



# MATRIX OLYMPIAD

The Most Innovative Talent Recognition Exam

# BIOLOGY

Class - IX



# MATRIX

Campus : Piprali Road, Sikar, Rajasthan 332001

Phone : 01572-241911, 01572-243911

Website: [www.matrixedu.in](http://www.matrixedu.in)

## *Few words for the Readers*

Dear Reader,

*"Matrix Olympiad is established to encourage school students to go a step further than their regular studies, and get a chance and exposure to competition on a wide scale. It also helps students enhance their learning of basic cognitive skills and deeper knowledge of subjects like Science, Mathematics, English, Mental Ability, Social Studies. "Matrix Olympiad helps students nurture their minds for higher targets of tomorrow and enables them to study School for JEE, NEET, CLAT, NDA, Olympiads , NSEJS, NTSE , STSE etc."*

The above thought has been our guiding principle while designing and collating the study material for **Matrix Olympiad** . And hence, we hope that this particular material will be helpful towards your preparation for **Matrix Olympiad**.

Our team at **MATRIX** has put in their best efforts for making this particular module interesting and relevant for you. Additional efforts have been made to ensure that the content is easy to understand and error free to the extent possible. However, there might remain some inadvertent errors in answer keys and theoretical portion and we would welcome your valuable feedback regarding the same.

If there are any suggestions for corrections, please write to us at [smd@matrixacademy.co.in](mailto:smd@matrixacademy.co.in) and we would be highly grateful.

Finally, we would like to end this message by a famous quote by Ernest Hemingway - *"There is no friend as loyal as a book."* So, please give your study material the time and attention it deserves, and it will surely help you reach newer heights in your fight with competition examinations.

With love and best wishes !

Team MATRIX

# CONTENTS

S. NO.	CHAPTER	PAGE NO.
1.	FUNDAMENTAL UNIT OF LIFE CELL	04 - 25
2.	TISSUE	26 - 48
3.	DIVERSITY IN LIVING ORGANISMS	49 - 80

# FUNDAMENTAL UNIT OF LIFE CELL

# 1

## Concepts

### Introduction

#### 1. Microscope

##### 1.1 Cell theory

##### 1.2 Size and shape of cell

##### 1.3 Types of cells

#### 2. Structural organisation of a cell

#### 3. Ultra structure of cell

##### 3.1 Cell wall

##### 3.2 Cell Membrane

##### 3.3 Nucleus (headquarter of the cell)

##### 3.4 Cytoplasm

##### 3.5 Endoplasmic reticulum

##### 3.6 Golgi body

##### 3.7 Lysosomes

##### 3.8 Vacuoles

##### 3.9 Mitochondria

##### 3.10 Plastid

##### 3.11 Ribosome

##### 3.12 Centrosome

#### 4. Cell division

##### 4.1 Cell cycle

##### 4.2 Types of cell division

## NCERT Solution

### Exercise – I (Competitive Exam Pattern)

### Exercise – II (Board Pattern Type)

### Answer Key

## INTRODUCTION

All organisms are composed of cells. Some are composed of a single cell and are called unicellular organisms while others, like us, composed of many cells, are called multicellular organisms.

- Unicellular organisms are capable of independent existence and performing the essential functions of life. Hence, cell is the fundamental structural and functional unit of all living organisms.
- First dead cell discovered by - **Robert Hooke** in Cork
- **Anton Van Leeuwenhoek** first saw and described a live cell. **Robert Brown** later discovered the nucleus.

## 1. MICROSCOPE

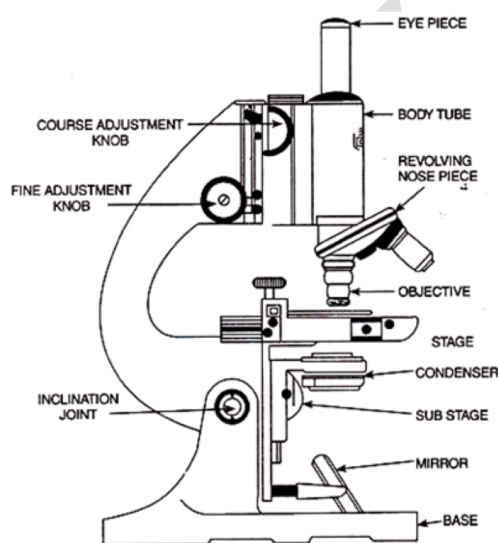


Figure : Microscope

- It is an instrument which is used to study those objects that cannot be seen with the naked eye or with the help of hand lens. A microscope has more than one lens.
- The 1st compound microscope was built by F. Janssen and Zacharias Janseen (1590)

### 1.1 CELL THEORY

- In 1838, **Malthias Schleiden**, a botanist, examined a large number of plants and observed that all plants are composed of different kinds of cells which form the tissues of the plant. At about the same time, **Theodore Schwann** (1839), a zoologist, studied different types of animal cells and reported that cells had a thin outer layer which is today known as the 'plasma membrane'. He also concluded, based on his studies on plant tissues, that the presence of cell wall is a unique character of the plant cells.
- **Schwann** proposed the hypothesis that the bodies of animals and plants are composed of cells and products of cells.
- **Schleiden** and **Schwann** together formulated the cell theory. This theory however, did not explain as to how new cells were formed. **Rudolf Virchow** (1855) first explained that cells divided and new cells are formed from pre-existing cells (**Omnis cellula-e cellula**). He modified the hypothesis of **Schleiden** and **Schwann** to give the cell theory a final shape. Cell theory as understood today is:
  - (i) All living organisms are composed of cells and products of cells.
  - (ii) All cells arise from pre-existing cells.

**Note:-** Virus is an exception of cell theory.

## 1.2 SIZE AND SHAPE OF CELL

### (a) Size :

- Cell differ greatly in size, shape and activites.
- Mycoplasma (Smallest cells) : Only  $0.3 \mu\text{m}$  in length [PPLO (pleuro pneumonia like organisms) is a type of mycoplasma having the size about  $0.1 \mu\text{m}$ ]
- Bacteria  $\rightarrow 3$  to  $5 \mu\text{m}$
- Largest isolated single cell  $\rightarrow$  egg of an ostrich.
- Human red blood cell  $\rightarrow 7.0 \mu\text{m}$  in diameter
- Nerve cell  $\rightarrow$  longest animal cell
- Largest plant cell  $\rightarrow$  Acetabularia
- Longest plant cell  $\rightarrow$  Hemp fibre

### (b) Shape :

- The shape of the cell may vary with the funtion they perform.
- They may be disc-like, polygonal, columnar, cuboid, thread like or even irregular.

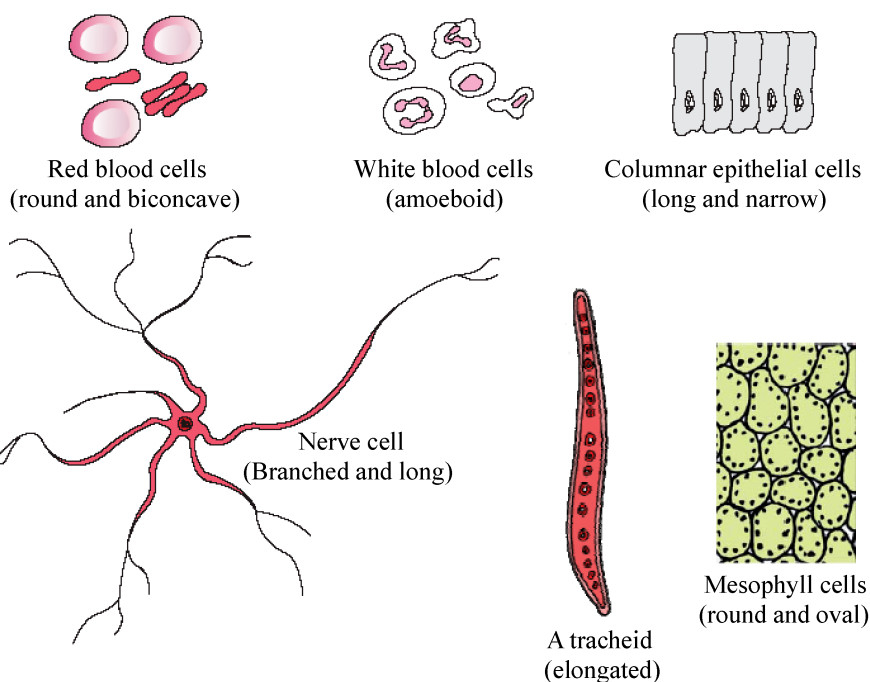


Figure. different shapes of the cell

## 1.3 TYPES OF CELLS

### (a) PROKARYOTIC CELLS

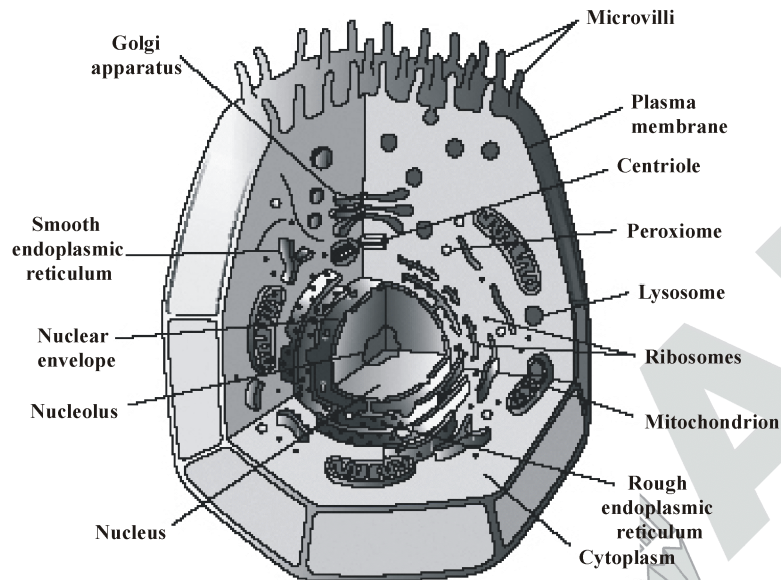
- The prokaryotic cells are represented by bacteria, blue-green algae, mycoplasma and PPLO (Pleuro Pneumonia Like Organisms). They are generally smaller and multiply more rapidly than the eukaryotic cells.

### (b) EUKARYOTIC CELLS

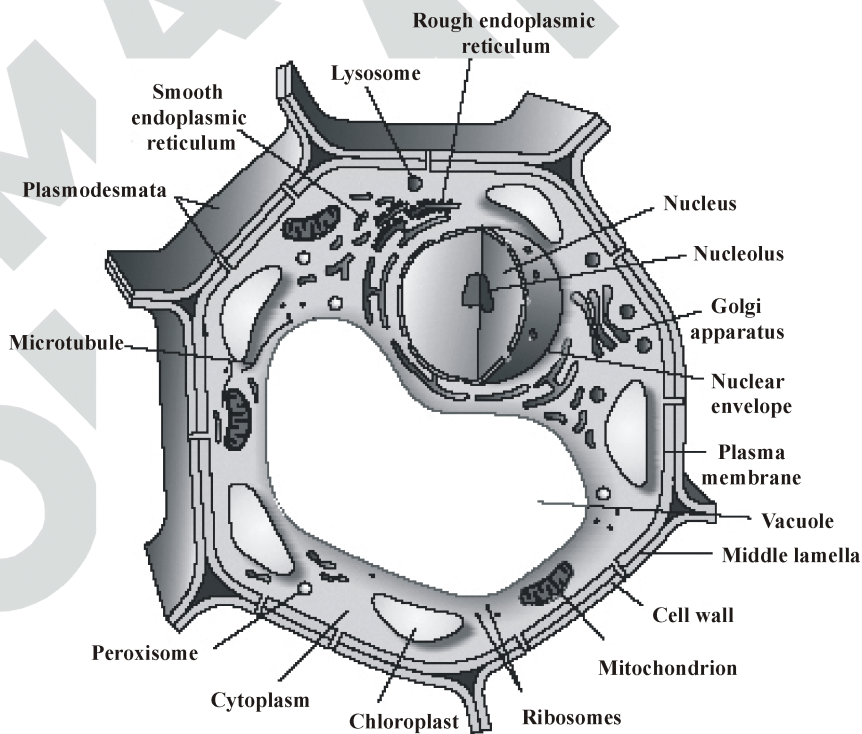
- The eukaryotes include all the protists, plants, animals and fungi. In eukaryotic cells there is an extensive compartmentalisation of cytoplasm through the presence of membrane bound organelles.
- Eukaryotic cells possess an organised nucleus with a nuclear envelope. In addition, eukaryotic cells have a variety of complex locomotory and cytoskeletal structures. Their genetic material is organised into chromosomes.

- All eukaryotic cells are not identical. Plant and animal cells are different as the former possess cell walls, plastids and a large central vacuole which are absent in animal cells. On the other hand, animal cells have centrioles which are absent in higher plant cells.

**2. STRUCTURAL ORGANISATION OF A CELL**

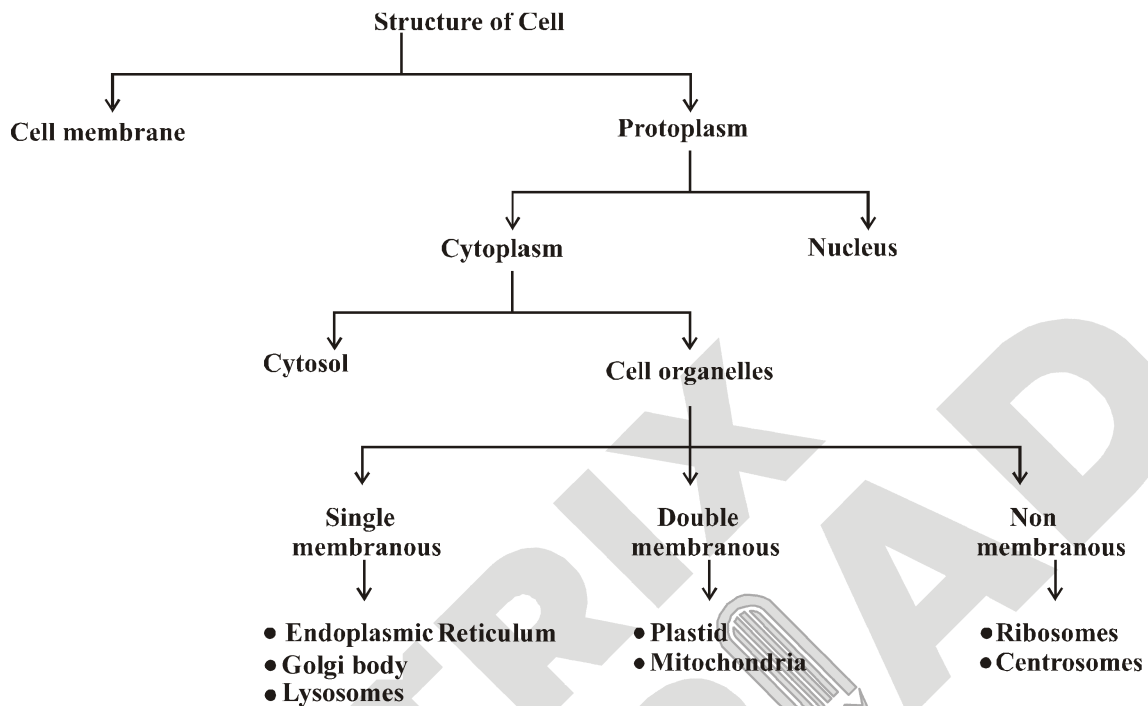


**Figure : Animal cell**



**Figure : Plant cell**

3. ULTRA STRUCTURE OF CELL



3.1 CELL WALL

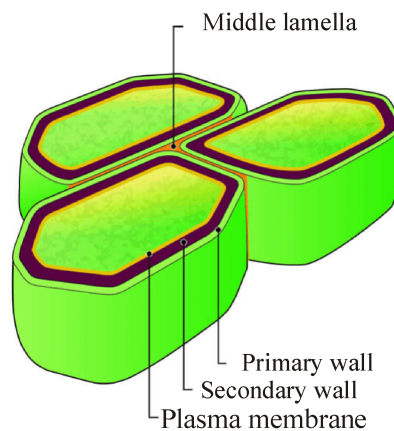


Figure : Cell wall

- A non-living rigid structure called the cell wall forms an outer covering for the plasma membrane of Bacteria Fungi, Algae and Plants.
- Cell wall not only gives shape to the cell and protects the cell from mechanical damage and infection, it also helps in cell-to-cell interaction and provides barrier to undesirable macromolecules.
- Algae have cell wall made of cellulose, galactans, mannans and minerals like calcium carbonate.
- In other plants it consists of cellulose, hemicellulose, pectins and proteins.
- Bacterial cell wall is mainly composed of Peptidoglycans (Polysaccharide + amino acid).
- The cell wall of Fungi are composed of Chitin and Polysaccharides.

### 3.2 CELL MEMBRANE

- This is the outermost covering of cell.
- It separates the contents of cell from external environment.
- It permits the entry and exit of some material.
- It is called selectively permeable membrane as it prevents movement of some material.

#### → TRANSPORT THROUGH PLASMA MEMBRANE

##### (a) Passive transport.

- One of the most important functions of the plasma membrane is the transport of the molecules across it. The membrane is selectively permeable to some molecules present on either side of it. Many molecules can move briefly across the membrane without any requirement of energy and this is called the passive transport.
- Neutral solutes may move across the membrane by the process of simple diffusion along the concentration gradient, i.e., from higher concentration to the lower. Water may also move across this membrane from higher to lower concentration. Movement of water by diffusion is called osmosis.



### Focus Point

#### Types of solutions on the basis of concentration :

**(A) Isotonic solution :** When the concentration of the solution outside the cell is equal to the concentration of cytoplasm of the cell it is called as isotonic solution. Net movement of water is zero.

**(B) Hypertonic solution :** When the concentration of the solution outside the cell is more than that inside the cell. Due to this cell loses water and becomes plasmolysed.

**(C) Hypotonic solution :** When the concentration of the solution outside the cell is lesser than that of cytoplasm, the cell swells up and bursts.

- As the polar molecules cannot pass through the nonpolar lipid bilayer, they require a carrier protein of the membrane to facilitate their transport across the membrane.

##### (b) Active transport

- A few ions or molecules are transported across the membrane against their concentration gradient, i.e., from lower to the higher concentration. Such a transport is an energy dependent process, in which ATP is utilised and is called active transport e.g.  $\text{Na}^+/\text{K}^+$  Pump.

##### (c) Bulk transport

###### (i) Endocytosis

- **Pinocytosis or Cell Drinking :-** Ingestion of liquid material by plasmalemma in the form of vesicles or bag like structure (Pinosome) is called pinocytosis.
- **Phagocytosis or Cell eating :-** Ingestion of solid complex materials by membranes in the form of vesicles (Phagosome) is called Phagocytosis.

**(ii) Exocytosis/Emiocytosis/Cell vomiting :-** Egestion of waste materials from cell through plasma membrane.

→ **FUNCTIONS OF CELL MEMBRANE**

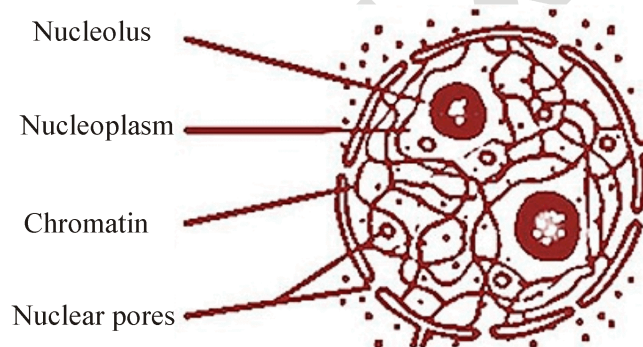
- Plasma membrane regulates the exchange of materials between the cytoplasm and extracellular fluid.
- It allows the movement of selected quantities of selected materials across it.
- It is flexible enough to engulf larger molecules and food particles.
- It protects the cell from injury.

**3.3 NUCLEUS (HEADQUARTER OF THE CELL)**

→ **DISCOVERY** – Robert Brown (1831)

- “Nucleus is double membrane bound dense protoplasmic body, which controls all cellular metabolism and encloses the genetic information of cell”.
- Nucleus is considered as controller or director of the cell.

→ **STRUCTURE** : It is made up of following four components.



**Figure : Structure of nucleus**

- (a) **Nuclear envelope** : Nucleus is surrounded by two membranes, that separates nucleoplasm from cytoplasm. The nuclear membrane has minute pores. These are called nucleopores. Nucleopore takes part in exchange of different substances between nucleoplasm and cytoplasm.
- (b) **Nucleoplasm** : The part of protoplasm which is enclosed by nuclear membrane is called nucleoplasm. It contains chromatin threads and nucleolus.
- (c) **Nucleolus** : Discovered by Fontana. Usually one nucleolus is present in a nucleus but sometimes more than one nucleoli are present. It is a store house of RNA.
- (d) **Chromatin threads** : A darkly stained network of long and fine threads called chromatin threads is present. Chromatin threads are intermingled with one another forming a network called chromatin reticulum. Whenever the cell is about to divide the chromatin material gets organized into chromosomes.

→ **FUNCTIONS OF NUCLEUS**

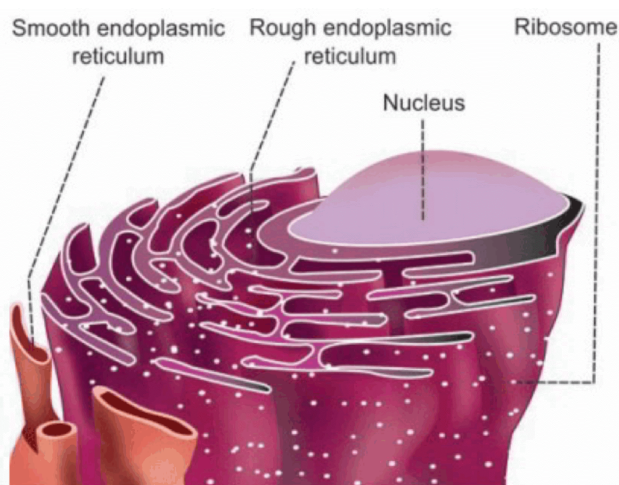
The nucleus performs following functions :

- (i) It controls all the metabolic activities of the cell.
- (ii) It brings about growth of the cell by directing the synthesis of structural proteins.
- (iii) It regulates cell cycle.
- (iv) It contains genetic information and is concerned with the transmission of hereditary traits from one generation to another.

### 3.4 CYTOPLASM

- Term "Cytoplasm", was given by **Strasburger** for the part of cell, presents between the nucleus and cell membrane. Cytoplasm can be divided into two parts.
- **Ground plasm / Hyaloplasm / Cytosol** → Liquid matrix of cytoplasm except organelles
- **Trophoplasm** → Part of cytoplasm containing organelles & non living Inclusions.
- Permanent **metabolically active and living structures of cytoplasm are called organelles.**

### 3.5 ENDOPLASMIC RETICULUM



**Figure : Endoplasmic reticulum**

#### → STRUCTURE

- Electron microscopic studies of eukaryotic cells reveal the presence of a network of reticulum of tiny tubular structures scattered in the cytoplasm that is called the endoplasmic reticulum (ER)
- Structure of E.R. is like the golgi body but in E.R. cisternae, vesicles and tubules are isolated in cytoplasm and these do not form complex.
- Golgi body is localised cell organelle while E.R. is widespread in cytoplasm. E.R. is often termed as "**System of Membranes**"
- ER divide the intracellular space into two distinct compartment i.e. **Luminal (inside ER)** and **extra luminal (cytoplasm)** compartments.

#### → TYPES OF E.R.

- (a) Rough endoplasmic reticulum (RER)** : Ribosomes attached on its surface for synthesising proteins. Thus, RER is engaged in the synthesis and transport of proteins.
  - (b) Smooth endoplasmic reticulum (SER)** : It does not have ribosomes and is meant for synthesis of fat or lipids.
- Some of proteins and lipids, which are synthesised in the cell with the help of ER, are utilised in building the cell membrane. This process is known as **membrane biogenesis.**



## Focus Point

### Difference between Rough and Smooth E.R.

	Rough E.R. (Granular)		Smooth E.R. (Agranular)
(1)	80s ribosomes binds by their larger subunit, with the help of two glycoproteins ( <b>Ribophorin I and II</b> On the surface of Rough E.R.)	(1)	Ribosomes and Ribophorins absent
(2)	More stable structure	(2)	Less stable structure
(3)	Mainly composed of cisternae and vesicles	(3)	Mainly composed of tubules.
(4)	Abundantly occurs in cells which are actively engaged in <b>protein synthesis</b> and <b>secretion</b> . e.g. liver, pancreas, goblet cells.	(4)	Abundantly occurs in cells concerned with <b>glycogen</b> and <b>lipid metabolism</b> . In animal cell lipid like steroidal hormones are synthesised in SER. e.g. Adipose tissue, Interstitial cells, muscles, Glycogen storing liver cells, and adrenal cortex.

#### → FUNCTIONS OF E.R.

- **Intracellular exchange** :- E.R. forms intracellular conducting system. Transport of materials in cytoplasm from one place to another may occurs through the E.R.
- Rough E.R. provides site for the protein synthesis, because rough E.R., has ribosomes on its surface.
- **Lipid Synthesis** :- Lipids (cholesterol & phospholipids) synthesized by the agranular portion of E.R. (**Smooth E.R.**). The major lipids synthesized by S. E. R. are phospholipids and cholesterol.
- **Cellular metabolism** :- The membranes of the reticulum provides an increased surface for metabolic activities within the cytoplasm.

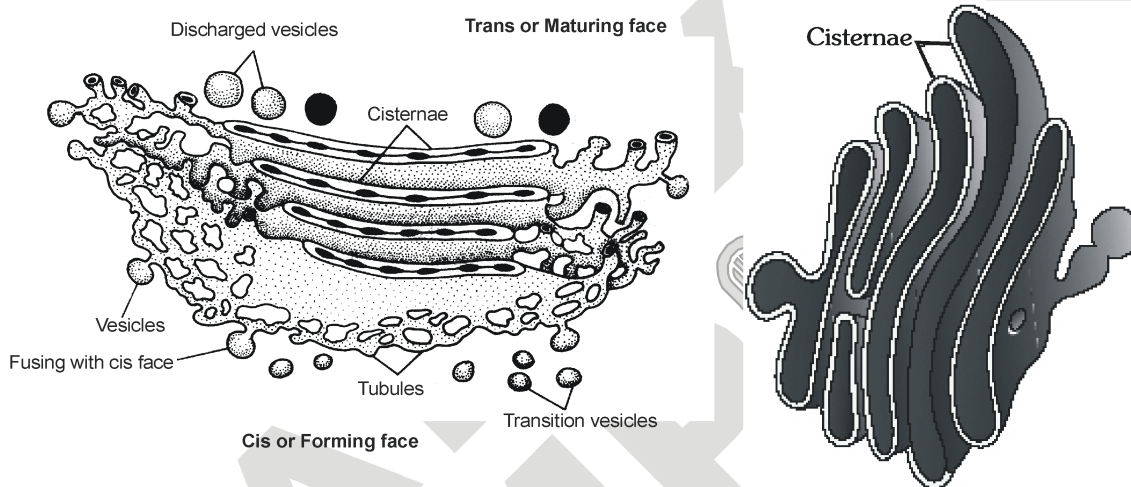
### 3.6 GOLGI BODY

- **Camillo Golgi** (1898) first observed densely stained reticular structure near the nucleus. These were later named Gogi bodies after him.
- Golgi body also named as
  - Dalton complex
  - Golgi complex
  - Dictyosome (in plants)

#### → STRUCTURE

Golgi complex is made up of **four** parts –

- (a) **Cisternae** :- These are flat disc shaped, sacs like structure many cisternae are arranged in a stack (parallel to each other). Diameter 0.5  $\mu\text{m}$  to 1.0  $\mu\text{m}$ . Dense opaque material inside cisternae is called **Nodes**.
- Varied number of cisternae are present in Golgi complex.
  - Convex surface of cisternae which is towards the nucleus is called **cis- face** or **forming face**.
  - Concave surface of cisternae which is towards the membrane is called **Trans face** or **maturing face**.
  - The cis and trans faces of the organelle are entirely different but inter connected.
- (b) **Tubules** :- These are branched and irregular tube like structures associated with cisternae.
- (c) **Vacuoles** :- Large spherical structures associated to tubules.
- (d) **Vesicles** :- Spherical structures arise by budding from tubules. Vesicles are filled with secretory materials.



**Figure : Golgi Body**

→ **FUNCTIONS OF GOLGI BODY**

**Cell Secretion** :- Chief function of golgi body is secretion (export) of macromolecules.

**Secretion involve three steps :**

- (a) Golgi body receives the materials from E.R. through its cis - face.
- All the macromolecules which are to be sent outside the cell, move through the golgi body. So golgi body is termed as "**Director of macromolecular traffic in cell**" or "**middle men of cell.**"
  - Synthesis of cell wall Material (Polysaccharide synthesis)
  - Formation of acrosome during spermiogenesis. (formation of male gametes)
  - Formation of lysosome.

**3.7 LYSOSOMES**

- The term lysosome was introduced by De Duve in 1955.
- Lysosome are simple tiny spherical sac like structures evenly distributed in the cytoplasm.
- Lysosome is small vesicle surrounded by a single membrane and contains powerful enzymes.
- It contain 40 type of enzymes which are called as hydrolases.
- Lysosomes serve as interacellular digestive system, hence called digestive bags.
- Lysosomes also remove the worn out and poorly working cellular organelles by digesting them.
- During disturbances in cellular metabolism i.e. in case of cell damage lysosomes burst and their enzymes are released into the cytoplasm and they digest their own cell so they are also called as "**Suicidal Bags**".

### 3.8 VACUOLES

- Vacuoles of animal cells arise from Golgi-complex.
- **Tonoplast**:- Plasma membrane that covers the vacuole is called tonoplast.

**Vacuoles are of three types :-**

- |                        |   |   |
|------------------------|---|---|
| a. Food vacuole        | – | The vacuole which contain food material.                        |
| b. Sap vacuole         | – | The vacuole which is filled by liquid material (sap)            |
| c. Contractile vacuole | – | The vacuole that concern with osmoregulation e.g. <i>Amoeba</i> |

→ **Functions :-**

- Storage of food, water and other substances.
- They help in the elimination of excess water from the cell (**osmoregulation**), and maintains internal pressure of the cell



## Focus Point

### ENDOMEMBRANE SYSTEM (GERL SYSTEM)

- While each of the membranous organelle is distinct in terms of its structure and function, many of these are considered together as an endomembrane system because their functions are coordinated.
- The endomembrane system include **endoplasmic reticulum (ER), golgi complex, lysosomes and vacuoles**. Since the functions of the mitochondria, chloroplast and peroxisomes are not coordinated with the above components, these are not considered as part of the endomembrane system.

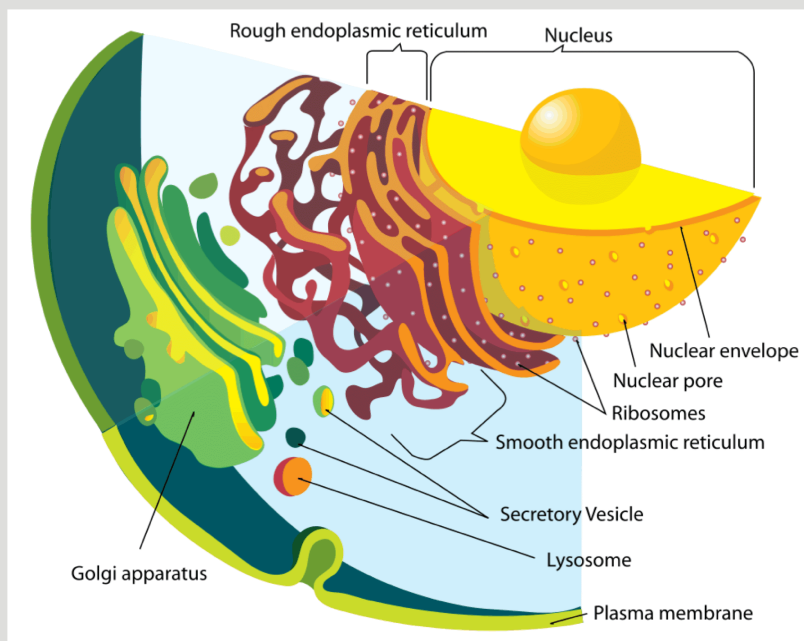


Figure : Endomembrane system

### 3.9 MITOCHONDRIA

Mitochondria are double membrane bound organelles of eukaryotic cells.

#### → OCCURRENCE

These are found in all eukaryotic cells except mature mammalian RBCs. These are absent in prokaryotic cells.

#### → SHAPE

The shape may be, fibrillar, spherical (in yeast), oval, sausage shaped discoidal.

#### → ORIGIN

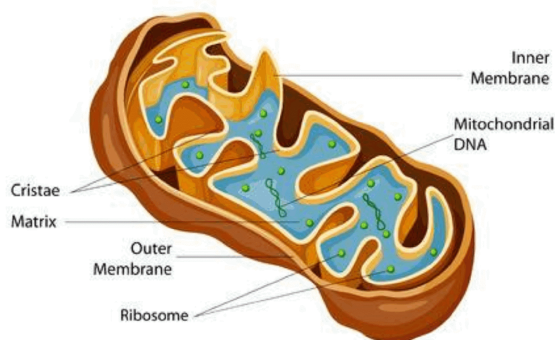
Mitochondria have a small and circular chromosome and 70S ribosome of their own and make some of their own proteins, showing that they were once aerobic bacteria.

#### → STRUCTURE

Mitochondria are semi autonomous organelles bound by an envelope of two unit membranes and filled with a fluid matrix. The outer membrane is smooth and has porous proteins which forms channels for the passage of molecules through it. The inner membrane is semipermeable. It usually produces numerous infolds called cristae. The cristae greatly increase the inner surface area of the mitochondria to hold a variety of enzymes. Cristae bear minute, regularly spaced tennis racket shaped particles known as  $F_0$  particles or oxysomes. The membrane of oxysomes have various respiratory enzymes.

#### → FUNCTION

Mitochondria are the main sites of cellular respiration. They bring about complete oxidation of food stuffs or respiratory substrates into carbon dioxide and water. They are commonly known as 'power houses of the cell' because they contain enzymes necessary for the complete oxidation of food and for release of high amount of energy in the form of ATP (Adenosine triphosphate) molecules. The body uses energy stored in ATP for synthesis of new chemical compounds and for mechanical work. ATP is also known as energy currency of the cell.



**Figure : Mitochondria**

### 3.10 PLASTID

Plastid are double membrane bound organelles of eukaryotic cells. Plastids are major organelles found in the cells of plants and green algae. Plastids are the site of manufacture and storage of important chemical compounds used by the cell. Plastids often, contain pigments used in photosynthesis and the types of pigments present can change or determine the cell's colour. Plastids are responsible for photosynthesis, storage of products like starch.

#### → ORIGIN

Like mitochondria the chloroplast are self duplicating organelles. They also have circular DNA and 70s ribosome of their of their own. They also have a prokaryotic origin.

#### → TYPES OF PLASTIDS

##### (i) Chromoplasts

For pigment synthesis and storage. Chromoplasts are red yellow and orange in colour and are found in petals of flower and in fruits.

##### (ii) Leucoplasts

Leucoplasts are colourless or white plastid. They occur in plant cell not exposed to light, such as roots and seeds.

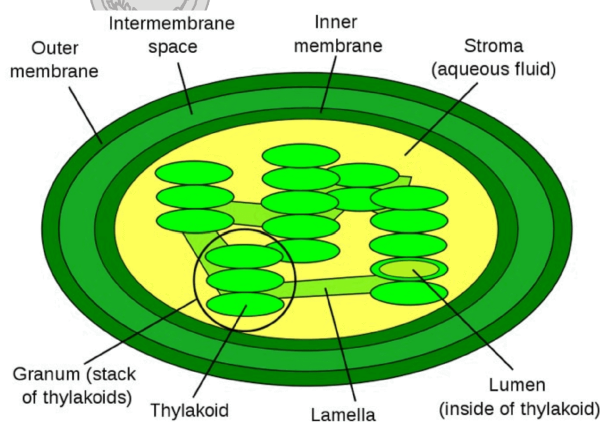
They are of three types :- Amyloplast (store starch), Aleuroplast (store protein) and Elaioplast (store oil and fats) Leucoplasts are the centre of starch grain formation and they are also involved in the synthesis of oil and proteins.

##### (ii) Chloroplasts

Chloroplasts are probably the most important among the plastids they are directly involved in photosynthesis. They are usually situated near the surface of the cell and occur in those parts that receive sufficient light e.g. the palisade cells of leaves. The green colour of chloroplasts is caused by the green pigment chlorophyll.

#### → STRUCTURE OF CHLOROPLAST

Chloroplasts are usually disc-shaped and surrounded by a double membrane. Inside the inner membrane there is a watery protein-rich ground substance called as stroma in which is embedded a continuous membrane system, the granal network. The network forms a three-dimensional arrangement of membrane bound vesicles called thylakoids. The thylakoids usually lie in stacks called grana and contain the photosynthetic pigments green chlorophyll. The grana are interconnected by tubular membranes called the stromal lamellae/Fret's channel.



**Figure : Chloroplast**

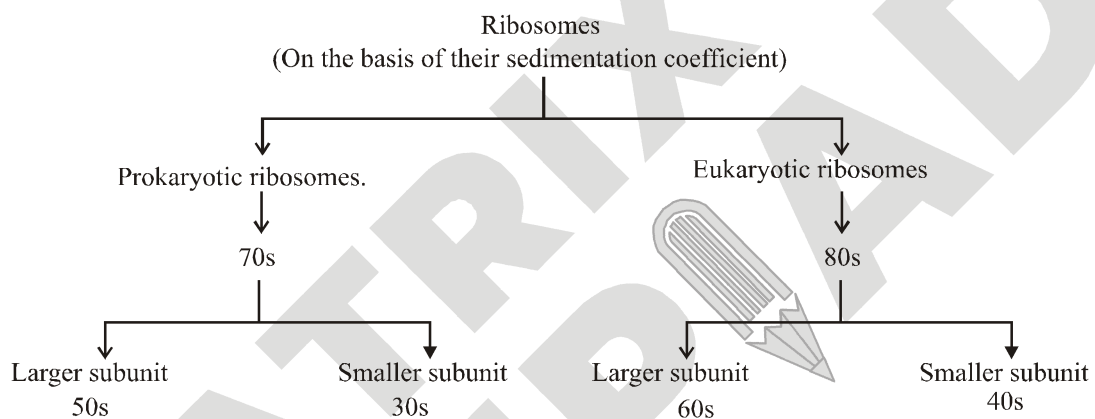
→ **FUNCTIONS OR CHLOROPLAST**

- Chloroplasts are the sites of photosynthesis.
- Grana is the site of light reaction and stroma is the site of dark reaction.
- They contain enzymes and coenzymes necessary for the process of photosynthesis.

**3.11 RIBOSOME**

- **Claude (1941)** First observed them and called **microsome**.
- **Palade (1955)** coined the term Ribosome. That’s why it is also known as Palade’s particles.
- All living cells have Ribosomes. [Both prokaryotes & Eukaryotes]
- These are **smallest and membraneless cell organelles**.

→ **TYPES OF RIBOSOMES**



**3.12 CENTROSOME**

- It is present only in animals cell and it is located near the nucleus. If the differentiated into a clear homogeneous mass of cytoplasm called centrospheres and one or a pair of microtubular centrioles.
- **FUNCTION OF CENTROSOME** : The centrosome is concerned with cell division and formation of basal bodies of cilia and flagella.

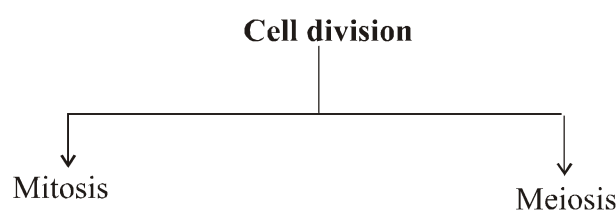
**4. CELL DIVISION**

- Cell division was first observed by **Prevost and Dumas (1824)** in zygote of frog and also by **Nageli** in plant cell (1842).

**4.1 CELL CYCLE**

- It is a series of programmed cyclic changes by which the cell duplicates its contents and divides into two parts.

**4.2 TYPES OF CELL DIVISION**





**NS. 1**

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

**Ans.** There will be spilling of cytoplasm and cell organelles, bursting of lysosomes and digestion of cellular contents.

**NS. 2**

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

**Ans.** There would not be any lysosome for intracellular digestion and cleaning, no complexing of molecules, no excretion and no formation of new plasma membrane.

**NS. 3**

Which organelle is known as power house of the cell? Why?

**Ans.** Mitochondria is known as power house of the cell because it produces most of the molecules of ATP (adenosine triphosphate) which are required for providing energy for synthesis of new chemicals, as well as mechanical and other cellular functions.

**NS. 4**

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

**Ans.** Proteins are synthesised over ribosomes of RER while lipids are synthesised over SER.

**NS. 5**

How does Amoeba obtain food?

**Ans.** Plasma membrane of Amoeba is flexible. With its help, Amoeba engulfs food particle. The engulfed food particle passes into the body of Amoeba as a phagosome. Phagosome combines with lysosome to produce digestive or food vacuole. Digestion occurs in food vacuole. The digested food passes into surrounding cytoplasm. The undigested matter is thrown out of the cell.

**NS. 6**

What is osmosis?

**Ans.** Osmosis is diffusion of water from the region of its higher concentration (pure water or dilute solution) to the region of its lower concentration (strong solution) through a semipermeable membrane.

**NS. 7**

Carry out the following osmosis experiment.

Take four peeled potato halves and hollow each one out to make potato cups. One of these potato cups should be made from the boiled potato. Put each potato cup in the trough containing water. Now

- (a) Keep cup A empty,
- (b) Put one tea spoon sugar in cup B.
- (c) Put one tea spoon of salt in cup C.
- (d) Put one tea spoon sugar in boiled cup D. Keep this set up for two hours. Then observe the four potato cups and answer the following:
  - (i) Explain why water gathers in the hollowed portion of B and C.
  - (ii) Why is potato A necessary for this experiment?
  - (iii) Explain why water does not gather in the hollowed out portion of A and D.

**Ans.** (i) Sugar and salt increase osmotic concentration which results in passage of water osmotically from the through the cells of potato into its cavity.  
 (ii) Potato A functions as control experiment which indicates that the cavity of potato does not induce movement of water.  
 (iii) Water does not gather in the hollowed out portion of A because it does not have a higher osmotic concentration than the cells of potato tuber. Potato tuber D does not have living cells. Osmosis does not occur in dead cells. Therefore, despite presence of sugar in the cavity of D, no water passes through dead potato cells into cavity of the tuber.

## EXERCISE – I

### ONLY ONE CORRECT TYPE

- Powerhouse of cell is -  
(A) Lysosome (B) Ribosome  
(C) Mitochondria (D) Vacuole
- Who discovered the cell -  
(A) Robert hooke (B) Purkinje  
(C) Robert brown (D) Davson
- Mitochondria are site of -  
(A) Electron transport  
(B) Cellular respiration  
(C) ATP formation  
(D) All
- Golgi body take part in -  
(A) Lipid synthesis  
(B) Carbohydrate synthesis  
(C) Protein synthesis  
(D) Oxidative phosphorylation
- Protein synthesis occurs on -  
(A) Ribosome (B) Lysosome  
(C) Nucleus (D) Chloroplast
- Which of the following has a single membrane : -  
(A) Nucleus (B) Mitochondrion  
(C) Golgi Bodies (D) Plastid
- What is the function of ER -  
(A) Nucleus  
(B) Chloroplast  
(C) ATP formation  
(D) Exchange of molecules
- Grana , Stroma and lamella occur in -  
(A) Ribosome (B) Chloroplast  
(C) Mitochondria (D) Golgi body
- Kreb's cycle occurs in -  
(A) Matrix of mitochondria  
(B) Nucleoplasm  
(C) Cytoplasm  
(D) Protoplasm
- Organelle, which remove worn-out cell organelle is  
(A) Lysosome (B) Plastid  
(C) Mitochondria (D) Golgi complex
- Which of the following organelle is involved in formation of lysosomes  
(A) SER (B) Golgi complex  
(C) RER (D) Mitochondria
- Numerous membrane layer present in plastid known as -  
(A) Cisternae (B) Stroma  
(C) Grana (D) Matrix
- Chromosomes are made up of -  
(A) DNA (B) Protein  
(C) DNA & protein (D) RNA
- Cell wall of which one of these is not made up of cellulose-  
(A) Bacteria (B) Hydrilla  
(C) Mango tree (D) Cactus
- Kitchen of the cell -  
(A) Mitochondria (B) ER  
(C) Chloroplast (D) Golgi complex
- Membrane biogenesis is related with -  
(A) Cell membrane  
(B) Nuclear membrane  
(C) Cell wall  
(D)None
- Organelle other than nucleus, containing DNA is -  
(A) Endoplasmic reticulum  
(B) Mitochondria  
(C) Golgi apparatus  
(D) Lysosome
- Amoeba acquires its food through a process termed as -  
(A) Exocytosis (B) Plasmolysis  
(C) Endocytosis (D)BothA&B
- The outermost layer of human cheek cell is -  
(A) Cell wall  
(B) Nuclear membrane  
(C) Plasma membrane  
(D) Cytoplasm
- The diffusion of water from external solution into dry raisins is called -  
(A) Exosmosis (B) Endosmosis  
(C) Imbibition (D) Plasmolysis
- The plasma membrane of all living cell is -  
(A) Impermeable  
(B) Semi permeable  
(C) Permeable  
(D)Selectively permeable



## EXERCISE – II

### VERY SHORT ANSWER TYPE

1. What are chromosomes ?
2. Name the protein factory of cell ?
3. What are leucoplasts ?
4. Which cell organelle is commonly called cellular housekeeper ?
5. Name any cell organelle which is non-membranous.
6. Name the organelles having double membrane envelope.
7. Give two examples of unicellular organisms.
8. Define osmosis.
9. Define diffusion.
10. Name two types of Endoplasmic reticulum present in the cell.

### SHORT ANSWER TYPE

1. Who discovered cell & how ?
2. Why is plasma membrane called selectively permeable membrane ?
3. Which organelle is known as the power house of cell & why ?
4. What is osmosis ?
5. Why are lysosomes known as suicide bags ?

### LONG ANSWER TYPE

1. Draw a well labelled sketch of a ultra structure of animal cell ?
2. Explain the following -
  - (a) Membrane biogenesis
  - (b) Diffusion
  - (c) Endocytosis
  - (d) Cell organelles
3.
  - (a) Draw a diagram of an animal cell & label its seven parts.
  - (b) Mention two cell organelles which are bounded by double membrane. Give structural detail also.

### TRUE / FALSE TYPE

1. Plant cell has cell wall.
2. Mitochondria is power house of cell.
3. Lysosome is a protein factory.
4. Chloroplast is single membranous structures.
5. Head quarter of cell is nucleus.

### FILL IN THE BLANKS

1. Transporting channels of cell is .....
2. Powerhouse of cell is.....
3. Digestive bag of cell is.....
4. Kitchen of cell is .....
5. Storage sacs of the cell is .....



## SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : FUNDAMENTAL UNIT OF LIFE CELL)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

### NOTES :

1. In the status, put “completed” only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.



*Space for Notes :*

A large rectangular area containing 25 horizontal dotted lines, intended for writing notes.



# TISSUE

# 2

## Concepts

### Introduction

#### 1. Plant Tissue

##### 1.1 Meristematic Tissue

##### 1.2 Permanent Tissues

#### 2. Animal tissues

##### 2.1 Epithelial Tissue

##### 2.2 Muscular Tissue

##### 2.3 Connective Tissue

##### 2.4 Nervous Tissue

## NCERT Solution

### Exercise – I (Competitive Exam Pattern)

### Exercise – II (Board Pattern Type)

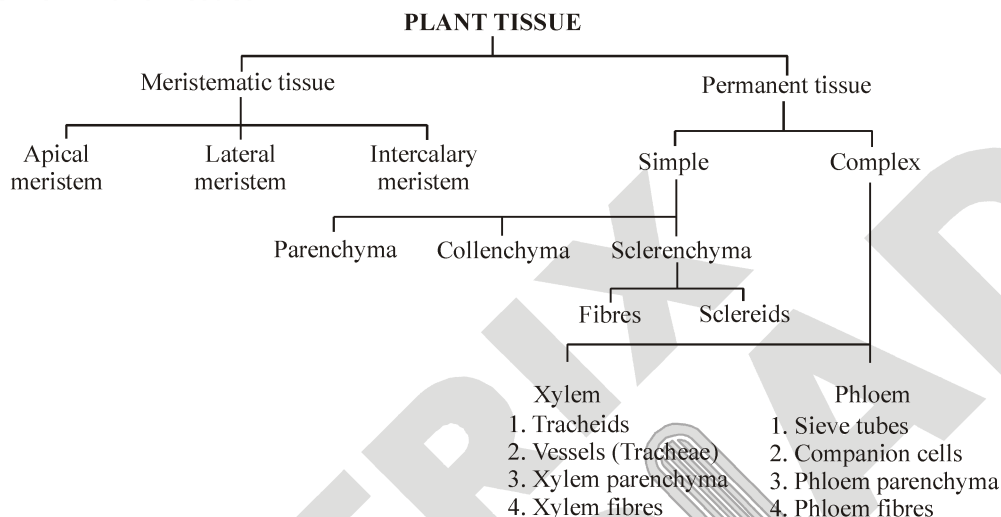
### Answer Key

## INTRODUCTION

"A tissues may be defined as a group or collection of similar or dissimilar cells that perform a common function & have a common origin."

### 1. PLANT TISSUE

Classification of Plant Tissues :



#### 1.1 MERISTEMATIC TISSUE

Meristematic tissues may be defined as a group or collection of living cells which are located specific locations and divide continuously to add new cells to the plant body.

**(a) Apical meristem :**

This meristem is located at the growing apices of main and lateral shoots and roots. These cells are responsible for linear growth of an organ. Example root apical meristem and shoot apical meristem.

**(b) Lateral meristem :**

This meristem consists of initials which divide mainly in one plane and cause the organ to increase in diameter and girth. The lateral meristem usually occurs on the sides both in stem and root. Lateral meristem is of two types, i.e., in the form of cork cambium and in vascular bundles of dicots in the form of vascular cambium. The activity of this cambium results in the formation of secondary growth.

**(c) Intercalary meristem :**

This meristem is located in between the regions of permanent tissues. The intercalary meristem are usually present at the base of node, base of internode or at the base of the leaf. They are responsible for growth of leaves and internodes.

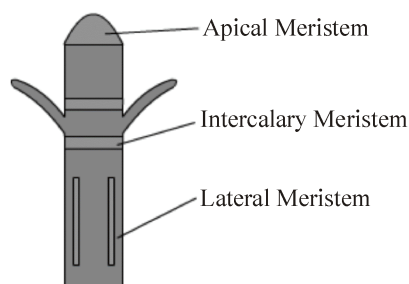


Figure : Meristematic tissues

→ **CHARACTERISTICS OF MERISTEMATIC TISSUES :**

- The cells of meristematic tissues are similar in structure and have thin and elastic primary cell walls made up of cellulose.
- These meristematic cells may be rounded, oval, polygonal or rectangular in shape.
- They are compactly arranged without intercellular spaces between them.
- Each cell contains dense or abundant cytoplasm and a large prominent nucleus.
- The dense protoplasm of meristematic cell contains few small vacuoles or no vacuoles at all.

## 1.2 PERMANENT TISSUES

These tissues are derived from the meristematic tissues but their cells have lost the ability of division and have attained their different forms. They are of two types-Simple and Complex.

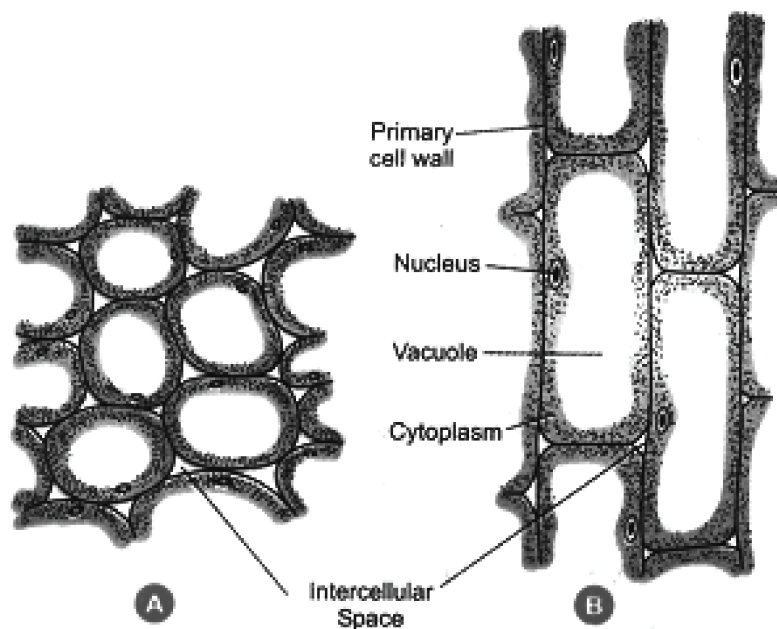
### (a) SIMPLE PERMANENT TISSUES :

These tissues are made up of cells which are structurally and functionally similar. These are of three types -

- (i) Parenchyma
- (ii) Collenchyma
- (iii) Sclerenchyma

#### (i) Parenchyma :

- The parenchyma tissue is composed of living cells which are variable in their morphology and physiology but generally having thin walls and a polyhedral shape and concerned with vegetative activities of the plant.
- They have intercellular spaces between them.
- They act as storage for food and water.



**Figure : PARENCHYMA ; A-TRANSVERSE SECTION  
B-LONGITUDINAL SECTION**



## Focus Point

### Types of Parenchyma :

#### Aerenchyma :

- In hydrophytes, the intercellular space between cells become wide & filled with air.
- Such a parenchymatous tissue having large air spaces is called Aerenchyma.
- These help in gaseous exchange and provide buoyancy to plant.

#### Chlorenchyma :

- When parenchyma is richly supplied with chloroplasts, it is called chlorenchyma.
- They are found in leaf mesophyll, sepals, phylloclades, phyllodes, cladodes etc. It is photosynthetic in function and posses chlorophyll.

### (ii) Collenchyma :

- It was discovered and coined by schleiden (1839).
- The cells are living with intercellular space in between the cells or junctional places filled with cellulose and pectin.
- Generally they are longer than parenchyma
- Usually they are known as living mechanical tissue owing to their supportive functions.
- It provides flexibility and strength to young plant organ.

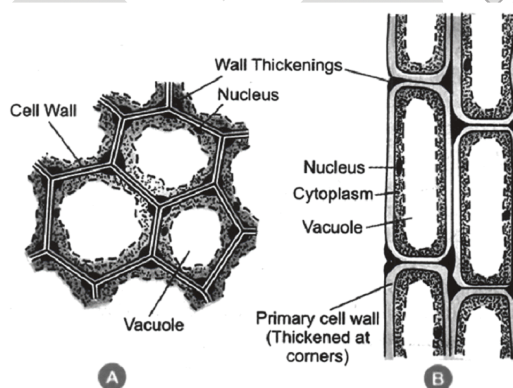


Figure : Collenchyma ; A-Transverse Section ; B - Longitudinal Section

### (iii) Sclerenchyma

- They were discovered and coined by Mettenius (1805).
- The cells are long, narrow, pointed at ends, thick walled and lignified. They are the dead cells.
- It impart hardness to plant parts and give mechanical strength.

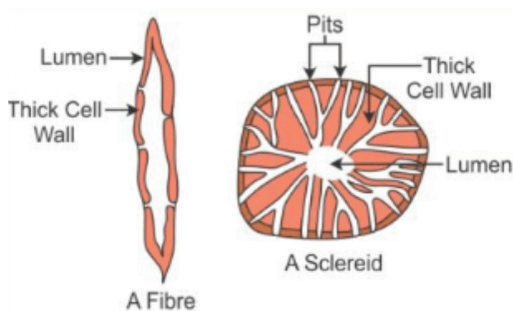


Figure : Sclerenchyma



## Focus Point

### Protective Tissue :

- It includes epidermis and cork.

#### Epidermis :

- It is usually present in the outermost layer of the plant body such as leaves, flowers, stem and roots.
- Epidermis is one cell thick and is covered with cuticle.
- This layer also have guard cells which have pore known as stomata.
- Cuticle is a water proof layer of a waxy substance called cutin which is secreted by epidermal cells.
- The main function of epidermis is to protect the plant from desiccation and infection.

#### Cork :

- As roots and stem grow older with time (increase in girth), tissues at the periphery become cork cell.
- Cork cells are dead cells and they do not have any intercellular spaces.
- The walls of cork cells are heavily thickened by the deposition of an organic substance (a fatty substance), called suberin.
- Cork is protective in function. cork cells prevent desiccation (loss of water from plant body), infection and mechanical injury.
- Cork is produced by cork cambium commercially it is obtained from oak (*Quercus suber*).
- Cork is used for making insulation boards, sports goods, bottle corks etc.

### (b) COMPLEX PERMANENT TISSUES :

- A complex tissues can be defined as a collection of different types of cells that help in the performance of a common function.
- The important complex tissues in vascular plants are xylem and phloem. Both these together called as vascular tissues.
- Both these tissues are an assemblage of living and dead cells and may be primary or secondary, depending upon their mode of origin.
- Complex tissue transport water, mineral salts (nutrients) and food material to various parts of plant body.

### COMPLEX TISSUES ARE OF FOLLOWING TWO TYPES :

#### (i) XYLEM :

- Its main function is conduction of water and mineral salts from root to the top of plant.
- Primary xylem elements originate from procambium of apical meristem.
- Secondary xylem elements originate from the vascular cambium of lateral meristem.
- The xylem elements are of 4 types : (a) xylem tracheids (b) vessels (c) fibers (d) parenchyma.

#### → Xylem Tracheids :

- These are lignified and dead cells with bordered pits.
- They help in conduction of water in pteridophytes and gymnosperms and provide mechanical support plants.

#### → Xylem Vessels :

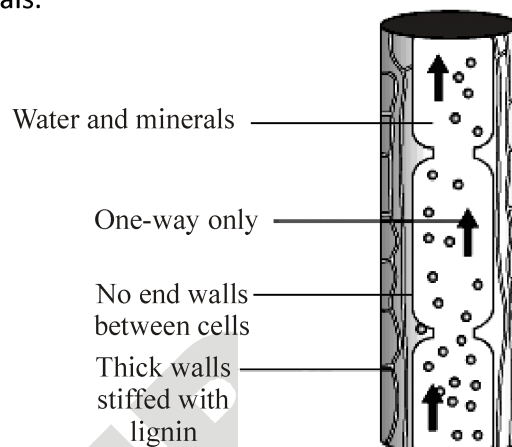
- The cells are long and tubular with lignified cell wall.
- The cross wall (end wall) at both the ends dissolves and form a pipe like channel.
- They help in ascent of sap in angiosperms.

→ **Xylem Fibers :**

- Long and narrow sclerenchymatous fibers with tapering end. The wall is heavily lignified leaving a very narrow Lumen.
- It provides tensile strength and mechanical strength.

→ **Xylem Parenchyma :**

- They are thin walled living cells present in both primary and secondary xylem.
- They store food materials.



**Figure : Xylem**

**(ii) PHLOEM :**

- The dead matter in them is known as bast.
- Its main function is conduction of food material from leaves to other plant parts.
- The phloem elements are of four type : (a) Sieve tubes (b) Companion cells (c) Fibres (d) paranchyma.

→ **Sieve Tubes :**

- These are living but lack nucleus at maturity.
- Cell wall is thin and made up of cellulose.
- The transverse walls of sieve tube form sieve plate.
- They help in conduction of food material.

→ **Companion Cells :**

- The cells are living, thin walled, narrow and found attached to the lateral side of sieve element.
- They are absent in pteridophytes and gymnosperms.
- They support the sieve tube in transport of food.
- These are living and thin walled cells.
- They are absent all monocots and some dicots.

→ **Phloem Fibers (bast fibers) :**

- These are sclerenchymatous fibers having thick wall and narrow Lumen.
- They provide mechanical support to the plant.

→ **Phloem Parenchyma -**

- The chief function of parenchyma is to store food material and other substances like mucilage, tanins and resins.

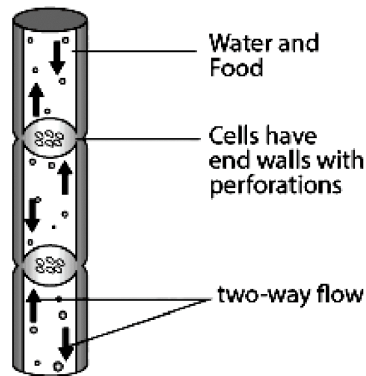
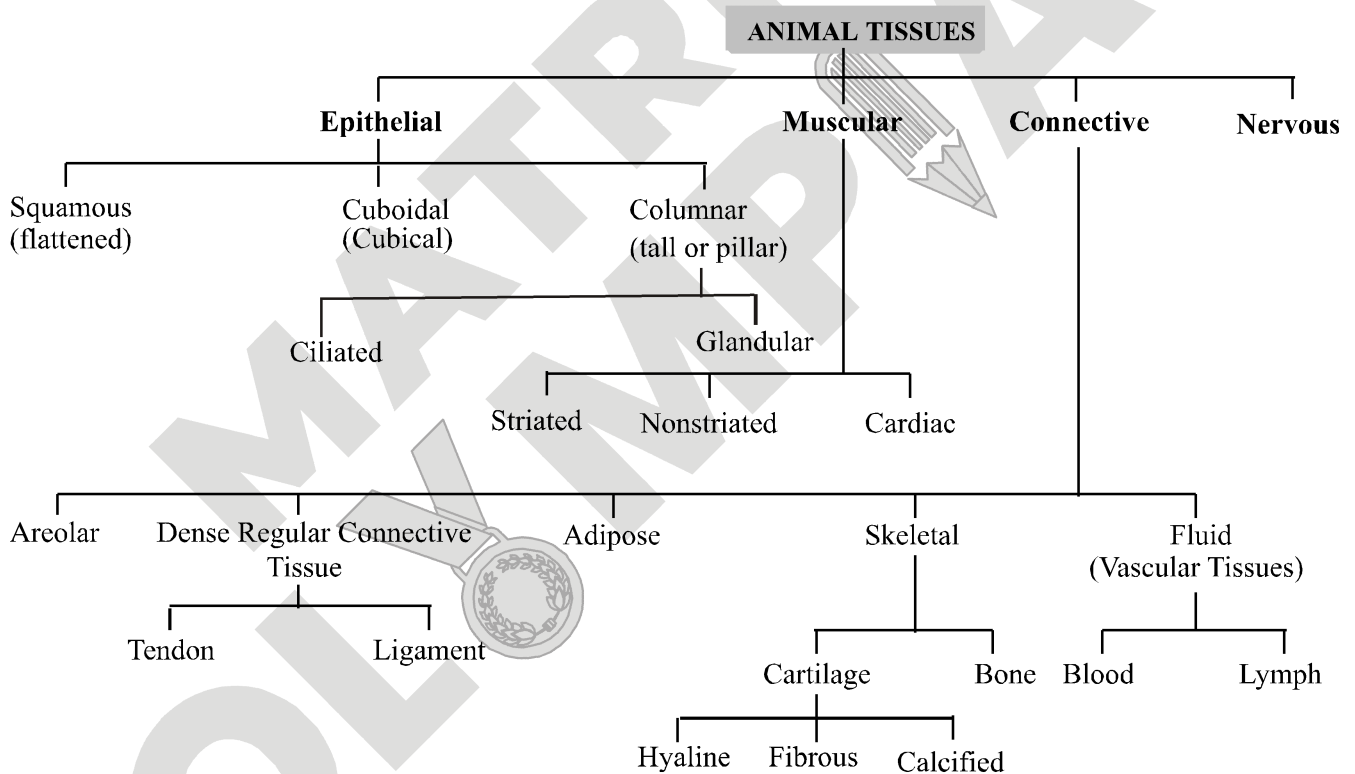


Figure : Phloem

2. ANIMAL TISSUES



2.1 EPITHELIAL TISSUE

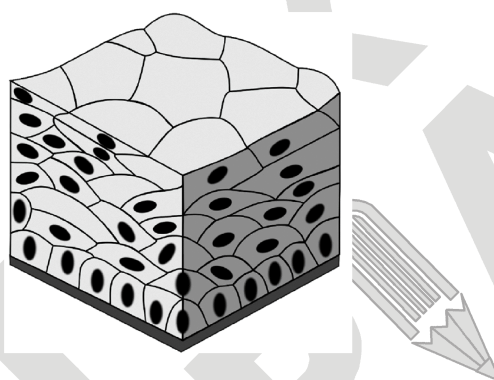
- Epithelial tissue is a simplest as a protective covering.
- **FUNCTION OF EPITHELIAL TISSUE:**
- Epithelial cover the body surface as an outer layer of skin and provide protection to the underlying tissues from mechanical injury, drying up, entry of germs (viral or bacterial pathogens), and harmful chemicals.
- Epithelia forms inner lining of mouth, alimentary canal and other internal organs inside the body and protect these organs.

- Epithelial lining of the intestine absorbs water and digested food.
- Epithelial tissues help in the elimination of nitrogenous and other waste products.
- Epithelial lining of the cavities give rise to glands that provide valuable secretions such as mucus, gastric juice, etc.

**TYPE OF EPITHELIAL TISSUE :**

**(a) SQUAMOUS EPITHELIUM :**

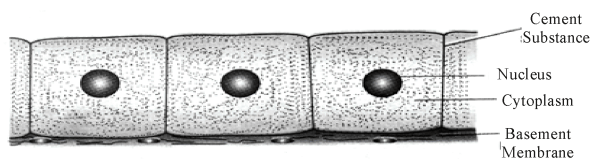
- **Structure:** Simple squamous epithelial cells are extremely thin and flat and form a delicate lining. It consists of tiles shaped cells. (Pavement epithelium)
- **Occurrence:** The skin, which protects the body, is also made of squamous epithelium. The oesophagus and the lining of the mouth are also covered with squamous epithelium.
- **Function:** Diffusion



**Figure. Squamous epithelium**

**(b) CUBOIDAL EPITHELIUM :**

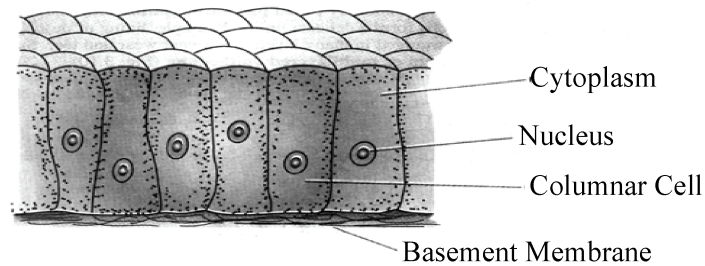
- **Structure:** This epithelium consists of cube-like cells which are about as tall as wide. The outline of cells is polygonal in surface view and square in section.
- **Occurrence:** The cuboidal epithelium lines the small salivary ducts, pancreatic ducts, sweat glands, salivary glands and thyroid glands. It also covers the ovaries and lines the sperm-producing tubules. Cuboidal epithelium (with cube-shaped cells) forms the lining of kidney tubules and ducts of salivary glands, where it provides mechanical support.
- **Function:** It helps in protection, secretion, absorption, excretion and gamete formation.



**Figure : CUBOIDAL EPITHELIUM**

**(c) COLUMNAR EPITHELIUM**

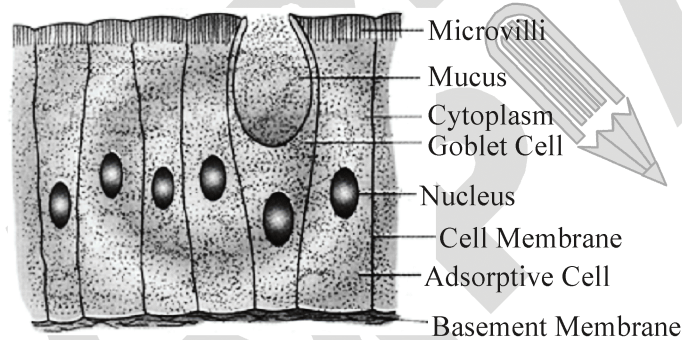
- **Structure.** This epithelium consists of tall or pillar-like cells that are much taller than wide. The nuclei are generally elongated along the long axis of cells.
- **Occurrence.** The columnar epithelium lines the stomach, intestine and gall bladder. It also lines mammary gland ducts and parts of urethra.
- **Function.** Secretion, absorption



**Figure : Columnar Epithelium**

→ **GLANDULAR EPITHELIUM :**

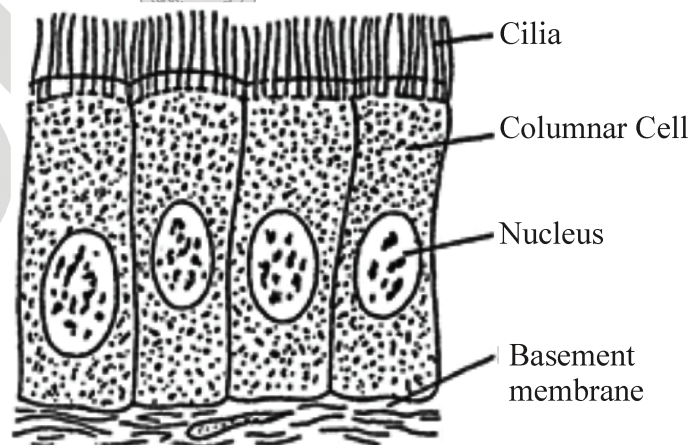
- **Structure.** Tall, slender cells, some cells from the free surface invaginate inside to form secretory cells – goblet cells.
- **Occurrence.** Lining of intestine & glands, trachea, bronchi.
- **Function.** Protection, movement of substances in a particular direction for e.g. of mucus in nasal passages.



**Figure : Glandular epithelium**

→ **CILIATED COLUMNAR EPITHELIUM**

- **Structure.** Tall, slender cells which possess cilia.
- **Occurrence.** Lines the nasal passages, oviducts, terminal bronchioles.
- **Function.** Secretion of mucus and other secretions.

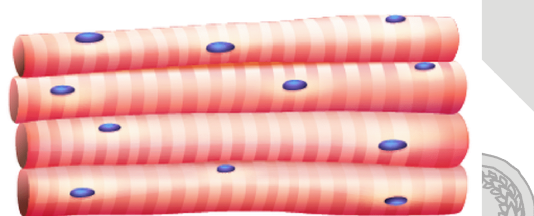


**Figure : Ciliated columnar epithelium**

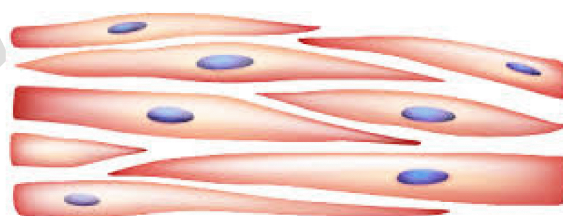
## 2.2 MUSCULAR TISSUE

- Locomotion and movements are due to muscular tissues which contain highly contractile muscle cells.
- It is made up of muscle fibres.
- On the basis of their structures and functions, they can be divided as striated, unstriated and cardiac muscles.
- Muscle is a contractile tissue which brings about movements, regarded as motors of the body.
- Muscle cells are elongated slender like cells and called muscle fibres.
- The muscles are of three types as compared below :

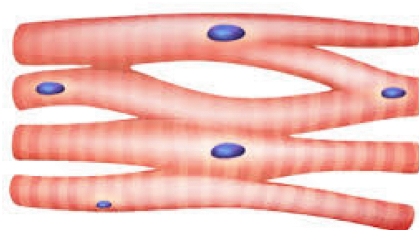
Characteristics	Striped	Unstriped	Cardiac
<b>Location</b>	Occur in the body wall, limbs, tongue, pharynx and beginning of oesophagus	Occur in the wall of hollow viscera, iris of the eye and dermis of the skin.	Occur in the walls of heart, pulmonary veins and superior venacava.
<b>Other names</b>	Also called striated, skeletal and voluntary muscle fibres	Also called non-striated, smooth, visceral and involuntary muscle fibres.	Also called heart muscle fibres.
<b>Shape</b>	Cylindrical	Spindle	Cylindrical
<b>Action</b>	Voluntary	Involuntary	Involuntary
<b>Light &amp; Dark bands</b>	Present	Absent	Absent
<b>Branching</b>	Absent	Absent	Present



**Skeletal muscle**



**Smooth muscle**



**Cardiac muscle**

*Figure : Muscular tissue*

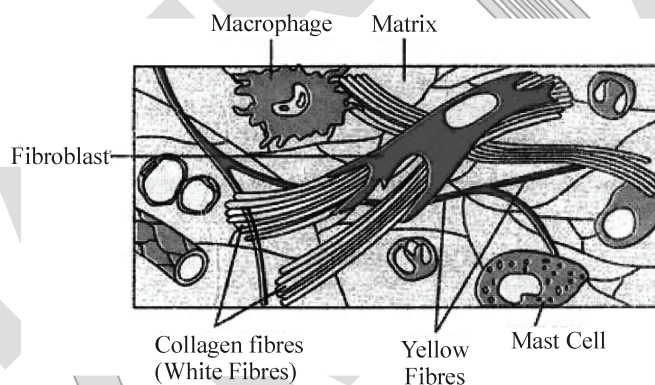
### 2.3 CONNECVE TISSUE

Connective tissues of animals serve the functions of binding and joining one tissue to another (i.e. connecting bones to each other, muscles to bones etc.) forming protective sheath and packing material around the various organs separating them so that they do not interfere with each other acitivities carrying materials from one part to another in the body, forming a supporting framework of cartilage and bones for the body etc.

→ **TYPES OF CONNECTIVE TISSUE :**

**(a) AREOLAR TISSUE :**

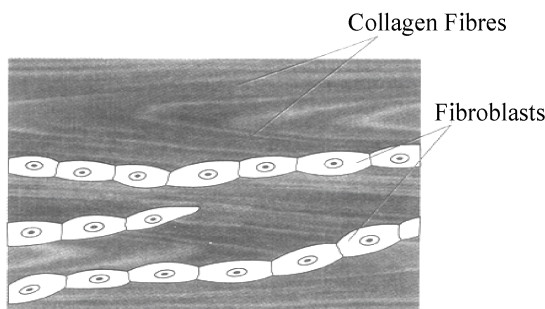
- The areolar tissue is also known as loose connective tissue. It is most widely distributed connective tissue in the animal body. It consists of a transparent, jelly-like sticky matrix containing numerous fibres and cells and abundant mucin. The fibres are mostly of two types : (a) White collagen fibres. They are made up of a protein called collagen, which on boiling with water changes to gelatin and (b) yellow elastic fibres. They are formed of a protein called elastin. Collagen fibres provide flexibility and strength whereas elastin fibres provide elasticity.
- The areolar tissue is connective in function. It fixes the skin with the muscles, fills the spaces inside the organs, Attaches the blood vessels and nerves with the surrounding tissues, fastens the peritoneum to the body wall and viscera. It is commonly called "**Packaging tissue**" of the body. Examples bone periosteum, muscle perimysium, nerve perineurium, etc.



**Figure : Areolar tissue**

**(b) DENSE REGULAR CONNECTIVE TISSUE :**

- Dense regular connective tissue consists of orderd and densely packed fibres and cells. The fibres are loose and very elastic in nature. They are secreted by the surrounding connective tissue cells. This tissue is the principal component of tendons and ligaments.



**Figure : DENSE REGULAR CONNECTIVE TISSUE**

- (i) **Tendon** : Tendons are cord-like, very tough, inelastic bundles of white collagen fibres bound together by areolar tissue. The cells present in the tendons are elongated fibroblasts which lie in almost continuous rows here and there. The tendons connect the skeletal muscles with the bones.
- (ii) **Ligaments** : Ligaments are cords formed by yellow elastic tissue in which many collagen fibres are bound together by areolar tissue. The fibroblasts are irregularly scattered. This tissue combines strength with great flexibility. The ligaments serve to bind the bones together.

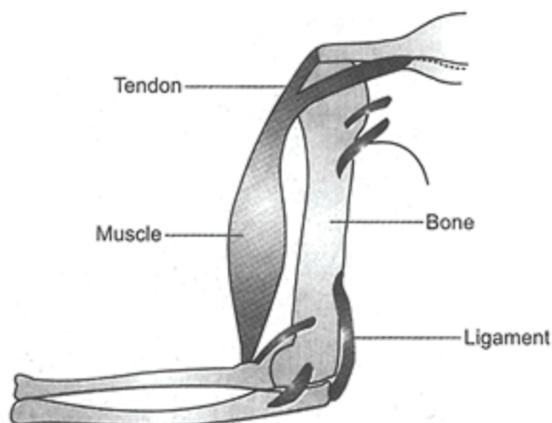


Figure : ATTACHMENT OF TENDONS AND LIGAMENTS



### Build The Concept

#### Difference between Tendons and Ligaments

Tendons	Ligaments
1. Tendons are very tough and inelastic	1. Ligaments are elastic
2. They connect the skeletal muscles with the bones	2. Ligaments connect bones to other bones at joints.
3. Tendons are made up of white fibrous tissue. Yellow elastic fibres are however absent	3. Ligaments are made up to yellow elastic fibres. The white occur but they are very fine.
4. Fibroblasts occur in rows.	4. Fibroblast lies scatted.

#### (c) ADIPOSE TISSUE :

- Adipose is primarily a fat storing tissue in which the matrix is packed with large, spherical or oval fat cells (or adipocytes). Each fat cell contains a large fat globule. The matrix also contains fibroblasts, macrophages, collagen fibres and elastic fibres. The adipose tissue is arranged in lobules encased in areolar tissue.
- The adipose tissue is found beneath the skin, in the covering of the heart, around the blood vessels and kidney and in yellow bone marrow. This tissue stores fat and insulates the body against heat loss. It forms a shock absorbing cushion around the kidneys and the eyeballs. Blubber in whales is, in fact, an insulating fat body.

Similarly, hump in camel is also rich in adipose tissue.

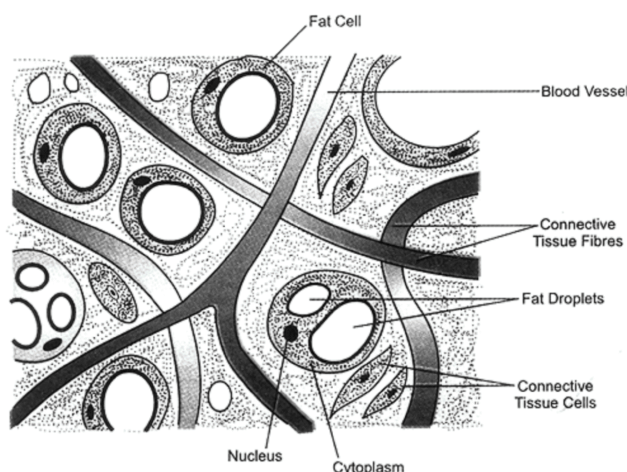


Figure : ADIPOSE TISSUE

**(d) SKELETAL TISSUE :**

- Skeletal tissue forms the rigid skeleton which supports the vertebrate body, helps in locomotion and provides protection to many vital organs. There are two types of skeletal tissues.

**(i) Cartilage**

- **Characteristics.** Cartilage is a hard but flexible skeletal tissue consisting of living cells embedded in a matrix. The cells (chondroblasts) become chondrocytes when get surrounded within special fluid-filled chambers, called lacunae (sing. lacuna). The lacunae (containing chondrocytes) are separated by the amorphous matrix (chondrin) that contains glycoproteins, collagen and elastic fibres. The surface of cartilage is surrounded by irregular connective tissue forming the perichondrium. Growth of cartilage occurs continuously due to multiplication of chondrocytes by mitosis, deposition of matrix within existing cartilage and from activity of the deeper cells of the perichondrium. Blood vessels and nerves are absent in the matrix.

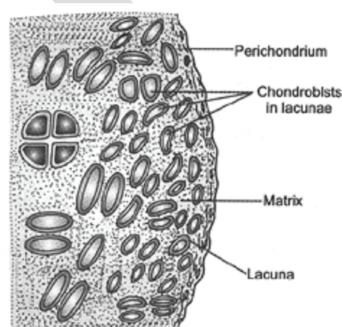


Figure : CARTILAGE

- **Occurrence :** This tissue occurs in very few parts of the body. In humans, the cartilage occurs at the ends of long bones, the pinnae of ears, the ends of nose, in the walls of respiratory ducts, within intervertebral discs, etc. In sharks and rays, the entire skeleton is cartilage.
- **Functions:** Cartilage is more compressible than bone. It absorbs stresses and provides flexibility to the body parts.

(ii) Bone

- Characteristics:** Bone is a very strong and non-flexible vertebrate connective tissue. A compact bone consists of living bone cells. Called osteoblasts, embedded in a firm, calcified matrix. The osteoblasts are contained in lacunae (spaces) which are arranged in concentric circles present throughout the matrix. The lacunae are also surrounded by nerves and blood vessels. The blood vessels passing through them provide nutrients to osteoblasts and help exchange of materials. The matrix is composed of about 30% organic materials (chiefly collagen fibres and glycoproteins) and 70% inorganic bone salts (mainly phosphates and carbonates of calcium and magnesium, hydroxyapatite etc.). These inorganic salts are responsible for hardness of the bone.

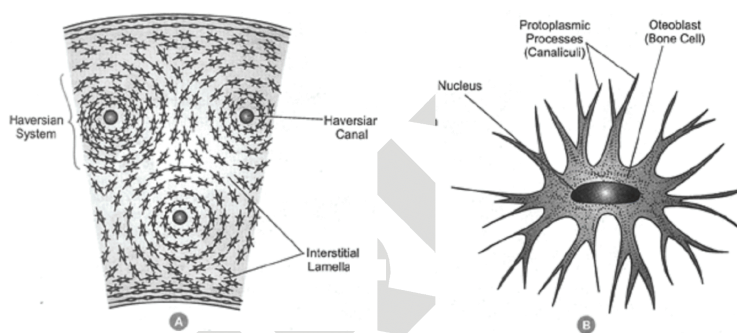


Figure : T.S. Of LONG BONE

Figure : OSTEOLAST



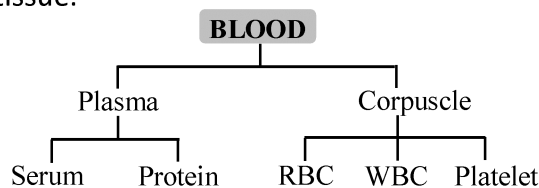
Build The Concept			
Difference between Cartilage and Bones			
	Cartilage		Bone
1.	Cartilage is soft, elastic and flexible.	1.	Bone is hard, tough and inelastic.
2.	Matrix of cartilage consists of entirely organic matter.	2.	Ligaments connect bones to other bones.
3.	Cartilage do not have blood supply (except in (perichondrium).	3.	Bones have rich blood supply.
4.	Elastic fibres are absent.	4.	Elastic fibres are present.
5.	Growth of cartilage is unidirectional.	5.	Growth of bone is bidirectional.

(e) Fluid Connective Tissue : (Vascular Tissue)

- Fluid connective tissue links the different parts of body and maintains a continuity in the body. It includes blood and lymph.

(i) Blood :

- It is a fluid connective tissue.



→ **Functions of blood :**

- Blood transports nutrients, hormones and vitamins to the tissues and transports excretory products from the tissues to the liver and kidney.
- The red blood corpuscles (RBC's) carry oxygen to the tissues for the oxidation of food stuff.
- The white blood cells (WBC's) fight disease either by engulfing and destroying foreign bodies or by producing antitoxins and antibodies.
- Granulocytes include neutrophils, eosinophils and basophils.
- Agranulocytes include lymphocytes and monocytes.
- Blood platelets disintegrate at the site of injury and help in the clotting of blood.

**(ii) Lymph:**

→ **Nature :**

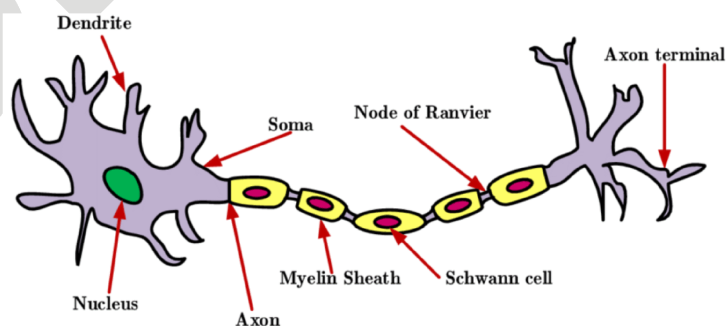
- Lymph is a colourless fluid that has filtered out of the blood capillaries. Red blood corpuscles and some blood proteins are absent in it. In the lymph, white blood cells are found in abundance.

→ **Functions :**

- Lymph transports the nutrients (oxygen, glucose) that may have filtered out of the blood capillaries back into the heart to be recirculated in the body.
- It brings CO<sub>2</sub> and nitrogenous wastes from tissue fluid to blood.

**2.4 NERVOUS TISSUE**

- The nervous tissue, which contains densely packed nerve cells, called neurons (Gk. neuro = nerve), is present in the brain, spinal cord and sense organs. The neurons are specialized for conduction of nerve impulses. They receive stimuli from within or outside the body and conduct impulses (signals) which travel from one neuron to another neuron. Each neuron is composed of the following three parts.
  - (a) Cyton or cell body.** The cell body contains the major concentration of the cytoplasm and the central nucleus of the neuron. The cell body also contains **Nissl's granules**, which are groups of ribosomes and rough endoplasmic reticulum.
  - (b) Dendrons.** These are short much-branched and tapering projections arising from the cell body. The dendrons are further branched into dendrites. They provide a large surface area for synaptic connections with other neurons. They conduct nerve impulses towards the cell body.
  - (c) Axon (Nerve fibre).** The axon is a long cylindrical process of uniform diameter that arises from the axon hillock of the cyton. It shows fine branching at the terminal end. Each branch ends in a swollen structure, called synaptic knob. The axons carry impulses away from the cell body to other neurons. The synaptic knobs of terminal branches of neuron are connected with dendrite branches of an adjacent neuron. Each such junction, in fact, has minute gap called synapse. It is meant for the transmission of nerve impulse from one neuron to the other.



**Figure : Neuron**

NS. 1

What is a tissue?

**Ans.** Tissue is a group of related cells that have a common origin and perform a common function .

NS. 2

What is the utility of tissues in multicellular organisms?

**Ans.** (i) **Division of Labour** - Tissues bring about division of labour in multicellular organisms. It increases efficiency.

(ii) **Higher organisation** - Tissues become organised to form organs and organ systems.

(iii) **Individual Cells** - Work load of individual cells has decreased.

(iv) **Higher survival** - Because of division of labour, higher efficiency and organisation, the multicellular organisms have high survival.

NS. 3

Name types of simple tissues.

**Ans.** Three types of simple permanent tissues are -Parenchyma, collenchyma and sclerenchyma. (Meristematic tissue is also a simple tissue).

NS. 4

Where is apical meristem found?

**Ans.** Apical meristem occurs at root and stem tips.

NS. 5

Which tissue makes up the husk of coconut?

**Ans.** Sclerenchyma.

NS. 6

What are the constituents of phloem?

**Ans.** Sieve tubes, companion cells, phloem parenchyma and phloem fibres.

NS. 7

How many types of elements together make up the xylem tissue? Name them.

**Ans.** Xylem tissue is formed of four types of elements. They are tracheids, vessels, xylem parenchyma and xylem fibres.

NS. 8

Name the regions in which parenchyma tissue is present.

**Ans.** It occurs in almost all soft parts of the plants, and mesophyll of leaves. Aerenchyma in aquatic plants is also modified parenchyma. Epidermis is special type of parenchyma.

NS. 9

How does the cork act as a protective tissue?

**Ans.** Cork acts as a protective layer because its cells are dead, filled with tannins, resin and air, impermeable due to deposition of suberin over the cell walls and absence of intercellular spaces. It is insulating (heat proof), fire proof, shock proof, water proof and repellent to microbes and animals.

NS. 10

How are simple tissues different from complex tissues in plants?

**Ans.** Difference between Simple and Complex Tissues

Simple Tissues	Complex Tissues
A simple tissue is all the cells perform formed of only one type of cells.	A complex tissue is made of more than one type of cells.
All the cells perform the same function.	The different cells perform different
There are three types of simple plant tissue parenchyma, collenchyma and	There are two types of complex plant tissues – xylem and phloem.
They form primary structure of the plant.	They form transport system of the plant.

NS. 11

Differentiate amongst parenchyma, collenchyma and sclerenchyma on the basis of the cell wall.

Ans.

Parenchyma	Collenchyma	Sclerenchyma
The cell wall is thin.	It is thickened.	It is thickened.
It is smooth.	It is unevenly thickened.	The wall is uniformly thickened.
Wall is formed of cellulose.	The thickening is of pectin.	The thickening is generally of lignin.

NS. 12

What are the functions of stomata?

Ans. Functions of stomata. (i) Gaseous exchange: Stomata are sites where exchange of gases (carbon dioxide and oxygen) occurs between the plant internal and external environment.. (ii) Transpiration: Major part of transpiration occurs through stomata. Transpiration removes excess water and keeps plant surfaces cool.

NS. 13

Identify the types of tissue in the following: bark of tree, vascular bundle, skin, bone, lining of kidney tubule.

Ans. **Bark of Tree** : Cork (Protective tissue).  
**Vascular Bundle** : Complex or vascular tissues, xylem and phloem.  
**Skin** : Epithelial tissue, connective tissue.  
**Bone** : Connective tissue with solid matrix.  
**Lining of Kidney tubule** : Epithelial tissue.

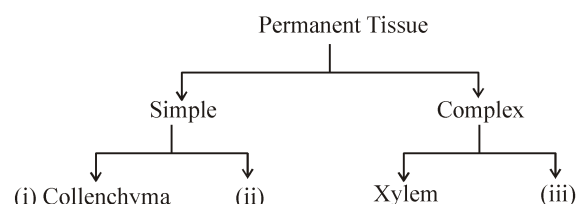
NS. 14

What is the role of epidermis in plants?

Ans. (i) Protection, (ii) Regulation of transpiration, (iii) Formation of insulating stationary air layer with the help of hair (iv) Exchange of gases.

NS. 15

Complete the table :



Ans.

NS. 16

Name the following :

- (a) Tissue that forms the inner lining of our mouth..
- (b) Tissue that connects muscle to bone in humans.
- (c) Tissue that transports food in plants.
- (d) Tissue that stores fat in our body.
- (e) Connective tissue with a fluid matrix.
- (f) Tissue present in the brain.

Ans.

- (a) Epithelial tissue
- (b) Tendon
- (c) Phloem
- (d) Adipose
- (e) Blood
- (f) Nervous tissue

## EXERCISE – I

### ONLY ONE CORRECT TYPE

- Permanent tissues are derived from  
(A) Simple tissue (B) Meristematic tissue  
(C) Complex tissue (D) Collenchyma
- Protective tissue is -  
(A) Xylem (B) Chlorenchyma  
(C) Respiration (D) Cork
- Which of the following is an example of photosynthetic type of tissue  
(A) Chlorenchyma (B) Sclerenchyma  
(C) Collecncyma (D) Aerenchyma
- Which of the following statement is false about meristematic tissue -  
(A) They contain dense cytoplasm  
(B) The endoplasmic reticulum & mitochondria are fully developed  
(C) These are the most metabolically active cells  
(D) Meristematics cells are similar in structure.
- One of the following is modification of parenchyma  
(A) Fibres found in phloem  
(B) Vessel  
(C) Tracheids  
(D) Chlorenchyma
- Mucilage, tannins & resins are stored materials of -  
(A) Xylem (B) Apical tissue  
(C) Phloem (D) Collenchyma
- Aerenchyma is found in -  
(A) Sciophytes (B) Xerophyte  
(C) Lithophytes (D) Hydrophytes
- Which is not a component of xylem?  
(A) Tracheid (B) Companion cell  
(C) Xylem Parenchyma (D) Vessels
- Aerenchyma provides -  
(A) Flexibility of plants  
(B) Buoyancy to plants  
(C) Mechanical strength to plants  
(D) Help floating
- Xylem & phloem occur in -  
(A) Connective tissue (B) Cortex  
(C) Periderm (D) Vascular bundle
- Periderm is produced by -  
(A) Cork cambium (B) Secondary cortex  
(C) Procambium (D) Vascular cambium
- Some parts of the plants are flexible due to the presence of -  
(A) Parenchyma (B) Collenchyma  
(C) Meristematic (D) Sclerenchyma
- Which of the following tissue has dead cells?  
(A) Parenchyma (B) Sclerenchyma  
(C) Collenchyma (D) Epidermins
- Collenchyma provides -  
(A) Flexibility of plant  
(B) Mechenical strength to plant  
(C) Buoyancy to plant  
(D) Help in floating
- Which is not a component of phloem?  
(A) Phloem paremchyma  
(B) Companion cell  
(C) Sieve tube  
(D) Vessels
- Large intercellular space are present in -  
(A) Epithelial tissue (B) Connective tissue  
(C) Muscular tissue (D) Nervous tissue
- Intestine absorbs the digested food materials. What type of epithelial cell are responsible for that?  
(A) Startified squamous epithelium  
(B) Brush Bordered Columnar epithelium  
(C) Spindle fibres  
(D) Cuboidal epithelium
- White fibres of connective tissue are made up of -  
(A) Elastin (B) Reticular fibre  
(C) Collagen (D) Myosin
- Spinal cord & brain are made of -  
(A) Muscular tissue (B) Vascular tissue  
(C) Nervous tissue (D) Skeletal tissue
- The cell body of nerve cell contains a nucleus & cytoplasm and is called the -  
(A) Cyton (B) Dendron  
(C) Axon (D) None



## EXERCISE – II

### VERY SHORT ANSWER TYPE

1. What is neuron ? Define it.
2. How many types of muscles occur in animals ?
3. Give 3 features of cardiac muscles.
4. Name the tissue responsible for the movement in our body.
5. What is the main function of nervous tissue?
6. Give one example of Apical meristem and Lateral meristem.
7. What is the main function of parenchyma?
8. Which chemical is deposited at the corner of cells in collenchyma ?
9. Which chemical is deposited in the cell wall of sclerenchyma ?
10. Give one main function of collenchyma.

### SHORT ANSWER TYPE

1. Give the chemical nature of white fibres.
2. What is the average life span of RBCs of man ?
3. Name the protein found in yellow fibres.
4. What is the function of blood platelets in human body ?
5. Which tissue is commonly known as 'packaging' tissue ?
6. Distinguish between xylem and phloem?
7. Explain the different types of elements present in phloem.
8. What are tracheary elements ? Describe their functions.
9. What are the function of xylem ?
10. What are different types of tissues in plant ?

### LONG ANSWER TYPE

1. Name the following:
  - (i) Tissue that forms the inner lining of our mouth.
  - (ii) Tissue that connects muscle to bone in humans.
  - (iii) Tissue present in the brain.
  - (iv) Tissue that stores fat in our body.
  - (v) Connective tissue with a fluid matrix.
2. Draw a flow chart showing the various types of connective tissues.
3. What are Nissl's granules ? Give their functions.

4. Give the functions of plasma of blood.
5. What are tissues ? Why are plant and animal tissues different ? Give importance of tissues.
6. What are meristematic tissues ? Explain with the help of suitable diagram. Give their classification on the basis of their position in the plant body.
7. Define simple tissue. Classify and explain its different types with suitable diagrams.
8. Define complex tissue. Classify and explain its different types with suitable diagrams.
9. Name and describe two protective tissues of plants. Give their other functions as well.
10. Differentiate between blood and lymph.

### TRUE / FALSE TYPE

1. Cambium has the apical meristem.
2. Parenchyma contains isodimetric cells.
3. Sclereids form gritty part of ripe fruits.
4. Cuboidal epithelium is located in salivary glands.
5. Collagen occurs in white fibres.

### FILL IN THE BLANKS

1. In higher plants food is conducted by \_\_\_\_\_
2. Blood is a \_\_\_\_\_ Tissue.
3. Bone consists of \_\_\_\_\_ cells.
4. Fibres are absent in \_\_\_\_\_ a type of fluid connective tissue.
5. A nerve impulse passes from one neuron to another across a \_\_\_\_\_.

**Answer Key**

EXERCISE-I														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B	D	A	B	D	A	D	B	B	D	A	B	B	A	D
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
B	B	C	C	A	B	A	C	D	B	C	B	B	B	A

EXERCISE – II				
<b>TRUE/FALSE TYPE</b>				
1. F	2. T	3. T	4. T	5. T
<b>FILL IN THE BLANKS</b>				
1. Phloem	2. Connective	3. Osteocyte		
4. Blood	5. Synapse			

## SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : TISSUE)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In-Text Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

### NOTES :

1. In the status, put “completed” only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.



*Space for Notes :*

A large rectangular area filled with horizontal dotted lines, intended for writing notes.



# DIVERSITY IN LIVING ORGANISMS

# 3

## *Concepts*

### *Introduction*

#### **1. Classification**

**1.1 Hierarchy of classification**

**1.2 Classification and evolution**

**1.3 Binomial nomenclature**

#### **2. Kingdom systems**

**2.1 Two kingdom classification**

**2.2 Three kingdom classification**

**2.3 Four kingdom classification**

**2.4 Five kingdom classification**

#### **3. Plant Kingdom**

**3.1 Thallophyta**

**3.2 Bryophyta**

**3.3 Pteridophyta**

**3.4 Gymnosperms**

**3.5 Angiosperms**

#### **4. Kingdom - Animalia**

**4.1 Porifera**

**4.2 Coelenterata (Cnidaria)**

**4.3 Platyhelminthes**

**4.4 Nematoda (Nemathelminthes or Aschelminthes)**

**4.5 Annelida**

**4.6 Arthropoda**

**4.7 Mollusca**

**4.8 Echinodermata**

**4.9 Chordata**

---

## *NCERT Solution*

*Exercise - I (Competitive Exam Pattern)*

*Exercise - II (Board Pattern Type)*

*Answer Key*

 **INTRODUCTION**

- Biodiversity refers to all the diverse plants, animals and micro organisms present on earth.
- Biological diversity or biodiversity is the occurrence of diverse or varied forms of living beings which differ from one another in external appearance, size, colour pattern, internal structure, nutrition, behaviour, habitat, etc.
- They range in size from microscopic **Bacteria** (hardly a few micrometers in size) to **Blue Whale** (about 30 m in length) and Redwood trees (**Sequoia**) of California (about 100 m in height). Similarly some pine trees (**e.g. Pinus**) live for thousands of years while many insects like mosquitoes have a life span of a few days. There are transparent jelly fishes and worms on one hand to brightly coloured birds and flowers on the other hand.
- It is estimated that there are at least 10 million different species of plants and animals living today but only 1.7 million have been described so far worldwide.

**Focus Point**

Term "Biodiversity" was coined by " **Walter G. Rosen**" in 1986.

**Megadiversity** : The warm and humid tropical regions of the earth between the tropic of Capricorn and the tropic of Cancer, are rich in diversity of plant and animal life. This is called the region of "**megadiversity**".

There are **12** megadiversity centres in the world, which are rich in biodiversity.

**1. CLASSIFICATION**

- The method of arranging organisms into groups on the basis of their similarities and differences is called classification. Advantages of classification are as follows:
  - It gives information regarding the existing diversity of plants and animals.
  - It makes the study of wide variety of organisms convenient.
  - It helps us to understand the pattern of evolution.
  - It forms the basis for the development of other biological sciences like ecology, biogeography, biochemistry and other disciplines of Biology.
- Greek scientist, Aristotle classified animals according to their habitats i.e., whether they live on land, in water or in air. This was a misleading concept as different types of organisms can share the same habitat.

**⇒ BASIS OF CLASSIFICATION**

- In order to classify a broad group of organisms, we have to look for ways in which some of them are similar enough so as to be kept together.
- Such details of appearance, behaviour, form and function are called characteristics. For e.g. five fingers on each of our hand.
- In today's world, we look at many inter-related Characteristics (i.e. characters that relate to one other) to classify living organisms.

⇒ Some of the characteristics used for hierarchical classification are given below:

**(a) THE COMPLEXITY OF CELL STRUCTURE**

- The complexity of cell structure matters at first, i.e., whether the cell is prokaryotic or eukaryotic. In a eukaryotic cell, the membrane-bound organelles are present along with a nucleus. It efficiently allows isolated cellular processes to be carried out.
- On the contrary, in a prokaryotic cell, the membrane-bound organelles and a membrane bound nucleus are absent.
- Therefore, the biochemical pathways are organised in different ways in both cells. It facilitates different modes of cell division and ability to form multicellular organisms.
- This difference in cell structure forms the basic characteristic of classification.

**(b) THE BODY STRUCTURE**

- The organisms can be found as a single cell (unicellular) or group of cells (multicellular). The body structure changes the way the cell works, e.g. a multicellular organism like a worm shows division of labour by forming tissues, organs and organ systems. Unicellular organisms like Amoeba carry out all its functions through its single cell.

**(c) MODE OF NUTRITION**

- According to this characteristic organisms are of two types autotrophic and heterotrophic. Autotrophic organisms can make their own food through the process of photosynthesis (e.g. plants). Heterotrophic organisms depend on autotrophs and other animals for their food (e.g. animals and fungi).

**(d) LEVELS OF ORGANISATION OF BODY**

- The level of body organisation is different in different organisms. Like plants have different types of tissues as compared to animals. This is because plants require support, while animals require mobility.

**(e) FUNCTIONAL ORGANISATION**

- As the structure and the body design vary, the function of living organisms also show changes, for example in Amoeba, the pseudopodia are present for locomotion, while in higher animals, legs are present. Humans can run, but plants and trees cannot. This is the result of organisation of different organs and organ systems.

⇒ **IMPORTANCE OF CLASSIFICATION :**

- The bewildering variety of life around us has evolved on earth. In order to make relevant groups to study, variety of life forms, we classify organism.
- Classification makes the study of different type of organisms easy and systematic.
- From classification, we can know all life forms together and as a whole.
- Classification reveals the inter-relationship among organisms.
- It helps in understanding the other branches of life sciences.

**1.1 HIERARCHY OF CLASSIFICATION**

- Hierarchy is a system of classification into which taxonomic categories are arranged in descending order.
- **Category :-** Plants and animals are ranked in an arrangement of known categories. Such as Kingdom, Phylum (for animals) or Division (for plants), Class, Order, Family, Genus and Species.
- **Taxon :-** Taxon is defined as a unit of classification of organisms which can be recognised to a definite category at any level of classification e.g. fishes, insects etc.

Kingdom → **Largest Group**

Phylum (for animals) / Division (for plants)

Class

Order

Family

Genus

Species → **Lowest group**

- **SPECIES :** A group of organisms capable of interbreeding to produce fertile offspring. It is the lowest category of living organisms. Species includes a group of individuals which resemble closely in structure as well as functions.
- **GENUS :** It is a group of closely related species with common ancestry e.g. potato and brinjal are placed in same genus Solanum but are different species.

- **FAMILY** : It is a group of closely related genus with common characters e.g. Cats, Tiger, Lion are combinedly placed in a common family Felidae.
- **ORDER** : A number of families having common characters are placed in Order e.g. Ursidae (Bears), Canidae (dogs, wolves, etc.) and Felidae (cats, tiger, etc.) belong to same Order Carnivora.
- **CLASS** : Similar orders are placed together in a Class. Class Mammalia includes order like Carnivora, Chiroptera, Primata and Rodentia.
- **PHYLUM OR DIVISION** : Many classes with some common characters are included in Phylum, Phylum Chordata includes classes like Pisces, Amphibia, Reptilia, Aves and Mammalia.
- **KINGDOM** : It is the highest category of taxonomic studies. All animals are included in kingdom Animalia and all plants are included in kingdom Plantae.

## 1.2 CLASSIFICATION AND EVOLUTION

- **Charles Darwin** first described the idea of evolution in 1859 in his book, "**The Origin of Species**".
- **Darwin** suggested that organisms are related to each other by descent. They had common ancestors from which they gradually evolved into their present form.
- The ancestral forms were simple and are called primitive and primitive organisms have evolved into advanced organisms which are more complex.
- This process of gradual change from simple life forms to complex life forms is called '**Evolution**'.

## 1.3 BINOMIAL NOMENCLATURE

- The Binomial nomenclature system was proposed by **Carolus Linnaeus**. According to this the name of any organism consists of two words.
- The first word denoting the name of '**genus**' and second word denoting '**species**'.
- First letter of **generic name** must be written in **capital letter** whereas **species name** is started with **small letter**.
- Scientific name is generally derived from **Greek** or **Latin** words.
- The binomial names are printed in **italics** and **underlined separately** when written.

→ **Examples :**

**Potato - Solanum tuberosum**

**Tiger - Panthera tigris**



## Build The Concept

**Carolus Linnaeus** proposed scientific name of plants in his book "**Species Plantarum**" (1753).

For animals scientific name - "**Systema Naturae**" (1758).

In this system, first name denoting to **genus** second to **species** and third to the **subspecies**.

e.g. **Scientific name of crow** → **Corvus splendens**

**Indian crow** → **Corvus splendens splendens**

**Sri Lankan crow** → **Corvus splendens protegatus**

- **ICBN [International Code of Botanical Nomenclature]** - Book of rules for nomenclature of plants.
- **ICZN [International Code of Zoological Nomenclature]** - Book of rules for nomenclature of animals.

## 2. KINGDOM SYSTEMS

- Living beings have been classified in different ways from time to by different scientists. All living beings are classified into broad categories called Kingdoms.

### 2.1 TWO KINGDOM CLASSIFICATION

- First suggested by **Carolus Linnaeus** in 1758.
  - Living organisms have been divided into two kingdoms.
- (a) **KINGDOM PLANTAE** - All the plants constitute kingdom plantae. The kingdom includes bacteria, lichens, fungi, algae, bryophytes, ferns, gymnosperms and angiosperms.
- (b) **KINGDOM ANIMALIA** - All the animals constitute kingdom animalia. The kingdom animalia includes protozoans, sponges, Hydra, Jelly Fish, worms, insects, spiders, octopus, star fish, fishes, frogs, salamanders, lizards, snakes, birds and mammals.

→ **DRAWBACKS IN TWO KINGDOM CLASSIFICATION :-**

- Certain organisms did not strictly fit either under plant or animal kingdom like : Euglena and Viruses.

### 2.2 THREE KINGDOM CLASSIFICATION

- First suggested by **Ernst Hackel**.
  - Living organisms have been divided into three kingdoms.
- (a) Kingdom Plantae
- (b) Kingdom Animalia
- (c) Kingdom Protista

### 2.3 FOUR KINGDOM CLASSIFICATION

- First suggested by **Copeland**.
  - Living organisms have been divided into four kingdoms.
- |                      |                      |
|----------------------|----------------------|
| (a) Kingdom Plantae  | (b) Kingdom Animalia |
| (c) Kingdom Protista | (d) Kingdom Monera   |

### 2.4 FIVE KINGDOM CLASSIFICATION

- This concept was propounded by **Robert H. Whittaker** in 1969.
- On the basis of **cell structure, complexity in organisms** and **type of nutrition**, he divided living organisms into five kingdoms.

#### (a) KINGDOM - MONERA :

- The genetic material is not organised into a nucleus. It lies directly inside the cytoplasm and is called nucleoid. Membrane bound cell organelles like mitochondria, Golgi apparatus, plastids, lysosomes, are absent.
- Monerans are basically unicellular. In filaments and colonies the cells are similar and independent. Mode of nutrition is either **autotrophic** (Blue-green algae) or **heterotrophic** (Mycoplasma and most bacteria).
- Some organisms have cell wall (bacteria) while other lacking (Mycoplasma).

#### → Examples :

- **Blue Green Algae (Cyanobacteria)** – Anabaena, Nostoc.
- **Bacteria** – Vibrio cholerae, Clostridium botulinum, Escherichia coli
- **Mycoplasma** – Produces diseases in humans, animals and plants.

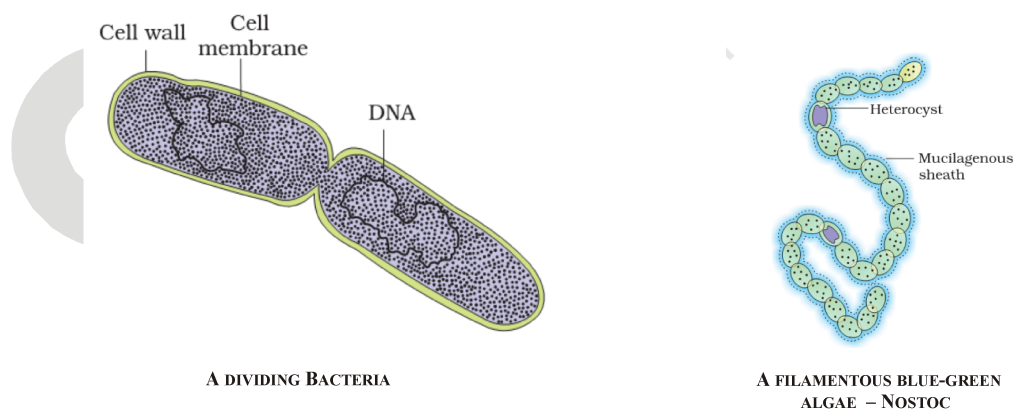


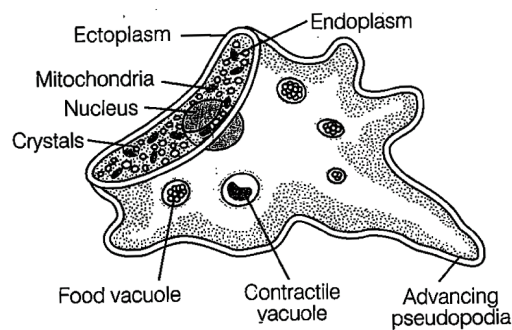
Figure : Monera

**(b) KINGDOM - PROTISTA :**

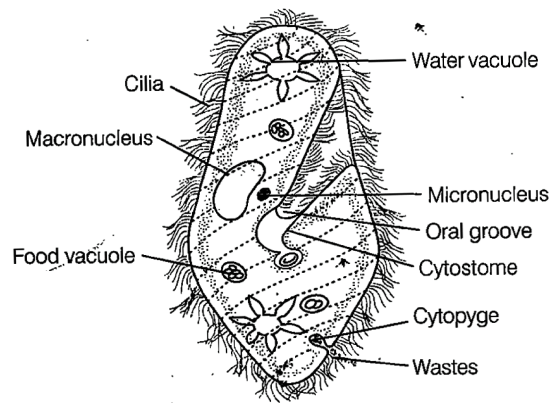
- This group consists of unicellular eukaryotes.
- True nucleus is present in them, Membrane-bound cell organelles-like mitochondria, plastids and sap vacuoles are also present.
- Some protists use appendages, such as hair-like cilia (Paramecium), pseudopodia (Amoeba) or whip-like flagella (Euglena) for locomotion.
- Mode of nutrition can be autotrophic (Euglena) or heterotrophic (Paramecium).

⇒ **Examples :**

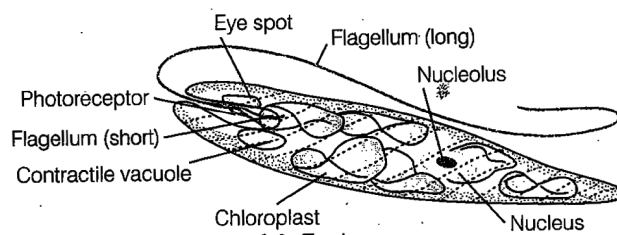
- Euglena, diatom (Navicula)
- Protozoans (Amoeba and Paramecium)



(a) *Amoeba*



(b) *Paramecium*



(c) *Euglena*

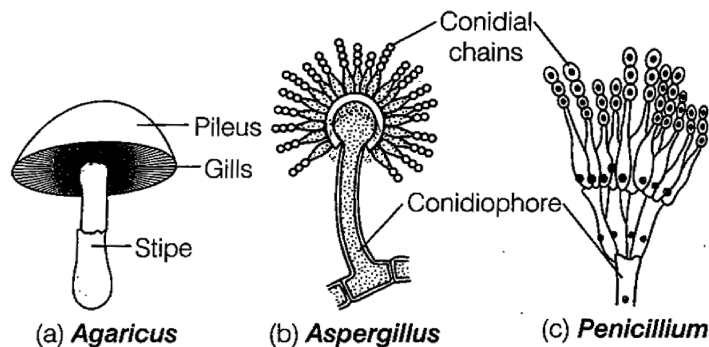
**Figure : Some protozoan organisms**

**(c) KINGDOM - FUNGI :**

- These are heterotrophic and eukaryotic organisms.
- They may be unicellular (yeast) or filamentous (most fungi). Many of them have a capacity to become multicellular organism at certain stages of their lives.
- Some are parasitic (depends on host for their food) such as Puccinia, Albugo and Ustilago. Some are saprophytes (use decaying organic material as food) such as Mucor and Agaricus.
- Their cell wall is made up of tough complex sugar called chitin or fungal cellulose e.g. yeast, Aspergillus, Penicillium and mushrooms (Agaricus).
- Some fungi live in permanent, mutually dependent relationship with blue-green algae (cyanobacteria). This relationship is known as symbiosis. These symbiotic life forms are called lichens or dual organisms. These are seen as slow-growing large coloured patches on tree barks.
- Algae provide the fungus with food whereas fungi provide them shelter.

→ **Examples :**

- Agaricus • Aspergillus • Penicillium



**Build The Concept**

**LICHEN**

- Symbiotic association between algae and fungi.
- Algal component is known as "**Phycobiont**" and fungal component is called "**Mycobiont**".
- The algae manufactures food not only for itself but also for the fungus. Fungus provides protection to algae, helps in fixation and absorption of water as well as minerals.

**(d) KINGDOM - PLANTAE**

- These are multicellular eukaryotes with cell walls made up of cellulose.
- Growth is unlimited and continues till death.
- They are always fixed at one site and cannot move like animals.
- Their mode of nutrition is autotrophic. They produce their own food by a process called photosynthesis in the presence of light, with the help of chlorophyll.

(e) **KINGDOM - ANIMALIA**

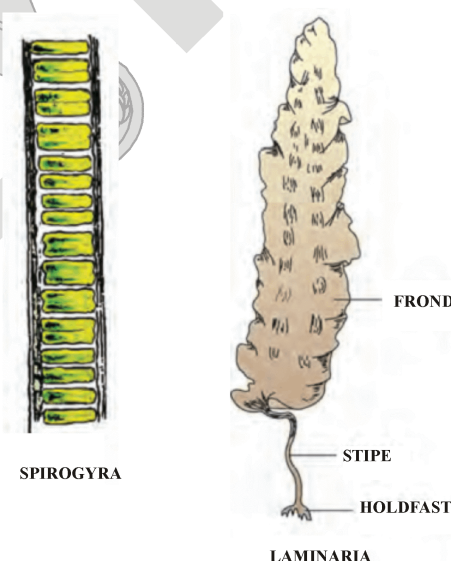
- These are multicellular eukaryotes without cell wall. They have definite shape and size.
- Most of them can move easily from one place to another.
- Their mode of nutrition is heterotrophic depend on autotrophs or plants for their food.

**3. PLANT KINGDOM**

- Plantae includes multicellular, eukaryote organisms with cellulosic cell wall.
- A mature plant cell commonly possess a single large central vacuole.
- Plastids are found in all plants. Some plastids possess photosynthesis pigment. They are called chloroplasts.
- Plants are autotrophic in nature because they are able to perform photosynthesis with the help of chlorophyll present in chloroplasts.
- Reserve food is starch.
- We classify plants on the basis of differentiation of plant body.
- We classify plants on the basis of conducting tissue.
- We classify plants on the basis of ability to bear seeds and seed are enclosed within fruits.

**3.1 THALLOPHYTA**

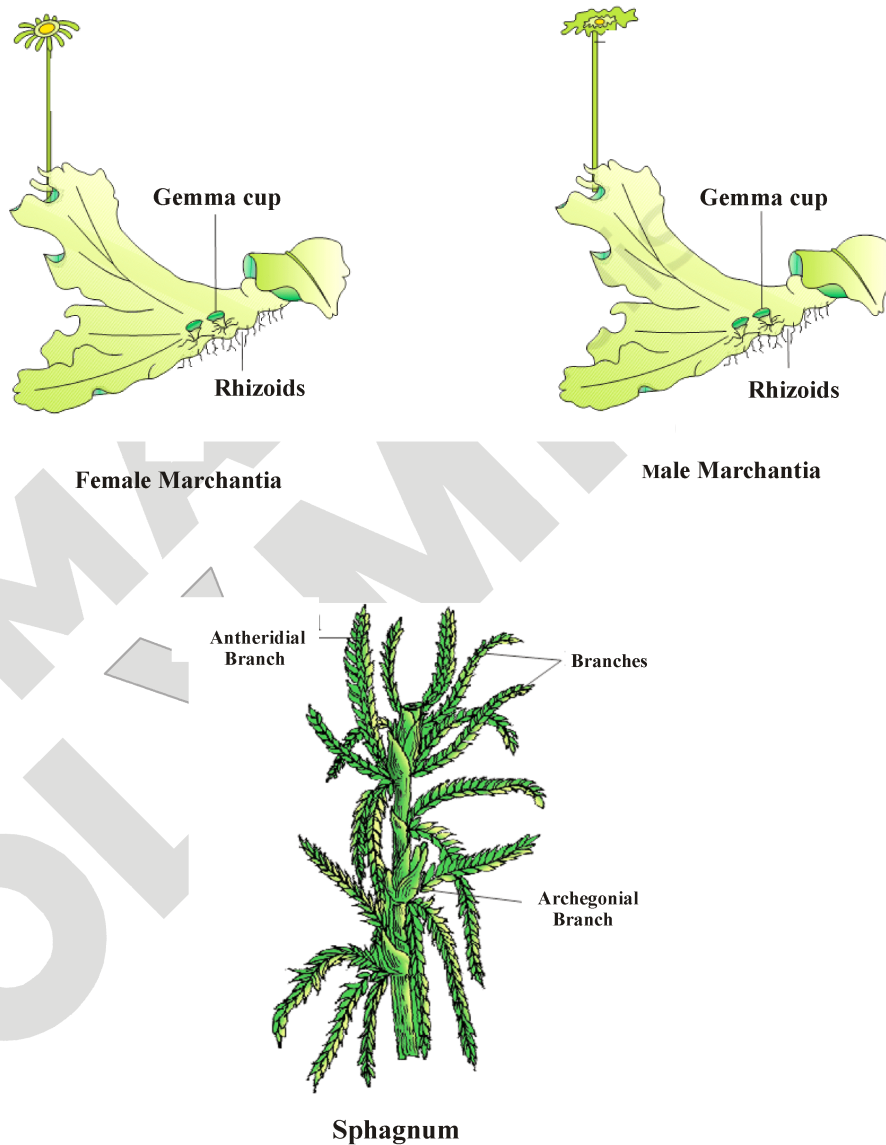
- They do not have well differentiated body design.
  - Plants in this group are commonly known as algae.
  - These are predominantly aquatic.
- **Examples :** Spirogyra, Chara, Ulothrix, Cladophora (green algae), Laminaria.



*Figure : Thallophyta*

**3.2 BRYOPHYTA**

- These are called as **the amphibians of the plant kingdom** because they can live in soil, but are dependent on water for sexual reproduction.
- In bryophytes, true vascular system is absent. They do not have specialised tissues for the conduction of water and food materials from one part of the body to another.
- The body is commonly differentiated into stem and leaf-like structures. They lack real roots, stems, leaves, etc. and do not bear flowers.
- It includes Riccia, Marchantia, Funaria and Sphagnum



*Figure : Bryophyta*

### 3.3 PTERIDOPHYTA

- These are the **first land plants** having vascular tissues.
- The body of these plants is differentiated into roots, stems and leaves. They have specialised tissue for the conduction of water and food (xylem & phloem). Therefore called as vascular cryptogams.
- They do not bear flowers and do not produce seeds.
- These include ferns (Dryopteris), club moss (Selaginella) and horse tails (Equisetum)

### 3.4 GYMNOSPERMS

- These are the most primitive seed bearing plants.
- The seeds produced are naked and are not enclosed within the fruits.
- Plants are usually perennial, evergreen and woody.
- Sporophylls (spores bearing structures) are aggregated to form cones, which are separated into male and female cones, e.g. Cycas, Finns (pine) and Cedrus (deodar).

### 3.5 ANGIOSPERMS

- These are also called flowering plants. Their seeds develop inside an organ called ovule. It modifies to become a fruit.
  - Plant embryos in seeds have structures called cotyledons. Cotyledons are also called seed leaves because in many cases they emerge and become green when seed germinates.
  - The angiosperms are divided into two groups on the basis of number of cotyledons present in the seed.
- The groups are:
- (i) Dicotyledonous plants or Dicots
  - (ii) Monocotyledonous plants or Monocots

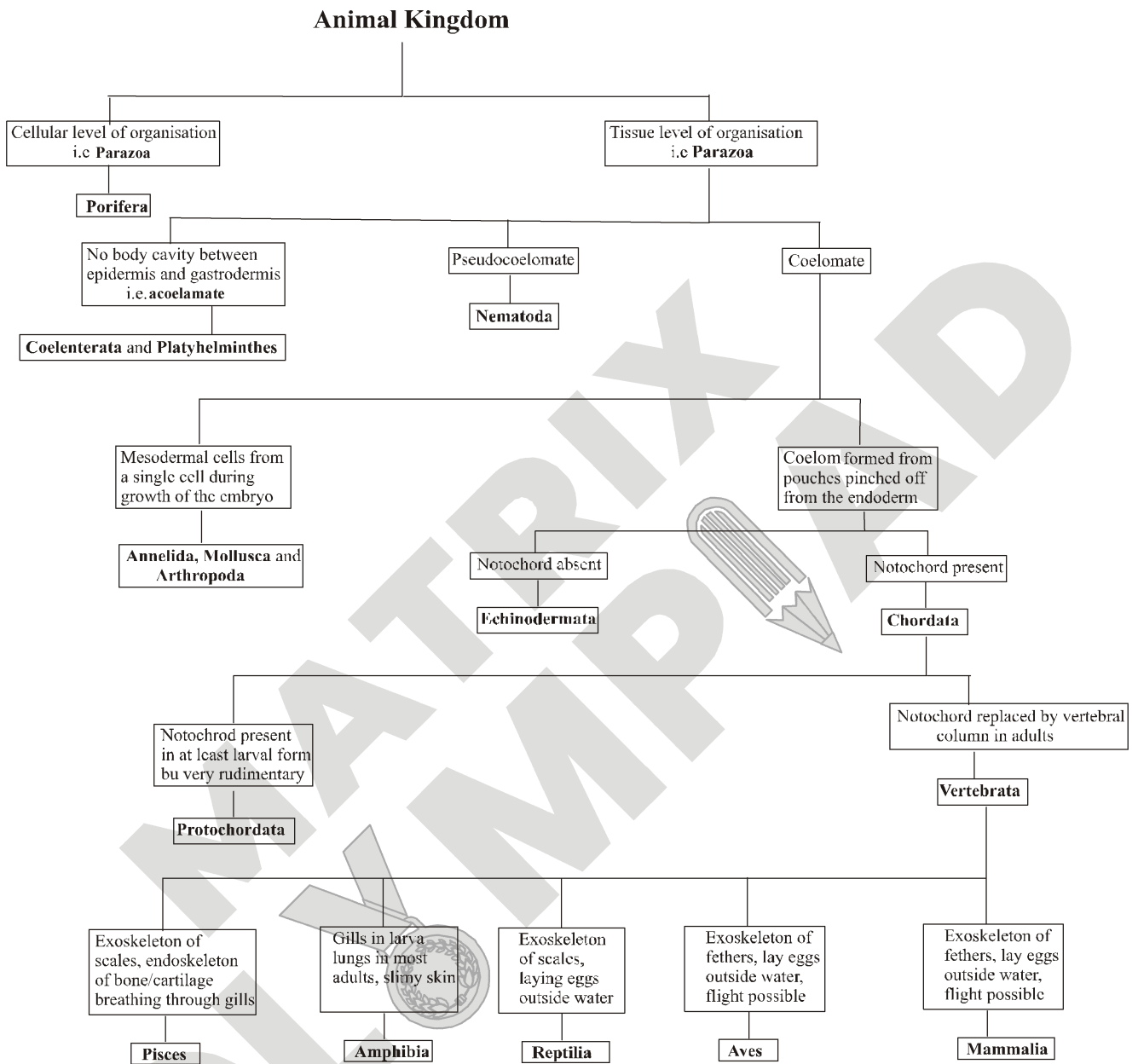


### Focus Point

#### Difference between Monocots and Dicots

Monocots	Dicots
(i) They contain one cotyledon.	(i) They contain two cotyledons.
(ii) Leaves have parallel venation	(ii) Leaves have reticulate venation.
(iii) Fibrous root system is present.	(iii) Tap root system is present.
(iv) Flowers are trimerous. Example-Rice ( <i>Oryza sativa</i> ), Onion ( <i>Allium cepa</i> ), Maize ( <i>Zea-mays</i> ) and Sugarcane ( <i>Saccharum officinarum</i> ), etc.	(iv) Flowers are penlamerous. Example - Pea ( <i>Pisum sativum</i> ), Rose ( <i>Rosa indica</i> ) and Neem ( <i>Azadirachta indica</i> ).

4. KINGDOM - ANIMALIA



## 4.1 PORIFERA

- Animals belong to this phylum are commonly called sponges.
- These have minimal differentiation and division into tissues.
- These organisms are acoelomate (body cavity absent) with cellular level of body organisation.
- They are mostly marine but few species are found in freshwater like Spongilla.
- They may be rounded, sac-like or branched.
- They consist of innumerable holes or pores all over the body which lead to a canal system. This system helps in circulation of water throughout the body to bring in food and oxygen.
- Only the young forms or larvae are motile. In adult stage they attach themselves to submerged solid objects and become stationary (sessile).
- Their body is covered with a hard outside layer or skeleton, e.g. Sycon (freshwater sponge), Sycon (Scypha), Euplectella (Venus flower basket) etc.

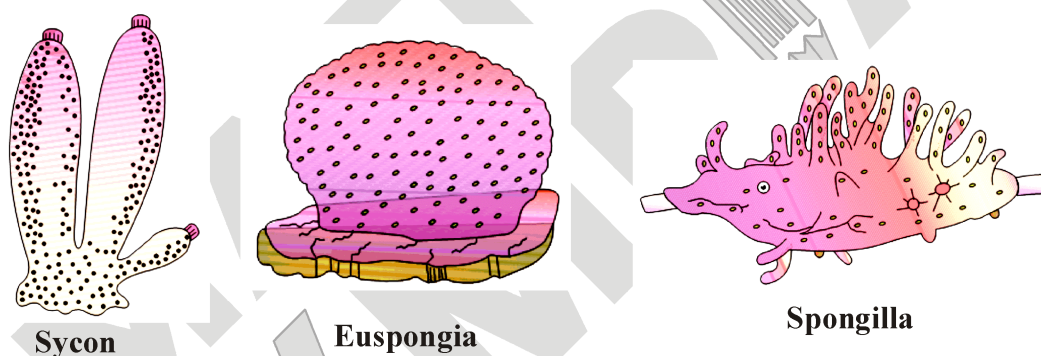


Figure : Porifera

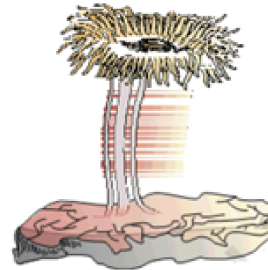
## 4.2 COELENTERATA (CNIDARIA)

- These animals show better body design and differentiation than porifera.
- These organisms are multicellular and acoelomate. They have tissue level of organisation with a distinct division of labour.
- They live in water and have tentacles (appendages) for locomotion.
- Coelenterates have a central body cavity called coelenteron or gastrovascular cavity.
- The body is made up of two layers of cells. One makes up cells on the outside of the body and other makes the inner lining of the body. Therefore, these are called as diploblastic animals.
- Body of these animals show radial symmetry. In this type of symmetry body design is arranged in a circular pattern with a centre point.

- Some species are colonial (corals) while others have a solitary lifespan (Hydra).
- **Example :** Hydra Metridium (sea anemone), Aurelia (jelly fish) are examples of freshwater cnidarians.



Aurelia

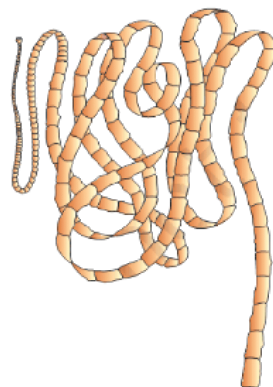


Adamsia

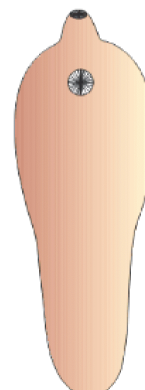
*Figure : Coelenterata (Cnidaria)*

### 4.3 PLATYHELMINTHES

- These are triploblastic (body made up of three layers of cells), dorsoventrally flattened (flattened from back through to the abdomen) leaf-like animals. They have tissue level of organisation. So, these are also called flatworms.
  - They have bilateral symmetry i.e. the left and right halves of the body has the same design.
  - There is no true internal body cavity or coelom.
  - They are either free living or parasitic animals (living in the bodies of other animals) like liver fluke and some are free-living like Planaria.
- **Examples :** Taenia solium (pork tapeworm), Dugesia (Planaria), Fasciola (liver fluke), etc.



TAPE WORM

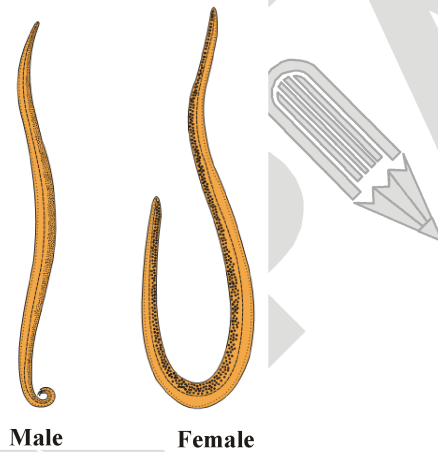


LIVER FLUKE

*Figure : Platyhelminthes*

#### 4.4 NEMATODA (NEMATHELMINTHES OR ASCHELMINTHES)

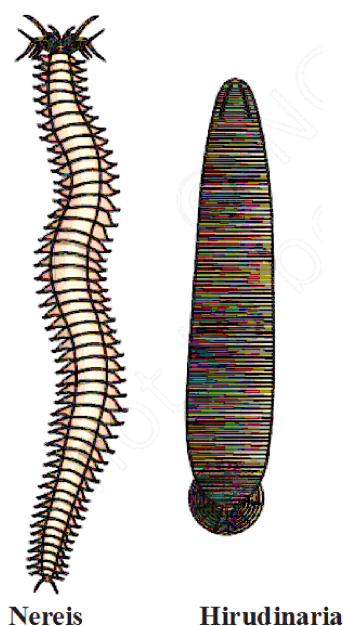
- These are triploblastic, cylindrical worms with pseudocoelom (no true body cavity or coelom),
  - Their body is bilaterally symmetrical.
  - They are parasitic worms causing diseases such as elephantiasis (filarial worms). These worms are also found in the intestines (roundworms or pinworms).
  - These are called roundworms because they appear circular in cross-section and are unsegmented.
  - These are the first animals that have complete and straight alimentary canal. It consists of mouth and anus.
- **Example:** Ascaris (giant intestinal roundworm), Ancylostoma (hookworm), Wuchereria bancrofti (filarial worm) etc.



**Figure : Aschelminthes**

#### 4.5 ANNELIDA

- These are triploblastic animals having bilateral symmetry. They are elongated, vermiform, cylindrical or dorsoventrally flattened organisms.
  - These animals are found in a variety of habitats i.e. freshwater, marine water as well as on land.
  - Annelids are the first animals to develop true body cavity or coelom, i.e. they are coelomates.
  - There is extensive organ differentiation. This differentiation occurs in a segmental fashion. The segments are lined up one after the other from head to tail (i.e. metameric segmentation).
  - Locomotion is done with the paired, lateral appendages called parapodia or chitinous setae or chaetae.
- **Example:** Nereis (sandworm), Hirudinaria (Indian cattle leech that sucks blood from its host), earthworm etc.



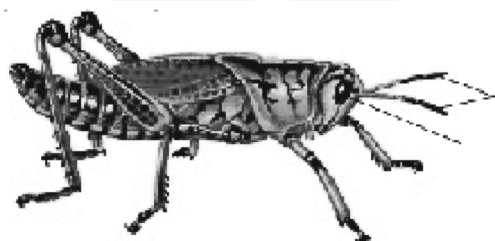
Nereis

Hirudinaria

*Figure : Annelida*

#### 4.6 ARTHROPODA

- Arthropoda is the largest group of animals. These are found everywhere on the earth.
  - These are triploblastic, bilaterally symmetrical and segmented animals.
  - Body is segmented and is grouped into three regions, i.e. head, thorax and abdomen.
  - Body consists of exoskeleton. It is light weight, tough and made up of chitin.
  - Body segments of these animals usually bear paired, lateral and jointed legs or appendages.
  - Body cavity or coelomic cavity is filled with blood (haemocoel). Open circulatory system is present, i.e. (haemocoel) blood does not flow in blood vessels.
  - In many arthropods, compound eyes are present with mosaic vision on the head.
- **Example :** Periplaneta (cockroach), Palaemon (prawn), Aranea (spider), Cancer crab), centipede, butterflies, (houseflies), etc.



Locust

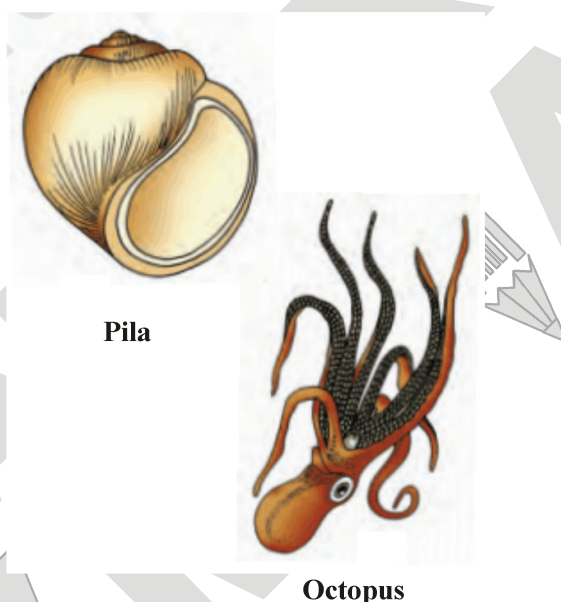


Butterfly

*Figure : Arthropoda*

#### 4.7 MOLLUSCA

- Body of these animals is soft and has bilateral symmetry.
- Little segmentation is present and animals are without appendages.
- The coelomic cavity is reduced. Oysters of this group produce pearls.
- Open circulatory system is present. Kidney-like structures or a pair of metanephridia is present for excretion.
- The body is divided into an anterior head, a ventral muscular foot and a dorsal visceral mass.
- Animals perform locomotion through their muscular foot.
- Example- Pila (apple snail), Unio, Chiton, Octopus etc.



*Figure : Mollusca*

#### 4.8 ECHINODERMATA

- These are simple spiny skinned animals with star like, spherical or elongated body.
- These are triploblastic, coelomate and unsegmented. Their body has radial symmetry in adults, but bilateral in larvae.
- These are exclusively free-living marine animals.
- They also have a peculiar water-driven tube system. They possess tube feet (podia) for locomotion and exchange of gases.
- Their digestive system is usually complete. Well developed excretory organs are absent.
- Body wall is covered with spiny hard calcium carbonate plates (ossicles). They form a rigid or flexible endoskeleton.

→ **Example:** Antedon (feather star), Holothuria (sea cucumber), Echinus (sea urchin), Asterias (star fish or sea star), etc.

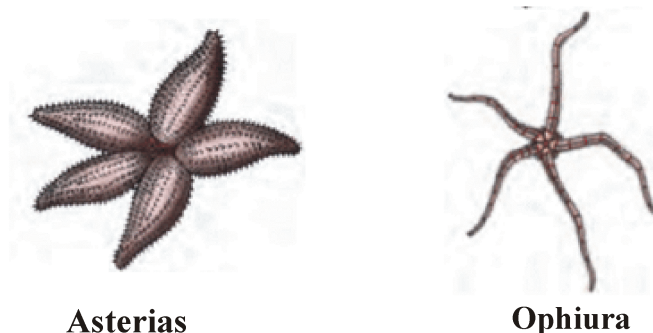


Figure : Echinodermata

#### 4.9 CHORDATA

- Body of these animals is triploblastic, coelomate with bilateral symmetry.
- All of them have a notochord (a new feature of body design). Notochord is a long rod-like support structure that runs along the back of the animal. It separates the nervous tissue from the gut. It provides site for muscle attachment.
- They have dorsal nerve cord and paired gill pouches.
- A post-anal tail present at some stage of life.
- Ventral heart is present with dorsal and ventral blood vessels and closed blood vascular system.
- Complete digestive system is present.

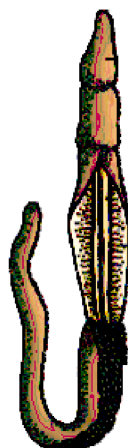
→ Chordata is divided into two groups or sub-phylum :

⇒ Protochordata (Acraniata)

⇒ Vertebrata (Craniata)

#### ⇒ PROTOCHORDATA

- They are triploblastic, have bilaterally symmetrical body and a coelom.
- They show the presence of notochord in some stages of life, i.e. tail of young larvae.
- These are mostly marine animals.
- Respiration occurs through gill slits.
- Example- Balanoglossus, Herdmania, Amphioxus, etc.



Balanoglossus

*Figure : Protochordata***⇒ VERTEBRATA**

- They have a true vertebral column and internal skeleton. It allows completely different distribution of muscle attachment points that help in movement,
- Their body is bilaterally symmetrical, triploblastic, coelomic and segmented.
- In these animals, complex differentiation of body tissues and organs is present.
- They have a dorsal nerve cord and paired gill pouches.
- Thus, vertebrates are considered the most advanced group of animals. These are further grouped into five classes :

**(i) CLASS-PISCES (FISHES)**

- These are exclusively aquatic animals.
- They have streamlined body covered with scales. It ends in a muscular tail (which helps in movement).
- Fins are present, but limbs are absent.
- Respiration occurs through gills by taking oxygen dissolved in water.
- They are cold-blooded (Ectothermic) and have two-chambered heart.
- Most of them lay eggs, e.g. angle fish, lion fish, rohu, Scoliodon.
- Pisces are of two types based on the nature of their skeleton, i.e. Chondrichthyes (cartilaginous fishes) and Osteichthyes (bony fishes).

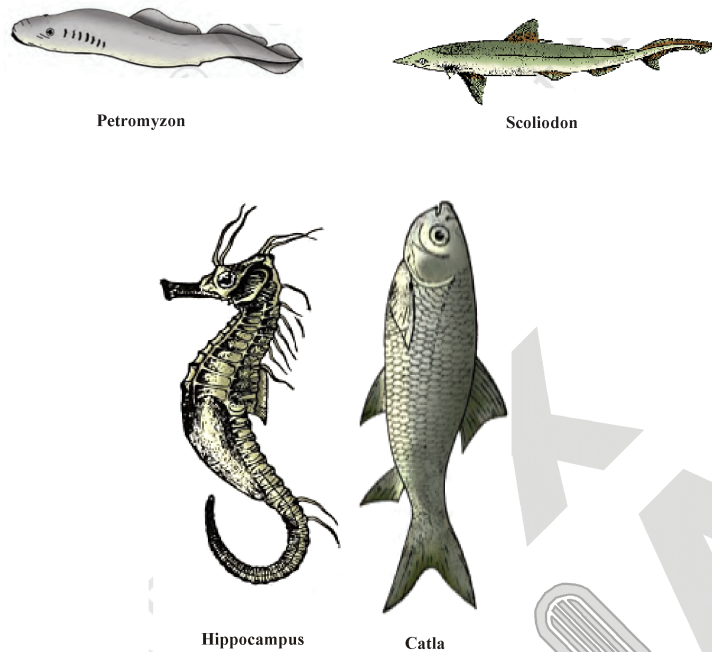


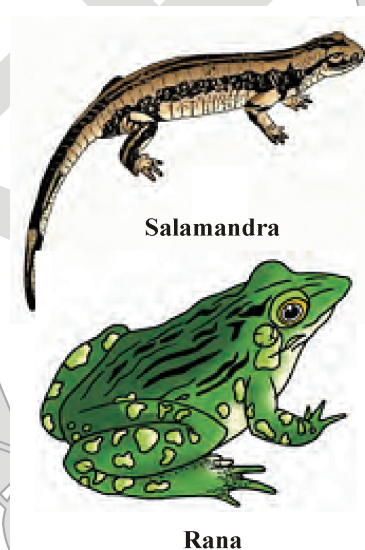
Figure : Pisces

**Focus Point**

Difference between Bony and Cartilaginous Fishes	
Bony Fishes	Cartilaginous Fishes
(i) Bony endoskeleton	(i) Cartilaginous endoskeleton
(ii) Gills are covered by operculum	(ii) Gills are not covered by operculum
(iii) Mouth is terminal in position	(iii) Mouth is ventral in position
(iv) Air or swim bladder is present Example-Labeo rohita (Rohu), Hippocampus (Sea hourse), Eocoetus (Flying tish), Anabas (Climbing perch), etc.	(iv) Air or swim bladder is absent Example - Synchiropus splendidus (Mandarin fish), Electric ray (Torpedo) String ray, Scoliodon (Dog fish) ,etc

**(ii) CLASS - AMPHIBIA**

- In evolutionary terms, these are the first group among the chordates to live on land.
  - They are amphibious in nature as they can live on land as well as in water.
  - They lack scales and have mucus glands in their skin which secrete mucus that keep the skin moist
  - Amphibians are cold-blooded and have three-chambered Heart.
  - They have distinct head and trunk. Neck and tail may or may not be present.
  - Respiration can be either by gills in larva (in water) or by lungs in most adults (on land).
  - Generally require water for the completion of their life cycle as the eggs are laid in water and the larvae are aquatic.
  - Limbs tetrapodus (four-limbed) pentadactyl type (five-fingered). The digits do not possess claws.
  - They lay eggs (oviparous).
- **Example :** Rana (frog), Bufo (toad), Salamandra (salamander), Hyla (tree-frog) etc.

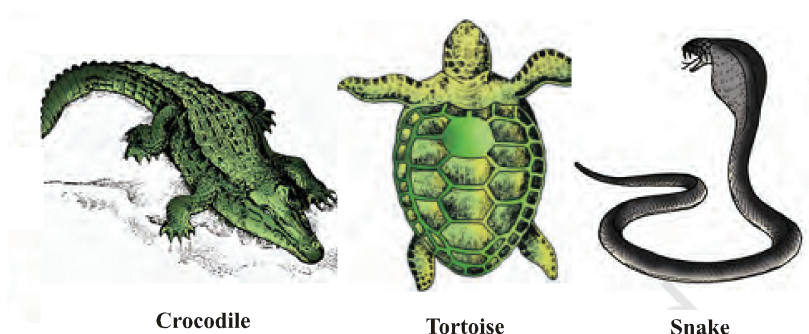


**Figure : Amphibia**

**(iii) CLASS - REPTILIA**

- These animals possess dry skin, with scales and mostly live in warmer regions. They are cold-blooded.
- These are the first class of terrestrial animals.
- They lay eggs with tough covering on land unlike amphibians that lay eggs in water.
- Lungs are the respiratory organs.
- Reptiles bear two pairs of pentadactyl (five digits) limbs and some have no limbs.
- Most of them have three-chambered heart except crocodile, which has a four-chambered heart.

→ **Example :** Chelone (turtle), Chamaeleon, Naja (cobra), Hemidactylus (house wall lizard), Testudo (tortoise), Draco (flying lizard) etc.

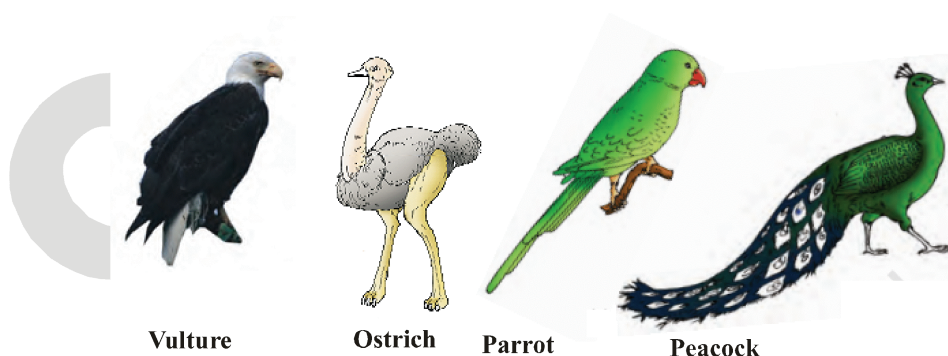


*Figure : Reptilia*

**(iv) CLASS - AVES**

- These are warm-blooded animals having four-chambered heart.
- Their body is divisible into head, neck, trunk and tail.
- These are flying animals, having exoskeleton (outside covering) of feathers.
- They have forelimbs modified into wings. Jaws are modified into horny toothless beak.
- Bones are light in weight because of air spaces (pneumatic bones) and body is streamlined to reduce air resistance during flight.
- They breathe through lungs.
- Birds lay eggs (outside water). Their egg possesses large amount of yolk and the shell covering the yolk is hard and calcareous.

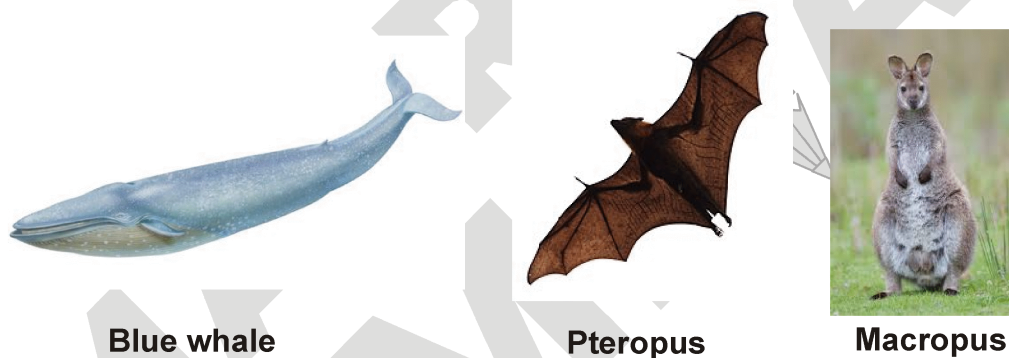
→ **Example:** Ciconia ciconia (white stork), Struthio camelus (Ostrich), pigeon, crow, sparrow, humming bird (smallest).



*Figure : Aves*

**(v) CLASS - MAMMALIA**

- These are warm-blooded animals which have four-chambered heart.
- Females have mammary glands for the production of milk to nourish the young ones. Therefore, called mammals.
- These are known to be the most advanced group of animals with a very well-developed brain.
- Sweat glands and oil glands are present in their skin and serve as lubricants and detoxificants of the body.
- Skin is covered with hair.
- Mammalia is the first class to mark the presence of ear pinna (external fleshy ear).
- Limbs are adapted for walking, running, swimming, burrowing and even flying (bats).
- Most mammals produce live young ones (i.e. they are viviparous). Some like platypus is oviparous Kangaroos give birth to poorly developed young ones.
- Respiration is through lungs only. e.g. Rattus (rat), Homo sapiens (human), Felis (cat), Bat, Canis (dog), chimpanzee, Macropus (kangaroo), whale, dolphins (aquatic mammals).



**Figure : Mammalia**

**NS. 1**

What are the advantages of classifying organisms?

**Ans.** Advantages of classifying organisms are as follows:

- (i) It gives information regarding the present diversity of plants and animals.
- (ii) It makes the study of wide variety of organisms convenient.
- (iii) It helps us to understand the pattern of evolution.
- (iv) It forms the basis for the development of other biological sciences like ecology, biogeography, biochemistry and other disciplines of biology.

**NS. 2**

How would you choose between two characteristics to be used for developing a hierarchy in classification?

**Ans.** For developing a hierarchy in classification, we choose more fundamental characteristics among two organisms for classifying them into groups. These include:

- (i) The cell has membrane-bound organelles or not.
- (ii) The cells occur individually or in groups.
- (iii) The organisms are autotrophs (make their own food) or heterotrophs (acquire food from plants).

Within these groups small sub-groups will be decided by less important characteristics. This process must continue and each time new characteristics should be used.

**NS. 3**

Explain the basis for grouping organisms into five kingdoms.

**Or**

Write any three criteria on the basis of which organisms are grouped into five kingdoms.

**Ans.** Following criteria are the basis of classification of the organisms:

- (i) Cell structure (prokaryotic or eukaryotic).
- (ii) Body organisation (unicellular or multicellular).
- (iii) Modes and source of nutrition (autotrophic or heterotrophic).

**NS. 4**

What are the major divisions in the kingdom-Plantae?

What is the basis for these divisions?

**Ans.** Major divisions of kingdom-Plantae are:

- (i) Thallophyta
- (ii) Bryophyta
- (iii) Pteridophyta
- (iv) Gymnosperms
- (v) Angiosperms

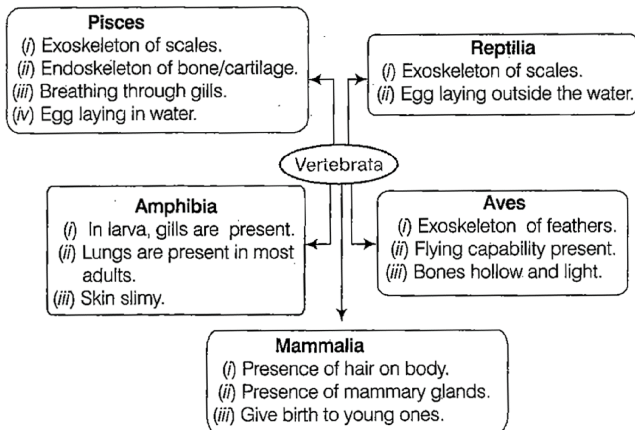
Basis of these divisions in Plantae are:

- (i) The presence or absence of well-differentiated plant body with distinct parts.
- (ii) The presence or absence of special tissues for the transport of water and other substances.
- (iii) Ability to bear seeds.
- (iv) Seeds are enclosed within the fruits or not.

**NS. 5**

Explain, how animals in Vertebrata are classified into further sub-groups?

**Ans.** Characteristics for classifying Vertebrata into further sub-groups (classes) are shown below:



**NS. 6**

How are the criteria for deciding divisions in plants different from the criteria for deciding the sub-groups among animals?

**Ans.** The criteria for deciding divisions in plants is base on whether they have an ability to bear seeds or not. Whether the plant body has well-differentiated, distinct components or not. It is different from the criteria for deciding the sub-groups among animals as they are divided on the basis of the cell organisation, symmetry, presence or absence of notochord and body cavity.

*Space for Notes :*

## EXERCISE – I

### ONLY ONE CORRECT TYPE

- Algae are –  
(A) Autotrophic (B) Heterotrophic  
(C) Both (D) None
- Chlamydomonas is the examples of -  
(A) Algae (B) Fungi  
(C) Lichens (D) None
- Which class is called amphibians of the plant kingdom?  
(A) Thallophyta (B) Bryophyta  
(C) Pteridophyta (D) Gymnosperm
- Examples of pteridophyta is -  
(A) Selaginella (B) Cycas  
(C) Pinus (D) None
- Cnidoblasts is characteristic feature of -  
(A) Coelenterata (B) Porifera  
(C) Protozoa (D) Arthropoda
- Palemon (prawn) is the example of -  
(A) Arthropoda (B) Annelida  
(C) Coelenterata (D) Protozoa
- Four chambered heart is found in-  
(A) Draco  
(B) Hemidactylus  
(C) Tortoises and turtles  
(D) Crocodile
- In mollusca respiratory organ is called -  
(A) Ctenidia (B) Lungs  
(C) Book-lungs (D) All of the above
- In larval stage which symmetry is present in echinodermata -  
(A) Radial (B) Biradial  
(C) Bilateral (D) None of these
- Whittaker failed to give any place to one of the following in his classification -  
(A) Cyanobacteria (B) Virus  
(C) Slime moulds (D) All above
- Parazoa includes -  
(A) Protozoans  
(B) Porifera  
(C) Parasites of invertebrates (mosozoa)  
(D) None above
- Viruses are essentially made up of-  
(A) Proteins and nucleic acid  
(B) Proteins and carbohydrates  
(C) Lipids and nucleic acids  
(D) Starch, proteins and lipid
- Prokaryotes are included in the group -  
(A) Monera (B) Basidiomycetes  
(C) Bryophytes (D) Tracheophyta
- Four kingdom system of classification was given by -  
(A) Copeland (B) Whittaker  
(C) Linnoeus (D) Von mohl
- Which group of plants are called "Reptiles of plant world" -  
(A) Pteridophytes (B) Gymnosperms  
(C) Algae (D) Fungi
- Which of the following organism has characters of both animals and plants -  
(A) Blue-green algae (B) Euglena  
(C) Moss (D) Cycas
- Vascular bundle are found in -  
(A) Thallophyta (B) Bryophyta  
(C) Pteridophyta (D) Lichens

18. A branch of biology which deals with the identification, nomenclature and classification of organisms is called -  
 (A) Morphology (B) Ecology  
 (C) Taxonomy (D) Phytogeography
19. Binomial nomenclature was introduced by -  
 (A) John Ray  
 (B) A. P. de Candolle  
 (C) A. L. de Jussion  
 (D) Carolus Linnaeus
20. Plants with hidden reproductive organs are included in -  
 (A) Gymnosperms (B) Angiosperms  
 (C) Phanerogams (D) Cryptogams
21. The basic unit of classification is -  
 (A) Family (B) Genus  
 (C) Species (D) Order
22. Which of the following kingdoms includes many kinds of unicellular eukaryotic organisms  
 (A) Monera (C) Fungi  
 (B) Protista (D) Animalia
23. Whale belongs to the class -  
 (A) Pisces (B) Amphibia  
 (C) Reptilia (D) Mammalia
24. Which group of animals are called 'flat worms'?  
 (A) Porifera  
 (B) Coelenterata  
 (C) Platyhelminthes  
 (D) Nematoda
25. Sweat and oil glands are present in the skin of-  
 (A) Amphibians (B) Reptiles  
 (C) Aves (D) Mammals
26. You are identifying a plant that possesses seeds but not fruits. It may belong to -  
 (A) Pteridophyta (B) Gymnosperm  
 (C) Bryophyta (D) Angiosperm
27. Seeds are naked in -  
 (A) Gynosperm (B) Angiosperm  
 (C) Both (A) and (B) (D) Monocots
28. Two chambered heart occurs in -  
 (A) Crocodiles (B) Fish  
 (C) Aves (D) Amphibians
29. One of the following is not an Annelid -  
 (A) Nereis (B) Earthworm  
 (C) Leech (D) Urchins
30. **Column I** **Column II**  
 (i) Coelom A. Planaria  
 (ii) Triploblastic B. Wuchereria bancrofti  
 (iii) Elephantiasis C. Star-fish  
 (iv) Flame cells D. mesoderm  
 (v) Tube feet E. Excretion  
 (A) i→A, ii→D, iii→B, iv→E, v→C  
 (B) i→D, ii→A, iii→B, iv→E, v→C  
 (C) i→A, ii→B, iii→D, iv→E, v→C  
 (D) i→A, ii→D, iii→E, iv→B, v→C

## EXERCISE – II

### VERY SHORT ANSWER TYPE

1. Name the group of plants which produce seeds but not fruits.
2. Name any two liverworts.
3. Name the three major groups of the kingdom : Protista.
4. In which animal phylum body cavity appears for the first time?
5. After which structure the phylum Echinodermata has been named?
6. What is the basic taxonomic category?
7. Name the highest taxonomic category.
8. Define prokaryotes.
9. Which division is known as ‘Amphibians of plant kingdom’?
10. Name the reproductive organs of -  
(i) Gymnosperms  
(ii) Angiosperms
11. Name atleast two monocots and two dicot plants.
12. Name the group of vascular Cryptogams.
13. Which phylum includes segmented worms?
14. Who proposed binomial nomenclature?
15. Name two groups of warm blooded animals with four-chambered heart.

### SHORT ANSWER TYPE

1. What are bryophytes?
2. Write important characters of viruses.
3. What are lichens?
4. Differentiate between dicotyledonae and monocotyledonae plants.
5. What are the sub phylum of chordata? Give examples.

### LONG ANSWER TYPE

1. Give the general characteristics of the Angiosperms and list the distinguishing features of monocot and dicot.
2. List the distinguishing features of the phylum Chordata? Mention its classes with one example of each.

### FILL IN THE BLANKS

1. In Thallophyta sex organs are simple and .....
2. Tube feet are the ..... organs of echinoderms.
3. Skeleton of sponges is made up of.....
4. Skin of reptiles is covered by .....
5. Scales, feathers and hairs form ..... of vertebrates.

**Answer Key**

EXERCISE-I														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
A	A	B	A	A	A	D	D	B	B	A	A	A	A	A
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
B	C	C	D	D	C	B	D	C	D	B	A	B	D	A

EXERCISE – II	
<b>FILL IN THE BLANKS</b>	
1. Multicelled	2. Locomotry
3. Calcareous or siliceous spicules	4. Chloroplast
5. Exoskeleton	

## SELF PROGRESS ASSESSMENT FRAMEWORK

(CHAPTER : DIVERSITY IN LIVING ORGANISMS)

CONTENT	STATUS	DATE OF COMPLETION	SELF SIGNATURE
Theory			
In- Text Examples			
NCERT Exercises			
Exercise I			
Exercise II			
Short Note-1			
Revision - 1			
Revision - 2			
Revision - 3			
Remark			

### NOTES :

1. In the status, put “completed” only when you have thoroughly worked through this particular section.
2. Always remember to put down the date of completion correctly. It will help you in future at the time of revision.



*Space for Notes :*

A large rectangular area filled with horizontal dotted lines, intended for writing notes.

