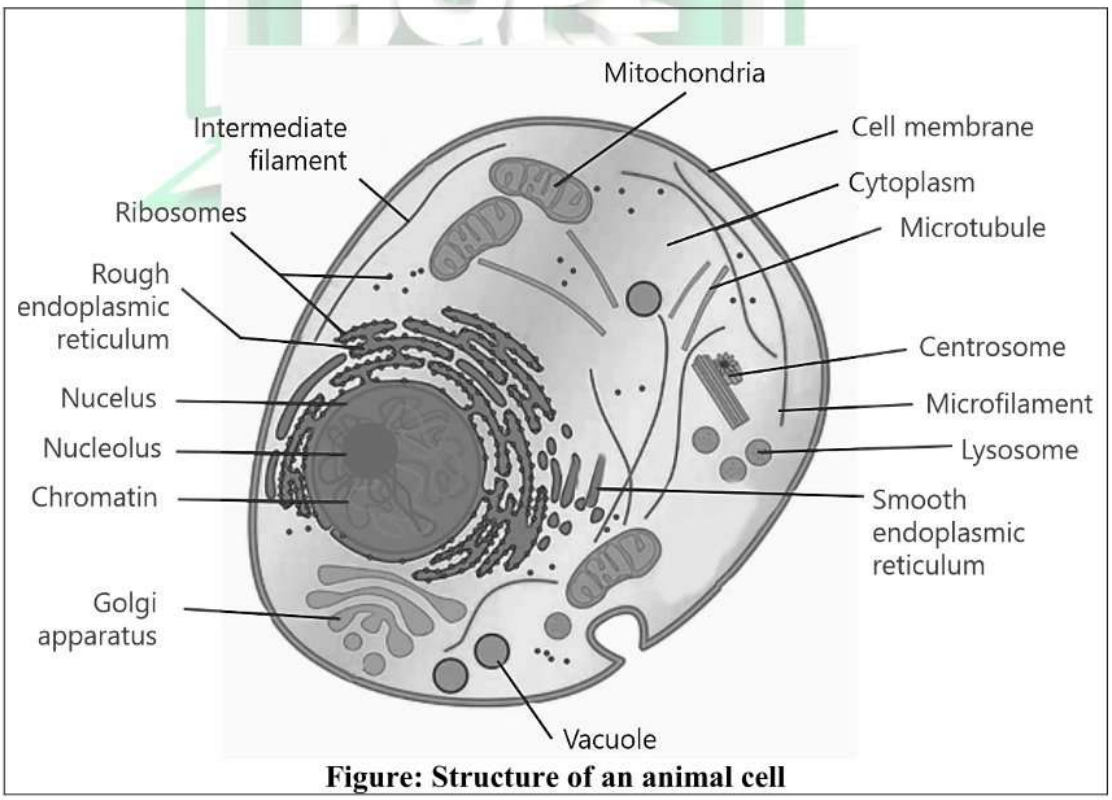
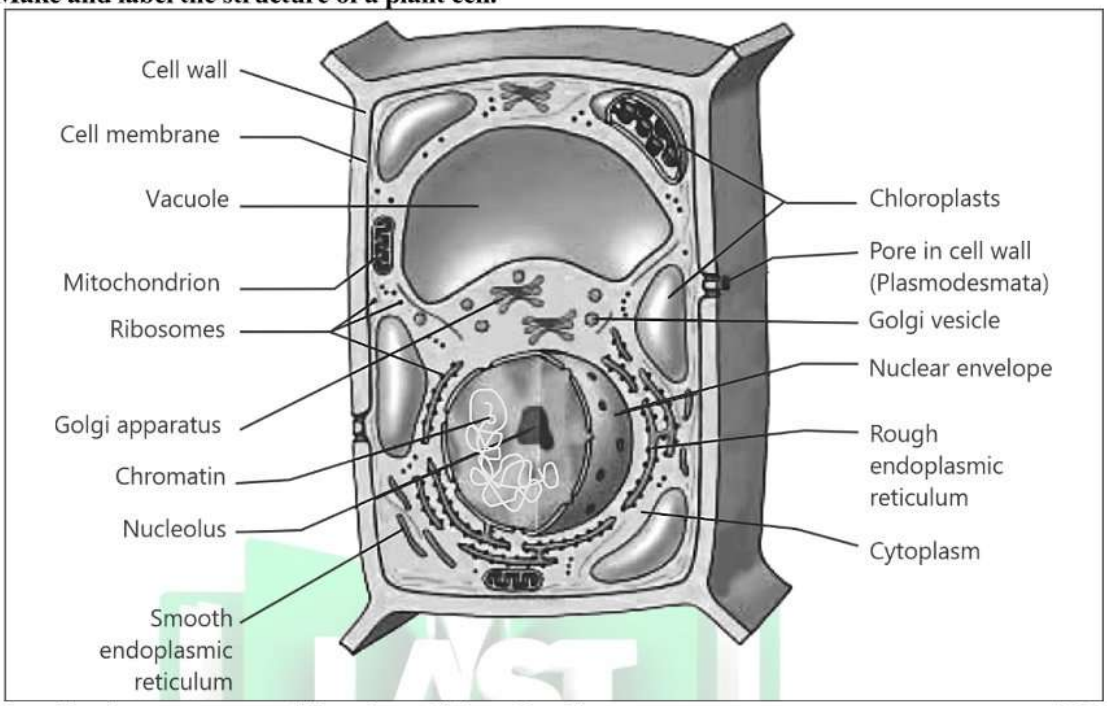


Figure: Structure of an animal cell

Q.2 Make and label the structure of a plant cell.



Q.3 Describe the structure and functions of the cell wall. (K.B)

Ans:

CELL WALL

Definition:

The cells of bacteria, fungi, plants and some protists have a rigid non-living wall around cell membrane. It is called cell wall.

Composition of Plant Cell Wall:

The plant cell wall is made of three layers i.e. middle lamella, primary wall, and secondary wall.

1. **Primary Wall**
   - The primary wall is present just above the cell membrane.
   - It is mainly composed of cellulose, hemicellulose, and pectin.
   - Cellulose forms fibres that crisscross over one another to form strong primary wall.
2. **Middle Lamella**
   - Middle lamella holds together the primary walls of adjacent cells.
   - It contains magnesium, calcium and pectin.
3. **Secondary Wall**
   - Some plant cells e.g., xylem cells make secondary wall on the inner side of primary wall.
   - It is mainly made of cellulose, lignin and other chemicals.

Composition in other Organisms:

- The cell wall of algae is also composed of cellulose.
- The cell wall of prokaryotes is made of peptidoglycan (a single molecule made of amino acids and sugars).
- The cell wall of fungi is made of chitin.

Plasmodesmata:

Plasmodesmata (singular plasmodesma) are the channels in cell walls that allow the exchange of molecules between adjacent cells.

Functions:

It provides shape, strength, protection and support to the inner living matter (protoplasm) of the cell.

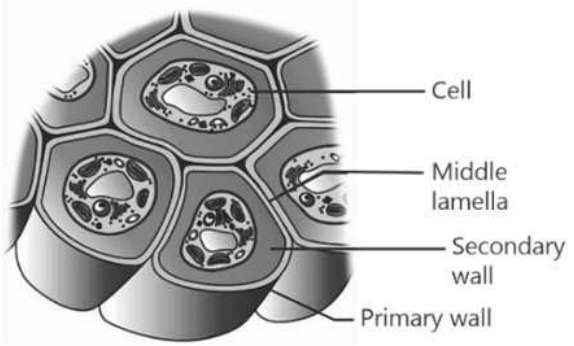


Figure: Layers of plant cell wall

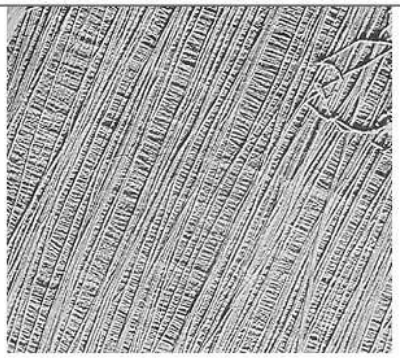


Figure: Cellulose fibres in primary wall

Q.4 What do you know about cell membrane? Also discuss fluid-mosaic model. (K.B)

OR

Explain the fluid-mosaic model of the cell membrane.

Ans:

CELL MEMBRANE

Definition:

All cells have a thin and elastic membrane around the cytoplasm known as cell membrane.

Composition:

Cell membrane is composed of proteins (60-80%), lipids (20-40%) and small quantities of carbohydrates.

Fluid-Mosaic Model:

The structure of cell membrane is described as fluid-mosaic model. According to this model:

- The lipids make a fluid-like bilayer in which protein molecules are submerged.
- The lipids and proteins can move laterally.
- Due to these movements, the pattern or "mosaic," of lipids and proteins constantly changes.
- Carbohydrates are joined with proteins (in the form of glycoproteins) or with lipids (in the form of glycolipids).

Functions:

- It is selectively-permeable.
- It allows very few molecules to pass through it while blocks many other molecules.
- In eukaryotic cell many organelles e.g. mitochondria, chloroplasts, Golgi apparatus and endoplasmic reticulum are also bounded by membranes.

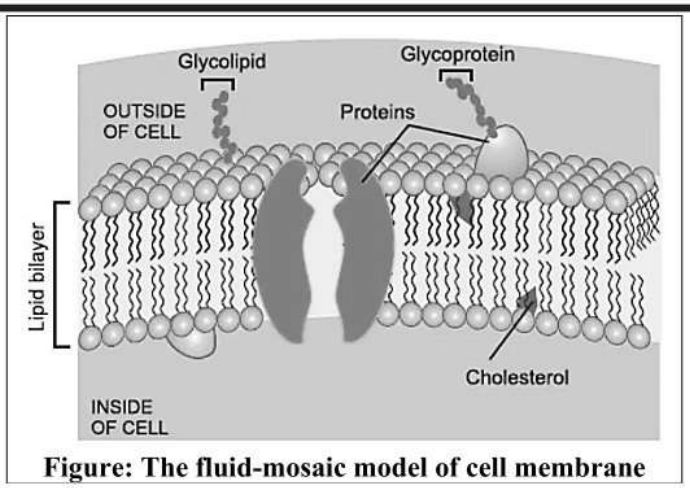


Figure: The fluid-mosaic model of cell membrane

Q.5 Write a note on cytoplasm. **(K.B)**

Ans:

CYTOPLASM

Definition:

It is the jelly-like substance that fills the inside of a cell.

Composition:

It's a complex mixture of water, proteins, enzymes, salts, and other substances.

Functions:

- Cytoplasm provides a medium for organelles to move and function.
- It also helps in the transport of materials throughout the cell.
- It acts as the site for various metabolic reactions e.g., Glycolysis (breakdown of glucose).
- It also stores food and wastes of the cell.

Cytosol:

The liquid part of the cytoplasm that includes molecules and small particles, such as ribosomes, but not membrane-bound organelles is called cytosol.

Q.6 Discuss the components of the nucleus. Also make a diagram. **(K.B)**

Ans:

NUCLEUS

Occurrence:

- All eukaryotic cells have a prominent nucleus.
- The prokaryotic cells do not contain a prominent nucleus. Their chromosome is made of DNA only and floats in cytoplasm.

Location:

- In animal cells, it is present in the center.
- In mature plant cells, it is pushed to side due to a large central vacuole.

Structure:

a) Nuclear Envelope

- The nucleus is bounded by a double membrane known as nuclear envelope.
- It is semi-permeable and has many small pores called nuclear pores.

b) Nucleoplasm

The inner jelly-like material of nucleus is called nucleoplasm.

c) Nucleolus

- In nucleoplasm, there are one or more small bodies called nucleoli (singular; nucleolus).
- Here, ribosomes are assembled.

d) Chromatin

- Nucleoplasm contains fine thread-like material known as chromatin.
- It is composed of deoxyribonucleic acid (DNA) and proteins.

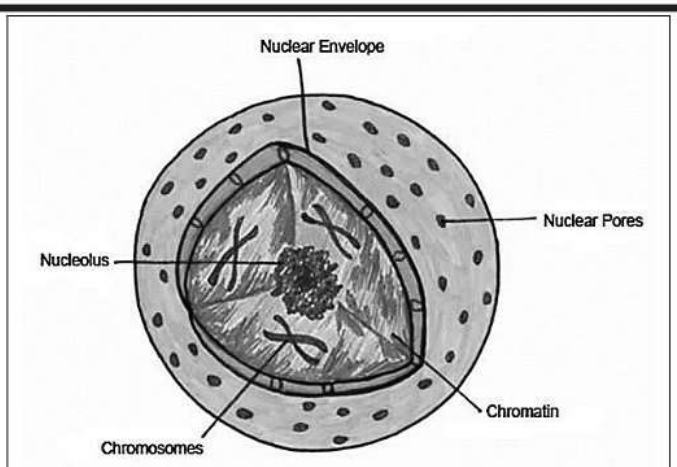


Figure: Structure of nucleus

e) Chromosomes

When a cell starts dividing, its chromatin condenses and takes the shape of thick chromosomes.

f) Hereditary Material

- DNA contains genes which control all the activities of the cell.
- DNA is also responsible for the transmission of characteristics to the next generation.
- That is why it is called the hereditary material.

Functions:

- The nucleus serves as the cell's "control center".
- It overseas cellular activities by directing the production of proteins.

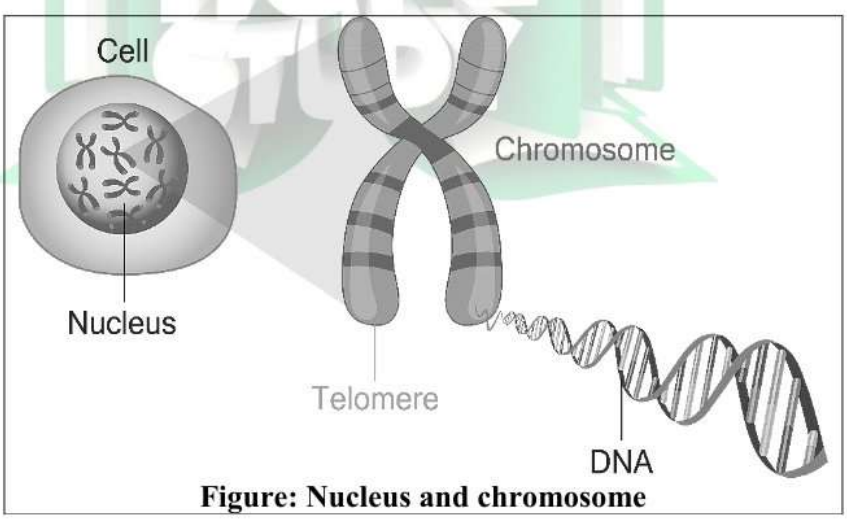


Figure: Nucleus and chromosome

Q.7 Write a note on cytoskeleton. (K.B)

Ans:

CYTOSKELETON

Definition:

It is a network of thin tubes and filaments present throughout the cytoplasm.

Composition:

It consists of three parts i.e. microtubules, microfilaments, and intermediate filaments.

1. Microtubules

- Microtubules are hollow tubes made up tubulin protein.
- This part holds organelles in place, maintains a cell's shape, and act as tracks for organelles.
- Microtubules also make mitotic spindle, cilia and flagella.

2. Microfilaments

- Microfilaments are finer than microtubules.
- These are made up of contractile proteins, mainly actin.
- They help in cell movement e.g., the crawling of white blood cells and the contraction of muscle cells.

3. Intermediate filaments

- Intermediate filaments are rods made of variety of proteins, mainly *keratin* and *vimentin*.
- They anchor the nucleus and some other organelles in the cell.
- They also make cell-to-cell junctions.

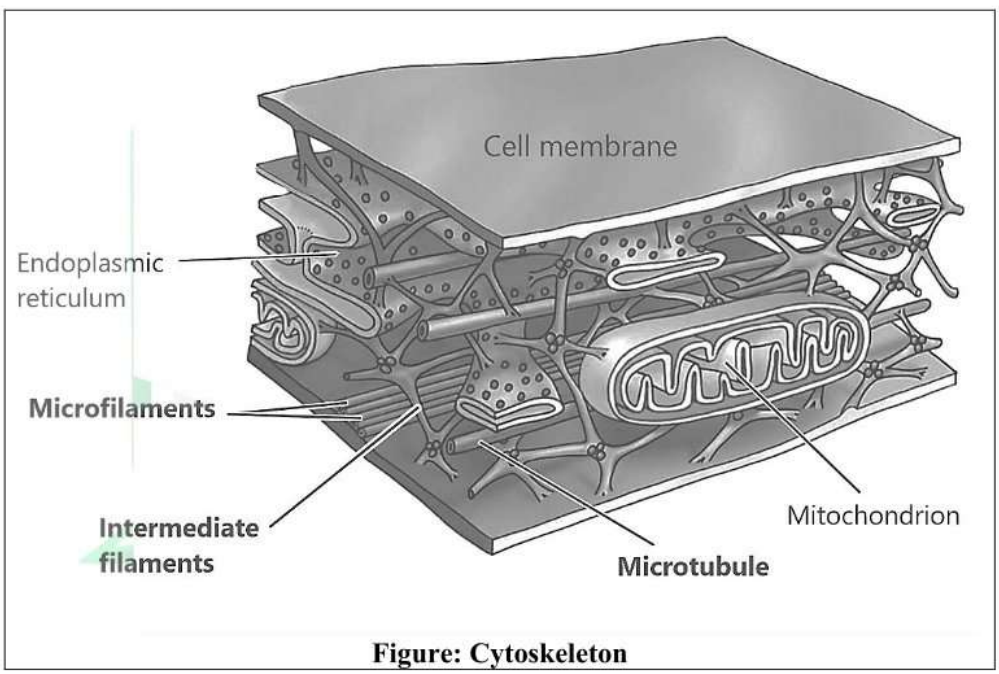


Figure: Cytoskeleton

Q.8 Write a note on ribosomes. Make diagram as well. (K.B)

Ans:

RIBOSOMES

Definition:

Ribosomes are tiny granular structures.

Occurrence:

- Ribosomes are not bounded by membranes and so are also found in prokaryotes.
- Eukaryotic ribosomes are slightly larger than prokaryotic ones.

Location:

Ribosomes float freely in the cytoplasm and are also attached on the surface of rough endoplasmic reticulum.

Composition:

They are composed of almost equal amounts of proteins and ribosomal RNA (rRNA).

Function:

They are the sites of protein synthesis.

Structure:

- Each ribosome consists of two subunits.
- The two subunits of a ribosome unite during the process of protein synthesis.
- When a ribosome has finished its work, its subunits get separated again.

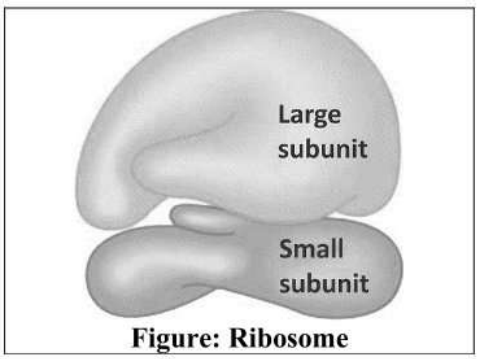


Figure: Ribosome

Q.9 Describe the structure and function of lysosome and endoplasmic reticulum. (K.B)

Ans:

LYSOSOMES

Discovery:

Lysosomes were discovered by Belgian scientist **Christian Rene de Duve**.

Structure:

- These are small membrane-bound vesicles that contain digestive enzymes.
- Lysosomes are predominantly found in animal cells.

Formation:

Lysosomes bud off from Golgi apparatus.

Functions:

- Cell engulfs the food material in the form of food vacuole.
- Lysosome fuses with food vacuole and its digestive enzymes break down the food present in vacuole.
- Lysosomes also have enzymes for breaking cellular wastes.
- They also engulf the damaged organelles and break them.
- Lysosomes can store certain molecules for later use.

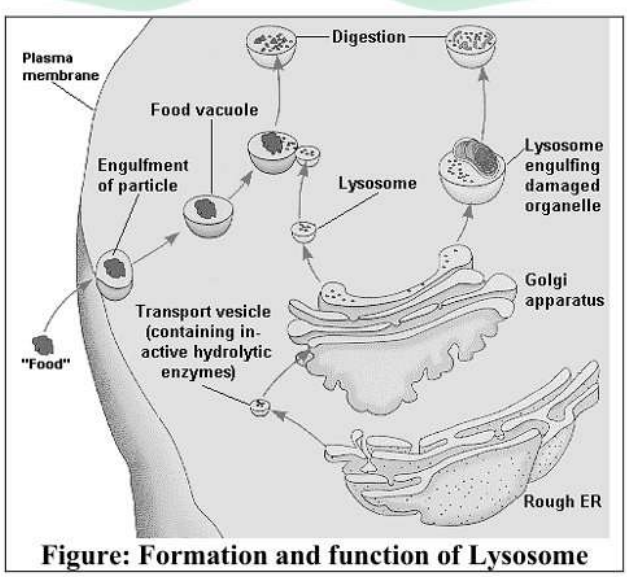


Figure: Formation and function of Lysosome

ENDOPLASMIC RETICULUM

Definition:

It is a network of membrane-bounded channels present throughout the cytoplasm of eukaryotic cell.

Type of Endoplasmic Reticulum:

There are two types of endoplasmic reticulum.

1. **Rough Endoplasmic Reticulum (RER)**
   - Numerous ribosomes are attached on its surface.
   - RER serves the function in protein synthesis.
2. **Smooth Endoplasmic Reticulum (SER)**
   - It lacks ribosomes.
   - It is involved in lipid metabolism and in the transport of materials from one part of the cell to the other.
   - It also detoxifies the harmful chemicals that have entered the cell.
   - In muscle cells, the SER is also involved in contraction process.

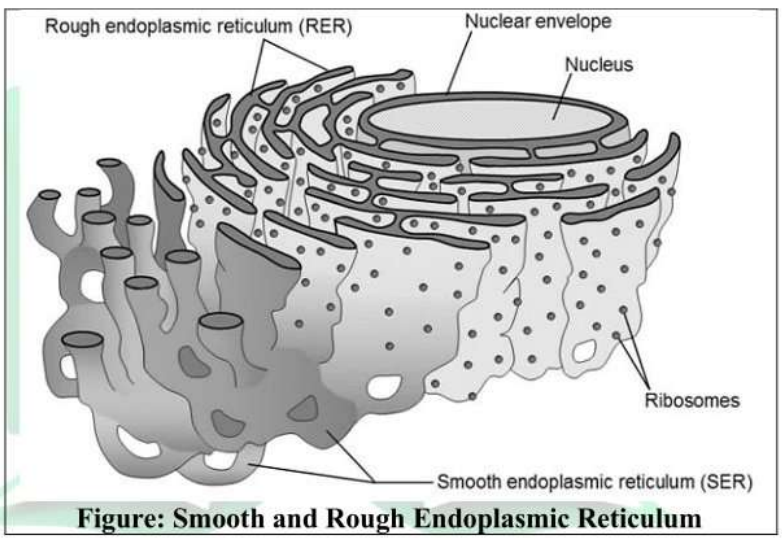


Figure: Smooth and Rough Endoplasmic Reticulum

Q.10 Describe the formation and function of Golgi complex. Also make a diagram. (K.B)

Ans:

GOLGI COMPLEX

Discovery:

- In 1898, an Italian physician Camillo Golgi discovered the Golgi complex.
- In 1906 Golgi was awarded Nobel Prize for physiology and medicine.

Definition:

There is a set of flattened sacs in the cytoplasm. These flattened sacs, called cisternae, are stacked over each other and make a structure known as Golgi apparatus.

Occurrence:

It is found in both plant and animal cells.

Function:

- It modifies molecules coming from rough ER and packs them into small membrane-bound sacs called Golgi vesicles.
- These sacs are kept in cell or are transported to exterior in the form of secretions.

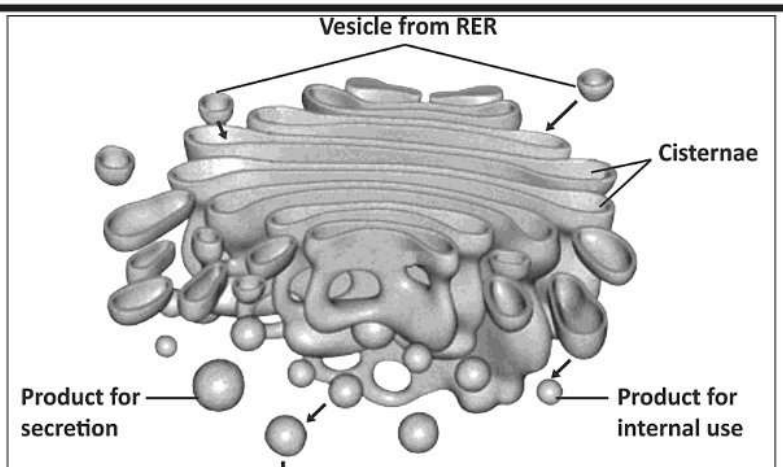


Figure: Golgi apparatus

Q.11 Write a note on mitochondria. Also make a diagram. (K.B)

Ans:

MITOCHONDRIA

Definition:

Mitochondria are double membrane-bounded organelles present only in eukaryotes.

Structure:

1. **Membranes**
   - The outer membrane of mitochondria is smooth but the inner membrane forms many folds.
   - These folds are called cristae (singular crista).
   - They increase the surface area for respiration.
2. **Matrix**
   The inner fluid-like material is called matrix.
3. **DNA and Ribosomes**
   - Mitochondria contain their own DNA and ribosomes.
   - They can multiply within the cell on their own.
   - The ribosomes of mitochondria are more similar to prokaryotic ribosomes than to eukaryotic ribosomes.

Functions:

- Mitochondria (singular mitochondrion) are the "powerhouse" of the cell because they produce energy.
- They perform the reactions of aerobic respiration in which oxygen is used to break food (glucose) to release energy (ATP - adenosine triphosphate).

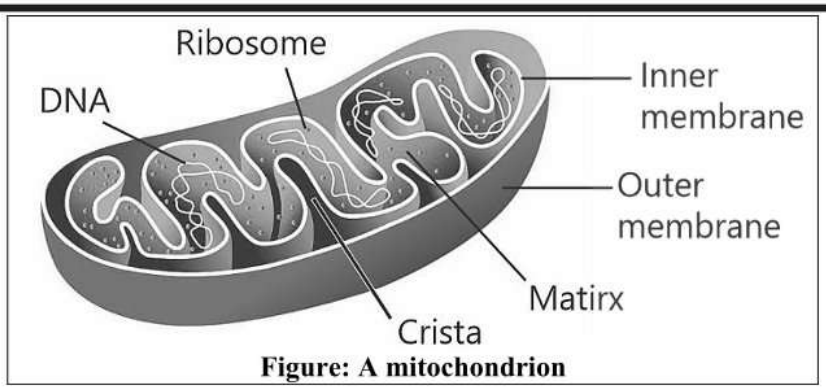


Figure: A mitochondrion

Q.12 What are plastids? Briefly describe the types of plant plastids. (K.B)

Ans:

PLASTIDS

Definition:

Plastids are pigment containing organelles, present in the cells of plants and photosynthetic protists (algae).

Types of Plastids:

There are three main types of plastids:

- Chloroplasts
- Chromoplasts
- Leucoplasts

1. Chloroplasts

Chloroplasts are green plastids present in the cells of green parts of plants and in algae.

Pigments:

They contain photosynthetic pigments e.g., the green pigment chlorophyll.

Structure:

1. **Membranes**
   Like mitochondria, chloroplast is enclosed within two membranes.
2. **Granum**
   On the internal side of inner membrane, there are many sets of stacked membranes. These stacks are called grana (singular: granum).
3. **Thylakoids**
   - The sac-like structures which make a granum are called thylakoids.
   - Photosynthetic pigments are present on the surface of thylakoids.
4. **Stroma**
   A fluid called stroma surrounds the thylakoids.
5. **DNA and Ribosomes**
   Like mitochondria, chloroplasts also contain DNA and ribosomes.

Functions:

- They carry out photosynthesis.
- With the help of their photosynthetic pigments, they capture light energy and convert it into chemical energy in the form of glucose.

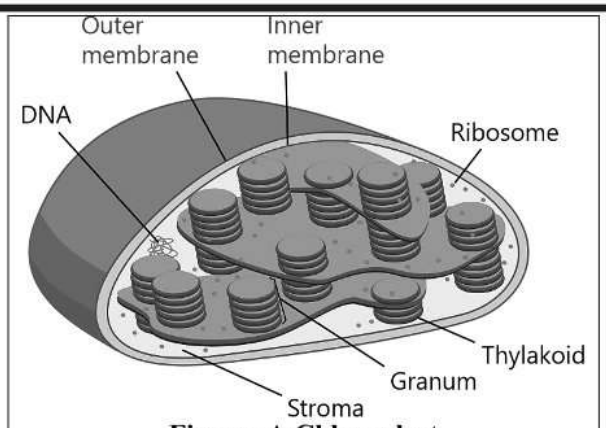


Figure: A Chloroplast

2. **Chromoplasts**

Chromoplasts are the plastids that contain pigments such as carotenoids. These pigments are associated with bright colours.

Location:

They are present in the cells of flower petals and fruits.

Function:

Chromoplasts give colours to petals and fruits, thus help in pollination and dispersal of fruit and seeds.

3. **Leucoplasts**

Leucoplasts are plastids that have no pigments.

Location:

They are present in the cells of those parts where food is stored e.g., underground stems, seeds, roots, etc.

Function:

They are involved in the storage of starches, lipids, and proteins.

Q.13 Write a note on vacuoles. (K.B)

Ans:

VACUOLE

Definition:

These are single membrane-bound sacs filled with fluid.

Types of Vacuoles:

1. **Animal Vacuole**
   - Animal cell may have many small temporary vacuoles.
   - They contain water and food substances.
2. **Contractile Vacuole**

   Some freshwater organisms like *amoeba* and sponges have contractile vacuoles which collect and pump out extra water and other wastes.
3. **Food Vacuole**
   - Some cells ingest food by forming food vacuoles.
   - Food vacuoles also store food.
4. **Plant Vacuole**
   - Most mature plant cells have a single, large, central vacuole.
   - It is formed by the fusion of many small vacuoles.

   Structure:
   - The membrane of plant vacuole is called tonoplast and the sap inside plant vacuole is called cell sap.
   - It is a watery solution of salts.

   Turgor Pressure:

- Due to the large central vacuole, the cytoplasm is pushed to a side.
- This outward pressure of the vacuole on the cytoplasm and cell wall makes plant cells turgid.
- This pressure is called turgor pressure and the process is called turgor.

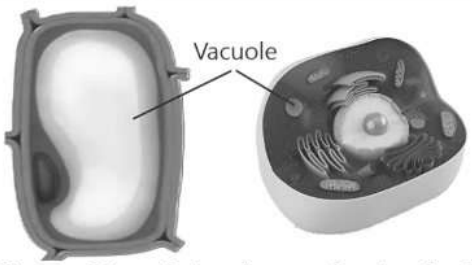


Figure: Vacuole in plant and animal cell

Q.14 Write a note on centrioles. Also make a diagram. (K.B)

Ans:

CENTRIOLES

Definition:

Centrioles are barrel-shaped organelles found in the cells of animals and most protists.

Occurrence:

- Centrioles are present in animal cells.
- They are absent in prokaryotes, higher plants and fungi.

Location in Animal Cell:

- There is a pair of centrioles in which both centrioles are at right angles to each other.
- In animal cells, the pair is called a centrosome and it is located near the nuclear envelope.

Structure:

Each centriole is formed of 9 triplets of microtubule (made up of tubulin protein).

Function:

- At the start of cell division, the pair of centrioles duplicates.
- The new pairs move to the opposite pole of the cell. There, they form spindle fibres.
- The cells which have cilia or flagella contain centriole near cell membranes.
- These centrioles are called basal bodies.
- Basal bodies are responsible for the formation of cilia and flagella.

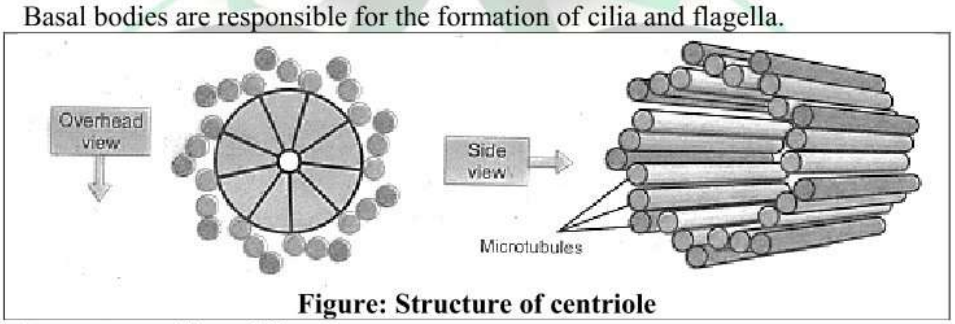


Figure: Structure of centriole

Q.15 Write a note on cilia and flagella. (K.B)

Ans:

CILIA AND FLAGELLA

Definition:

Some cells have thin, tail-like projections called cilia (singular cilium) and flagella (singular flagellum).

Cilia:

Cilia are short in length and are usually numerous in number.

Flagella:

Flagella are longer than cilia but less in number.

Composition:

1. **Eukaryotic Cells**
   - Eukaryotic cilia and flagella consist of nine pairs of microtubules which surround a single central pair of microtubules.
   - Cilia and flagella are connected to the basal body.
2. **Prokaryotic Cells**
   - Prokaryotic cells also have flagella but their structure is completely different.
   - Prokaryotic flagella are made of a protein called flagellin.

Function:
The function of cilia and flagella is movement.

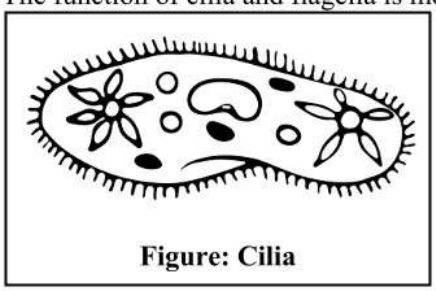


Figure: Cilia

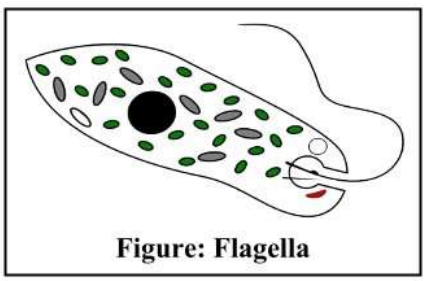


Figure: Flagella

Q.16 Give a comparison between plant and animal cells. (K.B + U.B)

Ans:

PLANT AND ANIMAL CELL

The components which are common both in plant and animal cells are given below:

Component	Description	Where found	Function
Cytoplasm	• Jelly-like • Contains organelles in it	Between plasma membrane and nuclear envelope	• Provides the site to cell organelles • Sites of metabolic reactions
Cell membrane	A partially permeable membrane that forms a boundary around the cytoplasm	Around cytoplasm	Prevents cell contents; controls what substances enter and leave the cell
Nucleus	A spherical or oval organelle containing DNA	• In the center in animal cells • On a side in plant cells	• Controls cell division • Controls cell activities

There are few organelles which are specified to plant cells only and are not present in animal cells. They are given below:

Component	Description	Where found	Function
Cell wall	A tough and non-living outer layer, made of cellulose	Around the outside of plant cells	• Provides mechanical support • Allows water and salts to pass
Large vacuole	A fluid-filled space surrounded by a membrane	Inside the cytoplasm of plant cells	• Contains salts and water • Helps to keep plant

			cells turgid
Chloroplast	An organelle containing chlorophyll	Inside the cytoplasm of some plant cells	Traps light energy for photosynthesis

SHORT ANSWER QUESTIONS

Q.5 Define organelles. **(K.B)**

Ans:

ORGANELLES

Organelles are small subcellular structures with function present within the cytoplasm. Each organelle performs a specific function.

Examples:

- Nucleus
- Ribosomes
- Mitochondrion

Q.6 Enlist any six organelles of animal cell. **(U.B)**

Ans:

ORGANELLES OF ANIMAL CELL

Some organelles of animal cells are listed below.

- Nucleus
- Mitochondria
- Golgi apparatus
- Lysosomes
- Centrioles
- Vacuole

Q.7 Enlist the organelles of plant cell which are absent in animal cell. **(K.B)**

Ans: The organelles that are present in plant cell and absent in animal cell, are

- Central large vacuole
- Chloroplast
- Chromoplast
- Leucoplast
- Cell wall

Q.8 Define plasmodesmata. **(K.B)**

Ans:

PLASMODESMATA

Definition:

Plasmodesmata (singular plasmodesma) are the channels in cell walls that allow the exchange of molecules between adjacent cells.

Function:

The cell wall is non-living and does not allow water and dissolved substances to pass through. This role is played by these pores known as plasmodesmata.

Q.9 Enlist the composition of cell wall in different organisms. **(K.B)**

Ans:

COMPOSITION OF CELL WALL

Following table shows the composition of cell wall in cells of different organisms.

Cells of the Organism	Composition
Plant	Cellulose
Algae	Cellulose
Fungi	Chitin
Bacteria	Peptidoglycan

Q.10 Differentiate primary and secondary cell wall. **(K.B)**

Ans:

DIFFERENTIATION

The difference between primary and secondary cell wall of plants is explained by the table below:

PRIMARY CELL WALL	SECONDARY CELL WALL
LOCATION	
The primary wall is present just above the cell membrane.	It is present in some cells of the plant including • Xylem vessels • Cells of woody tissues i.e., nuts
COMPOSITION	
• It is mainly composed of cellulose, pectin and hemicellulose. • Cellulose forms fibres that crisscross over one another to form strong primary wall.	It is mainly made of cellulose, lignin and other chemicals.
THICKNESS	
It is thin and flexible.	It is a very thick and rigid

Q.11 What is the role of cell membrane. **(K.B)**

Ans:

CELL MEMBRANE

Functions of Cell Membrane:

- It is selectively-permeable.
- It allows very few molecules to pass through it while blocks many other molecules.
- In eukaryotic cell many organelles e.g. mitochondria, chloroplasts, Golgi apparatus and endoplasmic reticulum are also bounded by membranes.
- It maintains a fixed environment inside the cell.
- It regulates the exchange of materials between cell and its environment.

Q.12 Define fluid-mosaic model. **(K.B)**

Ans:

FLUID-MOSAIC MODEL

Explanation:

The structure of cell membrane is described as fluid-mosaic model. According to this model:

- The lipids make a fluid-like bilayer in which protein molecules are submerged.
- The lipids and proteins can move laterally.
- Due to these movements, the pattern or "mosaic" of lipids and proteins constantly changes.
- Carbohydrates are joined with proteins (in the form of glycoproteins) or with lipids (in the form of glycolipids).

Q.13 Define cytoplasm. Also mention its functions. **(K.B)**

Ans:

CYTOPLASM

Definition:

It is the jelly-like substance that fills the inside of a cell.

Composition:

It's a complex mixture of water, proteins, enzymes, salts, and other substances.

Functions:

- Cytoplasm provides a medium for organelles to move and function.
- It also helps in the transport of materials throughout the cell.
- It acts as the site for various metabolic reactions e.g., Glycolysis (breakdown of glucose).
- It also stores food and wastes of the cell.

Q.14 Define the role of nucleus in a cell. **(K.B)**

Ans:

ROLE OF NUCLEUS

The nucleus is like the control center of the cell and is a round structure in the cells of animals and plants.

Functions of Nucleus:

- The nucleus serves as the cell's "control center".
- It overseas cellular activities by directing the production of proteins.

Q.15 Differentiate between chromatin and chromosome. (K.B)

Ans:

CHROMATIN AND CHROMOSOME

Chromatin:

- Nucleoplasm contains fine thread-like material known as chromatin.
- It is composed of deoxyribonucleic acid (DNA) and proteins.

Chromosomes:

When a cell starts dividing, its chromatin condenses and takes the shape of thick chromosomes.

Q.16 Explain nucleolus with its functions. (K.B)

Ans:

ROLE OF NUCLEOLUS

Definition:

In nucleoplasm, there are one or more small bodies called nucleoli (singular; nucleolus).

OR

Nucleolus is a round darkly stained area in the nucleus.

Functions of Nucleolus:

In nucleolus, ribosomes are assembled.

Q.17 Write down the main components of cytoskeleton. (K.B)

Ans:

CYTOSKELETON

Three main types of cytoskeletal fibres that are discovered in the cell are:

- Microtubules – the thickest
- Microfilaments – the thinnest
- Intermediate filaments

Q.18 What are the function of microtubules and microfilaments? (K.B)

Ans:

MICROTUBULES AND MICROFILAMENTS

Microtubules:

- Microtubules are hollow tubes made up tubulin protein.
- This part holds organelles in place, maintains a cell's shape, and act as tracks for organelles.
- Microtubules also make mitotic spindle, cilia and flagella.

Microfilaments:

- Microfilaments are finer than microtubules.
- These are made up of contractile proteins, mainly actin.
- They help in cell movement e.g., the crawling of white blood cells and the contraction of muscle cells.

Q.19 What do you know about ribosomes? (K.B)

Ans:

RIBOSOMES

Definition:

Ribosomes are tiny granular structures which are not bounded by membranes.

Location:

Ribosomes float freely in the cytoplasm and are also attached on the surface of rough endoplasmic reticulum.

Composition:

They are composed of almost equal amounts of proteins and ribosomal RNA (rRNA).

Function:

They are the sites of protein synthesis.

Q.20 Explain the structure of ribosomes? (K.B)

Ans:

STRUCTURE OF RIBOSOMES

Structure:

- Ribosomes are not bound by any membrane.
- Each ribosome consists of two subunits.
- The two subunits of a ribosome unite during the process of protein synthesis.
- When a ribosome has finished its work, its subunits get separated again.

Q.21 What are lysosomes? Give their functions. (K.B)

Ans:

LYSOSOMES

Definition:

"Lysosomes are single membrane-bound vesicles, containing variety of digestive enzymes".

Functions:

- Cell engulfs the food material in the form of food vacuole.
- Lysosome fuses with food vacuole and its digestive enzymes break down the food present in vacuole.
- Lysosomes also have enzymes for breaking cellular wastes.
- They also engulf the damaged organelles and break them.
- Lysosomes can store certain molecules for later use.

Q.22 Explain the formation of lysosomes. (U.B)

Ans:

FORMATION OF LYSOSOMES

- The enzymes contained in lysosomes are synthesized on RER and then transported to Golgi apparatus.
- Lysosomes then bud off from the Golgi apparatus with their processed enzymes.

Q.23 Lysosomes are involved in autophagy. Justify. (K.B)

Ans:

AUTOPHAGY

Autophagy is defined as the eating of cellular organelles. Lysosomes engulf and digest unwanted cell organelles for recycling purposes. Therefore, they are termed as organelles involved in autophagy.

Q.24 Discuss the structure and functions of Endoplasmic Reticulum. (K.B)

Ans:

STRUCTURE OF E.R.

Definition:

It is a network of membrane-bounded channels present throughout the cytoplasm of eukaryotic cell.

Type of Endoplasmic Reticulum:

There are two types of endoplasmic reticulum.

1. **Rough Endoplasmic Reticulum (RER)**
   - Numerous ribosomes are attached on its surface.
   - RER serves the function in protein synthesis.
2. **Smooth Endoplasmic Reticulum (SER)**
   - It lacks ribosomes.
   - It is involved in lipid metabolism and in the transport of materials from one part of the cell to the other.
   - It also detoxifies the harmful chemicals that have entered the cell.
   - In muscle cells, the SER is also involved in contraction process.

Q.25 What do you know about Camillo Golgi? Discuss his contributions. (K.B)

Ans:

CONTRIBUTIONS OF CAMILLO GOLGI

Camillo Golgi was an Italian physician.

Contribution:

In 1898, he discovered the Golgi complex.

Nobel Prize:

In 1906, Golgi was awarded Nobel prize for physiology and medicine.

Q.26 Differentiate between SER and RER. **(U.B)**

Ans:

DIFFERENTIATION

The difference between SER and RER is as follows.

SER	RER
STRUCTURE	
SER is smooth in appearance because ribosomes are not attached to it.	RER is rough in appearance because ribosomes are attached to it.
FUNCTIONS	
• It is involved in lipid metabolism and in the transport of materials from one part of the cell to the other. • It also detoxifies the harmful chemicals that have entered the cell. • In muscle cells, the SER is also involved in contraction process.	• It plays role in protein synthesis. • It also helps in transport of substances like proteins.

Q.27 Why mitochondrion is called as power-house of the cell?

Ans:

POWERHOUSE OF CELL

Function of Mitochondria:

- Mitochondria (singular mitochondrion) are the "powerhouse" of the cell because they produce energy.
- They perform the reactions of aerobic respiration in which oxygen is used to break food (glucose) to release energy (ATP - adenosine triphosphate).

Q.28 Define aerobic respiration. **(K.B)**

Ans:

AEROBIC RESPIRATION

- Energy is an important theme in biology. All systems, from cells to ecosystems, require energy to work.
- Cells get energy by the breakdown of organic food in a process called respiration. If it requires oxygen, it is called aerobic respiration.

Q.29 What is cristae? **(K.B)**

Ans:

CRISTAE

Definition:

The outer membrane of mitochondria is smooth but the inner membrane forms many folds. These folds are called cristae (singular crista).

Function:

Cristae increase the surface area for respiration, as it can accommodate more number of electron transport chains.

Q.30 Write a note on chloroplast. **(K.B)**

Ans:

CHLOROPLAST

Definition:

Chloroplasts are green plastids present in the cells of green parts of plants and in algae. They contain photosynthetic pigments e.g., the green pigment chlorophyll.

Structure:

- Chloroplast is double membrane bounded i.e., an outer and an inner membrane.
- They have their own DNA and ribosomes, similar to mitochondria.
- Its fluid is known as stroma which contains coin like structures known as thylakoids.

Functions:

- They carry out photosynthesis.
- With the help of their photosynthetic pigments, they capture light energy and convert it into chemical energy in the form of glucose.

Q.31 Where are chromoplasts located? What are their functions? (K.B)

Ans:

CHROMOPLASTS

Location:

They are present in the cells of flower petals and fruits.

Function:

Chromoplasts give colours to petals and fruits, thus help in pollination and dispersal of fruit and seeds.

Q.32 Define granum. (K.B)

Ans:

GRANUM

Definition:

On the internal side of inner membrane of chloroplast, there are many sets of stacked membranes (i.e., thylakoids). These stacks are called grana (singular: granum).

Q.33 What are leucoplasts? Write their function. (K.B)

Ans:

LEUCOPLASTS

Definition:

Leucoplasts are plastids that have no pigments.

Location:

They are present in the cells of those parts where food is stored e.g., underground stems, seeds, roots, etc.

Function:

They are involved in the storage of starches, lipids, and proteins.

Q.34 Discuss contractile vacuole with reference to its function. (K.B)

Ans:

CONTRACTILE VACUOLE

Definition:

A contractile vacuole is a specialized organelle found in many protists (i.e., amoeba) and some unicellular algae.

Function:

They collect and pump out extra water and other wastes from the body of organism.

Q.35 Explain the structure and function of plant vacuole. (K.B)

Ans:

PLANT VACUOLE

Definition:

Most mature plant cells have a single, large and central vacuole which is formed by the fusion of many small vacuoles.

Structure:

- The membrane of plant vacuole is called tonoplast and the sap inside plant vacuole is called cell sap.
- It is a watery solution of salts.

Turgor Pressure:

- Due to the large central vacuole, the cytoplasm is pushed to a side.
- This outward pressure of the vacuole on the cytoplasm and cell wall makes plant cells turgid.
- This pressure is called turgor pressure and the process is called turgor.

Q.36 What is cell sap? (K.B)

Ans:

CELL SAP

Definition:

The fluid-like material present in the vacuole is known as cell sap.

Composition:

It has dissolved materials like mineral salts, sugars, and amino acids.

Function:

It provides support and helps in growth.

Q.37 Discuss the composition and role of cilia and flagella for a cell. (K.B)

Ans:

CILIA AND FLAGELLA

Composition Across various Cells:

1. **Eukaryotic Cells**
   - Eukaryotic cilia and flagella consist of nine pairs of microtubules which surround a single central pair of microtubules.
   - Cilia and flagella are connected to the basal body.
2. **Prokaryotic Cells**
   - Prokaryotic cells also have flagella but their structure is completely different.
   - Prokaryotic flagella are made of a protein called flagellin.

Function:

The function of cilia and flagella is movement.

Q.38 How turgor pressure maintains cell shape? (A.B)

Ans:

TURGOR PRESSURE

Turgor pressure occurs when the fluid content of a cell pushes the cell membrane against the cell wall. In this way it helps to provide shape to the plant cell.

MULTIPLE CHOICE QUESTIONS

8. The cell wall of fungi is made up of: (K.B)
(A) Cellulose (B) Lignin
(C) Peptidoglycan (D) Chitin

9. In the cell wall of plants, the chemical present is: (K.B)
(A) Cellulose (B) Chitin
(C) Sodium (D) Potassium

10. The cell wall of prokaryotes is made up of: (K.B)
(A) Cellulose (B) Lignin
(C) Peptidoglycan (D) Chitin

11. The pores in cell walls by which plant cells exchange materials are called: (K.B)
(A) Secondary wall (B) Plasmodesmata
(C) Cellular pores (D) Micropyle

12. Cell membrane is mainly composed of: (K.B)
(A) Protein (B) Lipids
(C) Carbohydrates (D) All of these

13. Which is not present in cell membrane: (U.B)
(A) Carbohydrates (B) Protein
(C) Lipids (D) DNA

14. In eukaryotic cell, which of the following organelles are surrounded by cell membrane: (U.B)
(A) Mitochondria (B) Golgi apparatus
(C) Endoplasmic reticulum (D) All of these

15. Chromatin consists of: (K.B)
(A) Protein (B) DNA
(C) Both A & B (D) Proteins and Lipids

16. The nature of cytoplasm is: (K.B)
(A) Jelly-like (B) Solid
(C) Water-like liquid (D) Granular

17. The liquid part of the cytoplasm that includes molecules and small particles is: (K.B)
(A) Cytogel (B) Cytosol
(C) Cytoskeleton (D) All of these

18. The darkly stained region of nucleus containing chromatin is called: (K.B)
(A) Nuclear pores (B) Nucleosome

(C) Chromosomes (D) Nucleolus

19. **The control center of cell is known as:** **(U.B)**
(A) Mitochondria (B) Ribosomes
(C) DNA (D) Nucleus

20. **Microtubules are made up of:** **(K.B)**
(A) Tubulin (B) Tropomyosin
(C) Myosin (D) Actin

21. **The cytoskeletal fiber containing actin is:** **(K.B)**
(A) Microtubule (B) Intermediate filament
(C) Microfilament (D) Both A and B

22. **Which organelles are involved in protein synthesis?** **(K.B)**
(A) Mitochondria (B) Lysosomes
(C) Ribosomes (D) Nucleus

23. **Ribosomes are formed in:** **(K.B)**
(A) Nucleus (B) Nucleolus
(C) Cytoplasm (D) Mitochondria

24. **De Duve won the noble prize for?** **(K.B)**
(A) Physiology (B) Medicine
(C) Both A & B (D) None

25. **Lysosomes are produced from:** **(K.B)**
(A) Nucleus (B) Ribosomes
(C) Golgi Apparatus (D) S.E.R.

26. **Golgi was awarded Nobel Prize in:** **(K.B)**
(A) 1905 (B) 1906
(C) 1907 (D) 1908

27. **Flattened sacs, cisternae are found in:** **(K.B)**
(A) Mitochondria (B) Golgi apparatus
(C) Ribosomes (D) Plastids

28. **Cell organelle which contains digestive enzymes:** **(K.B)**
(A) Ribosomes (B) Lysosome
(C) Centrioles (D) Endoplasmic reticulum

29. **Which organelles are involved in energy production?** **(K.B)**
(A) Mitochondria (B) Lysosomes
(C) Cytoplasm (D) Nucleus

30. **The mitochondrion function is:** **(U.B)**
(A) Lipids storage (B) Photosynthesis
(C) Protein synthesis (D) Aerobic respiration

31. **Which of these organelles have their own DNA:** **(K.B)**
(A) Lysosomes (B) Mitochondria
(C) Ribosomes (D) Golgi bodies

32. **Plastids are present in the cells of:** **(K.B)**
(A) Plants (B) Algae
(C) Both A & B (D) Fungi

33. **Function of Chloroplast is:** **(K.B)**
(A) Photosynthesis (B) ATP formation
(C) Protein formation (D) DNA replication

34. **The stack of thylakoids is called:** **(K.B)**
(A) Cristae (B) Leucoplast
(C) Granum (D) Stroma

35. **Chromoplasts are associated with bright colours and help in:** **(A.B)**
(A) Pollination (B) Dispersal of fruits

(C) Food storage (D) Both A & B

36. Leucoplasts are colourless and store: (K.B)
(A) Starch (B) Proteins
(C) Lipids (D) All of these

37. The type of plastids that contain pigments associated with bright colours: (K.B)
(A) Chloroplasts (B) Chromoplasts
(C) Leucoplasts (D) Plastids

38. Cilia and Flagellum are connected to: (K.B)
(A) Plasma membrane (B) Nucleus
(C) Basal body (D) E.R

39. Which organelle controls the activities of the cell? (U.B)
(A) Mitochondria (B) Nucleus
(C) Ribosomes (D) All of these

40. Smooth endoplasmic reticulum is involved in: (K.B)
(A) Lipids metabolism (B) Transport of materials
(C) Detoxification of harmful chemicals (D) All of these

41. Animal cells have two centrioles near the exterior surface of nucleus collectively called: (K.B)
(A) Centrosome (B) Nucleosome
(C) Chromosome (D) Nucleolus

42. Centrioles are involved in the formation of: (K.B)
(A) Spindle fibres (B) Cilia
(C) Flagella (D) All of these

43. Cell wall of non-cellulose component is found in _____. (U.B)
(A) Protista (B) Fungi
(C) Plant (D) Animals

44. Inner mitochondrial membrane forms many infoldings called: (K.B)
(A) Stroma (B) Cristae
(C) Granum (D) Thylakoid

45. Centrosome is containing of _____ centrioles: (U.B)
(A) 1 (B) 2
(C) 3 (D) 4

46. Cell organelle which helps in formation of spindle fibers is_____. (K.B)
(A) Ribosomes (B) Vacuoles
(C) Golgi Body (D) Centrioles

47. Cell wall is found in all except_____. (K.B)
(A) Plants (B) Fungi
(C) Animals (D) Bacteria

48. Fungi and many protists have cell walls although, they do not contain___: (U.B)
(A) Chitin (B) Peptidoglycan
(C) Cellulose (D) Glycogen

49. In which components of the leaf cell, chlorophyll is present. (K.B)
(A) Stroma (B) Plasma membrane
(C) Thylakoids (D) Cytoplasm

50. Which of this material is not a component of the plasma membrane? (K.B)
(A) Lipids (B) Proteins
(C) Carbohydrates (D) Glycogen

3.3 STRUCTURAL ADVANTAGES OF PLANT AND ANIMAL CELLS

LONG ANSWER QUESTIONS

Q.1 Explain some structural advantages of plant and animal cells. (U.B)

Ans: **STRUCTURAL ADVANTAGES OF PLANT AND ANIMAL CELL**

Plant and animal cells have distinct structural differences that reflect their specialized functions and adaptations. Here are some structural advantages of both plant and animal cells.

Advantages of Plant Cell Structures:

1. **Cell Wall**
   - Plant cells have a rigid cell wall made of cellulose.
   - It provides structural support and protection.
2. **Chloroplasts**
   - Plants contain chloroplasts, which are responsible for photosynthesis.
   - Chloroplasts convert light energy into chemical energy, allowing plants to produce food.
3. **Large Central Vacuole**
   - The large central vacuole stores water, nutrients, and waste products.
   - It provides turgor pressure that maintains cell shape.
4. **Plasmodesmata**
   Plant cells are interconnected by plasmodesmata, channels that allow direct communication and transport of substances between cells.

Advantages of Animal Cell Structures:

1. **Centrioles**
   - Animal cells have centrioles which make spindle fibres.
   - This ensures the accurate distribution of chromosomes during cell division.
2. **Lysosomes**
   - They contain lysosomes, filled with enzymes that break down waste materials.
   - Lysosomes contribute to cellular cleanup and recycling.
3. **Flagella and Cilia**
   - Some animal cells have structures called flagella and cilia, which are involved in movement.
   - For example, sperm cells have a flagellum that propels them toward the egg for fertilization.
4. **Lack of Cell Wall**
   - They lack a rigid cell wall, allowing them to change shape easily.
   - This flexibility is crucial for cell movements, such as white blood cells moving to sites of infection or injury.

SHORT ANSWER QUESTIONS

Q.1 Write down the advantage of plant cells due to having cell wall and chloroplasts. (U.B)

Ans: **ADVANTAGES**

Cell Wall:

- Plant cells have a rigid cell wall made of cellulose.
- It provides structural support and protection.

Chloroplasts:

- They contain chloroplasts, which are responsible for photosynthesis.
- Chloroplasts convert light energy into chemical energy, allowing plants to produce food.

Q.2 What is the function of cilia and flagella for animal cells? (U.B)

Ans: **ADVANTAGES**

Cilia and Flagella:

Some animal cells have structures called flagella and cilia, which are involved in movement.

Example:
Sperm cells have a flagellum that propels them toward the egg for fertilization.

Q.3 How is the movement of animal and plant cells related with the cell wall? (K.B)

Ans:

MOVEMENT IN ANIMAL AND PLANT CELLS

Movement in Plant Cell:
Plants cannot move from place to place because of rigidness provided by the cell wall.

Movement in Animal Cell:
Lack of cells walls make animal cells very flexible. Animal cells and animal as a whole can move to suitable environmental conditions, find shelter and better feeding fields and opportunities for reproduction.

3.4 CELL SPECIALIZATION

LONG ANSWER QUESTIONS

Q.1 Write a detailed note on cell specialization. (K.B + U.B)

Ans:

CELL SPECIALIZATION

Introduction:

- In multicellular organisms, all cells are not exactly alike.
- Rather, there are different types of cells.
- Each type has a special structure and performs special function.
- When cells are formed by cell division, they are all similar.

Cell Specialization:

- After their formation, cells undergo the process of specialization or differentiation.
- During this process, they get special sizes, structures, and metabolic features.
- As a result, they become specialized.

Here are some specialized cells of plants and animals.

1. **Mesophyll Cells**
   - These are green cells present in leaves.
   - They are specialized for photosynthesis.
   - They contain large number of chloroplasts, which contain the green pigment chlorophyll necessary for capturing light energy.
   - Their shape and arrangement in leaves is suitable for maximum absorption of light.

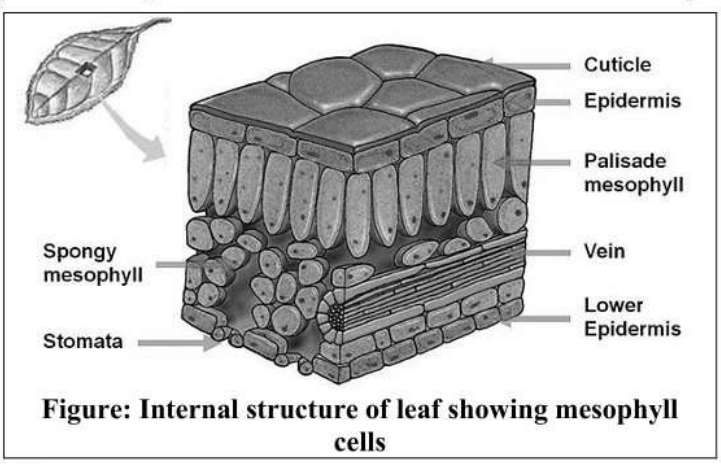


Figure: Internal structure of leaf showing mesophyll cells

2. **Epidermal Cells**

- They are flat and tightly packed cells that make the outer layer (epidermis) of plant organs.
- Epidermis protects the internal tissues.
- Modified cells of epidermis also perform other functions.

Modified Epidermal Cells:

- Epidermis of root contains root hair cells.
- These cells make extensions called root hairs to absorb water and minerals from soil.
- Similarly, lower epidermis of leaves contains guard cells which regulate opening and closing of stomata.

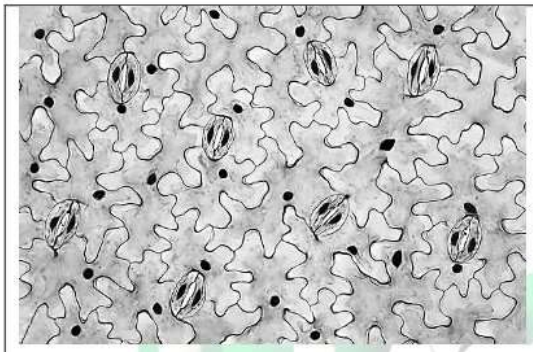


Figure: Epidermis of leaf showing stomata

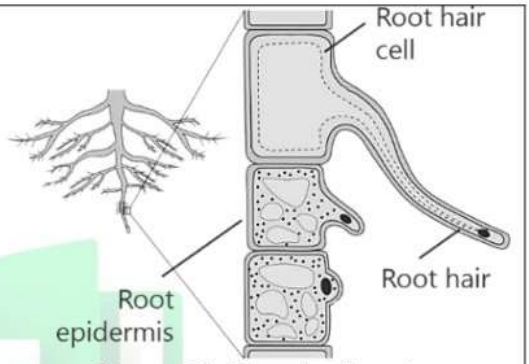


Figure: Epidermis of root

3. Muscle Cells

- Muscle cells are specialized animal cells that can contract.
- They are elongated cells filled with actin and other contractile proteins.

Skeletal Muscles:

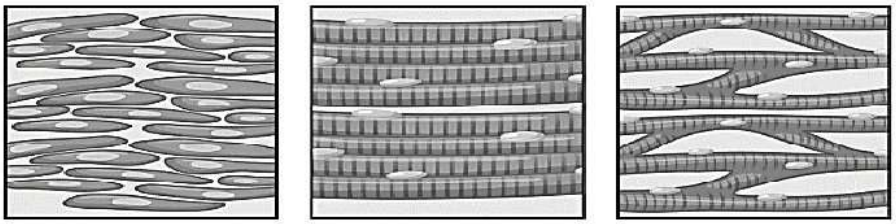
- Skeletal muscle cells are long and striated.
- They are attached to bones.
- They are voluntary in action and their contractions move the skeleton for body movements and locomotion.

Cardiac Muscles:

- Cardiac muscle cells are branched and striated.
- They are found in the heart walls.
- They are involuntary in action and their contractions result in the pumping action of heart.

Smooth Muscles:

- Smooth muscle cells are spindle shaped and non-striated.
- They are involuntary in action and are present in the walls of many internal organs.
- For example, smooth muscles in the alimentary canal contract to move food forward, while those in blood vessels regulate blood flow.



Smooth muscle cells | Skeletal muscle cells | Cardiac muscle cells

Figure: Muscle cells

4. Neurons

- These are the specialized cells of the nervous system.
- They are responsible for transmitting messages (nerve impulses) throughout the body.
- To perform this function, they have a unique structure.

Structure of Neuron:

- A neuron consists of a cell body and two types of cytoplasmic extensions.
- Dendrites, the shorter extensions, receive nerve impulses and transmit them to the cell body.
- Axons, the longer extensions, carry nerve impulses away from the cell body.

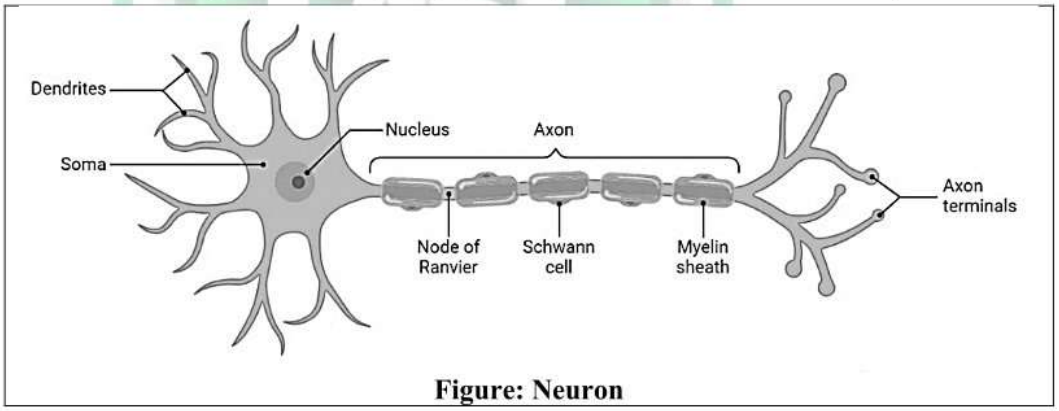


Figure: Neuron

5. Red Blood Cell (Erythrocyte)

- These blood cells are specialized to carry oxygen from the lungs to the body's tissues.
- They are biconcave disk-shaped cells.
- This shape provides more surface area to absorb and release oxygen.
- They are filled with haemoglobin that actually carries oxygen.
- In mammals, the mature red blood cells do not contain nucleus, mitochondria, and endoplasmic reticulum etc.
- It helps to accommodate more haemoglobin.

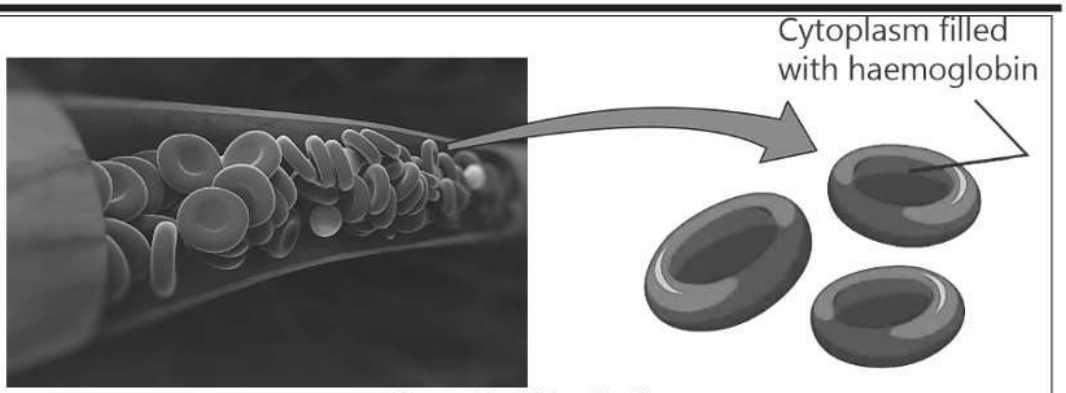


Figure: Red blood cells

6. Liver Cell

They are also called hepatocytes.

Functions of Liver Cells:

They are specialized for a lot of important functions like:

- Storage of glycogen, iron and some vitamins
- Detoxification of toxic substances
- Production of clotting proteins of blood
- Recycling of old red blood cells, etc.
- Toxic ammonia is converted into less toxic form urea in liver, hence it assists kidney function.

Structural Advantages:

- They have prominent nuclei for maximum activities required for making enzymes and other proteins.
- Large number of mitochondria provide the necessary ATP for energy-intensive processes.
- Expansive network of SER helps for extensive detoxification and lipid synthesis.
- There are large number of peroxisomes which contain enzymes to neutralize toxic substances.
- Small ducts are present between liver cells which collect and transport their secretion (bile) to the bile ducts.

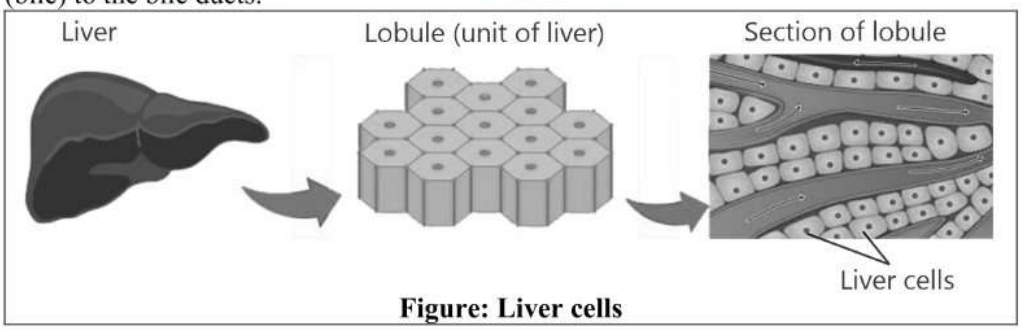


Figure: Liver cells

Q.2 Describe the concept of division of labour and how it applies in multicellular organisms. Give at least three examples. (U.B)

Ans:

DIVISION OF LABOUR

Definition:

Division of labour refers to the specialization of different parts of a system to perform specific tasks more efficiently. It is a fundamental principle that enhances efficiency and functionality in biological systems (both within and across cells).

Division of Labour Within Cells:

Within a cell, this concept is exemplified by the various organelles that each carry out distinct functions necessary for the cell's survival.

Examples:

1. **Mitochondria:** Generate energy in the form of ATP.
2. **Endoplasmic Reticulum:** Synthesizes proteins and lipids.
3. **Lysosomes:** Break down waste materials and cellular debris.

In this way, the function of each organelle contributes to the cell's overall survival, growth, and functioning.

Division of Labour Across Cells:

- In multicellular organisms, the division of labour extends across cells.
- Each type of cell performs a specific role and contributes to the overall functions of the organism.

Examples:

1. **Muscle Cells:** They are specialized for contraction and movement.
2. **Nerve Cells:** Transmit messages in the form of nerve impulses.
3. **Red Blood Cells:** Carry oxygen throughout various parts of body.

This intercellular specialization allows complex organisms to perform a wide range of functions.

SHORT ANSWER QUESTIONS

Q.1 How a cell becomes specialized? (U.B)

Ans:

CELL SPECIALIZATION

Explanation:

- After their formation, cells undergo the process of specialization or differentiation.
- During this process, they get special sizes, structures, and metabolic features.
- As a result, they become specialized.

Q.2 Relate the function of RBCs with its structure. (U.B)

Ans:

FUNCTION OF RBCs

Shape of RBCs:

- Red blood cells are specialized to carry oxygen from the lungs to the body's tissues.
- They are biconcave disk-shaped cells.
- This shape provides more surface area to absorb and release oxygen.

Absence of Organelles:

- RBCs are filled with haemoglobin that actually carries oxygen.
- In mammals, the mature red blood cells do not contain nucleus, mitochondria, and endoplasmic reticulum etc.
- It helps to accommodate more haemoglobin.

Q.3 How are epidermal cells modified? (K.B)

Ans:

EPIDERMAL CELLS

Modified Epidermal Cells:

- Epidermis of root contains root hair cells.
- These cells make extensions called root hairs to absorb water and minerals from soil.
- Similarly, lower epidermis of leaves contains guard cells which regulate opening and closing of stomata.

Q.4 Define neuron. Also explain its structure. (K.B)

Ans:

NEURON

Introduction:

- These are the specialized cells of the nervous system.
- They are responsible for transmitting messages (nerve impulses) throughout the body.

- To perform this function, they have a unique structure.

Structure of Neuron:

- A neuron consists of a cell body and two types of cytoplasmic extensions.
- Dendrites, the shorter extensions, receive nerve impulses and transmit them to the cell body.
- Axons, the longer extensions, carry nerve impulses away from the cell body.

Q.5 Write some roles of liver cells. (K.B)

Ans:

ROLE OF LIVER CELLS

Liver cells are specialized for a lot of important functions like:

- Storage of glycogen, iron and some vitamins
- Detoxification of toxic substances
- Production of clotting proteins of blood
- Recycling of old red blood cells, etc.
- Toxic ammonia is converted into less toxic form urea in liver, hence it assists kidney function.

Q.6 Write some structural advantages of liver cells. (K.B)

Ans:

STRUCTURAL ADVANTAGES

Structural Advantages of Liver Cells:

- They have prominent nuclei for maximum activities required for making enzymes and other proteins.
- Large number of mitochondria provide the necessary ATP for energy-intensive processes.
- Expansive network of SER helps for extensive detoxification and lipid synthesis.
- There are large number of peroxisomes which contain enzymes to neutralize toxic substances.
- Small ducts are present between liver cells which collect and transport their secretion (bile) to the bile ducts.

Q.7 Define division of labour. (K.B)

Ans:

DIVISION OF LABOUR

Introduction:

Division of labour refers to the specialization of different parts of a system to perform specific tasks more efficiently.

Division of Labour Within Cells:

Within a cell, this concept is exemplified by the various organelles that each carry out distinct functions necessary for the cell's survival.

Q.8 Give an example of division of labour within cells. (K.B)

Ans:

DIVISION OF LABOUR WITHIN CELLS

Example:

Mitochondria: Generate energy in the form of ATP.
Endoplasmic Reticulum: Synthesizes proteins and lipids.
Lysosomes: Break down waste materials and cellular debris.
In this way, the function of each organelle contributes to the cell's overall survival, growth, and functioning.

MULTIPLE CHOICE QUESTIONS

1. Guard cells regulate: (K.B)

(A) Food (B) Salts
(C) Stomata (D) Water

2. In plant leaves, chloroplasts are present in: (K.B)

(A) Cuticle layer (B) Mesophyll cells
(C) Xylem cells (D) Phloem cells

3. The shape of RBCs is: **(K.B)**
(A) Spindle-like (B) Needle-like
(C) Disc-like (D) Cylindrical

4. _____ carry messages away from the cell body. **(K.B)**
(A) Neuron (B) Dendrites
(C) Axon (D) Cell body

5. Muscle cells have the ability to: **(K.B)**
(A) Contract (B) Relax
(C) Expand (D) Contract & Relax

6. Liver cells are also known as: **(K.B)**
(A) Hepatocytes (B) Megakaryocytes
(C) Erythrocytes (D) Thrombocytes

7. Red blood cells are: **(K.B)**
(A) Biconcave (B) Biconvex
(C) Oval shaped (D) Irregular

8. Which of following is considered as unit of life? **(K.B)**
(A) Atom (B) Cell
(C) Molecule (D) Tissue

9. Red blood cells carry: **(K.B)**
(A) Oxygen (B) Hydrogen
(C) Helium (D) Nitrogen

10. Phloem cells transport: **(K.B)**
(A) Oxygen (B) Water
(C) Food (D) Hormones

11. Mitochondria acts as: **(U.B)**
(A) Protein synthesizer (B) Recyclers
(C) Powerhouse (D) Control center

12. A group of cells performing same function is called: **(K.B)**
(A) Specialized Cell (B) Organelle
(C) Organ (D) Tissue

13. The muscle cells which are spindle shaped: **(K.B)**
(A) Skeletal (B) Smooth
(C) Cardiac (D) Nervous

14. Which energy is harvested by chloroplasts? **(K.B)**
(A) Nuclear energy (B) Light energy
(C) Hydro-energy (D) Chemical energy

15. It is an example of voluntary muscle: **(K.B)**
(A) Skeletal (B) Smooth
(C) Cardiac (D) Nervous

3.5 STEM CELLS

LONG ANSWER QUESTIONS

Q.1 What are stem cells? Explain the differentiation and functions of stem cells. **(U.B)**

Ans:

STEM CELLS

Introduction:

- In sexually reproducing organisms, all different types of cells arise from a single cell (zygote).
- The zygote is an unspecialized cell but it has the ability to make new cells which can differentiate into specialized cells.

Definition:

The unspecialized cell (i.e., zygote) that has the ability to differentiate into a variety of specialized cell types is called stem cell.

Cell Lines:

- During development, when the earliest stem cell (zygote) divides, it makes different cell lines.
- The cells of each line differentiate into specific type like skin cells, muscle cells, nerve cells, blood cells etc.

Differentiation of Stem Cells:

- Stem cells remain in different parts of the body throughout life.
- These stem cells can divide and differentiate into specific cells as the body needs them.
- They can also regenerate damaged tissue under the right conditions.

Functions of Stem Cells:

- Stem cells present in skin help in wound healing.
- Stem cells present in liver also help it to repair after damage.
- Stem cells present in the bone marrow differentiate to make different types of blood cells and immune cells.
- In some parts of the body, such as the gut and bone marrow, adult stem cells regularly divide to produce new tissues for maintenance and repair.

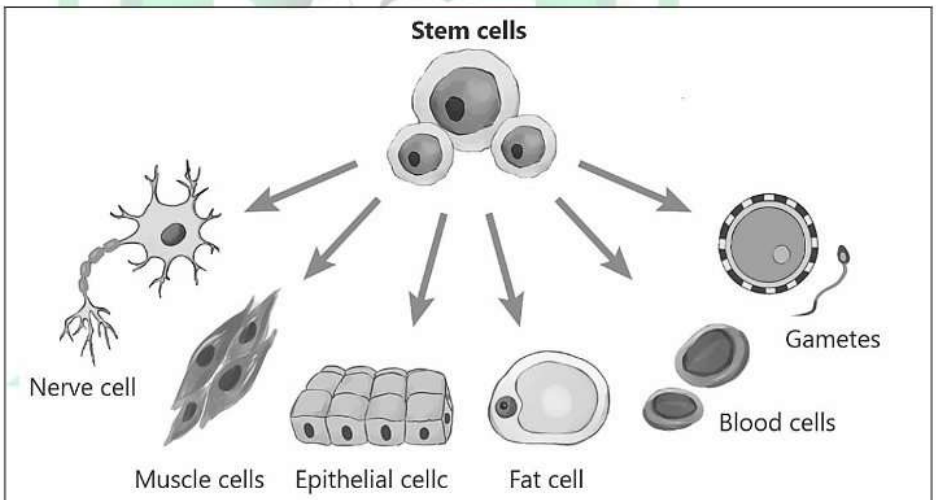


Figure: Differentiation of stem cell into specialized cells

SHORT ANSWER QUESTIONS

Q.1 Define stem cells. (K.B)

Ans:

STEM CELLS

Definition:

The unspecialized cell (i.e., zygote) that has the ability to differentiate into a variety of specialized cell types is called stem cell.

Examples:

- Hematopoietic stem cell gives rise to blood cells.
- Neural stem cells give rise to neurons and glial cells.
- The zygote is an unspecialized cell but it has the ability to make new cells which can differentiate into specialized cells.

Q.2 How different cells develop from a single stem cell? (U.B)

Ans:

DIFFERENTIATION OF STEM CELLS

Explanation:

- During development, when the earliest stem cell (zygote) divides, it makes different cell lines.
- The cells of each line differentiate into specific type like skin cells, muscle cells, nerve cells, blood cells etc.

Q.3 Write down some functions of stem cells? (K.B)

Ans:

FUNCTIONS OF STEM CELLS

Functions:

- Stem cells present in skin help in wound healing.
- Stem cells present in liver also help it to repair after damage.
- Stem cells present in the bone marrow differentiate to make different types of blood cells and immune cells.
- In some parts of the body, such as the gut and bone marrow, adult stem cells regularly divide to produce new tissues for maintenance and repair.

Q.4 Write some features of stem cells. (K.B)

Ans:

FEATURES OF STEM CELLS

Some important features of stems cells are:

- Stem cells by themselves are not differentiated and are un-specialized.
- Each daughter cell produced by division of a stem cell has capacity to remain un-specialized stem cell or differentiate into mature cell of some tissue.
- So, stem cells divide, renew themselves and daughter cells differentiate into distinct cell type.

Q.5 What is the origin of different cells of living organisms? (K.B)

Ans:

ORIGIN OF CELLS

Around 200 types of cells are identified in human body. These cells vary in their size, shape and role.

Origin of Cells:

All these types of cells have a common origin. They all develop from a single cell the zygote. The zygote is very basic stem cell which has ability to produce all kinds of cell an organism.

MULTIPLE CHOICE QUESTIONS

1. How many types of different cells are present in humans? (K.B)

(A) 250 (B) 300
(C) 200 (D) 100

2. Example of basic stem cell is: (K.B)

(A) Nucleus (B) Zygote
(C) Brain cell (D) RBCs

3. A common origin for all the cells of an organism is: (K.B)

(A) Nucleus (B) Zygote
(C) Brain cell (D) RBCs

4. Stem cells are: (K.B)

(A) Dead cells (B) Enucleated cells
(C) Blood cells (D) Undifferentiated

5. Which is not related with stem cells? (U.B)

(A) Stem cells are not differentiated (B) They can give rise to other stem cells
(C) Stem cells are un-specialized (D) They are formed in the brain tissues

TEXTBOOK EXERCISE

MULTIPLE CHOICE QUESTIONS

1. The process of cellular respiration occurs in:
(A) Nucleus (B) Mitochondria
(C) Ribosomes (D) Golgi apparatus

2. The smooth endoplasmic reticulum (SER) is primarily involved in the synthesis of:
(A) Proteins (B) Lipids
(C) Carbohydrates (D) Nucleic acids

3. Ribosomes are composed of:
(A) RNA and protein (B) DNA and protein
(C) Carbohydrates and lipids (D) RNA and carbohydrates

4. What is the primary function of ribosomes?
(A) Energy production (B) Protein synthesis
(C) Lipid synthesis (D) DNA synthesis

5. Which cell organelle is involved in packaging and modifying proteins?
(A) Nucleus (B) Mitochondria
(C) Golgi apparatus (D) Endoplasmic reticulum

6. Which cell organelle is responsible for breaking down waste materials?
(A) Golgi apparatus (B) Nucleus
(C) Mitochondria (D) Lysosome

7. Which of the following cell structures is involved in maintaining cell shape?
(A) Cytoskeleton (B) Centrioles
(C) Nucleus (D) Lysosome

8. What is the main function of the smooth endoplasmic reticulum in a cell?
(A) Synthesis of proteins (B) Synthesis of lipids
(C) Digestion of cellular waste (D) Storage of genetic material

9. Which specialized region of the nucleus is responsible for ribosome assembly?
(A) Nucleoplasm (B) Nucleolus
(C) Chromatin (D) Nuclear envelope

10. What is the main function of the nuclear pores?
(A) Regulation of cell division (B) Control of pH of the cell
(C) Protein synthesis (D) Control of transport of molecules

11. Which of the following cellular structures is found in animal cells and helps in cell division?
(A) Cell membrane (B) Centriole
(C) Plasmodesma (D) Vacuole

12. Which sub-cellular organelle plays a crucial role in energy production within the cell?
(A) Endoplasmic reticulum (B) Golgi apparatus
(C) Mitochondria (D) Lysosomes

13. In a multicellular plant, which cell type is responsible for the production of glucose?
(A) Xylem (B) Epidermal
(C) Phloem (D) Mesophyll

14. Which organelle can double its number by itself?
(A) Ribosomes (B) Lysosomes
(C) Mitochondria (D) Golgi apparatus

15. Which of these are present on the surface of rough endoplasmic reticulum?
(A) Ribosomes (B) Lysosomes
(C) Mitochondria (D) Vacuoles

SHORT ANSWER QUESTIONS

Q.15 What are the main functions of cell membrane?

Ans:

CELL MEMBRANE

Functions:

- It is selectively-permeable.
- It allows very few molecules to pass through it while blocks many other molecules.
- In eukaryotic cell many organelles e.g. mitochondria, chloroplasts, Golgi apparatus and endoplasmic reticulum are also bounded by membranes.

Q.16 What key role does the Golgi apparatus play in eukaryotic cells?

Ans:

GOLGI APPARATUS

In eukaryotic cells, Golgi apparatus has following major functions:

Functions:

- It modifies molecules coming from rough ER and packs them into small membrane-bound sacs called Golgi vesicles.
- These sacs are kept in cell or are transported to exterior in the form of secretions.

Q.17 How do lysosomes contribute to the cell's functioning?

Ans:

LYSOSOMES

Lysosomes perform many functions to the overall working of cells. Some of them are:

Functions:

- Cell engulfs the food material in the form of food vacuole.
- Lysosome fuses with food vacuole and its digestive enzymes break down the food present in vacuole.
- Lysosomes also have enzymes for breaking cellular wastes.
- They also engulf the damaged organelles and break them.
- Lysosomes can store certain molecules for later use.

Q.18 Which organelle detoxifies harmful substances and breaks down lipids?

Ans:

ORGANELLE

The **Smooth Endoplasmic Reticulum (SER)** is an organelle in cells that plays a crucial role in detoxifying harmful chemicals that enter the cell. Additionally, it is involved in lipid metabolism, where it synthesizes and breaks down lipids.

Q.19 What is the smooth endoplasmic reticulum responsible for?

Ans:

SMOOTH ENDOPLASMIC RETICULUM

The major functions of smooth endoplasmic reticulum are:

Functions:

- It lacks ribosomes.
- It is involved in lipid metabolism and in the transport of materials from one part of the cell to the other.
- It also detoxifies the harmful chemicals that have entered the cell.
- In muscle cells, the SER is also involved in contraction process.

Q.20 How do the vacuoles in plant cells differ from vacuoles in animal cells?

Ans:

VACUOLES

Animal cell may have many small temporary vacuoles that contain water and food substances. Whereas most mature plant cells have a single, large, central vacuole. It is formed by the fusion of many small vacuoles.

Structure of Plant Vacuole:

The membrane of plant vacuole is called tonoplast and the sap inside plant vacuole is called cell sap. It is a watery solution of salts.

Turgor Pressure:

- Due to the large central vacuole, the cytoplasm is pushed to a side.
- This outward pressure of the vacuole on the cytoplasm and cell wall makes plant cells turgid.
- This pressure is called turgor pressure and the process is called turgor

Q.21 What could happen if lysosomal enzymes stop working properly?

Ans:

LYSOSOMAL ENZYMES

If lysosomal enzymes stop working properly, waste materials and damaged cellular components cannot be broken down. This can lead to the accumulation of toxic substances in the cell, causing cell damage and diseases such as "lysosomal storage disorders".

Q.22 Why are the cristae important for cellular respiration?

Ans:

IMPORTANCE OF CRISTAE

The outer membrane of mitochondria is smooth but the inner membrane forms many folds. These folds are called cristae (singular crista).

Importance:

Cristae increase the surface area for respiration. This enhances energy production by providing more space for ATP generation.

Q.23 How are chromatin and chromosomes related?

Ans:

CHROMATIN AND CHROMOSOMES

Chromatin and chromosomes are related because chromatin is the thread-like material made of DNA and proteins in the nucleus, and it condenses to form chromosomes when a cell prepares to divide.

Both carry information for the working of cell.

Q.24 Which type of cell is responsible for sending nerve signals?

Ans:

TYPE OF CELL

Type of Cell:

Neurons are the specialized cells of the nervous system which are responsible for transmitting messages (nerve impulses) throughout the body. To perform this function, they have a unique structure.

Structure of Neuron:

- A neuron consists of a cell body and two types of cytoplasmic extensions.
- Dendrites, the shorter extensions, receive nerve impulses and transmit them to the cell body.
- Axons, the longer extensions, carry nerve impulses away from the cell body.

Q.25 What do mesophyll cells do in plant leaves?

Ans:

MESOPHYLL CELLS

Definition:

Mesophyll cells are the green cells present in leaves.

Structure:

- They contain large number of chloroplasts, which contain the green pigment chlorophyll necessary for capturing light energy.
- Their shape and arrangement in leaves is suitable for maximum absorption of light.

Function:

They are specialized for the process of photosynthesis.

Q.26 How would you define a stem cell?

Ans:

STEM CELL

Definition:

The unspecialized cell (i.e., zygote) that has the ability to differentiate into a variety of specialized cell types is called stem cell.

Examples:

- Hematopoietic stem cell gives rise to blood cells.
- The zygote is an unspecialized cell but it has the ability to make new cells which can differentiate into specialized cells.

Q.27 Name the chemical compounds that make up:
Cell membrane, Fungal cell wall, Plant cell wall, Bacterial cell wall, Ribosomes, Chromosomes

Ans:

CHEMICAL COMPOSITION

Component	Chemical Composition
Cell membrane	Lipids, proteins and carbohydrates.
Fungal cell wall	Chitin
Plant cell wall	Cellulose, hemicellulose, and pectin
Bacterial cell wall	Peptidoglycan (murein)
Ribosomes	Proteins and rRNA
Chromosomes	DNA and histone proteins

Q.28 Label the parts of these cell diagrams?
Consult Q.No.1 and 2 of topic 3.2

EXTENSIVE ANSWER QUESTIONS

Q.1 Explain the fluid mosaic model of the cell membrane.
See Q.no.4 of topic 3.2

Q.2 Describe the structure and functions of the cell wall.
See Q.no.3 of topic 3.2

Q.3 Discuss the components of the nucleus.
See Q.no.6 of topic 3.2

Q.4 Describe the structure and function of lysosome and endoplasmic reticulum.
See Q.no.9 of topic 3.2

Q.5 Describe the formation and function of the Golgi complex.
See Q.no.10 of topic 3.2

Q.6 Describe the structure and functions of the chloroplast.
Consult Q.no.12 of topic 3.2

Q.7 How does turgor pressure develop in a plant cell?
Consult Q.no.13 of topic 3.2

Q.8 Write any four differences between a plant cell and an animal cell.
See Q.no.16 of topic 3.2

Q.9 Describe the concept of division of labour and how it applies in multicellular organisms. Give at least three examples.
See Q.no.2 of topic 3.4

Q.10 Write a note on cell specialization.
See Q.no.1 of topic 3.4

INQUISITIVE ANSWER QUESTIONS

Q.1 What impact might mitochondrial dysfunction or absence have on other organelle's ability to operate in a cell?

Ans:

MITOCHONDRIAL DYSFUNCTION

Mitochondrial dysfunction or absence can greatly affect other organelles because mitochondria provide the **energy** (ATP) needed for most **cellular processes**. Without enough ATP:

Energy-Dependent Processes Fail:

Organelles like the ER, Golgi apparatus, and lysosomes can't perform tasks like **protein folding**, **transport**, or **digestion properly**.

Calcium Balance Disrupts:

Mitochondria help control calcium levels, so their dysfunction affects organelles like the ER that rely on calcium for **signaling**.

Oxidative Stress Increases:
Without mitochondria **detoxifying** harmful molecules, damage can occur to organelles like the nucleus and membranes.

Cell Division Slows:
The lack of energy affects processes like **mitosis**, disrupting proper function of the cytoskeleton and centrosomes.

Q.2 What may happen if the coordination between the ribosomes and the nucleus were to fail, and why is it so important?

Ans: **FAILURE OF COORDINATION**

If the coordination between the ribosomes and the nucleus were to fail, the cell would face several problems because these two structures are essential for protein production:

1. **Protein Synthesis Disruption:**
   - The nucleus provides the **instructions** for making proteins in the form of mRNA.
   - If coordination fails, ribosomes may not receive the correct mRNA or enough mRNA to synthesize the required proteins.
2. **Incorrect or Missing Proteins:**
   - Ribosomes might produce **defective** or incomplete proteins if they don't receive accurate instructions, or certain proteins may not be made at all.
   - This can **disrupt** essential processes like enzyme activity, cell signaling, or structural maintenance.
3. **Cell Function Breakdown:**
   - Proteins are needed for almost all cell functions.
   - Without proper coordination, vital processes like energy production, transport, and repair could stop, leading to cell damage or death.

Importance of Coordination:
- The nucleus and ribosomes work together to ensure the **right proteins** are made at the right time and in the right amounts.
- This coordination is important for maintaining the cell's structure, function, and ability to respond to changes in its environment.
- Without it, the cell cannot survive or carry out its functions properly.

EXTRA CONCEPTUAL

MULTIPLE CHOICE QUESTIONS

1. Which organelle is present in plant cell and absent in animal cells?
(A) Cytoplasm (B) Vacuole
(C) Chloroplast (D) Nucleus

2. Which organelle is present in the center of animal cell?
(A) Vacuole (B) Nucleus
(C) Cell membrane (D) Mitochondria

3. Lignin is present in:
(A) Primary wall (B) Middle lamella
(C) Secondary wall (D) Cell membrane

4. What is the percentage of phospholipids in the cell membrane?
(A) 60-80% (B) 20-50%
(C) 20-40% (D) Trace amount

5. Which is not a feature of cell membrane?
(A) It has cholesterol (B) It acts as a barrier
(C) It helps in cell movement (D) It is semipermeable

6. Which of the following is not found in the cytoplasm?
(A) Mitochondria (B) Nucleus
(C) Chloroplast (D) Vacuoles

7. Ribosomes can be found in:
(A) Lysosomes (B) Cell membrane
(C) Cytoplasm (D) Vacuoles

8. RER is involved in:
(A) Lipid synthesis (B) DNA synthesis
(C) Drugs detoxification (D) Protein synthesis

9. Which is related with the synthesis of steroids?
(A) SER (B) Cell membrane
(C) RER (D) Golgi complex

10. Autophagy is performed by:
(A) Mitochondria (B) Nucleus
(C) Lysosomes (D) Cell membrane

11. The fluid of mitochondria is known as:
(A) Matrix (B) Stroma
(C) Cytoplasm (D) Nucleoplasm

12. The stack of thylakoids is called:
(A) Cristae (B) Leucoplast
(C) Granum (D) Stroma

13. The membrane of plant vacuole is called:
(A) Plasma membrane (B) Tonoplast
(C) Cell sap (D) Cell membrane

14. Food vacuole:
(A) Makes food (B) Stores food
(C) Transport food (D) Contains urea

15. Cell structure is maintained by:
(A) Microtubules (B) Intermediate filaments
(C) Microfilaments (D) Both A and C

16. A flagellum is:
(A) Whip-like (B) Hair-like
(C) Tail-like (D) Motor-like

17. Ribosomes are formed by the combination of proteins and:
(A) DNA (B) RNA
(C) tRNA (D) rRNA

18. Chromatin is made up of:
(A) Chromosomes (B) DNA
(C) DNA + Histones (D) All of these

19. In plants, cell wall helps in the formation of:
(A) Cytoplasm (B) Food
(C) Xylem (D) Oxygen

20. Compared to plant cells, animal cells are generally:
(A) More rigid and stationary (B) Less flexible and mobile
(C) More flexible and mobile (D) Larger in size

21. The site of enzyme synthesis in cells is:
(A) Lysosomes (B) Smooth endoplasmic reticulum
(C) Golgi bodies (D) Ribosomes

22. A red blood cell and a plant root hair cell both have:

(A) Cellulose cell wall (B) Haemoglobin
(C) Large surface area (D) Nucleus

23. The diagrams show cells from different types of tissues (not drawn on scale). Which type of cell contracts when it is stimulated?

(A) (B) (C) (D)

24. Which of the following cell organelles does not contain DNA?

(A) Nucleus (B) Lysosomes
(C) Chloroplast (D) Mitochondria

25. Phospholipids required for cell membrane formation are synthesized in:

(A) Mitochondria (B) Cytoplasm
(C) Cytoplasm (D) Smooth endoplasmic reticulum

26. Cytoskeleton is an important component of eukaryotic cells. Which of the following statement correctly describes cytoskeleton?

(A) All the cytoskeletal structures are made up of same protein
(B) There is no contractile protein in any cytoskeletal component
(C) Cytoskeleton provides mechanical support and has role in cell division
(D) The entire cytoskeleton is present around the cell membrane

27. The shape of normal red blood cells is:

(A) Oval (B) Crescent
(C) Biconvex (D) Biconcave

28. Plastids of different types are correctly represented by:

	Photosynthetic	Pigmented	Food Storage	Colour Variety
(A)	Chloroplasts	Leucoplasts	Chromoplasts	Chloroplasts
(B)	Chromoplasts	Chloroplasts and chromoplasts	Chromoplasts and leucoplasts	Chromoplasts
(C)	Leucoplasts and chloroplasts	Chromoplasts and leucoplasts	Leucoplasts	Chloroplasts
(D)	Chloroplasts	Chloroplasts and chromoplasts	Leucoplasts	Chromoplasts

29. Which of the following statement correctly represents ribosomes?

(A) They are present only in eukaryotic cell
(B) They are produced in the nucleus then migrate to the cytoplasm where they synthesize proteins
(C) They are covered by single membrane
(D) All ribosomes are attached to the inner surface of RER.

SHORT ANSWER QUESTIONS

Q.1 Why mitochondria are known as powerhouse of the cell?

Ans:

POWERHOUSE OF THE CELL

Mitochondria are known as powerhouse of the cell because they are responsible for producing energy from food through aerobic respiration.

Aerobic Respiration:

This process involves the conversion of food (glucose) into ATP, which serves as the energy

currency of the cell.

Need of the Energy:

Mitochondria play a crucial role in generating ATP, which is essential for various cellular functions, including growth, maintenance, and reproduction.

Q.2 What makes red blood cells more suitable for the transport of oxygen?

Ans: **SPECIFICATIONS OF RBCs**

Shape:

RBCs are biconcave disk-shaped cells. They are also enucleated (lacks nucleus). This shape provides more surface area to absorb and release oxygen. It helps to accommodate more haemoglobin.

Lack of Organelles:

As nucleus, mitochondria, endoplasmic reticulum etc. are absent. These cells become very flexible so they can easily pass through blood capillaries.

Q.3 Give the modifications of epidermal cells for;

a) Exchange of gases

b) Absorption of water and minerals

Ans: **MODIFICATIONS OF EPIDERMAL CELLS**

a) Exchange of Gases

In leaves, epidermal cells give rise to Guard cells which regulate the opening and closing of stomata.

b) Absorption of Water and Minerals

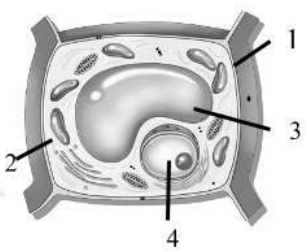
In roots of the plant, epidermal cells form root hairs which increases the surface area to absorb water and minerals from the soil.

Q.4 Following diagram shows a plant cell. Keeping in view the parts labelled 1 to 4, answer the following questions:

a) Give the number indicating the structure which controls the cell activities?

b) Name a biochemical process taking place in part 2.

c) What will happen to cell if part 1 is removed and part 3 is overfilled with water?



Ans:

a) Give the number indicating the structure which controls the cell activities?

The structure which controls the cell activities is represented by number 4, which is nucleus.

b) Name a biochemical process taking place in part 2.

Cytoplasm is represented by part 2. The process of glycolysis takes place here.

c) What will happen to cell if part 1 is removed and part 3 is overfilled with water?

If part 1 (cell wall) is removed and part 3 (vacuole) is overfilled with water, then the cell will become turgid. As there will be no cell wall to protect the cell, the cell will eventually burst.

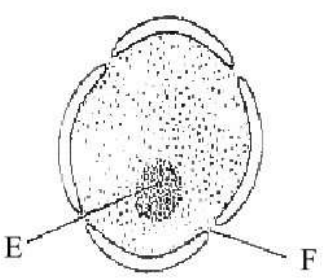
The diagram below represents a nucleus.

a) Name the structure labeled E and F

b) Give the function of F

c) Which cytoplasmic organelles are formed by E?

d) What happens to E during cell division?



Ans:

a) Name the structure labeled E and F

The structure E is nucleolus.

The structure F is nuclear pore.

b) Give the function of F

Nuclear pores serve as gateways by which nucleus communicates with the cytoplasm. Some nutrients and proteins enter the nucleus through these pores and ribosomes and mRNA leave the nucleus.

c) Which cytoplasmic organelles are formed by E?

Nucleolus is the region in nucleus where proteins and ribosomal RNA (rRNA) combines to give rise to Ribosomes.

d) What happens to E during cell division?

It disappears for some time during the cell division.

Q.5 Plasma membrane has two main components according to fluid mosaic model. Which component represents fluid and which components represents mosaic?

Ans:

FLUID-MOSAIC MODEL

According to fluid mosaic model of cell membrane:

- The **phospholipids bilayer** is represented as "fluid" as it gives the membrane its fluidity.
- The **proteins** that are incorporated in this fluid are represented as "mosaic".

Q.6 Which cells in animals and plants do not have a nucleus? How do these cells perform their functions without nucleus?

Ans:

CELLS THAT LACK NUCLEUS

In animal and plants, following cells lack nucleus and still perform their functions.

Red Blood Cells

In animals, red blood cells do not have nucleus. They perform their function without the need of a control center because they are specialized for their oxygen carrying ability in the body, due to haemoglobin in them.

Tracheid Cells

In plants, tracheid cells that are part of xylem tissues do not posses nucleus. They are also called dead cells. They are specialized for their water carrying ability, so do not need a control center.

Q.7 Unripe oranges are green in colour. After ripening their colour changes. Suggest which organelles' number changed in them during ripening.

Ans:

When the oranges ripe and their color changes from green to orange, this is because the number of chloroplasts decreases as the fruit ripens, while the number of chromoplasts increases.

This fact is also true because chromoplast is responsible for making colours other than green, in fruits.

Q.8 Which organelles are abundant in the salivary gland cell? Explain.

Ans:

SALIVARY GLAND CELLS

Salivary gland is responsible for making saliva that helps to lubricate and digest some of food particles, as the saliva also contains enzymes. So, the organelle that is abundant in salivary gland cells is **Golgi apparatus**, because it is involved in the production of enzymes, mucous, and hormones.

STUDENT LEARNING OUTCOMES (SLOs)

SHORT ANSWER QUESTIONS

Q.3 Discuss the concept of Anucleate and Multinucleate Cells. Give one example of each.

Ans:

ANUCLEATE AND MULTINUCLEATE CELLS

Anucleate Cell:

The cells that do not have a nucleus are termed as anucleate cells.

Example:

Mature red blood cells in humans.

Multinucleate Cell:

The cells that have multiple nuclei are called multinucleate cells.

Example:

- Skeletal muscle cells
- Some fungi

Q.4 What is the structural advantage of the central vacuole in plant cells, and how does it differ from the vacuoles in animal cells?

Ans: **ADVANTAGE OF CENTRAL VACUOLE**

Plant Vacuole

In plant cells, a central large vacuole

- Stores water, nutrients, and waste products.
- Maintains turgor pressure.
- Regulates pH and ionic balance.

We can say that it is a defining feature of plant cells that provides critical structural support, water regulation, and compartmentalization functions that are not as prominent in animal cells.

Animal Vacuoles

Animal vacuoles are small and do not play important roles like those in plant cells.

Q.5 Are lysosomes present in plant cells? What critical functions do they perform in animal cells?

Ans: **OCCURRENCE OF LYSOSOMES**

Lysosomes are absent in plant cells. While in animal cells, they perform some important functions.

- Contain enzymes for intracellular digestion.
- Play a significant role in recycling cellular components.
- Plays a defense role against foreign invaders.

Q.4 Differentiate microtubules and microfilaments. (K.B)

Ans: **DIFFERENTIATION**

MICROTUBULES	MICROFILAMENTS
DEFINITION	
Microtubules are unbranched hollow tube-like structures.	Microfilaments are very thin protein fibres.
COMPOSITION	
Microtubules are made up of tubulin protein.	They consist of contractile proteins mainly actin.
FUNCTIONS	
Microtubules give rise to • Spindle fibres • Cilia • Flagella	• They are responsible for the streaming movements of the cytoplasm. • The overall cell movement is also regulated by the microfilaments.

Q.5 What are the two types of mesophyll cells found in plant leaves, and how do their structures relate to their functions?

Ans: **TYPES OF MESOPHYLL CELLS**

There are two kinds of these cells:

- **Palisade Mesophyll**
  Palisade cells are long and packed tightly at the upper part of the leaf.
  Function:
  They are good at absorbing sunlight, which helps with photosynthesis.
- **Spongy Mesophyll**
  Spongy cells are shaped differently, with irregular forms and air spaces.
  Function:
  They help with gas exchange, which is also important for photosynthesis.

Q.6 Describe the unique structure of neurons and explain how it supports their function in the nervous system.

Ans: **STRUCTURE OF NEURON**

Neurons, or nerve cells, have a unique shape.

Structure:

- They have a cell body with a nucleus.
- Branch-like parts called dendrites, that receive electrical signals.
- A long part called an axon, that carries the signals over long distances.

Neurons also communicate with each other at places called synapses.

Function:

This design helps them quickly send information through the nervous system. Thus, the unique structure of neurons directly supports their primary function of processing and conveying information throughout the body.

Q.7 Explain the relationship between the structure and function of liver cells (hepatocytes).

Ans: **LIVER CELLS**

Structure of Liver Cells:

- Liver cells, called hepatocytes, are shaped like a polygon (usually hexagonal) with a nucleus in the middle.
- They are grouped in units called lobules.

Relation of Structure with the Function:

This structural arrangement enables them to do many functions, like

- Cleaning toxins from the blood (detoxification)
- Making proteins
- Producing bile for digestion

They also have tiny finger-like structures called microvilli that increase their surface area, making it easier for them to work on

- Metabolism
- Manage nutrients
- Regulate blood glucose levels

Q.8 How does the division of labor among sub-cellular organelles contribute to the efficiency of cellular processes?

Ans: **DIVISION OF LABOUR AT SUB-CELLULAR LEVEL**

In biology, every part of a cell or an organism has a specific role.

Example:

Inside a cell, organelles like the

- Nucleus give instructions
- Mitochondria create energy
- Ribosomes make proteins
- The endoplasmic reticulum helps make proteins and fats
- The Golgi apparatus packages them
- Chloroplasts in plants turn sunlight into energy

This division of labour within cells across sub-cellular organelles helps everything run efficiently.

Q.9 What is cell specialization, and why it is essential in multicellular organisms?

Ans: **DIVISION OF LABOUR AT SUB-CELLULAR LEVEL**

Definition:

Cell specialization, also known as cell differentiation, is the process during which generic cells transform into specific cells that have unique functions in the body.

Explanation:

All cells in a multicellular organism start from a single cell, the zygote. As this cell divides, the

new cells activate or deactivate different parts of their DNA. This decides what proteins they make and what function they perform.

Example:

In humans, only certain cells in the pancreas produce insulin, even though all cells have the information for it.

MULTIPLE CHOICE QUESTIONS

14. The number of mitochondria in a liver cell are over:

(A) 1200 (B) 1000

(C) 450 (D) 500

15. The number of plasmodesmata in a typical plant cell are:

(A) 500-40,000 (B) 1000-100,000

(C) 20,000 (D) 200,000

16. Liver cells are also called:

(A) Erythrocytes (B) Hematopoietic cells

(C) Hepatocytes (D) Leucocytes

17. Which structure is exclusive to plant cells?

(A) Centriole (B) Lysosome

(C) Chloroplast (D) Nucleus

18. What is the primary role of centrioles in animal cells?

(A) Energy production (B) Protein synthesis

(C) Cell division (D) Photosynthesis

19. Which plastid is primarily involved in the storage of food molecules in plant cells?

(A) Chromoplasts (B) Chloroplasts

(C) Lysosomes (D) Leucoplasts

20. The biconcave disc shape of red blood cells is advantageous for:

(A) Oxygen transport (B) Carbon dioxide storage

(C) Nucleus protection (D) Muscle contraction

21. Liver cells, hepatocytes, are well-suited for various functions due to their:

(A) Hexagonal shape (B) Central nucleus

(C) Striated structure (D) Haemoglobin content

22. What is cell specialization?

(A) The process of cells dividing and multiplying

(B) The process where a cell changes to perform a unique function

(C) The process of creating new cells in a multicellular organism

(D) The process of cell fusion in the body

23. Which of the following organisms is a prokaryote?

(A) Amoeba (B) Mushroom

(C) *Escherichia coli* (D) Human

24. What is the primary pigment responsible for capturing sunlight in chloroplasts?

(A) Carotene (B) Melanin

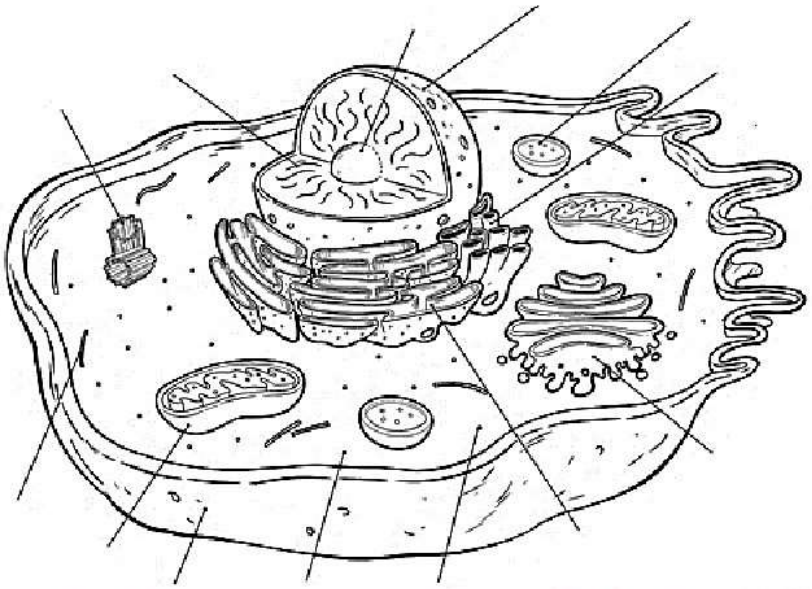
(C) Haemoglobin (D) Chlorophyll

ASSIGNMENT

LET'S DRAW AND LABEL

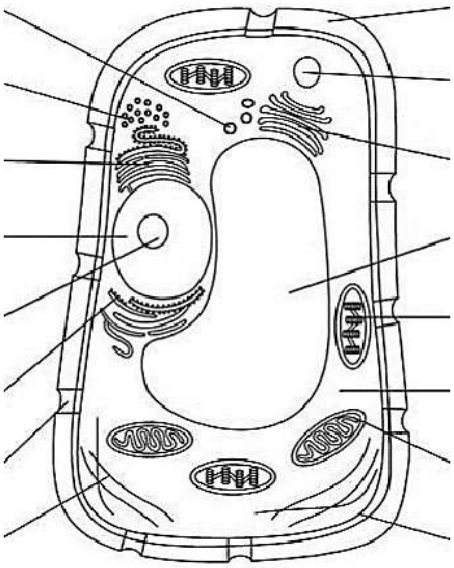
(A) Animal Cell
Instructions:

- Label the diagram carefully
- Search the web for components



(B) Plant Cell
Instructions:

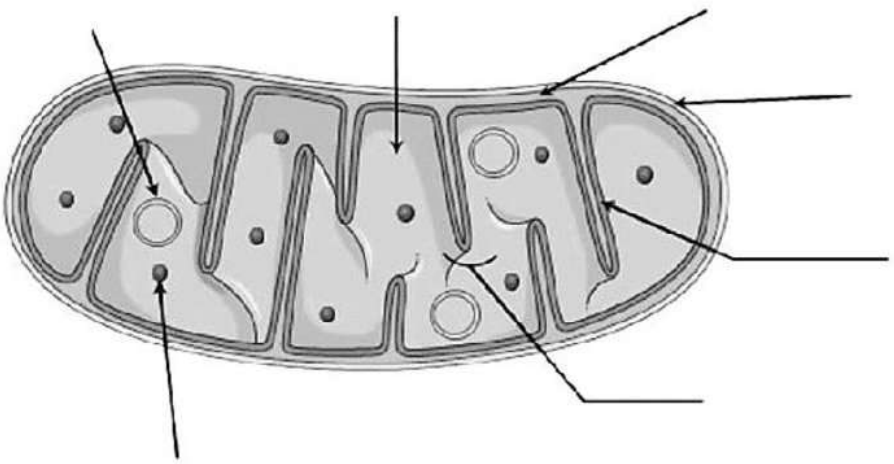
- Label the diagram carefully
- Search the web for components



(C) Mitochondrion

Instructions:

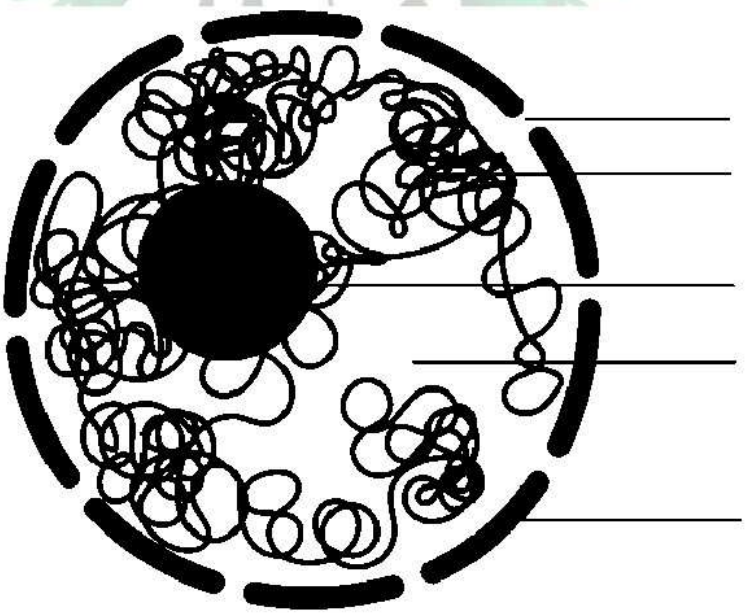
- Label the diagram carefully
- Search the web for components



(D) Nucleus

Instructions:

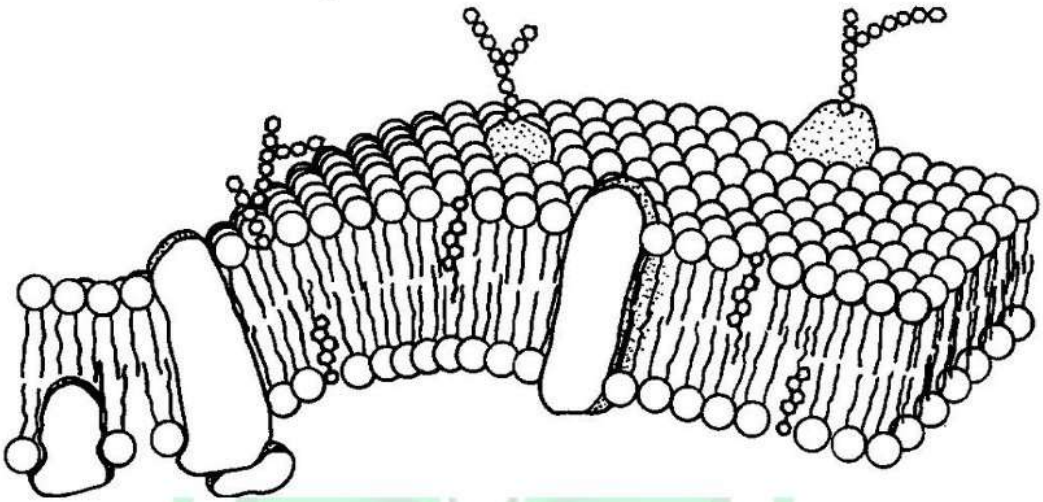
- Label the diagram carefully
- Search the web for components



(E) Cell Membrane

Instructions:

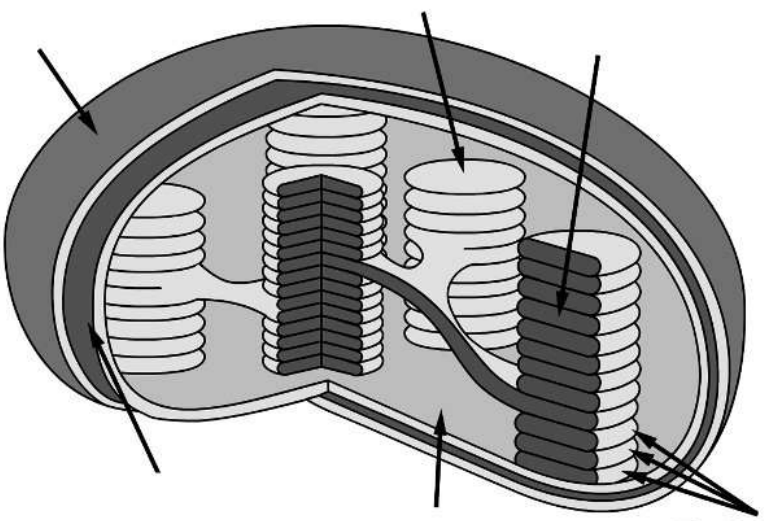
- Label as much components as you can
- Search the web for components



(F) Chloroplast

Instructions:

- Label the diagram carefully
- Search the web for components



Terms to Know	
Autophagy	A process in which cell eats its own organelles which are damaged or no more needed.
Cell	The cell is considered as the basic unit of life because it is the smallest unit of living material.
Cell Membrane	The cell membrane is a highly fluid mixture of phospholipids and proteins.
Nucleus	A nucleus is a double membrane system with pores that communicates with the cytoplasm. It contains genetic information, which is carried by the DNA.
Nucleolus	Nucleolus is a region in the nucleus that is the site for ribosomal RNA synthesis and ribosome assembly.
Mitochondria	Mitochondria are double membrane organelles in which the inner membrane is folded to form cristae, Mitochondrion is the site of aerobic respiration.
Golgi bodies	Golgi bodies are a series of flattened membrane sacs that process, sort, and modify proteins synthesized on the ER, and transport proteins to the plasma membrane, to the outside the cell and the lysosomes.
Endoplasmic Reticulum	The endoplasmic reticulum is a series of internal membranes with many functions, i.e., protein synthesis, lipid synthesis and transport.
Ribosomes	Ribosomes are the site of protein synthesis.
Chitin	A nitrogen-containing structural polysaccharide that forms the exoskeleton of insects and the cell walls of many fungi.
Chromatin	The complex of DNA, protein, and RNA that makes up eukaryotic chromosomes.
Chromosomes	The condensed thread-like structures in the nucleus of cell, composed of chromatin and containing the genes.
Chromosomes	Thread-like structures in the nucleus, which carry the gene.
Contractile vacuoles	A special kind of vacuole found in small freshwater animals or animal like protests to remove out extra water.
Cristae	Small finger-like projections formed by the inner membrane of mitochondria.
Cuticle	Waxy, waterproof layer covering the outer surface of leaves and stems.
Epidermis	The outermost layer of the cells covering plant surfaces, providing protection and regulation water loss.
Exosmosis	Outward movement of water across a semipermeable membrane.
Haemoglobin	Iron contains protein in the red blood cells that combines with oxygen and transports oxygen.
Histones	Proteins on which DNA coils to from chromatins fibers and chromosomes.
Homeostasis	The tendency to maintain a stable, relatively constant internal environment.
Intracellular digestion	A process in which complex substances are digested within the cell.
Mesophyll cells	Cells in the interior of leaves are responsible for photosynthesis.
Oxygen	A gas is essential for aerobic respiration and metabolic processes in plants.
Pectin	A structural fiber is found in the cell wall of plants.
Peptidoglycan	A modified protein or peptide possessing an attached carbohydrate; components of bacterial cell wall.
Photosynthesis	Process by which green plants and some other organisms coverts lights energy into chemical energy, producing oxygen and carbohydrates from carbon dioxide and water.
Prokaryotes	Organism whose cells lack of defined nucleus.
Proteins	A large complex organic compound composed of amino acids.
Protista	Include eukaryotic organisms with unicellular or colonial organization.
Plasmodesmata	Cell wall bears tiny pores through which neighbouring cells form cytoplasmic connections called plasmodesmata.
Root hairs	Tiny, hair-like extensions of root epidermal cells, increasing surface area for nutrient absorption.
Stem cells	Mother cells which give rise to the cells of others types.

Answer Key

TOPIC 3.2

1	D	2	A	3	C	4	B	5	D
6	D	7	D	8	C	9	A	10	B
11	D	12	D	13	A	14	C	15	C
16	A	17	C	18	C	19	B	20	B
21	B	22	A	23	D	24	B	25	C
26	A	27	C	28	D	29	D	30	B
31	C	32	B	33	D	34	A	35	D
36	B	37	B	38	B	39	D	40	C
		41	C	42	C	43	D		

TOPIC 3.4

1	C	2	B	3	C	4	C	5	A
6	A	7	A	8	B	9	A	10	C
11	C	12	D	13	B	14	B	15	A

TOPIC 3.5

1	C	2	B	3	B	4	D	5	D

TEXTBOOK EXERCISE MCQs

1	B	2	B	3	A	4	B	5	C
6	D	7	A	8	B	9	B	10	D
11	B	12	C	13	D	14	C	15	A

EXTRA CONCEPTUAL MCQs

1	C	2	B	3	C	4	C	5	C
6	B	7	C	8	D	9	A	10	C
11	A	12	C	13	B	14	B	15	D
16	A	17	D	18	C	19	C	20	C
21	D	22	C	23	B	24	B	25	D
26	C	27	D	28	D	29	B		