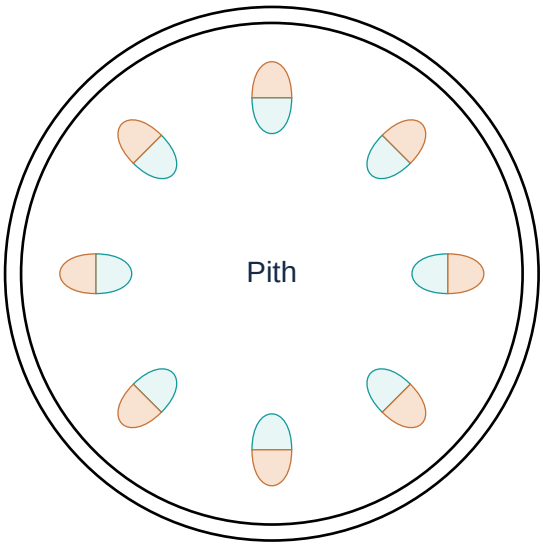
Stem: a ring of vascular bundles

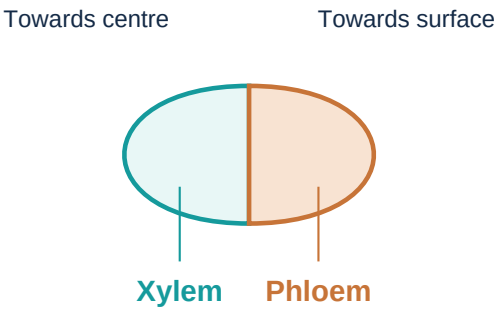
In a typical herbaceous dicot stem, the vascular bundles form a ring around the central pith. Within each bundle, xylem faces the centre and phloem faces the outside.

1. LOCATE THE RING, THEN ORIENT ONE BUNDLE



Whole stem TS

ONE BUNDLE ENLARGED



Colour key throughout: teal = xylem; orange = phloem. Simplified tissue diagrams, not individual cells or natural stain colours.

2. DESCRIBE POSITION, NOT JUST FUNCTION

Say: bundles form a ring; xylem is on the inner side of each bundle; phloem is on the outer side. Avoid saying that all stem xylem is at the centre: the pith occupies the centre.

3. KEEP THE TWO TISSUES DISTINCT

Xylem carries water and mineral ions. Phloem carries organic solutes such as sucrose. These roles identify the tissues, but a distribution description must state where they are. Cell structure is covered in the next lesson.

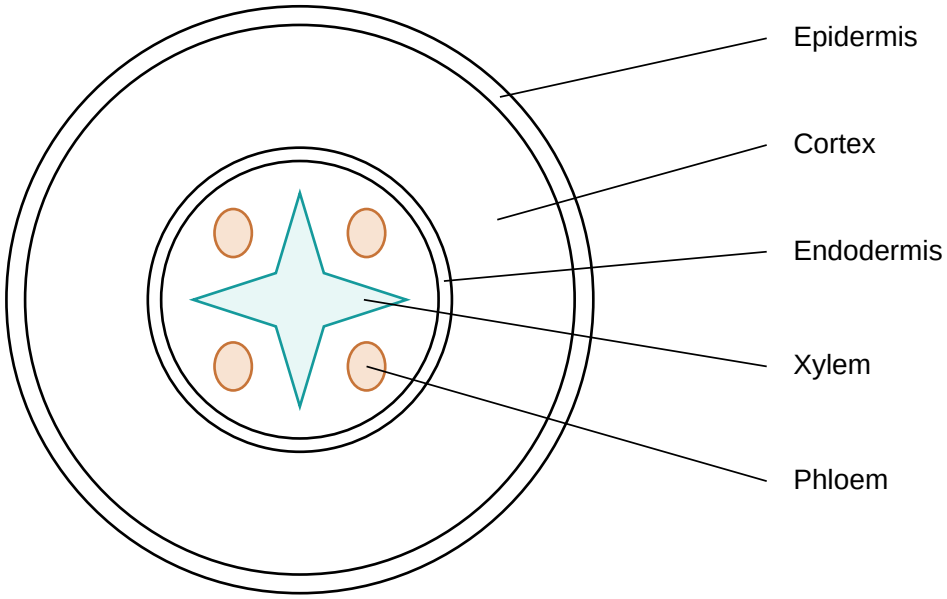
Stem bundle arrangement and tissue roles: OpenStax Biology 2e, section 30.2.

Scope: Cambridge Biology 9700 syllabus, section 7.1, outcome 2, p. 26.

Root: central xylem, phloem between

In a typical young dicot root, xylem occupies the centre and extends into arms. Phloem occurs in separate regions between the xylem arms, within the central vascular cylinder.

1. LOOK INSIDE THE ENDODERMIS



Teal star = xylem tissue; orange ovals = phloem regions. Four arms are illustrative, not a fixed number for every dicot root.

2. USE "BETWEEN THE ARMS" PRECISELY

Phloem lies between neighbouring arms of xylem, not inside a xylem vessel and not as a complete outer ring. The endodermis is a boundary around the vascular cylinder; the broad cortex lies outside it.

3. COMPARE ROOT WITH STEM

The stem has separate bundles around a pith; the young dicot root has central xylem with alternating phloem regions. Use the observed arrangement to distinguish them. Match the specimen rather than copying an idealised shape.

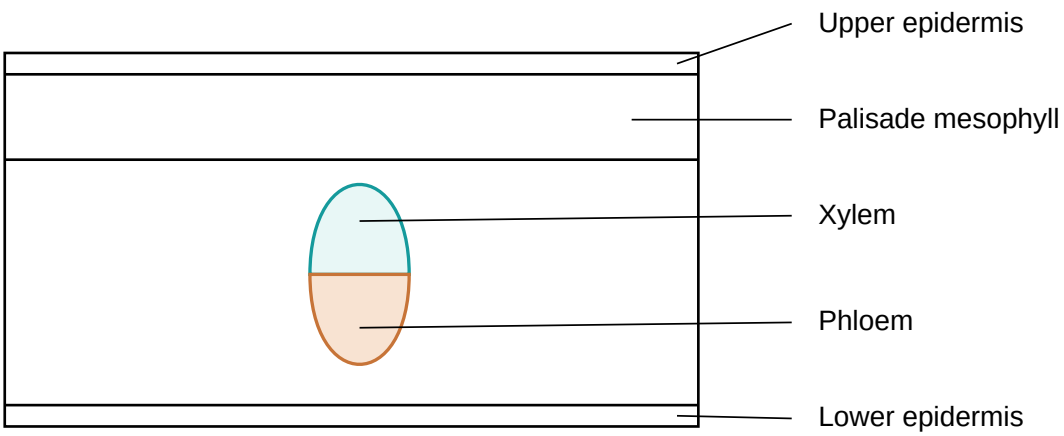
Root vascular arrangement: OpenStax Biology 2e, section 30.3.

Scope: Cambridge Biology 9700 syllabus, section 7.1, outcome 2, p. 26.

Leaf: xylem above, phloem below

Leaf veins contain vascular bundles. In a typical dicot leaf, xylem is nearer the upper surface and phloem nearer the lower surface. Describe position relative to the leaf, not the top of a rotated image.

1. ORIENT THE LEAF SURFACES FIRST



Part of the lamina in transverse section; the midrib is not shown. The teal and orange regions together represent one vein bundle. Colours aid teaching, not plan-drawing practice.

2. DO NOT CONFUSE ORIENTATION WITH FLOW

"Upper" and "lower" identify tissue positions in the section. They do not mean xylem always moves towards the top of the page or phloem always moves down the plant. This view shows arrangement, not a transport-direction diagram.

3. THREE LOCATION RULES

Stem: xylem inside and phloem outside each bundle in a ring. Root: central xylem with phloem between the arms. Leaf: xylem towards the upper surface, phloem towards the lower surface. These are typical young herbaceous dicot arrangements.

Leaf vascular bundles and orientation: OpenStax Biology 2e, section 30.4.

Scope: Cambridge Biology 9700 syllabus, section 7.1, outcome 2, p. 26.