Plant Structure and Growth : Growth Overview

- Determinate vs. indeterminate growth
- Meristems- the key to indeterminate growth
  - apical meristem is responsible for primary growth
  - lateral meristems are responsible for secondary growth

Plant Structure and Growth : Primary Growth

- Apical meristem
  - zone of active cell division near tip of root or shoot
  - lays down 3 primary meristems
    - Protoderm —» dermal tissue
    - Ground meristem —» ground tissue
    - Procambium —» vascular tissue
  - 3 growth zones (division, elongation, maturation)

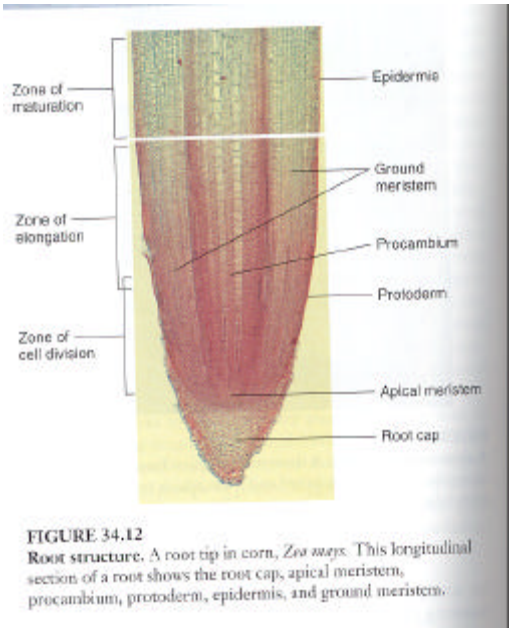


FIGURE 34.12
Root structure. A root tip in corn, *Zea mays*. This longitudinal section of a root shows the root cap, apical meristem, procambium, protoderm, epidermis, and ground meristem.

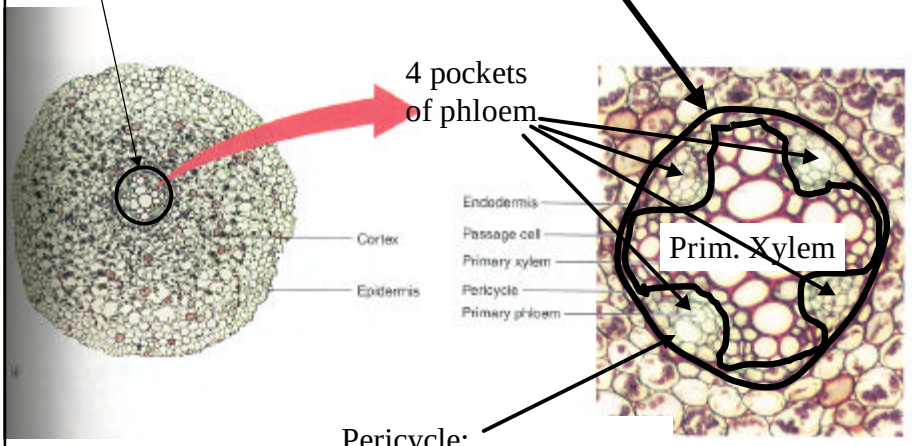
Plant Structure and Growth : Primary Growth

- Growth of dicot primary root
  - epidermis
  - cortex (ground tissues just inside epidermis)
    - active in nutrient uptake & food storage
    - innermost layer = endodermis
  - Stele (vascular bundle in center of root)
    - Xylem & phloem
    - pericycle (outermost layer)

Organization of primary root tissues of a dicot.

Endodermis (= inside skin):
innermost layer of cortex
cell walls coated with suberin
stele= tissue <u>inside</u> endodermis

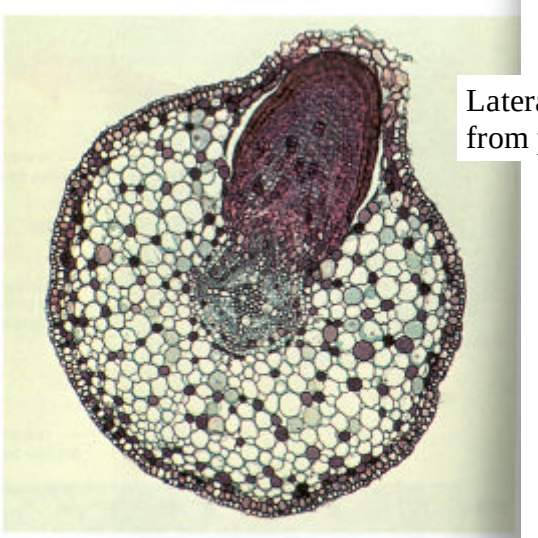
Stele= central vascular bundle



4 pockets of phloem

Prim. Xylem

Pericycle:
first layer of stele
may give rise to lateral roots



Lateral roots develop from pericycle

FIGURE 34.14
A lateral root. A lateral root growing out through the cortex of black willow, *Salix nigra*. Lateral roots arise in the pericycle beneath the surface of the main root, while lateral stems arise from buds located in the axils of the leaves.

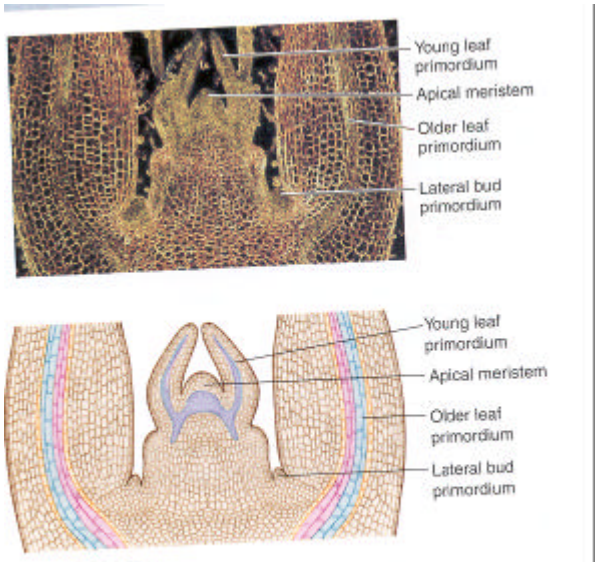
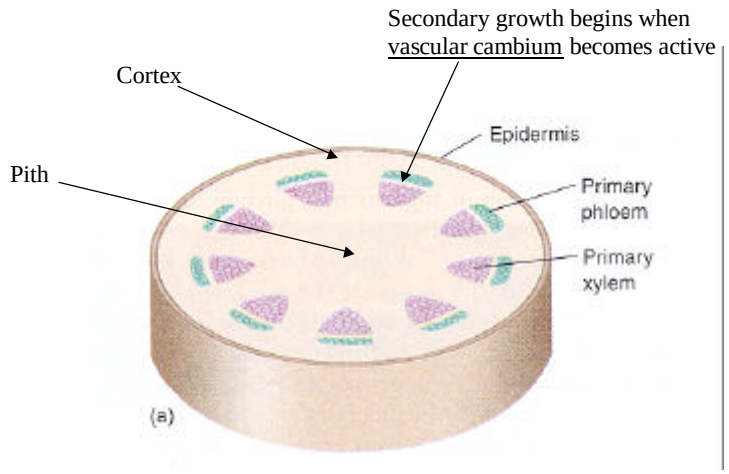


FIGURE 34.5
An apical shoot meristem. This longitudinal section through a shoot apex in *Coleus* shows the tip of a stem. Between the young leaf primordia is the apical meristem.

Plant Structure and Growth : Primary Growth

- Growth of dicot primary stem
  - apical meristem —» 3 primary meristems
    - epidermis covering stems & leaves formed by protoderm
    - vascular bundles formed by procambium
    - split ground tissue formed by ground mersitem
      - pith
      - cortex (external to vascular bundles)

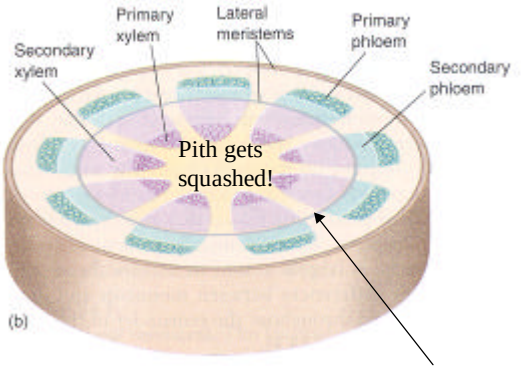
Cross section of dicot stem- primary tissues



Plant Structure and Growth: Secondary Growth

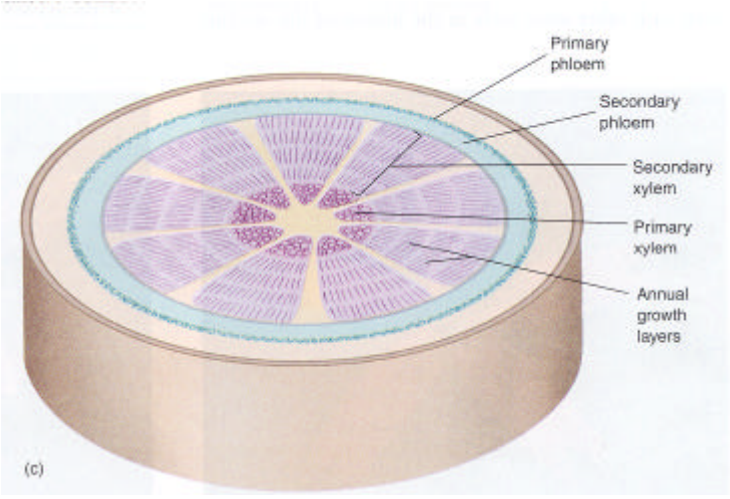
- Growth produced by two lateral meristems
  - vascular cambium —» secondary xylem & phloem
  - cork cambium —» thick covering over roots and stems
- Vascular cambium
  - layer of parenchyma cells between primary xylem & phloem becomes meristematic
  - soon forms continuous ring
  - xylem to the inside, phloem to the outside
  - tree rings
  - sapwood vs. heartwood

Cross section of dicot stem- early secondary growth



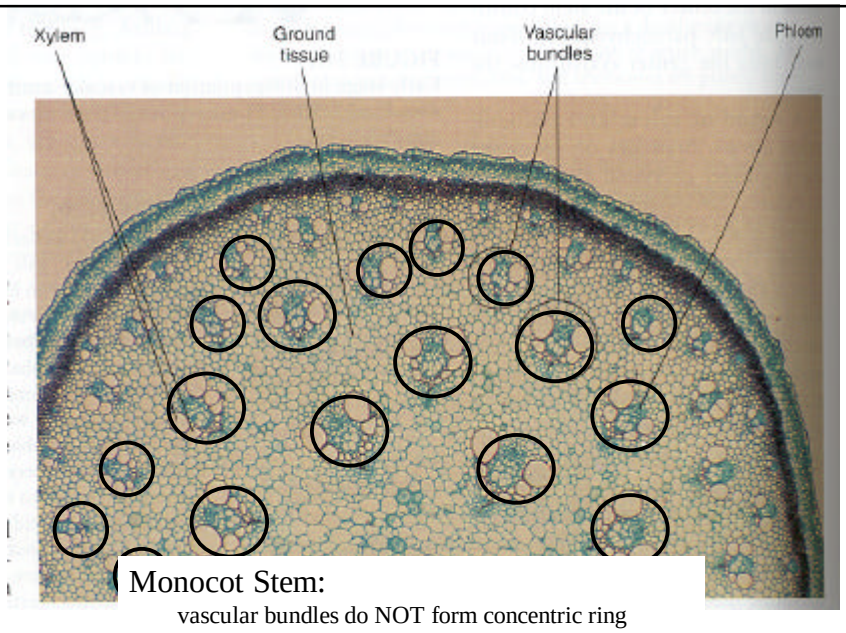
Vascular Cambium forms solid ring

Cross section of dicot stem-
well-developed secondary growth



Plant Structure and Growth: Secondary Growth

- Cork Cambium (woody plants)
  - single layer epidermis replaced by multi-layer "bark"
  - a layer of cells in cortex becomes meristematic and produces cork cells & phelloderm
  - cork cells deposit wax in cell walls & then die
- "Bark" = more than tissues produced by cork cambium
  - outer bark= cork cambium and all tissues it produced (cork & phelloderm)
  - inner bark = phloem
  - "Bark" = everything outside the vascular cambium



Monocot Stem:

vascular bundles do NOT form concentric ring

do not have Vascular Cambium (no secondary growth

Modified Stems

- Rhizomes- thick underground stems w/ new plant produced at each node (ferns, irisis, grasses)
- Runners and Stolons- horizontal stems with long internodes (strawberries)
- Bulbs- very large underground bud- composed of a short stem and highly modified leaves (e.g. onion)
- Tubers- not a root… enlarged tip of a stolon (potato)
- Tendrils- stems modified for climbing (ivy)
- Cladophylls- flattened stems which look and function like leaves.

"Sticky" plant parts

- Spines- modified leaves (e.g. cactus)
- Thorns- modified stems (e.g. honey locust)
- Prickle- outgrowth of epidermis (e.g. rose)