

## PUC I YEAR SEMESTER-II

### UNIT–IV. INTERNAL ORGANIZATION IN PLANTS

#### Module 21 : ANATOMY OF DICOTYLEDONOUS AND MONOCOTYLEDONOUS STEM

##### **INTERNAL ORGANIZATION OF DICOT STEM**

A transverse section taken through the young stem of Sun-flower reveals the following regions: **Epidermis**, **Cortex** and **Stele**.

##### **1. Epidermis:**

Epidermis is the outermost covering of the stem. It is represented by a single layer of compactly arranged, barrel-shaped **parenchyma** cells. Intercellular spaces are absent. The cells are slightly thick walled. The epidermis shows the presence of numerous multicellular projections called **trichomes**. Externally, a thin transparent waxy covering called **cuticle** which prevents excessive evaporation of water, surrounds the epidermis. The epidermis also contains numerous minute openings called **stomata**, which are mainly involved in transpiration.

##### **2. Cortex:**

It is further divided into hypodermis, general cortex and endodermis. **Hypodermis** is a region lying immediately below the epidermis. It is represented by a few layers of **collenchyma** cells with angular thickenings. The cells are compactly arranged without any intercellular spaces. Hypodermis provides mechanical support and additional protection.

**General Cortex** is the major part of the stem and is represented by several layers of loosely arranged parenchyma cells. Intercellular spaces are prominent. Cortex is the major storage tissue in the stem.

**Endodermis** is the innermost layer of cortex represented by compactly arranged barrel shaped cells, without any intercellular spaces. The endodermis is wavy in appearance. The radial transverse walls have lens shaped thickenings called casparian bands. The cells are richly deposited with starch grains and hence, endodermis is commonly described as **starch sheath**.

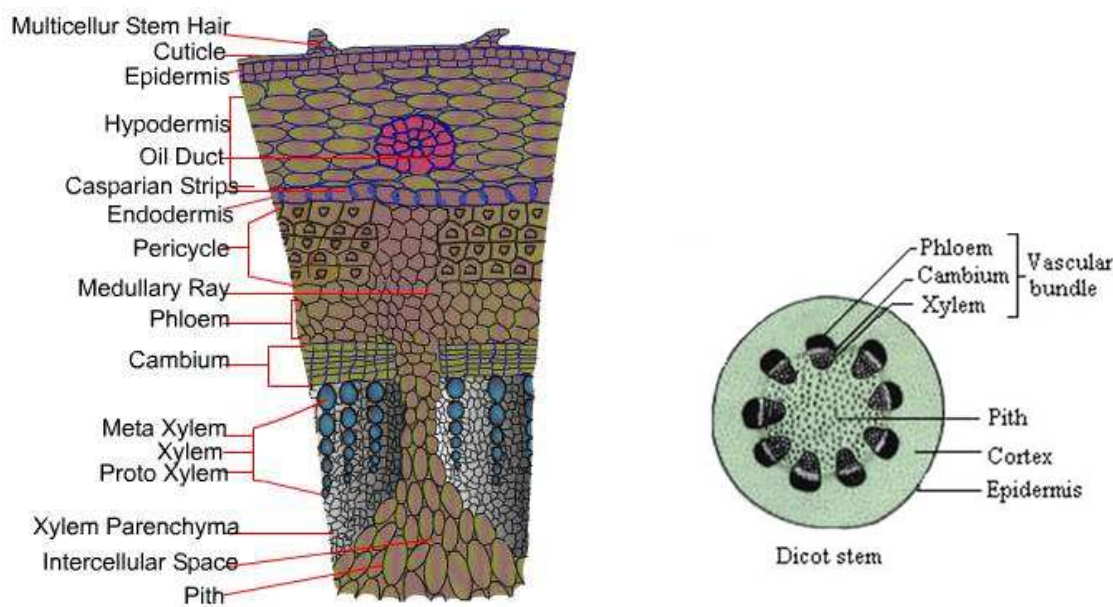
### **3. Stele:**

Stele is the central cylinder of the stem, consisting of **pericycle**, **medullary rays**, **pith** and **vascular bundles**. When a stele is distinct with a ring of vascular bundles it is referred to as **eustele**.

**Pericycle** is the outermost covering of the stele, which lies immediately below the endodermis. It is represented by a few layers of compactly arranged sclerenchyma cells. Above each vascular bundle, the pericycle forms a distinct cap-like structure known as **bundle cap**.

**Medullary Rays** are found in between the vascular bundles. They are meant for the storage of food. **Pith** is the innermost part of the stem formed by a group of loosely arranged parenchyma cells. Intercellular spaces are prominent. The pith is also meant for storage of food.

**Vascular bundles** are eight in number, arranged in form of a ring. The vascular bundles are **conjoint**, **collateral** and **open**. Xylem is on the inner surface and phloem on the outer surface. Xylem is described as **endarch**.



## **INTERNAL ORGANIZATION OF MONOCOT STEM**

Example: Maize

### **Epidermis:**

Epidermis is the outermost covering of the stem represented by a single layer of compactly arranged, barrel-shaped parenchyma cells. Intercellular spaces are absent. Trichomes are absent. A cuticle is present. The epidermis contains numerous minute openings called stomata.

### **Hypodermis:**

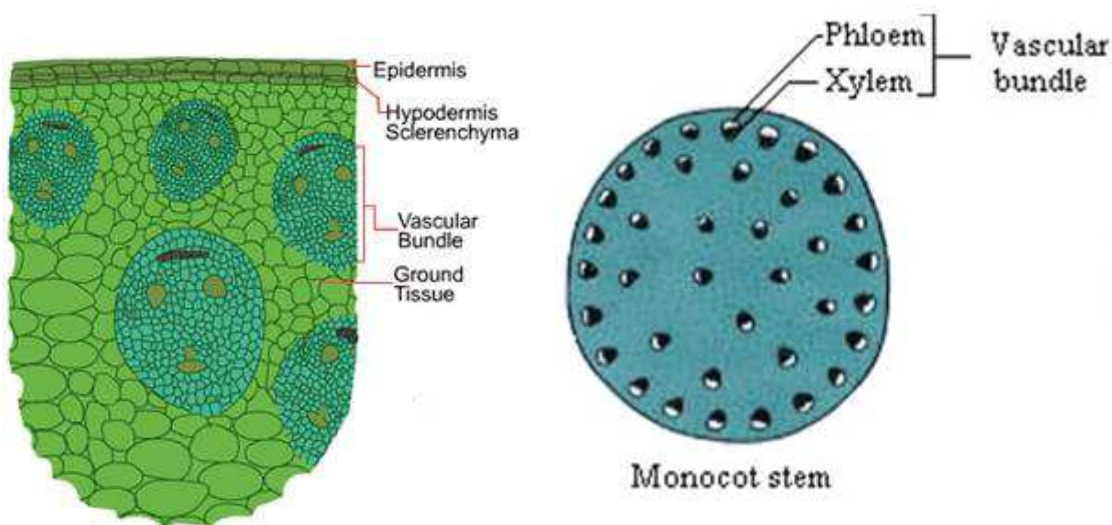
Hypodermis is a region that lies immediately below the epidermis. It is represented by a few layers of compactly arranged sclerenchyma cells.

### **Ground Tissue:**

Ground tissue is a major component of the stem. It is undifferentiated. The ground tissue is represented by several layers of loosely arranged parenchyma cells enclosing prominent intercellular spaces. The ground tissue is meant for storage of food and lateral conduction.

### Vascular Bundles:

They are found irregularly scattered in the ground tissue and also throughout the center of the stem. This type of stele is called [atactostele](#). Towards the periphery, the bundles are smaller in size while towards the centre, they are larger in size. Each vascular bundle has a covering called bundle sheath formed by a single layer of sclerenchyma cells hence called fibrovascular bundles. The vascular bundle encloses both xylem and phloem. Xylem is found towards the inner surface and phloem towards the outer surface. Cambium is absent. Hence the vascular bundles are described as [conjoint](#), [collateral](#) and [closed](#). In the xylem, there are two metaxylem and two protoxylem vessels arranged in 'the shape of 'Y'. The lower protoxylem vessel is non functional and remains as a water filled cavity called [lysigenous cavity](#) or protoxylem cavity. Xylem is described as [endarch](#).



### **Check points**

1. The internal organization of dicot stem (sunflower) and monocot stem (maize) shows the presence of epidermis, cortex and ground tissue.

2. The epidermis is the outermost single layered parenchymatous tissue with stomata and covered with cuticle which is meant for protection.
3. In dicot stem, the cortex is identified with three regions: hypodermis consists of sclerenchyma that gives mechanical support to the stem.
4. The general cortex occupies major part of the stem consists of loosely packed parenchyma cells helps in storage and lateral conduction.
5. The outer region of vascular tissue is pericycle made up of sclerenchyma cells.
6. Stele is a distinct central cylinder of the stem with a ring of eight vascular bundles; it is referred to as eustele. Stele consisting of pericycle, medullary rays, pith and vascular bundles.
7. The vascular bundles are conjoint, collateral and open. Xylem is endarch.
8. The monocot stem consists of ground tissue where vascular bundles are scattered. There is no general cortex and pith. The vascular bundles are conjoint, collateral and closed.

### **Short answer questions**

1. Give an account of the distinguishing features of vascular bundles of dicot stem
2. Differentiate eustele and atactostele.
3. Give an account of vascular bundles in  
(a) Dicot stem and (b) Monocot stem
4. Explain the character of hypodermis in Dicot and Monocot stem.
5. Write about the ground tissue system of dicot stem.
6. Describe briefly about the conducting system of monocot stem.
7. What are the similar characters present in the anatomy of dicot and monocot stem?

### Long answer questions

- 1) Describe in detail the transverse section of dicot stem?
- 2) Explain the anatomy of maize stem.

### MCQS

1. Which is **not** found in a monocot stem? (*e.g.* corn stem)
  - A. Vascular bundle
  - B. Metaxylem
  - C. Metaphloem
  - D. Cambium**
2. Closed vascular bundles are found in:
  - A. Dicot stem
  - B. Monocot stem**
  - C. All angiosperms
  - D. Dicot root
3. Which statement is not correct to describe the vascular bundles in a dicot stem
  - A. Xylem and phloem are together in the same vascular bundle
  - B. They are located on the same radius of the stem
  - C. Metaxylem is pointing towards the pith
  - D. All the vascular bundles are arranged in a ring around a large, central pith.**
4. Which statement is correct to describe the vascular bundles in a monocot stem

- A. Xylem and phloem are together in the same vascular bundle and are separated by cambium
  - B. They are arranged in a ring around a large, central pith
  - C. They are scattered in ground tissue**
5. Which of the following statement is correct with reference to cortex of dicot stem but not to monocot stem?
- A. The hypodermis is made up of sclerenchyma
  - B. The cortex is distinguished into hypodermis, general cortex and endodermis**
  - C. The cortex is devoid of endodermis
  - D. The general cortex is made up of collenchyma cells