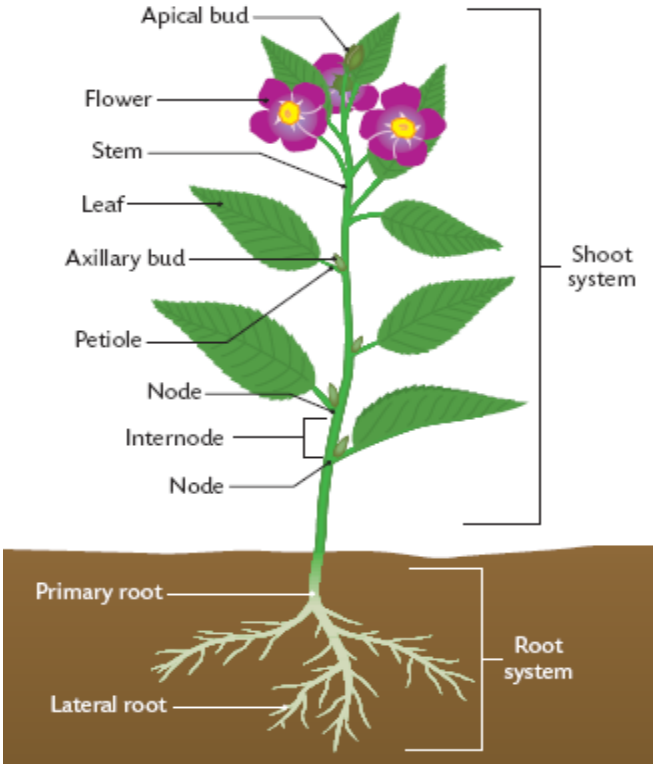
Chapter 24 – Structure of Flowering Plants

3.2 Organisation & The Vascular Structure	Learning Objectives
3.2.1 Organisational Complexity of Flowering Plants	1. Organisational structures of the flowering plant. 2. Function of the root and shoot system. 3. Explanation of the term "meristem": location in the root and shoot. 4. Location of three tissue types – in TS and LS of the root and stem. 5. Xylem and phloem as examples of vascular tissues – their function and structure. 6. Identification of dicotyledons and monocotyledons under the headings: woody/herbaceous, arrangement of floral parts, arrangement of vascular bundles, cotyledon or seed leaf number. 7. Prepare and examine microscopically the TS of a dicotyledonous stem

All plants look very different but each has the same basic system; 1. Vascular Transport Structures, 2. Leaves, 3. Stems, 4. Roots, 5. Seeds, 6. Fruits, 7. Flowers.

External structure:



Roots:

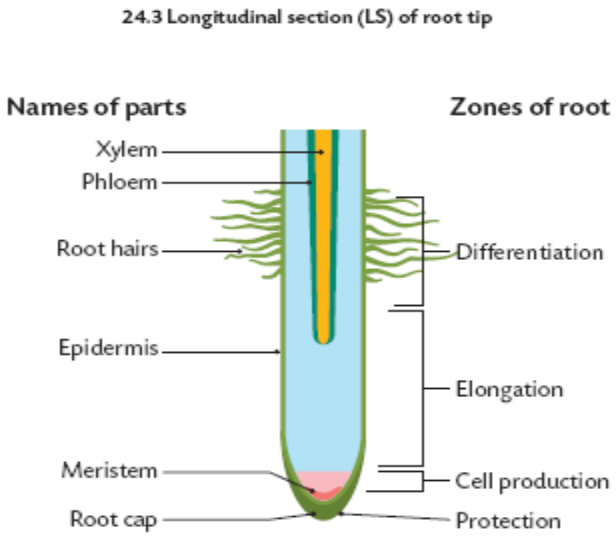
Types of roots

- **Tap root** – consists of a main root that developed from the radicle. Lateral roots emerge from the tap (primary) root. E.g. carrot, turnip
- **Fibrous roots** – form when the radicle dies away leaving equal sized roots. E.g. grasses, daffodils
- **Adventitious roots** – are roots which do not develop from the radicle. They are said to grow in strange places. E.g. onion, strawberry plant

Root Functions:

- To anchor the plant in the soil.
- To absorb water & minerals
- To transport absorbed materials to the shoots.
- Some store food. E.g. carrots

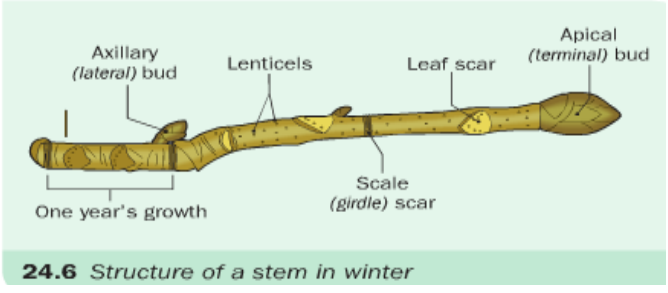
Zones in a root:



1. **Zone of protection** – the root cap protects the root as it passes through the soil.
2. **Meristematic zone (cell production)** – (***meristem – plant tissue capable of mitosis***)
   - allows plants to grow
3. **Zone of elongation** – plant growth regulators stimulate the cells produced in the Meristematic zone to grow longer.
4. **Zone of differentiation** – elongated cells develop into different types of tissues.
   - Dermal tissue – protects the plant
   - Ground tissue – found between the dermal & vascular tissues
   - Vascular tissue (xylem & phloem) – transports materials.

Stems:

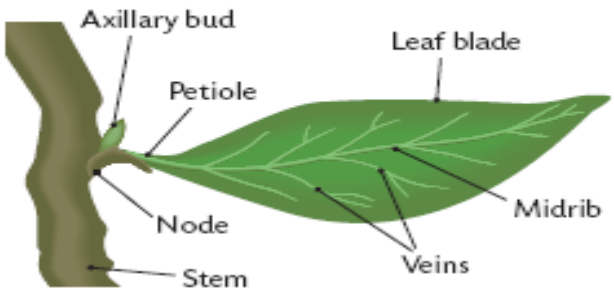
- The stem carries leaves which emerge from **nodes**, each one divided by an **internode**.
- The tip of the stem contains a **terminal or apical bud** (growth tip), if removed a low bushy plant will develop.
- An **axil** is the angle between a leaf and stem. **Axillary/lateral buds** are found here.
- **Lenticels** are openings in stems which allow for gas exchange.
- In winter herbaceous plants develop a woody layer.
- **Apical bud** produces following years growth.
- **Scale scars** show location of previous apical bud. Thus distance between 2 scale scars shows **one years growth**.
- **Leaf scars** show where leaves have fallen from.



Stem Functions:

- They support the aerial parts of the plant.
- They transport water & minerals from the root to the leaves/flowers.
- They transport food made in the leaves to the roots.
- They carry out photosynthesis when green.
- They may store food.

Leaves:

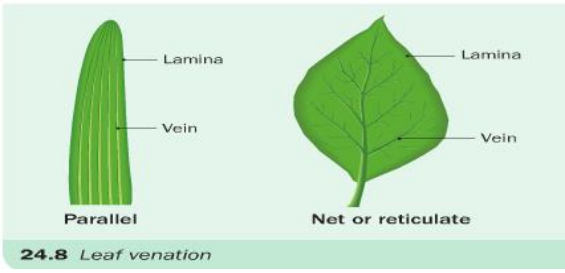


- Leaves are attached to stems at a **node**.
- The stalk is called a **petiole**.
- **Sessile leaves are leaves that are attached directly to the stem, they have no petiole**.
- The flat blade of the leaf is called the **lamina**.
- The petiole, midrib and lamina contain transport tissues called xylem and phloem.

Venation:

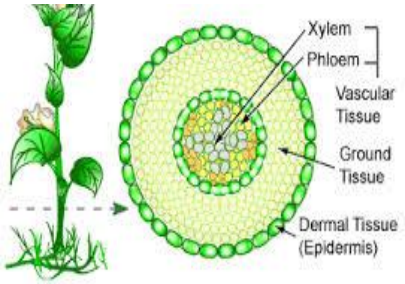
- Parallel venation means the veins run in straight lines beside each other.
  - Found in monocots (grasses, daffodils, tulips).
- Net/Reticulate venation means the veins form a network through the lamina.
  - Found in dicots (horse chestnut, rose, buttercup)

Leaf *Functions:*



- They make food by photosynthesis
- They exchange gases (carbon dioxide & oxygen)
- They lose water by transpiration
- They may store food e.g lettuce, cabbage

Tissues in flowering plants:



1. Dermal tissue:
   - Forms the covering layer on a plant
   - function→ to protect the plant, form root hairs
2. Ground tissue:
   - Occupies the area between the dermal & vascular tissue
   - Functions→ Photosynthesis, storage of food & wastes, gives strength & support to the plant.
3. Vascular tissue:

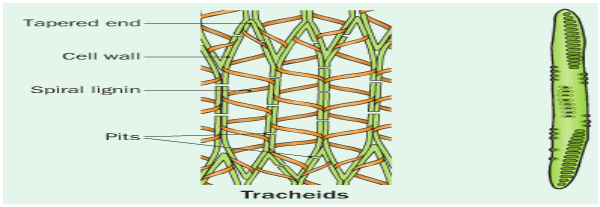
- Consists of xylem & phloem
- Xylem and Phloem are normally found close together in bundles called vascular bundles

Xylem:

- Made up of two main types of cells; vessels and tracheids
- The living parts of tracheids & vessels die before they reach maturity. For this reason xylem is a dead tissue.

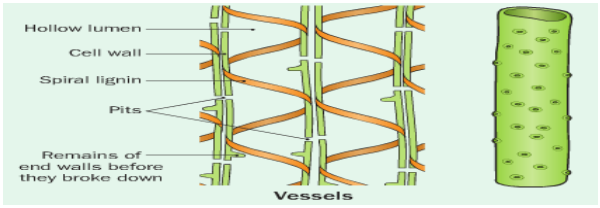
Xylem tracheids:

- Long, tapering cells, hollow inside.
- They overlap allowing water to pass from one to the other, through pits.
- Found mostly in conifers.



Xylem vessels:

- Tubular structures formed when a number of cells join end to end
- They are wider than tracheids
- Their end walls break down to form a continuous tube.
- They have pits in their side walls to allow water to pass from one vessel to another.



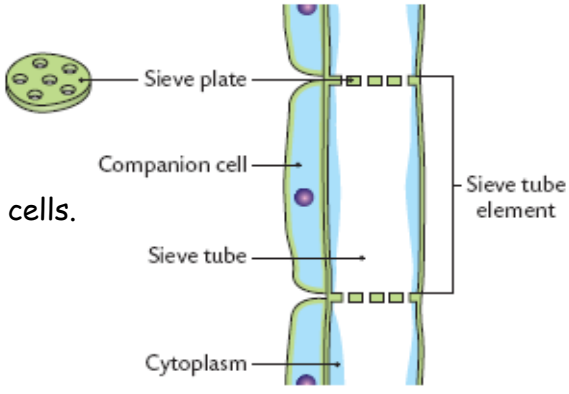
- Both tracheids & vessels have thick lignin containing cell walls (lignin is a hard, strong chemical)

Xylem Functions/Location:

- Transports water and minerals from the roots to the leaves
- Found in roots, stems, leaves and flowers (usually in vascular bundles)

Phloem:

- Composed of sieve tubes and companion cells
- Sieve tubes – long tubular structures
- Formed when sieve tube elements joined end to end
- The end walls develop pores called sieve plates which allows passage of materials from one element to another
- Each sieve tube element has an accompanying companion cell on its outside
- These have a nucleus and cytoplasm
- Phloem is a living tissue because of these companion cells.

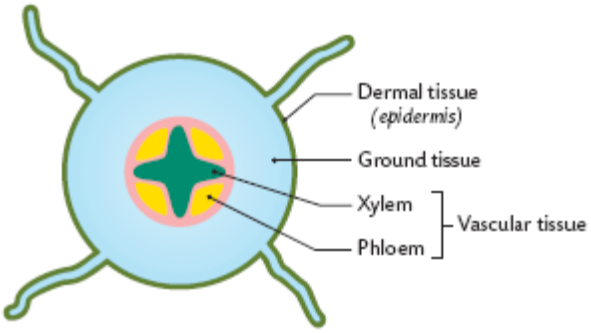


Phloem Functions/Location:

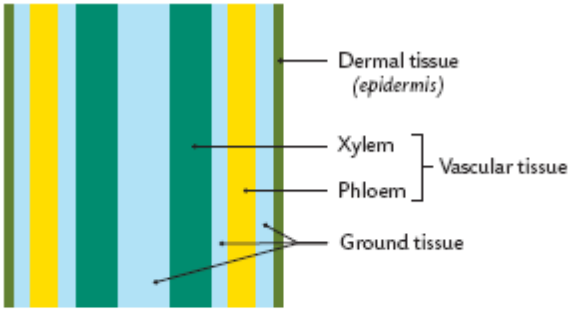
- Transports food made by photosynthesis
- Found in roots, stems, leaves & flowers in vascular bundles

Location of Plant tissue:

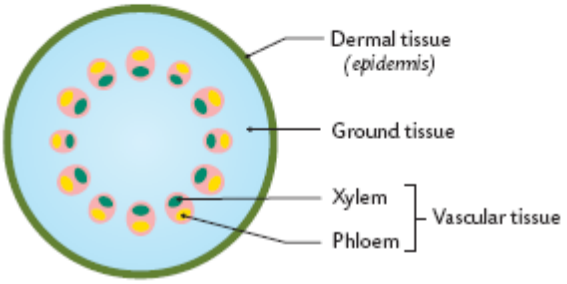
24.10 TS of root



24.11 LS of stem



24.12 TS of dicot stem



Main differences between xylem and phloem	
Xylem	**Phloem**
Carries water and minerals	Carries food
Is dead	Is living
Has lignin	No lignin
Has no companion cells	Has companion cells

Monocotyledons and dicotyledons:

- **A cotyledon** – is a leaf in the seed specialised for food storage

Monocots	Dicots
• Grasses, daffodils, tulips	• Beans, peas, peanuts, roses
• Have one cotyledon in their seeds	• Have two cotyledons in their seeds
• Leaves are long & narrow and have parallel venation	• Leaves are broad and have netted venation
• Vascular bundles are scattered	• Vascular bundles are arranged in a ring
• Flower parts are in multiples of 3	• Flower parts are in multiples of four/five
• Mostly herbaceous	• May be herbaceous/woody