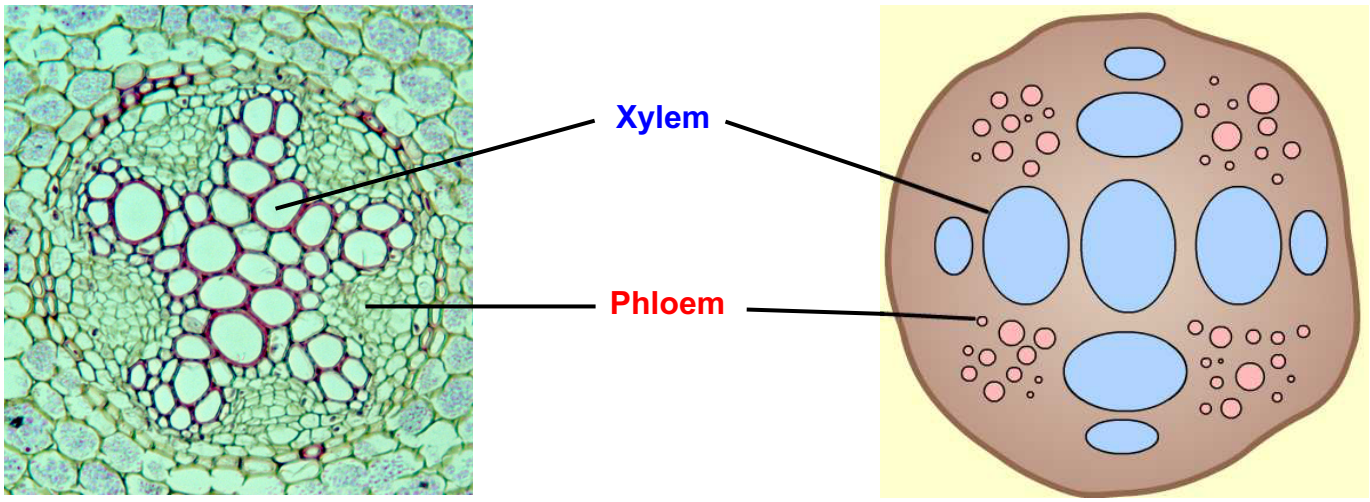
A. VASCULAR BUNDLES

These contain **two** types of vessel that transport substances around the plant:

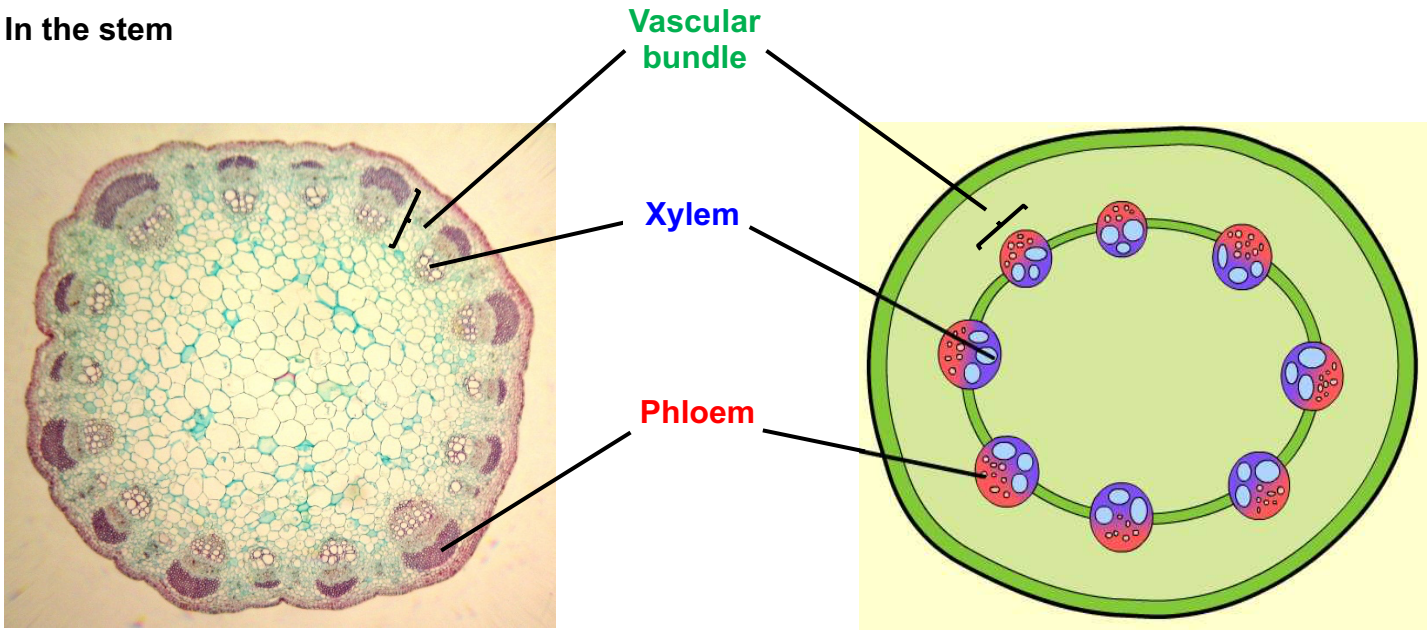
- **Xylem** - transports **water** and **mineral ions** from **roots** to **leaves**.
- **Phloem** - transports **sugar**, as **sucrose**, in **both directions**.

In the root



- Easy to remember as xylem tissue is shaped like the letter 'X', for Xylem.

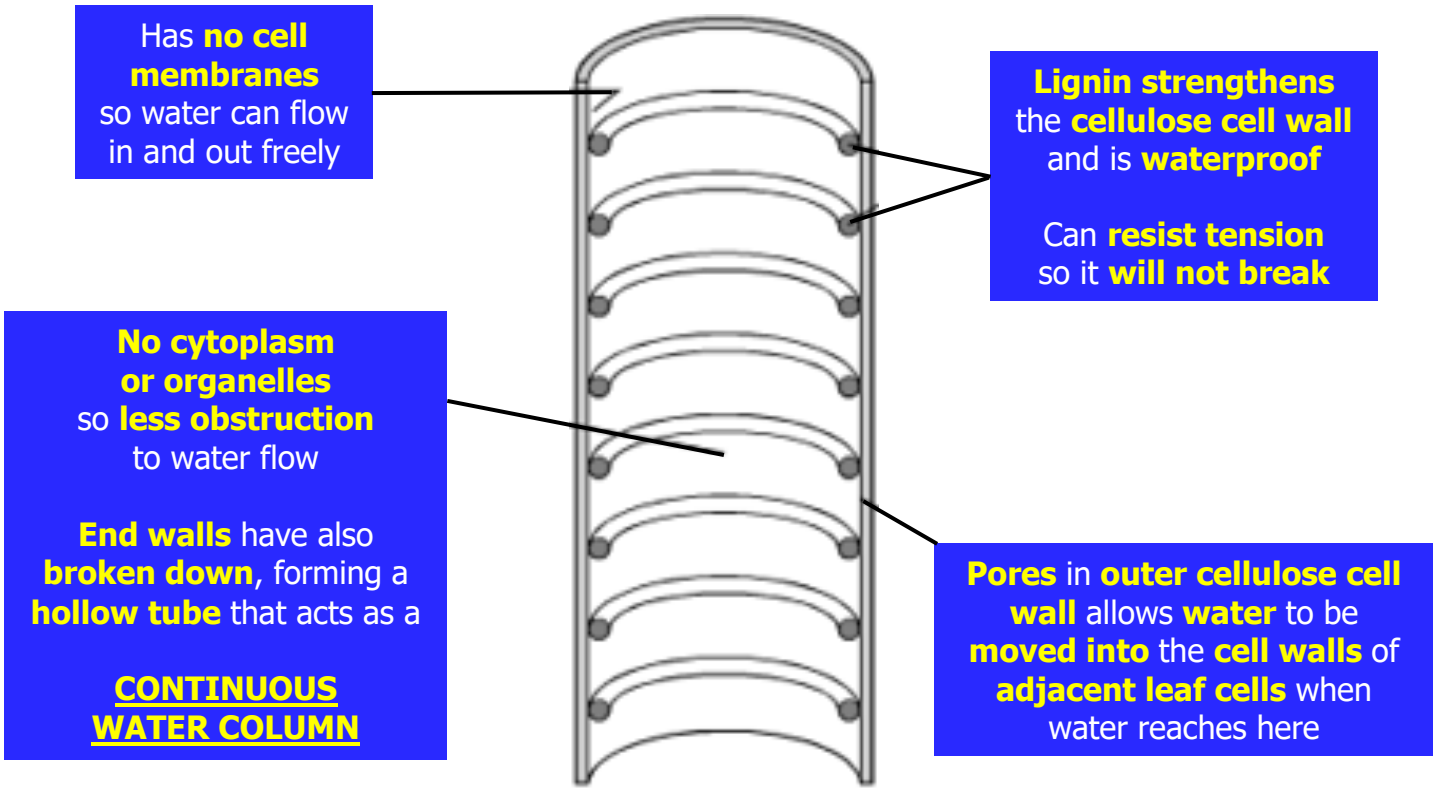
In the stem



- Xylem tissue is on the inside of the vascular bundle and phloem tissue is on the outside.

B. XYLEM TISSUE

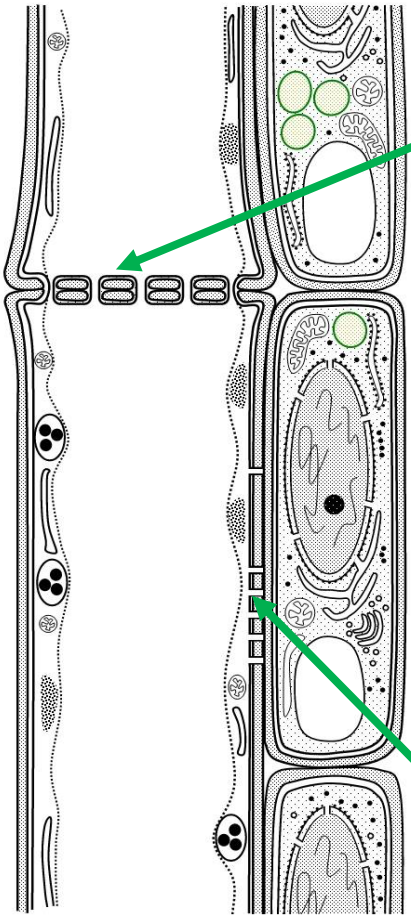
- You **do need** to be able to **draw xylem primary vessels**.
- The diagram below shows how their **structure** is **adapted** for their **function** of **transporting water** and **mineral ions**.
- Xylem vessels are **hollow tubes** made of **dead cells**, whose **end walls** have **broken down**.
- Xylem vessels are **wider** than phloem sieve tubes and have **thicker walls**.



C. PHLOEM TISSUE

- You **do not need** to be able to **draw phloem tissue**.
- The diagram below shows how its **structure** is **adapted** for the **function** of **transporting sap** (a liquid containing **dissolved sucrose**) around the plant.
- Phloem vessels are made of **living cells** and they have two units: a **sieve element** and a **companion cell**. These are **side-by-side**.

Sieve tubes **do** have a **cell membrane** (unlike xylem)



sieve plate

is a **cross wall** that **strengthens** the **sieve tube**

has **pores** that allows **sap** (dissolved sucrose) to **pass** through in **both directions**

Lumen has **no nucleus** or **organelles** so **less obstruction** of **sap flow**

sieve element/tube

transports sap containing sucrose

companion cell

provides energy for the transport of sucrose

contain **many mitochondria** to provide **energy** for **active transport**

plasmodesmata

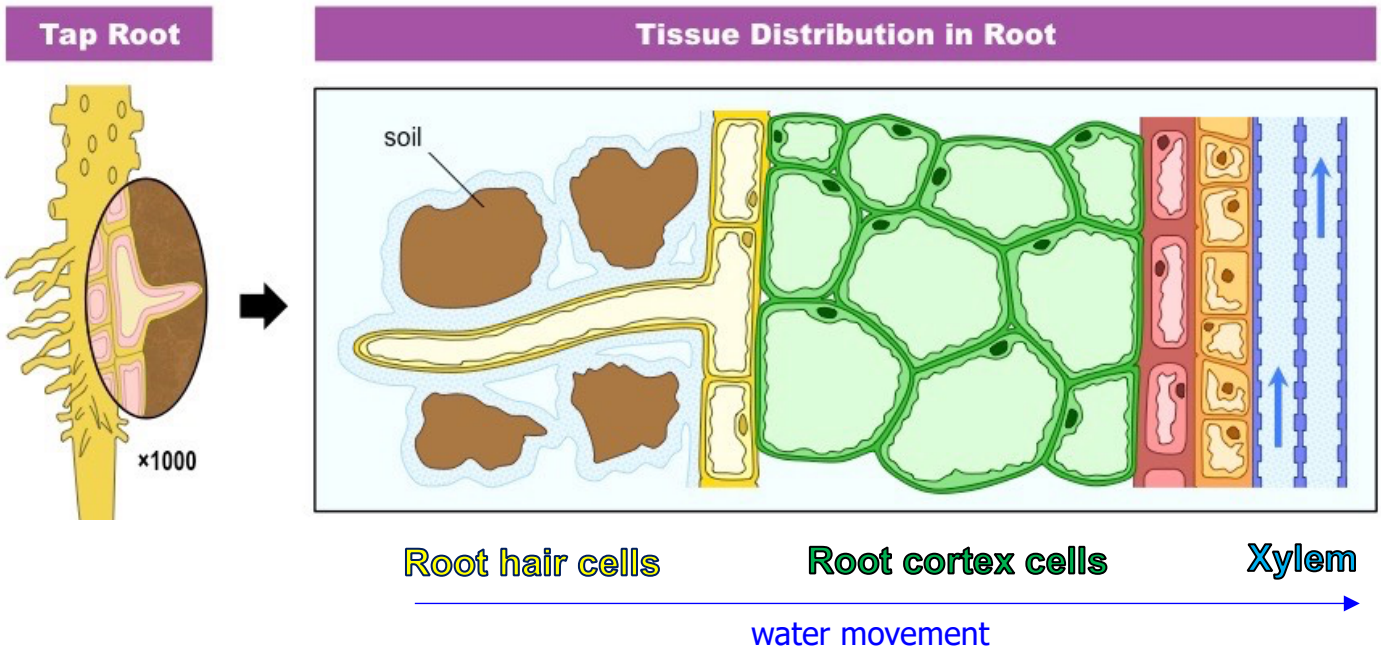
allow **transport** between a **sieve element** and its adjacent **companion cell**

D. COMPARISON OF XYLEM TISSUE AND PHLOEM TISSUE

	Xylem	Phloem
What is transported?	**Water, minerals and salts**	**Sugar (sucrose), amino acids and fatty acids**
Direction of transport?	**Unidirectional (Up)**	**Bidirectional (Up & Down)**
Made of **cells** that are:	**Dead (hollow)**	**Living (release energy)**

E. THE ROOTS

The pathway that water takes



root hair cell → root cortex cells → xylem → mesophyll cells → stomata

How minerals & water enter root hairs

- **minerals**/ions enter root hairs by **active transport**/using ATP
- (root hairs) contain **many mitochondria** for **increased respiration**/energy/ATP release (for active transport)
- (so) **solute concentration** inside **root** is **higher** (than in the soil)
- (so) **water enters** (root) by **osmosis**
- **water** is **absorbed** by **root hairs**
- (many small) root hairs create a **large surface area**
- (finally) **water** then enters **xylem vessels**