

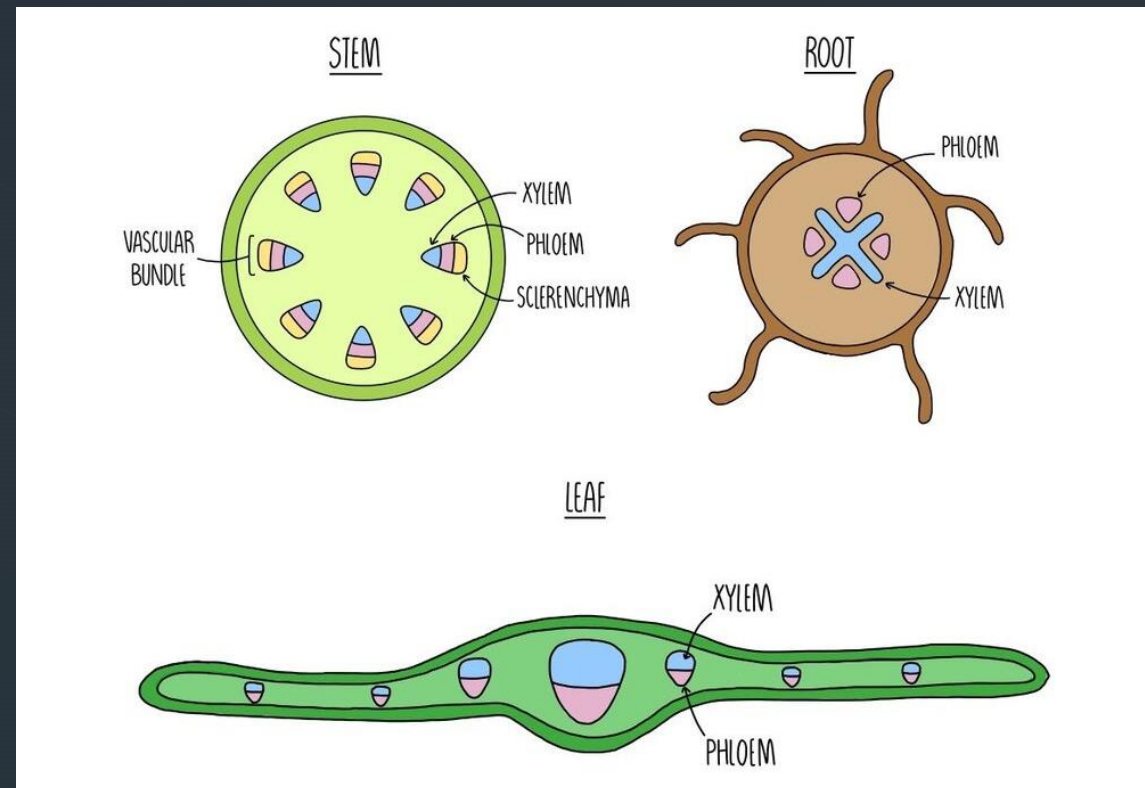
The Vascular Tissue System

Anto Joseph



- The vascular Tissue system consist of a number of vascular bundles which are found to be distributed in the stele.
- The stele is the central cylinder portion of stem and the root, commonly surrounded by endodermis, and consists of vascular bundles, pericycle, pith and medullary rays.

- In root separate xylem and Phloem strands are found.



Functions of Vascular tissue system

- Conduction of water and nutrients from roots to leaves
- Translocation of prepared carbohydrates from leaves to other storage organs and growing regions of the plant



Procambium

- The vascular bundle elements are derived from procambial stands of the primary meristem.
- The meristematic tissue from which primary phloem and xylem are formed is called procambium.

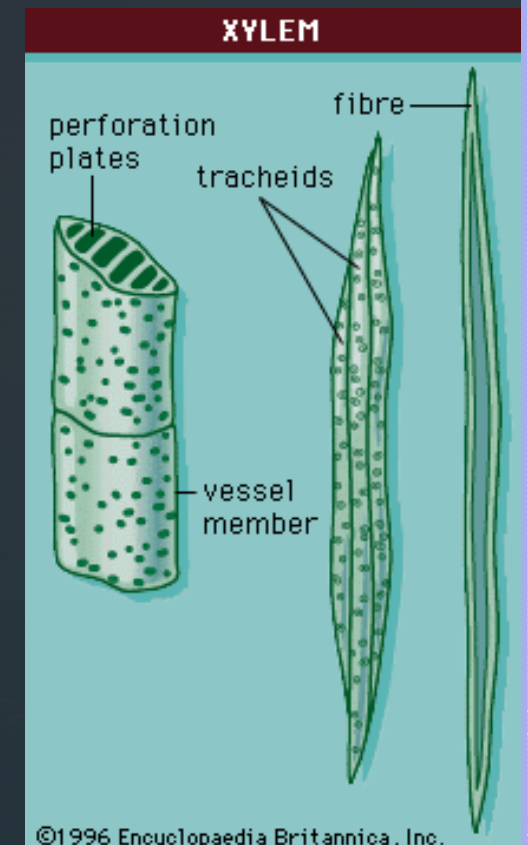
Constituents of a vascular bundle

Three major Zones

- Xylem or wood
- Phloem or bast
- Cambium

Xylem

- Xylem is composed of Vessels, Tracheids, Wood fibres, Wood parenchyma

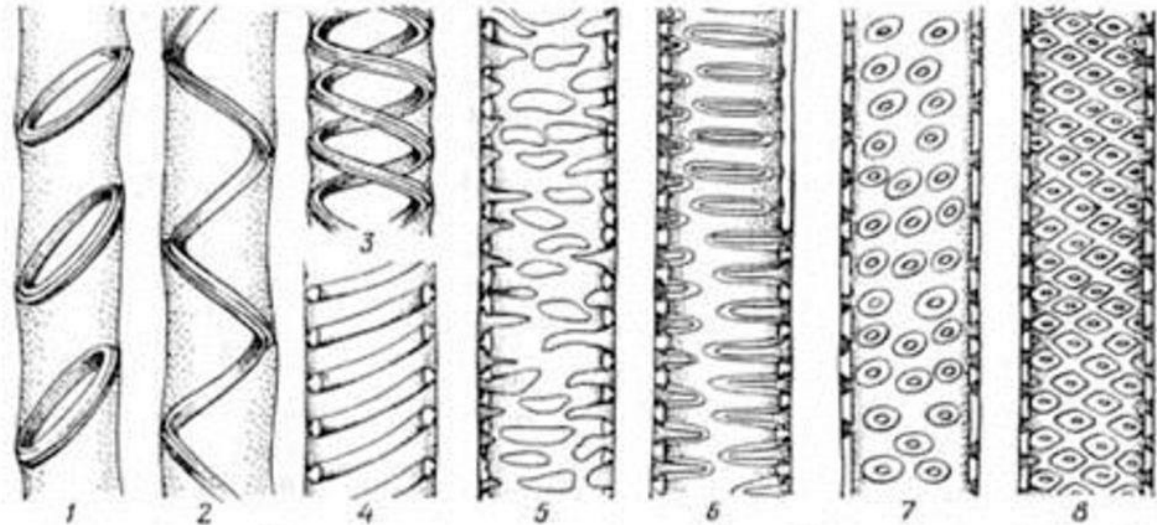




Xylem vessels

- Tube like structures

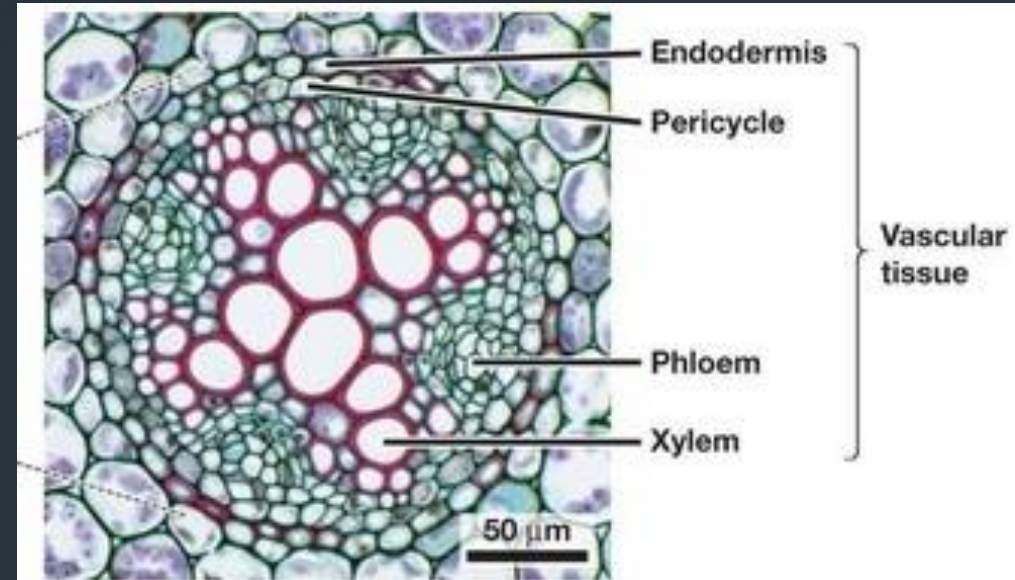
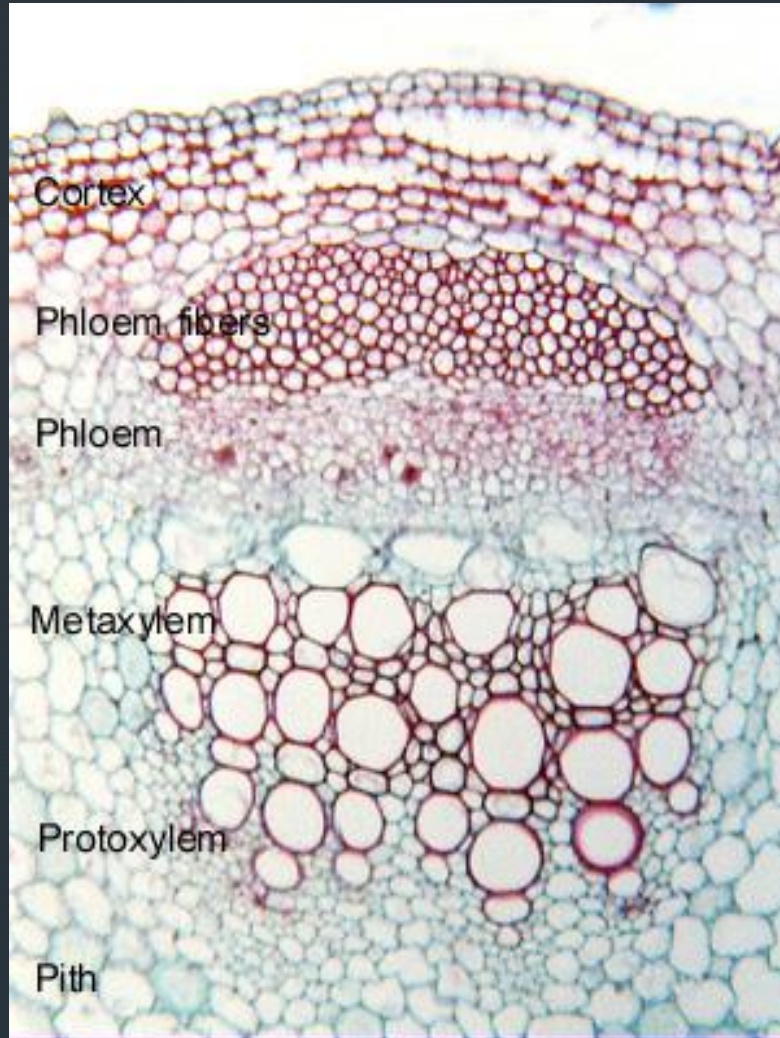
Secondary Wall Thickenings





- Vessels and tracheids aid in the conduction of water
- Xylem parenchyma – Living tissue – Storage
- Xylem fibres- Give mechanical support to the plant body.

- The first formed xylem is called Protoxylem.
- It is a complex tissue made up of tracheids, Vessels and parenchyma cells
- The vessels in protoxylem possess annular, spiral, Scalariform thickenings
- In stem, it lies towards the centre of the axis, where as in roots it lie towards the periphery.
- The vessels of the protoxylem have smaller cavities.
- The xylem which develops afterwards with reticulate and pitted vessels and some tracheids is called meta xylem.





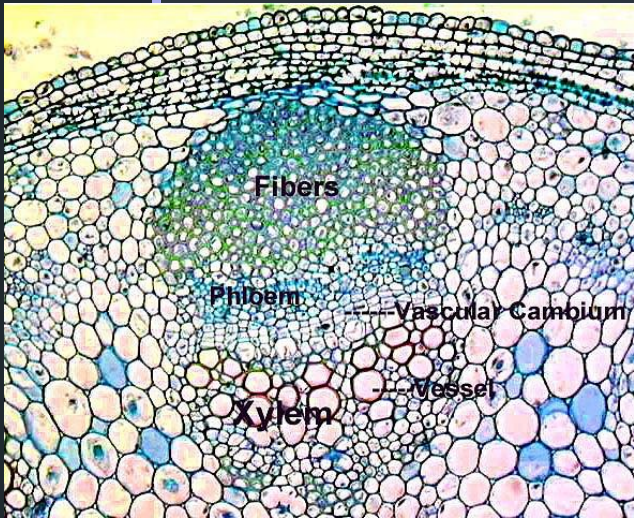
- Exarch xylem – Centripetal development
- Endarch Xylem – Centrifugal development



Phloem

- Found away from centre of the axis towards the periphery
- Consist of Sieve tubes, Companion cells, Phloem parenchyma and phloem fibres
- The first cells of the phloem to mature is called protophloem
- It contains narrow sieve tubes
- Phloem with bigger sieve tubes is called metaphloem.

Cambium



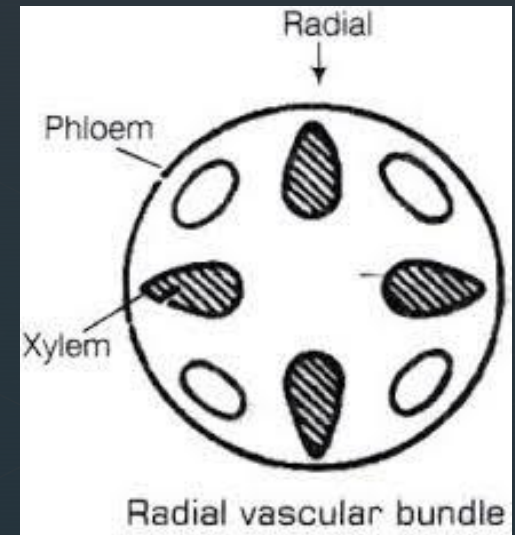
- The thin strip of primary meristem which is seen in between xylem and phloem of dicot stem is called Cambium.
- Cells of cambium are thin walled.
- A vascular bundle with cambium is known as open vascular bundle
- A vascular bundle with out cambium is known as Closed vascular bundle

Types of vascular bundles

- Radial
- Conjoint
- Concentric

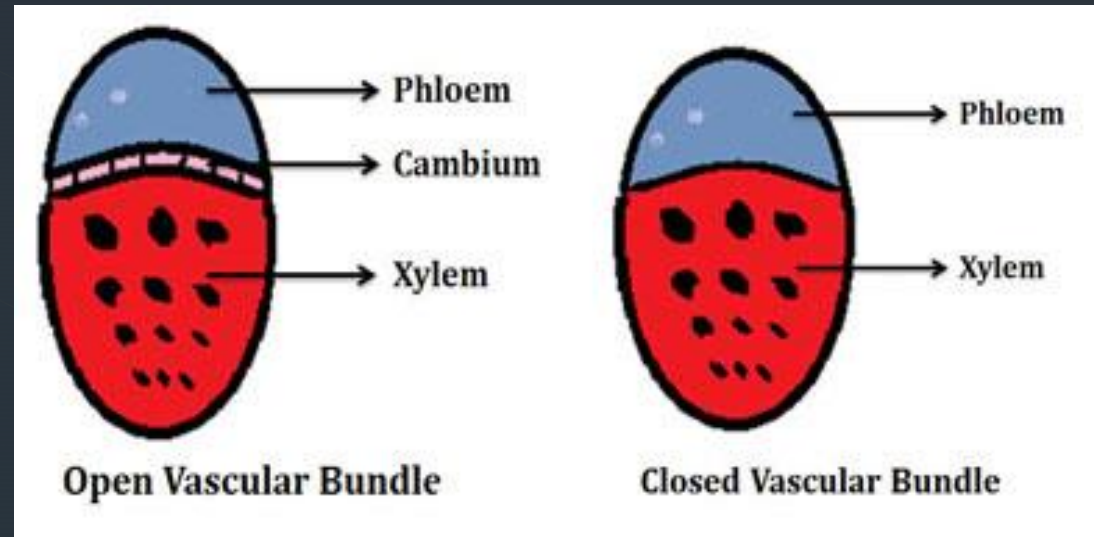
Radial Vascular bundle

- Those in which the xylem and phloem lie radially side by side
- Most primitive type
- Eg: Roots of angiosperms.

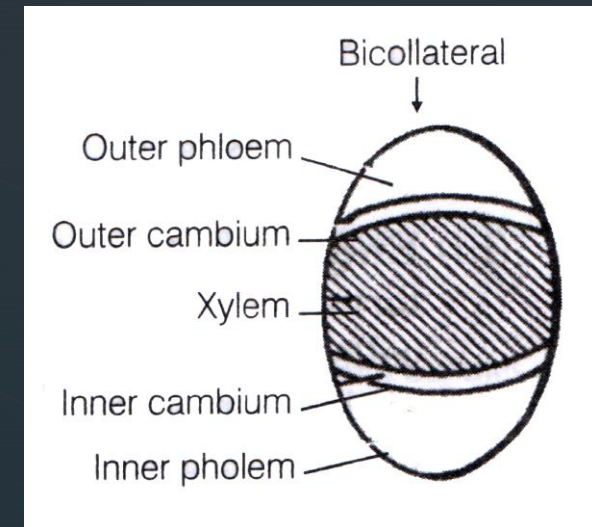


Conjoint Vascular Bundle

- Xylem and phloem together form a bundle
- Two subtypes
- Collateral – Xylem and phloem lie together on the same radius. Xylem lie inwards and phloem outwards. Here phloem occurs on one side of the xylem strand
- In dicot stem – cambium is present in between xylem and phloem - Collateral open vascular bundles
- In monocot stem cambium is absent in between xylem and phloem – Collateral Closed vascular bundles.



- Bicollateral vascular bundles – Phloem is found to be present on both sides of xylem
- Simultaneously two cambial strips also occur.
- Such bundles are commonly found in the members of Cucurbitaceae.
- These bundles are always open.

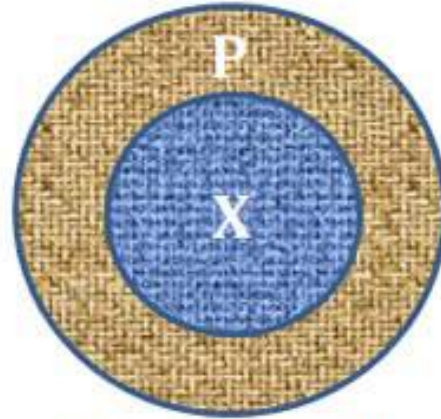


Concentric Vascular bundles

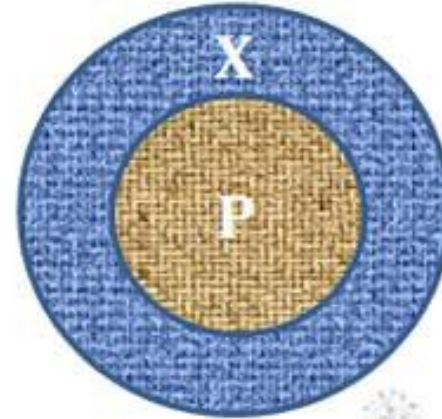
- Those in which one type of vascular tissue surrounds the other
- Such bundles are always closed
- Two subtypes – Amphicribal and Amphivasal
- If the xylem surrounds the phloem – Amphivasal bundle ; Eg – *Dracaena* (leptocentric type)
- If the phloem surrounds the xylem – Amphicribal bundle ; Eg – Ferns (Hacrocentric)



Concentric Vascular Bundles



Amphicribal



Amphivasal

