



# ST. LAWRENCE HIGH SCHOOL



A JESUIT CHRISTIAN MINORITY INSTITUTION

## STUDY MATERIAL -3

Class: IX

Sub: LIFE SCIENCE

Date: 09.05.2020

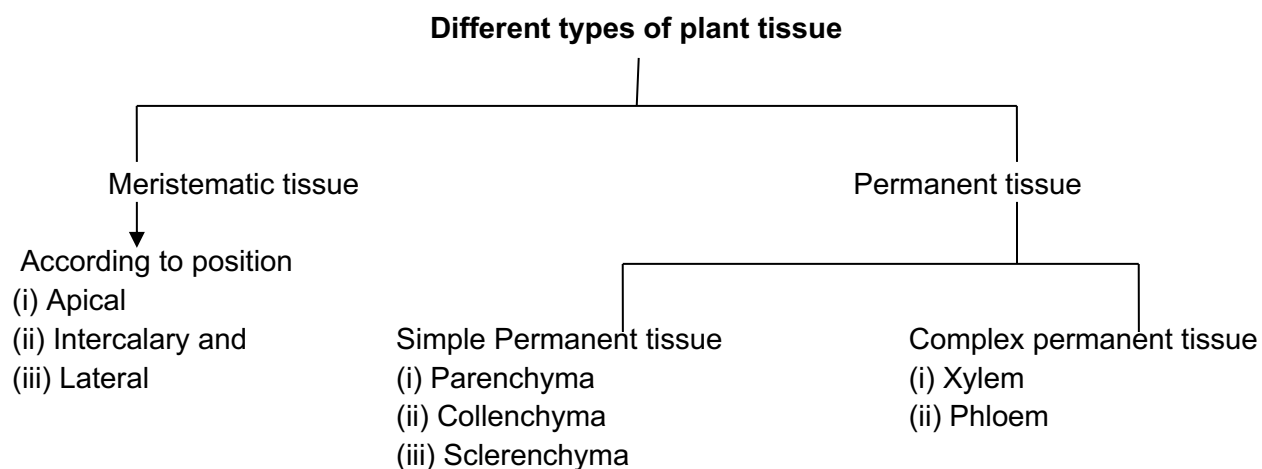
Topic - PLANT TISSUES AND IT'S CLASSIFICATION

## PLANT TISSUES AND IT'S CLASSIFICATION

### INTRODUCTION

In multi cellular organisms, body consists of a single cell, which is capable of performing cells from different groups on the basis of their common origin and specific functions. **A group of cells, similar or dissimilar in shape and of same origin and performing particular functions in a multi cellular living body is called tissue.**

The term tissue was given by **Bichat**.



### ➤ **Plant tissue**

There are two broad kinds of plant tissues, namely – **Meristematic tissue** and **Permanent tissue**.

## MERISTEMATIC TISSUE

Tissue comprising of immature cells which are always in a state of division forming new cells is called meristematic tissue.

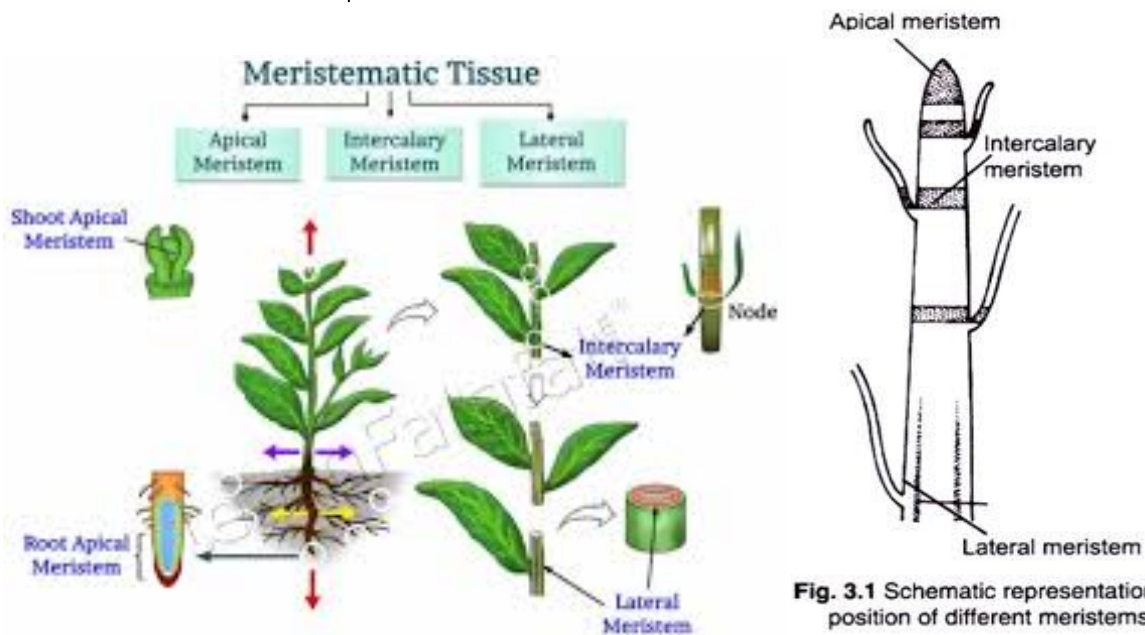
### CHARACTERISTIC FEATURES

- Cells are arranged compactly without intercellular spaces.
- Cells filled up with dense cytoplasm.
- Vacuoles if present are small and few in number.
- Cell wall is thin, made up of cellulose and pectin.
- Nucleus is prominent and larger.
- Cells are always in constant state of division.

### DISTRIBUTION

According to location. i.e. distribution meristematic tissues are –

- Apical Meristem** – Present at the growing apex of root, stem and leaf. If apical meristem divides and grows, the plant increases in length known as **primary growth**.
- Intercalary meristem** - Present in between the permanent tissues.
- Lateral meristem** – Present at the lateral sides of roots and stems. If lateral meristem divides and grows, the plant increases in width and thickness, called secondary growth.



**Fig. 3.1** Schematic representation of position of different meristems

### FUNCTION

Meristematic tissues help in the overall growth of plant organ from which other tissues develop.

### PERMANENT TISSUE

The tissue in the plant body which has lost the power of division is called permanent tissue.

#### CHARACTERISTIC FEATURES

- Intercellular space may be present between the cells.
- Cells may or may not contain protoplasm, hence may be living or dead.
- Cell wall is made up of cellulose and may be thin or thick.
- Cells are mature and have no power of division.
- Vacuoles are present.

#### TYPES OF PERMANENT TISSUE

Permanent tissue is classified into two broad types, namely:

- (i) Simple tissue – e.g. Parenchyma, Collenchyma and Sclerenchyma and
- (ii) Complex tissue – e.g. Xylem and Phloem

#### **i) SIMPLE PERMANENT TISSUE:**

Tissue consisting of only one type of cells (homogenous) forming mass and performing same function is called simple permanent tissue.

##### TYPES OF SIMPLE TISSUE

According to shape of the cell, these are of three types such as parenchyma, collenchyma and sclerenchyma.

##### A) PARENCHYMA

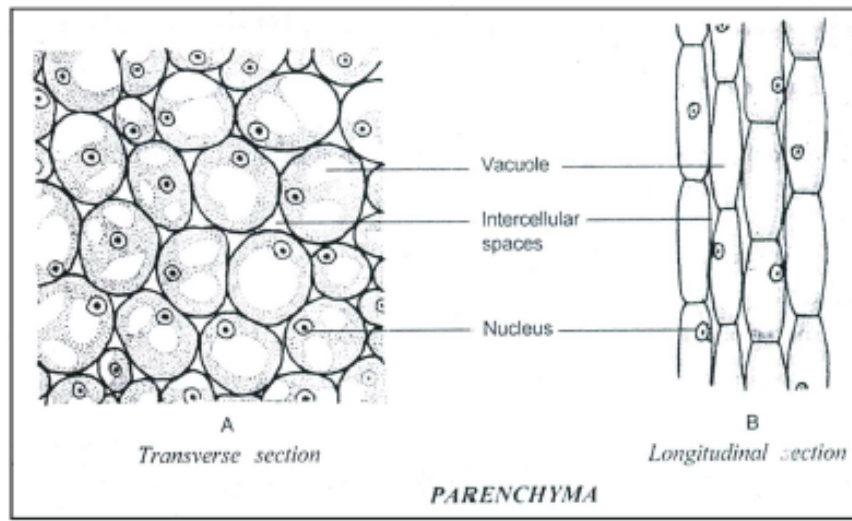
Simple permanent tissue with thin-walled living cells are parenchyma.

#### CHARACTERISTIC FEATURES

The living cells are oval to round in shape, thin-walled and with intercellular spaces. The cells contain central vacuole and starch granules in their cytoplasm. Cells contain abundant cytoplasm with a prominent nucleus. Parenchyma cells with chloroplasts are called **chlorenchyma**, which helps in photosynthesis and cells with abundant air cavities in between are called **aerenchyma**.

#### DISTRIBUTION

Parenchyma tissue forms the ground tissue of plants and occupies large portions of plant bodies. They are present in cortex, pith, medullary rays, epidermis of roots and stems, mesophyll tissue of leaves, pulp of fruits, embryo, endosperm of seeds and in the conducting tissues like xylem and phloem.

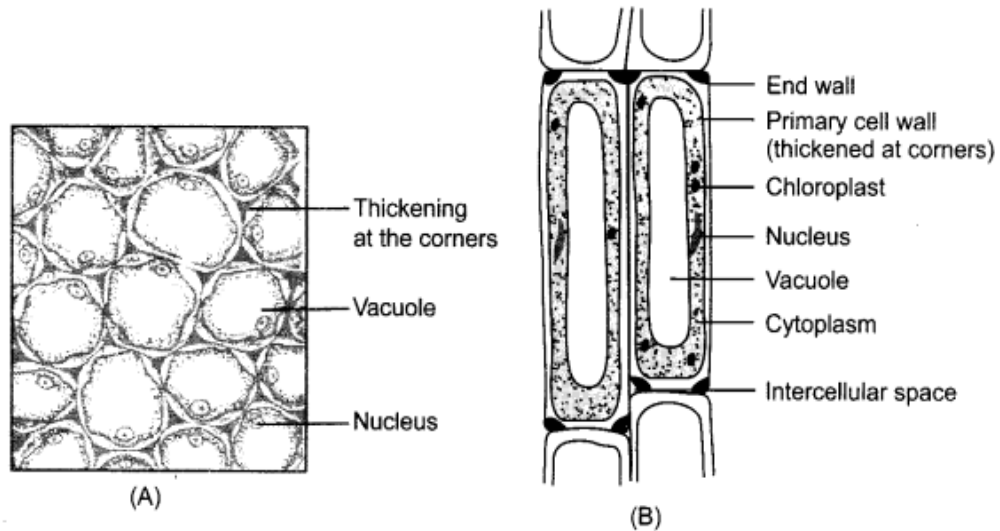


### **FUNCTIONS**

- Helps in manufacturing food by photosynthesis. Parenchyma containing chlorophyll is called **chlorenchyma** (as in leaf) whereas parenchyma containing air is called **aerenchyma** (as in lotus).
- They function as storage tissue by storing starch (reserve food).
- When associated with conducting tissues like xylem and phloem, they help in transportation of water and food matters. In turgid condition they provide support to delicate parts.

### (ii) **COLLENCHYMA**

Simple permanent tissue walls of whose cells are unevenly thickened by additional cellulose deposition are called collenchyma.



Collenchyma: (A) Transverse section and (B) Longitudinal section

Fig. 6.2.

### CHARACTERISITC FEATURES

The living cells are closely packed, elongated in shape, with thickenings at their corners due to uneven deposition of cellulose. Cells have no intercellular spaces in between. The cells contain chloroplast and appear to be polygonal in cross section.

### DISTRIBUTION

Collenchyma is present below the epidermis of dicot stems and also in the stalk of flowers i.e., petiole, leaf blades.

### FUNCTIONS

- Provides mechanical support to plant organs.
- Collenchyma cells containing chloroplasts can prepare food by photosynthesis.
- The cells are responsible for providing flexibility and plasticity, and also give strength to the plant parts.

### iii) SCLERENCHYMA

Simple permanent tissue whose cells contain thick uniformly had lignified walls, and are dead in nature is called sclerenchyma.

### CHARACTERISTIC FEATURES

The tissue comprises of two types of cells – Sclerenchyma fibres and Sclereids or Stone cells.

#### a) SCLERENCHYMA FIBRES :

Long, narrow cells with pointed ends, with uniformly thickened lignified walls, and with small openings (pits) are called **sclerenchyma fibres**. At maturity the cells die due

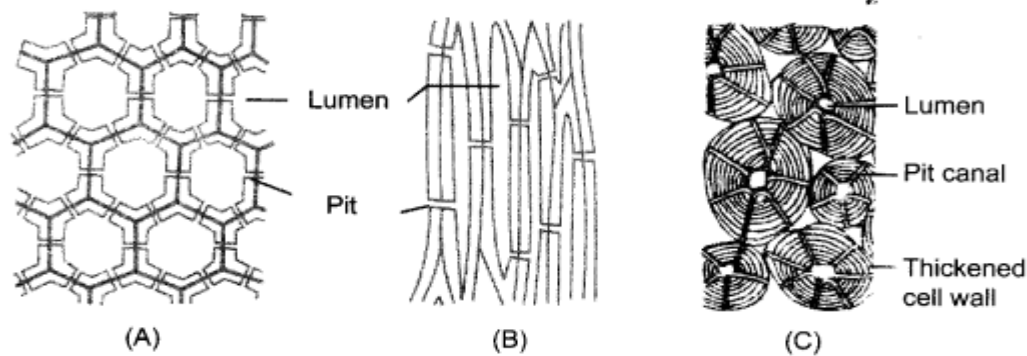
to loss of protoplast. Cross section of fibres shows angular cells e.g., fibres of hemp, flax, jute are sclerenchyma fibres, fibres are present in the vascular tissues of root, stem and leaf. **Cotton fibre is not sclerenchyma fibre but they are outgrowth of epidermis of seed coat.**

**b) SCLEREIDS or STONE CELLS :**

Spherical, or oval cells with unevenly very much thickened walls are called sclereids or stone cells. They are shorter in size with many pits on their walls. Walls of sclereids are hard and lignified, also called **stone cells** or **grit cells**.

**DISTRIBUTION**

Sclerenchyma fibres are present in the hypodermis, in the vascular tissues, and sclereids are present in the fruit wall of guava, pears, etc. seed coats, bark of trees and leaves.



Sclerenchyma: (A) Transverse section, (B) Longitudinal section and (C) Sclereids (Stone cells)  
**Fig. 6.3.**

**FUNCTIONS**

- Provides rigidity and strength to plant parts .
- The tissue also helps in withstanding stress and strains.

**DIFFERENCE BETWEEN PARENCHYMA, COLLENCHYMA AND SCLERENCHYMA**

<b>PARENCHYMA</b>	<b>COLLENCHYMA</b>	<b>SCLERENCHYMA</b>
(i) Originates from the ground meristem and protoderm.	(i) Originates from procambium like cells in the ground meristem.	(i) Originates from protoderm, procambium and ground meristem.
(ii) Cells are living at maturity i.e. simple living tissue.	(ii) Cells are living at maturity i.e. simple living tissue.	(ii) Cells are nonliving at maturity i.e., simple dead tissue.
(iii) Generally iso diametric cells.	(iii) Elongated cells with blunt ends.	(iii) Needle like cells with pointed ends.
(iv) Uniformly thickened cell wall.	(iv) Unevenly thickened cell wall, thickened more at the corners.	(iv) Uniformly thickened cell wall.
(v) Cellulose is the component	(v) Cellulose, hemicelluloses	(v) Lignin is the component of

of the cell wall.	are the components of the cell wall.	the cell wall; cell wall possess simple or bordered pits.
(vi) Cell wall primary in nature.	(vi) Cell wall primary in nature.	(vi) Cell wall secondary in nature.
(vii) No ornamentation is found over the cell wall.	(vii) No ornamentation is found over the cell wall.	(vii) Various ornamentation found over the cell wall.
(viii) Soft nature of the cell wall.	(viii) Slightly hard nature of the cell wall.	(viii) Very hard nature of the cell wall.
(ix) End walls not interlocked.	(ix) End walls interlocked . Intercellular spaces may be present or absent.	(ix) End walls interlocked. Intercellular spaces totally absent.
(x) Cell's possess dense cytoplasm, nucleus and smaller vacuoles.	(x) Cells possess cytoplasm, nucleus and vacuoles.	(x) Cells does not possess cytoplasm and nucleus.
(xi) It acts primarily as a storage tissue.	(xi) Acts as a storage cum mechanical tissue.	(xi) Acts as a mechanical tissue.

## ii) COMPLEX PERMANENT TISSUE

Tissue made up of two or more cell (heterogeneous) types are called complex tissue.

### TYPES OF COMPLEX TISSUE

**Xylem and Phloem** are the two types of complex tissues, also called **conducting tissues** or **vascular tissues** and together they form **vascular bundles**.

#### i) XYLEM

The complex permanent tissue associated with conduction of water and mineral salts in vascular plants is called xylem.

#### TYPES

Xylem is a complex tissue as it consists of different types of cells, both living and non-living, namely – Tracheid, Trachea or Xylem vessels, Xylem parenchyma or Wood parenchyma and Xylem fibre or Wood fibre.

- (i) **TRACHEID** – Elongated dead cells, tubular in shape and with tapering end walls.
- (ii) **TRACHEA or XYLEM VESSELS** – Elongated dead cells, tubular in shape but with no end walls and joined end to end forming a continuous pipe, are trachea or vessels. The cells are thick and lignified.
- (iii) **XYLEM PARENCHYMA or WOOD PARENCHYMA** – The living parenchyma cells of xylem tissue are called xylem parenchyma or wood parenchyma. The cells may be thin or thick walled. This is only living tissue of xylem.
- (iv) **XYLEM FIBRE OR WOOD FIBRE** – Thick walled fibre like sclerenchyma fibres forming components of xylem tissue are xylem fibres or wood fibres.

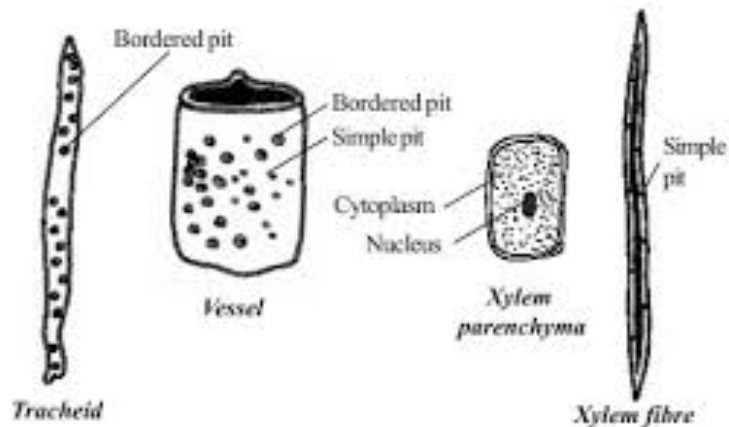


Fig. Kinds of xylem cells

### DISTRIBUTION

Xylem is present in the vascular bundles of higher plants.

### FUNCTIONS

- Xylem helps in transportation of water and solutes unidirectionally called **ascent of sap.**
- Acts as supportive tissue, imparting mechanical strength to the plant body.
- Helps in storage of water and mineral salts.

### ii) PHLOEM

Complex permanent vascular tissue responsible for transporting food in plant body is called phloem

### TYPES

The components of phloem are Sieve tube, Companion cells, Phloem fibres or Bast fibres and Phloem Parenchyma.

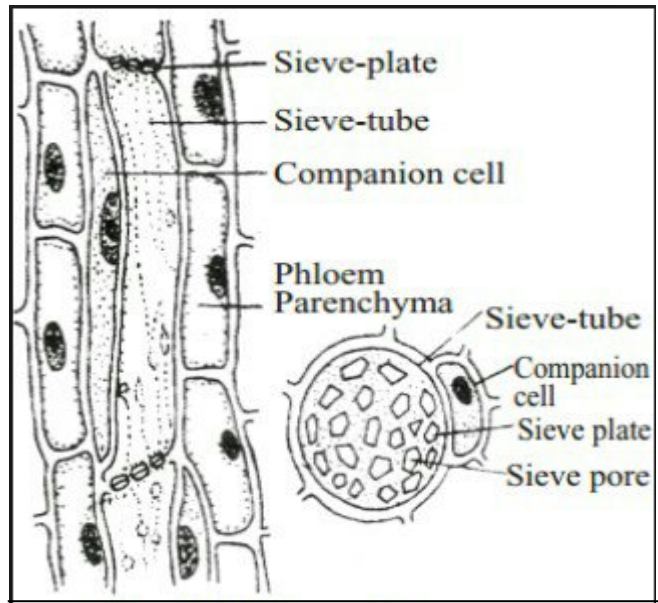
- (i) **SIEVE TUBE** - Elongated tube like living cells arranged in a row, with their perforated end walls forming a sieve. The cells are non-nucleated and their protoplast are inter-connected through sieve plates. They possess vacuolated cytoplasm.
- (ii) **COMPANION CELL** - Elongated, lens-shaped cells containing dense cytoplasm and prominent nuclei are called companion cells. Cells maintain connection with sieve cells through pits



- (iii) **PHLOEM FIBRE OR BAST FIBRE** - Elongated fibre like sclerenchymatous dead cells with thick walls containing pits and inter blocked ends, are phloem fibres or bast fibres. **Jute fibres are bast fibres.**
- (iv) **PHLOEM PARENCHYMA** - Living thin walled parenchyma cells associated with phloem are called phloem parenchyma

**DISTRIBUTION**

Phloem occurs in the vascular bundles of higher plants, forming conducting or vascular tissue.



**Cells of Phloem**

**FUNCTIONS**

- Conduction of food-by sieve tubes of phloem both in upward and downward directions.
- Storage of organic food matters.
- Lateral translocation of food by the companion cells.

**DIFFERENT BETWEEN XYLEM AND PHLOEM**

	<b>XYLEM</b>	<b>PHLOEM</b>
(i) Characteristic features	Complex dead permanent	Complex living permanent

	tissue. All cell elements are dead except xylem parenchyma, cell wall thickenings are found like – annular, spiral, scalariform, reticulate, pitted, etc. Tracheids and trachea are the conducting channels.	tissue. All the cell elements are living except phloem or bast fibre, cell wall thin, composed of cellulose but the cell wall of phloem or bast fibre is thick due to the deposition of lignin. Cell wall thickening is not found. Sieve tubes are the conducting channels.
(ii) Distribution	Distributed within the conducting tissue or within the vascular bundle.	Distributed within the conducting tissue, or within the vascular bundle.
(iii) Types	Xylem composed of the following cell elements – Tracheid, Trachea, Xylem parenchyma and Xylem or wood fibre.	Phloem composed of the following cell elements. Sieve tubes, Companion cell, Phloem parenchyma and Phloem or Bast fibre. In some cases sieve cells are present.
(iv) Functions	Conduction of water unidirectionally and mechanical support and in some cases water storage.	Conduction of food matters like carbohydrates, proteins, etc., bidirectionally from the leaves to the different regions of the plant body and storage of prepared food matters. Mechanical function of phloem is very little.

Shaista Ahmed