23 - Structure of Flowering Plants

Learning objectives

- To understand the organisation of the parts of a flowering plant (to include the roots, stem, leaves and vascular structures) and describe their functions
- To define the term 'meristem' and describe its location in roots and shoots
- To identify three types of tissue in transverse and longitudinal sections of root and stem
- To describe the structure and function of xylem and phloem
- To know the difference between monocotyledons and dicotyledons in terms of whether they are woody or herbaceous, how the floral parts and vascular bundles are arranged and how many seed leaves (cotyledons) they have
- To prepare a transverse section of a dicotyledonous stem and examine it under a microscope.

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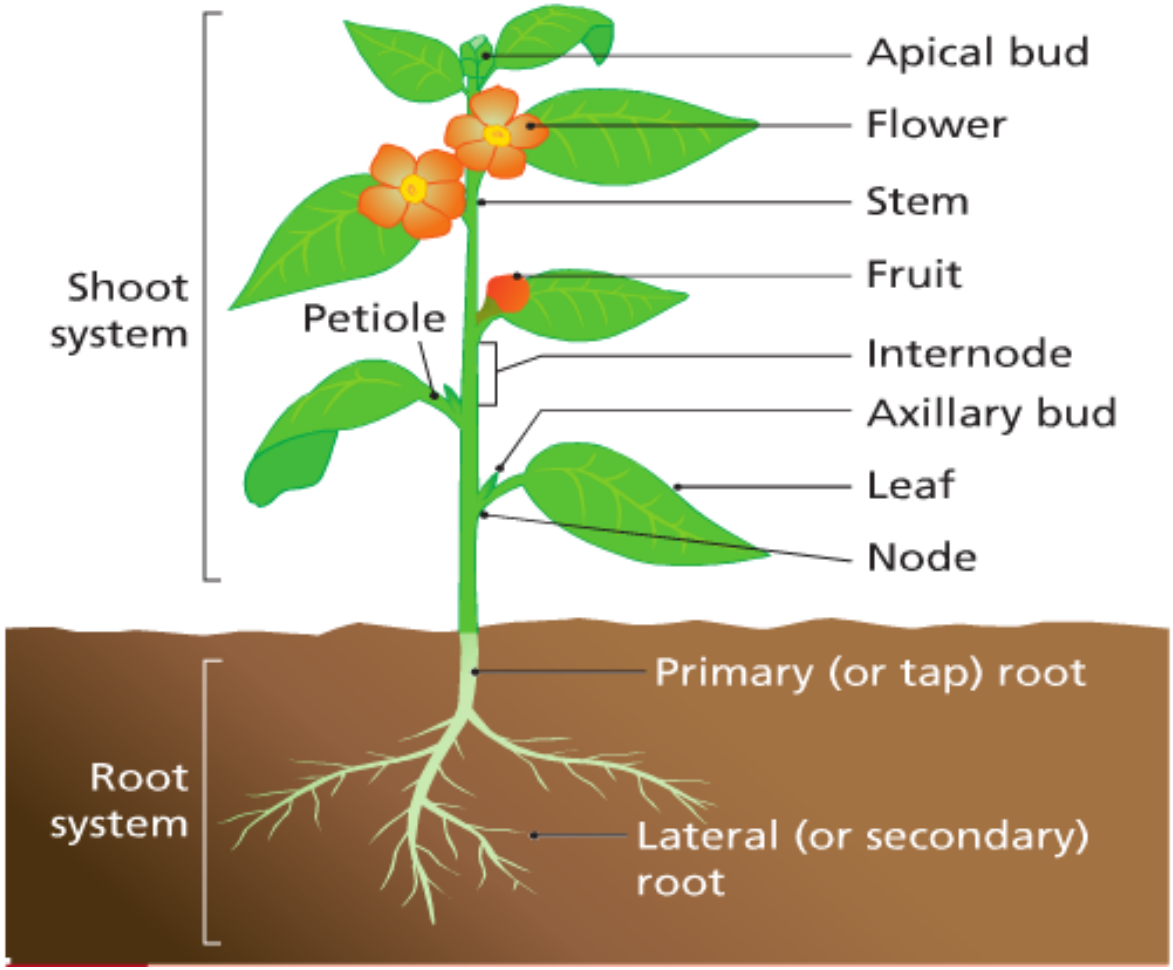
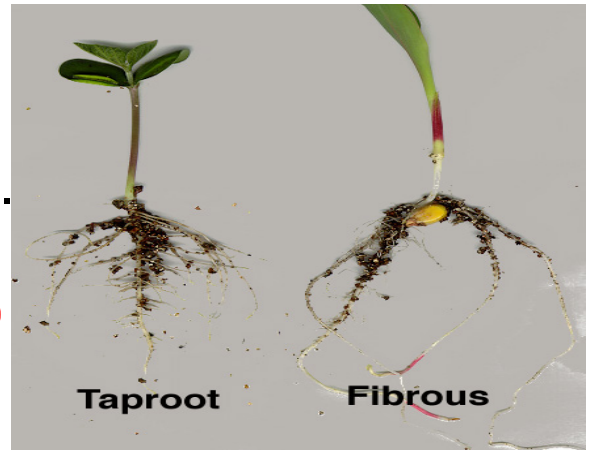


ROOTS

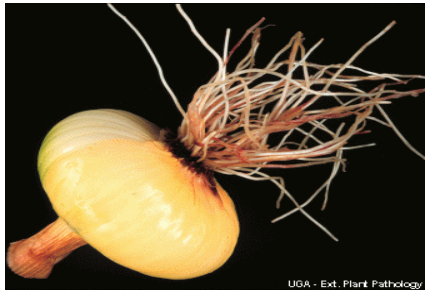
Tap Roots

These have a main root that develops from the radicle. Other roots branch from this one. The roots have millions of tiny hairs for absorbing water and minerals.(surface area)
e.g. Dandelions and Broad bean.



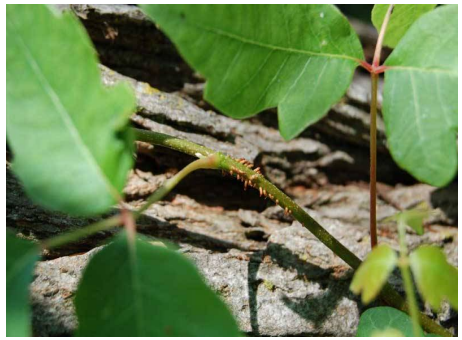
Fibrous Roots

The radicle dies away to leave a clump of equal sized roots. e.g. grass and daffodils



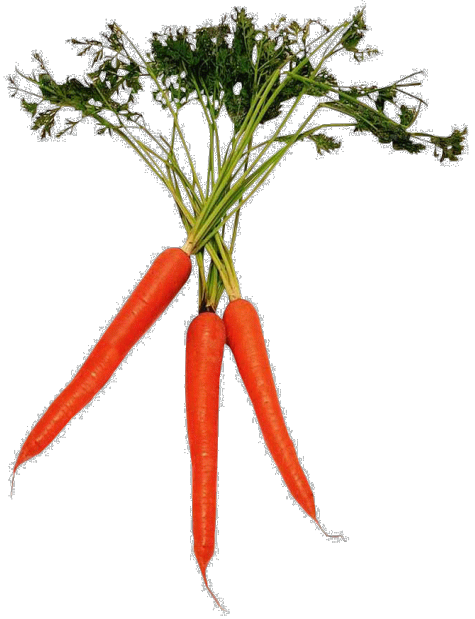
Adventitious Roots

These are roots that grow in strange places. They take advantage of a situation to put down roots and grow wherever they can.
e.g. Onion and Ivy



Functions of Roots

- Anchor the plant in the soil
- Absorb water and mineral salts from the soil
- Transport material to the shoots for photosynthesis
- Store food in some plants, e.g. carrots, turnips.



Zones of a Root

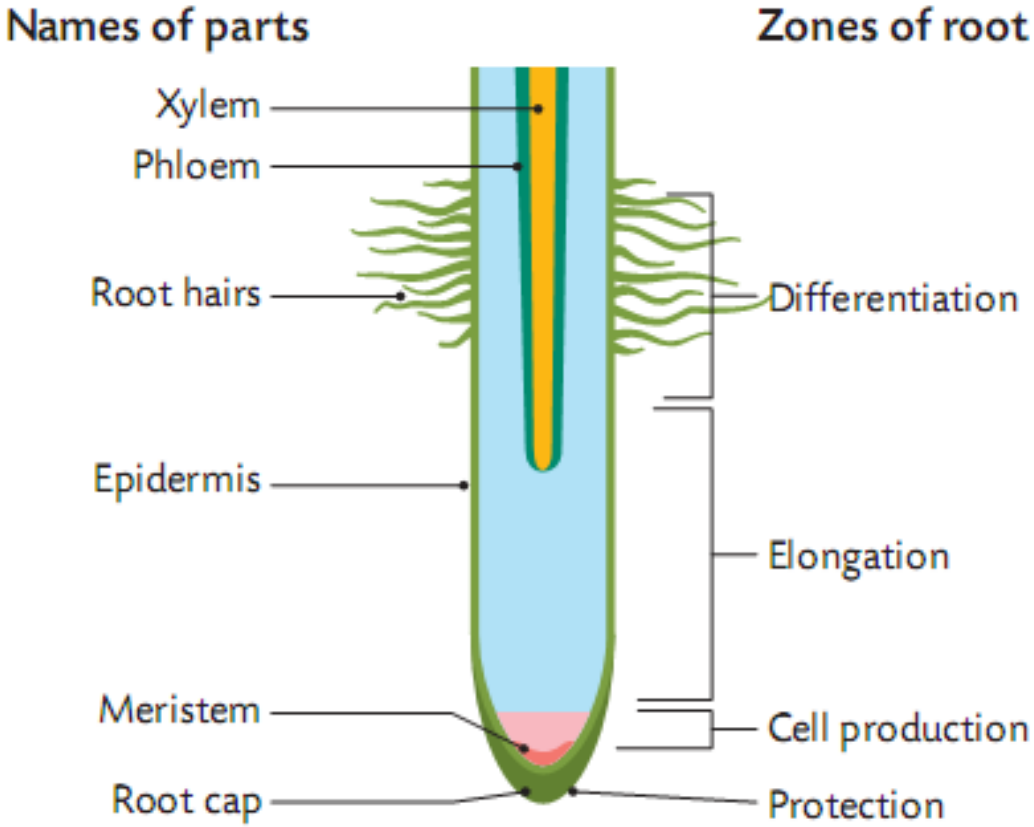
The **root cap** protects the growing tip.
The cells reproduce by **mitosis** in the tip.
The growing tip is called the apical **meristem**.

A **meristem** is a plant tissue capable of mitosis.

New cells form at the tip and move backwards. They get longer and bigger and then start doing a particular job in the root.

The **zone of differentiation** is where the cells become either dermal tissue, vascular tissue or ground tissue.

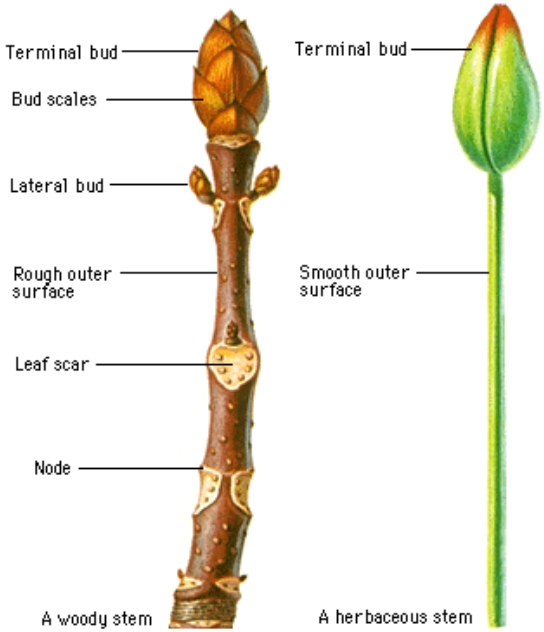
1. **Dermal tissue** protects the plant.
2. **Vascular tissue** is made of xylem and phloem.
   Xylem carries water and minerals, phloem carries food.
3. **Ground tissue** is every other type of tissue, it carries out photosynthesis.



STEMS

Herbaceous plants - do not contain wood or lignin and are green.
Woody plants - contain wood or lignin. (Bark on a tree)

Stems have holes for gas exchange called **lenticels**.
Leaves have holes underneath called **stomata**.



Functions of a Stem

- Support the aerial parts of the plants
- Transport water from roots to leaves
- Transport food from leaves to roots
- Carry out photosynthesis
- They can store food (e.g. potato)

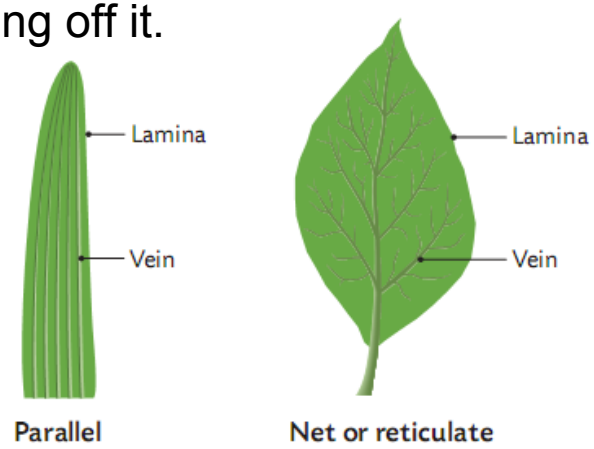
Leaves

Leaf Structure

Leaves are attached at the node by a stalk called a petiole.
The leaf has a line called the **midrib** and veins coming off it.

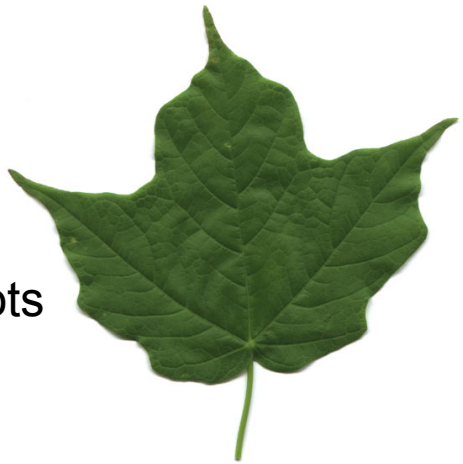
Venation

The veins on the leaf can be arranged in two ways, **Parallel** and **Net** (reticulate).



Parallel means the veins run in parallel lines.
These plants are usually monocots. e.g. grasses

Net or Reticulate means the veins come out from the midrib.
These plants are usually dicots. e.g. buttercup



Functions of a Leaf

- Leaves make food
- Gas exchange
- Lose water - allows water/minerals to enter the roots
- Store food - e.g. lettuce

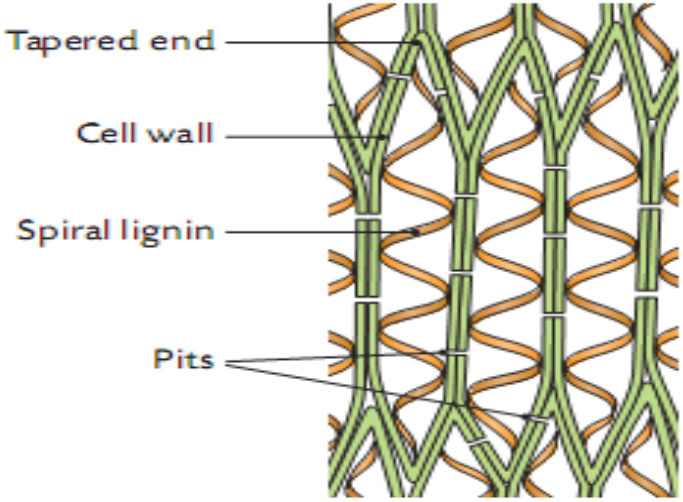
Vascular Tissue

This is made up of Xylem and Phloem.

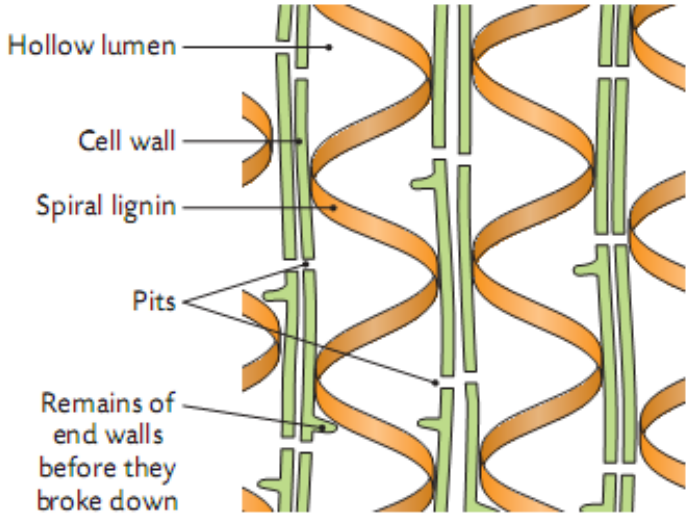
Xylem

These cells are dead, hollow, tubes.

This is made of two main types, tracheids and vessels.
The **tracheids** are long, tapered cells that overlap and are open-ended.
There are small holes in their walls called 'pits'.
The **vessels** are more advanced type of xylem cell that aren't tapered.
Both have **spiral lignin** that gives strength to the cells.
Lignified xylem is what **wood** is made of.

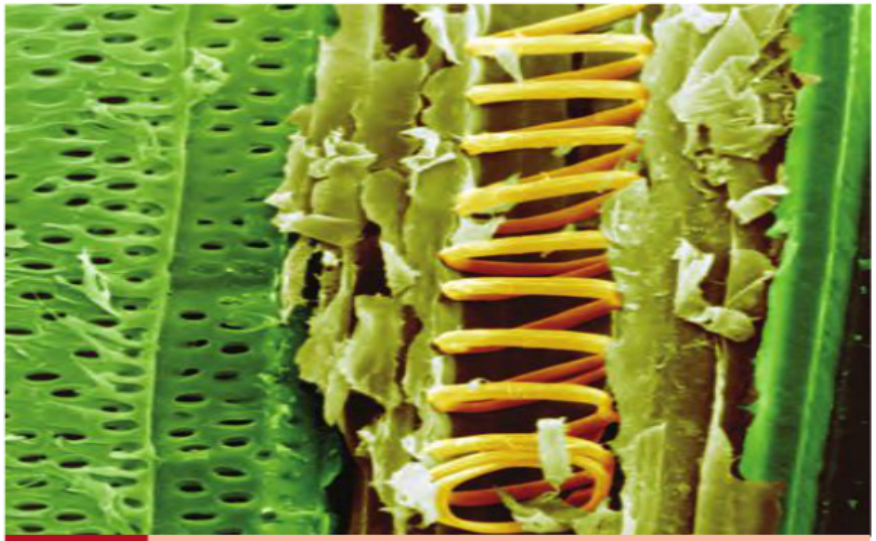


Tracheids



Vessels

Vascular Tissues



23.13 *LS of xylem: tracheids in green and a spiral of lignin in yellow/brown*

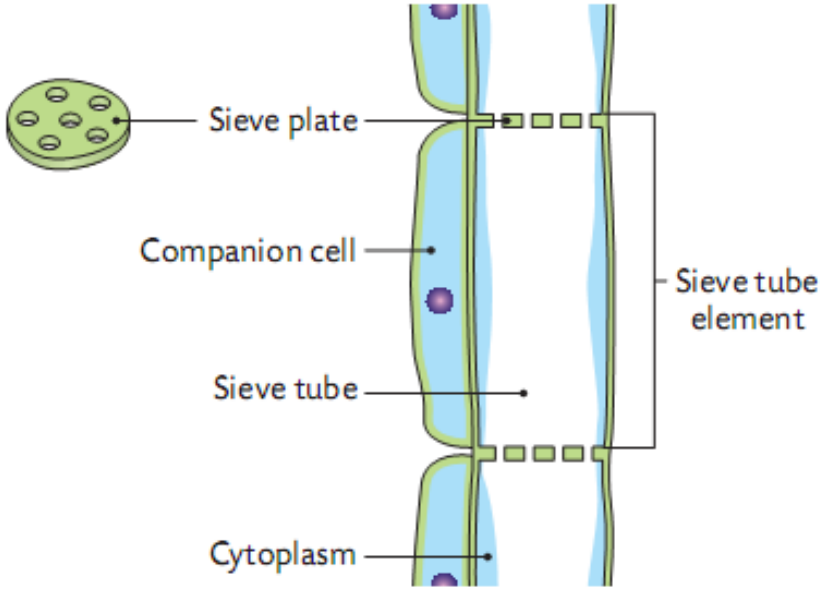
23.15 *Transverse section (TS) of sieve plates*

Phloem

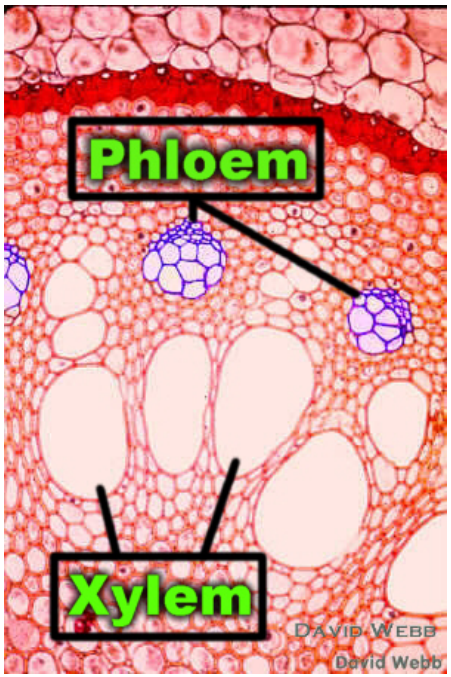
These cells are living.

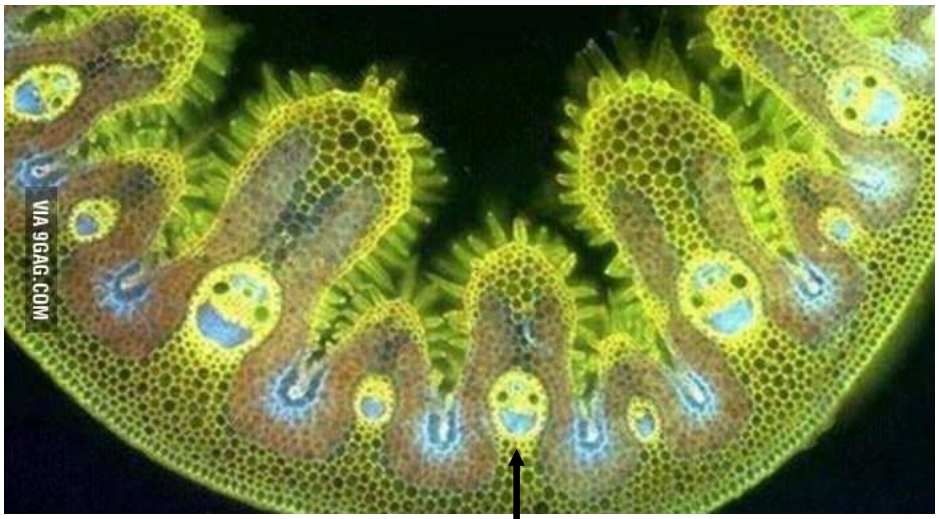
It is composed of two cells called sieve tubes and companion cells.

The sieve tubes are long, tubular structures that have little holes at the bottom of each cell (like a sieve!). The walls are made of cellulose and there is no lignin present.
The companion cell is attached to this tube and provides energy for moving food along the tubes throughout the plant.



Xylem	Phloem
Carries water and minerals	Carries food (cell sap)
Is a dead cell	Is a living cell
Has spiral lignin	Has no lignin
No companion cells	Has companion cells



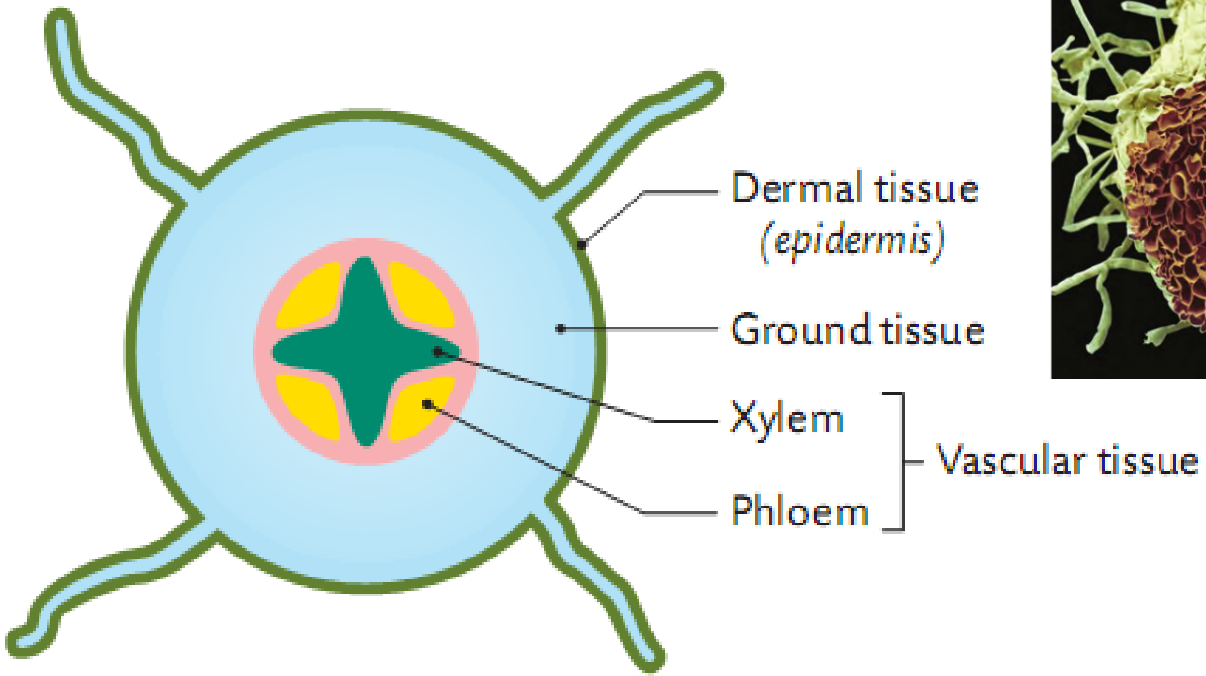


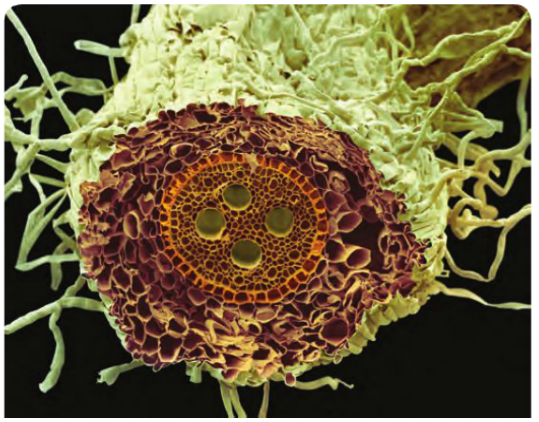
Vascular Bundle

Location of plant tissues

Roots

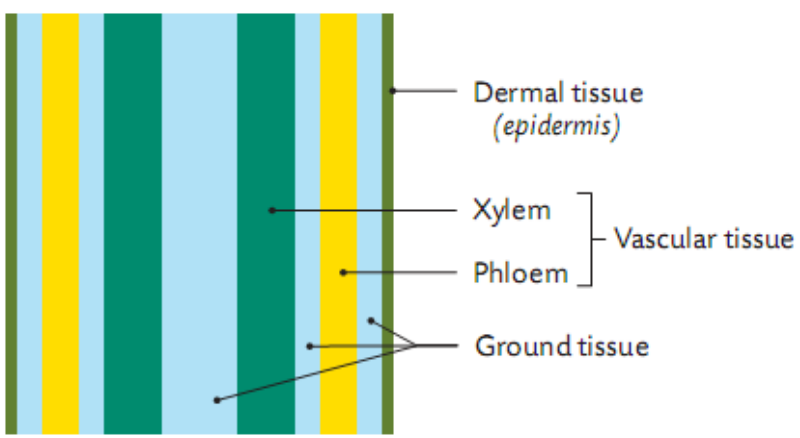
A transverse section (t.s.) of a root is shown below.
The xylem has a cross shape.

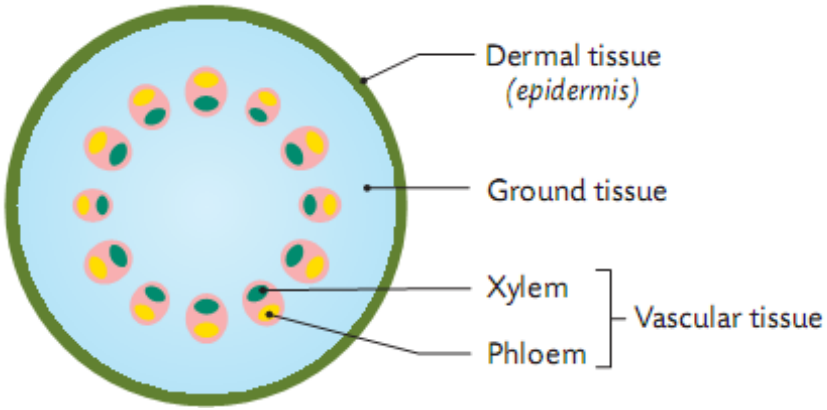


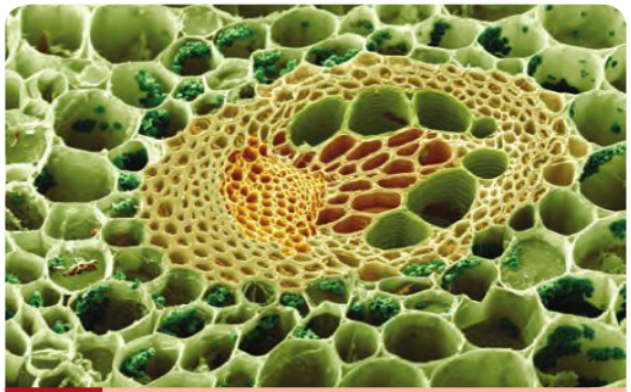


Stems

Longtitudinal (l.s.) and transverse (t.s.) sections of a stem.
The bundles have a circular shape (in a dicot).



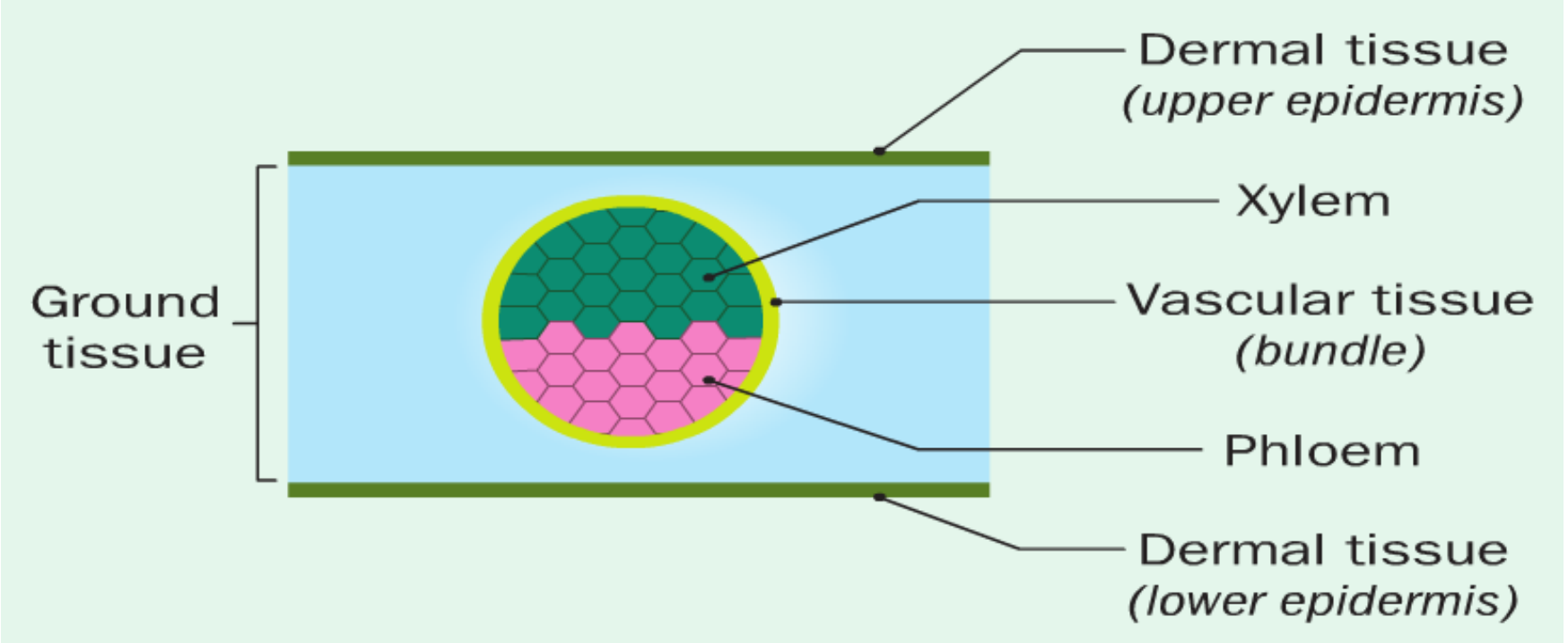




23.19 *TS of stem showing a vascular bundle: note the seven green xylem vessels in a semicircle around the orange-brown phloem*

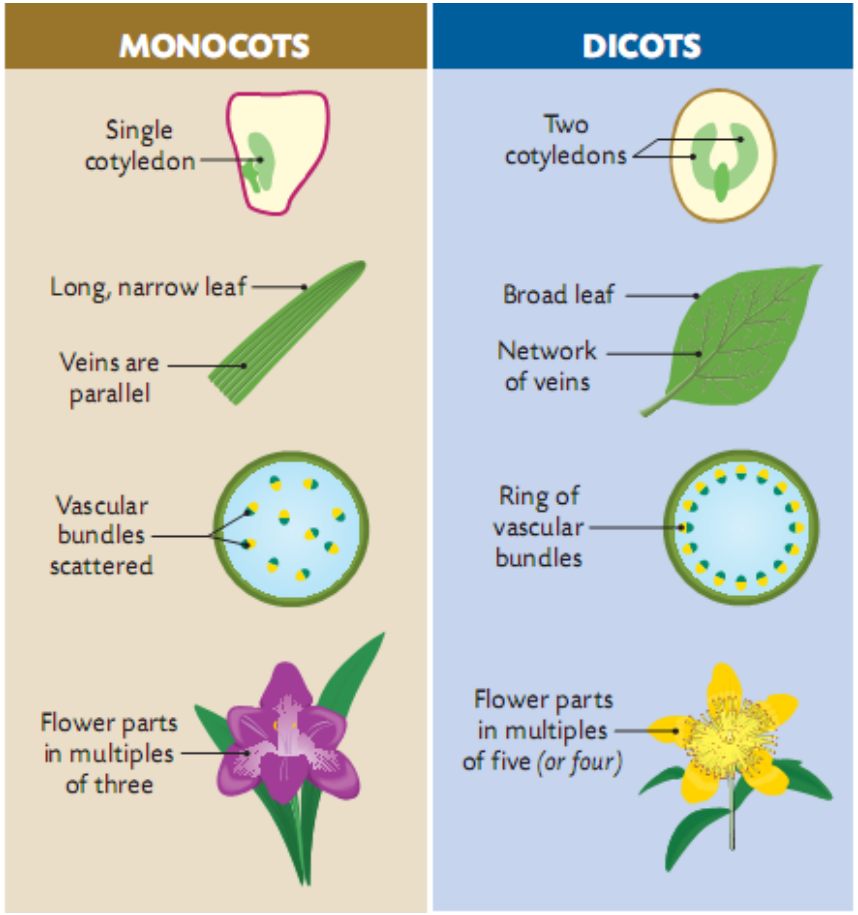
Leaves

Dicot Leaf

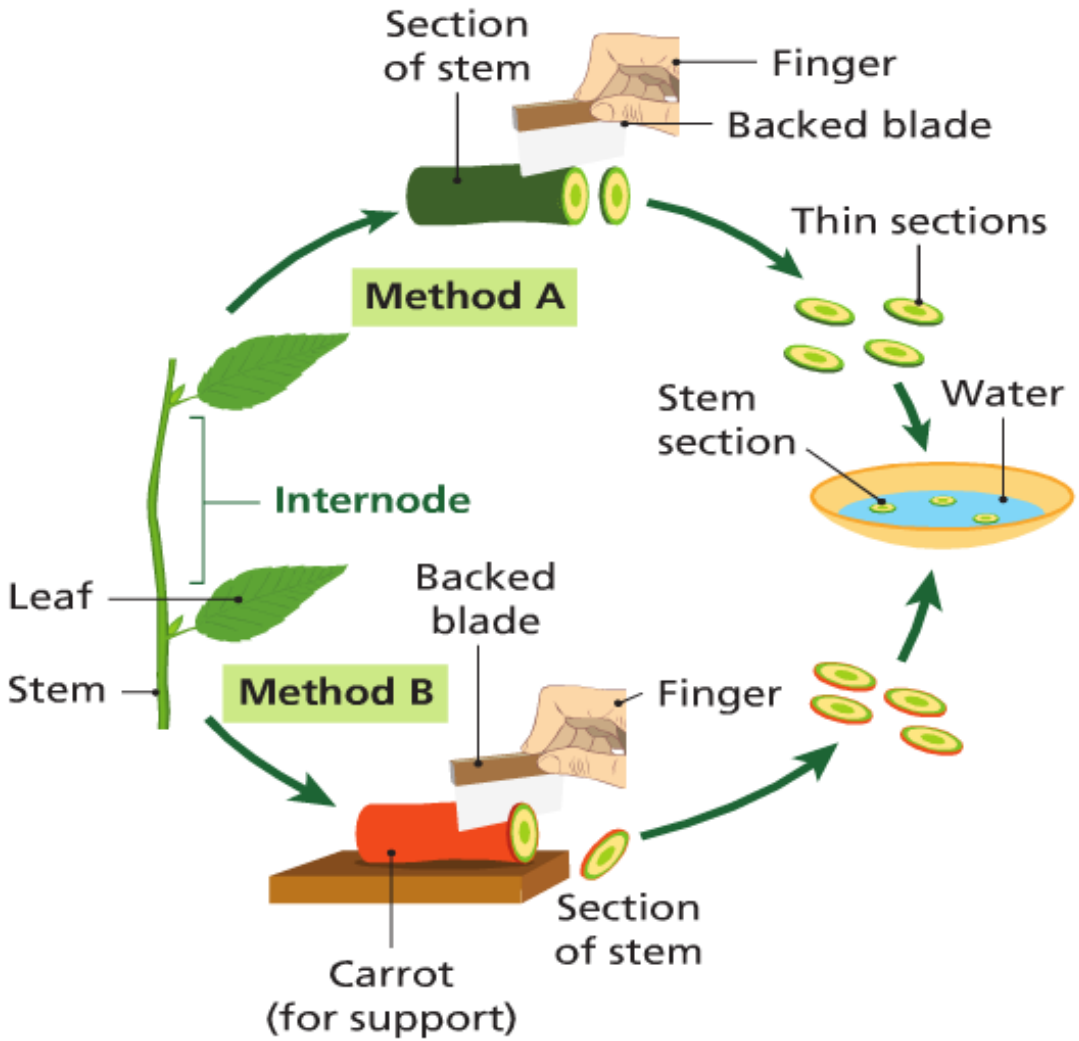


Monocots and Dicots

Monocots only have one leaf when in the seed. Mostly herbaceous. Examples are - Grasses and Daffodils.	**Dicots** have two leaves when in the seed. Mostly woody. Examples are - Beans, Sunflowers, Trees.



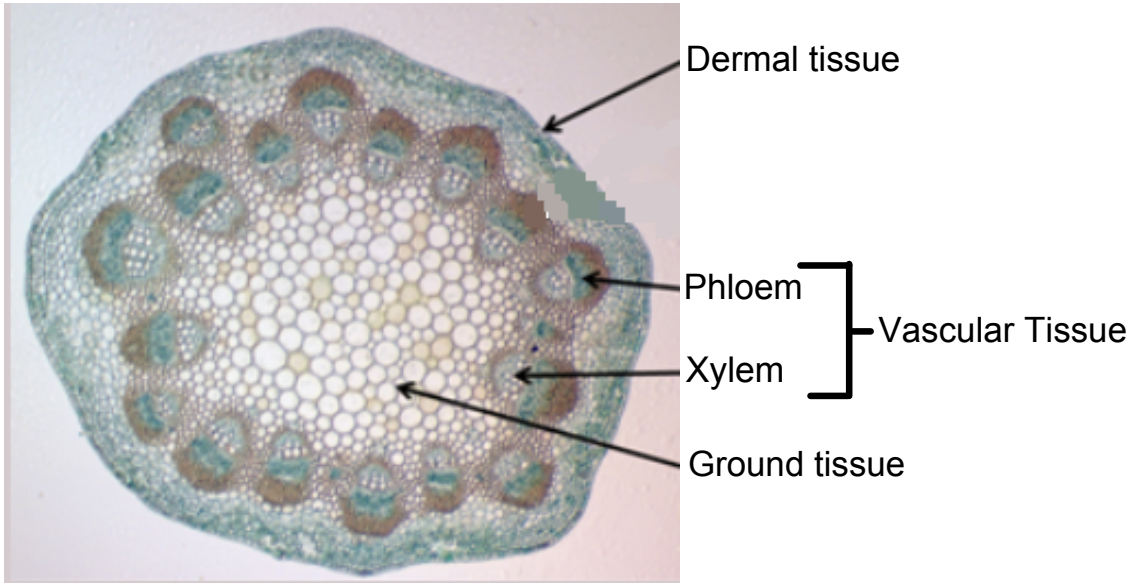
To prepare and examine a transverse section (t.s.) of a dicot stem



Results of Experiment

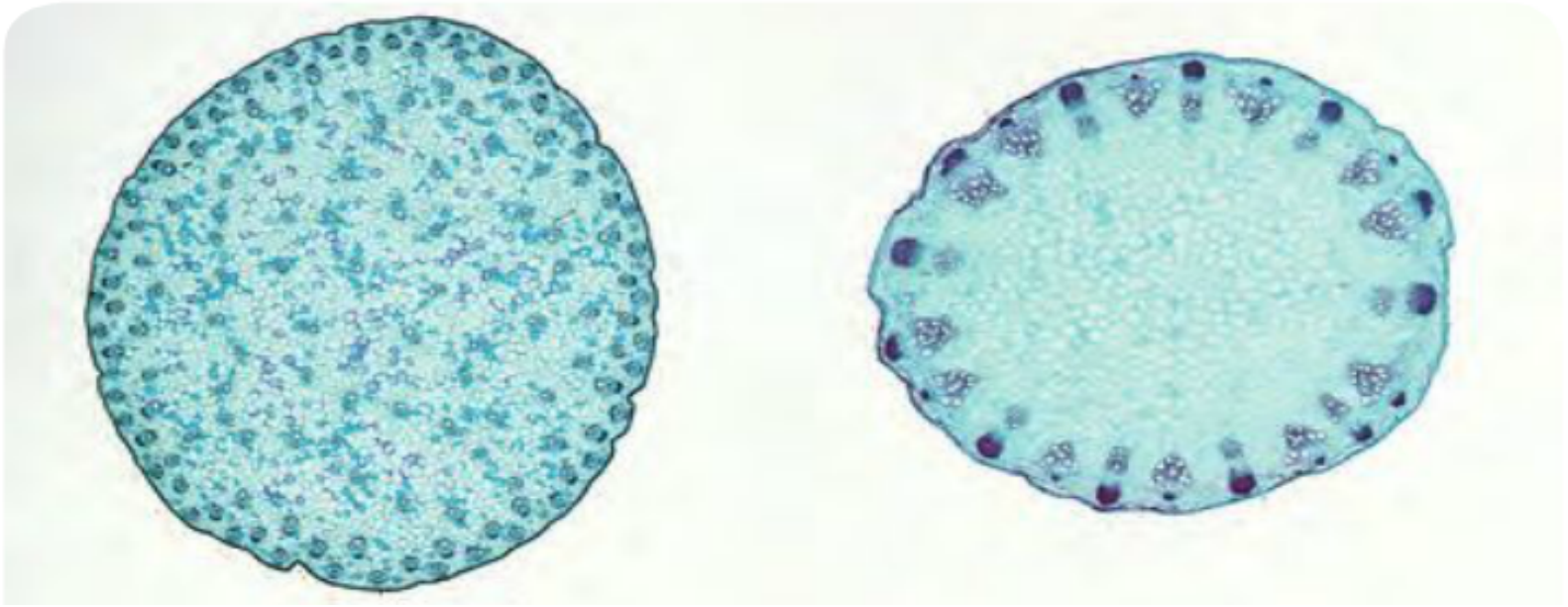
We see that the **Vascular Bundles** (xylem and phloem) are arranged in a **circle**.
The phloem faces outside of the circle while the xylem is on the inside.
We can see the Dermal tissue on the outside of the stem.
The rest of the cells are ground Tissue.

This means the plant we used was a Dicot.

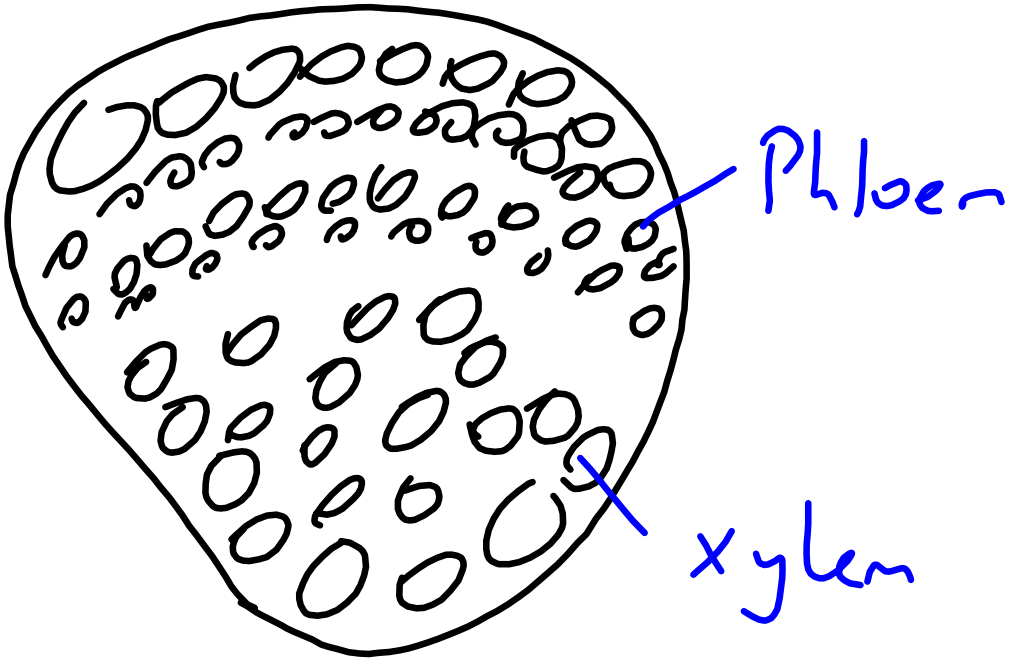


Monocot

Dicot

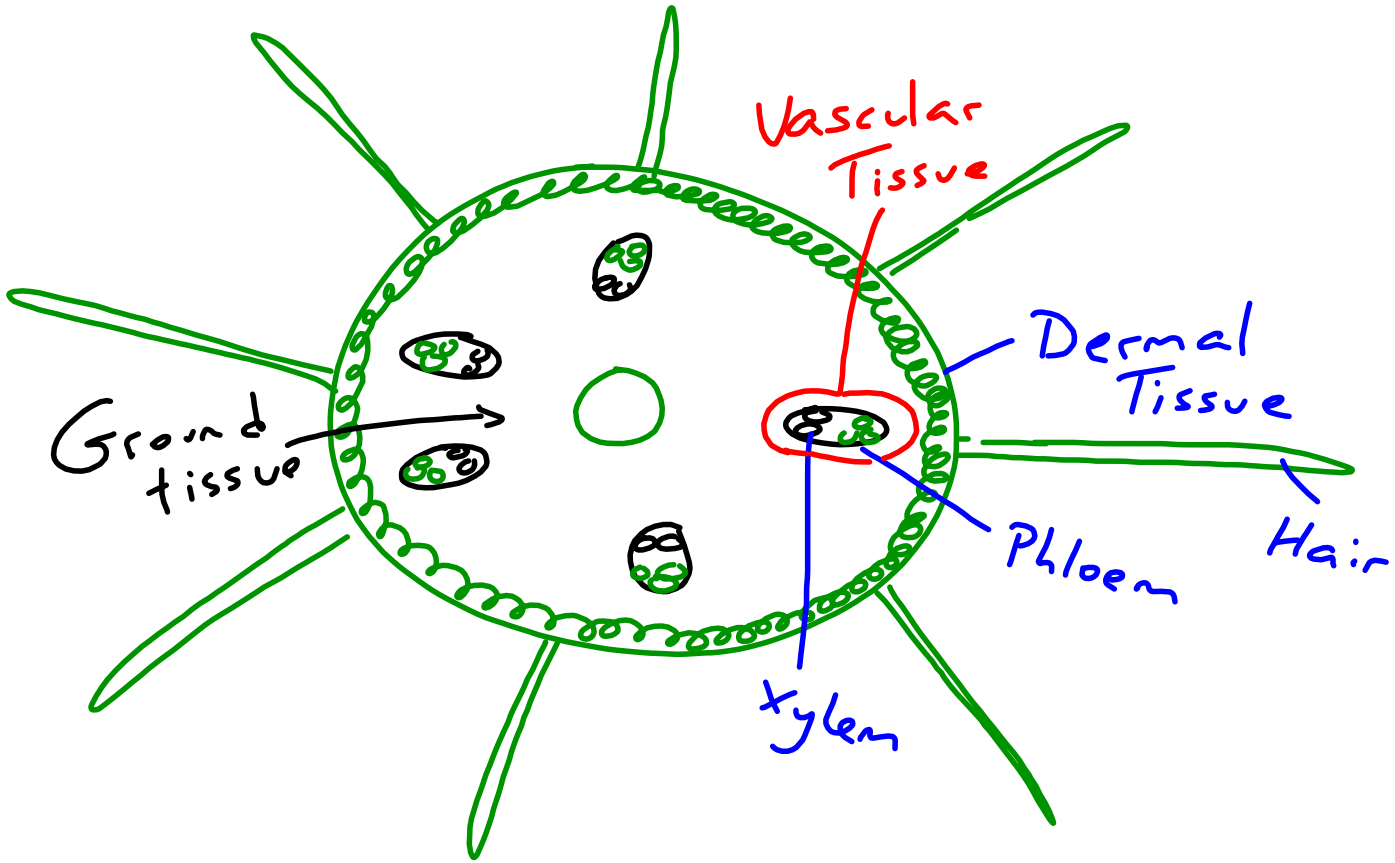


vascular bundle



in Celery.

Transverse section (t.s.) of a dicot stem - e.g. Geranium



Summary

Flowering plants are divided into:
- Underground root systems for anchorage and absorption of water and minerals
- Over-ground shoot systems, which consist of stems, leaves, flowers and fruits.

Roots can be:
- Tap roots (where one main root grows down into the soil)
- Fibrous roots (where a mass of small, branched roots emerge from the stem).

The **zones in a root** are:
- The zone of protection (root cap)
- The zone of cell production (meristem)
- The zone of elongation
- The zone of differentiation.

The **main functions of stems** are:
- To support the aerial parts
- To transport materials to and from the leaves.

Leaf venation (the pattern of veins on a leaf) is of two types:
- Parallel (typical of monocots)
- Reticulate or net (typical of dicots).

The **main functions of leaves** are:
- To make food
- To exchange gases
- To allow water loss (transpiration).

The **three main categories of plant tissues** are:
- Dermal tissue (forms a protective covering layer)
- Vascular tissue (xylem for water transport, phloem for food transport)
- Ground tissue (found between the other two tissues, carrying out a range of functions).

Xylem is a dead tissue that transports water.

Phloem is a living tissue that transports food.

Flowering plants are subdivided into monocots and dicots.

Monocots (such as daffodils and grasses) have:
- One seed leaf, or cotyledon
- Long, narrow leaves with parallel veins
- Scattered vascular bundles in the stem
- Flowering parts arranged in multiples of three.

Dicots (such as beans and oak trees) have:
- Two seed leaves or cotyledons
- Broad leaves with a network of veins
- Vascular bundles arranged in a ring in the stem
- Flowering parts arranged in multiples of four or five.

To prepare and examine a TS of a dicot stem:
- Cut thin sections of a stem
- Prepare a microscope slide using the sections
- Examine the sections under low and then high power of the microscope
- Draw a labelled diagram to show the three categories of tissue.