

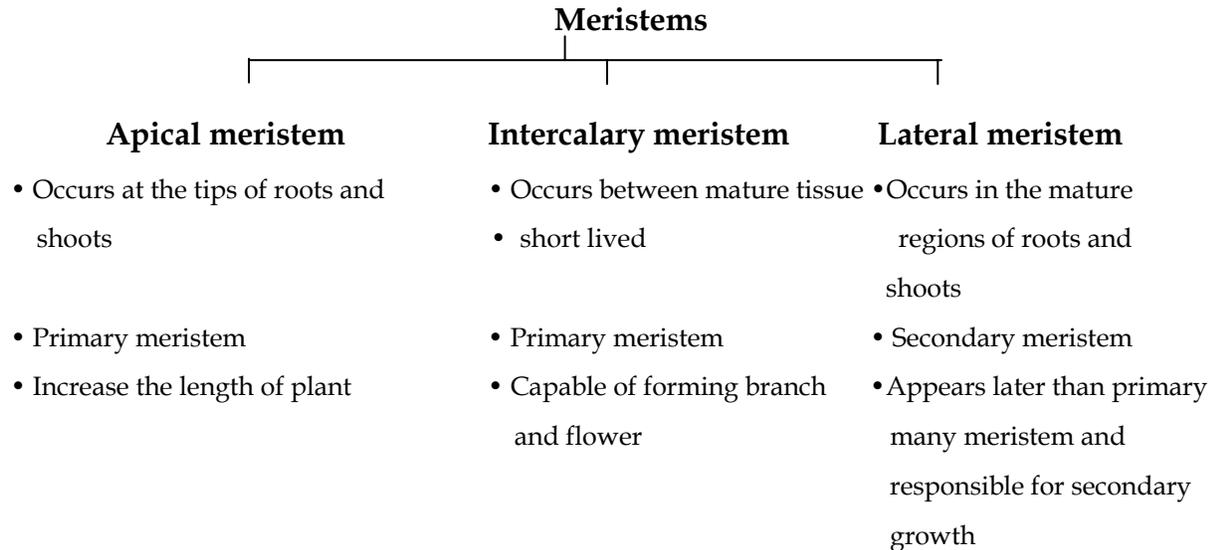
# CHAPTER - 6

## ANATOMY OF FLOWERING PLANTS

**Anatomy:** Anatomy is the study of internal structure of organisms. Plant anatomy includes organization and structure of tissues.

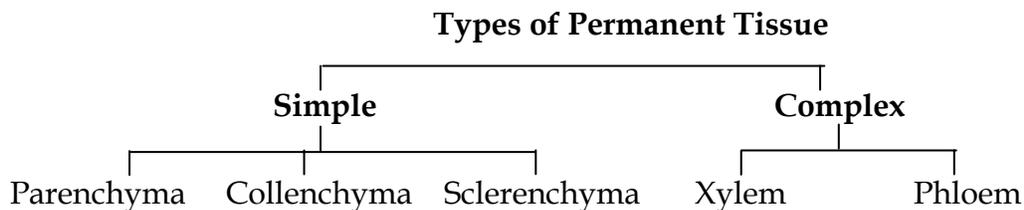
**Tissue:** A group of interdependent identical or non-identical cells along with intercellular substance having common origin to perform a specific (definite) function in multicellular organisms is called tissue.

**Meristematic tissues:** The meristematic tissue is made up of the cells which have the capability to divide. Meristems in plants are restricted to a specialized regions and responsible to the growth of plants.



**Axillary bud:** The buds which are present in the axils of leaves and are responsible for forming branches or flowers.

**Permanent tissues:** The permanent tissues are derived from meristematic tissue and are composed of cells, which have lost the ability to divide.



**Parenchyma:** Thin walled cells, with intercellular spaces, cell wall is made up of cellulose. It performs the function like photosynthesis, storage, secretion.

**Collenchyma:** It is formed of living, closely packed isodiametric cells. It's cells are thickened at the corners due to deposition of cellulose and pectin. It provides mechanic support to the growing parts of the plant.

**Sclerenchyma:** It is formed of dead cells with thick and lignified walls meant for mechanical support. They have two types of cells: fibres and sclereids.

**Xylem:** Xylem consists of tracheids, vessels, xylem fibres and xylem parenchyma. It conducts water and minerals from roots to other parts of plant.

**Protoxylem:** The first formed primary xylem elements.

**Metaxylem:** The later formed primary xylem elements.

**Endarch xylem:** Protoxylem lies towards the centre and metaxylem towards the periphery of the organ.

**Exarch xylem:** Protoxylem towards periphery and metaxylem towards the centre.

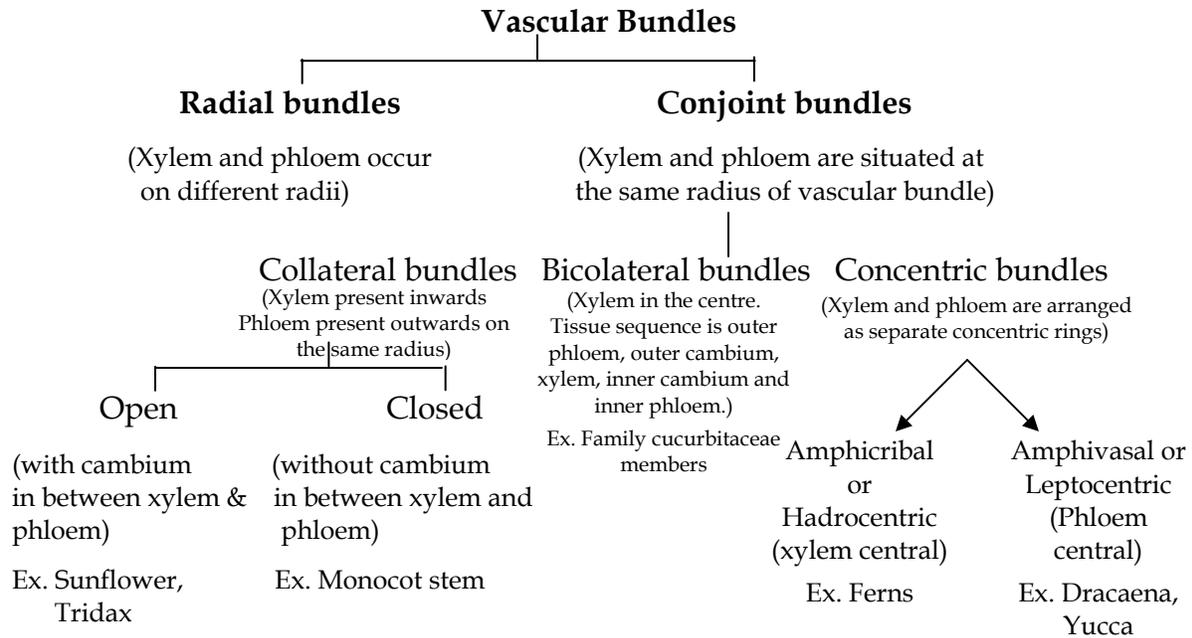
**Phloem:** Phloem consists of sieve tube elements, companion cells, phloem fibres and phloem parenchyma. Phloem transports the food material from leaves to various parts of the plant.

**Protophloem:** First formed phloem with narrow sieve tubes.

**Metaphloem:** Later formed phloem with broader sieve tubes.

### **The Tissue System:**

- 1. Epidermal tissue system:** It includes cuticle, epidermis, epidermal hairs, root hairs, trichomes and stomata.
- 2. The ground tissue system:** It is made up of parenchyma, collenchyma, sclerenchyma. In dicot stems and roots the ground tissue is divided into hypodermis, cortex, endodermis, pericycle, medullary rays and pith.
- 3. The vascular tissue system:** It includes vascular bundles which are made up of xylem and phloem.



### Anatomy of Root

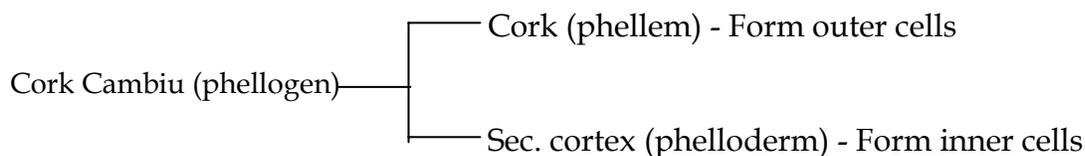
Dicot Root	Monocot Root
1. Cortex is comparatively narrow.	1. Cortex is very wide.
2. Endodermis is less thickened casparian stripes are more prominent.	2. Endodermal cells are highly thickened Casparian strips are visible only in young roots.
3. The xylem and phloem bundles are 2 to 6.	3. Xylem and phloem are more than six and varies (polyarch).
4. Pith is absent or very small.	4. Well developed pith is present.
5. Secondary growth takes place.	5. Secondary growth is absent.

### Anatomy of Stem

Dicot Stem	Monocot Stem
1. The ground tissue is differentiated into cortex, endodermis, pericycle and pith.	1. The ground tissue is made up of similar cells.
2. The vascular bundles are arranged in a broken ring (Eustele).	2. The vascular bundles are scattered throughout the ground tissue (Atactostele).
3. Vascular bundles are open, without bundle sheath and wedge-shaped outline.	3. Vascular bundles are closed, surrounded by sclerenchymatous bundle sheath, oval or rounded in shape.
4. The stem shows secondary growth	4. Secondary growth is absent.
5. Stomata have kidney-shaped guard cells.	5. Stomata have dumb bell shaped guard cells.

**Secondary growth in dicot stem:** An increase in the girth (diameter) in plants. Vascular cambium and cork cambium (lateral meristems) are involved in secondary growth.

1. Formation of cambial ring: Intrafascicular cambium + interfascicular cambium.
2. Formation of secondary xylem and secondary phloem from cambial ring.
3. Formation of spring wood and autumn wood.
4. Formation of heart wood and sap wood.
5. Development of cork cambium (phellogen)



(Phellogen + Phellem + Phelloderm) = Periderm

**Secondary growth in dicot roots:** Secondary growth in dicot root occurs with the activity of secondary meristems (vascular cambium). This cambium is produced in the stele and cortex, and results in increasing the girth of dicot roots.

### Anatomy of Leaf

Dorsiventral (Dicot) Leaf	Isobilateral (monocot) Leaf
1. Generally stomata are absent or less abundant on the upper side.	1. The stomata are equally distributed on both sides.
2. Mesophyll is differentiated into two parts upper palisade parenchyma and lower spongy parenchyma.	2. Mesophyll is undifferentiated.
3. Bundle sheath is single layered and formed of colourless cells.	3. Bundle sheath may be single or double layered.
4. Bundle sheath extension is collenchymatous.	4. Bundle sheath extension is sclerenchymatous.

**Note:** For Diagrams and Figures see the NCERT Standard XI Biology Text Book

## SUMMARY :

Anatomically, a plant is made of different kinds of tissues. The plant tissues are broadly classified into meristematic (apical, lateral and intercalary) and permanent (simple and complex). Assimilation of food and its storage, transportation of water, minerals and photosynthates, and mechanical support are the main functions of tissues. There are three types of tissue systems – epidermal, ground and vascular. The epidermal tissue systems are made of epidermal cells, stomata and the epidermal appendages. The ground tissue system forms the main bulk of the plant. It is divided into three zones – cortex, pericycle and pith. The vascular tissue system is formed by the xylem and phloem. On the basis of presence of cambium, location of xylem and phloem, the vascular bundles are of different types. The vascular bundles form the conducting tissue and translocate water, minerals and food material. Monocotyledonous and dicotyledonous plants show marked variation in their internal structures. They differ in type, number and location of vascular bundles. The secondary growth occurs in most of the dicotyledonous roots and stems and it increases the girth (diameter) of the organs by the activity of the vascular cambium and the cork cambium. The wood is actually a secondary xylem. There are different types of wood on the basis of their composition and time of production.

## EXERCISE QUESTIONS

### Very Short Answer Questions (1 mark each)

1. Name the tissue represented by the jute fibres used for making the ropes.
2. Which kind of roots have polyarch vascular bundles?
3. What is heart wood?
4. State the role of pith in stem.
5. Where are bulliform cells found in leaves?
6. Which meristem does produce growth in length?
7. What forms the cambial ring in a dicot stem during the secondary growth?
8. Name the anatomical layer in the root from which the lateral branches of root originate.
9. Which tissue of the leaf contains chloroplast?
10. A plant tissue when stained, showed the presence of hemicellulose and pectin in cell wall of its cells. Name the tissue.

### **EXERCISE - ANSWERS**

1. Sclerenchyma.
2. Monocotyledonous roots.
3. The hard central region of tree trunk made up of xylem vessels.
4. Pith stores the food material.
5. Bulliform cells are found in the upper epidermis of monocot leaves.
6. Primary meristem.
7. Fascicular and intrafascicular strips of meristem.
8. Pericycle of mature zone.
9. Mesophyll tissue.
10. Chollenchyma.
11. Sclerenchyma.
12. Monocotyledonous roots.
13. The hard central region of tree trunk made up of xylem vessels.
14. Pith stores the food material.
15. Bulliform cells are found in the upper epidermis of monocot leaves.
16. Primary meristem.
17. Fascicular and intrafascicular strips of meristem.
18. Pericycle of mature zone.
19. Mesophyll tissue.
20. Chollenchyma.