UNIT 03

The Cell

Descriptive Questions

Cell and Its Structure

Q.1. What do you know about cell and its discovery? 09403001

Introduction

Ans: The cell is the basic unit of life. Cells are the building blocks of living organisms, including plants, animals, and humans. Every living thing, from the smallest bacterium to the largest whale, is made of cells.

Size of Cells

i. 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. e.g. the size of RBCs is 8μm.

ii. Some cells are large enough to be seen with naked eye e.g., the egg cell of ostrich, a unicellular green algae Acetabularia, and a unicellular giant Amoeba.

Discovery of Cell and Nucleus

i. The basic structure of a cell was discovered by a curious scientist Robert Hooke. In 1665, using a simple microscope, Hooke examined a thin slice of cork and discovered tiny, box like structures that he called "cells." He could not study the details of the internal structure of cell.

ii. However, in the 19th century the quality of microscope improved. In 1831, while studying plant cells under microscope, Robert Brown observed the "nucleus". After that, many organelles were discovered in coming years.

Types of Cells

There are two basic types of cells:

1. Prokaryotic cell
2. Eukaryotic cell

Eukaryotic cell are more complex than the prokaryotic cells.

Q.2. Differentiate between animal and plant cell. 09403002

Ans. The difference between animal and plant cell is given below:

i. Animal Cell

An Animal cell has membrane bounded nucleus and organelles. Animal cells have no cell wall and chloroplast.

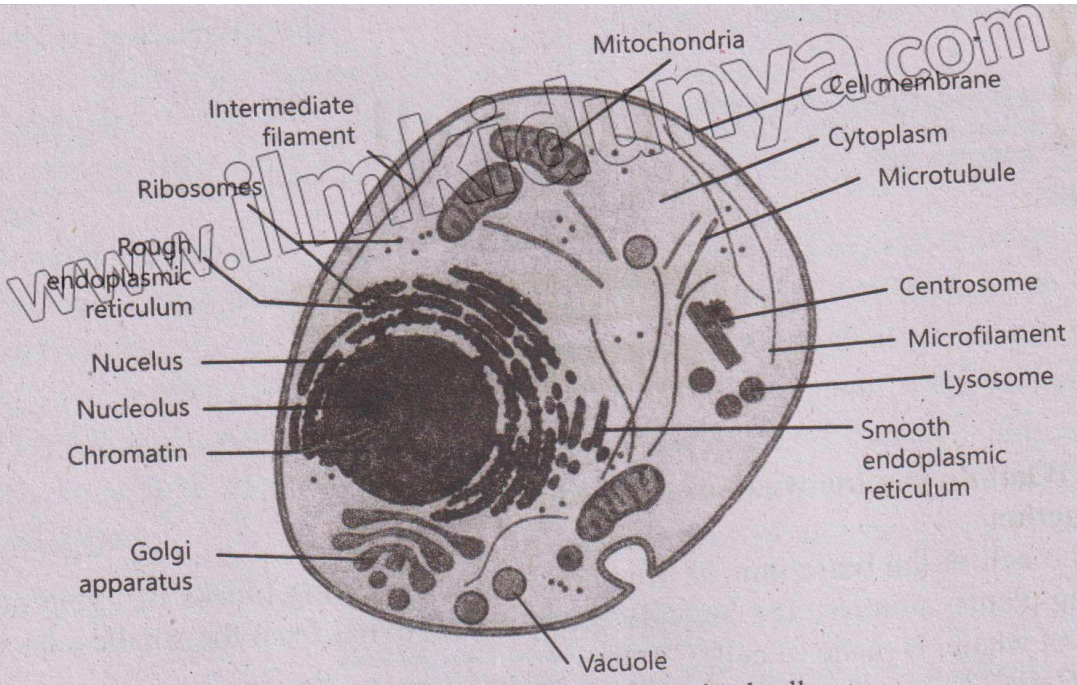


Figure 3.1: Structure of an animal cell

ii. Plant Cell

A plant cell is different from animal cell in having cell wall, single large vacuole and plastids.

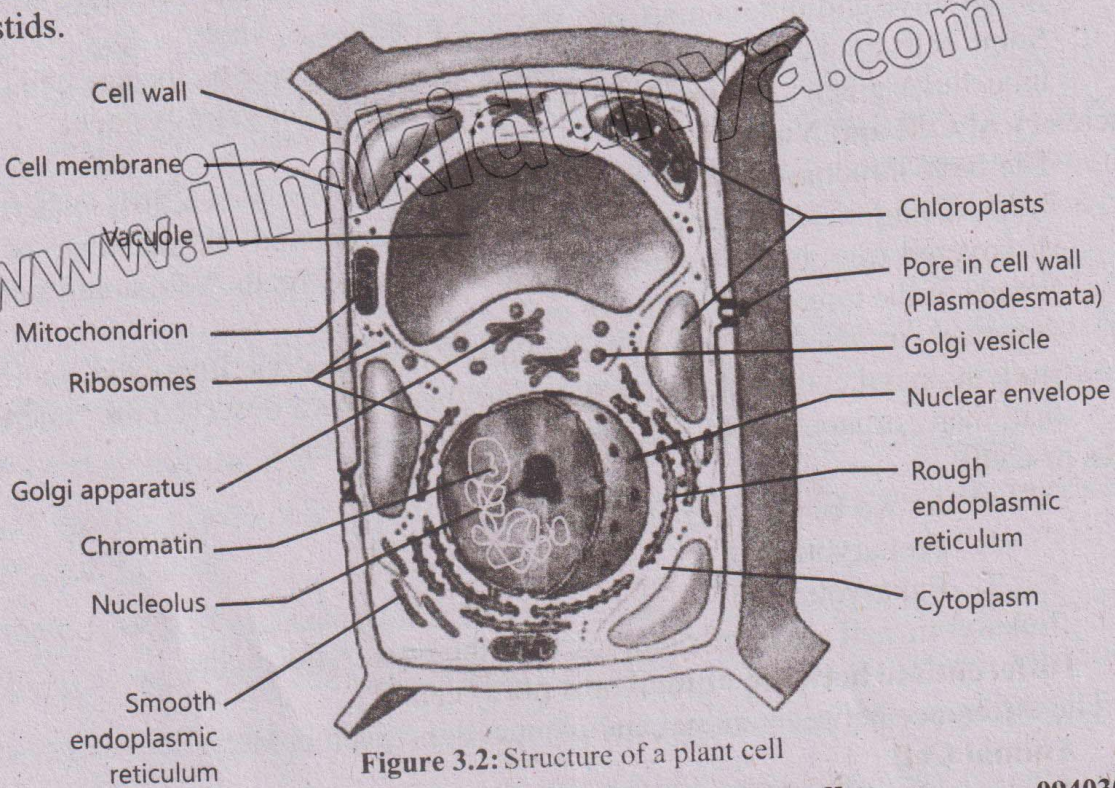


Figure 3.2: Structure of a plant cell

Q.3. Describe the structure and the functions of the cell wall. **09403003**

Ans: Introduction

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

Functions

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

Structure

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

i. 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.

ii. **Middle lamella** holds together the primary walls of adjacent cells. It contains magnesium, calcium and pectin.

iii. 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.

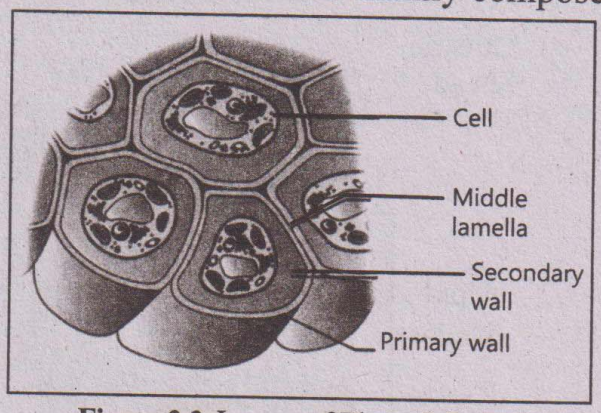


Figure 3.3 :Layers of Plant Cell Wall

Chemical Composition

i. The cell wall of algae is also composed of cellulose.

ii. The cell wall of prokaryotes is made of peptidoglycan (a single molecule made of amino acids and sugars).

iii. The cell wall of fungi is made of chitin.

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

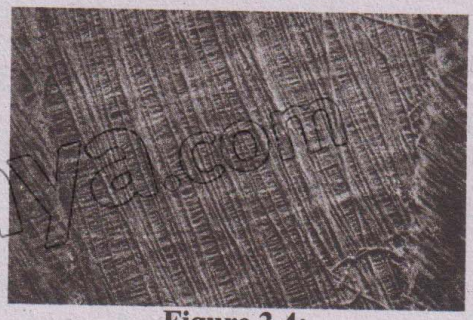


Figure 3.4:
Cellulose fibres in primary wall

Q.4. Explain the fluid mosaic model of the cell membrane. **09403004**

Ans: Introduction

All cells have a thin and elastic cell membrane around the cytoplasm of both plant and animal cells.

Function

It is selectively-permeable. It allows very few molecules to pass through it while blocks many other molecules.

Structure

i. Cell membrane is composed of proteins and lipids and small quantities of carbohydrates.

ii. The structure of cell membrane is described as fluid-mosaic model.

iii. According to this model the lipids make a fluid-like bilayer in which protein molecules are submerged.

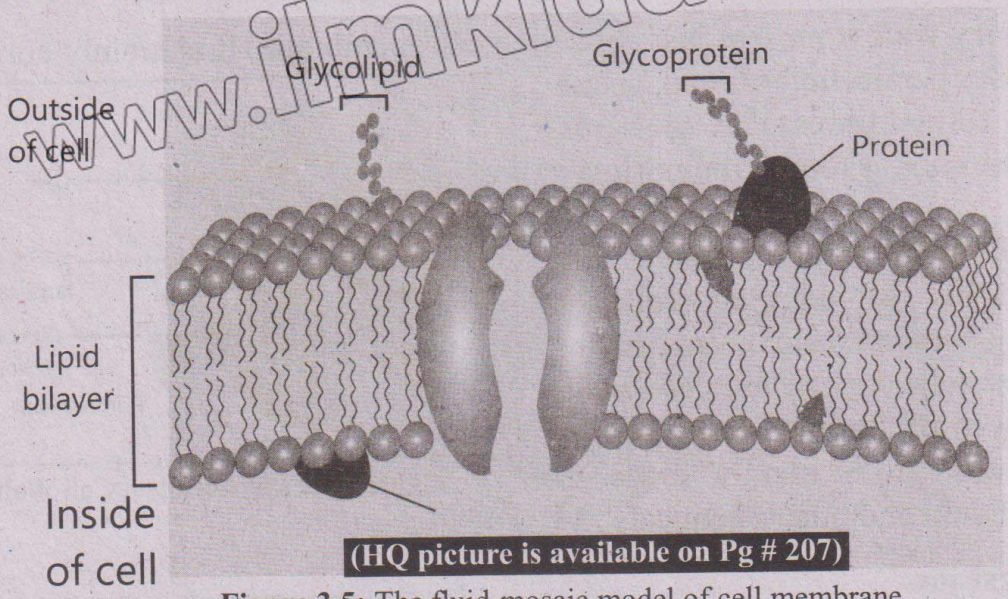
iv. The lipids and proteins can move laterally. Due to these movements, the pattern or "mosaic," of lipids and proteins constantly changes.

v. Carbohydrates are joined with proteins (in the form of glycoproteins) or with lipids (in the form of glycolipids).

vi. Another lipid, cholesterol, is attached with the inner sides of the lipid bilayer. Cholesterol is absent in the membranes of most bacteria.

Examples

In eukaryotic cell many organelles e.g. mitochondria, chloroplasts Golgi apparatus and endoplasmic reticulum are also bounded by membrane.



(HQ picture is available on Pg # 207)

Figure 3.5: The fluid-mosaic model of cell membrane

Q.5. Write a note on cytoplasm. **09403005**

Ans: Introduction

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

Chemical Composition

i. It's a complex mixture of water, proteins, enzymes, salts, and other substances.
ii. The liquid part of the cytoplasm that includes molecules and small particles, such as ribosomes, but not membrane-bound organelles is called cytosol.

Functions

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

Q.6. Describe the components of the nucleus. **09403006**

Ans: Introduction

All eukaryotic cells have a prominent nucleus. 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

i. Nuclear Envelope
The nucleus is bounded by a double membrane known as nuclear envelope.

ii. Nuclear Pores
It is semi-permeable and has many small pores called nuclear pores.

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

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

v. Chromatin

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

vi. Chromosomes

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

i. The nucleus serves as the cell's "control center".

ii. It oversees cellular activities by directing the production of proteins.

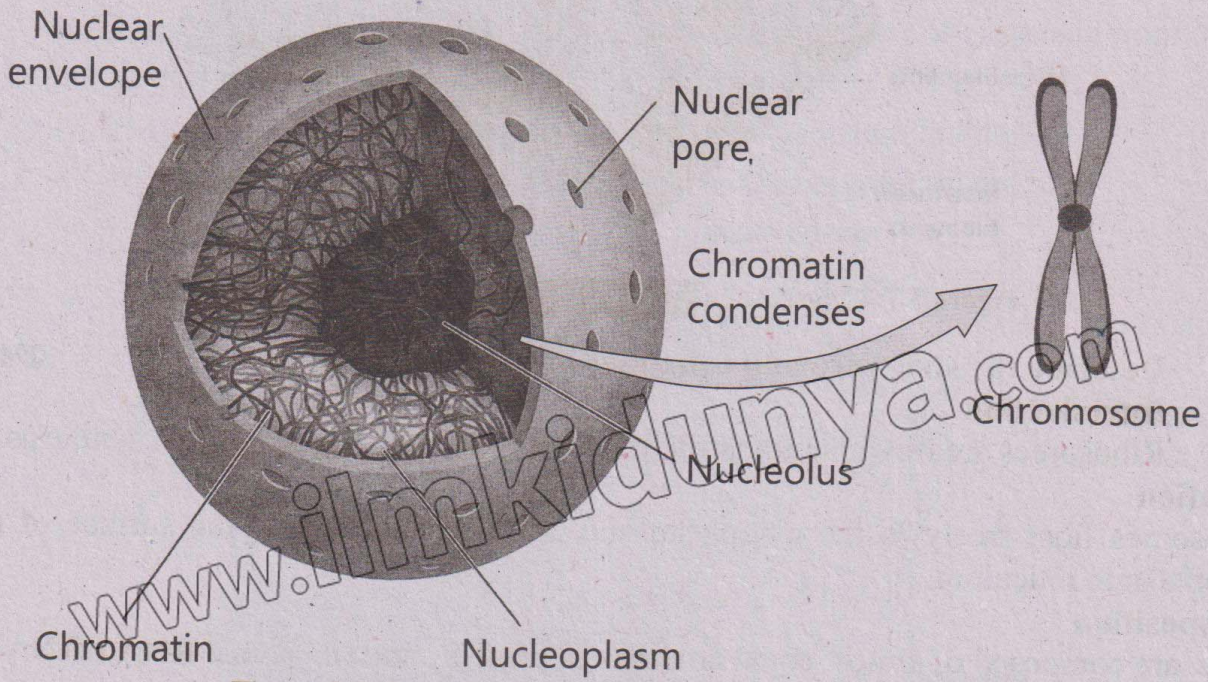


Figure 3.6: Structure of Nucleus and Chromosome

No Prominent Nucleus in Prokaryotic Cells

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

Q.7. Write a note on cytoskeleton. **09403007**

Ans: Introduction

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

Structure

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

i. Microtubules

Microtubules are hollow tubes made up of 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.

ii. 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.

iii. 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.

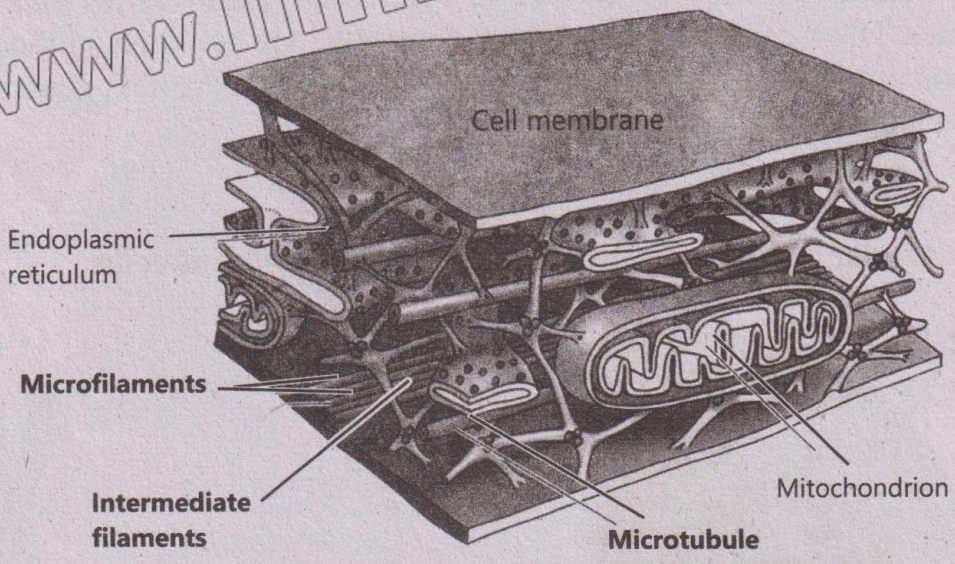


Figure 3.7: Cytoskeleton **(HQ picture is available on Pg # 207)**

Q.8. Describe the structure and functions of the ribosome. **09403008**

Ans: **Introduction**

Ribosomes are tiny granular structures. They are the sites of protein synthesis.

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).

Structure

Ribosomes are not bounded by membranes and so are also found in prokaryotes. Eukaryotic ribosomes are slightly larger than prokaryotic ones. Each ribosome consists of two subunits.

Functions

i. Ribosomes are the sites of protein synthesis.
ii. The two subunits of a ribosome unite during the process of protein synthesis.
iii. When a ribosome has finished its work, its subunits get separated again.

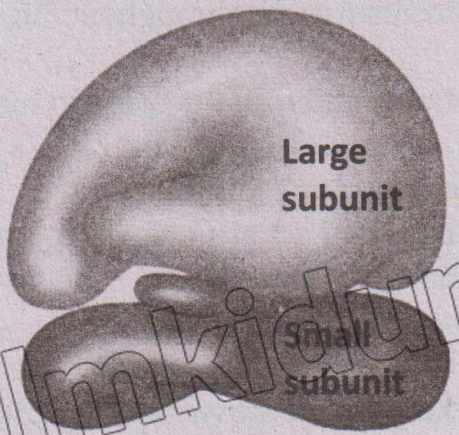


Figure 3.8: Ribosome

Q.9. Describe the structure and function of endoplasmic reticulum. 09403009

Ans: Introduction

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

Types

There are two types of endoplasmic reticulum.

(a) Rough Endoplasmic Reticulum (RER)

i. Numerous ribosomes are attached on its surface.
ii. RER serves the function in protein synthesis.

(b) Smooth Endoplasmic Reticulum (SER)

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

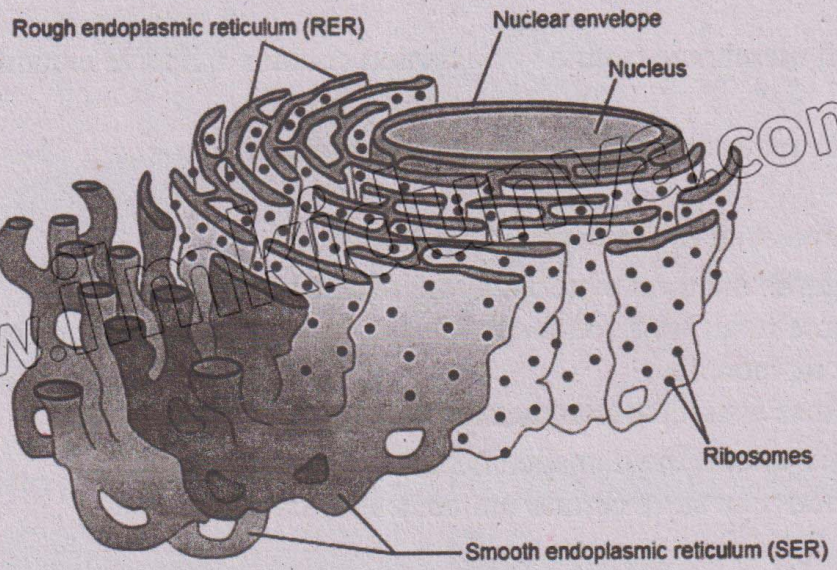


Figure 3.9: Smooth and Rough Endoplasmic Reticulum

Q.10. Describe the formation and function of Golgi apparatus. 09403010

Ans: Introduction

In 1898, an Italian physician Camillo Golgi discovered a set of flattened sacs in the cytoplasm.

Formation

These flattened sacs, called cisternae, are stacked over each other and make a structure known as Golgi apparatus.

Location

It is found in both plant and animal cells.

Function

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

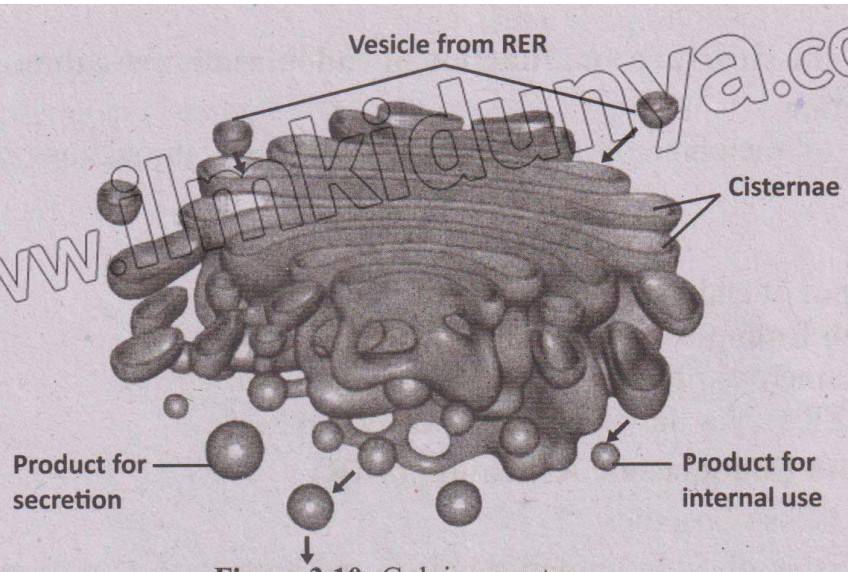


Figure 3.10: Golgi apparatus

Q.11. Describe the structure and functions of lysosomes. **09403011**

Ans: Discovery

Lysosomes were discovered by Belgian scientist Christian Rene de Duve.

Definition

These are small membrane-bound vesicles that contain digestive enzymes.

Location

Lysosomes are predominantly found in animal cells.

Functions

i. Lysosomes bud off from Golgi apparatus.
ii. Cell engulfs the food material in the form of food vacuole.
iii. Lysosome fuses with food vacuole and its digestive enzymes break down the food present in vacuole.
iv. Lysosomes also have enzymes for breaking cellular wastes.
v. They also engulf the damaged organelles and break them.
vi. Lysosomes can store certain molecules for later use.

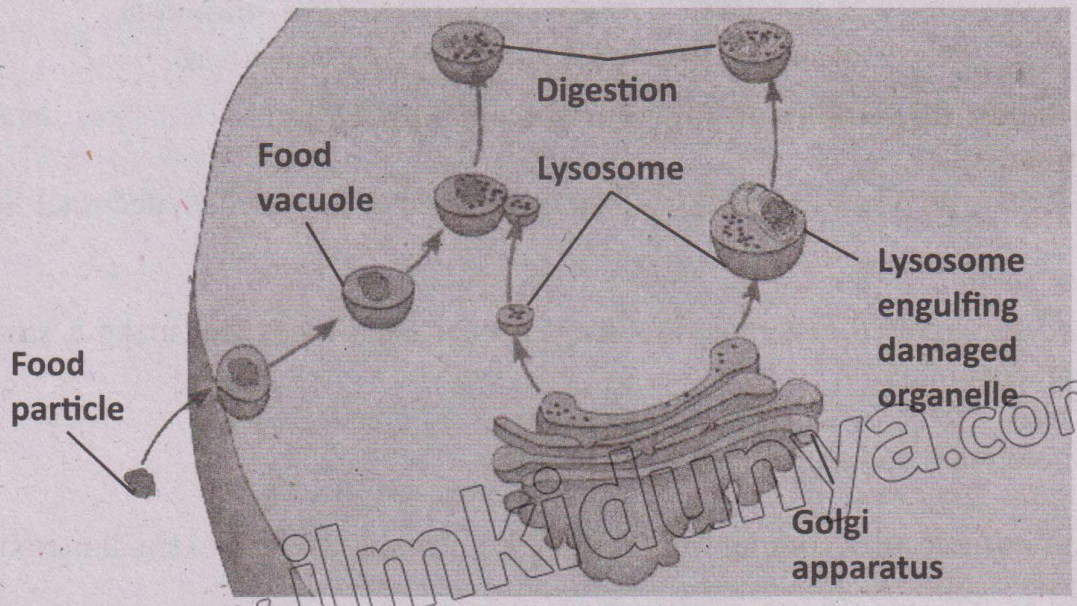


Figure 3.11: Formation and function of lysosome

Q.12. Describe the structure and functions of mitochondria. 09403012

Ans: Functions

i. Mitochondria (Singular: mitochondrion) are the "powerhouse" of the cell because they produce energy.

ii. They perform the reactions of aerobic respiration in which oxygen is used to break food (glucose) to release energy (ATP - adenosine triphosphate).

Structure

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

ii. 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.

iii. The inner fluid-like material is called **matrix**.

iv. Mitochondria contain their own DNA and ribosomes. They can multiply within the cell on their own.

Ribosomes of Mitochondria

The ribosomes of mitochondria are more similar to prokaryotic ribosomes than to eukaryotic ribosomes

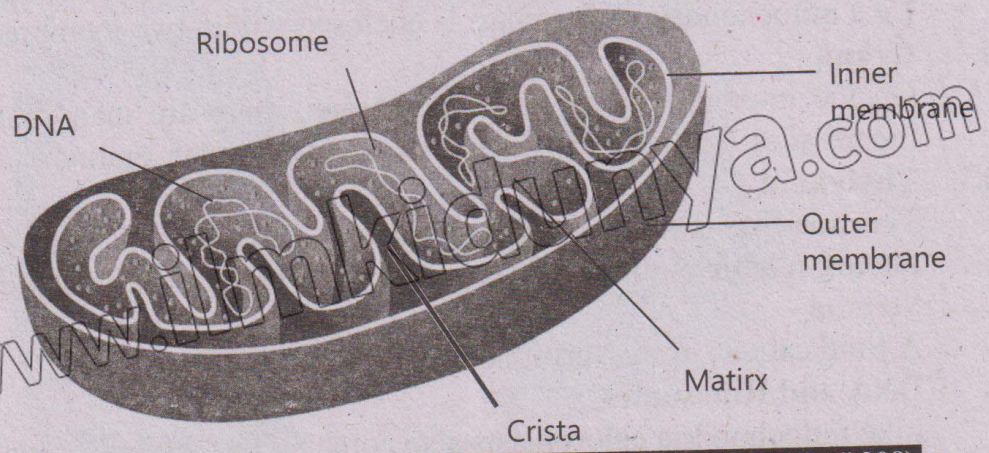


Figure 3.12: A Mitochondrion **(HQ picture is available on Pg # 208)**

Q.13. Describe the structure and functions of plastids. 09403013

Ans: Introduction

Plastids are present in the cells of plants and photosynthetic protists (algae).

Types.

There are three main types of plastids:

1. Chloroplasts
2. Chromoplasts
3. Leucoplasts.

1. Chloroplasts

Introduction

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

Function

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

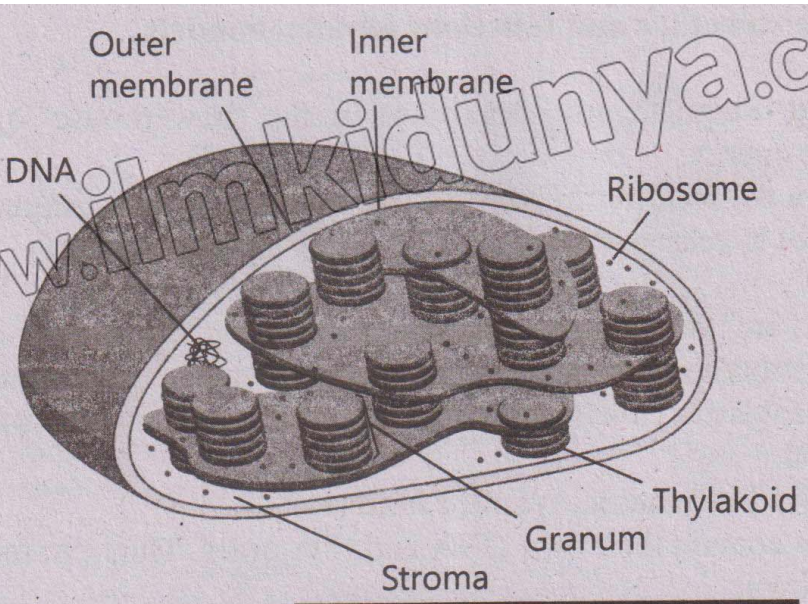


Figure 3.13: A Chloroplast **(HQ picture is available on Pg # 208)**

Structure

i. **Membranes**
Like mitochondria, chloroplast is enclosed within two membranes.

ii. **Grana**
On the internal side of inner membrane, there are many sets of stacked membranes. These stacks are called grana (singular, granum).

iii. **Thylakoid**
The sac-like structures which make a granum are called thylakoids. Photosynthetic pigments are present on the surface of thylakoids.

iv. **Stroma**
A fluid called stroma surrounds the thylakoids.

v. **DNA and Ribosomes**
Like mitochondria chloroplasts also contain DNA and ribosomes.

2. **Chromoplasts**

Introduction
Chromoplasts are the plastids that contain pigments such as carotenoids.

Location
These pigments are associated with bright colours and are present in the cells of flower petals and fruits.

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

3. **Leucoplasts**

Introduction
Leucoplasts are plastids that have no pigments.

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

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

Q.14. Write a note on vacuoles. 09403014

Ans: Introduction

These are single membrane-bound sacs filled with fluid.

Vacuoles in an Animal Cell

i. Animal cell may have many small temporary vacuoles.
ii. They contain water and food substances.
iii. Some freshwater organisms like amoeba and sponges have contractile vacuoles which collect and pump out extra water and other wastes.
iv. Some cells ingest food by forming food vacuoles. Food vacuoles also store food.

Vacuole in a Plant Cell / How does turgor pressure develops in plants cells?

i. Most mature plant cells have a single, large, central vacuole.
ii. It is formed by the fusion of many small vacuoles.
iii. 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).
iv. Due to this large central vacuole, the nucleus 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**.

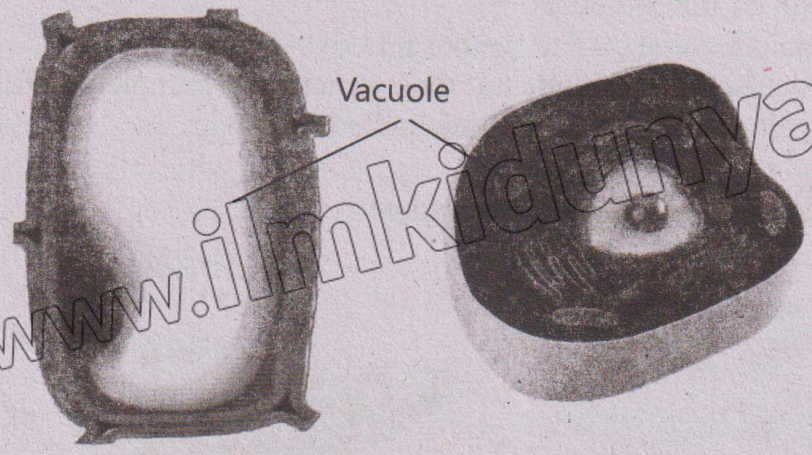


Figure 3.14: Vacuole in plant and animal cell

Q.15. Write a note on centrioles. 09403015

Ans: Introduction

Centrioles are barrel-shaped organelles found in the cells of animals and most protists. They are absent in prokaryotes, higher plants and fungi. In animal cell there is a pair of centrioles, both centrioles are at right angle to each other. This 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).

Functions

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

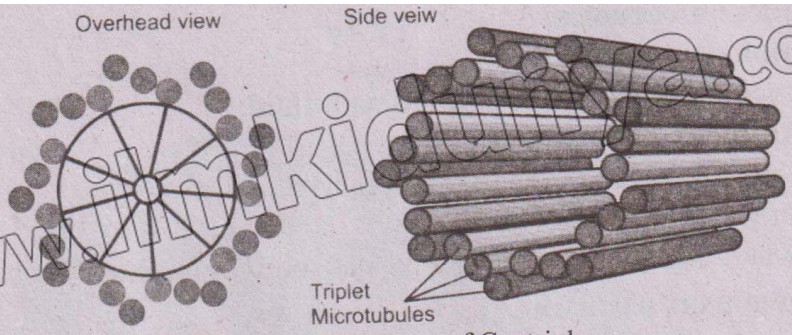


Figure 3.15: Structure of Centriole

Q.16. Write about cilia and flagella. 09403016

Ans: Introduction

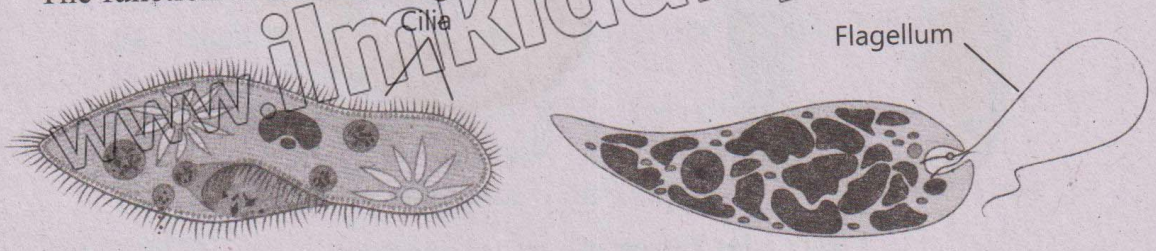
Some cells have thin, hair-like projections called cilia (singular cilium) and flagella (singular flagellum).

Structure

i. Cilia are short in length and are usually numerous in number, while flagella are longer but less in number.
ii. Eukaryotic cilia and flagella consist of nine pairs of microtubules which surround a single central pair of microtubules.
iii. Cilia and flagella are connected to the basal body.
iv. Prokaryotic cells also have flagella but their structure is completely different.
v. Prokaryotic flagella are made of a protein called flagellum.

Function

The function of cilia and flagella is movement.



Paramecium Euglena

Q.17. Write comparison between plant and animal cell in the form of table. 09403017

Ans:

	Component	Description	Location	Function
Animal And Plant Cell	Cytoplasm	Jelly-like, with organelles in it	Between plasma membrane and nuclear envelope	Provides the site to cell organelles, site 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 centre in animal cells, on a side in plant cells	Controls cell division; controls cell activities

Plant Cells only	Cell wall	A tough, non-living outer layer made of cellulose	Around the outside of plasma membrane	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

Structural Advantages of Plant and Animal Cells

Q.18. Describe the structural advantages of plant and animal cells. **09403018**

Ans: 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

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

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

iii. **Large Central Vacuole**
The large central vacuole stores water, nutrients, and waste products. It provides turgor pressure that maintains cell shape.

iv. **Plasmodesmata**
Plant cells are interconnected by plasmodesmata, channels that allow direct communication and transport of substances between cells.

Advantages of Animal Cell Structures

i. **Centrioles**
Animal cells have centrioles which make spindle fibres. This ensures the accurate distribution of chromosomes during cell division.

ii. **Lysosomes**
They contain lysosomes, filled with digestive enzymes that break down waste materials. Lysosomes contribute to cellular cleanup and recycling.

iii. **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.

iv. **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.

Q.19. Write a note on cell specialization. / State the relationship between structure and function of epidermal cells, mesophyll cells, red blood cells, neurons, muscle and liver cells. 09403019

Ans: 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. 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.

Some examples of the specialized cells of plants and animals are given below:

Cell Specialization in Plants

1. Mesophyll Cells

Introduction

These are green cells present in leaves.

Function

i. They are specialized for photosynthesis.

ii. They contain large number of chloroplasts, which contain the green pigment chlorophyll necessary for capturing light energy.

iii. Their shape and arrangement in leaves is suitable for maximum absorption of light.

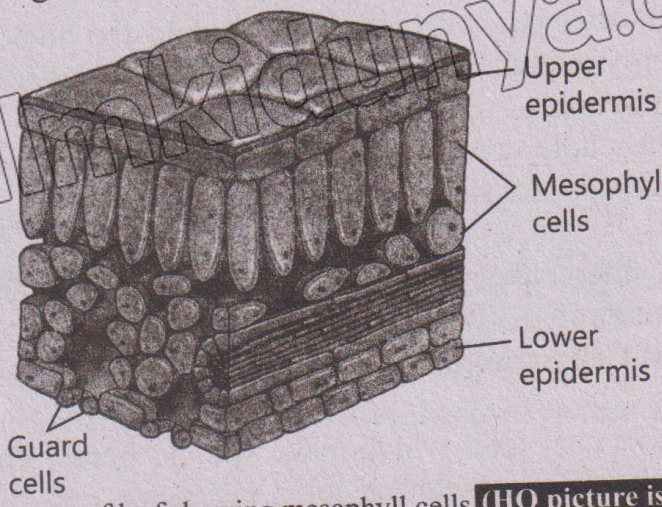


Figure 3.16: Internal Structure of leaf showing mesophyll cells **(HQ picture is available on Pg # 207)**

2. Epidermal Cells

They are flat and tightly packed cells that make the outer layer (epidermis) of plant organs.

Functions

i. Epidermis protects the internal tissues.

ii. Modified cells of epidermis also perform other functions.

Examples

(a) Epidermis of root contains root hair cells. These cells make extensions called root hairs to absorb water and minerals from soil.

(b) Similarly, lower epidermis of leaves contains guard cells which regulate opening, and closing of stomata.

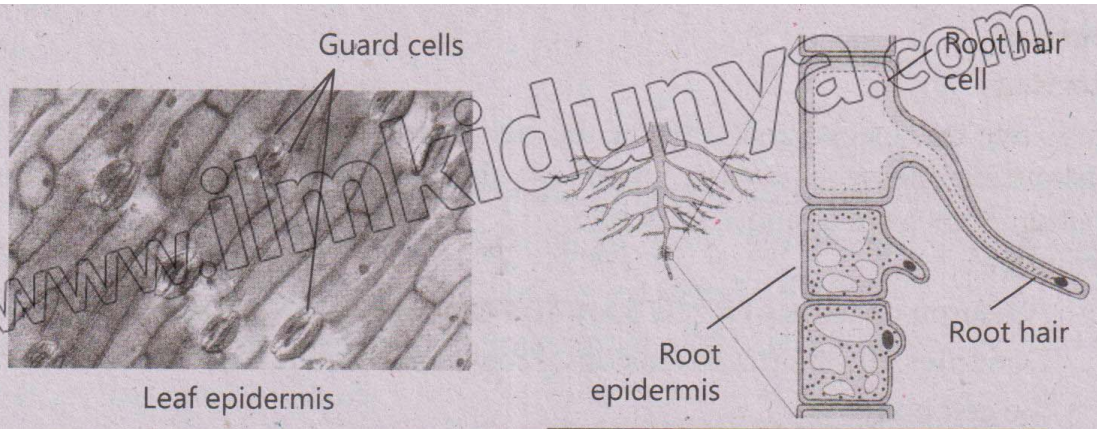


Figure 3.17: Epidermis of leaf and root **(HQ picture is available on Pg # 207)**

Cell specialization in Animals

3. Muscle Cells

Introduction

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

Types

i. Skeletal Muscle Cells

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

ii. Cardiac Muscle Cells

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.

iii. Smooth Muscle Cells

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.

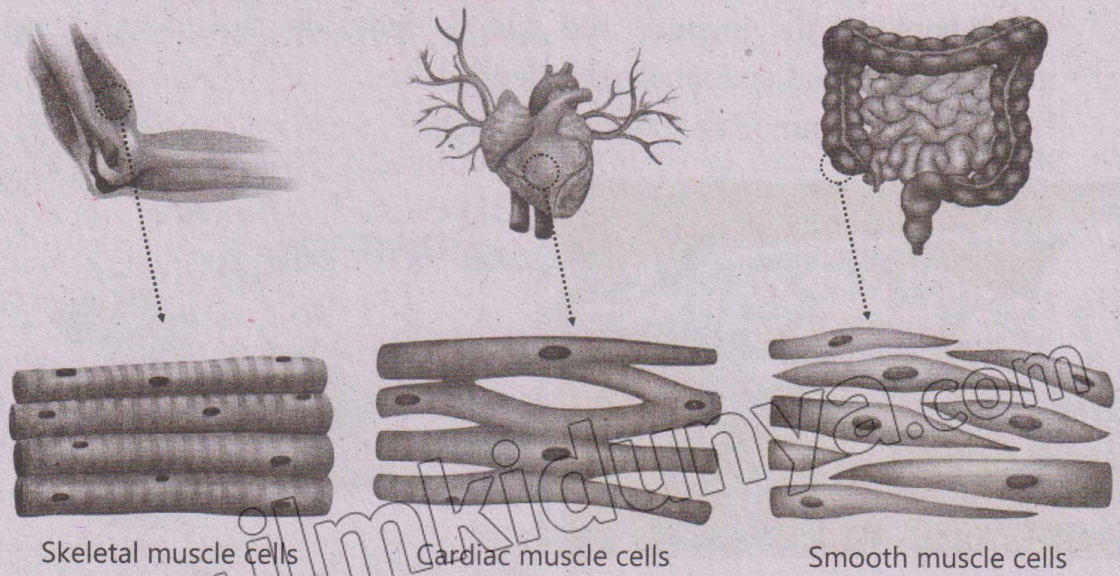


Figure 3.18: Muscle cells

4. Neurons

Functions

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

i. A neuron consists of a cell body and two types of cytoplasmic extensions.

ii. Dendrites, the shorter extensions, receive nerve impulses and transmit them to the cell body.

iii. Axons, the longer extensions, carry nerve impulses away from the cell body.

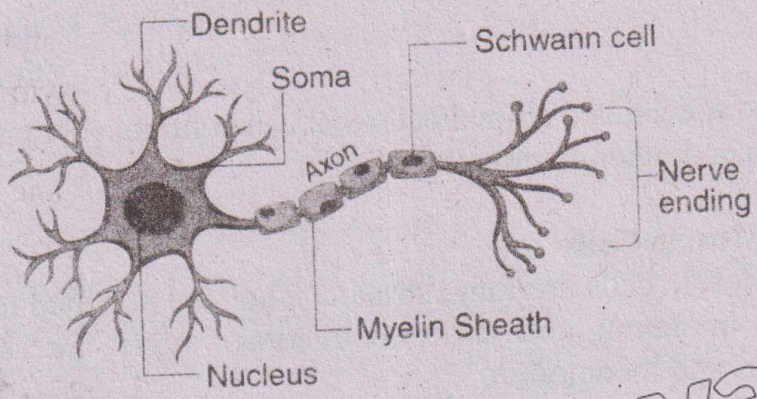


Figure 3.19: Neuron

5. Red Blood Cell (Erythrocyte)

Functions

These blood cells are specialized to carry oxygen from the lungs to the body's tissues.

Shape

i. They are biconcave disk-shaped cells.

ii. This shape provides more surface area to absorb and release oxygen.

iii. They are filled with haemoglobin that actually carries oxygen.

iv. In mammals, the mature red blood cells do not contain nucleus, mitochondria, and endoplasmic reticulum etc.

v. It helps to accommodate more haemoglobin.

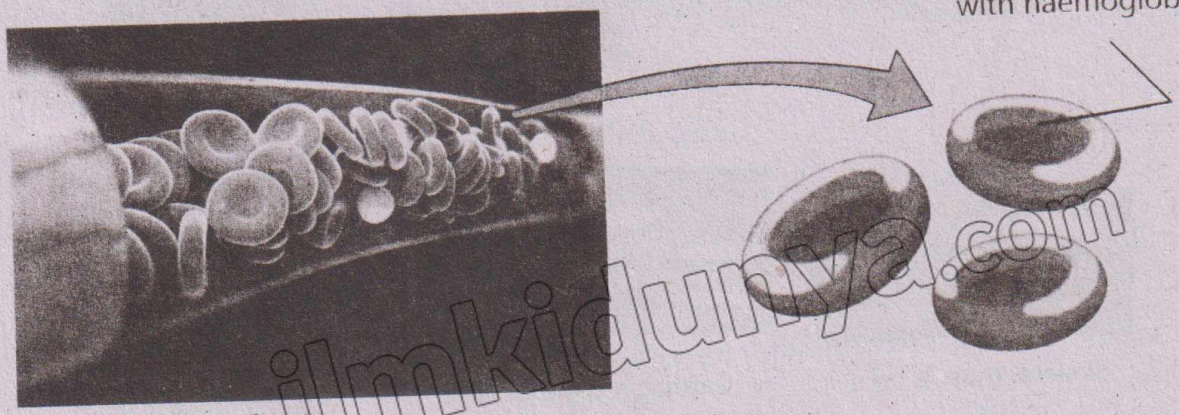


Figure 3.20: Red blood cells

6. Liver Cell

Introduction

They are also called hepatocytes.

Functions

i. 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.

ii. They have prominent nuclei for maximum activities required for making enzymes and other proteins.

iii. Large number of mitochondria provide the necessary ATP for energy-intensive processes.

iv. Expansive network of SER helps for extensive detoxification and lipid synthesis.

v. There are large number of peroxisomes which contain enzymes to neutralize toxic substances.

vi. Small ducts are present between liver cells which collect and transport their secretion (bile) to the Gall bladder.

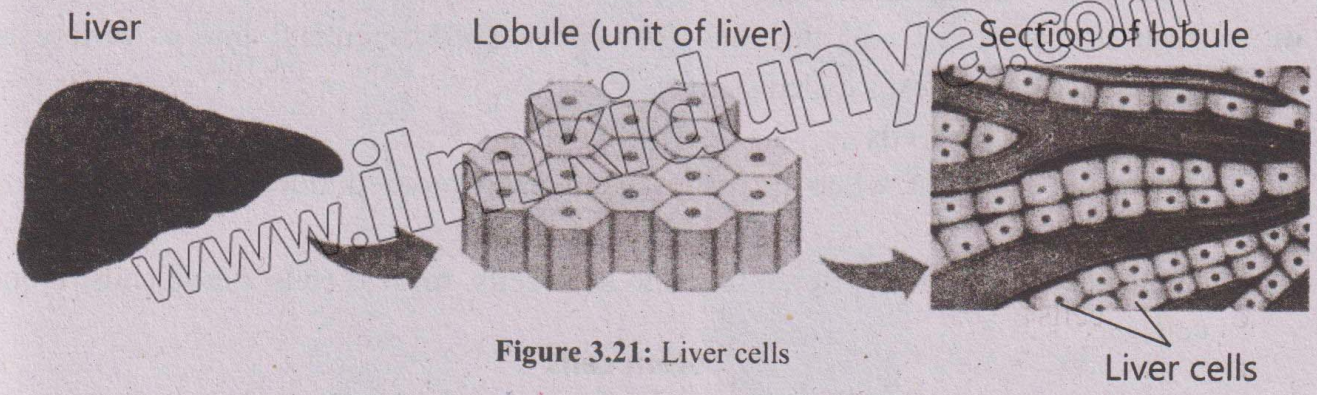


Figure 3.21: Liver cells

Division of Labour Within and Across Cells

Q.20. Describe the concept of division of labour and how it applies in multicellular organisms. Give at least three examples. / What is division of labour? Give examples. **09403020**

Ans: Introduction

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

Introduction

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

Mitochondria generate energy, endoplasmic reticulum synthesizes proteins and lipids, and

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

Division of Labour Across Cells

Introduction

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. **Example**, muscle cells are specialized for contraction and movement, nerve cells for transmitting messages, and red blood cells for carrying oxygen. This intercellular specialization allows complex organisms to perform a wide range of functions.

Stem Cells

Q.21. Write a note on stem cells. **09403021**

Ans: Zygote: An unspecialized cell

i. In sexually reproducing organisms, all different types of cells arise from a single cell (zygote).

ii. The zygote is an unspecialized cell but it has the ability to make new cells which can differentiate into specialized cells.

Stem Cells - Specialized Cells

iii. Such unspecialized cell that has the ability to differentiate into a variety of specialized cell types is called stem cell.

Division of Stem Cells

iv. During development, when the earliest stem cell (zygote) divides, it makes different cell lines.

v. The cells of each line differentiate into skin cells, muscle cells, nerve cells, blood cells etc.

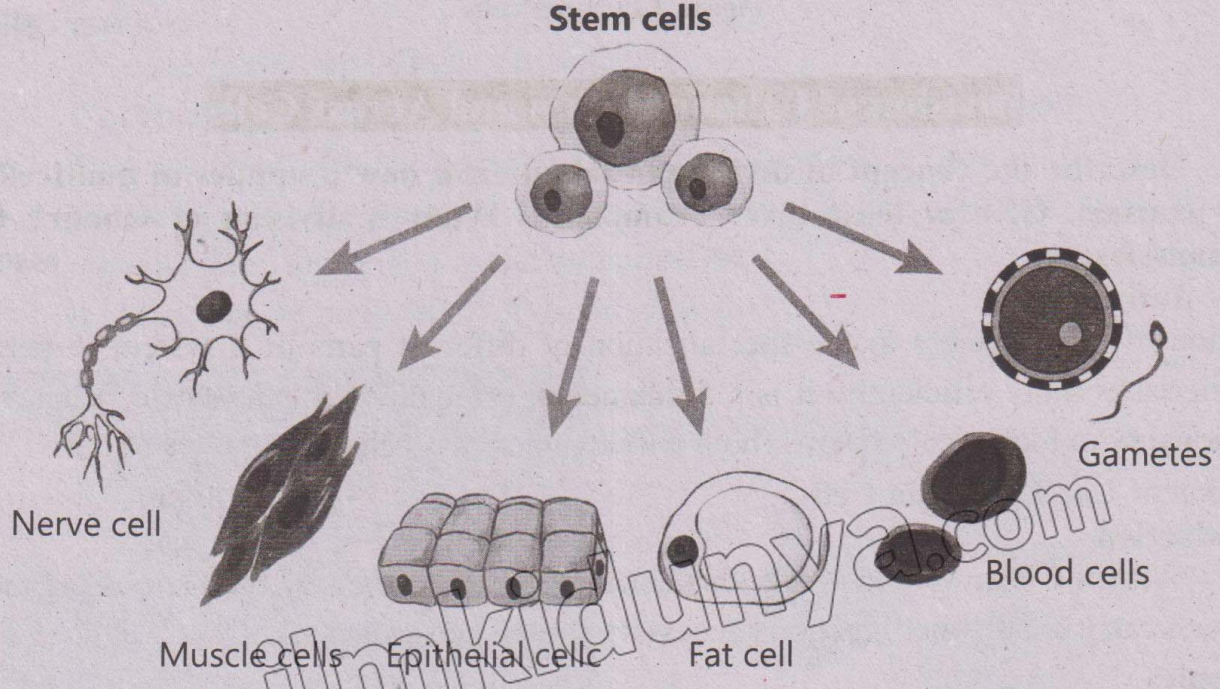


Figure 3.22: Differentiation of stem cell into specialized cells **(HQ picture is available on Pg # 208)**

Functions of Stem Cells

Stem cells also 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.

Examples

(a) Stem cells present in skin help in wound healing.

(b) Stem cells present in liver also help it to repair after damage.

(c) Stem cells present in the bone marrow differentiate to make different types of blood cells and immune cells.

(d) 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.

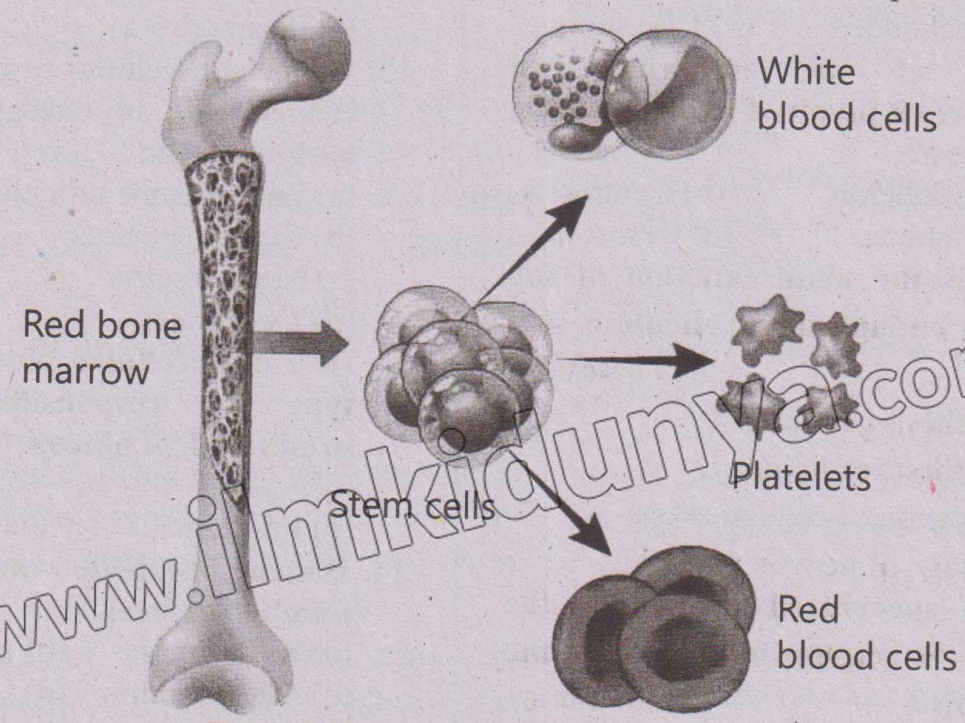


Figure 3.23: Stem cell of blood cells

Multiple Choice Questions (Exercise)

1. **The process of cellular respiration occurs in:** 09403022
   (a) Nucleus
   (b) Mitochondria
   (c) Ribosomes
   (d) Golgi apparatus
2. **The smooth endoplasmic reticulum (SER) is primarily involved in the synthesis of:** 09403023
   (a) Proteins
   (b) Lipids
   (c) Carbohydrates
   (d) Nucleic acids
3. **Ribosomes are composed of:** 09403024
   (a) RNA and protein
   (b) DNA and protein
   (c) Carbohydrates and lipids
   (d) RNA and carbohydrates
4. **What is the primary function of ribosomes?** 09403025
   (a) Energy production
   (b) Protein synthesis
   (c) Lipid synthesis
   (d) DNA synthesis

5. **Which cell organelle is involved in packaging and modifying proteins?** 09403026

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

6. **Which cell organelle is responsible for breaking down waste materials?** 09403027

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

7. **Which of the following cell structures is involved in maintaining cell shape?** 09403028

(a) Cytoskeleton (b) Centrioles
(c) Nucleus (d) Lysosome

8. **What is the main function of the smooth endoplasmic reticulum in a cell?** 09403029

(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?** 09403030

(a) Nucleoplasm (b) Nucleolus
(c) Chromatin (d) All above

10. **What is the main function of the nuclear pores?** 09403031

(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?** 09403032

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

12. **Which sub-cellular organelle plays a crucial role in energy production within the cell?** 09403033

(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?** 09403034

(a) Xylem (b) Phloem
(c) Epidermal (d) Mesophyll

14. **Which organelle can double its number by itself?** 09403035

(a) Ribosomes (b) Lysosomes
(c) Mitochondria (d) Golgi apparatus

15. **Which of these are present on the surface of rough endoplasmic reticulum?** 09403036

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

Multiple Choice Questions (Additional)

Cell and Its Structure

16. **A network of channels extending from cell membrane to nuclear membrane is called:** 09403037

(a) Centriole
(b) Endoplasmic reticulum
(c) Ribosomes
(d) Centrosome

17. **The site of enzyme synthesis in cells is** 09403038

(a) Lysosome
(b) Smooth endoplasmic reticulum
(c) Golgi bodies
(d) Ribosomes

18. **Which of the following cell organelles does not contain DNA?** 09403039
(a) Nucleus (b) Lysosomes
(c) Chloroplast (d) Mitochondria

19. **Phospholipids are required for cell membrane formation are synthesized in:** 09403040
(a) Mitochondria
(b) Cytoplasm
(c) Endoplasmic reticulum
(d) Smooth endoplasmic reticulum

20. **Cytoskeleton is an important of eukaryotic cells. Which of the following statement correctly describes cytoskeleton?** 09403041
(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.

21. **Which of the following statement correctly represents ribosomes?** 09403042
(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

22. **Cell walls are found in these organisms, except for.** 09403043
(a) Plants
(b) Animals
(c) Bacteria
(d) Fungi

23. **The chloroplast functions in.** 09403044
(a) ATP synthesis
(b) Protein synthesis
(c) Photosynthesis
(d) DNA replication

24. **Which plastid is primarily involved in the storage of food molecules in plant:** 09403045
(a) Chromoplasts
(b) Chloroplasts
(c) Leucoplasts
(d) Lysosomes

25. **The stacked membranous structure in the chloroplast is:** 09403046
(a) Thylakoids (b) Stroma
(c) Granum (d) Intergranum

26. **The membranous structure in the chloroplast is:** 09403047
(a) Thylakoids (b) Stroma
(c) Granum (d) Intergranum

27. **The type of plastids present in fruits are:** 09403048
(a) Chloroplasts (b) Chromoplasts
(c) Leucoplasts (d) All of the above

28. **The type of plastids present in roots are:** 09403049
(a) Chloroplasts (b) Chromoplasts
(c) Leucoplasts (d) All of the above

29. **Single membrane bounded organelles having strong digestive enzymes are:** 09403050
(a) Ribosomes (b) Lysosomes
(c) Chromosomes (d) Nucleosomes

30. **The organelle which provides energy to the cell:** 09403051
(a) Golgi apparatus (b) Ribosome
(c) Mitochondria (d) Nucleus

31. **Inside the nucleus, granular material is called:** 09403052
(a) Cytoplasm
(b) Protoplasm
(c) Nucleoplasm
(d) Cell sap

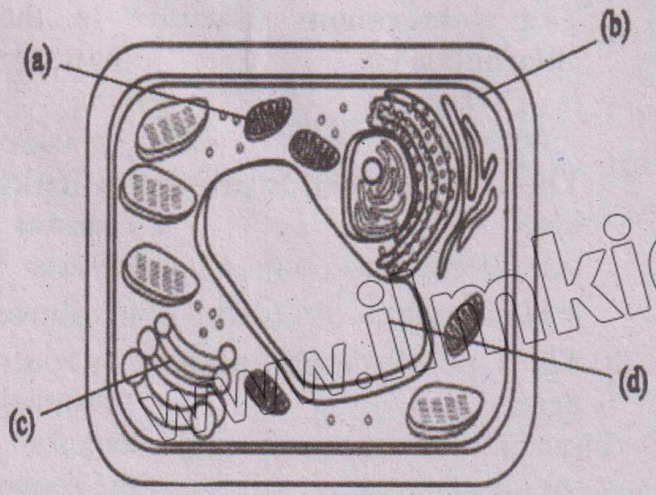
32. **Cell wall is present in the cells of:** 09403053

(a) Fungi only
(b) Plants only
(c) Plants and prokaryotes only
(d) All of the above

33. **Which organelles are covered with a double membrane?** 09403054

(a) Ribosomes (b) Vacuoles
(c) Centrioles (d) Mitochondria

34. **The diagram shows a plant cell which of the labelled structure is responsible for energy to the cell?** 09403055



35. **Which of following organisms is a prokaryote?** 09403056

(a) Amoeba (b) Mushroom
(c) *Escherichia coli* (d) Human

Structural Advantages of Plant and Animal Cells:

36. **Which structure is exclusive to plant cells?** 09403057

(a) Centriole (b) Lysosome
(c) Chloroplast (d) Nucleus

37. **What is the primary role of centrioles in animal cells?** 09403058

(a) Energy production
(b) Protein synthesis
(c) Cell division
(d) Photosynthesis

38. **What is the primary pigment responsible for capturing sunlight in chloroplasts?** 09403059

(a) Melanin (b) Chlorophyll
(c) Haemoglobin (d) Carotene

39. **Plastids of different types are correctly represented by:** 09403060

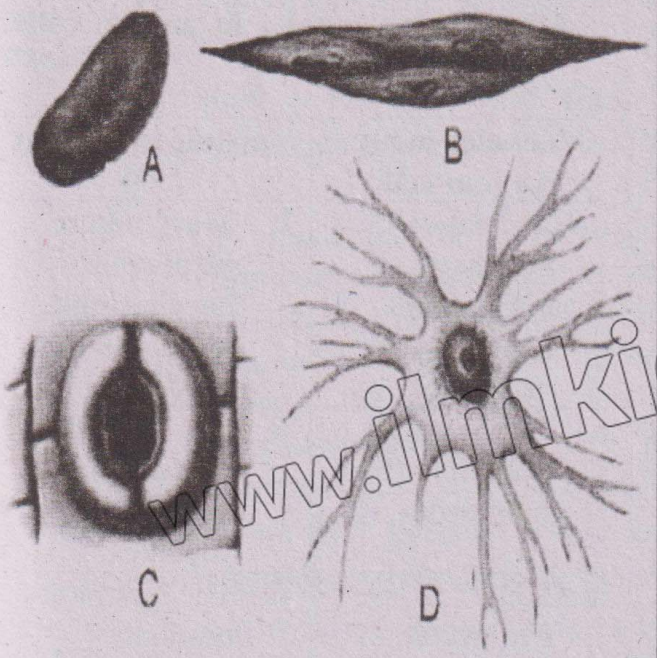
	Photsynthetic	Pigmented	Food storage	Colour variety
(a)	Chloroplasts	Leucoplasts	Chromoplasts	Chloroplasts
(b)	Chromoplasts	Chloroplasts and Chromoplasts	Chromoplasts and Leucoplasts	Chromoplasts
(c)	Leucoplasts and chloroplasts	Chromoplasts and leucoplasts	Leucoplasts	Chloroplasts
(d)	Chloroplasts	Chloroplasts and chromoplasts	Leucoplasts	Chromoplasts

Cell Specialization

40. A red blood cell and a plant root hair cell both have: 09403061

(a) Cellulose cell wall
(b) Haemoglobin
(c) Large surface area
(d) Nucleus

41. The diagrams show cells from different types of tissues (not drawn on scale). Which type of cell contracts when it is stimulated? 09403062



42. The shape of normal red blood cells is: 09403063

(a) Oval (b) Crescent
(c) Biconvex (d) Biconcave

43. The biconcave disc shape of red blood cells is advantageous for: 09403064

(a) Oxygen transport
(b) Carbon dioxide storage
(c) Nucleus protection
(d) Muscle contractions

44. Liver cells, hepatocytes, are well-suited for various functions due to their: 09403065

(a) Hexagonal shape
(b) Central nucleus
(c) Striated structure
(d) Haemoglobin content

45. What is cell specialization? 09403066

(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

Answer Key

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
16	b	**17**	d	**18**	b	**19**	d	**20**	c
21	b	**22**	b	**23**	c	**24**	c	**25**	c
26	a	**27**	b	**28**	c	**29**	b	**30**	c
31	c	**32**	d	**33**	d	**34**	a	**35**	c
36	c	**37**	c	**38**	b	**39**	d	**40**	c
41	b	**42**	d	**43**	a	**44**	a	**45**	b

Short Answer Questions (Exercise)

Q.1. What are the main functions of cell membrane. 09403067

Ans: i. It is selectively-permeable
ii. It allows very few molecules to pass through it while blocks many other molecules.

Q.2. What key role does the Golgi apparatus play in eukaryotic cells? 09403068

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

Q.3. How do lysosomes contribute to the cell's functioning? 09403069

Ans:
Functions of Lysosomes
i. Lysosomes bud off from Golgi apparatus.
ii. Cell engulfs the food material in the form of food vacuole.
iii. Lysosome fuses with food vacuole and its digestive enzymes break down the food present in vacuole.
iv. Lysosomes also have enzymes for breaking cellular water.
v. They also engulf the damaged organelles and break them.
vi. Lysosomes can store certain molecules for later use.

Q.4. Which organelle detoxifies harmful substances and breaks down lipids? 09403070

Ans:
i. Smooth endoplasmic reticulum involved in lipid metabolism.
ii. It also detoxifies the harmful chemicals that have entered the cells.

Q.5. What is the smooth endoplasmic reticulum responsible for? 09403071

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

Q.6. How do the vacuoles in plant cells differ from vacuoles in animal cells? 09403072

Ans:

Vacuoles in an Animal cell	Vacuole in a Plant Cell
i. Animal cell may have many small temporary vacuoles.	i. Most mature plant cells have a single, large, central vacuole.
ii. They contain water and food substances.	ii. It is formed by the fusion of many small vacuoles.
iii. Some freshwater organisms like amoeba and sponges have contractile vacuoles which collect and pump out extra water and other wastes.	iii. The membrane of plant vacuole is called tonoplast and the sap inside plant vacuole is called cell sap.
iv. Some cells ingest food by forming food vacuoles. Food vacuoles also store food.	iv. It is a watery solution of salts.

Q.7. What could happen if lysosomal enzymes stop working properly? 09403073

Ans: If lysosomal enzymes stop working properly, they do not digest food and cells accumulate waste and eventually die.

Q.8. Why are the cristae important for cellular respiration? 09403074

Ans: Cristae are important for cellular respiration because they increase the surface area of the inner mitochondrial membrane which allows the cell to produce more energy.

Q.9. How are chromatin and chromosomes related? 09403075

Ans:

i. Chromosomes are composed of chromatin and chromatin is a fibrous mass made up of DNA and proteins.

ii. Chromatin material condenses during cell division to form chromosomes.

iii. Chromosomes are visible only during cell division while during interphases (non-dividing phase) of cell they are in the form of thread like structures known as chromatin.

Q.10. Which type of cell is responsible for sending nerve signals? 09403076

Ans: Neurons are the specialized cells of nervous system which are responsible for sending nerve signals (nerve impulses) throughout the body.

Q.11. What do mesophyll cells do in plant leaves? 09403077

Ans: Funtion of mesophyll

i. They are specialized for photosynthesis.

ii. They contain large number of chloroplasts, which contain the green pigment chlorophyll necessary for capturing light energy.

iii. Their shape and arrangement in leaves is suitable for maximum absorption of light.

Q.12. How would you define a stem cell? 09403078

Ans:

i. Unspecialized cells that have ability to differentiate into a variety of specialized cell types is called stem cell.

ii. The zygote is an unspecialized cell but it has the ability to make new cells which can differentiate into specialized cells.

Q.13. Name the chemical compounds that make up: 09403079

(a) Cell membrane
(b) Fungal cell wall
(c) Plant cell wall
(d) Bacterial cell wall
(e) Ribosomes
(f) Chromosomes

Ans:

(a) Cell membrane is composed of proteins and lipids and small quantities of carbohydrates.

(b) The cell wall of fungi is made of chitin.

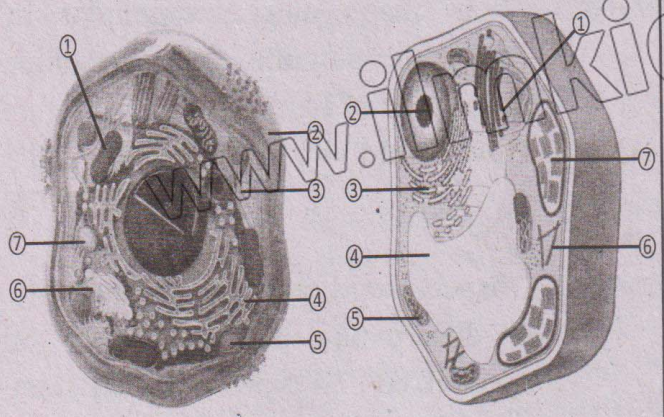
(c) Plant cell wall is made of cellulose.

(d) The cell wall of prokaryotes is made of peptidoglycan.

(e) Ribosomes are composed of proteins and ribosomal RNA (rRNA).

(f) Chromosomes are composed of proteins and DNA.

Q.14. Label the parts of these cell diagrams? 09403080



Animal cell Plant cell

Ans:

Animal Cell	Plant Cell
1. Mitochondria	1. Golgi apparatus
2. Cell membrane	2. Nucleus
3. Cytoskeleton	3. Rough endoplasmic reticulum
4. Smooth endoplasmic reticulum	4. Vacuole
5. Lysosome	5. Mitochondria
6. Golgi apparatus	6. Cytoskeleton
7. Vacuole	7. Chloroplast

Short Answer Questions (Additional)

Cell and Its Structure

Q.15. Why mitochondria are known as power house of the cell? 09403081

Ans: Mitochondria produce energy in the form of ATP that is why they are called power house of cell.

Q.16. Select the structures which are present in all cells of all kingdoms. Write one function of each selected structure. Cell membrane; Nucleus; Chromosomes; Cytoplasm; Ribosomes; RER; SER" Golgi apparatus; Lysosome; Mitochondria; Centriole; Cilia; Flagella; Cell wall; Cytoskeleton; Vacuole; Plastids. 09403082

Ans: Following structures are present in all cells of all kingdoms.

Structures present in all cells	Functions
1. Cell membrane	It stops the cell contents from escaping and also controls the substances which are allowed to enter or leave, the cell.
2. Chromosome	It contains DNA which is the genetic material of the cell.
3. Cytoplasm	It contains all the organelles. Many biochemical reactions take place in it.
4. Ribosomes	Ribosomes are the sites of protein synthesis.

Q.17. What is chloroplast? 09403083

Ans: Chloroplast is a type of a plastid bound by a double membrane. It is found in plant cells. Chloroplasts are the sites of photosynthesis in eukaryotes. They contain chlorophyll, the green pigment necessary for photosynthesis.

Q.18. What are Golgi apparatus? 09403084

Ans: It was discovered by Italian scientist Camillo Golgi in 1898. Golgi apparatus is also known as Golgi complex. It modifies the materials coming from rough ER and enclose them into golgi vesicles.

Q.19. What is mitochondrion? 09403085

Ans: Mitochondria are spherical, rod-like or elongated tiny organelles.

It produce energy for the cell.

Structure

Under EM a mitochondrion is a double membrane structure. The outer membrane is smooth. The inner membrane is folded to form cristae. Cristae provide a much greater area. Mitochondrial solution is called matrix.

Q.20. What do you know about nucleus? 09403086

Ans: It is located in central region in animal cells. Nucleus consists of a double nuclear membrane, nucleoplasm, nucleolus and chromosomes. It acts as control center of the cell.

Structure

Nuclear envelope: The surface of the nucleus is bounded by a double nuclear membrane called nuclear envelope. The nuclear membrane has many pores.

Nucleoplasm: The fluid inside the nucleus is called nucleoplasm.

Nucleolus: The darkly stained region in the nucleus is called nucleolus.

Chromosomes: The thread like structures in the nucleus are called chromosomes.

Chemical Composition of Chromosomes: Chemically chromosomes consist of deoxyribonucleic acid (DNA) and protein.

Centromere: The centromere is a constriction in chromosome.

Cell Specializaion

Q.21. What makes red blood cells more suitable for the transport of oxygen? 09403087

Ans: Red blood cells have a noticeable biconcave disc shape which means they are curved inward on both sides. This shape gives them more surface area and carry oxygen and carbon dioxide more efficiently.

Q.22. Give the modifications of epidermal cells for: 09403088

(a) Exchange of gases

(b) Absorption of water and minerals.

Ans:

(a) There are special epidermal cells on leaves called guard cells. These cells surround small opening called stomata and help to control gas exchange and transpiration from the plants.

(b) In roots, certain epidermal cells extend into long "roots hairs" that vastly increase the surface area for water and nutrient absorption from the soil.

Inquisitive Questions

Q1. What impact might mitochondrial dysfunction or absence have on other organelles' ability to operate in a cell? 09403089

Ans: Mitochondria produce energy (ATP) needed for all cellular activities, called power house of cell. Without functional mitochondria, the cell lacks energy, disrupting processes in other organelles like the **endoplasmic reticulum (ER)** and **Golgi apparatus**, which need ATP to function. They disrupted the ion balance especially calcium regulation slowing down protein synthesis. Mitochondrial dysfunction also weakened the cell defense, waste management, harming other organelles and overall cell health. This can trigger **apoptosis** lead to diseases, impaired cell function, or even cell death.

Q2. What may happen if the coordination between the ribosomes and the nucleus were to fail and why is it so important? 09403090

Ans: If the nucleus and ribosomes don't work together properly, problems can happen because the nucleus gives instructions for making proteins, and ribosomes are responsible for protein synthesis. Without coordination, ribosomes cannot produce the proteins needed for cell growth and repair, leading to malfunctioning of cell processes. Proteins control most cellular activities like enzyme production, transport, and cell division. It causes disrupted cell function triggering diseases like cancer or neurodegenerative disorders. So, lack of coordination between the ribosomes and the nucleus might lead to cell malfunction or death.