CELL AND TISSUE

The Cell

◈ Introduction

A cell the structural and functional unit of life. It is the building block of which all living organisms are made, and the smallest unit of life capable of all the living functions. It is defined as a mass of protoplasm bounded by a plasma membrane.

Cell vary in size. Most cells are very small (microscopic), some may be very large (microscopic). Some cells may exist as independent units of life. Some such cells like **Euglena** and **Amoeba** can change their shape, but most cells have a fixed shape. The number of cells vary from organism to organism. An amoeba is single-celled, while a human body weighing about 60 kg may have as many as 60×10^{15} cells. In unicelluar organisms, e.g. **Amoeba**, **Paramoecium** or **Chalamydomonas**, all the basic functions of a living being are performed in one cell, while multicellular organisms have well-developed division of labour. So, their different functions are performed by different organs. For example, we have a stomach to digest food, a heart to pump blood and a brain to think.

An English scientist, **Robert Hooke**, discovered the cell in 1665 while examining thin sections of cork under his simple microscope. He observed a mass of hexagonal chambers like a honeycomb and called them(compartments) cells. Cell is the Latin word for **'a little room'**.

Between 1838-39 Schleiden, a German botanist, and Schwann, a German zoologist, proved that plants and animals are cellular in character and founded the cell theory. They postulated that the cell is the basic unit of all life. Virchow, in 1855, proposed the idea that all cells arise from pre-existing cells.

Types of cell

◆ Prokaryotes and Eukaryotes

All living organisms are made of cells. And based on the kind of cells they are made up of, they are divided into two groups-prokaryotes and eukaryotes. Prokaryotes, which include bacteria other organisms are eukaryotes, and probably evolved from prokaryotes.

There are some structural differences between prokaryotic and eukaryotic cells. The most obvious difference is that unlike the eukaryotic cell, the prokayotic cell lacks a true nucleus. There is no nuclear membrane. The DNA or nuclear material lies in a circular loop in the cytoplasm. Such undefined nuclear region is called nucleoid. There are some other differences too. For instance, in prokaryotic cells the ribosomes are smaller and scattered in the cytoplasm. Besides, prokaryotic cells lack membrane-bound orgenelles like plastids, mitochondria and endoplasmic reticulum.

Structure of a cell

◈ Cell membrane or plasma membrane:

A cell is essentially a tiny 'bag' of living matter. The covering of this 'bag' is called the cell membrane or plasma membrane. It maintains the shape and size of the cell and protects its contents. It acts like a sentry-allowing only some things to enter and leave the cell and stopping others. For example, it allows oxygen and nutrients to pass into the cell and lets wastes pass out of it. This is why it is called selectively permeable.

◈ **Cell wall:**

Plant cells have an additional protective wll called the cell wall. It is thick, rigid and permeable, and is made up of a carbohydrate called cellulose.

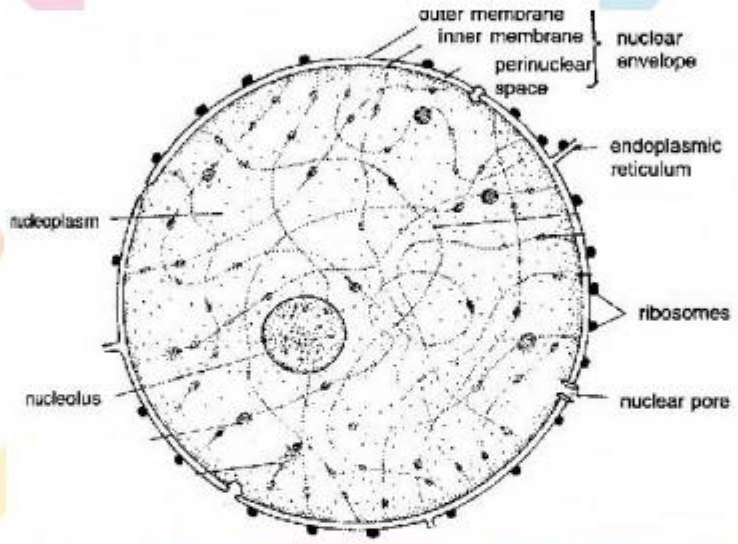
◈ **Cytoplasm:**

The matter inside the cell mebrane is called cytoplasm. It consists of a jellylike fluid with various structures, such as the nucleus, floating in it. These structures are called organelles.

Salts, proteins, sugar and other substances are dissolved in the fluid.

◈ **Nucleus:**

Almost every cell has a nucleus. Red blood cells are among the exceptions. The nucleus is the largest and the most important organelle of the cell. It is usually spherical or oval in shape. Inside it there are thread like structures called chromosomes. Nucleus is the controlling central cell. Chromosomes have genes arranged in a linear fashion.



Nucleus

◈ **Vacuoles:**

The central part of most plant cells is occupied by a large vacuole. You may have noticed it in some of the plant cells you observed. It is a sac like structure filled with fluid. Food, wastes pigments and other substances are dissolved in the fluid. Some plant cells have a number of large vacuoles.

Vaculoes are not so common in animal cells. When they ocour, they are much smaller in size.

◈ **Plastids:**

These organelles are not present in animal cells. **Chloroplasts** (a type of plastid) contain the green pigment chlorophyll and are responsible for photosynthesis. Only green parts of plants have chloroplasts.

There are two other types of plastids called chromoplasts and leucoplasts.

Chromoplasts contain pigments which give fruits and flowers their colours. **Leucoplasts** store food and are found in the storage organs of plants.

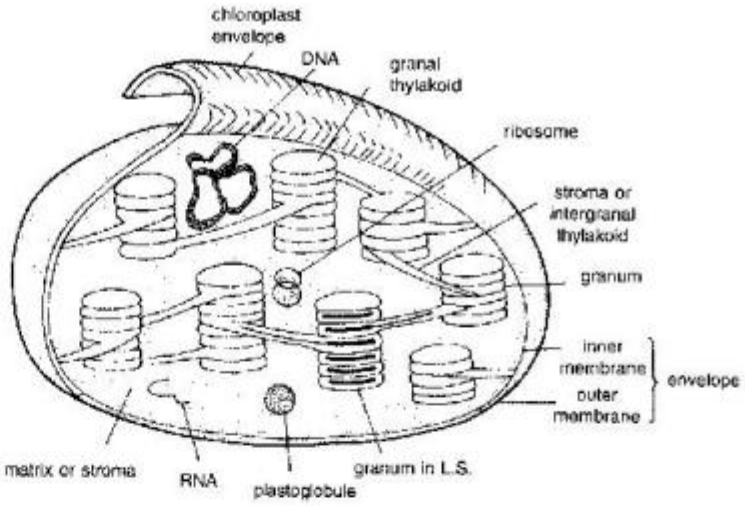


Fig. Chloroplast

◈ Endoplasmic reticulum (ER)

The endoplasmic reticulum is a network of tube-like structures running through the cytoplasm. If ribosomes are attached to it, the reticulm is rough, otherwise it is smooth.

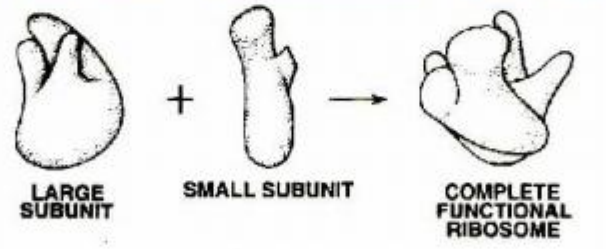
Function - It gives internal support to the colloidal matrix (cytoplasm).

Rough endoplamic reticulum (RER) is associated with the synthesis of proteins.

◈ Ribosomes

Ribosomes are extremely amall, round bodies found either in the state in the cytoplasm or attached to the surface of the ER. They are composed of ribonucleoprotein (ribonucleic acid and protein).

Functions - The main function of ribosomes is to act as a platform or work place for the synthesis of proteins.



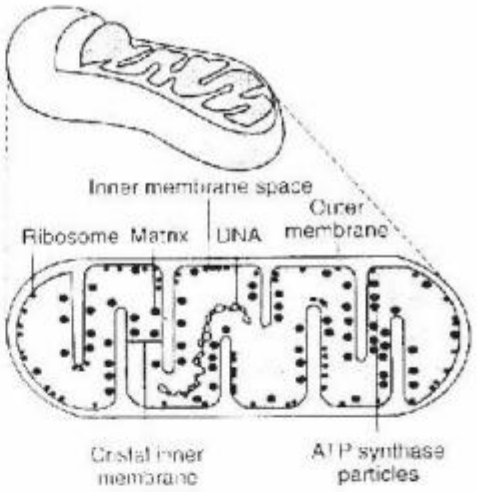
Ribosomes

◈ Mitochondria

Mitochondria are small, rod-shaped organelles found in large numbers. Each mitochondrion is bounded by two membranes-outer and inner. The outer membrane is smooth and the inner membrane is pushed inwards at intervals forming crests called cristae. The cristae lie in a ground substane called matrix. Mitochondria process enzymes necessary for the oxidation of carbohydrates. This process releases energy in the form of ATP. This is why mitochondria are known as the

powerhouses of the cell. Mitochondria have their own DNA and ribosomes. They can synthesize their own proteins and thus they are semiautonomous organelles.

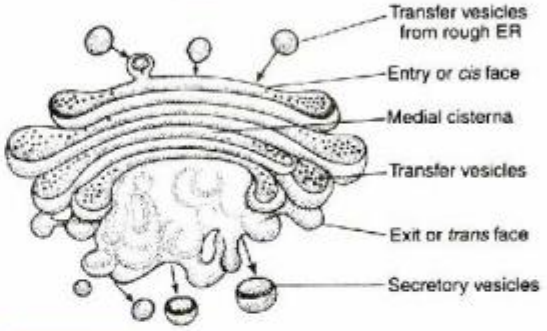
Function- Mitochondria provide energy for the vital activities of living cells.



Mitochondria

◈ Golgi body

They store, modify, package and condense the proteins synthesized in the ribosomes.

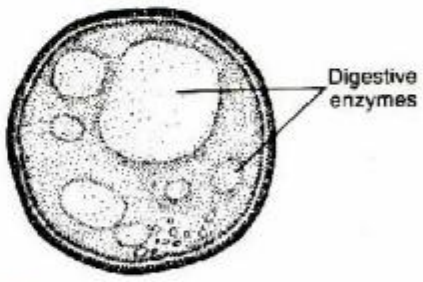


Golgi body

◈ Lysosomes

These saclike, small spherical, single membrane-bound vesicles contain enzymes. These enzymes are synthesized in the RER, which are brought to the Golgi complex. Lysosomes are formed by the Golgi complex. They occur in animal cells and in the meristematic cells of a few plants.

Function- They help in breaking down (digesting) large molecules of the cell. They work in defence againt bacteria and viruses. During stavation, lysosomes act on their own cellular organelles and digest them. This results in cell death. Hence lysosomes are called suicide bags or demonlition squads.



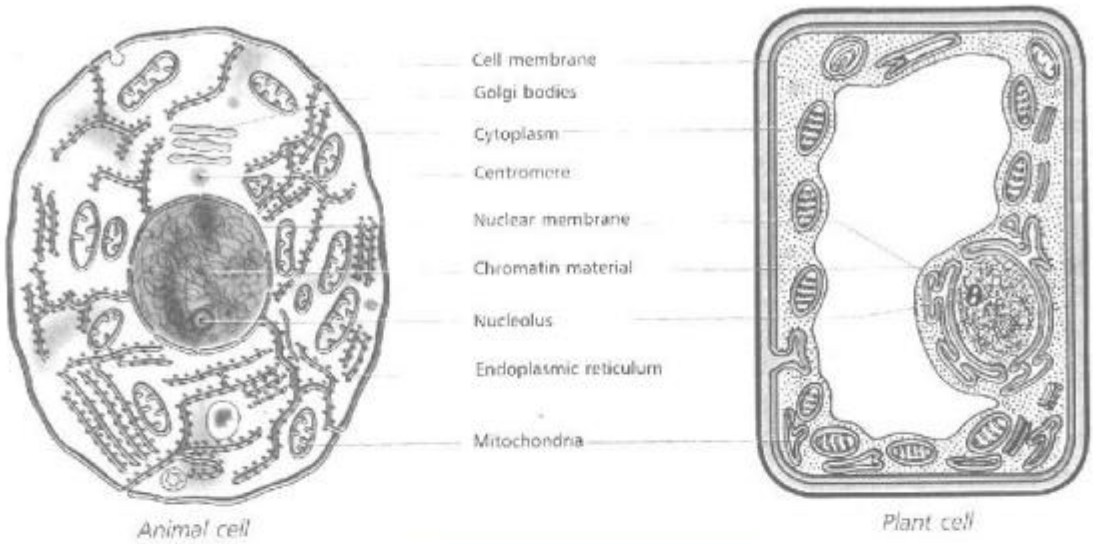
Lysosomes

◈ Centrioles

The centrosome is a distinct region of the cytoplasm close to the nucleus of animal cells. It usually has two central granules called centrioles. The centrioles are hollow, cylindrical structure made of microtubules arranged in a specific manner. They are arranged at right angles to each other.

Function- At the time of cell division, centrioles move to the poles and form spindle fibre which help in the movement of chromatids (daughter chromosomes) in the daughter cells. They help in the formation of cilia and flagella.

◈ Plant Cell & Animal Cell



◆ Difference between plant cell & animal cell :

Plant cell	Animal cell
Plant cells have a cell wall in addition to the plasma membrane	Animal cell do not have a cell wall
Plant cells have plastids	Animal cells do not have plastids
Most of the space in a plant cell is occupied by one or several large vacuoles.	Even when vacuoles are present in ainmal cell, they are much smaller in size

◈ Movement of subtances across the cell membrane

◆ Diffusion:

Diffusion is the process of mixing up or different substances due to the random motion of their component atoms, molecules and ions. Diffusion takes place in solids, liquids and gases.

Ex. Burning of incense stick.

◆ Osmosis:

Diffusion of water across a semipermeable membrane is called Osmosis. The movement of water in living beings depends on osmosis. The movement of water molecules across the cell membrane is affected by the amount of solute dissolved in it. Here also the water molecules are free to pass across the membrane in both directions. But the net movement of water molecules takes place from the dilute solution to the concentration one, i.e., from the region of greater concentration of water towards the region of lower concentration of water.

Ex. Grains in water.

◈ Plant Tissues

Plant tissue are basically of two types-meristematic and permanent. This differentiation is based on the ability of the mature cells of the tissue to divide and produce new cells. Meristematic tissue cells are capable of dividing, while permanent tissue cells are not.

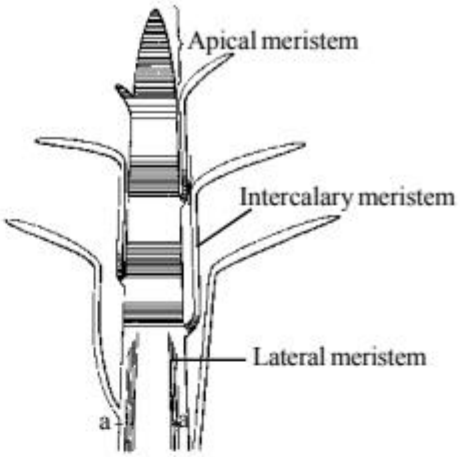
◆ Meristematic Tissue

This tissue consists of actively dividing cells and is present in the growing regions of plants, e.g., the tips of roots and stems. The cells can be round, oval, polygonal or rectangular, but there are a few things they have in common. They are packed closely without intercellular spaces, have thin cellulose walls, dense cytoplasm and prominent nuclei. Vacuoles are almost absent in such cells because they are completely filled with sap. Depending on the region of the plant where it is present, meristematic tissue can be of three types- apical, lateral and intercalary.

Apical (from apex) meristem, as the name suggests, is present at the growing tips of stems and roots. Apical meristem is primary meristem.

Lateral meristematic tissue occurs along the sides of the cental (longitudinal) axis of the plant. It gives rise to vascular tissues.

Intercalary meristem occurs at the base of leaves or internodes. These cells grow fast and soon change into permanent tissues.



Different types of meristems on the basis of position in plant body

◆ Permanent Tissue

The division and differentiation of the cells of meristematic tissues given rise to permanent tissues. Cell division is the formation of two or more daughter cells from one mother cell. Simple permanant tissue consist of similar permanent cells that perform the same function or a similar set of functions. Parenchyma, collencyma and sclerenchyma are three types of simple permanent tissues. Complex permanent tissue are a group of different types of cells that perform a common function. Xylem and phloem are two types of complex permanent tissue.

◆ Parenchyma

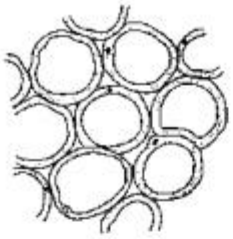
This tissue is composed of large, thin-walled cells which are generally oval or spherical. The cells are not packed closely, i.e., there are intercellular space. These living cells with a nucleus and a vacuole are found in the soft parts of the plant. They store food, fill up spaces between other tissue and provide temporary support to the plant. When they contain chloroplasts, as in leaves, they help manufacture food.

◆ Collenchyma

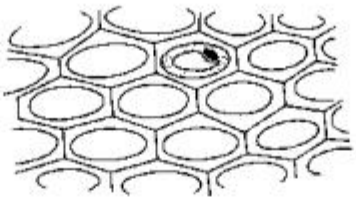
This tissue is composed of cells that are elogated and thickened with cellulose at the corners. There is no intercellular space. Collenchyma provides mechnical support to plant organs and is found in leaf stalks and below the epidermis of stems. It helps leaves and stems bend without breaking. It provides support, protection and flexibility ot plant organs. It is generally absent in roots.

◆ Sclerenchyma

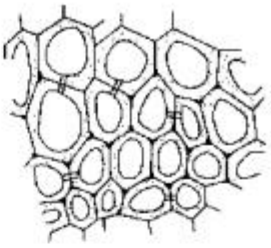
This tissue is composes of long, narrow cells whose walls are evenly thickened with lignin. Lignin is a chemical that acts like cement, sticking fibres and hardening them. Sclerenchyma cells are dead. They are packed together closely, and provide strength and flexibility to plant parts. They are present in stems, veins of leaves, the hard covering of seeds and nuts, and the husk of coconut. Fibre-yielding plants like jute and flax contain this tissue in abundance.



Parenchyma



Collenchyma



Sclerenchyma

◆ **Xylem**

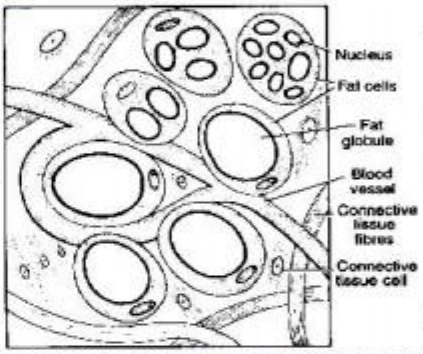
Xylem, or wood, as it is often called, is a complex tissue. The cells are thick-walled, tubular and often dead. This tissue has four types of cells– tracheids, vessels, xylem parenchyma and xylem fibres. Of these only tracheids and vessels transport sap.

◆ **Phloem**

Phloem too is a complex tissue made up of four types of cells, or elements–sieve tubes, companion cells, phloem fibres and phloem parenchyma. It is not necessary for the phloem to contain all four types of cells. Phloem to contain all four types of cells. Phloem cells are living cells (except phloem fibres) which help transport food from leaves to the storage organs

◈ **Animal Tissues**

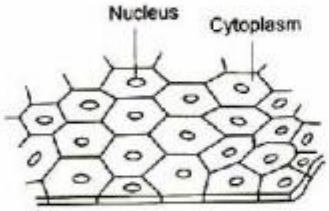
While doing the activities in this chapter, you have come acr cheek cells are a type of epithelial tissue, while blood is a kind of co types of animal tissue–muscular and nervous.



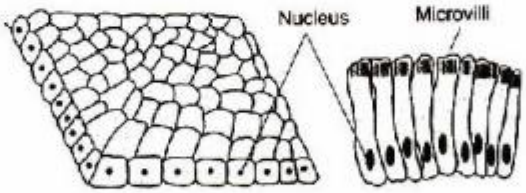
Connective Tissue

◆ **Epithelial Tissue:**

This tissue covers the surface of the body and lines the intern ection. The cells that form the different types of epithelial tissue diff some cubelike, while others are columnar.

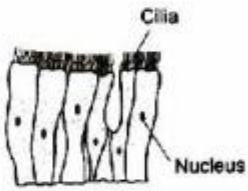


Squamous



Cuboidal

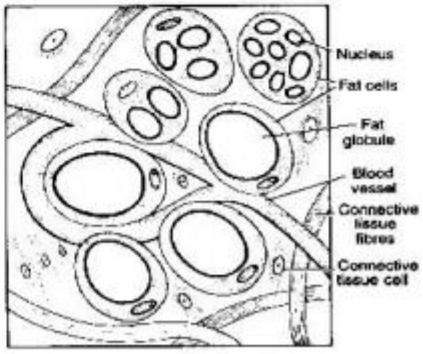
Columnar



Ciliated

◆ **Connective Tissue:**

Blood, bones cartilages, tendons (which connect muscles with bones) and ligaments (which tie bones together) are diferent types of connective tissue. Adipose tissue, or what is generally known as fat, is also a kind of connective tissue. Though different in structure, connective tissues have one thing in common-the cells are suspended or embedded in a matrix. In blood, the matrix is liquid and is called the plasma.



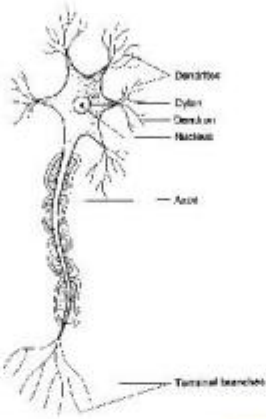
Connective Tissue

◆ **Muscular Tissue:**

Muscular tissue is also of different types. However, the different types of muscular tissue (or muscles) have the same basic functoin. They contract and relax to make different parts of the body move. The muscles in our arms, legs thighs, back and so on help us move. The muscles in the heart help it pump blood. The muscles in the alimentary canal help the passage of food. The muscles in the blood vessels help them dilate and get constricted.

◆ **Nervous Tissue:**

Nerve cells make up nervous tissue. A nerve cell has a long tail and short branches coming out of it.The tail too has branches. These help to carry message from one cell to the other. The brain and spinal cord are make up of nervous tissue.



EXERCISE - 1

SINGLE CORRECT ANSWER TYPE QUESTIONS

Q.1 Cheek cells are

(A) epithelial cells (B) epidermal cells

(C) vascular cells (D) guard cells

Q.2 The cell wall in plant cells is made up of

(A) Proteins (B) Facts

(C) Plasma (D) Cellulose

Q.3 Blood is a type of

(A) Epithelial tissue (B) Connective tissue

(C) Nervous tissue (D) Muscular tissue

Q.4 The brain and spinal cord are made up of

(A) Nervous tissue (B) Epithelial tissue

(C) Muscular tissue (D)Connective tissue

Q.5 Red blood cells

(A) have two nuclei

(B) have a cell wall

(C) have pigment-containing plastids

(D) do not have a nucleus

Q.6 The covering of an animal cell is:

(A) Cell wall

(B) Cell membrane

(C) Nuclear membrane

(D) Cytoplasm

Q.7 Organisms lacking a nucleus and membrane-bound organe celles are called:

(A) Diploid (B) Haploid

(C) Prokaryotes (D) Eukaryotes

Q.8 Relatively large vacuoles are present in:

(A) all prokaryotes (B) all eukaryotes

(C) Plant cells (D) Animal cells

Q.9 The growth of cells is regulated by

(A) mitochondrion (B) vacuole

(C) nucleus (D) Golgi complex

Q.10 The centriole is associated with:

(A) DNA synthesis (B) cell division

(C) Circulation (D) respiration

Q.11 Proteins are formed in the:

(A) Golgi complex (B) mitochondria

(C) plastids (D) ribsosomes

Q.12 The name suicide bag has been given to:

(A) Centroiles (B) Ribosome

(C) Mitochondrion (D) Lysosome

Q.13 Genes are located on the:

(A) Nuclear membrane

(B) Chromosomes

(C) Lysosomes

(D) Cell membrane

Q.14 Biological membrane includes

(A) only nuclear membrane

(B) only membranes of Golgi complex

(C) only mitochondrial membrane (D) all the intracellular membranes along with plasma membrane

Q.15 Which of the following is the main difference between onion peel cells and human cheek cells?

(A) Presence of mitochondria in onion peel cells only

(B) presence of cell wall in onion peel cells only

(C) Absence of plasma membrane in cheek cells

(D) Absence of endoplasmic reticulum in cheek cells

Q.16 Centrioles are found in

(A) onion peel cells

(B) human cheek cells

(C) all plant cells

(D) none of these

Q.17 The network of tube-like structure running through the cytoplasm is called

(A) Golgi complex

(B) mitochondria

(C) endoplasmic reticulum

(D) ribosomes

Q.18 The semipermeable membrane in the plant cell allows the diffusion of:

(A) solute molecules

(B) solvent molecules

(C) solute and solvent molecules

(D) none of these

Q.19 Entry of water into root hairs is an examples of :

(A) diffusion (B) imbibition

(C) osmosis (D) plasmolysis

Q.20 Gaseous exchange in plants takes place through:

(A) epidermal cells

(B) stomata

(C) stem

(D) vascular tissue

Q.21 When a cell is placed in strong salt solution, it shrinks because:

(A) salt solution enters the cell

(B) cytoplasm of the cell begins to decompose

(C) water comes out of the cell to develop equilibrium

(D) all of these

Q.22 Tissue is defined as:

(A) group of similar cells having a common function

(B) different types of cells performing the same functions

(C) different types of cells performing different functions

(D) organised group of cells performing many functions

Q.23 Cartilage and bone are type of:

(A) epithelial tissue (B) skeletal tissue

(C) muscular tissue (D) nervous tissue

Q.24 Muscles involved in the movement of the arm are:

(A) striated (B) nonstriated

(C) cardiac (D) smooth

Q.25 Blood is a type of:

(A) epithelial tissue (B) nervous tissue

(C) connective tissue (D) muscular tissue

EXERCISE - 2

FILL IN THE BLANKS

Q.1 Cell wall is found only in ..... cells.

Q.2 Ribosomes are located on the surface of ..... .

Q.3 All the components of a cell including the cell membrae is called ..... .

Q.4 A true nucleus is absent in bacteria and ..... .

Q.5 Two types of nucleic acids are ..... and ..... .

TURE & FALSE TYPE QUESTIONS.

Q.6 All living organisms consists of cells.

Q.7 The main function of ribosomes is to synthesize proteins.

Q.8 Plastids are the sites of photosynthesis.

Q.9 Chloroplasts are colourless plastids.

Q.10 Prokaryotic cells lack nuclear envelope.

VERY SHORT ANSWER TYPE QUESTIONS.

Q.11 Name the four types of animal tissue

Q.12 What is the importance of ribosomes?

Q.13 What is the function of mitochondria?

Q.14 Name the following:

(a) structural and function unit of life

(b) powerhouse of the cell

Q.15 Why does the plant cell remain more rigid then the animal cell?

SHORT ANSWER TYPE QUESTIONS

Q.16 Why is the plasma membrane called selectively permeable

Q.17 Prokaryotes lack a true nucleus, Explain.

Q.18 What is osmosis?

Q.19 Difine diffusion

Q.20 Why lysosomer are called suicidal bags?

LONG ANSWER TYPE QUESTIONS

Q.21 What are the basic differences between plant cells and animal cells?

Q.22 Describe the ultrastructure of a typical animal cell.

Q.23 Write short notes on the following:

Golgi complex, mitochondria, ribonsomes, nucleus, chromosomes

Q.24 Explain the type of animal tissue.

Q.25 Explain the type of plant tissue.

ANSWER KEY

EXERCISE-1

Q.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	A	D	B	A	D	B	C	C	C	B	D	D	B	D	B	B	C	B	C	B
Q.No.	21	22	23	24	25															
Ans.	C	A	B	A	C															

EXERCISE-2

FILL IN THE BLANKS

Sol.1 plant

Sol.2 endoplasmic reticulum

Sol.3 protoplasm

Sol.4 BGA (Blue green algae)

Sol.5 RNA & DNA

Ture & False type questions.

Sol.6 True **Sol.7** True

Sol.8 True **Sol.9** False

Sol.10 True

VERY SHORT ANSWER TYPE QUESTIONS.

Sol.11 Simple, connective, muscular and nervous tissue

Sol.12 Ribosomes synthesize protein

Sol.13 Mitochondria produce ATP

Sol.14 (a) cell (b) mitochondria

Sol.15 plant cell have cell wall