

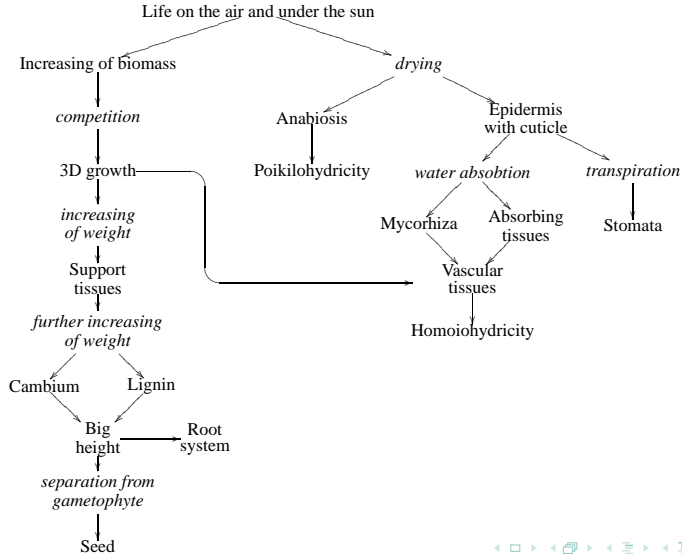
Introduction to Botany. Lecture 5

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Origin of organs and tissues



Outline

- 1 Meristems
- 2 Vascular tissues
 - Xylem
 - Phloem
- 3 Other tissues
 - Periderm

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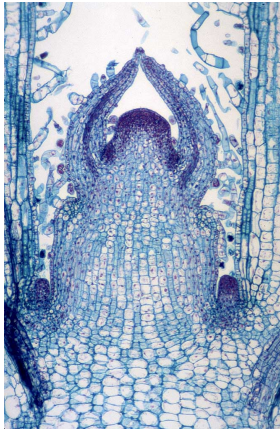
Outline

- 1 Meristems
- 2 Vascular tissues
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 - Phloem
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 - Periderm

Apical meristems

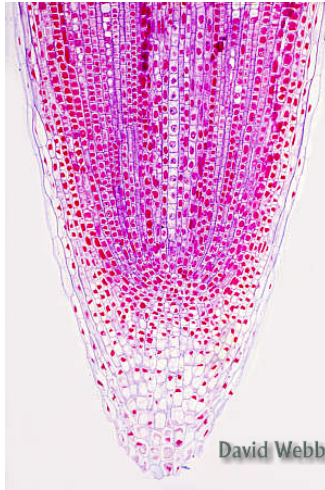
- Centers of plant development
- Locate on the very ends of roots (RAM) and shoots (SAM)
- Produce intermediate primary meristems which form all primary tissues

SAM



Coleus sp. stem apical meristem (LM $\times 100$)

RAM



Corn (*Zea mays*) root apical meristem (© D. Webb)

Lateral meristem: Cambium

- Originates from procambium which in turn originates from apical meristems
- Usually arises within vessel bundle or vessel cylinder, right between two vascular tissues
- Main function: produces secondary vascular tissues

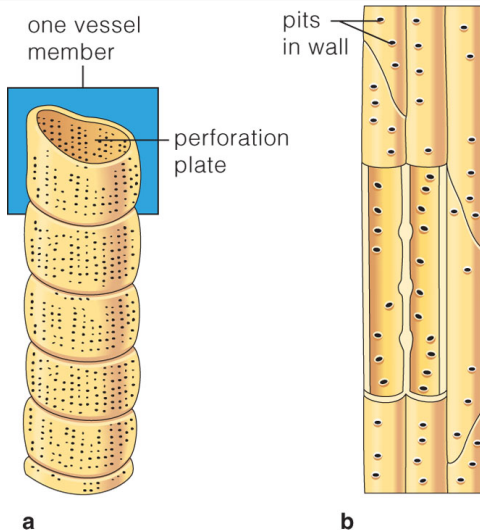
Primary and secondary tissues

- Primary tissues originate from stem or root apex through primary meristems
- Secondary tissues originate from lateral meristems

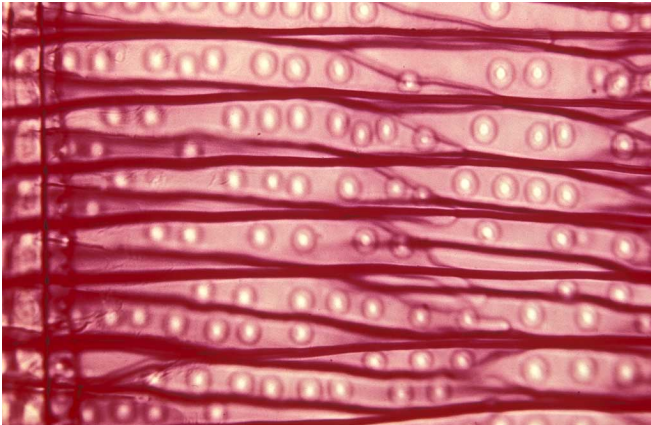
Xylem

- Occurs in vascular bundles or vascular cylinder
- Types of cells: tracheary elements (tracheids and vessel members), fibers, and parenchyma
- Tracheids have pits; vessel members have perforations; all of them are dead cells
- Primary xylem has mostly tracheids and vessels with scalariform perforations; secondary xylem has mostly vessels with open perforations
- Xylem elements (except parenchyma) are rich of lignin and are main components of wood
- Main functions: water transport and mechanical support

Tracheids vs. Vessel members



Tracheids



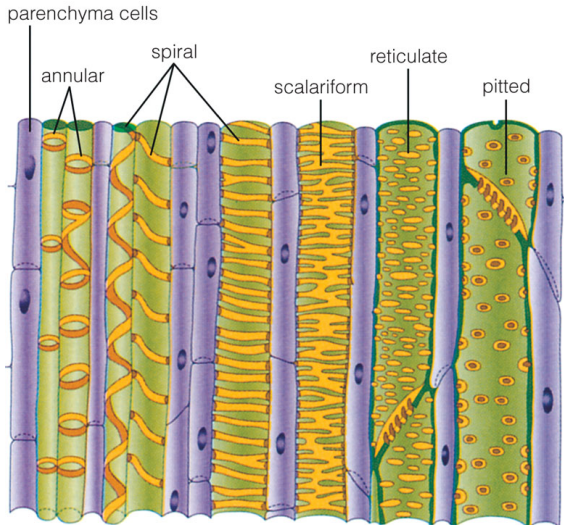
Pine (*Pinus* sp.) tracheids with pits

Vessels



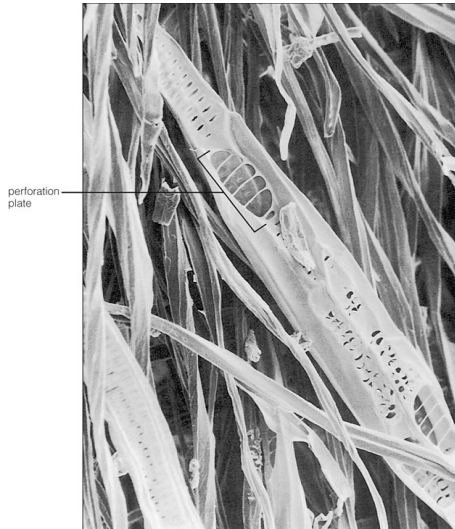
Ash (*Fraxinus americana*) secondary xylem
with vessels (LM $\times 26$)

Perforations



© 2006 Brooks/Cole - Thomson

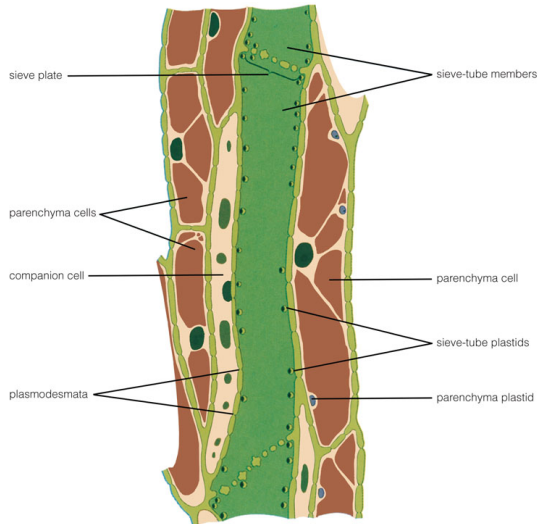
Scalariform perforations



Phloem

- Usually occurs adjacent to a xylem
- Types of cells: sieve tube cells, companion cells, fibers and parenchyma
- Sieve tube cells have plastids and sieve plates between cells but no nuclei, companion cells have nuclei
- Secondary phloem usually has more fibers than primary phloem
- Main functions: sugar transport and mechanical support

Cells of phloem 1



Cells of phloem 2

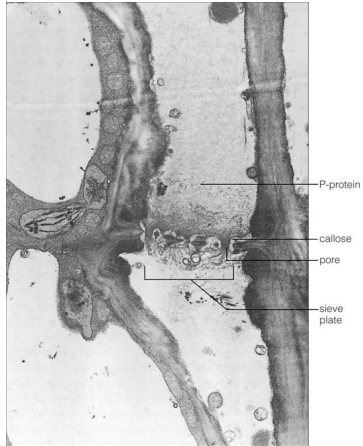
parenchyma cell

sieve-tube member



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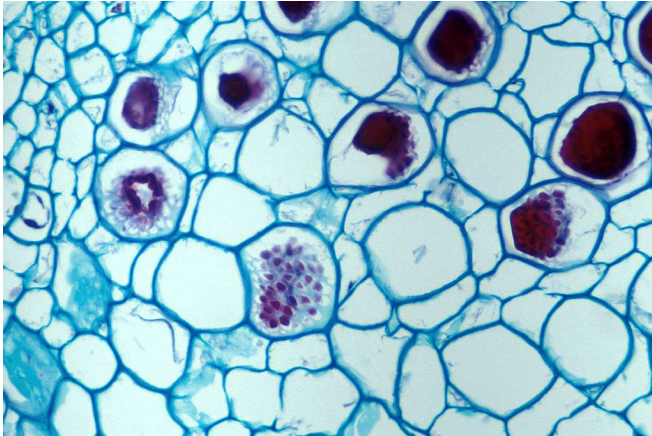
Sieve plates 1



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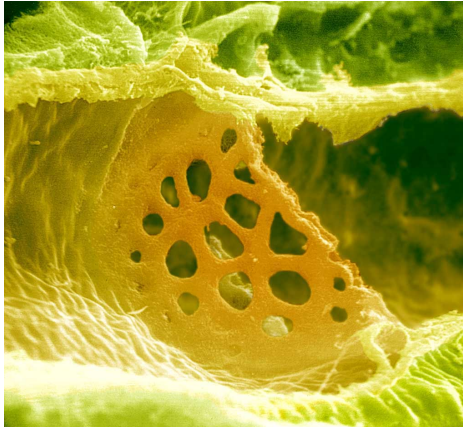
Cross-section (TEM)

Sieve plates 2



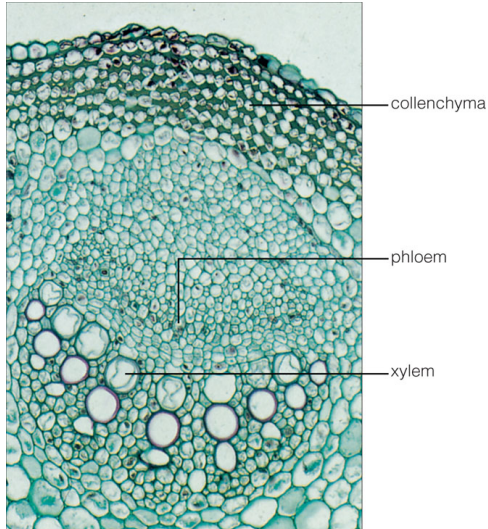
Frontal view (LM)

Sieve plates 3



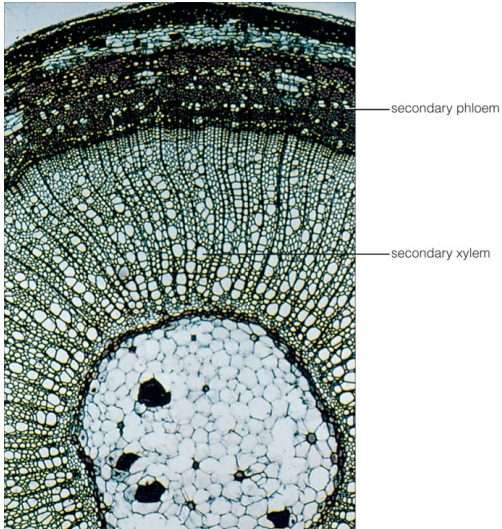
Sieve plate, a pore in the end wall of a sieve-tube member, through which phloem sap flows (SEM $\times 4800$)

Primary vascular tissues



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Secondary vascular tissues



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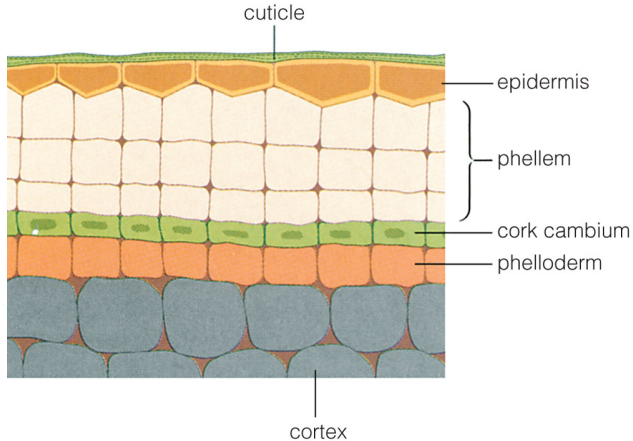
Xylem vs. Phloem

- Dead vs. live cells
- Water vs. sugar
- Up vs. down
- Big biomass vs. small biomass

Periderm 1

- Secondary dermal tissue
- Arises inside the stem ground tissue, closer to surface (cortex)
- Complex tissue: includes phellem, cork cambium, and phelloderm*
- Old periderm includes some other tissues and becomes a cork
- Cells of phellem are dead cells rich of suberin
- Main function is defense

Periderm 2



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Structure of periderm

Summary 1

- **Apical meristems** are primary centers of plant development
- **Secondary tissues** originate from lateral meristems (i.e., cambium)
- **Periderm** is a secondary complex tissue, old periderm become a cork
- **Xylem** transports water, consists of dead cells
- **Phloem** transport sugars, consists of live cells

Summary 2

- Simple and primary tissues: ...*
- Simple and secondary tissues: ...*
- Complex and primary tissues: ...*
- Complex and secondary tissues: ...*

For Further Reading



Th. L. Rost, M. G. Barbour, C. R. Stocking, T. M. Murphy.
Plant Biology. 2nd edition.
Thomson Brooks/Cole, 2006.
Chapters 4.2–4.3.