

**VIVEKANAND COLLEGE, KOLHAPUR  
(AUTONOMOUS)**

**Department of Botany**

**B.Sc. II**

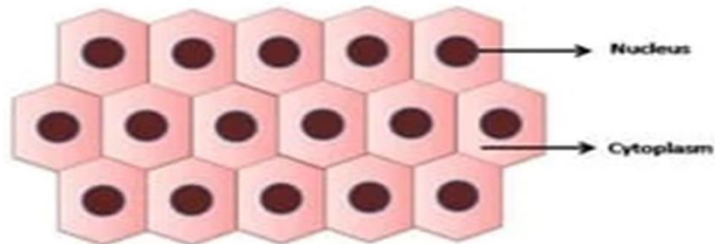
**TOPIC : TISSUE**

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M.Sc., Ph.D.

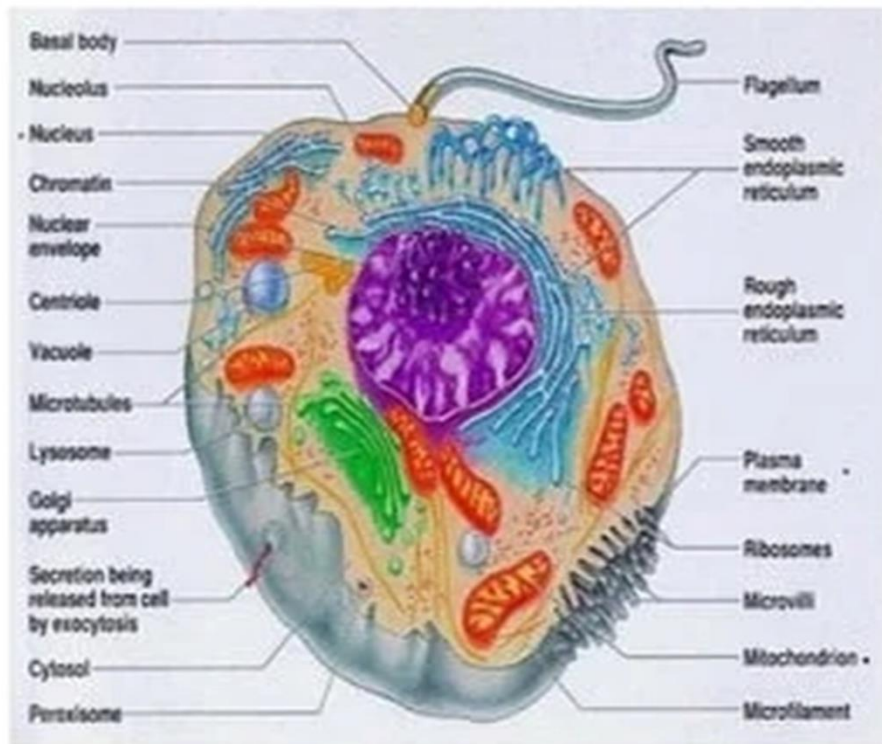
# Tissue

**An aggregation of similarly specialized cells which together perform specialized functions are called tissues**

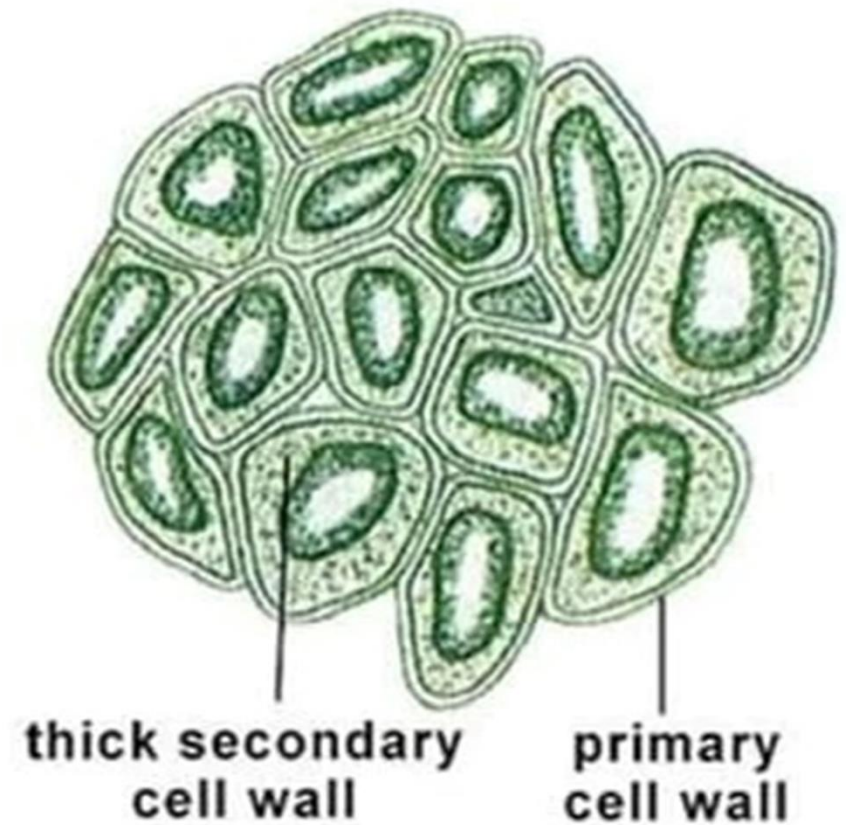
**A typical meristematic tissue**

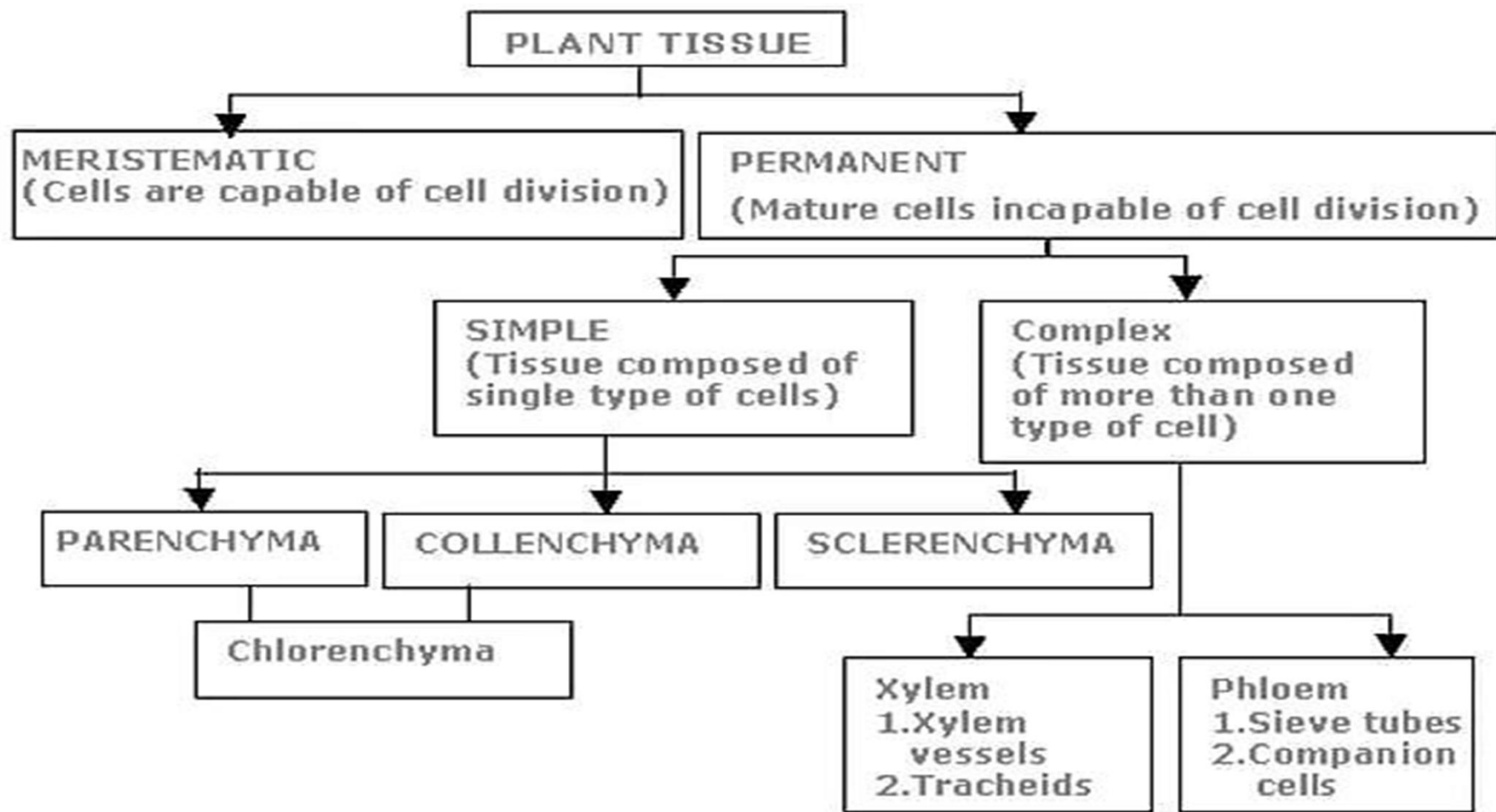


# Cell

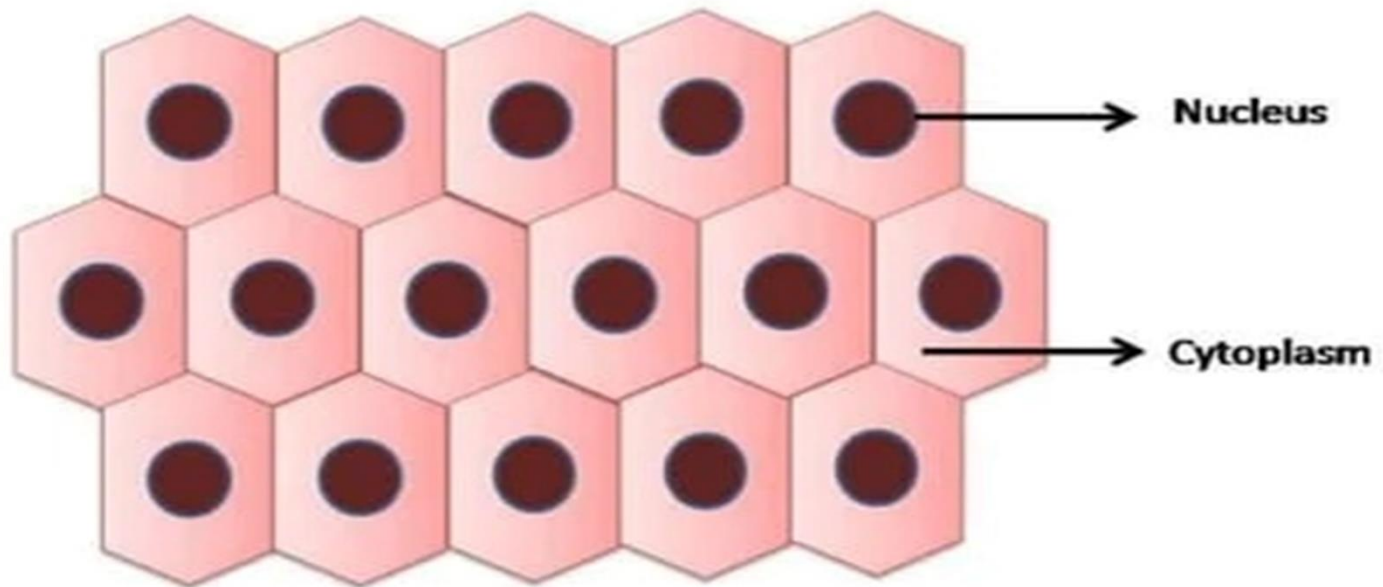


# Tissue





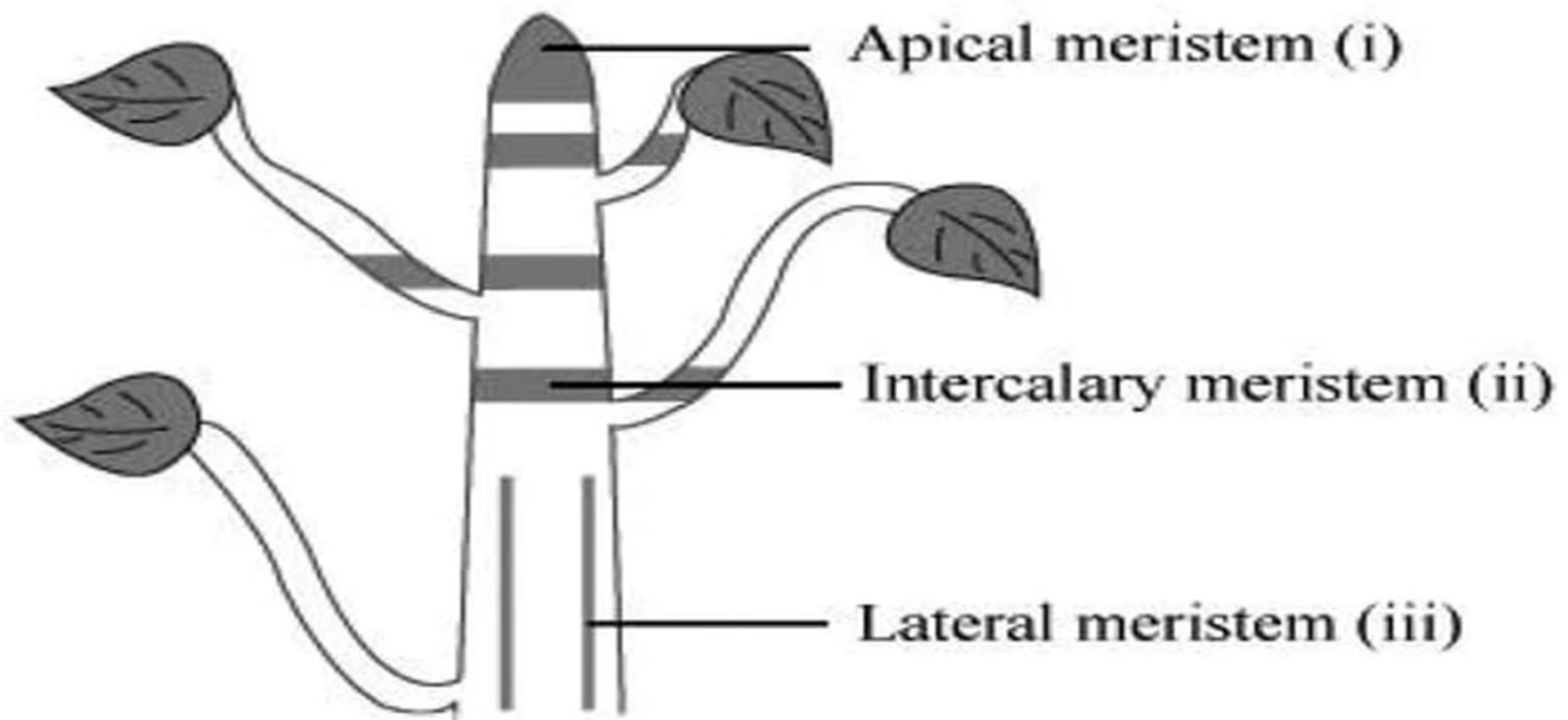
## A typical meristematic tissue



## Meristematic tissue

- **Meristematic tissues are composed of cells that divide continuously.**
- **The cells are spherical, oval, polygonal or rectangular**
- **The cell wall is thin and made up of cellulose**
- **The cells are closely arranged without inter-cellular spaces**
- **Cytoplasm is abundant and nuclei are large**
- **Vacuoles are absent and if present, very few**

## Classification of Meristems



# Classification of meristems

- **1. Apical meristem**

**Position:** At the root tip and shoot tip.

**Function:** To increase in length of the axis.

- **2. Lateral meristem**

**Position:** On the lateral side of stem and root.

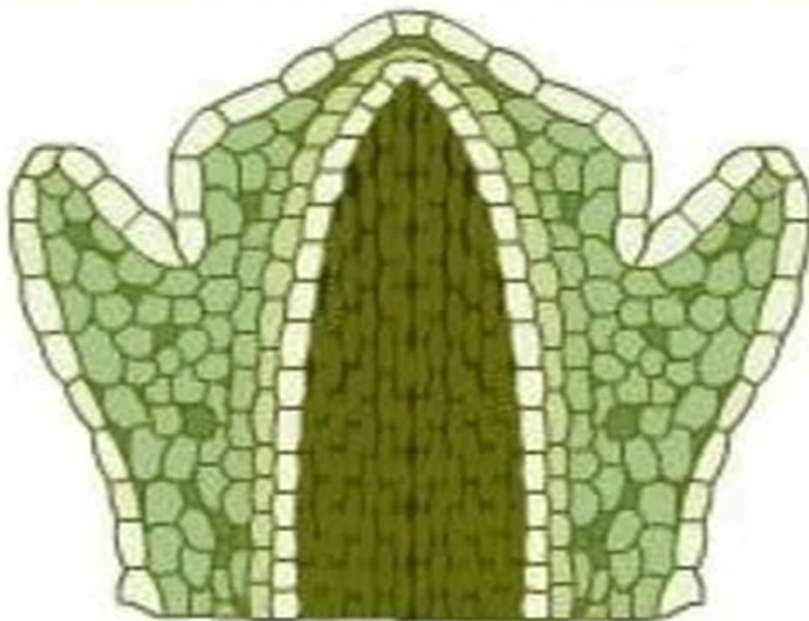
**Function:** To increase in diameter of plant.

- **3. Intercalary meristem**

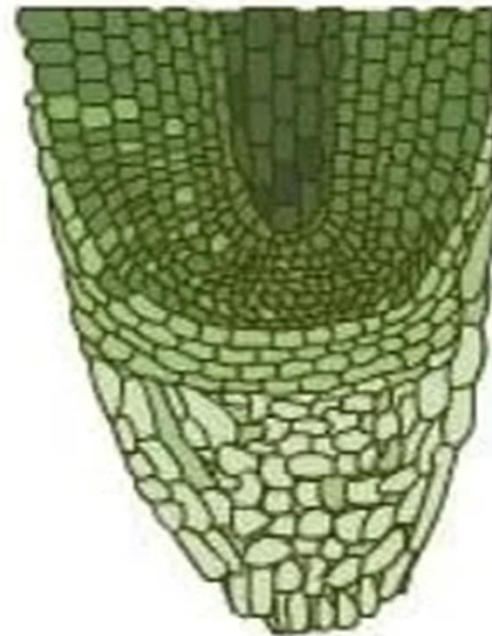
**Position:** At the base of the leaf/internodes/ leaf.

**Function:** To increase the length of the plant or its organs.





a



b

Sections Through (a) Stem Apex and (b) Root tip Showing Meristematic Tissue

## Function of the meristematic tissues

- The main function of meristematic tissue is to continuously form a number of new cells and help in growth
- **Forms permanent tissues**

## Permanent tissues

- **When the cells formed by meristematic tissue take up a specific role and lose the ability to divide. As a result, they form a permanent tissue. This process of taking up a permanent shape, size, and a function is called differentiation. Cells of meristematic tissue differentiate to form different types of permanent tissue.**

## Permanent Tissue

### Simple Permanent Tissue

- Parenchyma
- Collenchyma
- Sclerenchyma

### Complex Permanent Tissue

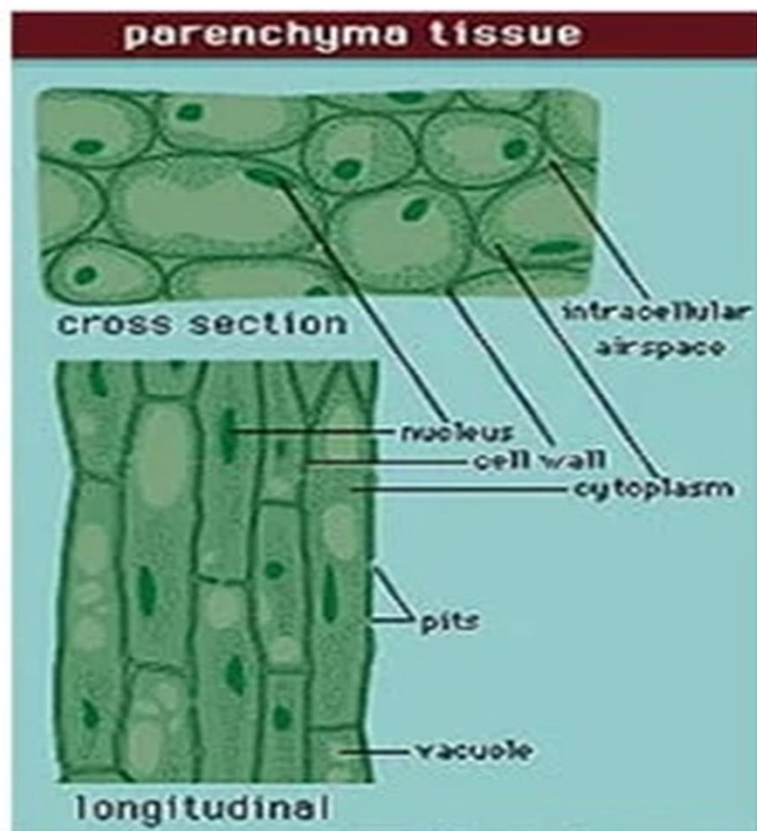
- Xylem
- Phloem

## Simple permanent tissue

- **A simple tissue is made up of one type of cells that form a homogeneous or uniform mass. Simple plant tissues include parenchyma, collenchyma and sclerenchyma**
-

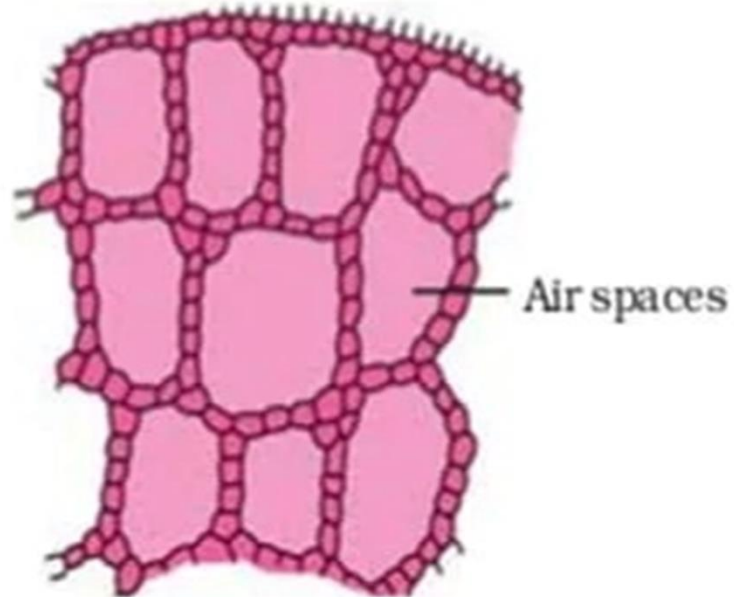
# Parenchyma

- Cells are isodiametric i.e. equally expanded on all sides.
- They may be oval, round, polygonal or elongated.
- **Nucleus is present and hence living.**
- The cell walls are thin and made of cellulose.
- **Cytoplasm is dense with a single large vacuole.**
- Intercellular spaces may be present.
- **May contain chlorophyll. Parenchyma which contain chlorophyll are called chlorenchyma.**

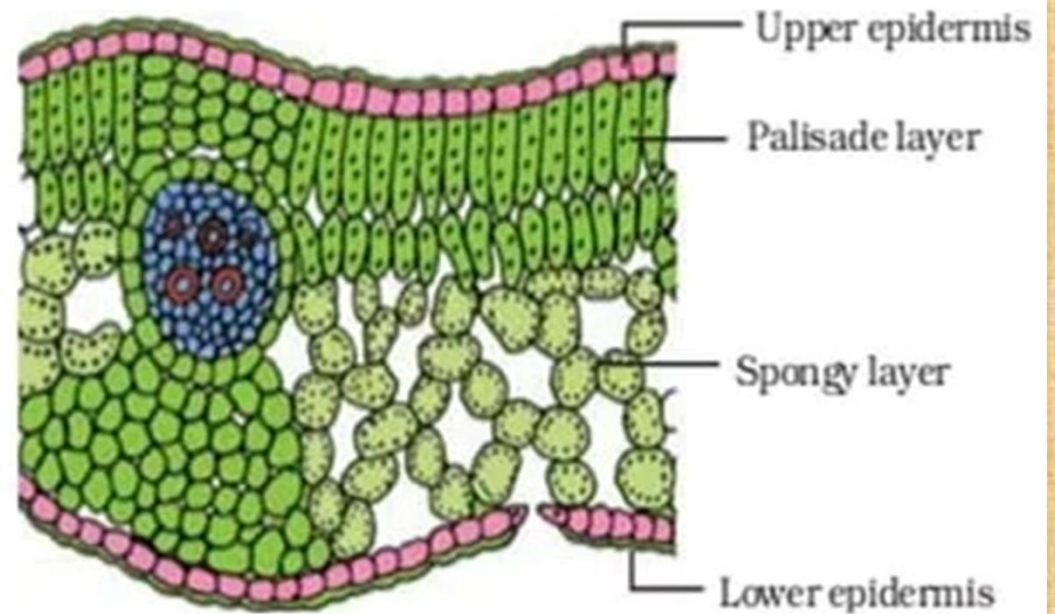


## Types of Parenchyma

### Aerenchyma

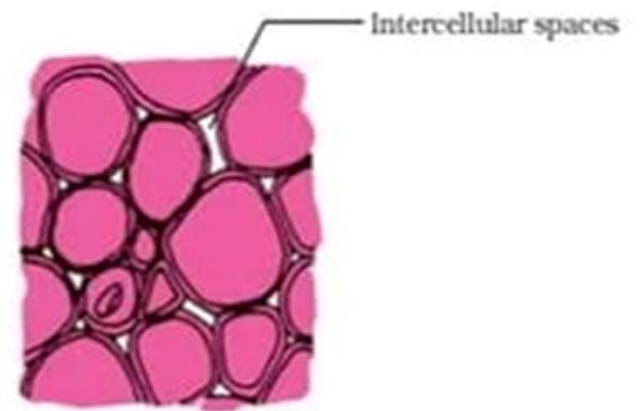


### Chlorenchyma



# Occurrence

- **Found in the cortex of root, ground tissue in stems and mesophyll of leaves.**



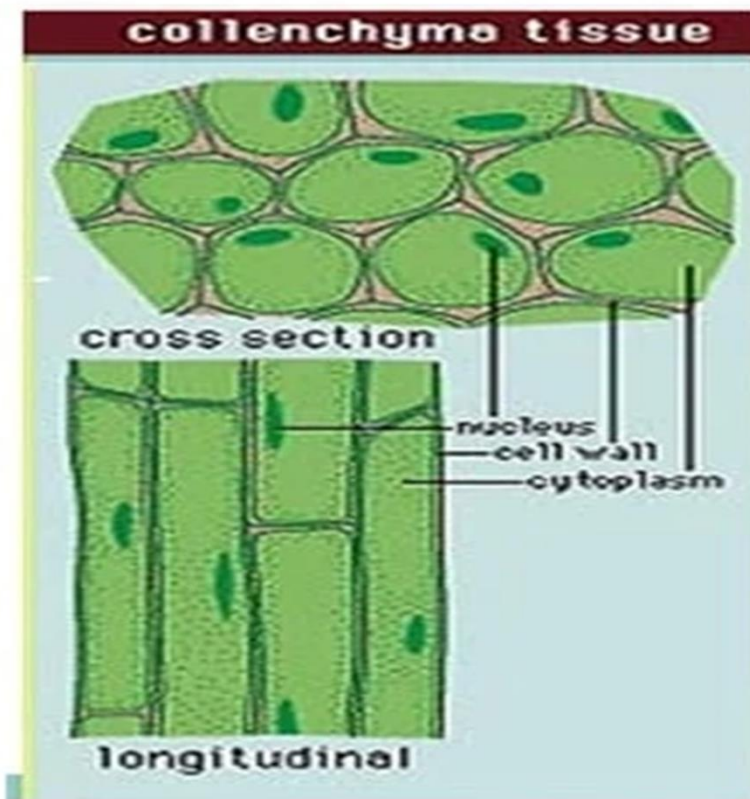


## Function

- **Store and assimilate food**
  - **Give mechanical strength by maintaining turgidity**
  - **Prepare food if chlorophyll is present**
  - **Store waste products like tanin, gum, crystals and resins**
-

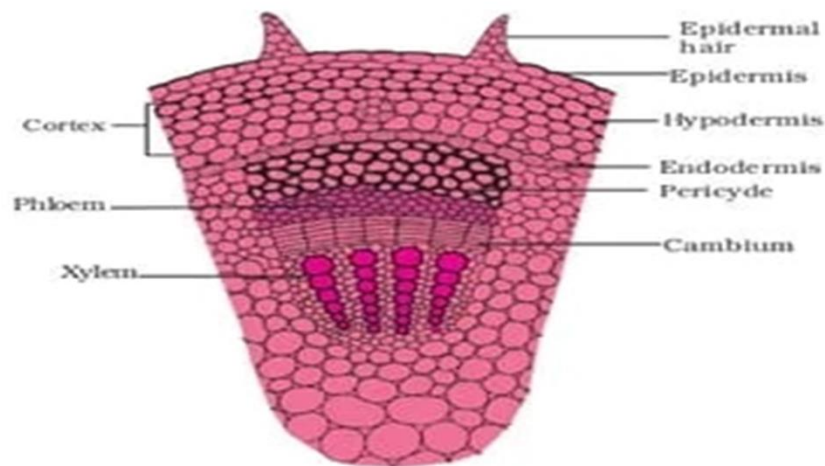
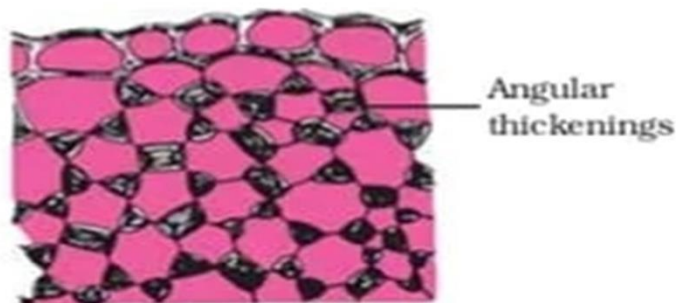
# Collenchyma

- The cells are elongated and are circular, oval or polygonal in cross-section.
- Cell wall is unevenly thickened with cellulose at the corners against the intercellular spaces.
- Nucleus is present and hence the tissue is living.
- Vacuoles are small.
- Intercellular spaces are generally absent.
- If they contain chlorophyll they are known as chlorenchyma.



# Occurrence

- Found under the skin i.e. below the epidermis in dicot stems



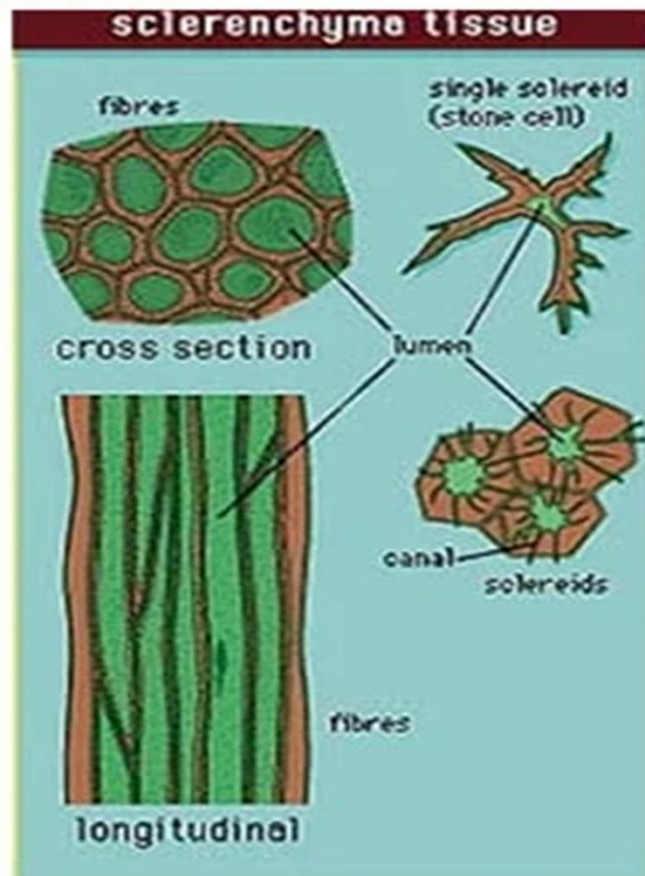
# Function

- Provide mechanical support to the stem.
  - Being extensible, these cells readily adapt themselves to the rapid elongation of the stem.
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# Sclerenchyma

## Nature

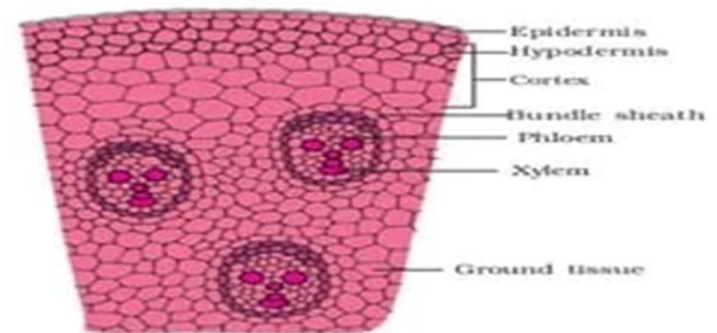
- The cells are long, narrow, thick and lignified, usually pointed at both ends.
- The cell wall is evenly thickened with lignin and sometimes is so thick that the cell cavity or lumen is absent.
- Nucleus is absent and hence the tissue is made up of dead cells.
- They have simple often, oblique pits in the walls.
- The middle lamella i.e. the wall between adjacent cells is conspicuous.



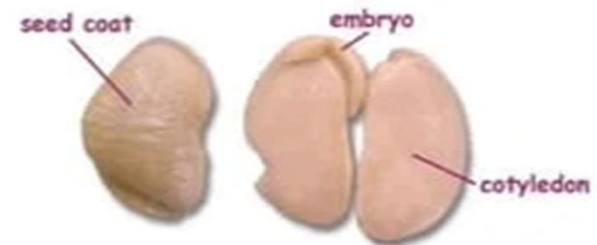
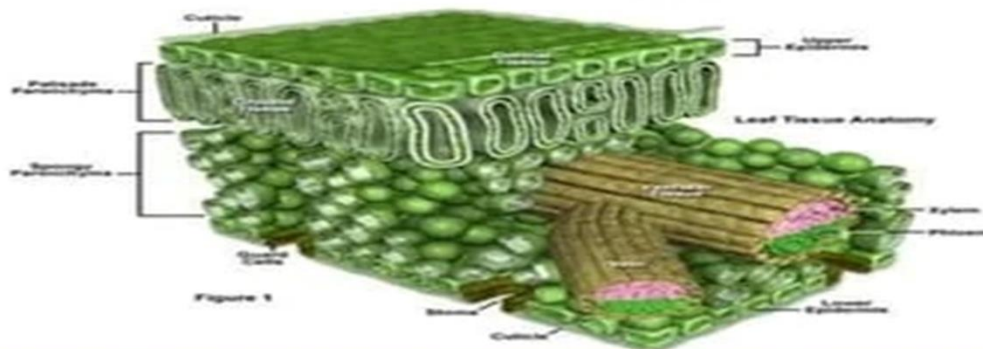
# Occurrence

- Found abundantly in stems of plants like hemp, jute and coconut.
- It is present in stems, around vascular plants, in the leaves, hard covering of seeds&nuts

## Monocot stem

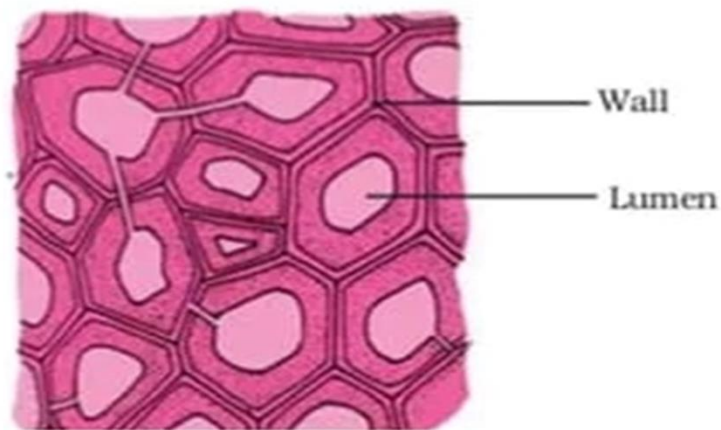


## Leaf

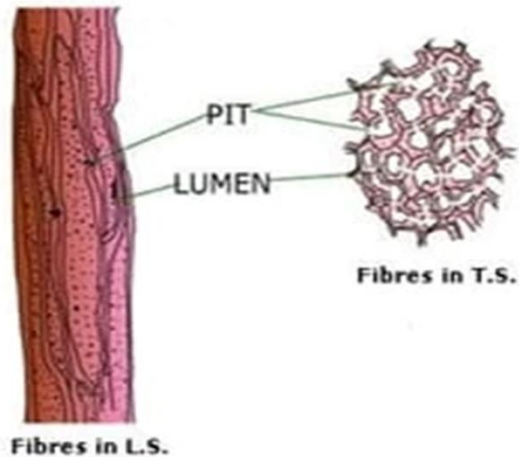


## Function

- Gives mechanical support to the plant by giving rigidity, flexibility and elasticity to the plant body.

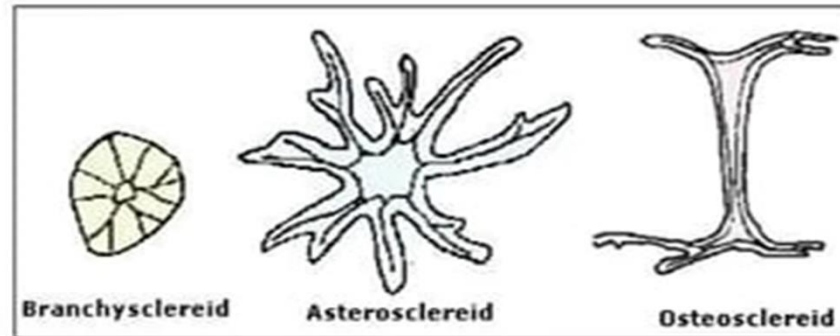


## Fibres



**The sclerenchyma cells are usually elongated, with tapering ends. Such cells are commonly described as sclerenchyma fibres**

## Sclerids

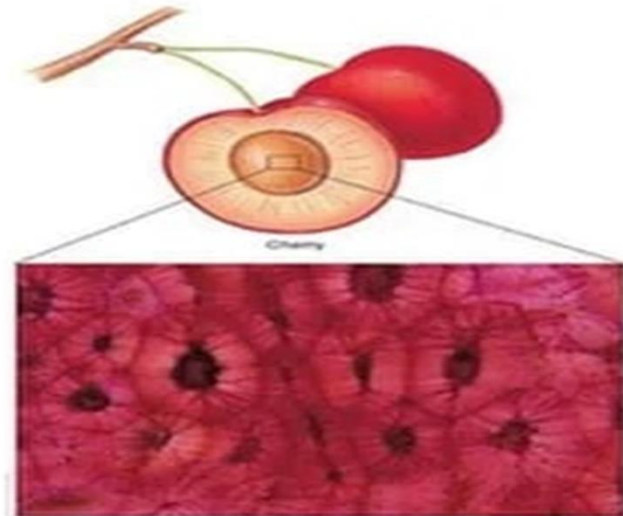


**cells are shorter and irregular in shape. Such cells are commonly described as sclereids or stone cells.**



# Sclerides

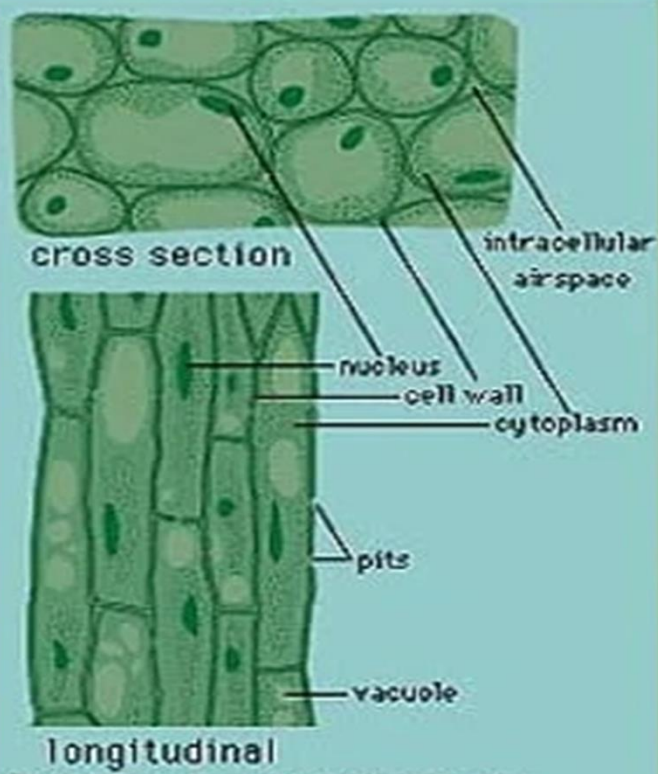
- **Sclereids ( Also known as stone cells or sclerotic cells)**
- **Occurrence : Most common in fruits and seeds**
- 
- **A) Structure**
- **Cells are short, isodiametric, spherical, oval, t shaped or cylindrical in shape.**
- **Usually have thick lignified secondary cell wall.**
- **Occur single or in loose groups.**
- **B) Functions**
- **Protects the plant from stress and strains from environment.**
- **Provide mechanical strength and rigidity.**
- **Provide grittiness to the pulp of fruits.**



64) Sclerids from a cherry (*Prunus avium*) stone. The cell walls are extremely thick and hard, providing structural support.

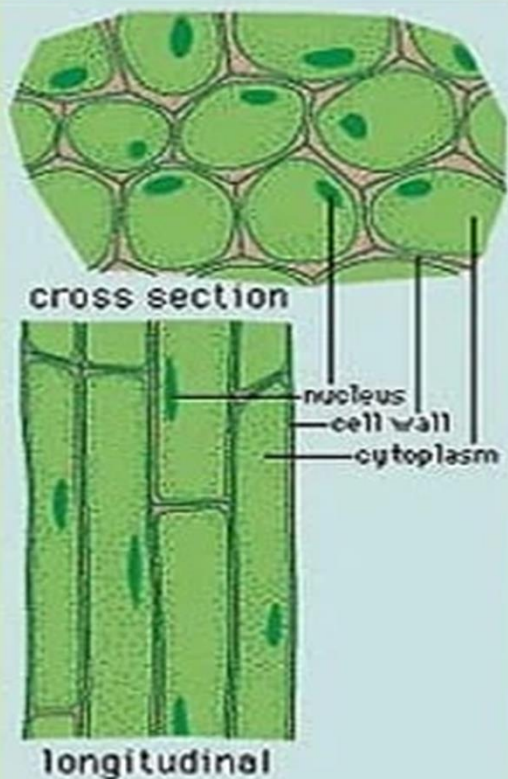
<b>Parenchyma</b>	<b>Collenchyma</b>	<b>Sclerenchyma</b>
Cells are thin walled. Only primary wall present	Thick primary wall at the corners.	Thick walled
Cells loosely arranged	Cells compactly arranged	Cells compactly arranged.
Cells are living, nucleus present	Cells living, nucleus seen	Cells dead, devoid of cellular contents.
Spherical, polygonal, oval, rectangular or rod shaped.	Shapes are variable.	Elongated
Many intercellular spaces.	Intercellular spaces absent	Intercellular spaces absent
Cells vacuolated	Vacuoles absent	Vacuoles absent

**parenchyma tissue**

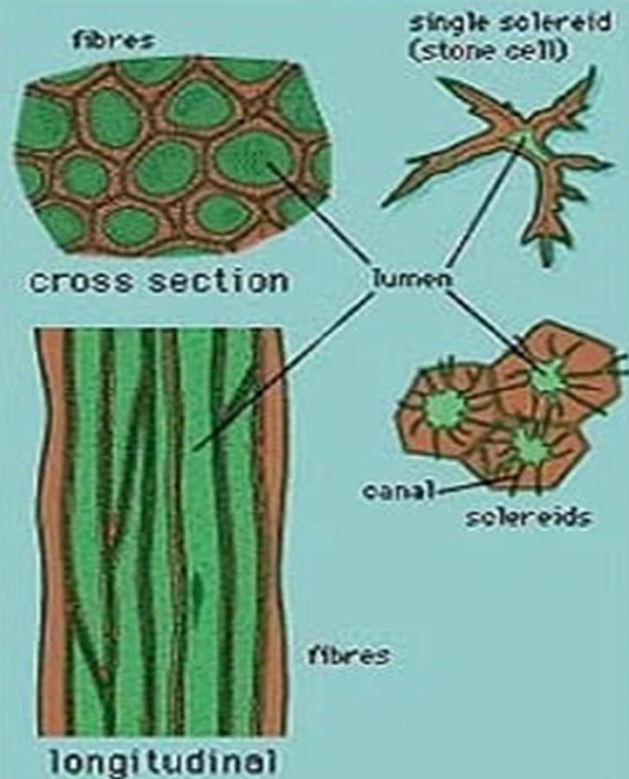


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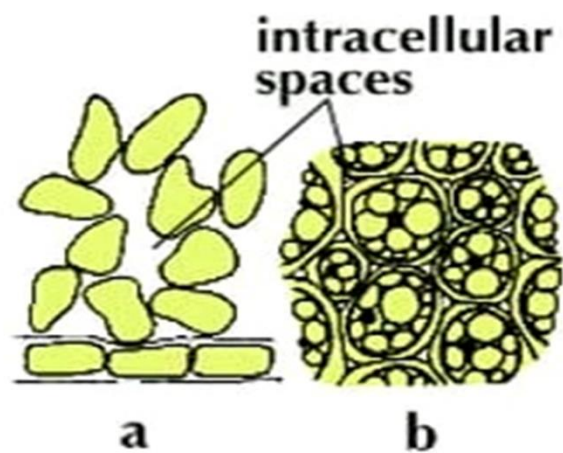
**collenchyma tissue**



**sclerenchyma tissue**

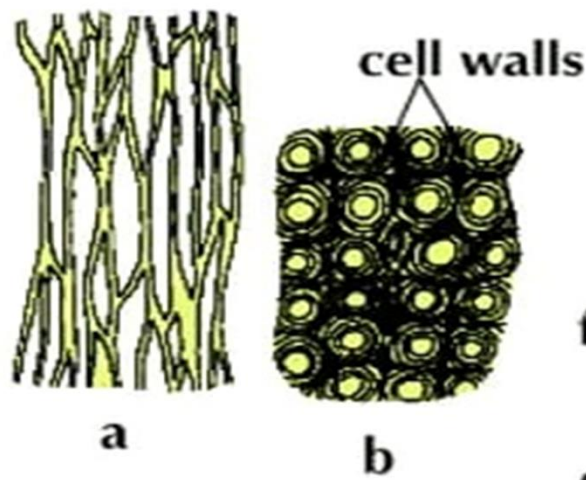


## THE THREE BASIC TYPES OF PLANT TISSUE

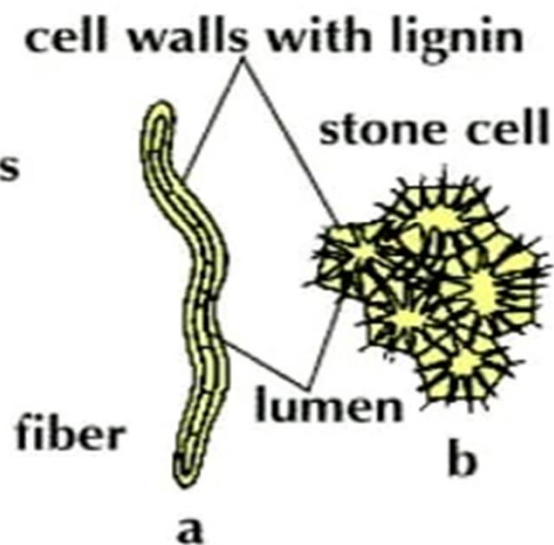


**Parenchyma Tissue**

a lengthwise  
b cross section



**Collenchyma Tissue**



**Sclerenchyma Tissue**

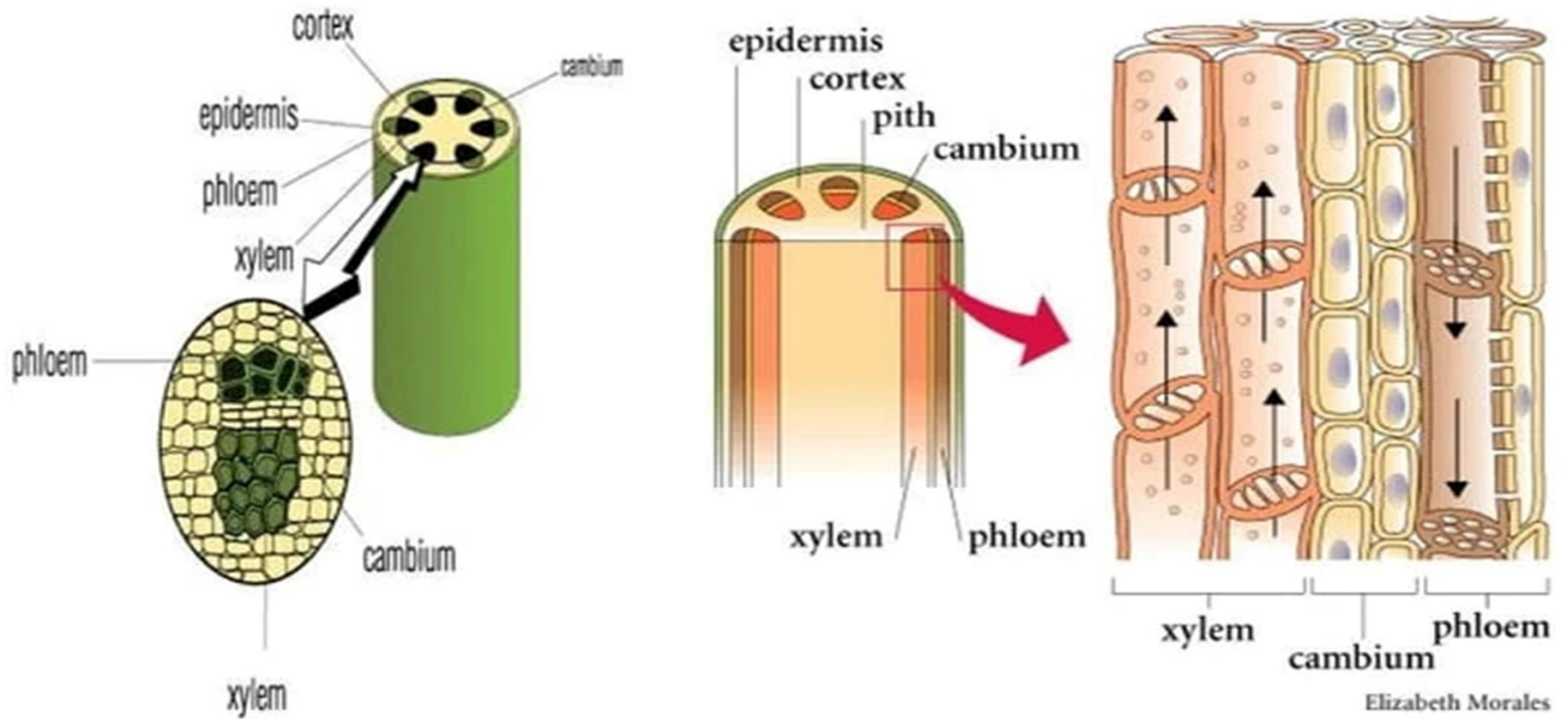
## **COMPLEX PERMANENT TISSUES**

- **These are made of more than one type of cells which combine together to work as a unit.**
- **They transport water and food material to various parts of the plant body.**
- **They are of two types- xylem and phloem.**

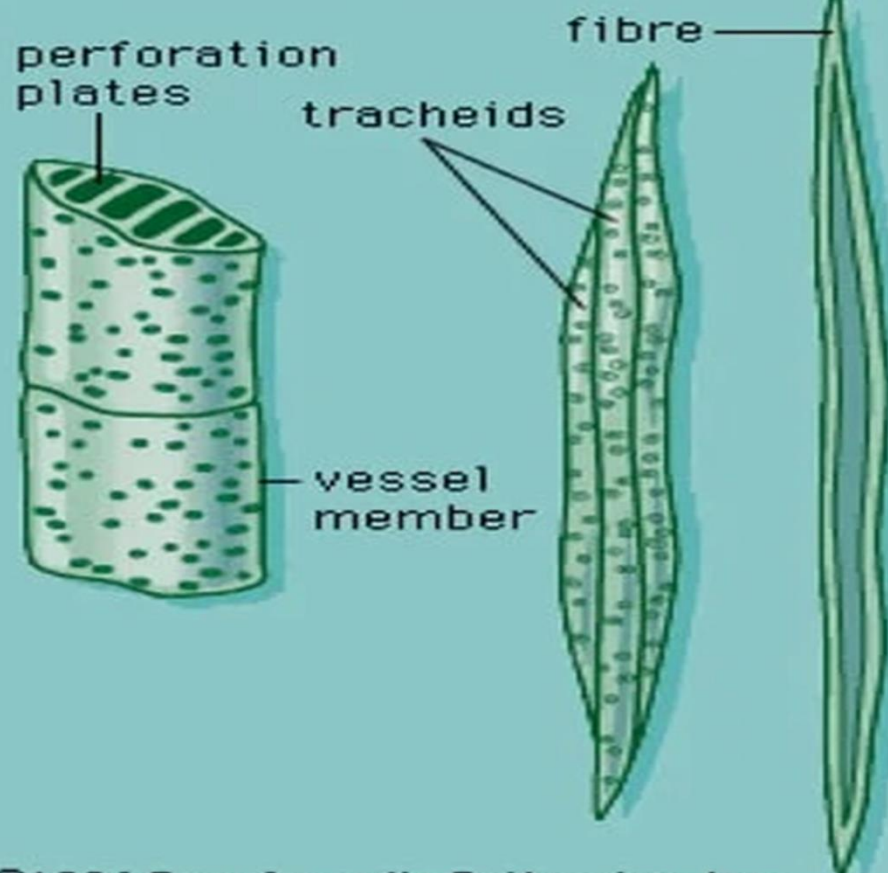
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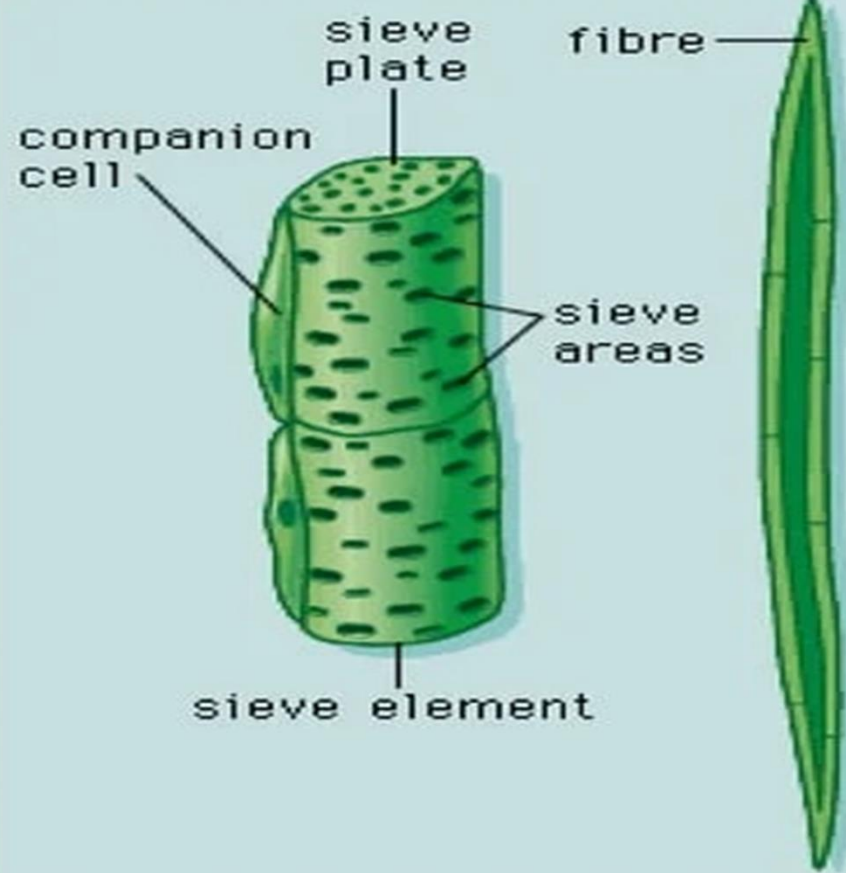
# Vascular tissues



## XYLEM



## PHLOEM



## **XYLEM**

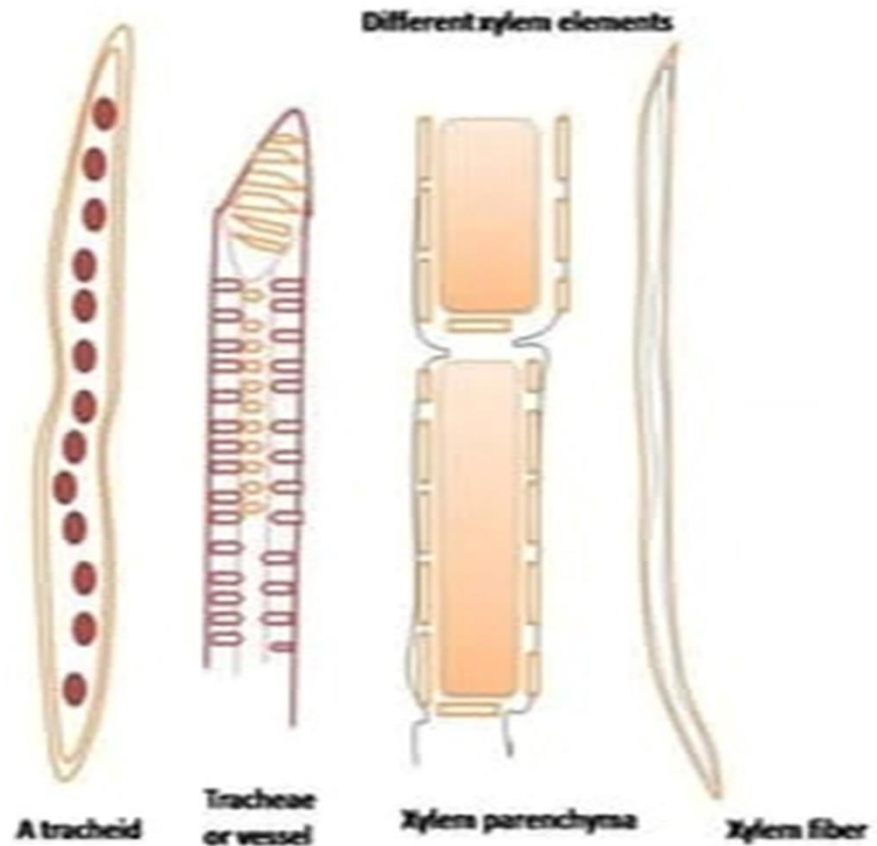
**This complex tissue helps in the transport of water and soluble mineral nutrients from the roots to all the parts of the plant body. It also helps in replacing the water lost during transpiration and photosynthesis.**

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## Components of xylem:

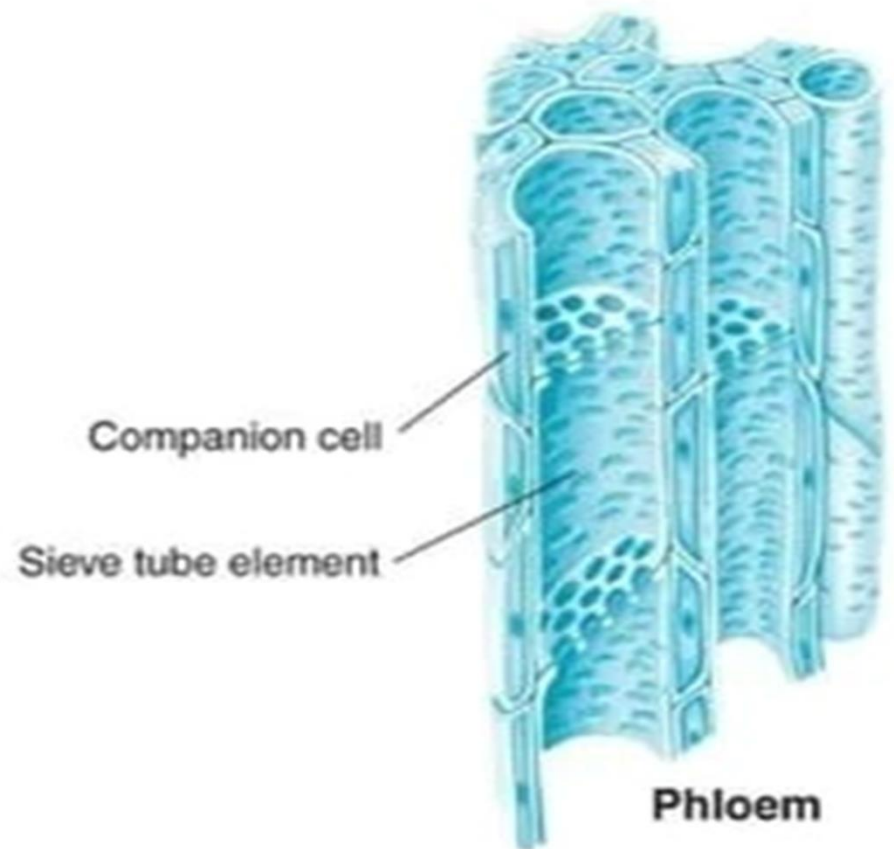
- Tracheids
- Vessels
- Xylem parenchyma
- Xylem fibre



# PHLOEM

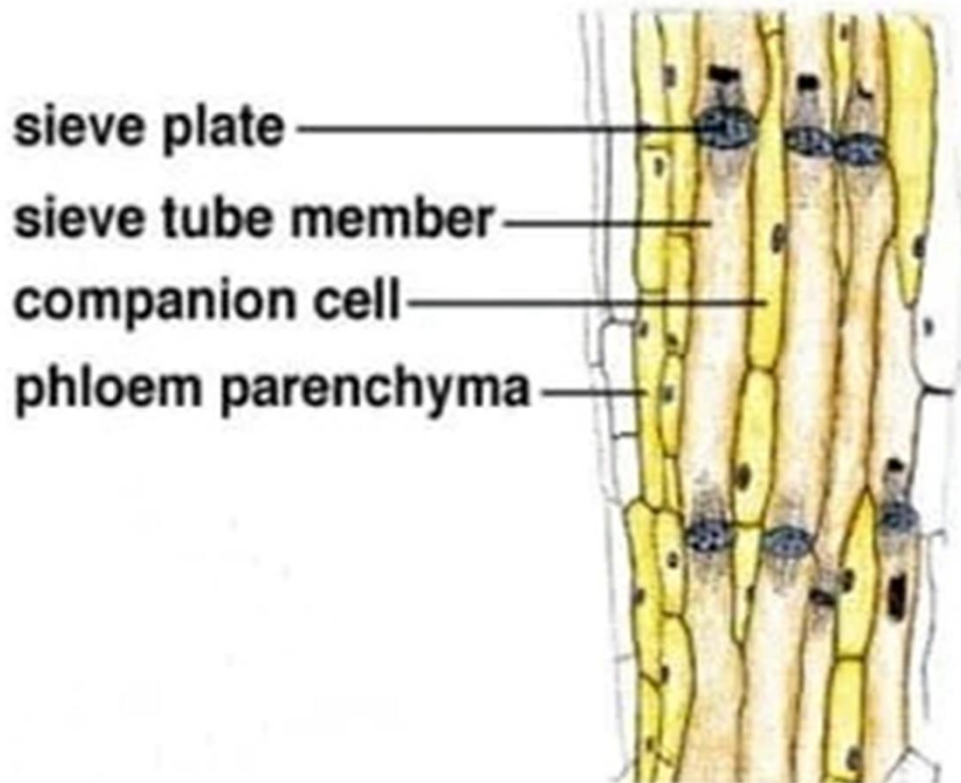
- **This tissue is found in the vascular plants. Its function is to transport sugars and other food materials from the leaves to the rest of the parts of the plant body.**

Xylem and Phloem together form the vascular bundle.



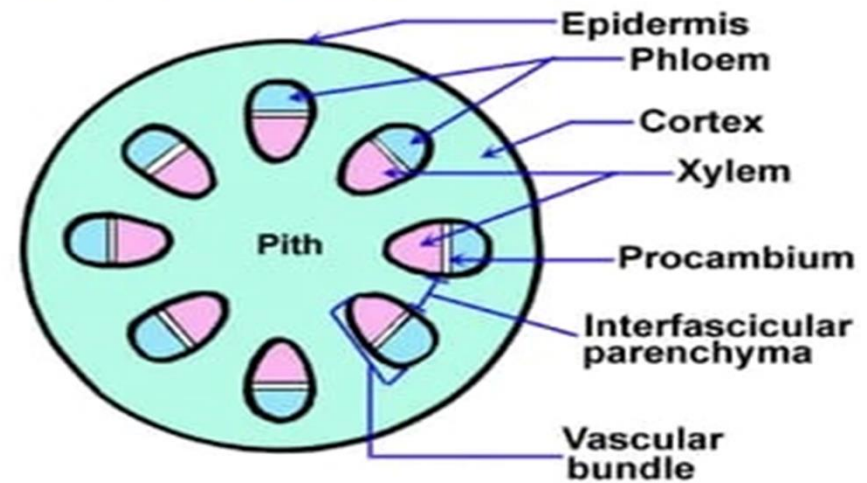
## Components of phloem

- **Sieve tube element**
- **Companion cell**
- **Phloem parenchyma**
- **Phloem fibre**



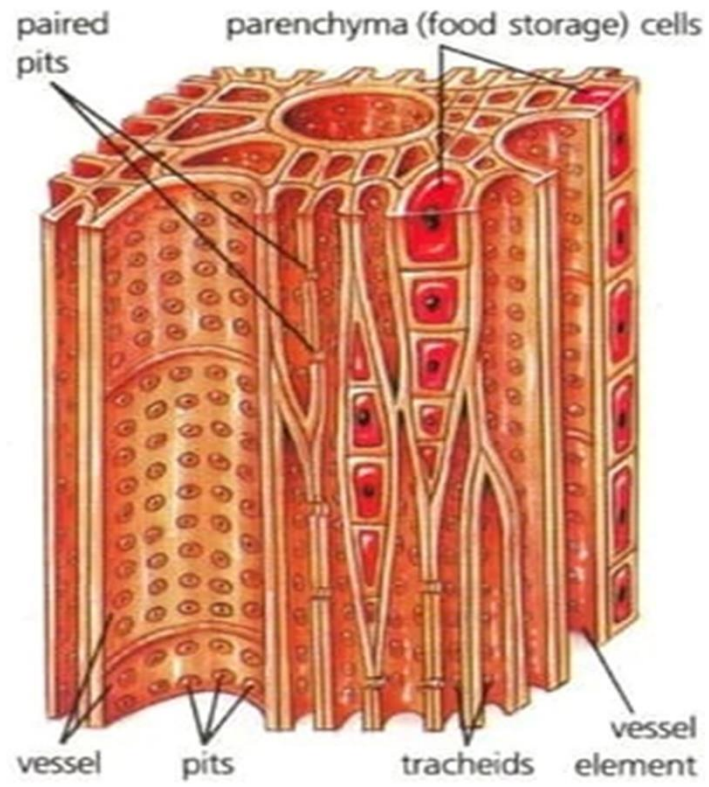
# Vascular bundle

- **Xylem and Phloem together form the vascular bundle.**

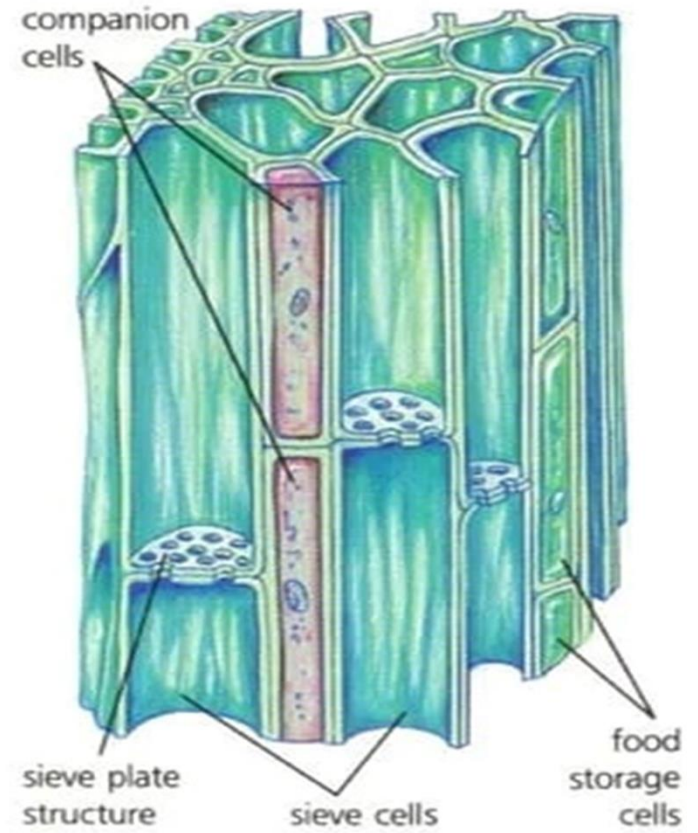


## 25. Vascular Tissue

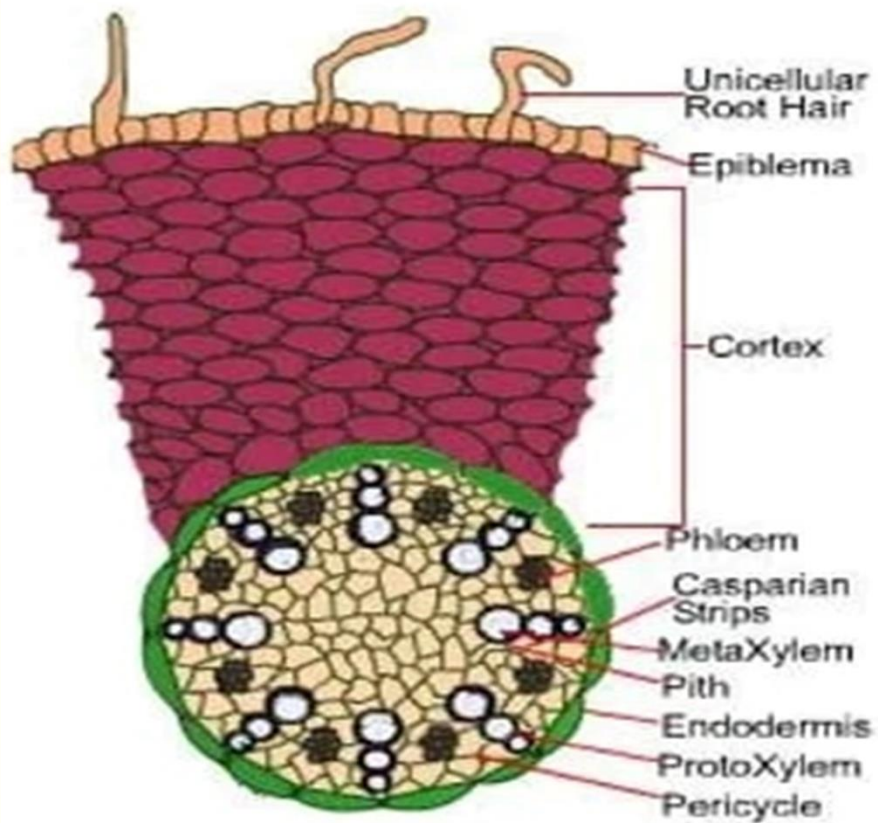
Xylem



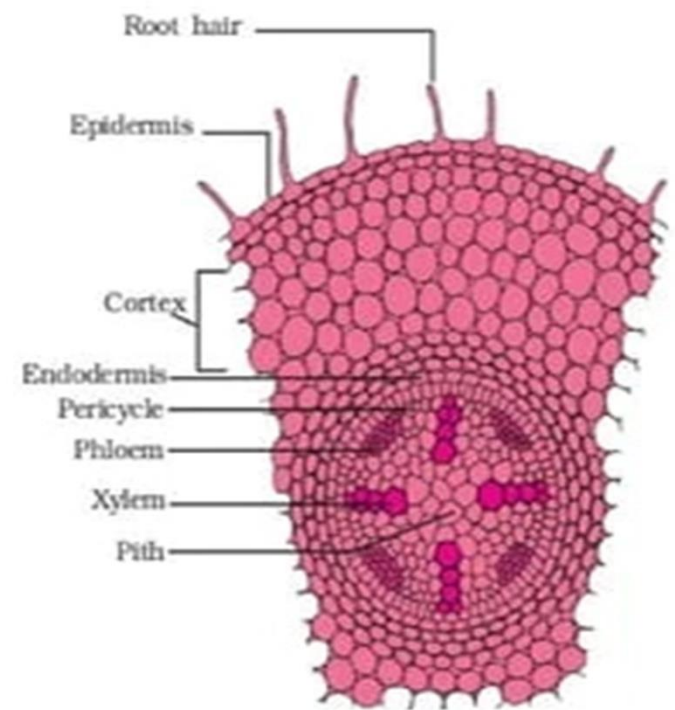
Phloem



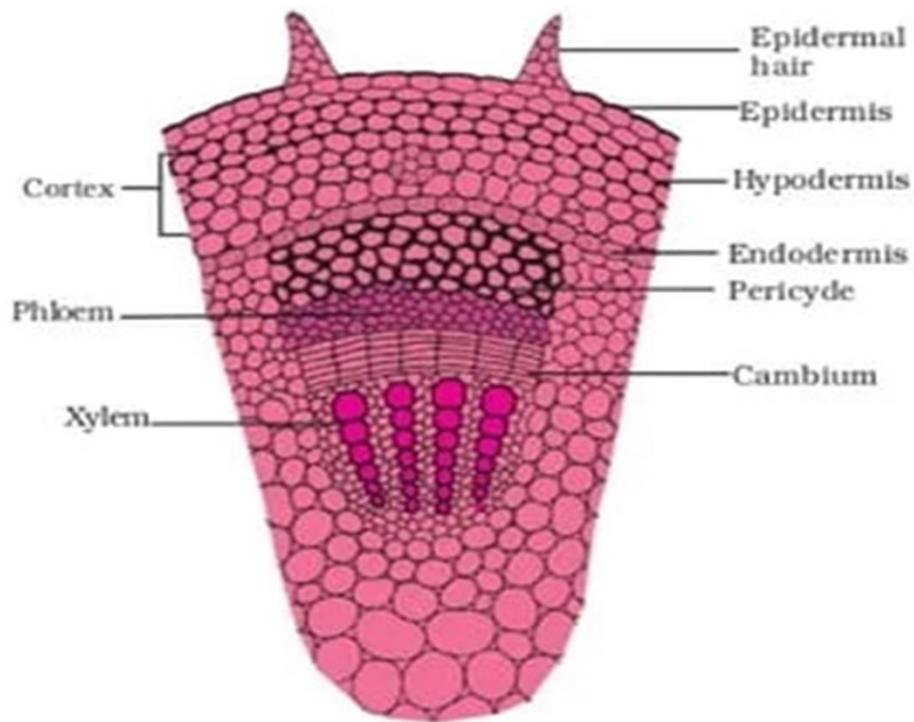
## Monocot root



## Dicot root



## DICOT STEM



## Monocot stem

