

## Lab (1)

### Plant tissue

Plant tissues are composed of cells that are similar and perform a specific function. Together, tissue types combine to form organs. Each organ itself is also specific for a particular function.

### Tissue types

- **Epidermis** – Cells forming the outer surface of the **leaves** and of the young plant body.
- **Vascular tissue** – The primary components of vascular tissue are the **xylem** and **phloem**. These transport fluids and nutrients internally.
- **Ground tissue** – Ground tissue is less **differentiated** than other tissues. Ground tissue manufactures nutrients by **photosynthesis** and stores reserve nutrients.

**Plant tissues can also be divided differently into two types:**

1. Meristematic tissues
2. Permanent tissues.

### **\*Meristematic tissue**

**Meristematic tissue** consists of actively dividing cells and leads to an increase in length and thickness of the plant. The primary growth of a plant occurs only in certain specific regions, such as in the tips of stems or roots. It is in these regions that meristematic tissue is present. Cells of this type of tissue are roughly spherical or polyhedral to rectangular in shape, with thin **cell walls**. New cells produced by meristem are initially those of meristem itself, but as the new cells grow and mature, their characteristics slowly change and they become differentiated as components of meristematic tissue, being classified as:

#### **1. Primary meristem.**

- **Apical meristem** : are located on the very ends of
  - shoots (**shoot apical meristem**)
  - roots (**root apical meristem**).

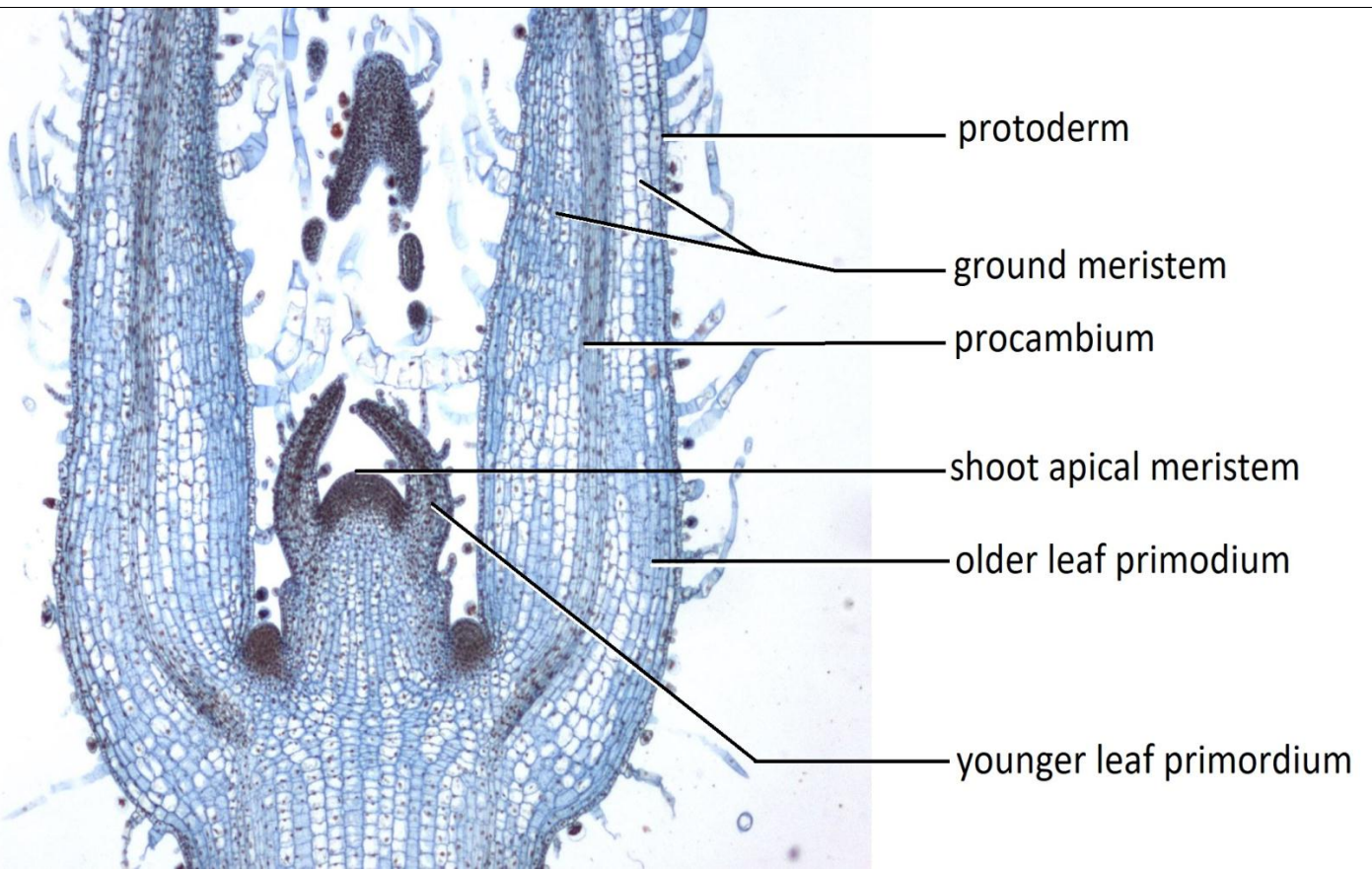
They produce three types

- **primary meristems:** the protoderm, ground meristem, and procambium. The **protoderm** gives rise to epidermis, which surrounds the plant.
- **ground meristem** gives rise to ground tissue, a group of tissues with generalized functions such as photosynthesis, storage, and support.
- **procambium** gives rise to the vascular tissue, which functions in transport.

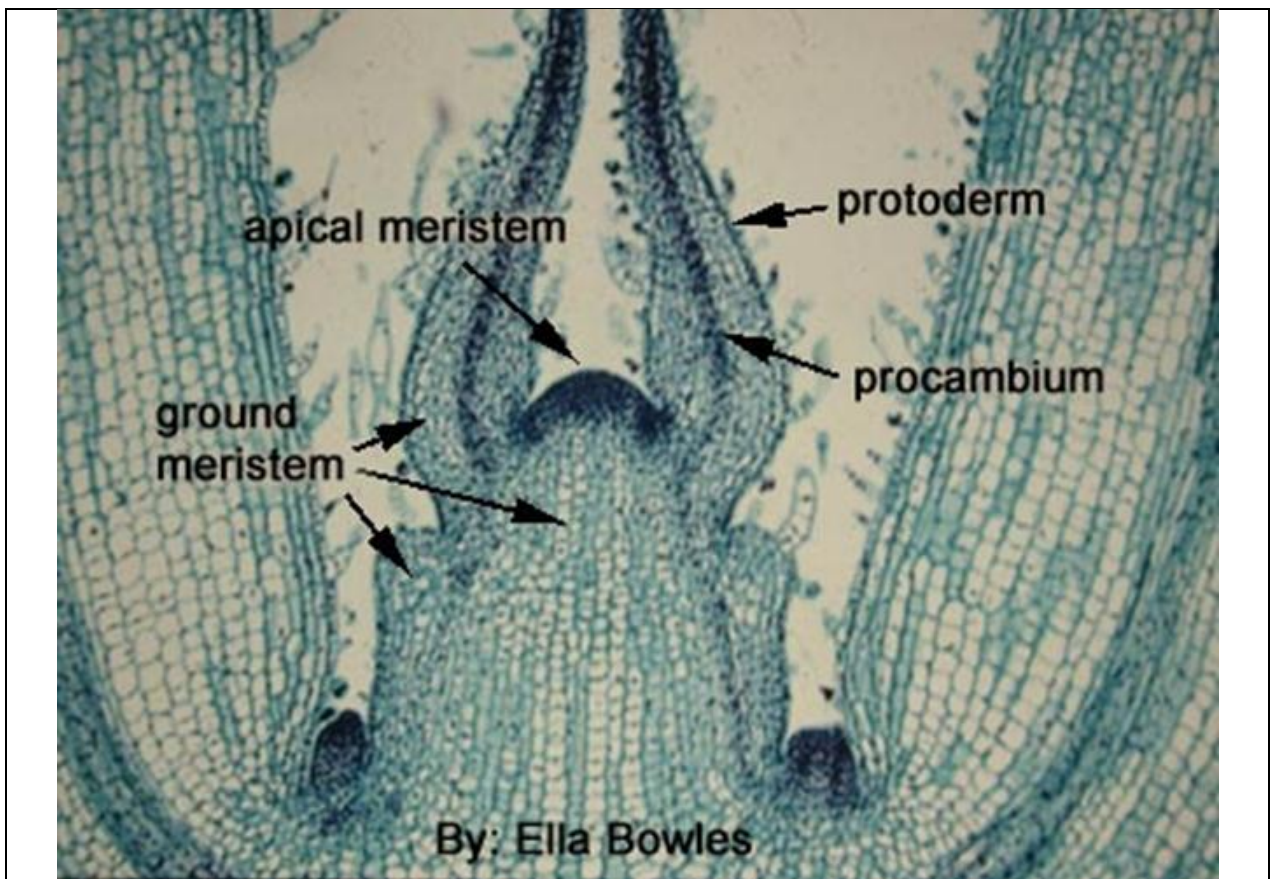
The three primary meristems first appear in the embryo proper, with the protoderm on the outside, the procambium in the center, and the ground meristem in between them.

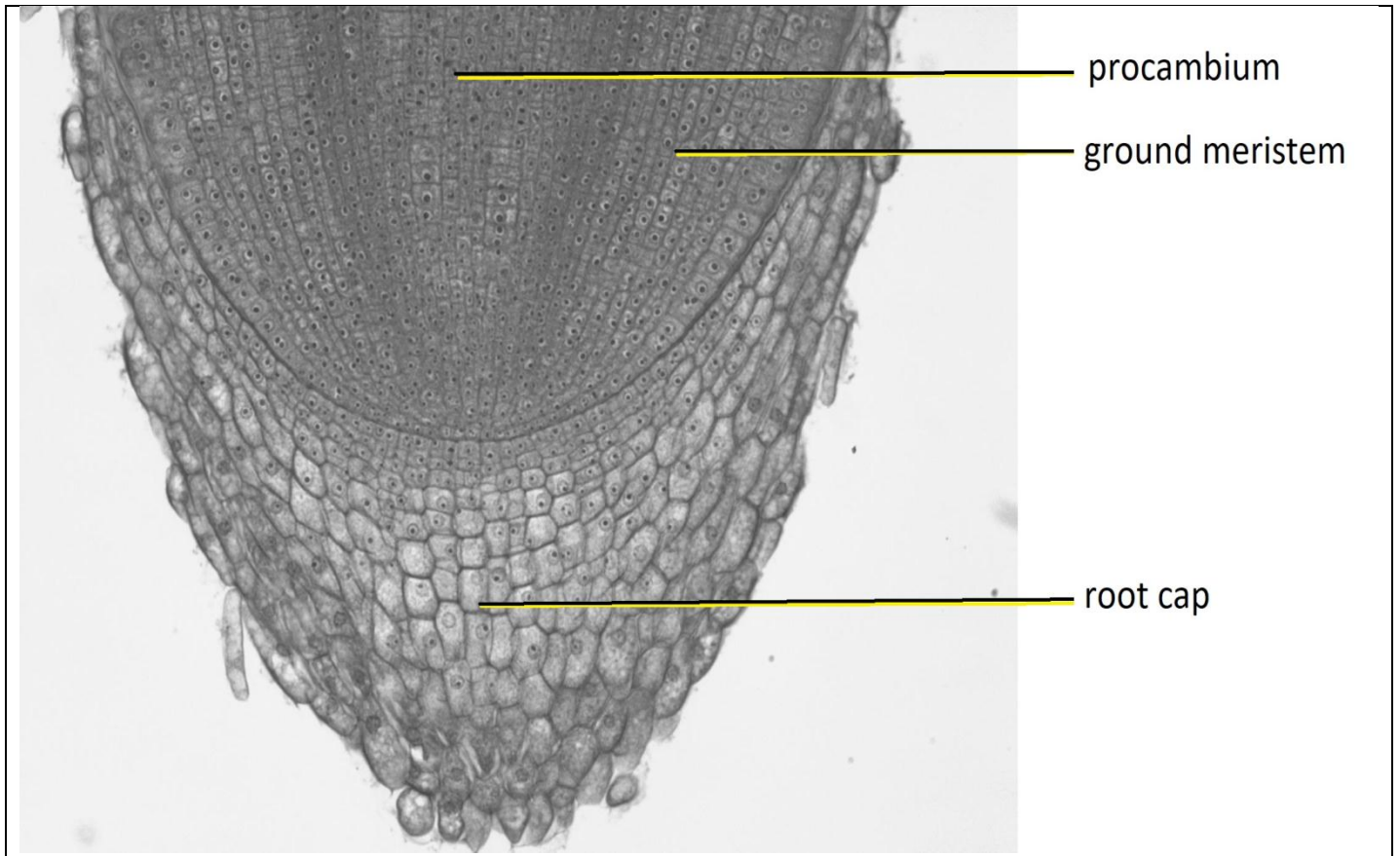
### 2. Secondary meristem.

- **Lateral meristem:** Cells which mainly divide in one **plane** and cause the organ to increase in diameter and girth. Lateral meristem usually occurs beneath the bark of the tree as **cork cambium** and in vascular bundles of **dicotyledons** as **vascular cambium**. The activity of this cambium forms secondary growth.
- **Intercalary meristem:** Located between permanent tissues, it is usually present at the base of the node, internode, and on leaf base. They are responsible for growth in length of the plant and increasing the size of the internode. They result in branch formation and growth.

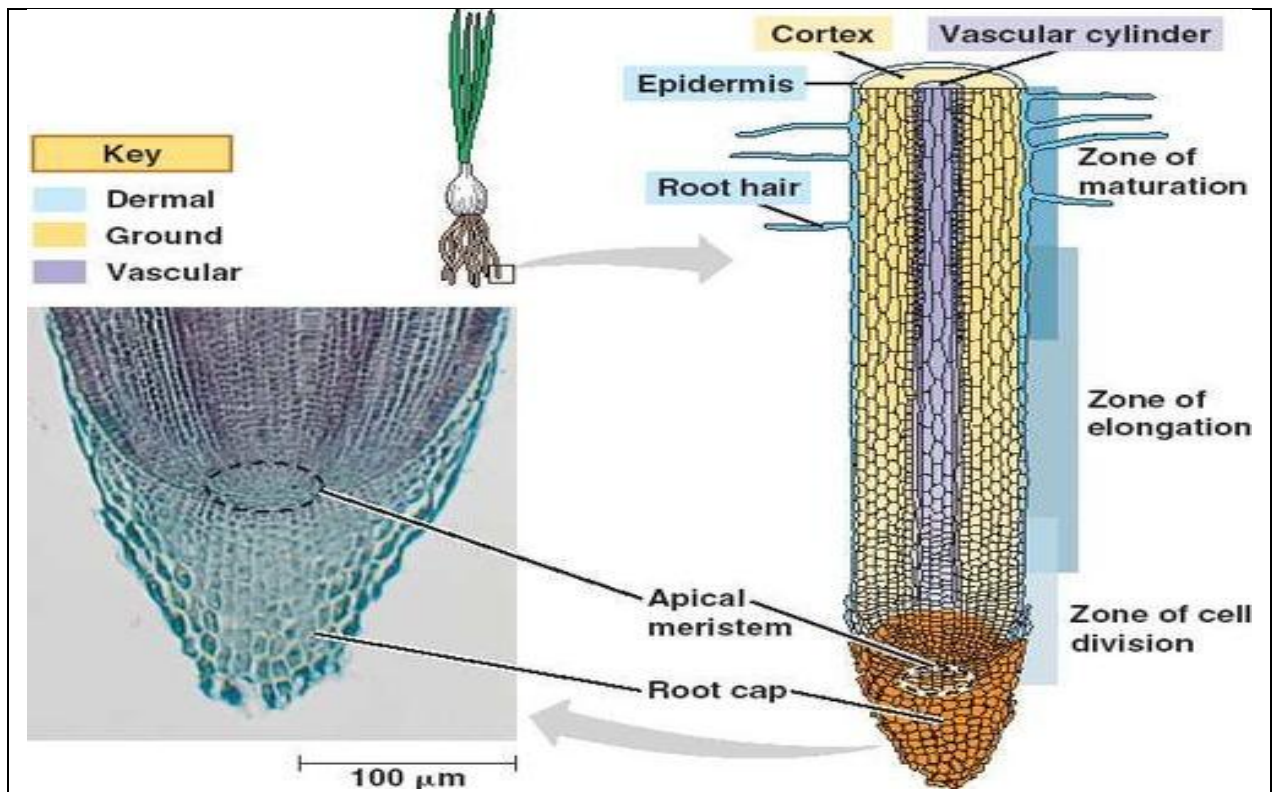


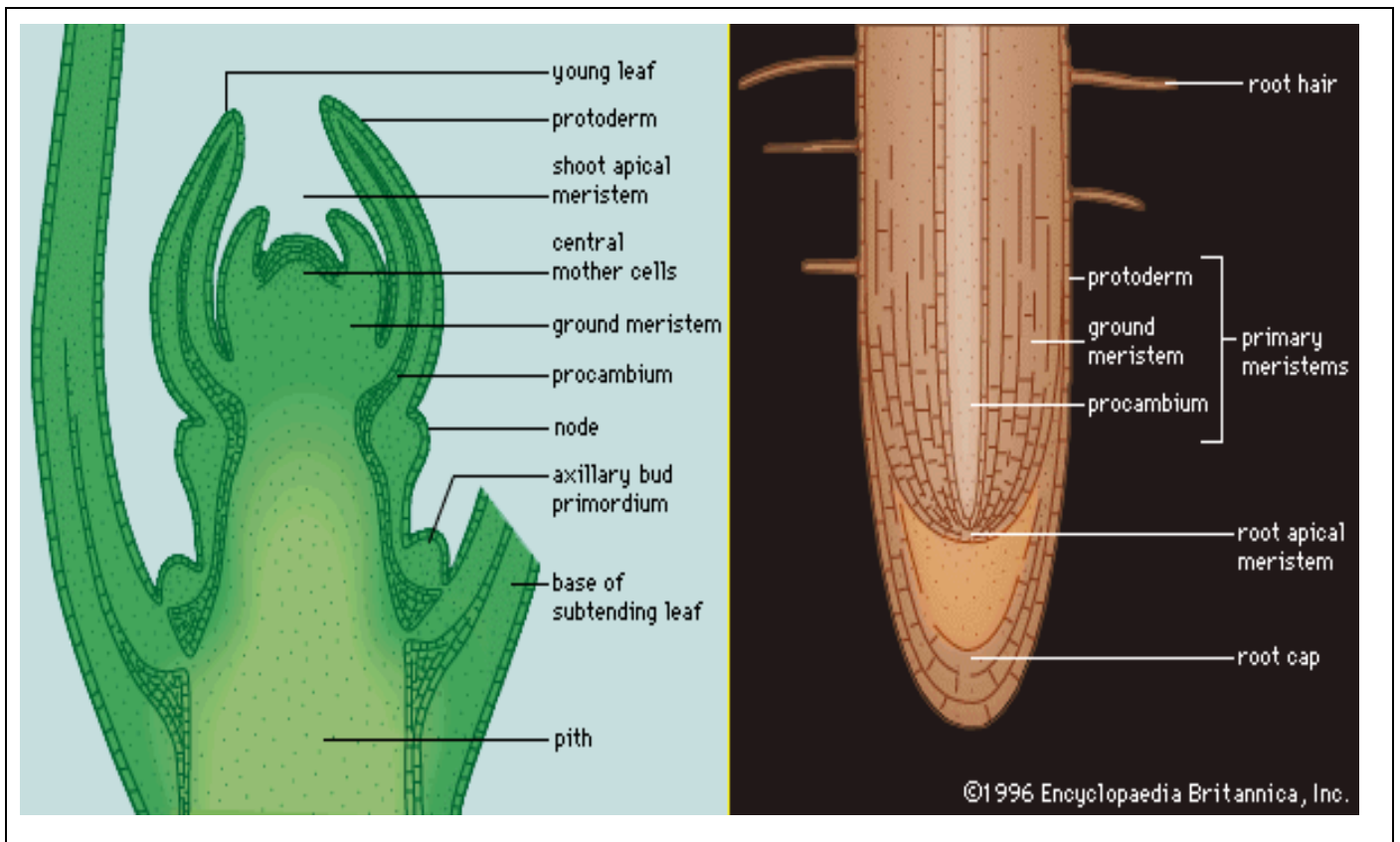
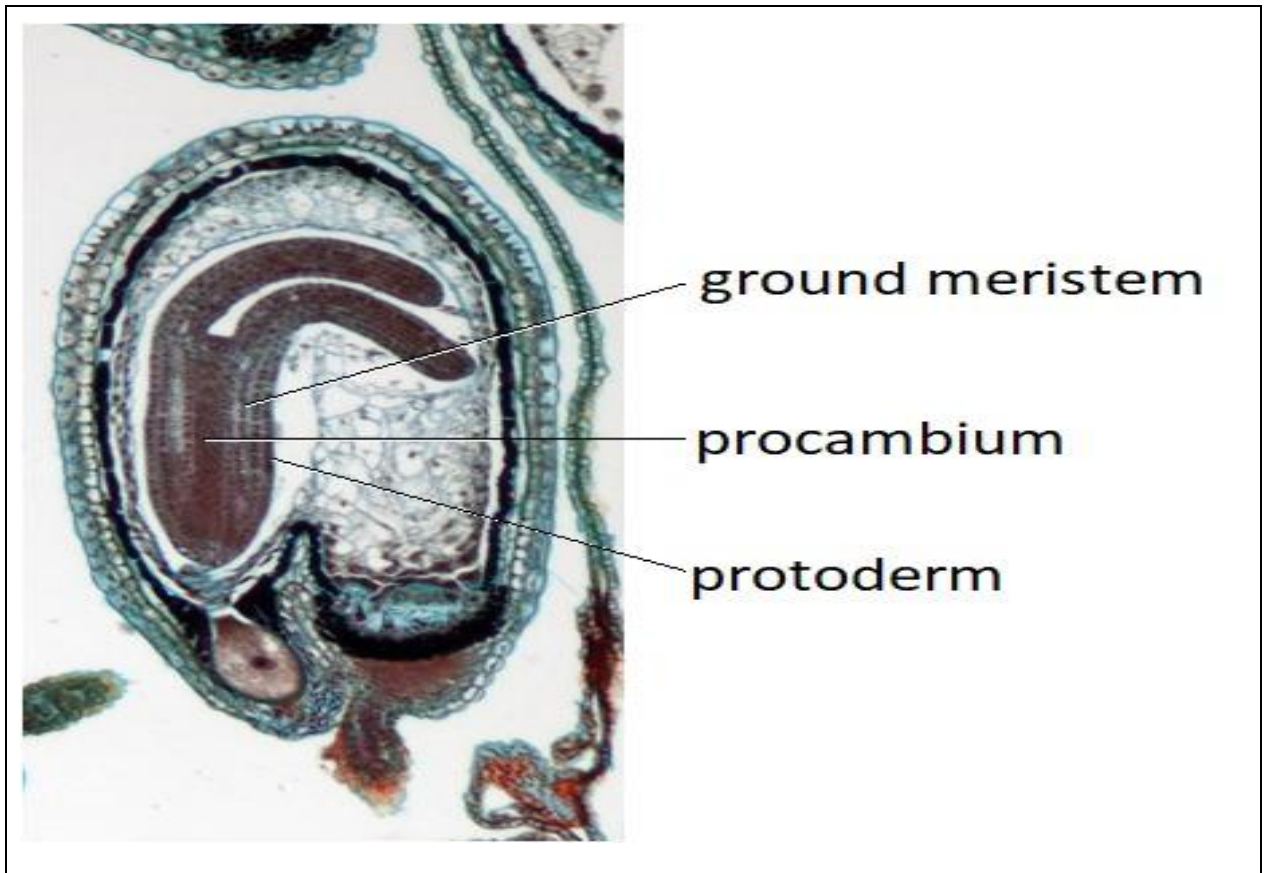
A longitudinal section of the shoot apex of *Coleus* includes the **shoot apical meristem**

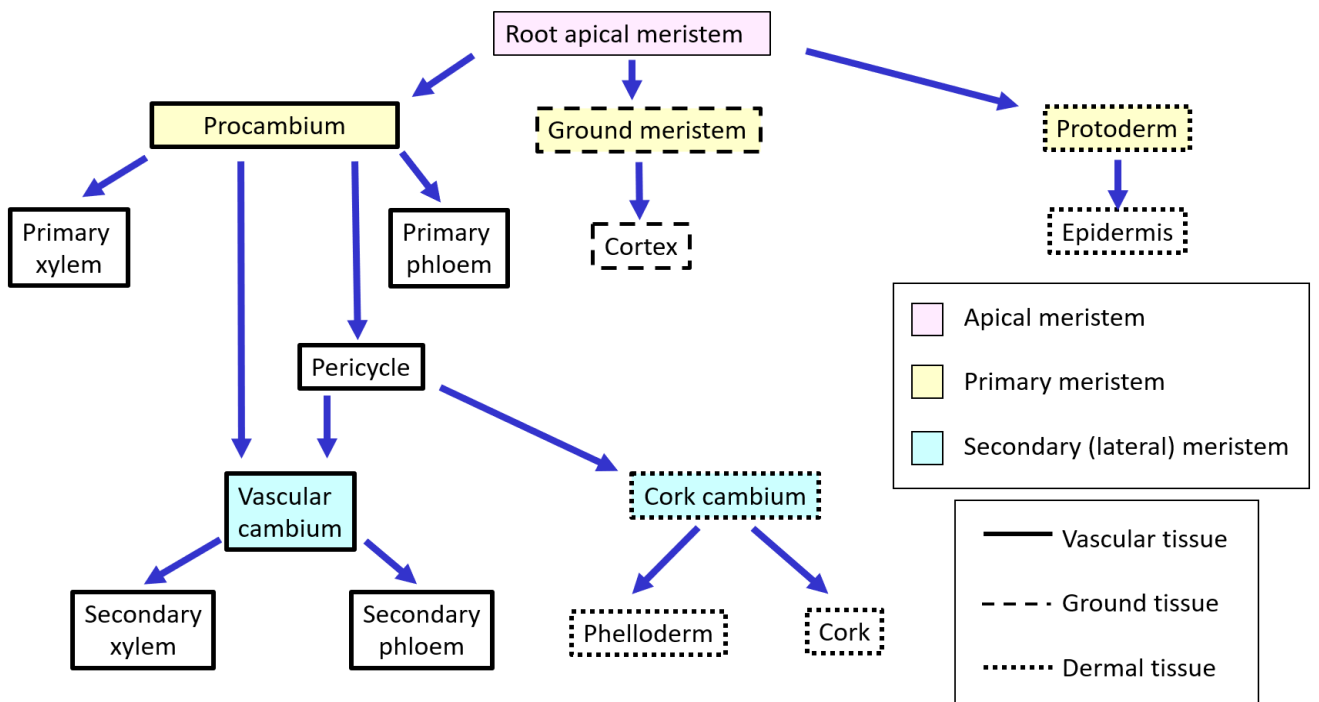
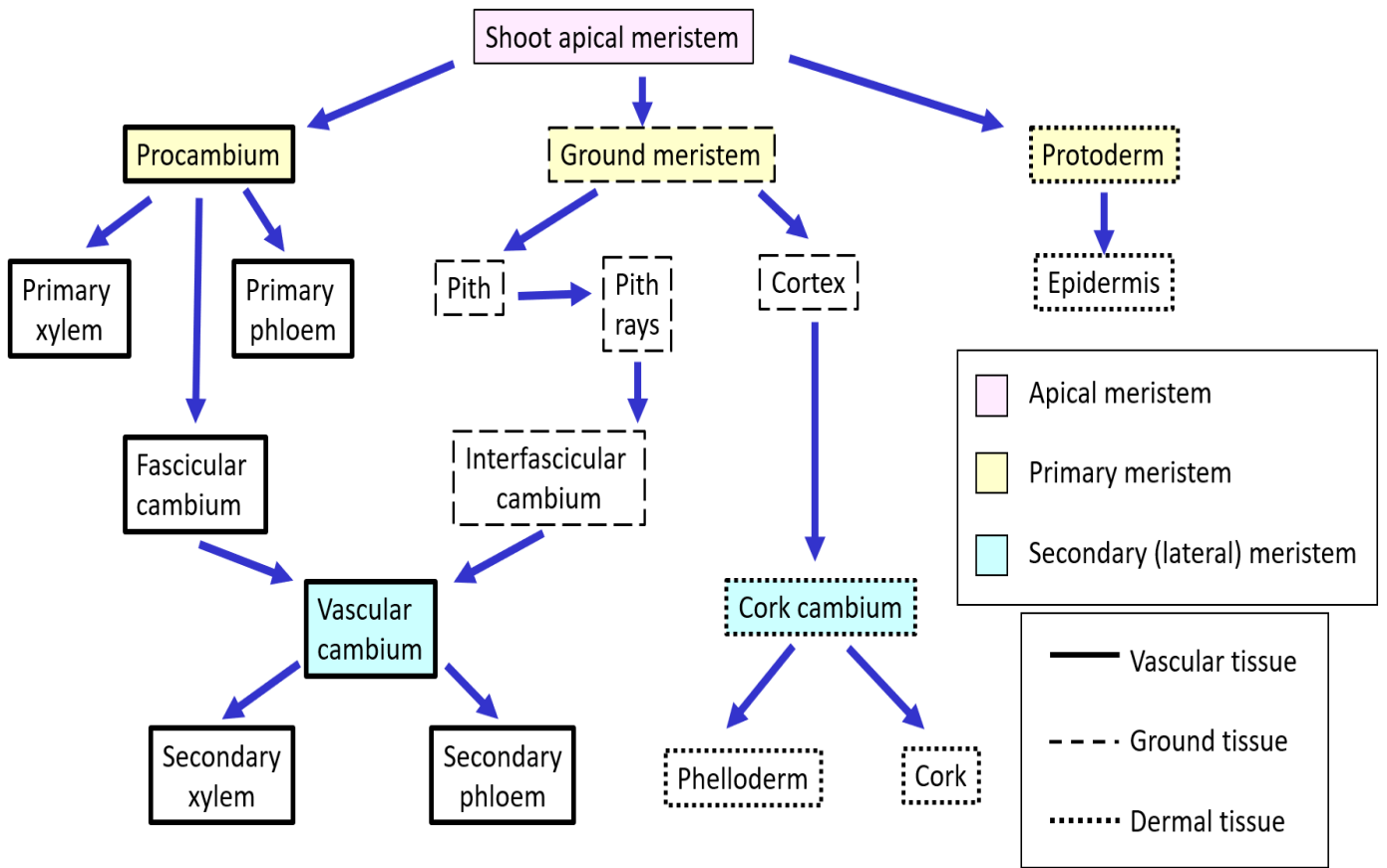




A longitudinal section of the root tip of corn (*Zea mays*)







### Lab (2)

#### \*Permanent tissues

**Permanent tissues** may be defined as a group of living or dead cells formed by meristematic tissue and have lost their ability to divide and have permanently placed at fixed positions in the plant body. Meristematic tissues that take up a specific role lose the ability to divide. This process of taking up a permanent shape, size and a function is called **cellular differentiation**. Cells of meristematic tissue differentiate to form different types of permanent tissues. There are 2 types of permanent tissues:

1. simple permanent tissues
2. complex permanent tissues

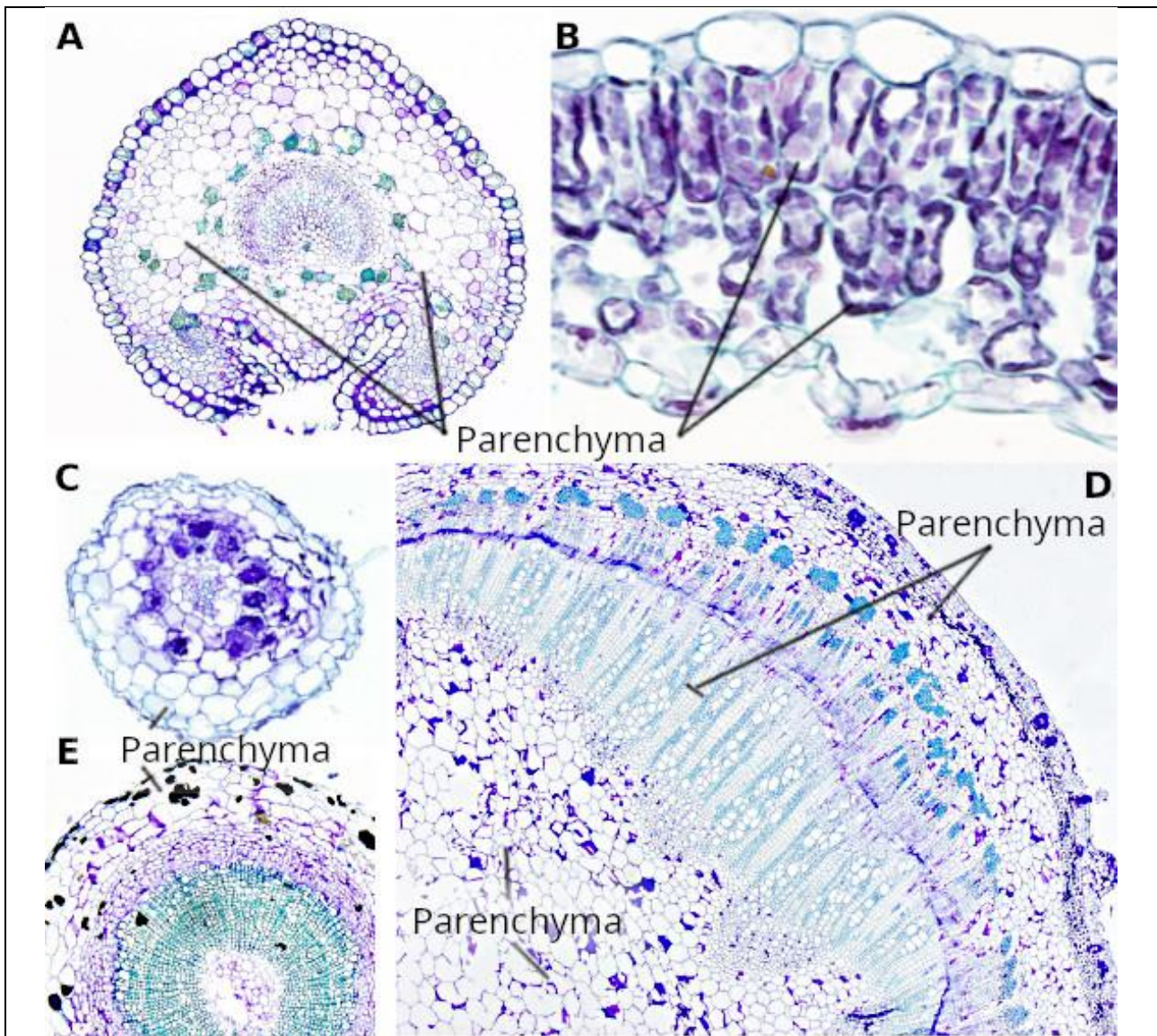
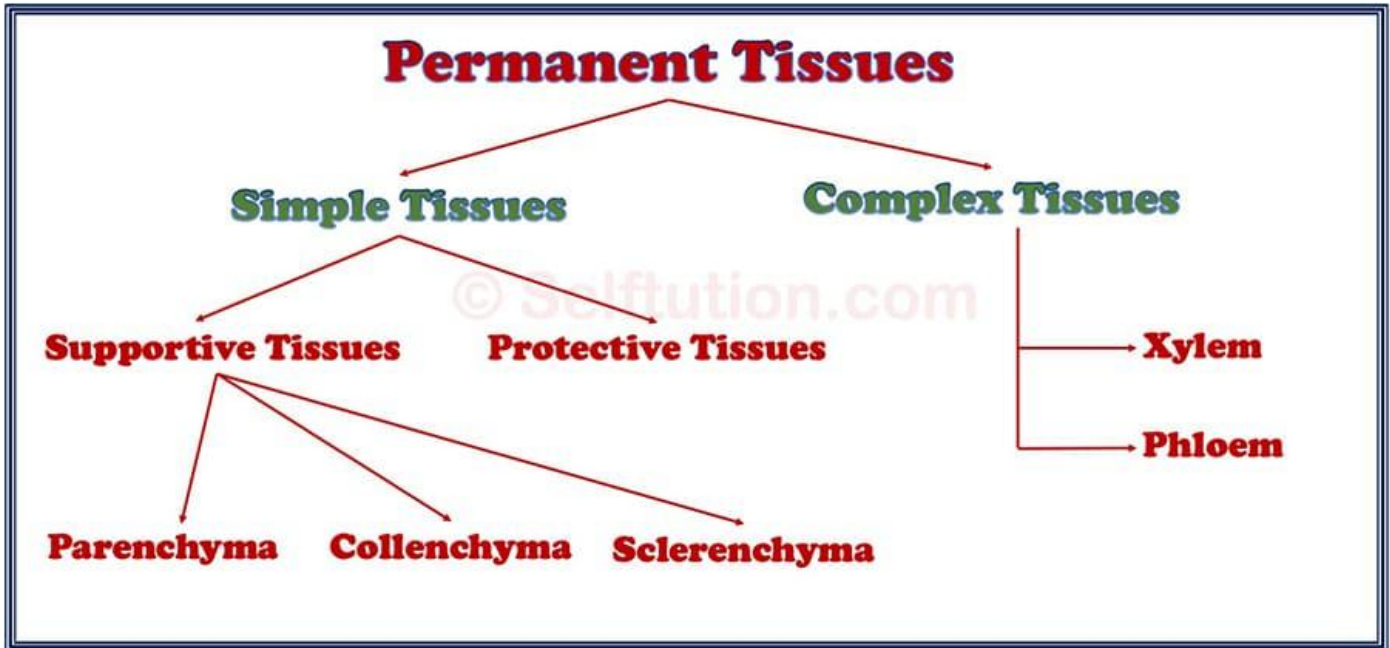
#### \*Simple permanent tissue

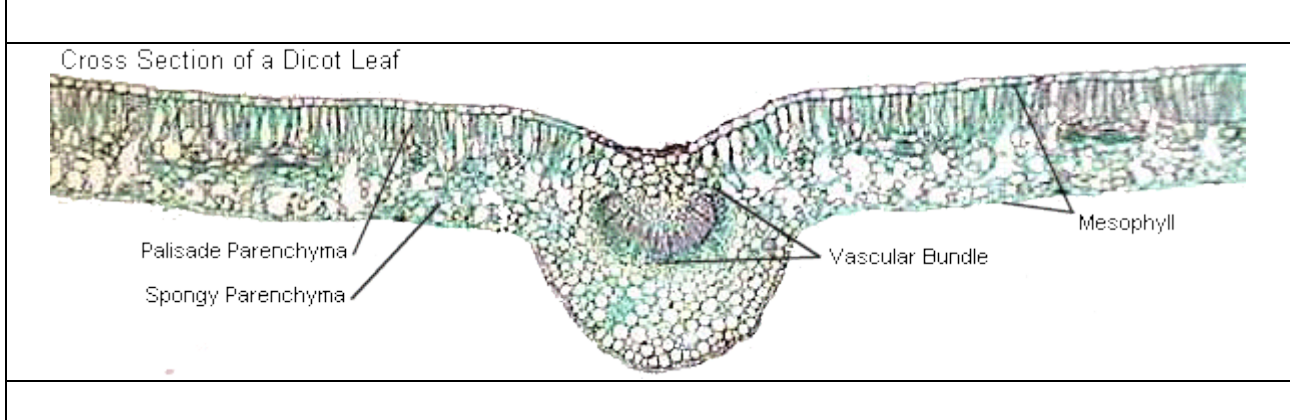
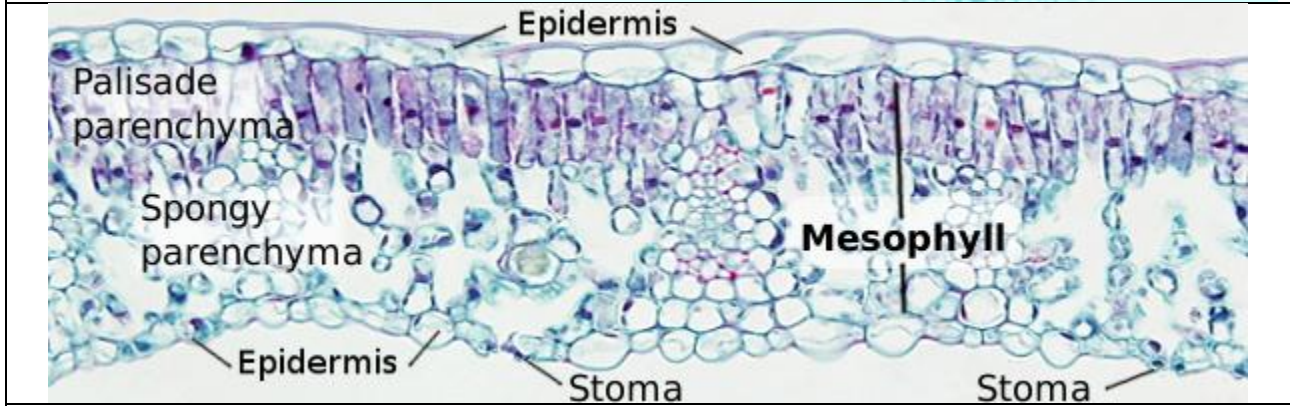
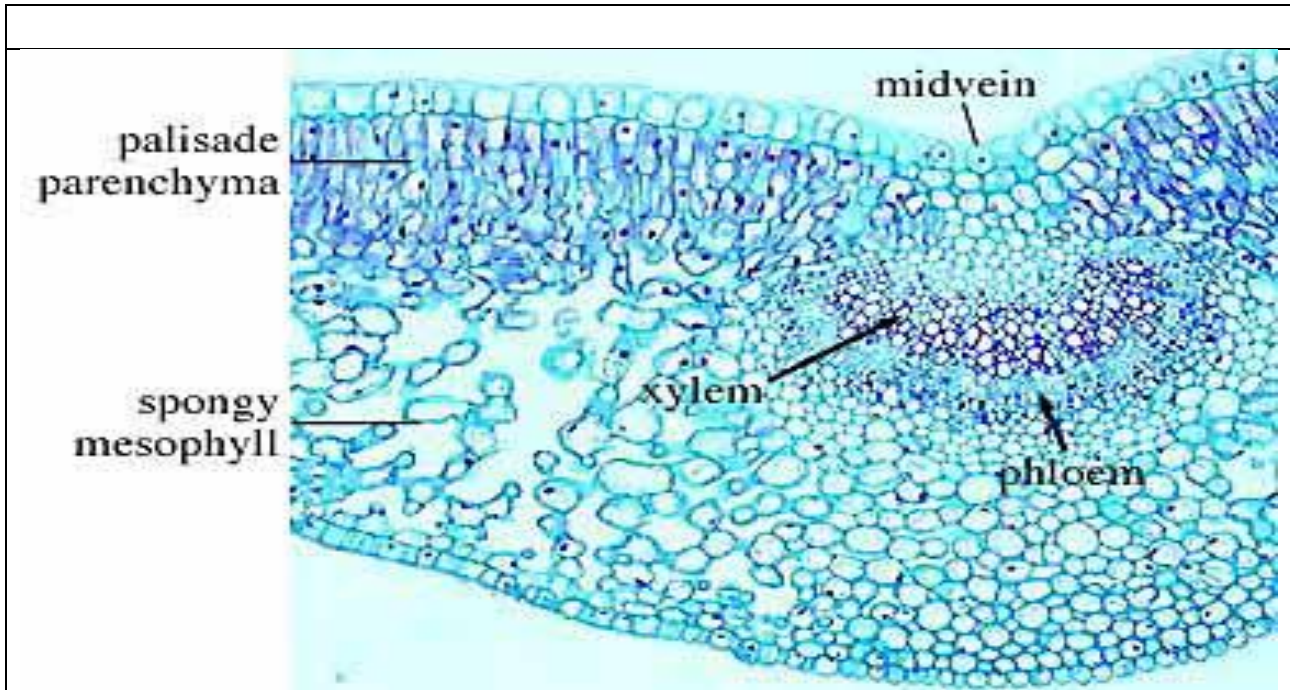
Simple permanent tissue is a group of cells that are similar in origin, structure, and function. They are of three types:

1. **Parenchyma**
2. **Collenchyma**
3. **Sclerenchyma**

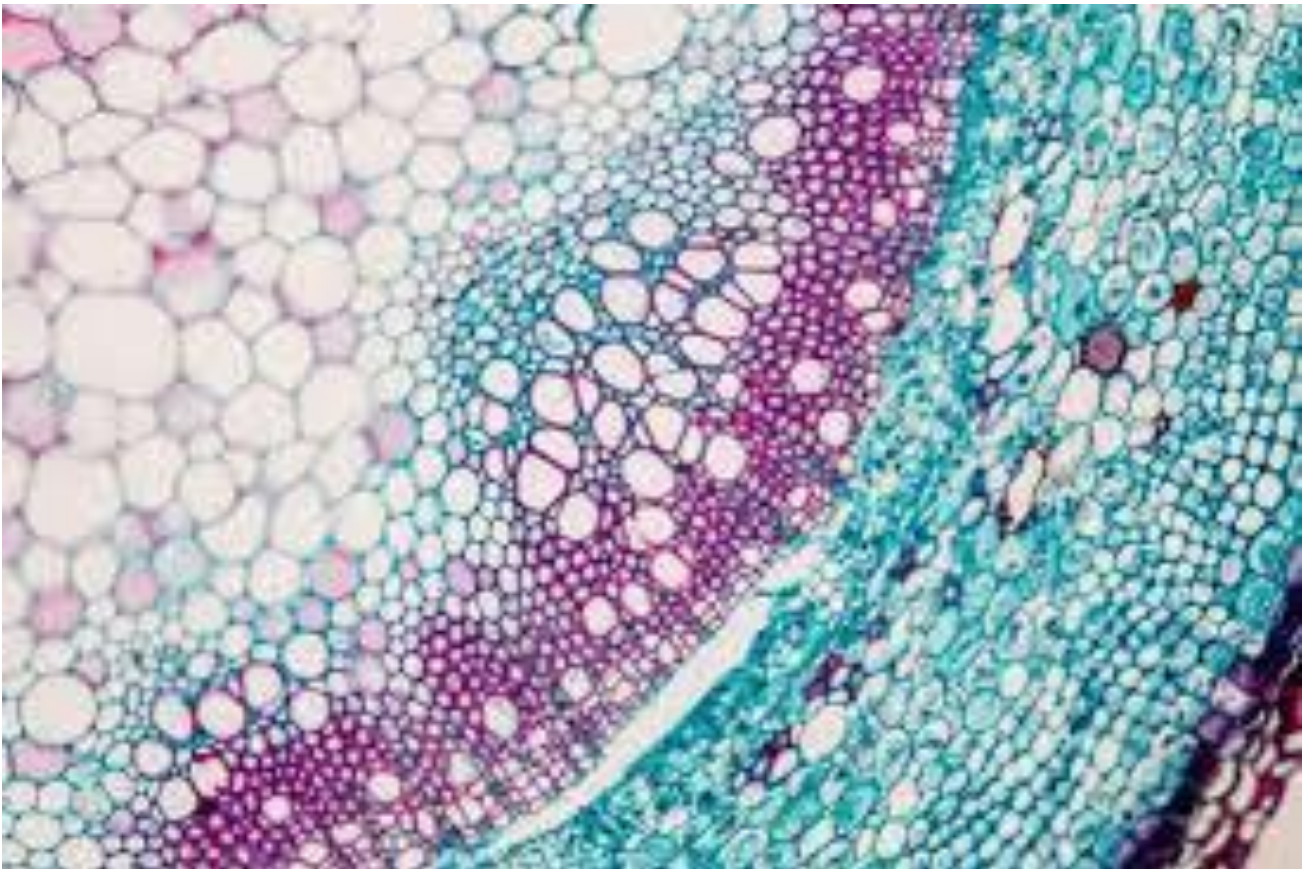
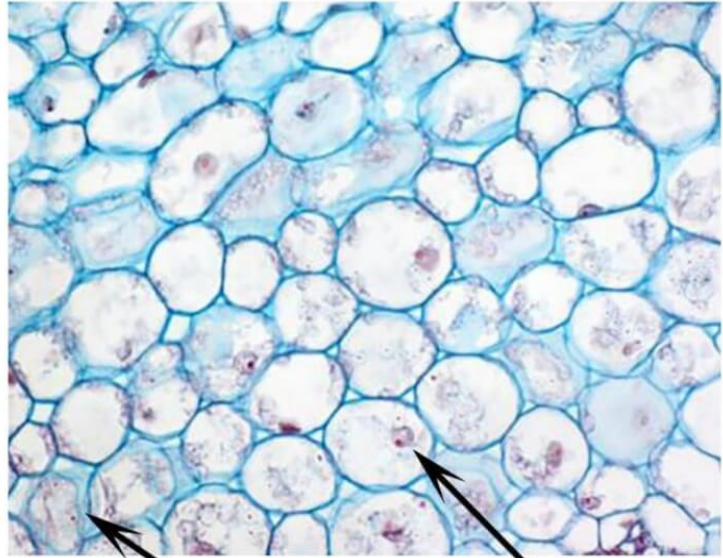
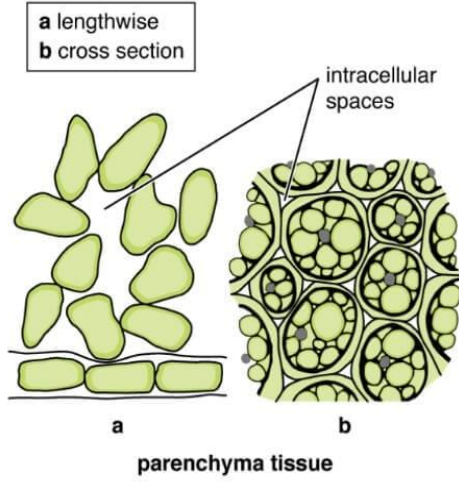
#### 1- Parenchyma

Is the bulk of a substance. In plants, it consists of relatively unspecialized living cells with thin cell walls that are usually loosely packed so that intercellular spaces are found between cells of this tissue. These are generally isodiametric in shape. They contain small number of vacuoles or sometimes they even may not contain any vacuole. Even if they do so the vacuole is of much smaller size than of normal animal cells. This tissue provides support to plants and also stores food. **Chlorenchyma** is a special type of parenchyma that contains **chlorophyll** and performs photosynthesis. In aquatic plants, **aerenchyma** tissues, or large air cavities, give support to float on water by making them buoyant. Parenchyma cells called idioblasts have metabolic waste. Spindle shaped fibers are also present in this cell to support them and known as prosenchyma, succulent parenchyma also noted. In **xerophytes**, parenchyma tissues store water.





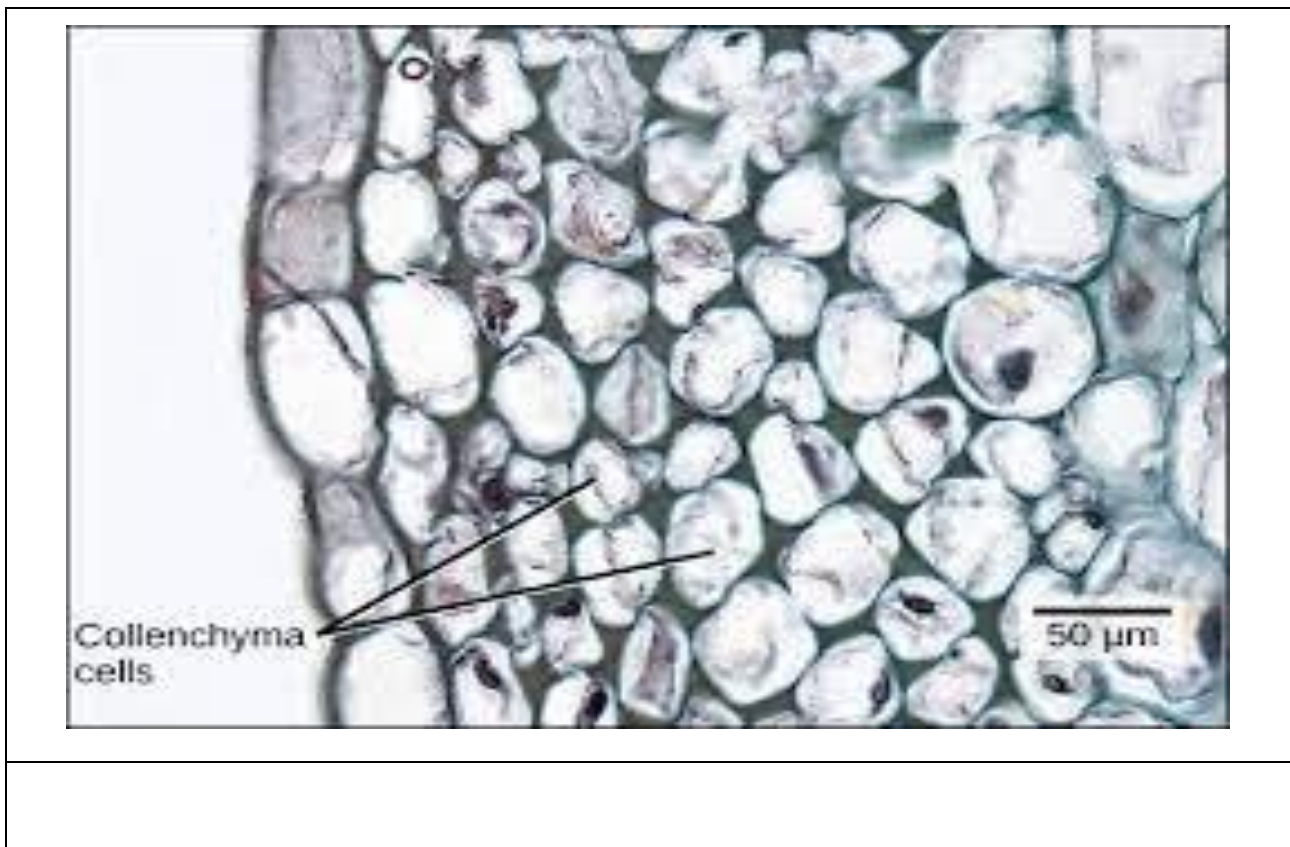
# Parenchyma Cell

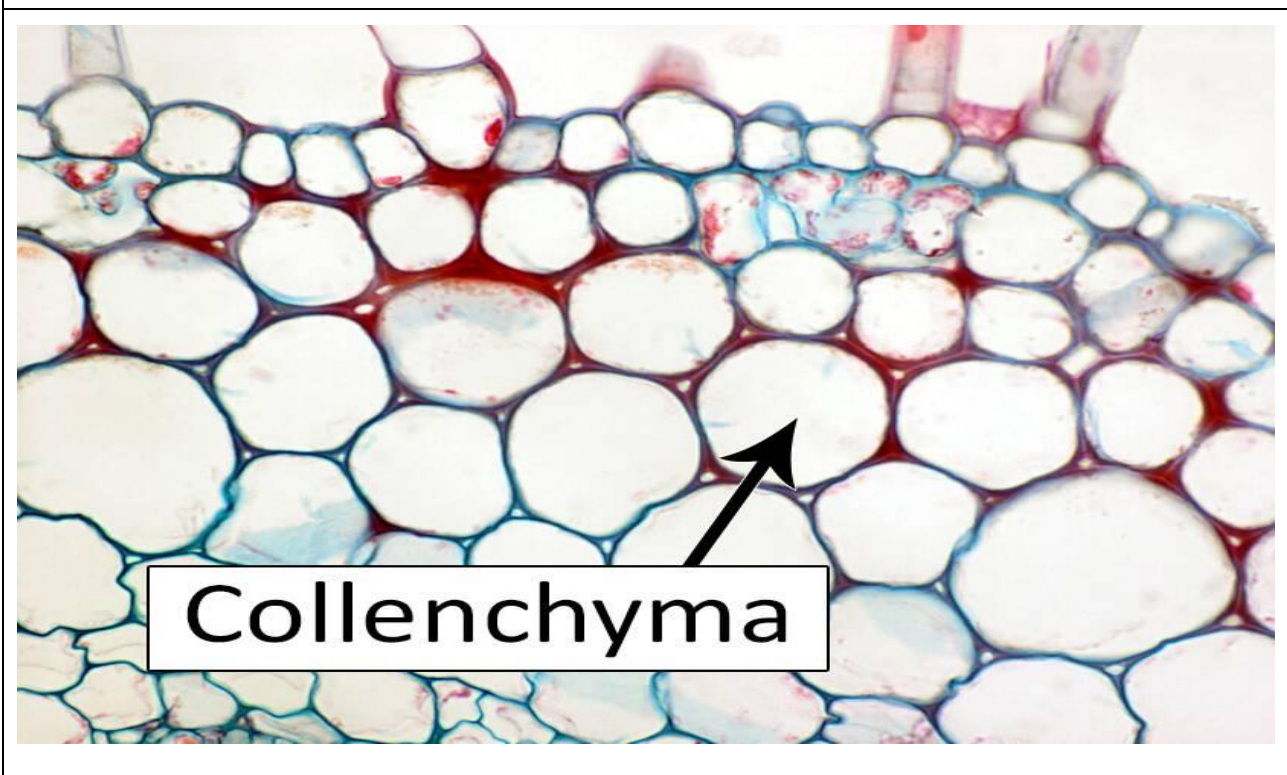
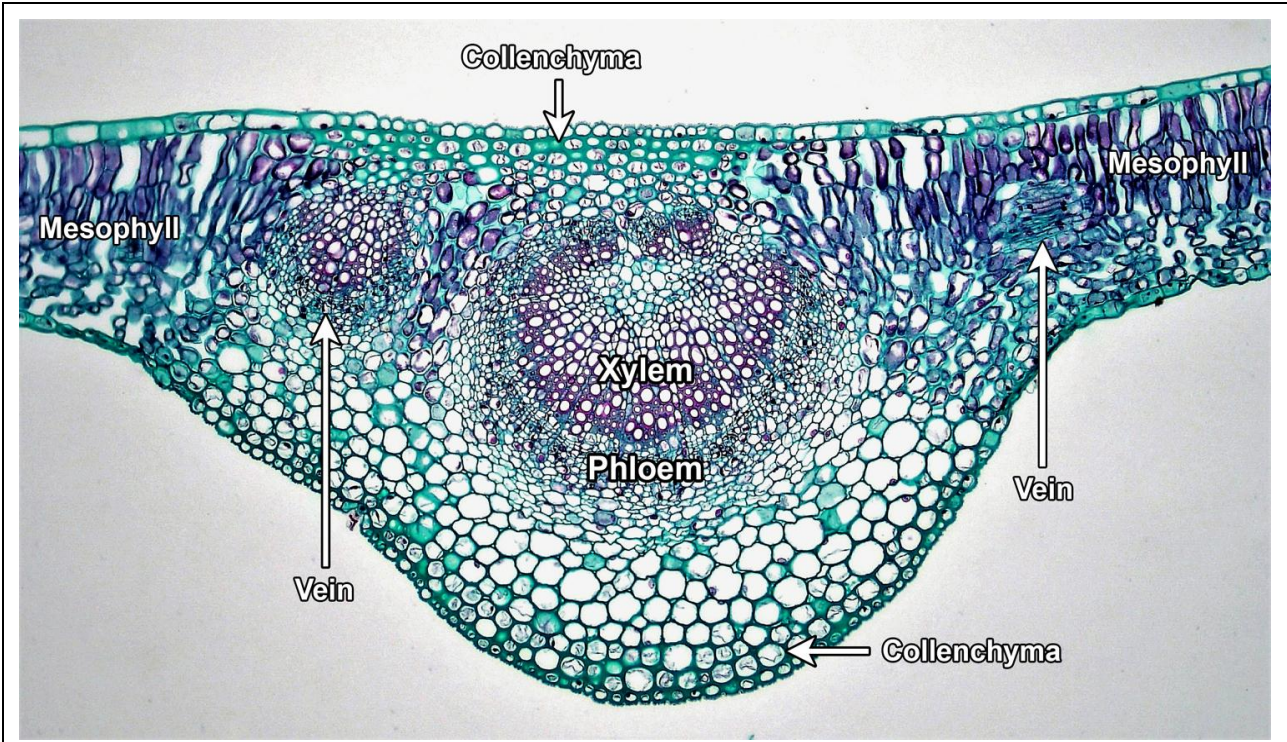


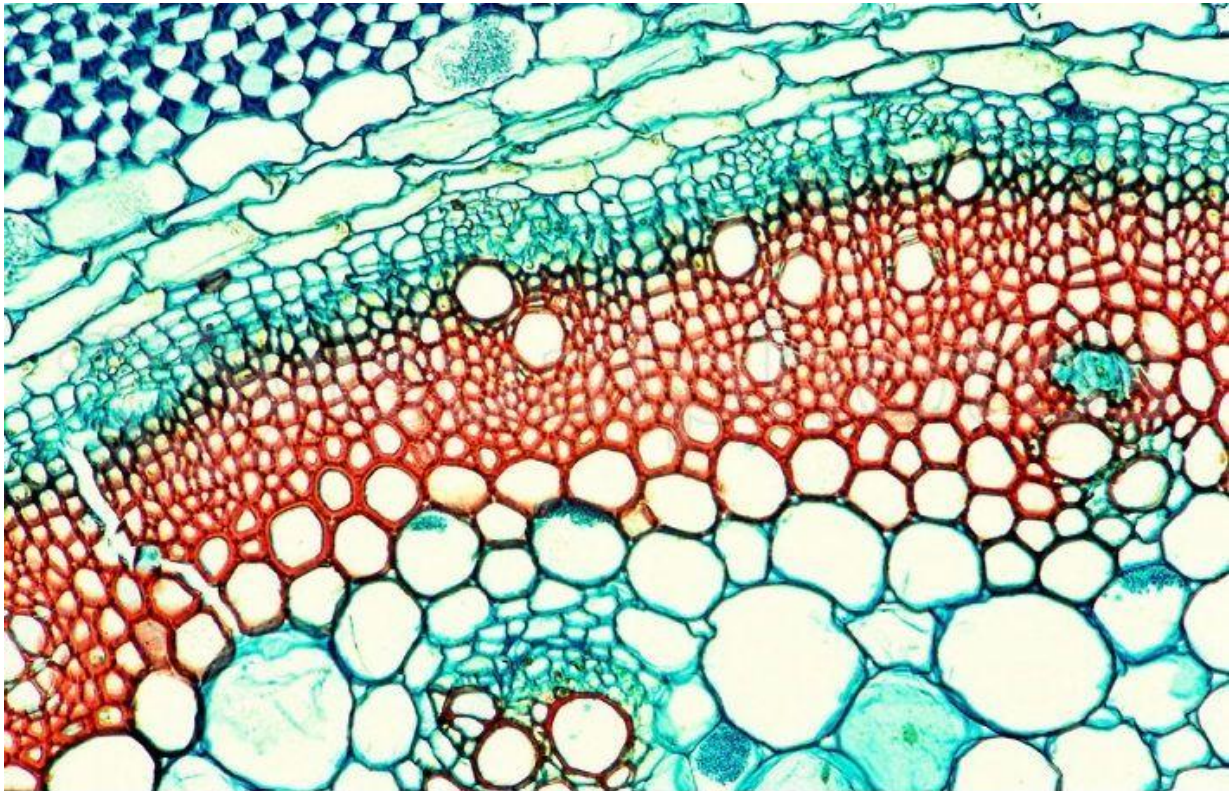
## 2- Collenchyma

**Collenchyma** is a living tissue of primary body like **Parenchyma**. Cells are thin-walled but possess thickening of **cellulose**, water and **pectin** substances (**pectocellulose**) at the corners where a number of cells join. This tissue gives tensile strength to the plant and the cells are compactly arranged and have very little inter-cellular spaces. It occurs chiefly in **hypodermis** of stems and leaves. It is absent in **monocots** and in roots.

Collenchymatous tissue acts as a supporting tissue in stems of young plants. It provides mechanical support, elasticity, and tensile strength to the plant body. It helps in manufacturing sugar and storing it as starch. It is present in the margin of leaves and resists tearing effect of the wind.







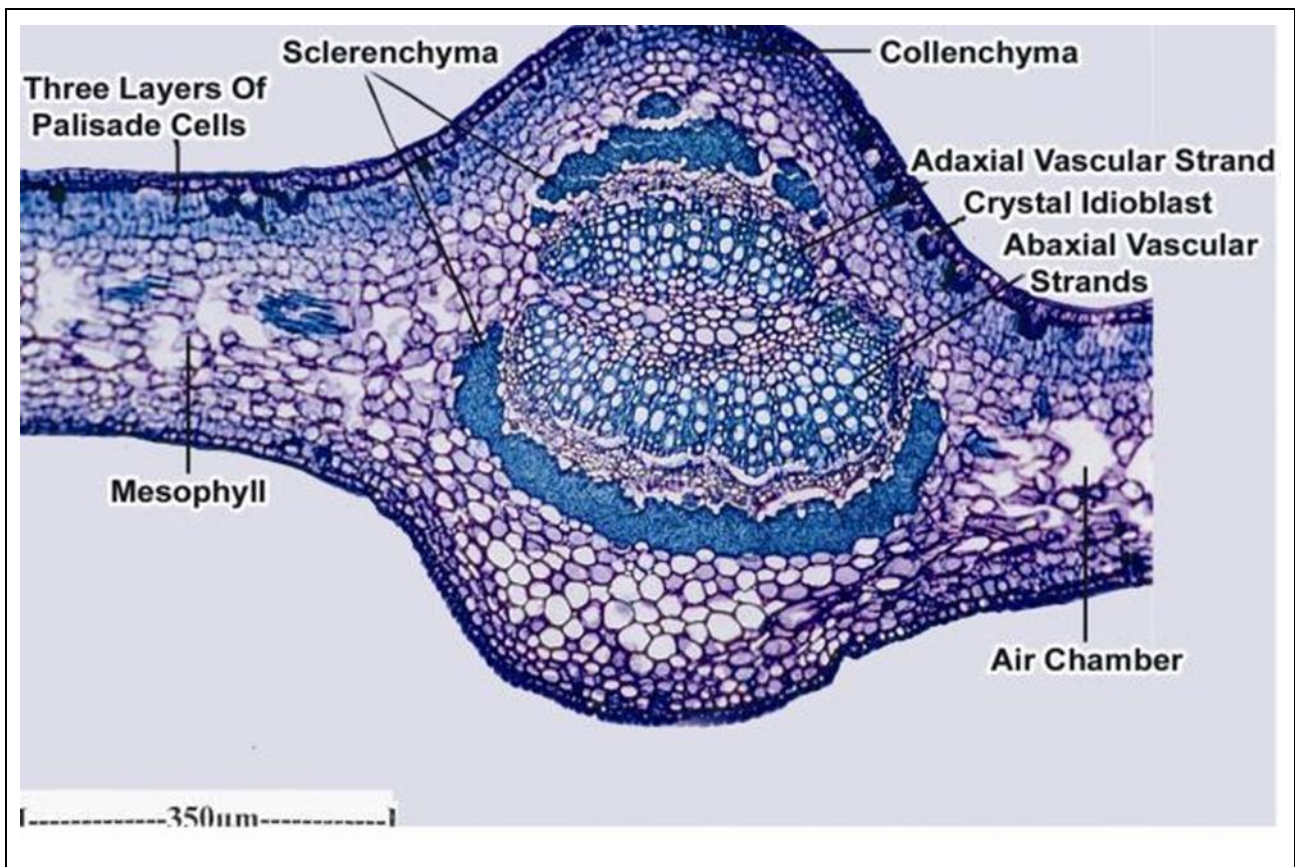
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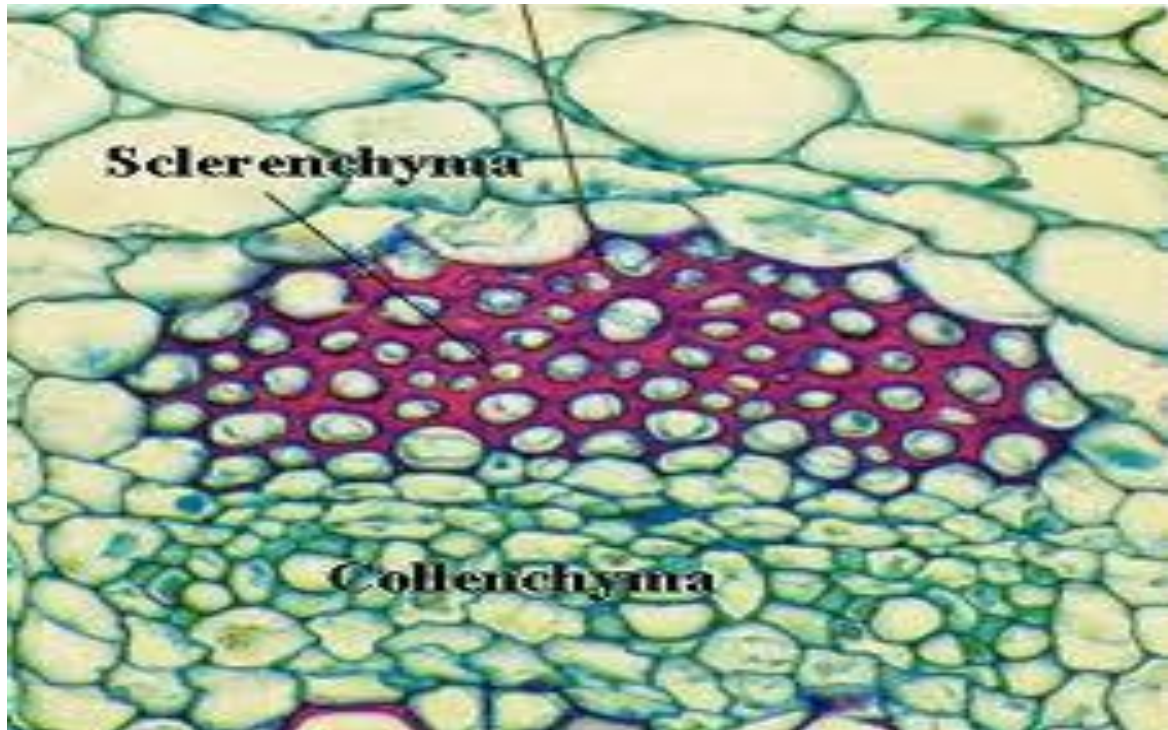
**Lab (3)****3- Sclerenchyma**

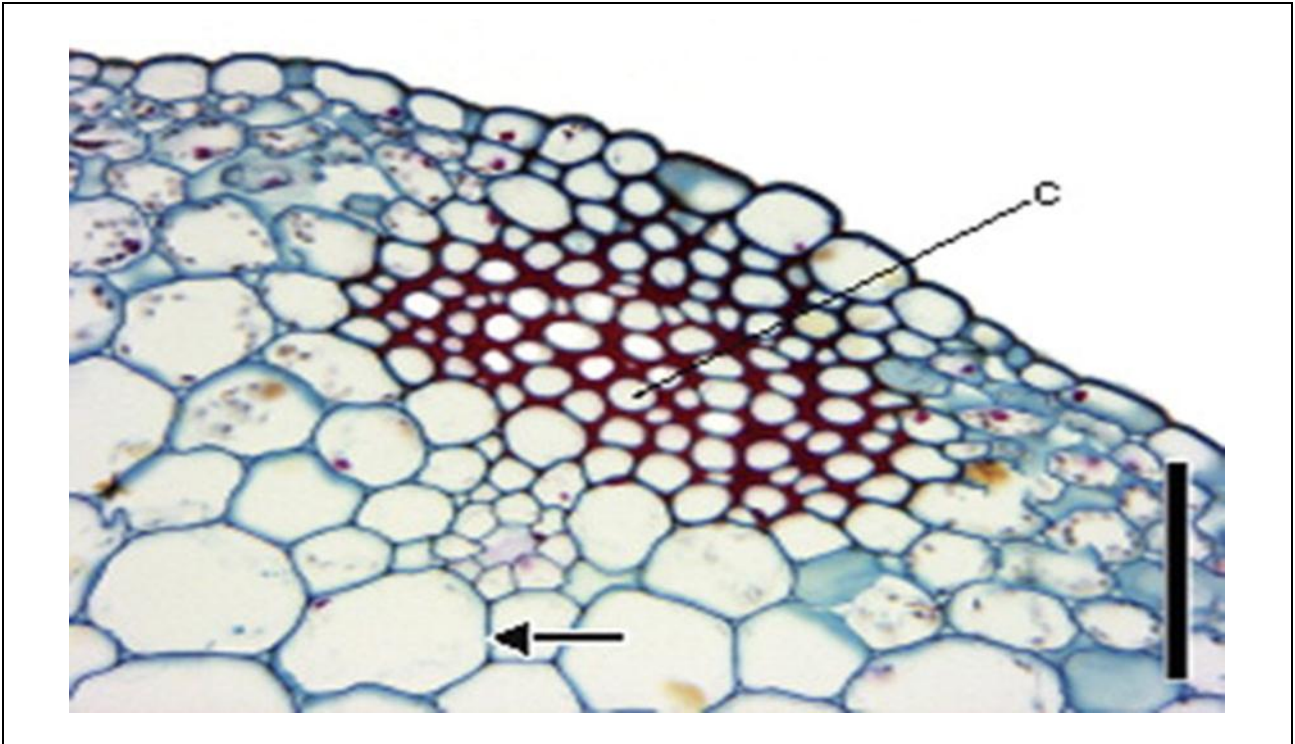
**Sclerenchyma** consists of thick-walled, dead cells and protoplasm is negligible. These cells have hard and extremely thick secondary walls due to uniform distribution and high secretion of **lignin** and have a function of providing mechanical support. They do not have inter-cellular spaces between them. Lignin deposition is so thick that the cell walls become stronger, rigid and impermeable to water, which are also known as a stone cells or sclereids.

These tissues are mainly of three types **sclerenchyma fiber**, **fiber** and **sclereid**.

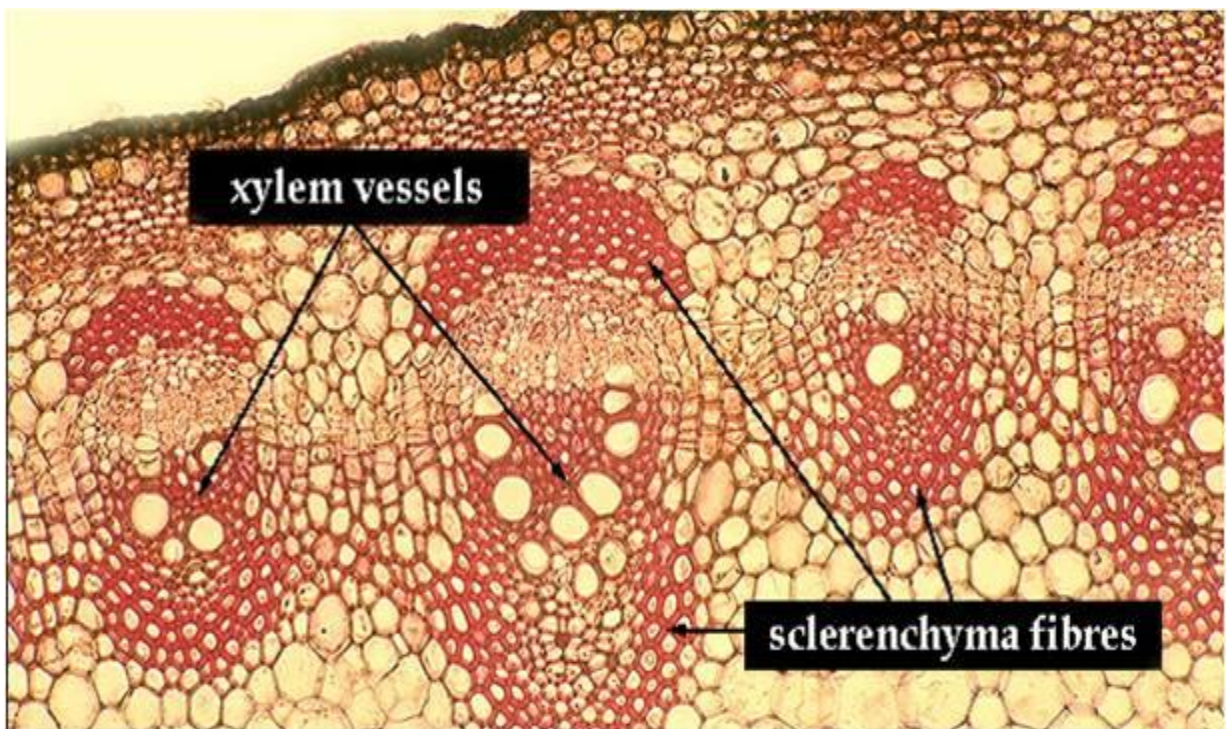
- **Sclerenchyma fiber** cells have a narrow lumen and are long, narrow and unicellular.
- **Fibers** are elongated cells that are strong and flexible, often used in ropes.
- **Sclereids** have extremely thick cell walls and are brittle, and are found in nutshells and legumes.





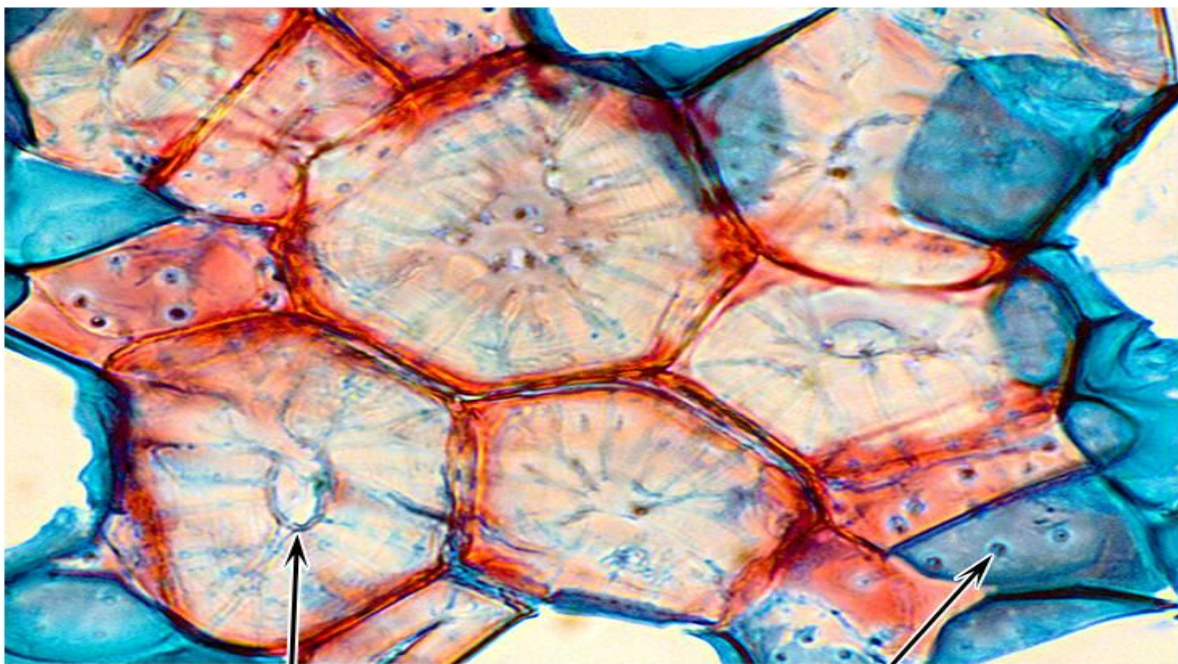
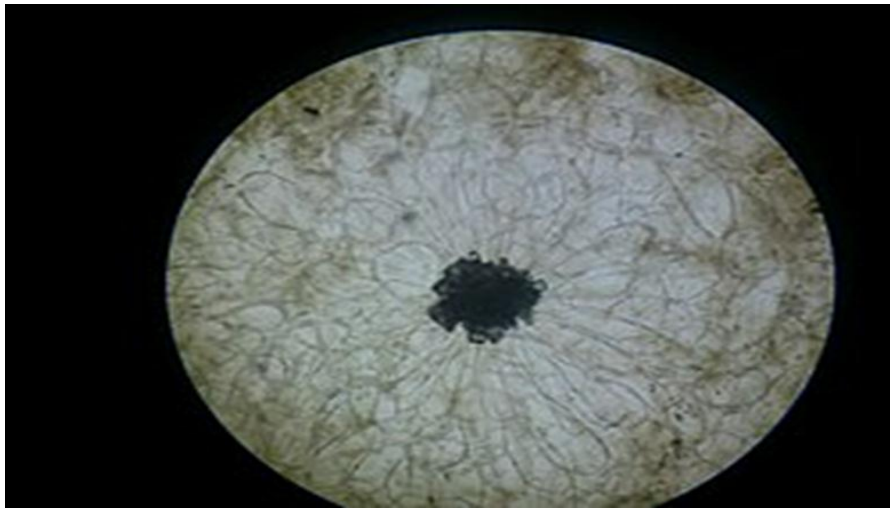


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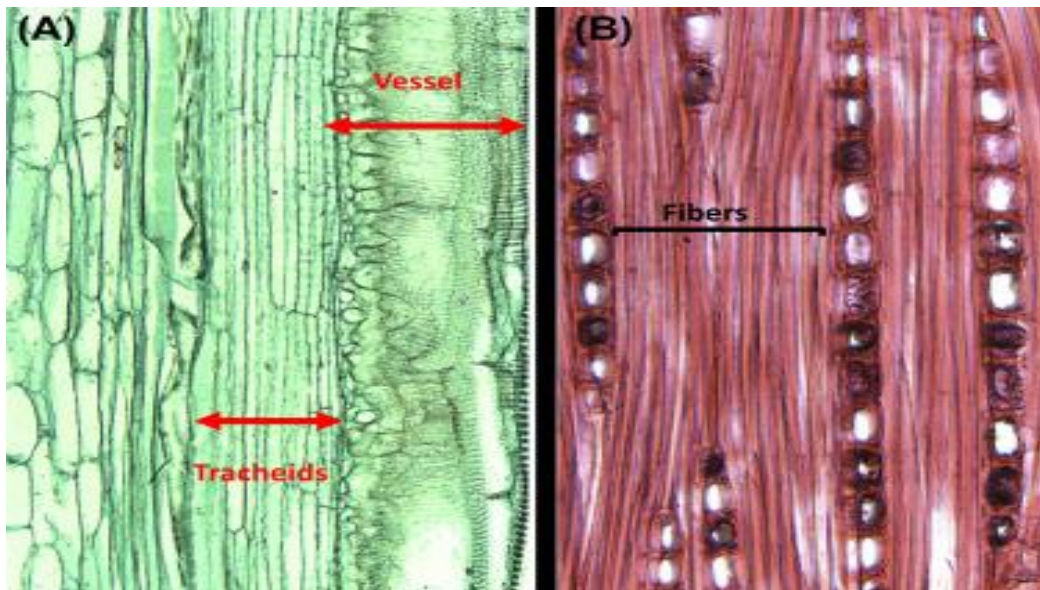
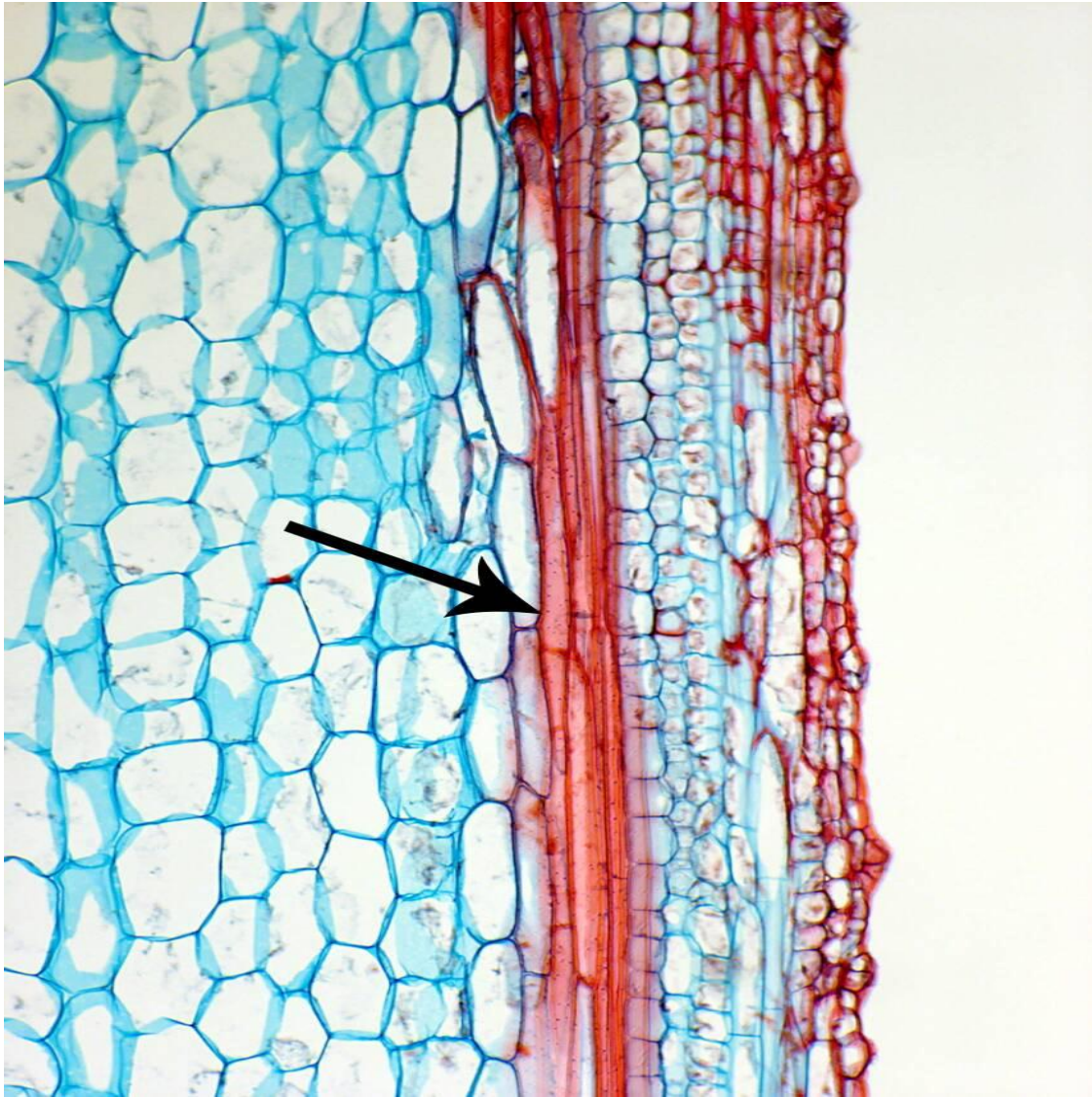
**Sclereids** are a reduced form of **sclerenchyma** cells with highly thickened, lignified **cellular walls** that form small bundles of durable layers of tissue in most **plants**. The presence of numerous sclereids form the cores of **apples** and produce the gritty texture of **guavas**.

Although sclereids are variable in shape, the cells are generally isodiametric, prosenchymatic, forked, or elaborately branched. They can be grouped into bundles, can form complete tubes located at the periphery, or can occur as single cells or small groups of cells within **parenchyma** tissues. An isolated sclereid cell is known as an **idioblast**. Sclereids are typically found in the **epidermis**, **ground tissue**, and **vascular tissue**.



Lumen

Pits



Fibers are elongated cells that are strong and flexible, often used in ropes

**Lab (4) + (5)****\*Complex permanent tissue**

The complex permanent tissue consists of more than one type of cells having a common origin which work together as a unit. Complex tissues are mainly concerned with the transportation of mineral nutrients, organic solutes (food materials), and water. That's why it is also known as conducting and vascular tissue. The common types of complex permanent tissue are:

- **Xylem** (or Wood)
- **Phloem** (or Bark).

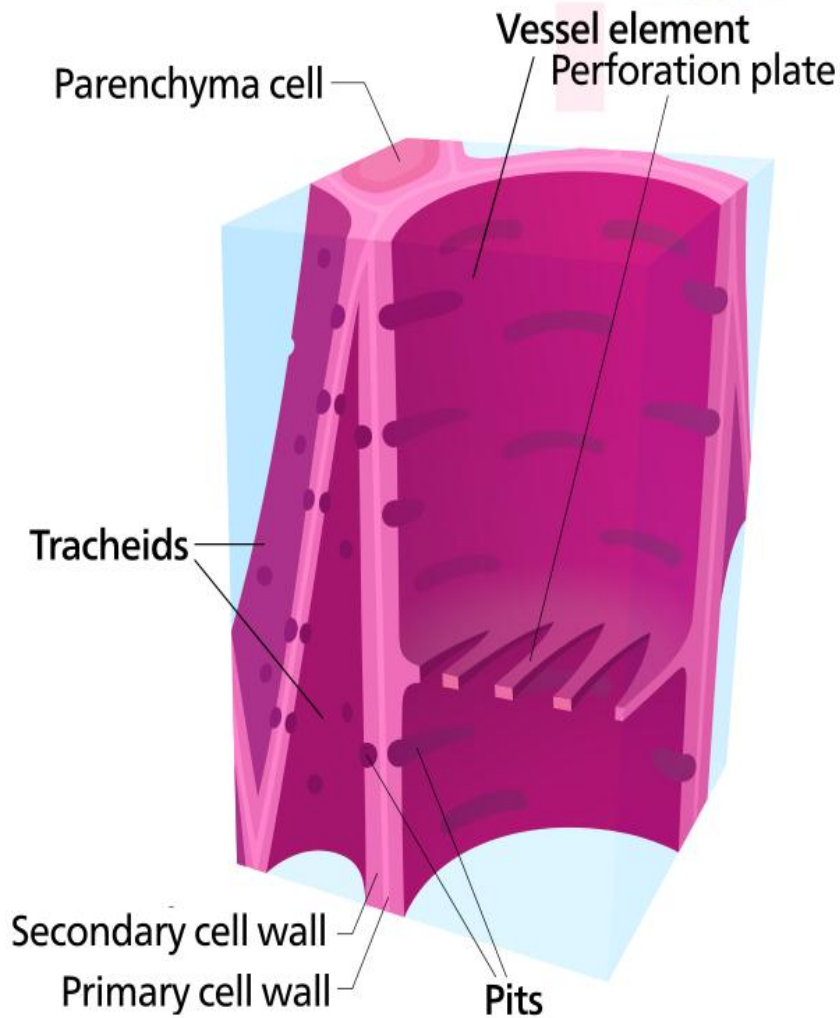
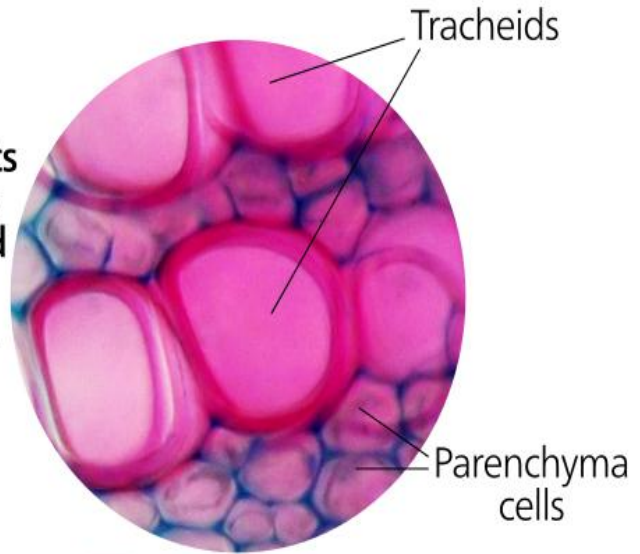
Xylem and phloem together form vascular bundles.

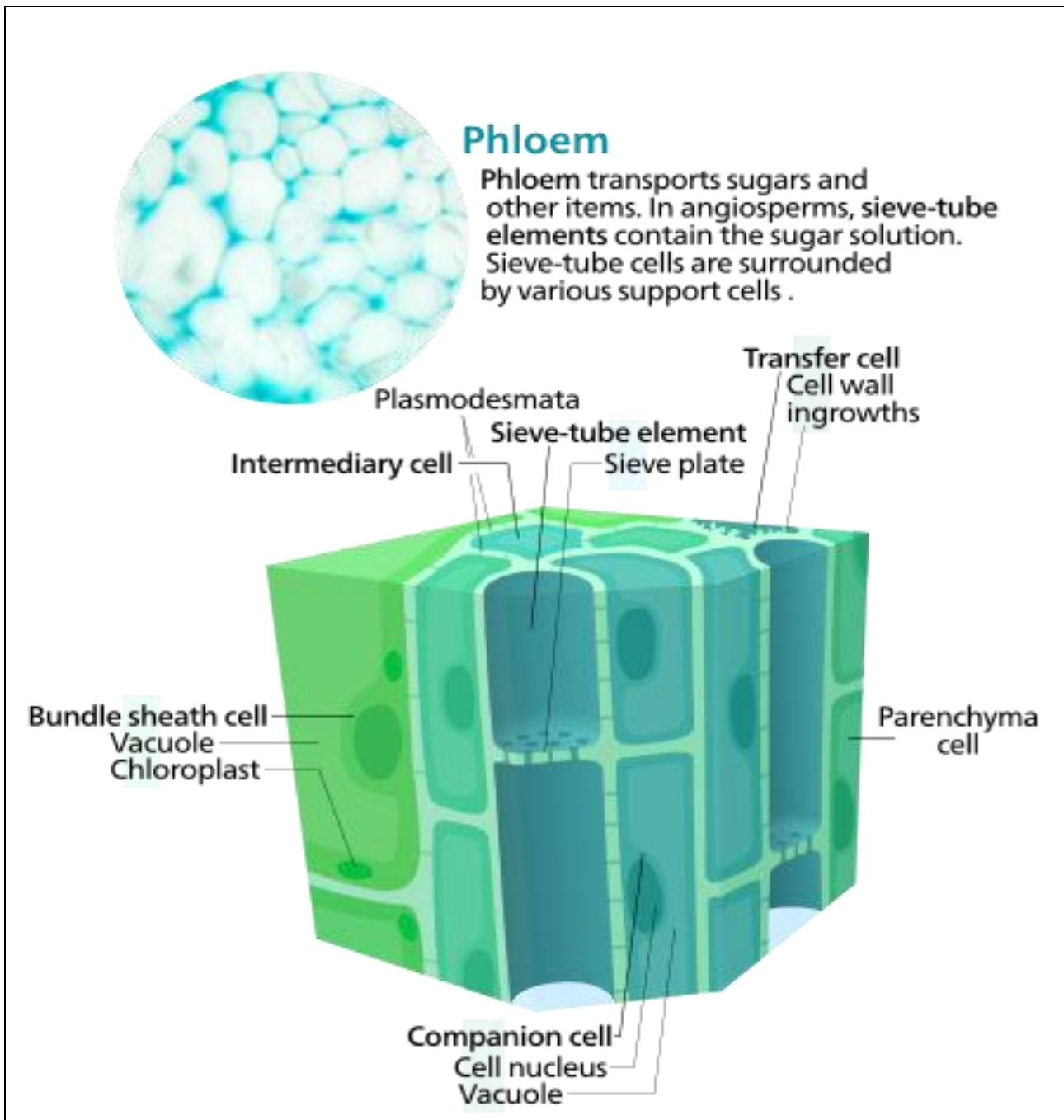
**Xylem** (wood) serves as a chief conducting tissue of vascular plants. It is responsible for the conduction of water and inorganic solutes. Xylem consists of four kinds of cells:

- **Vessels** (or tracheae)
- **Xylem fibers or Xylem sclerenchyma**
- **Xylem parenchyma**
- Xylem tissue is organized in a tube-like fashion along the main axes of stems and roots. It consists of a combination of parenchyma cells, fibers, vessels, tracheid's, and ray cells. Longer tubes made up of individual cells are vessels, while **vessel members** are open at each end. Internally, there may be bars of wall material extending across the open space. These cells are joined end to end to form long tubes. Vessel members and tracheid's are dead at maturity. Tracheid's have thick secondary cell walls and are tapered at the ends. They do not have end openings such as the vessels. The end overlaps with each other, with pairs of pits present. The pit pairs allow water to pass from cell to cell.
- Though most conduction in xylem tissue is vertical, lateral conduction along the diameter of a stem is facilitated via rays. Rays are horizontal rows of long-living parenchyma cells that arise out of the vascular cambium.

## Xylem

Xylem transports water and minerals through vessel elements and tracheids, which are dead at maturity and have a primary and secondary cell wall. In pits, the secondary wall is thin or missing, allowing water to flow laterally.





### Dermal Tissue

Dermal tissue covers the plant and can be found on the outer layer of roots, stems and leaves. Its main functions are *transpiration, gas exchange and defense*. The epidermis is an example of dermal tissue. It is composed of a single layer of epidermis cells. It may contains stomata and guard cells that allow gas exchange. It may contain root hairs that increase surface area or or trichomes used in transpiration or defense. It may contain a waxy cuticle if found on the upper surface of leaves, to aid with lowering transpiration.

### Vascular Tissue

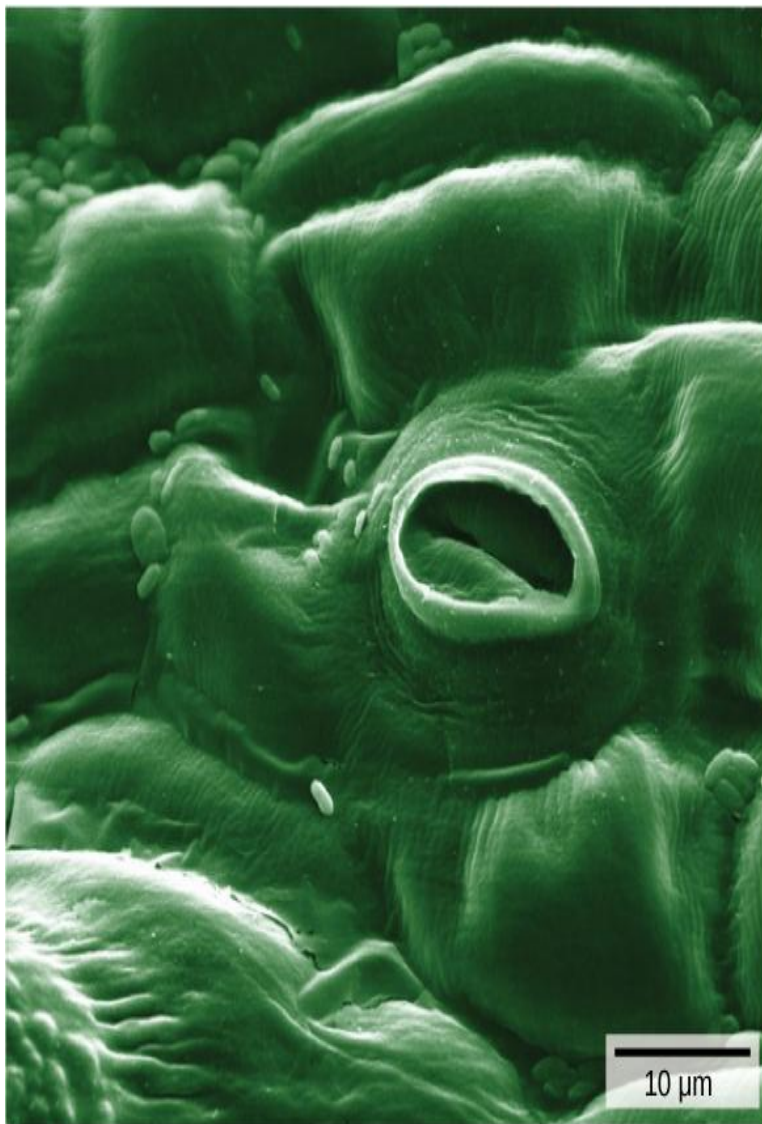
Vascular tissue is the plumbing system of the plant. It allows water, minerals, and dissolved sugars from photosynthesis to pass through roots, stems, leaves, and other parts of the plant. It is primary composed of two types of conducting tissue( **xylem and phloem**).

The **veins** on leaves are an example of vascular tissue, moving material through the plant in the same manner that our blood vessels carry nutrients through our body.

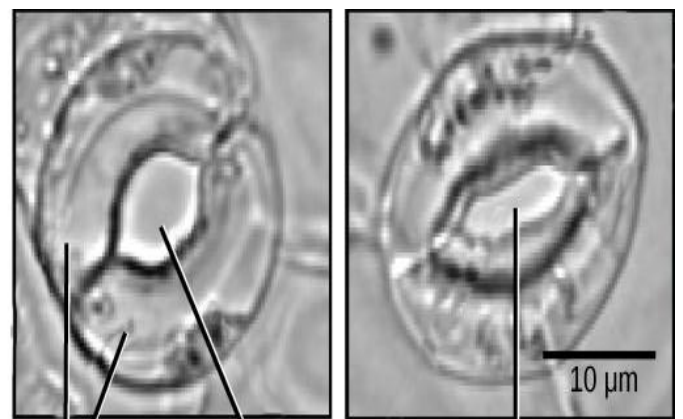
The **xylem and phloem always lie adjacent to each other**.

In stems, the xylem and the phloem form a structure called a (**vascular bundle**).

In roots, this is termed the (**vascular stele** or **vascular cylinder**).

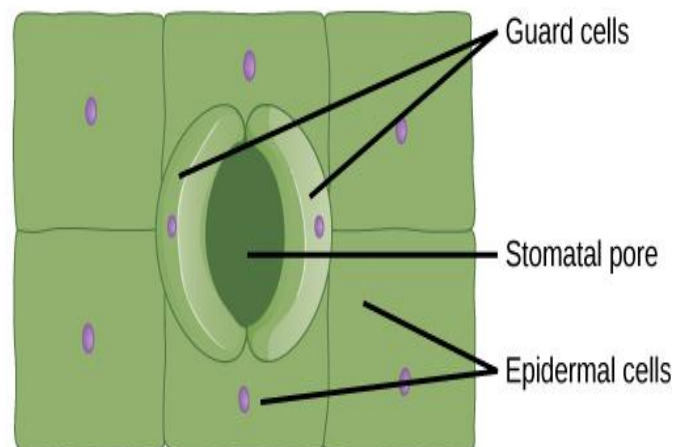


(a)



Guard cells      Open stoma      Closed stoma

(b)



(c)

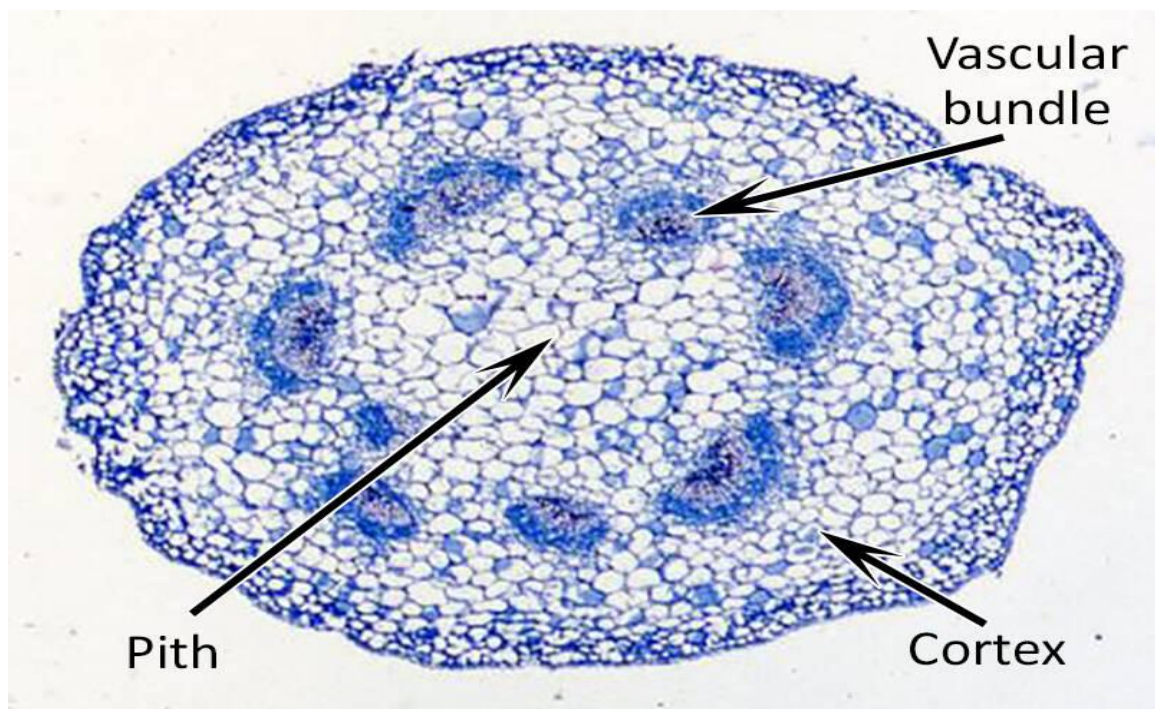
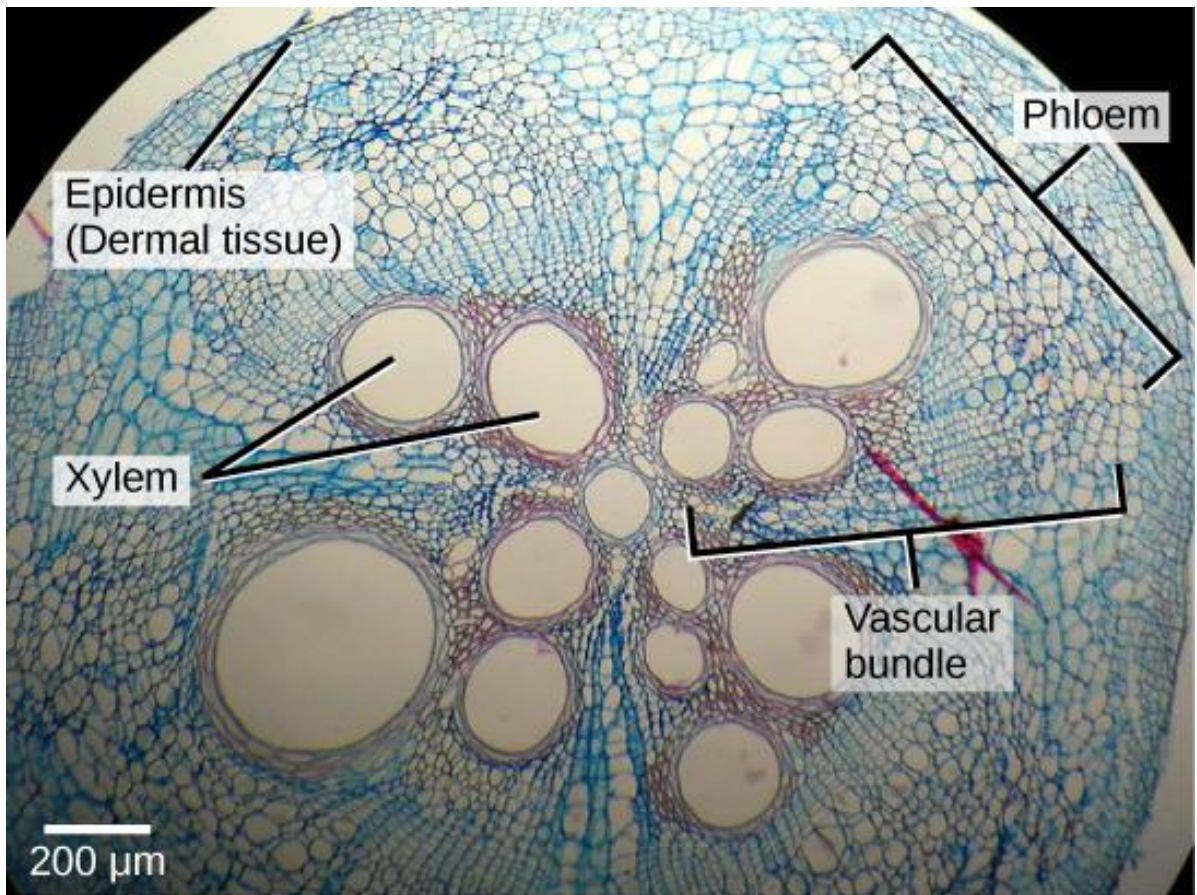
Openings called **stomata** (singular: stoma) allow a plant to take up carbon dioxide and release oxygen and water vapor.

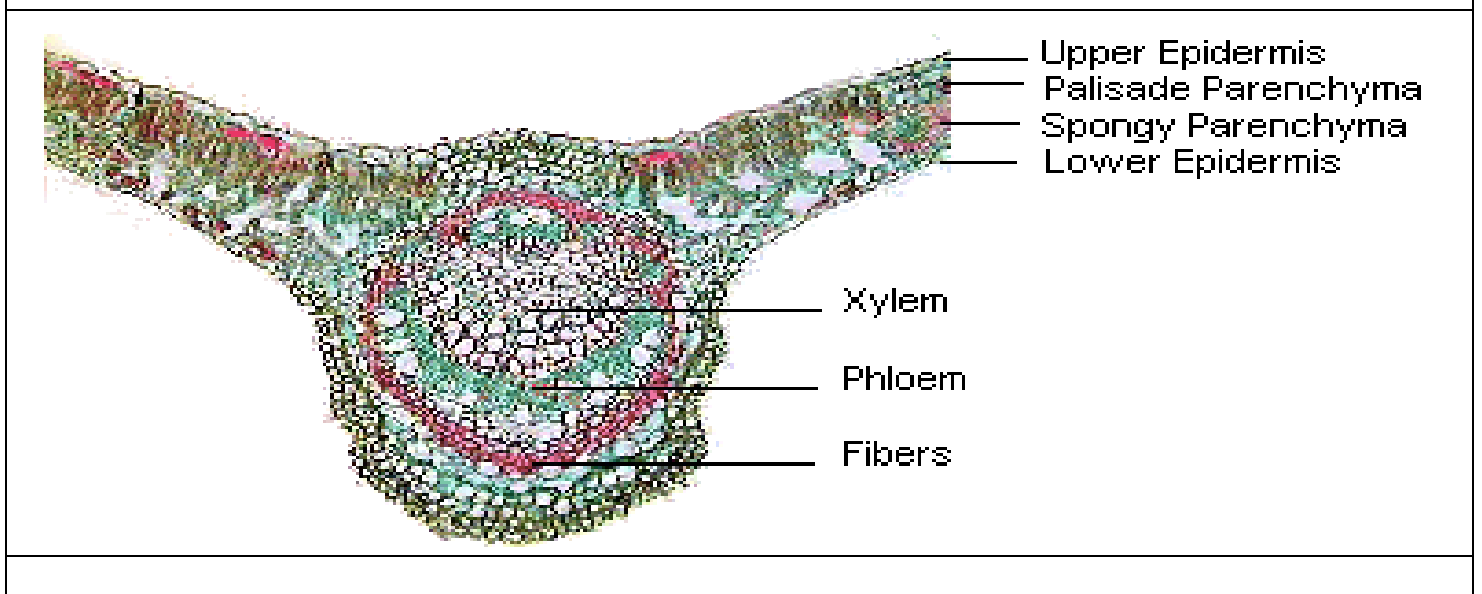
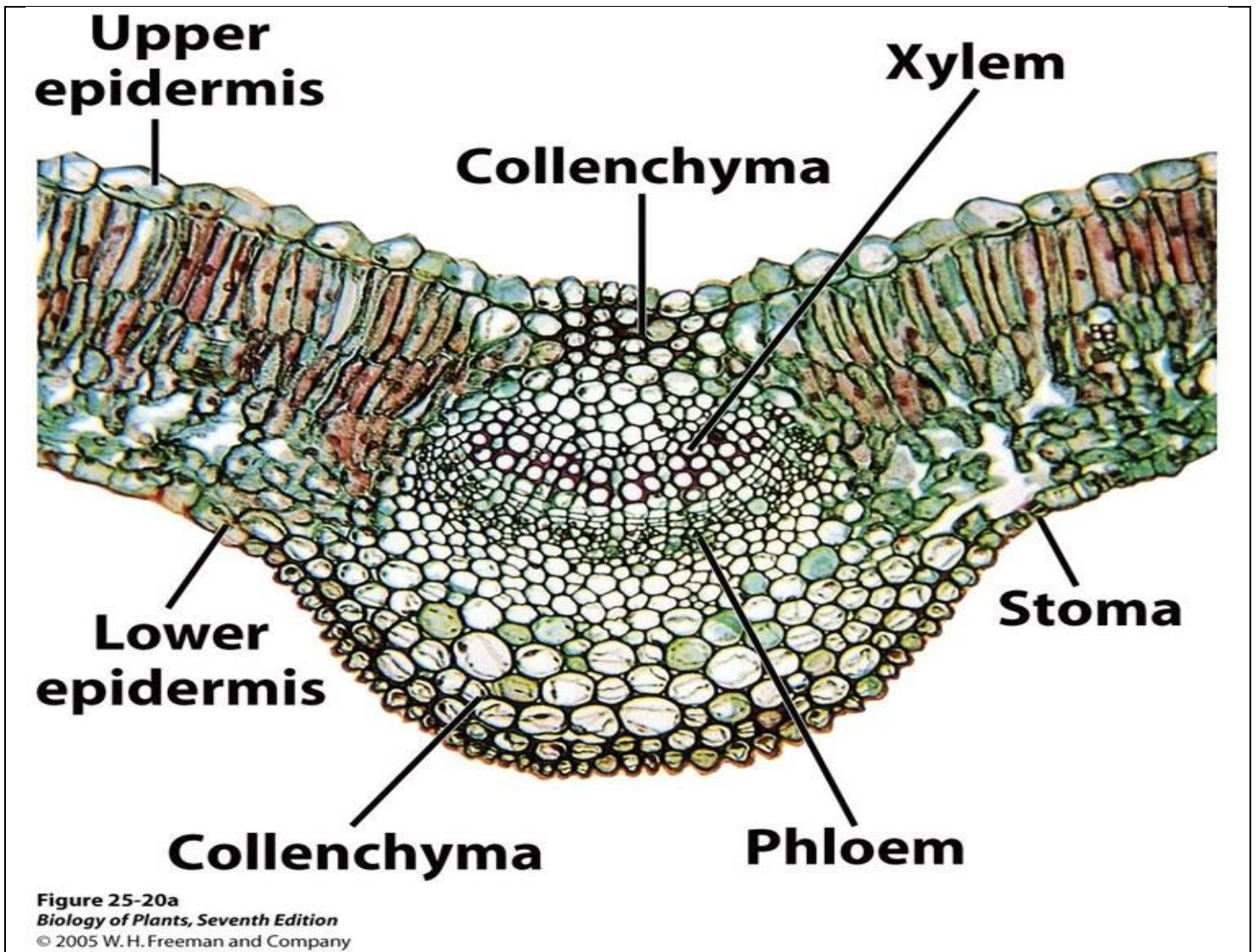
(a) colorized scanning-electron micrograph shows a closed stoma. Each stoma is flanked by two guard cells that regulate its.

(b) Opening and Closing. The guard cells are more curved when the stoma is opening compared to when it is closed.

(c) guard cells sit within the layer of epidermal cells

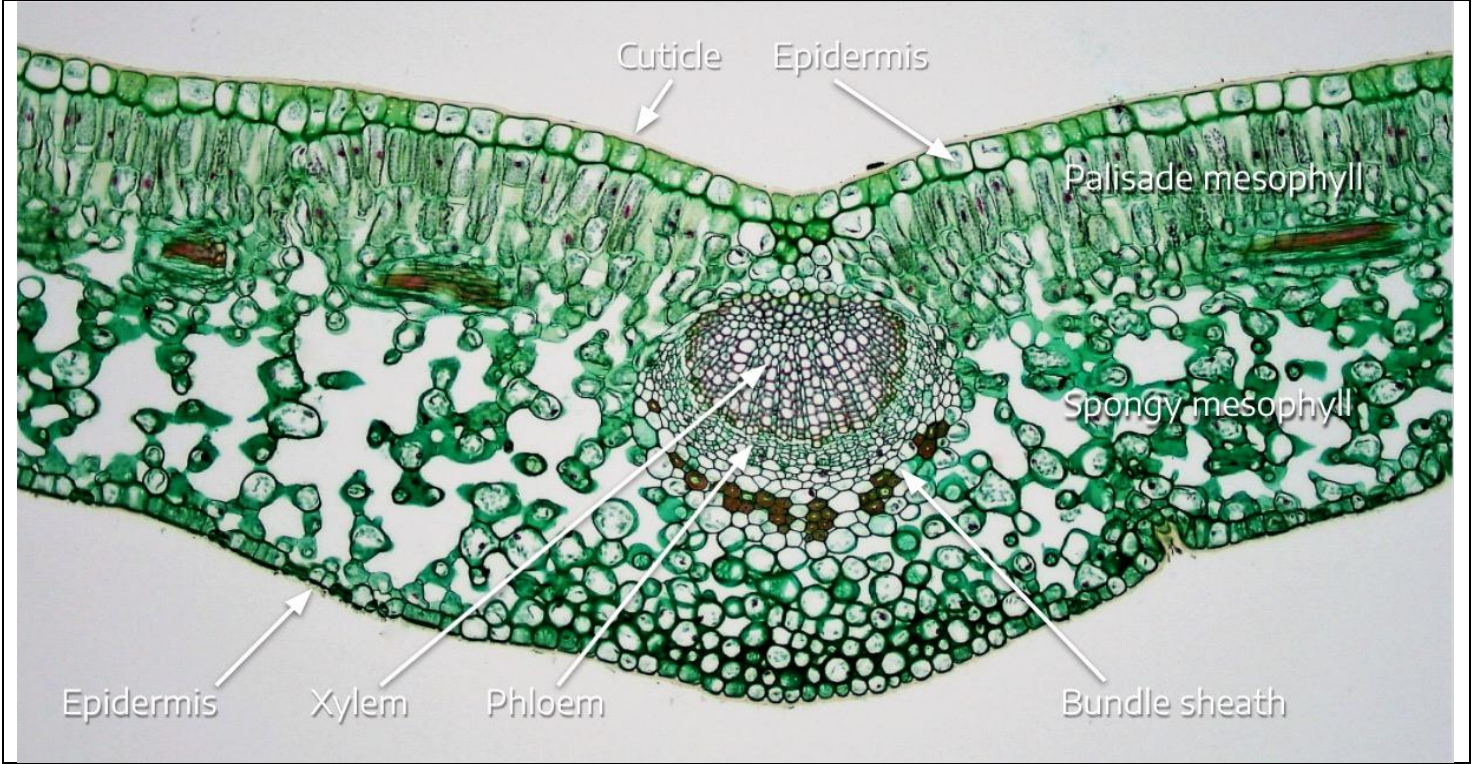
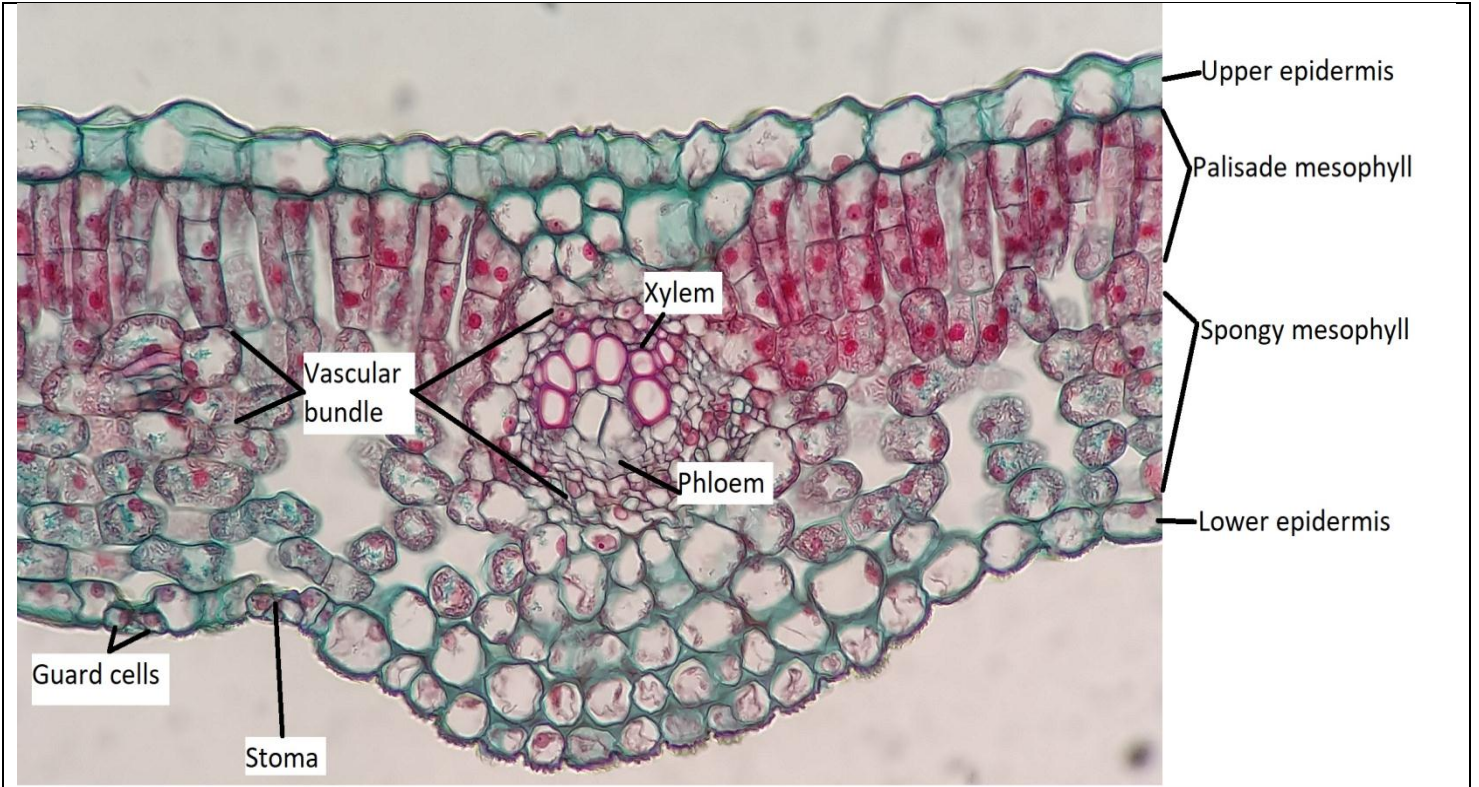


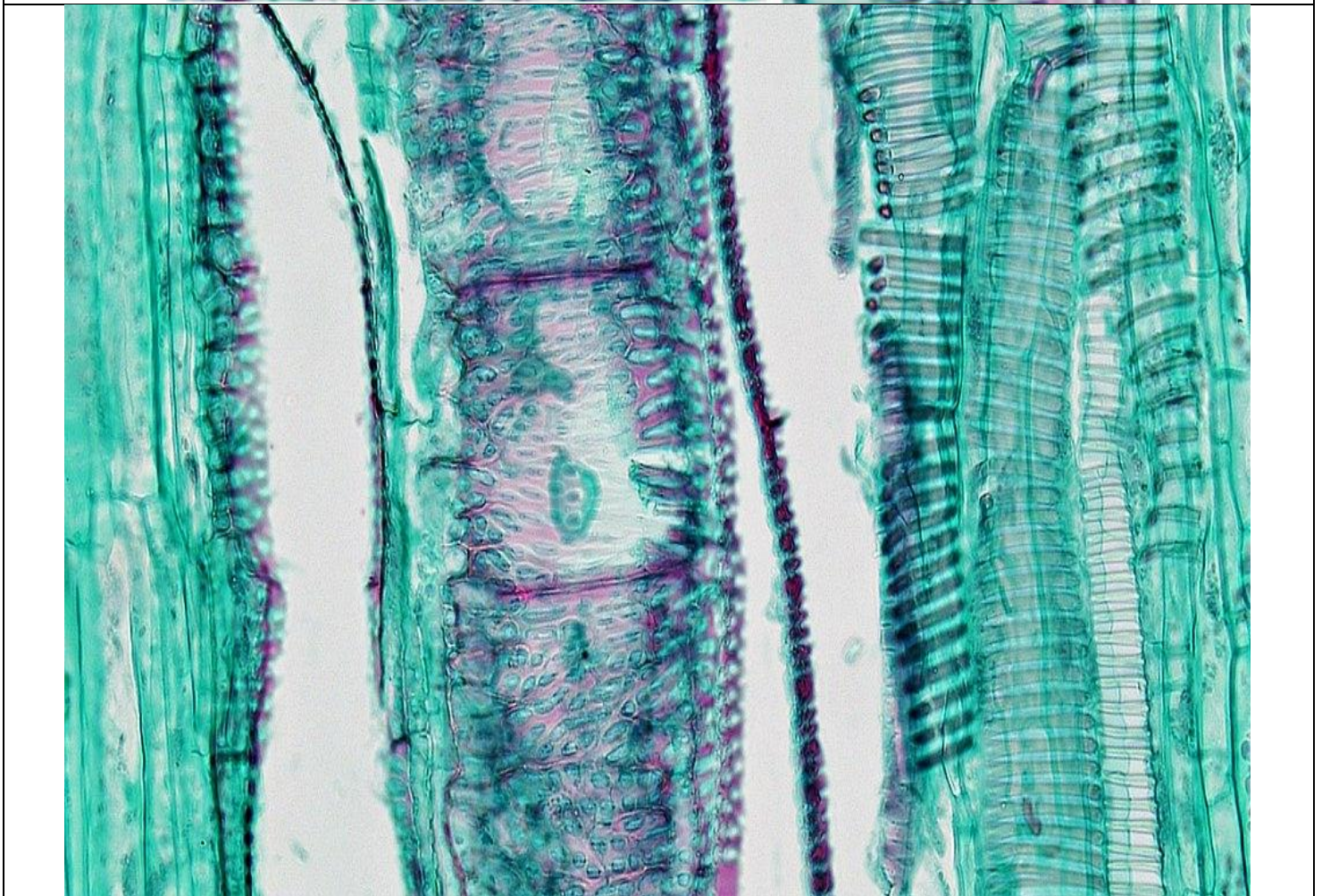
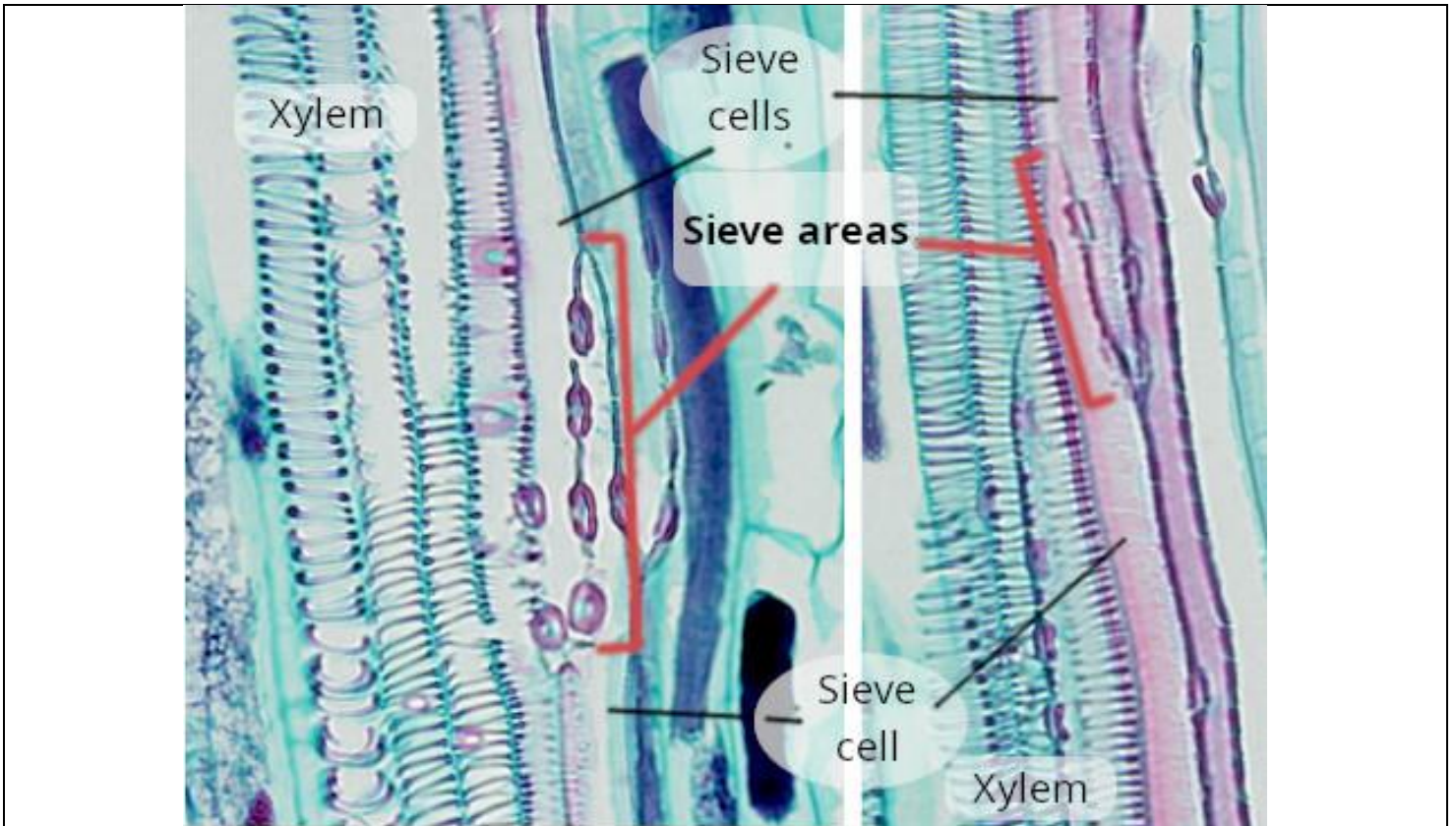


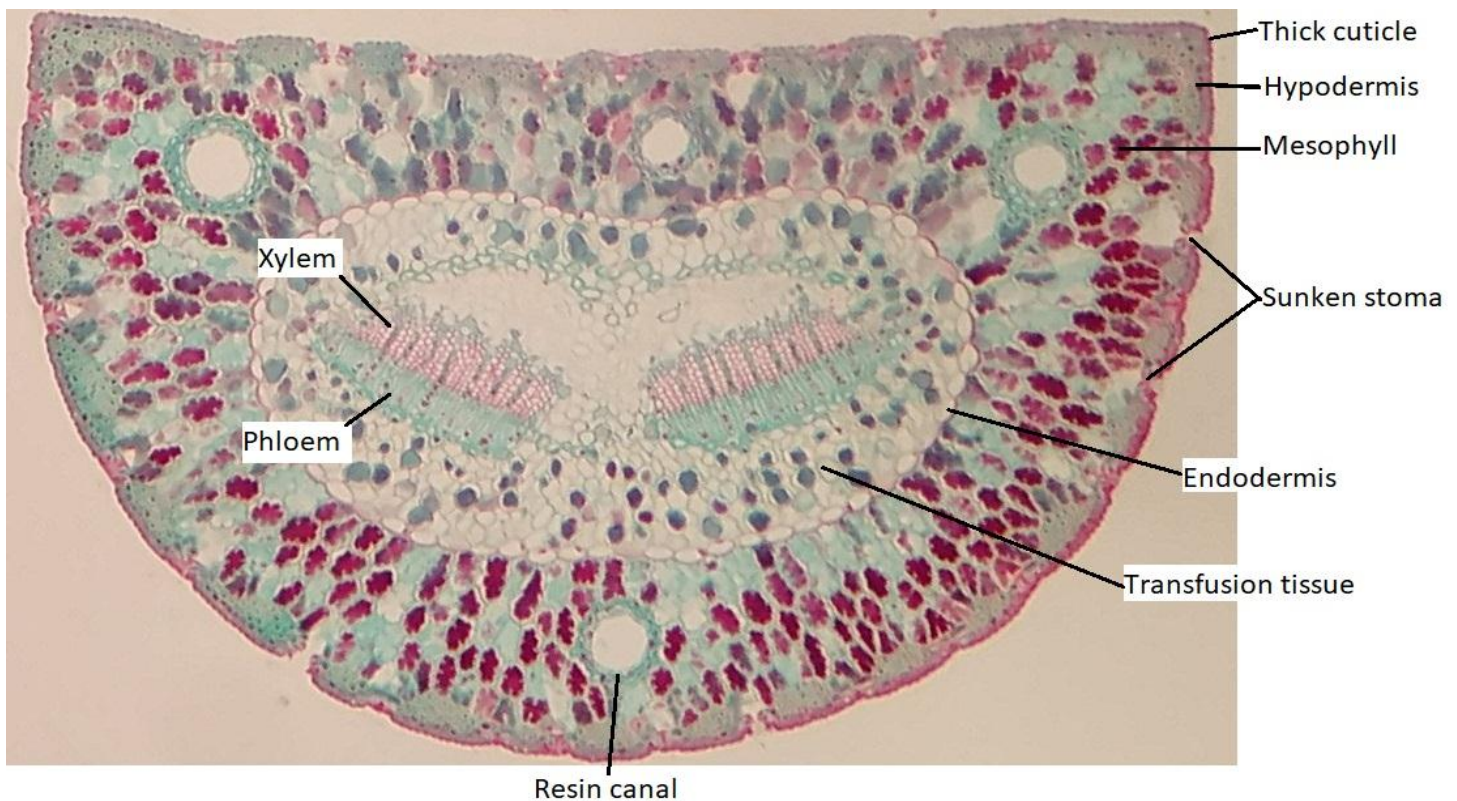


Plant tissue

أ.م. بان منعم تويج

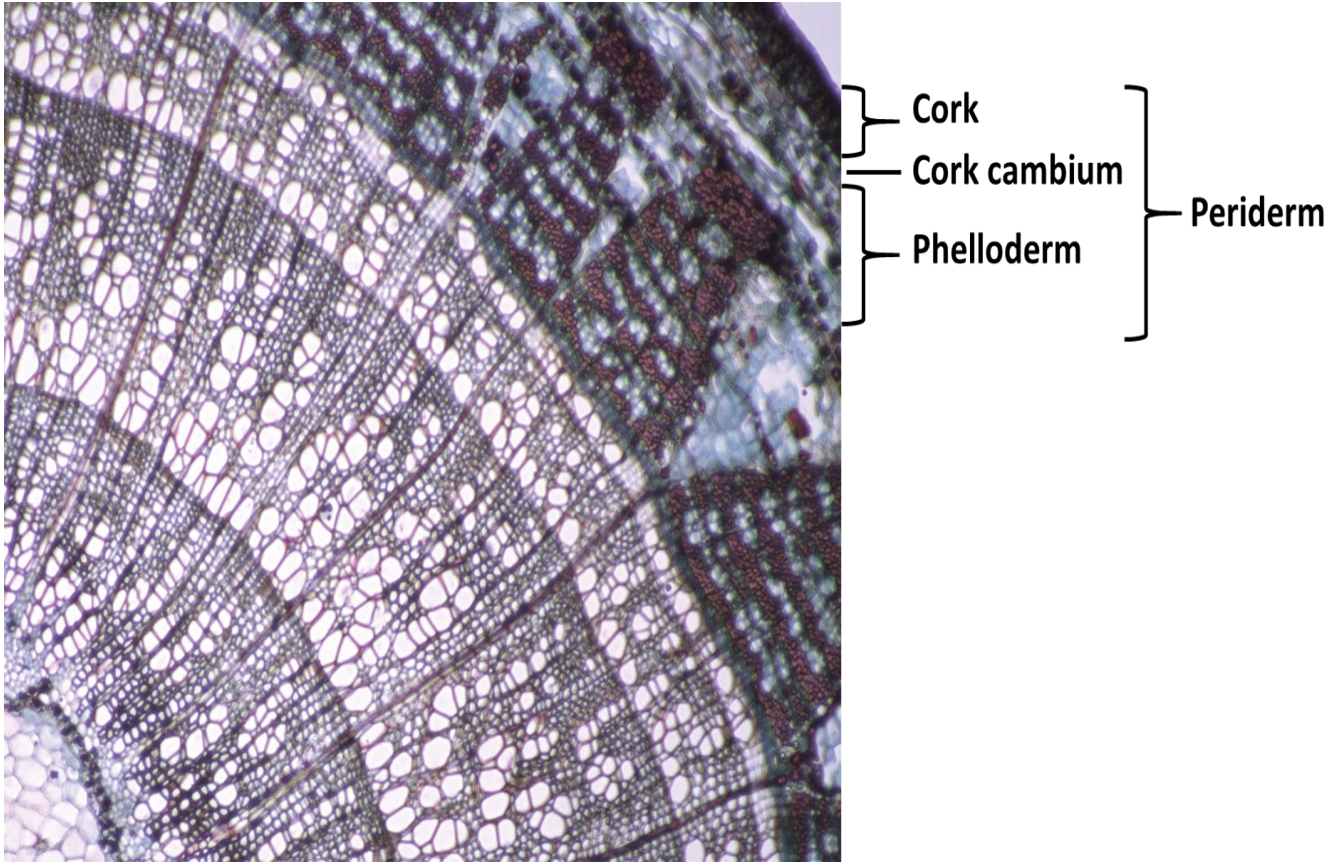






## Epidermis

In woody plants, the epidermis breaks apart into a thick **periderm** as secondary growth allows the plant to grow in girth. The cork cambium, which makes cork cells, the cork cells (which are dead at maturity), and the phelloderm (parenchyma cells on the inside of the cork cambium) together make up the periderm . The periderm functions as the first line of defense for the plant, protecting it from fire or heat injury, dehydration, freezing conditions, and/or disease.



Cross Section of a Stem

