

Science of Pharmacology

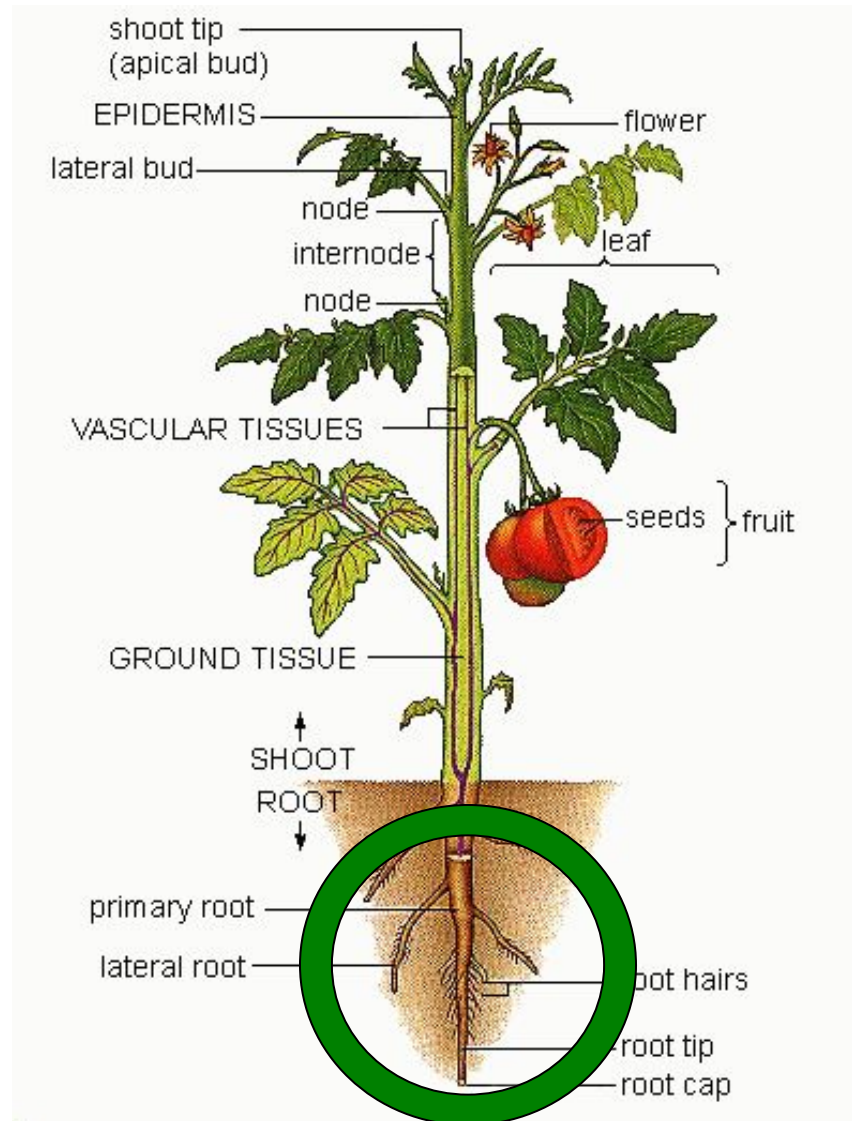
Grammar: Modal auxiliaries (must have, can't have, may have, was, were to have)

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Group: 207 a PhR

Senior Teacher : Korolevskaya S.A.

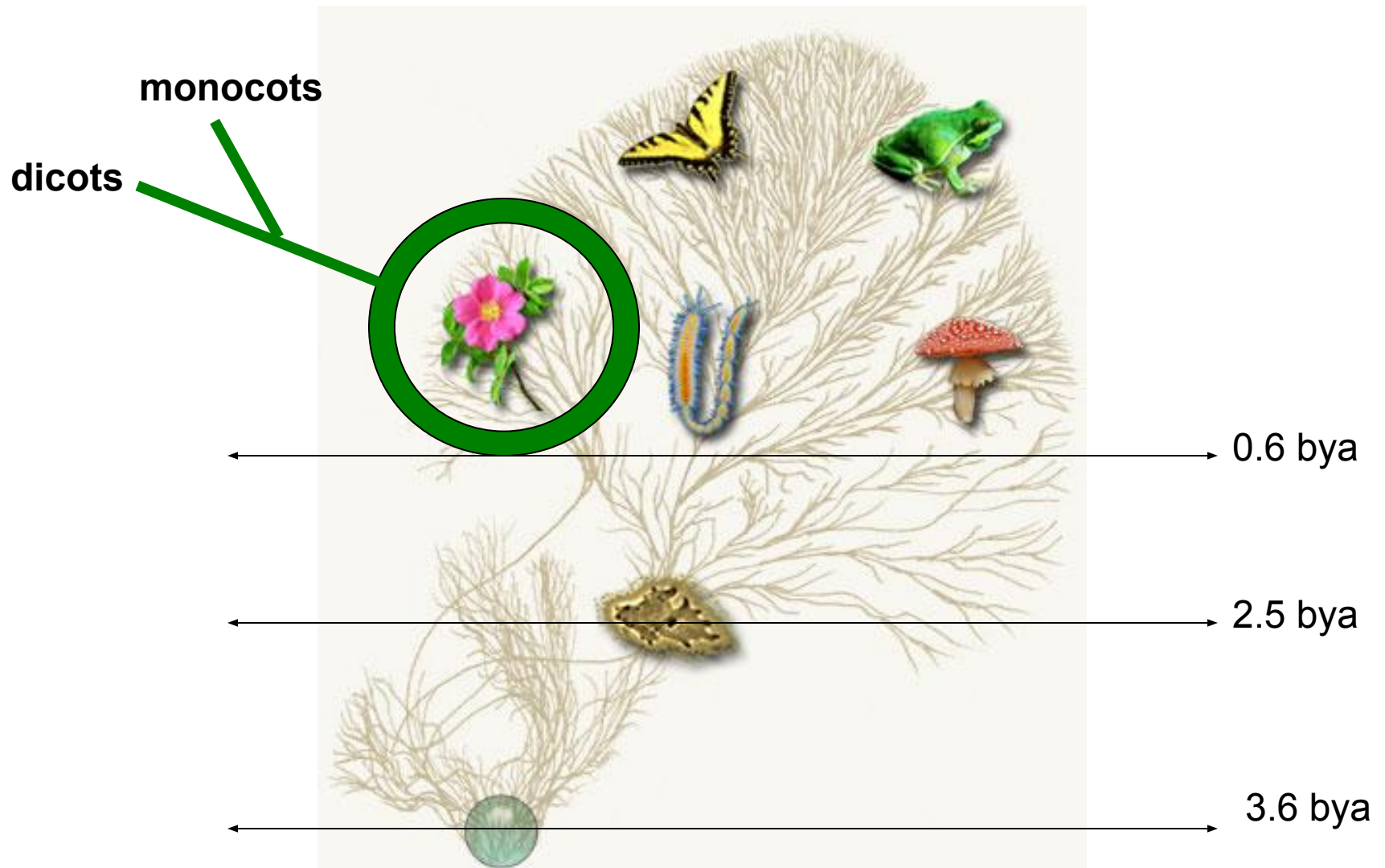
The Plant Body



ROOTS IN FLOWERING PLANTS











- Origin (Radicle or Adventitious)
- Function
- External Anatomy
- Internal Anatomy
- Specialized Roots
- Roots and Plant Nutrition

Evolutionary Lineages of Life



Monocotyledonous & Dicotyledonous Flowering Plants

Monocots and Dicots

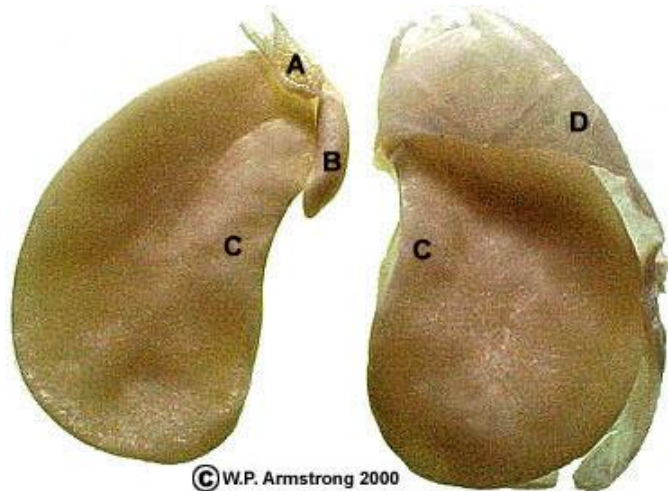
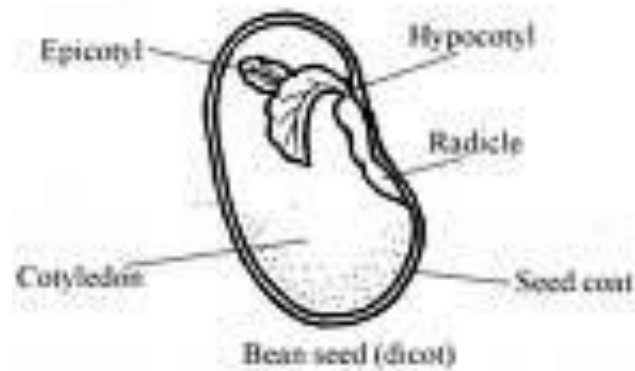
MONOCOTS				
 One cotyledon	 Veins usually parallel	 Vascular bundles usually complexly arranged	 Fibrous root system	 Floral parts usually in multiples of three
EMBRYOS	LEAF VENATION	STEMS	ROOTS	FLOWERS
DICOTS				
 Two cotyledons	 Veins usually netlike	 Vascular bundles usually arranged in ring	 Taproot usually present	 Floral parts usually in multiples of four or five

Examples

- Grasses
- Lilies
- Orchids
- Palms

- Oaks
- Bean
- Spinach
- Rose

Embryonic root or radicle



Radish - radicle

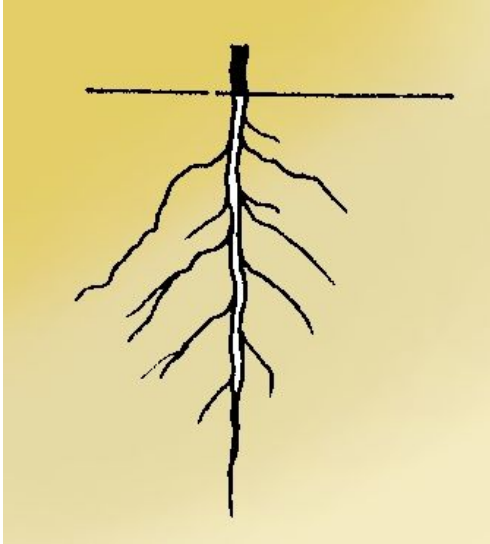


World's Biggest Seed with Embryonic Root or Radicle

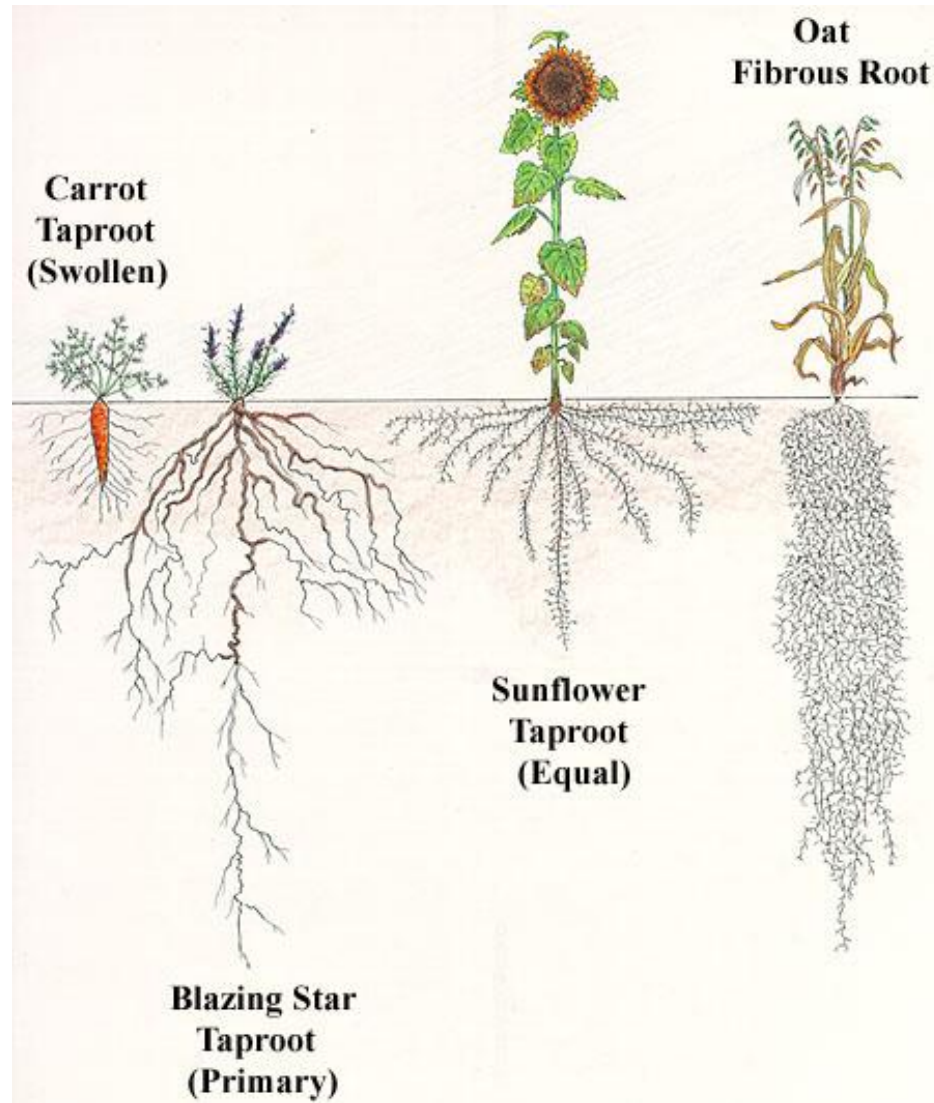
- The Royal Botanic Garden in Edinburgh germinated this bowling-ball-like coco de mer (*Lodicea maldivica*) palm.
- The seed weighs 35lb (16kg) and can produce a tree that will live up to 300 years.
- Scottish botanists put in a dark case, and now a root has developed. It will produce one leaf a year for the next few years. The tree will begin to flower in 20-30 years and produce its own seeds after another five to seven years (10-09-03).
- Source: <http://www.crocus.co.uk/whatsgoingon/regionalscotland/>



Tap root and Fibrous (Diffuse) Root Systems – Both arise from radicle



Comparison of Root Systems



Adventitious Roots: roots that arise from anything other than the radicle



Adventitious Roots: roots that arise from anything other than the radicle



Roots of the Future?

Carrot Man from “Lost in Space”

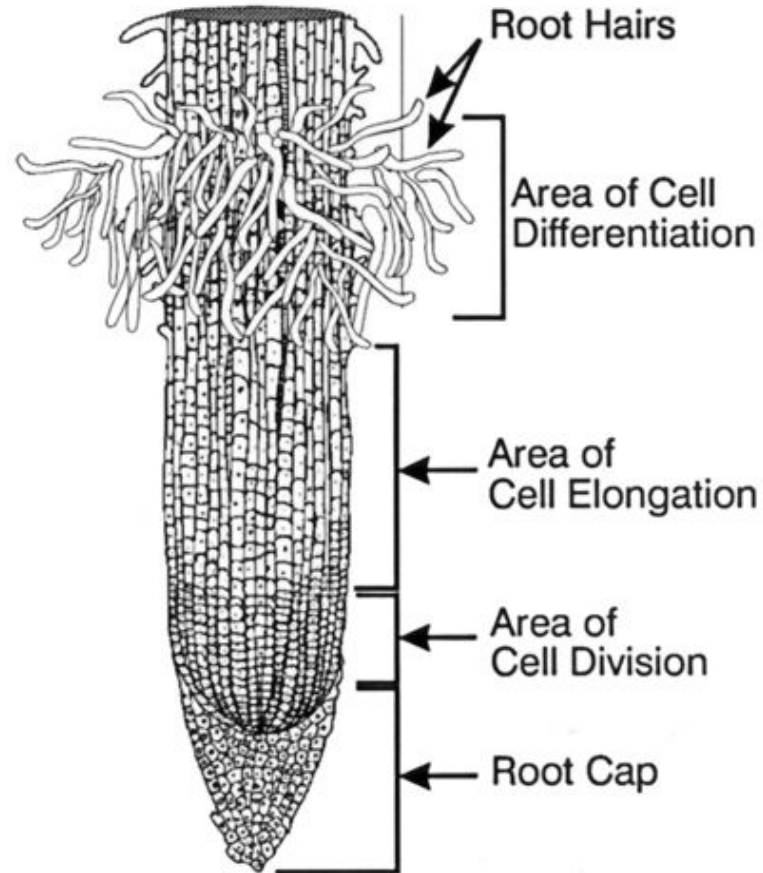


Roots: Function

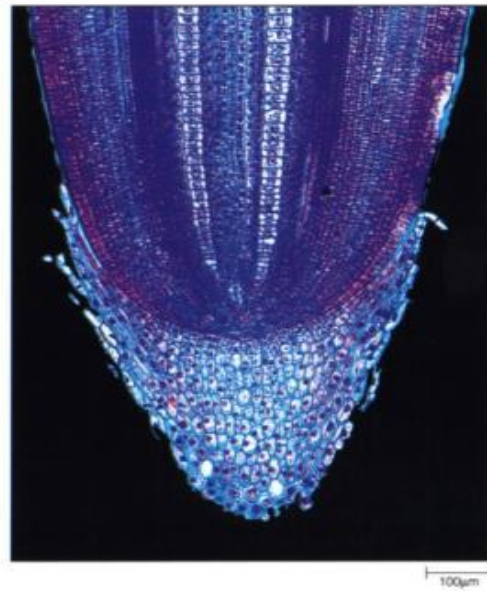
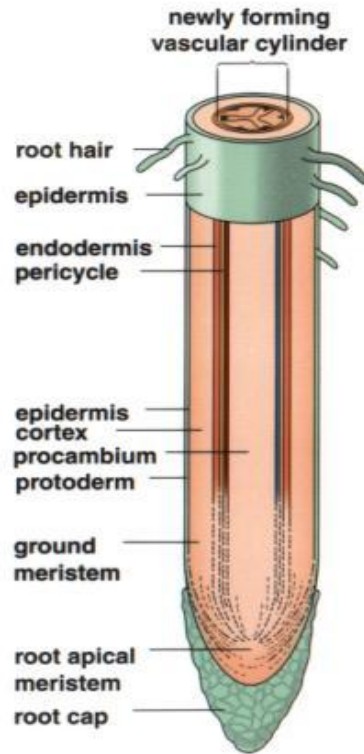
- Roots anchor the plant in the substratum or soil.
- Roots absorb water and dissolved nutrients or solutes (nitrogen, phosphorous, magnesium, boron, etc.) needed for normal growth, development, photosynthesis, and reproduction.
- In some plants, roots have become adapted for specialized functions.

EXTERNAL ANATOMY

- Root cap
- Region of cell division
- Region of elongation
- Region of differentiation or maturation



Root Cap



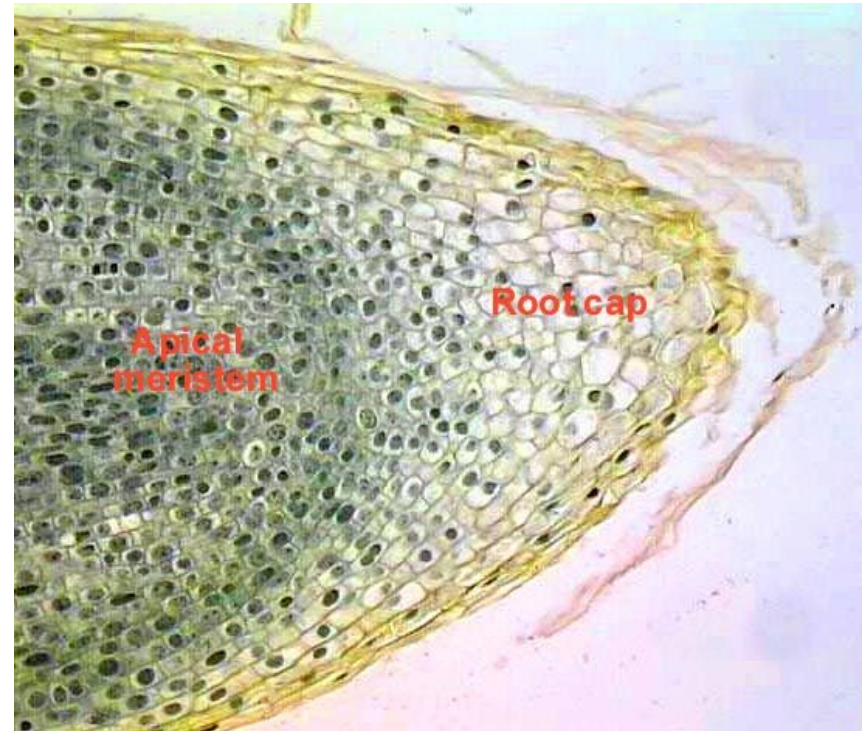
Root Cap

- thimble-shaped mass of parenchyma cells at the tip of each root
- protects the root from mechanical injury
- Dictyosomes or Golgi bodies release a mucilaginous lubricant (mucigel) cells lasts less than a week, then these die
- possibly important in perception of gravity (i.e., geotropism or gravitropism)
- amyloplasts (also called statoliths) appear to accumulate at the bottom of cells

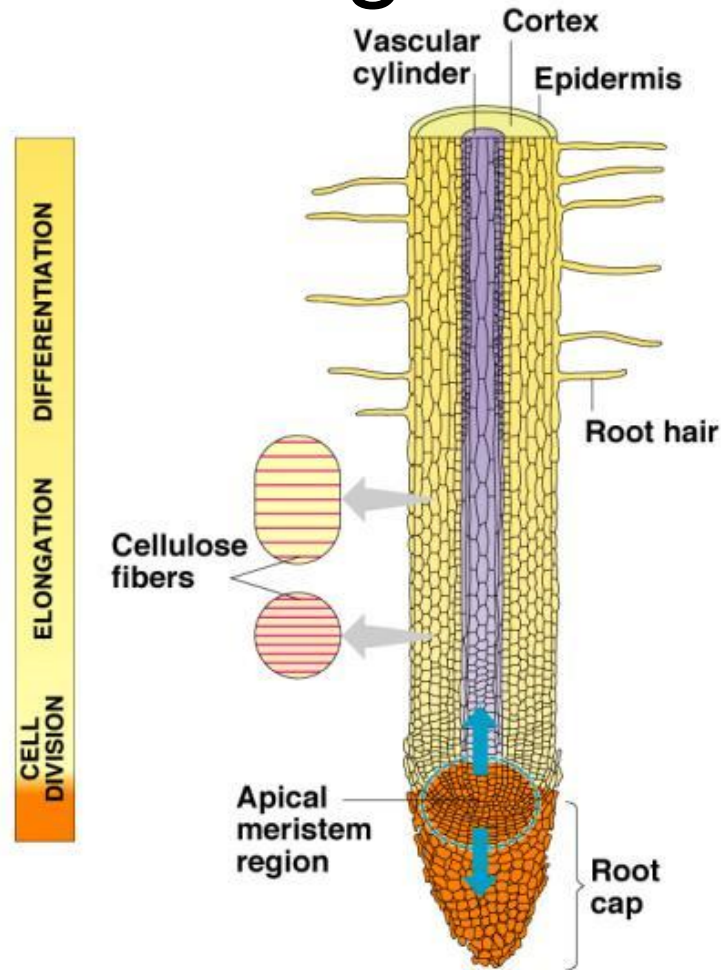


Region of Cell Division

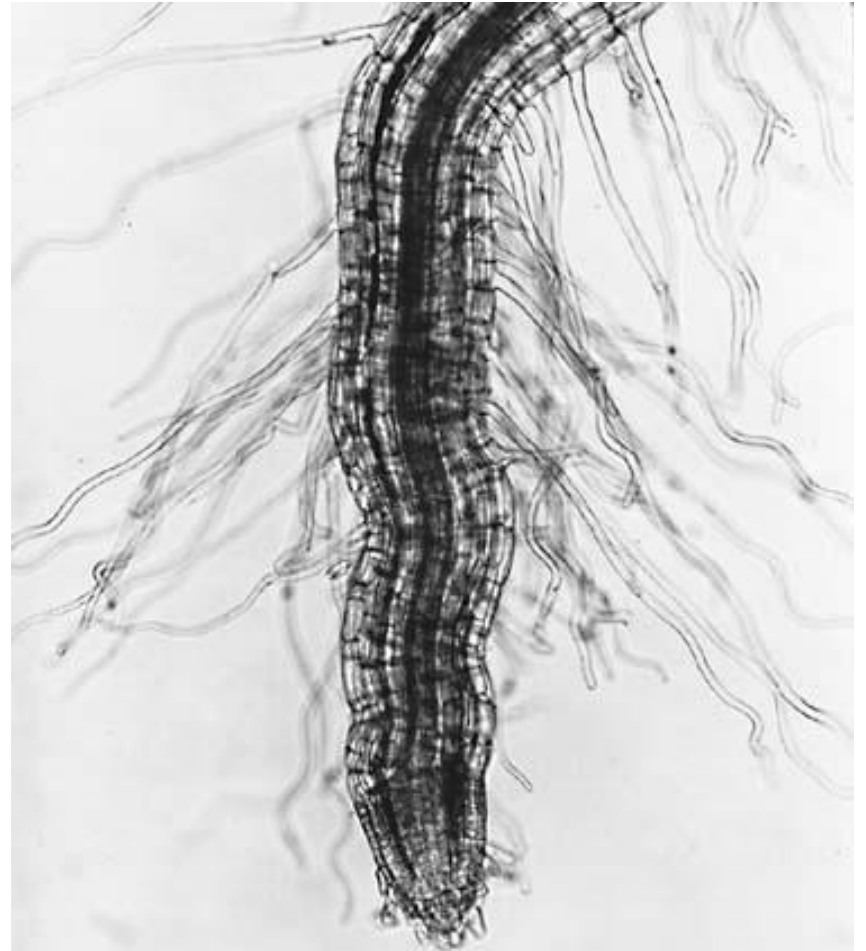
- Apical meristem - cells divide once or twice per day.
- The transitional meristems arise from the tips of roots and shoots. These include:
 - the protoderm (which forms the epidermis)
 - the ground meristem (which forms the ground tissue)
 - the procambium (forms the primary phloem and xylem).



Region of Elongation - cells become longer and wider

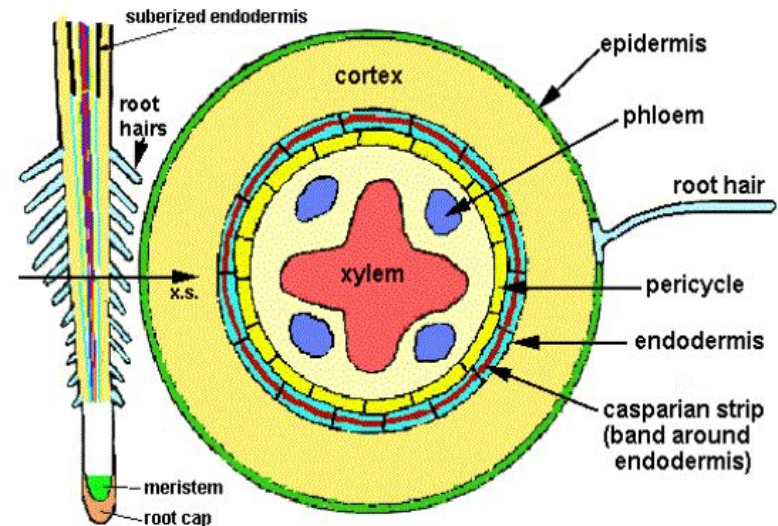


Region of Maturation or Differentiation

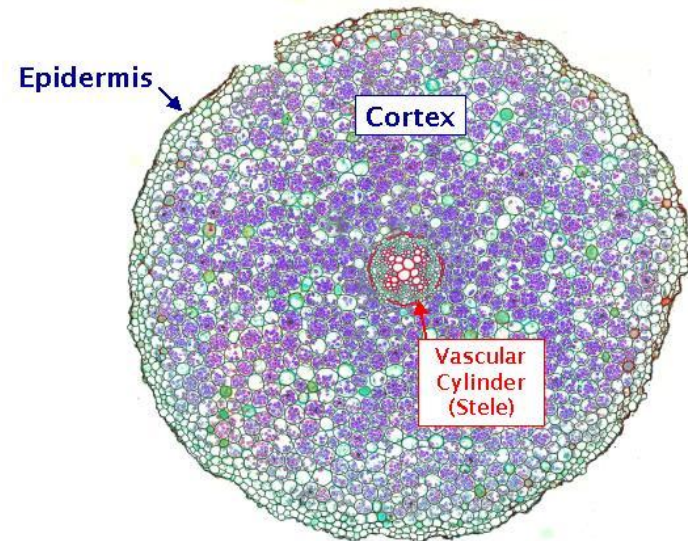
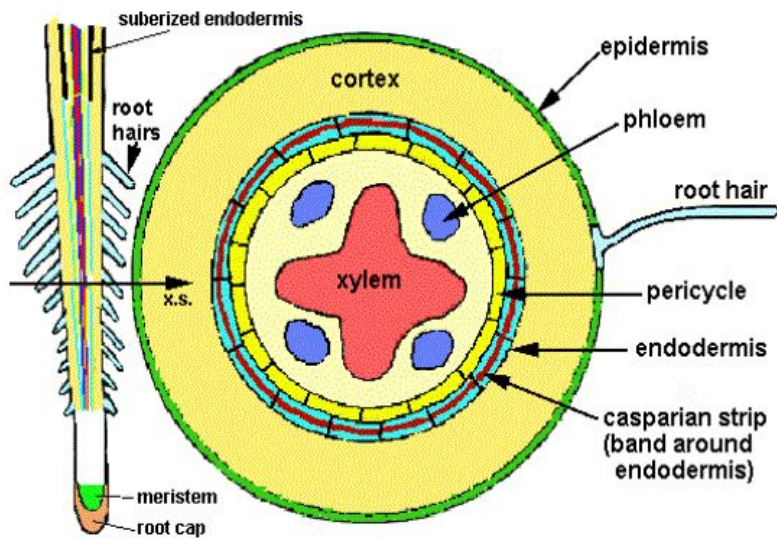


Region of Maturation or Differentiation

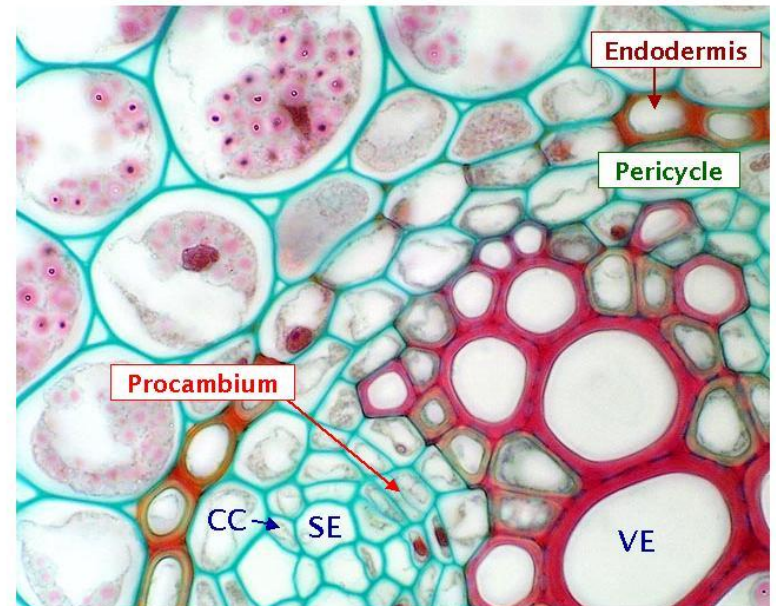
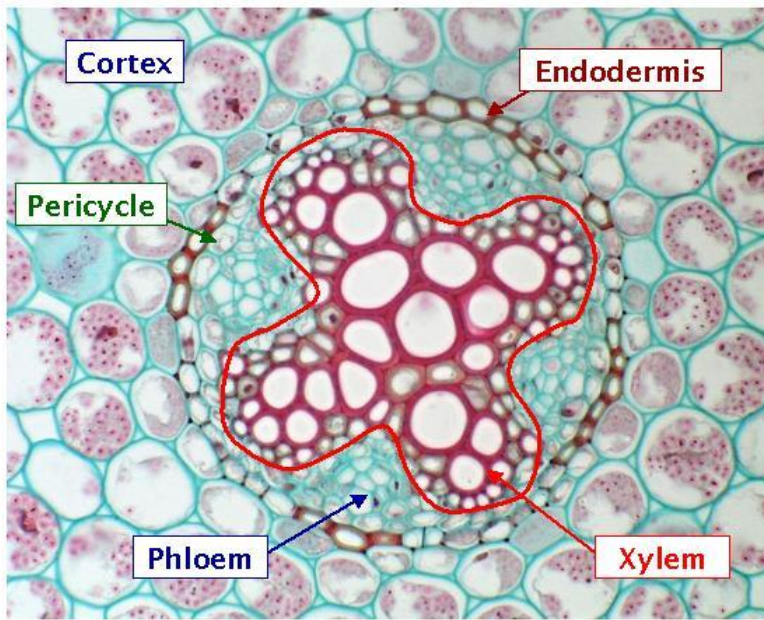
- root hairs develop as protuberances from epidermal cells
- increase the surface area for the absorption of water
- cuticle exists on root but not on root hairs



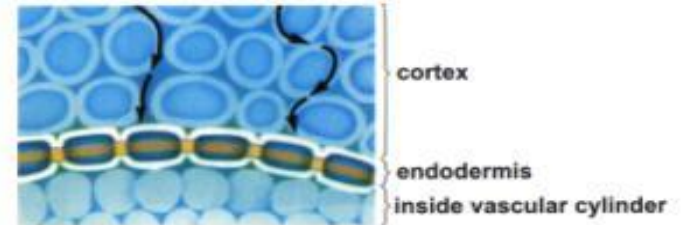
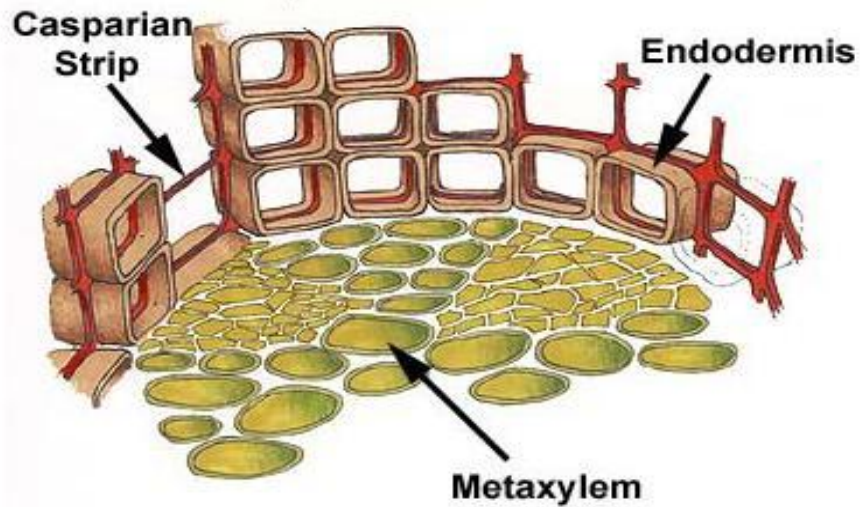
Dicot Root in Cross Section



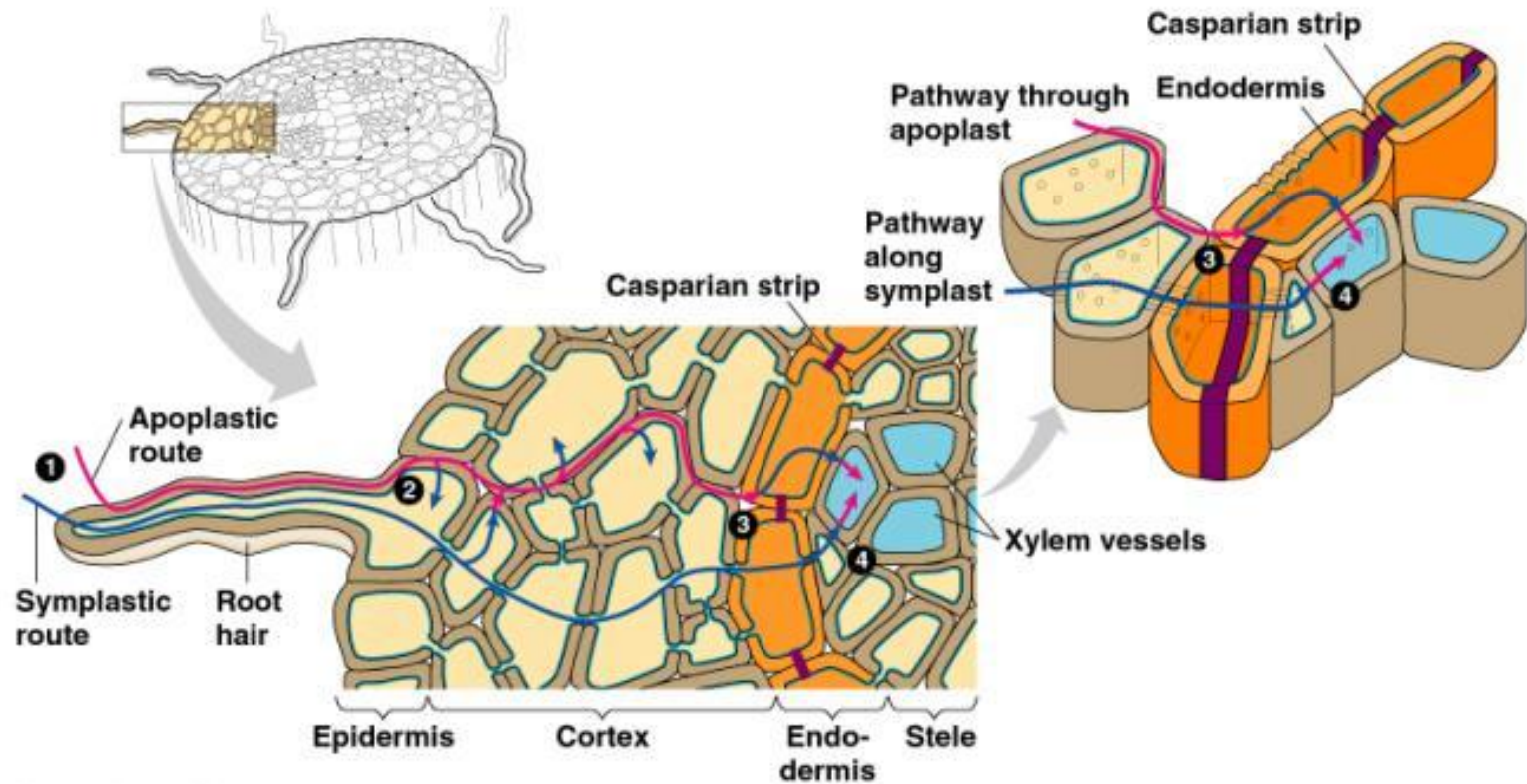
Dicot root in Cross Section



The Casparian Strip

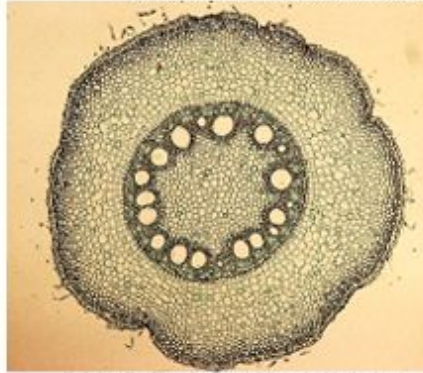


The Path of Water into Roots



Monocot Root in Cross Section

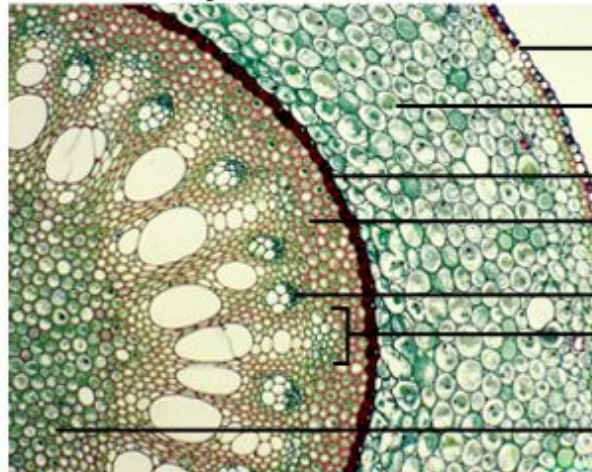
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Monocot root

a.

© John D. Cunningham/Visuals Unlimited



epidermis

cortex

endodermis

pericycle

primary phloem

primary xylem

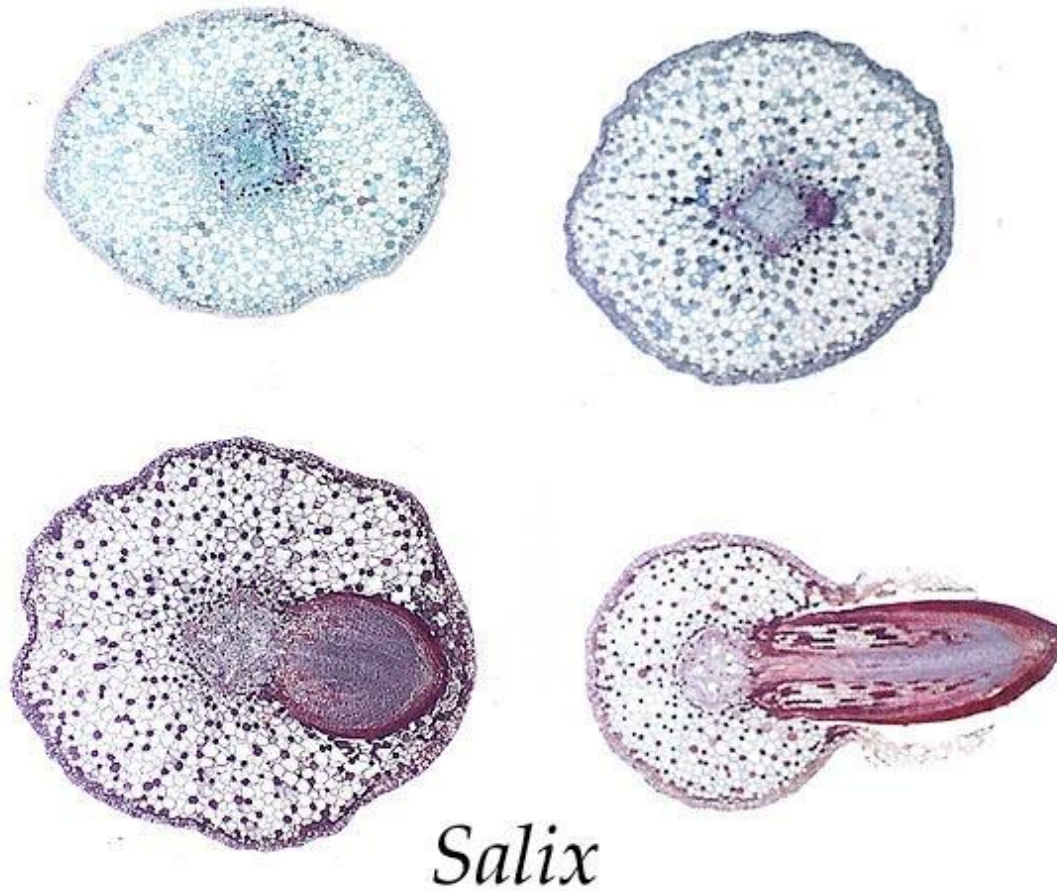
pith

b.

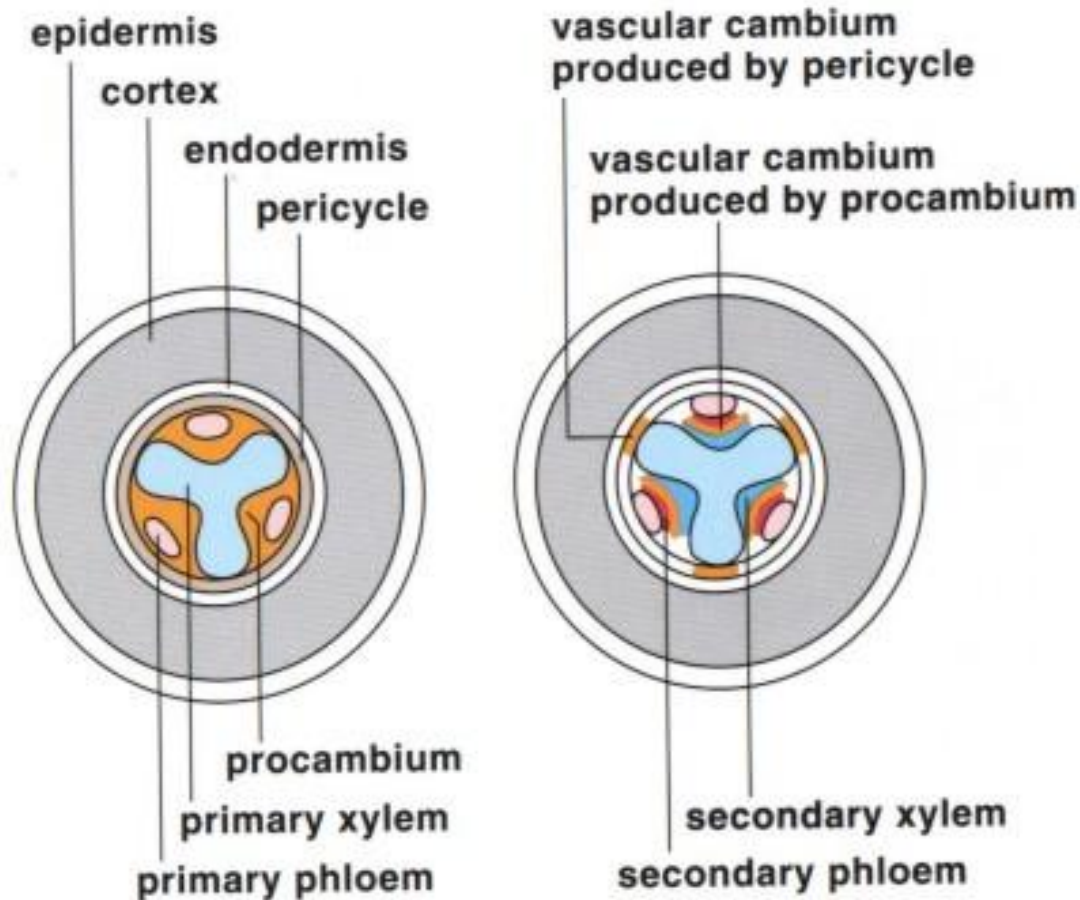
Courtesy of George Ellmore,
Tufts University

100 μ m

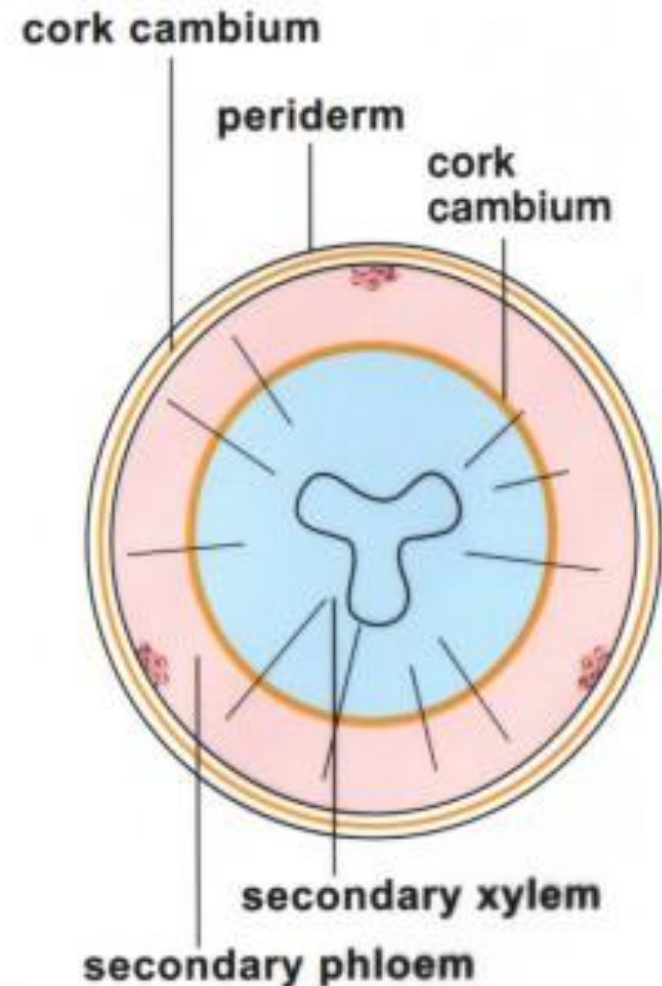
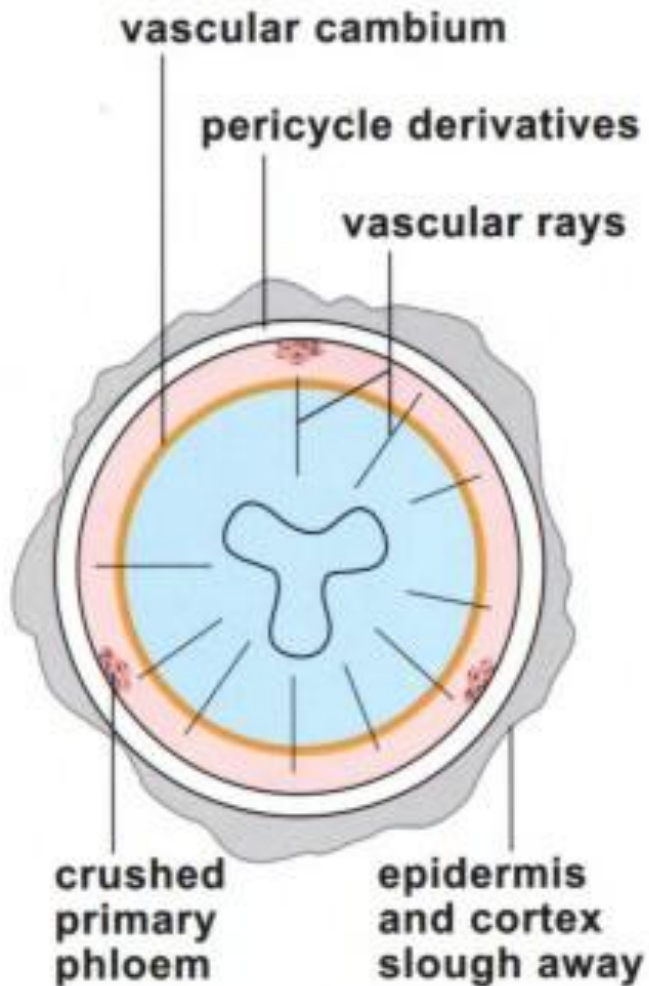
Lateral Roots Arise from the Pericycle of the Stele



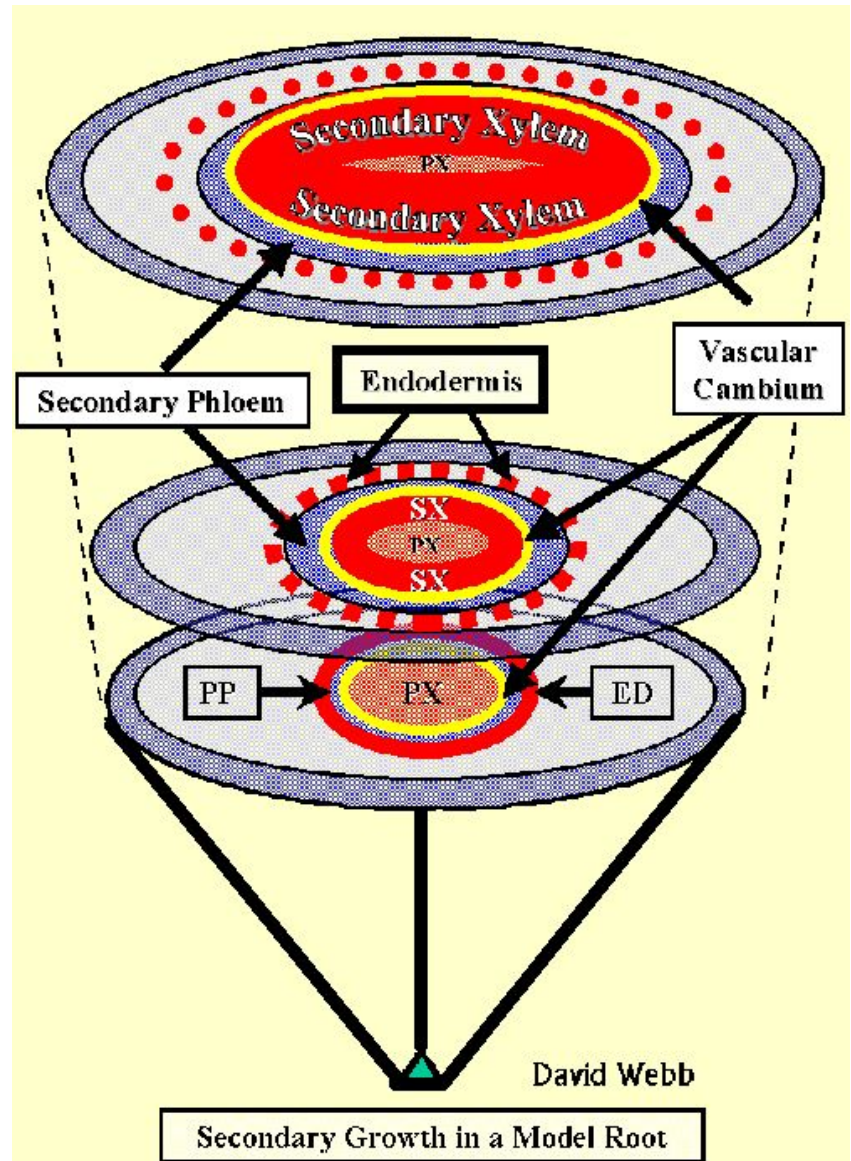
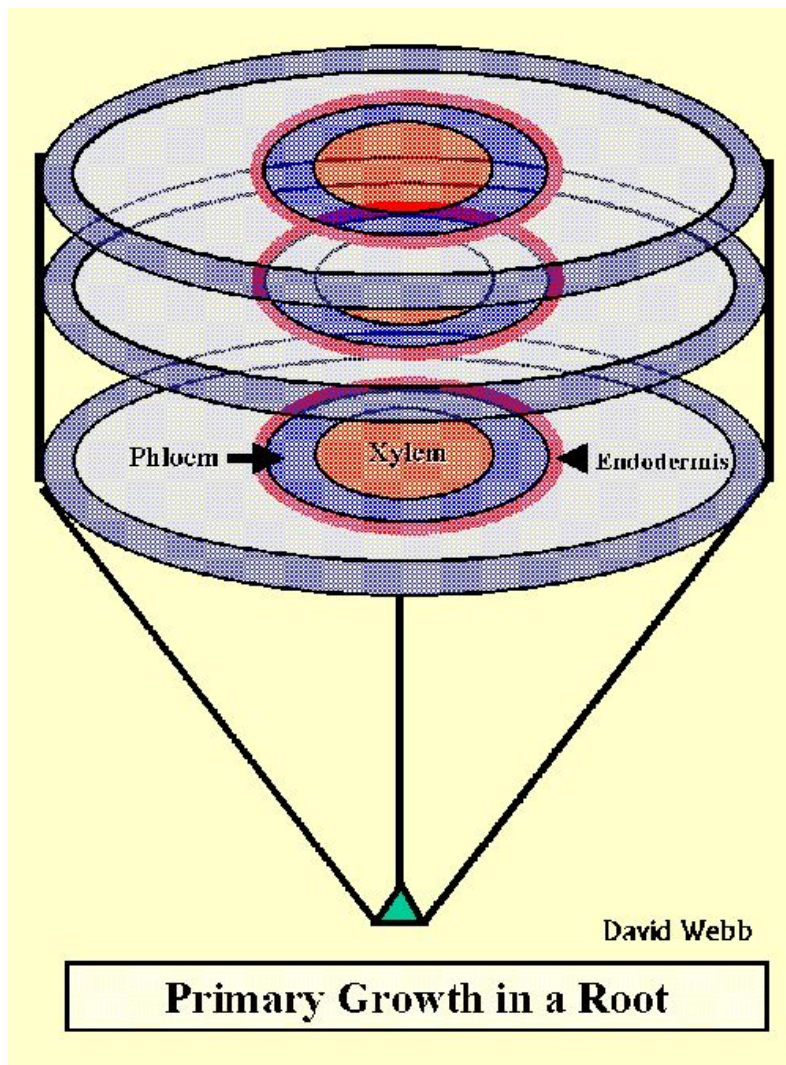
Secondary Growth in Dicot Roots

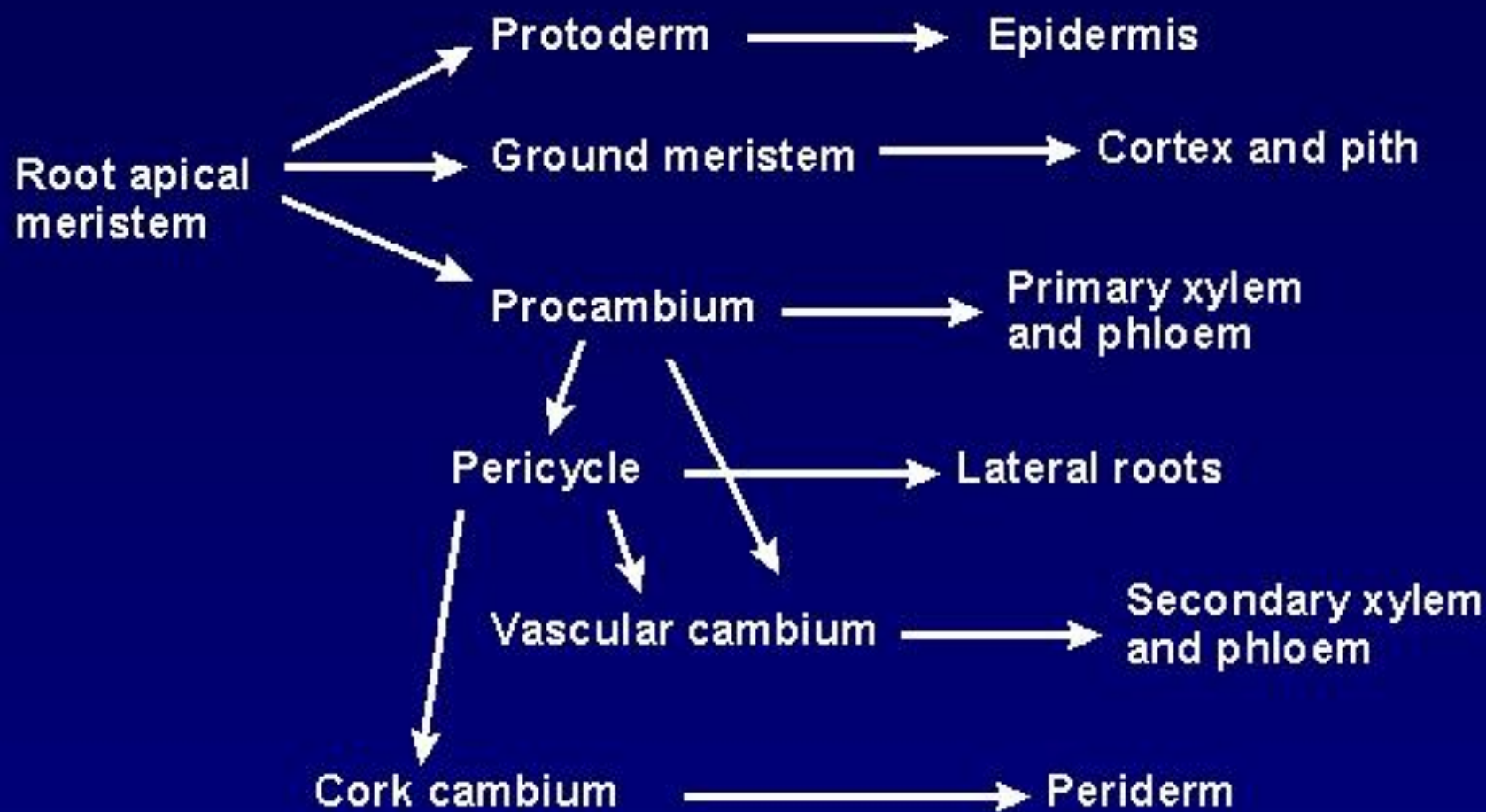


Secondary Growth in Dicot Roots



Primary and Secondary Growth in Roots





Modified Roots

- Food storage
- Propagative roots
- Pneumatophores
- Aerial Roots
- Photosynthetic roots of some orchids
- Contractile roots some herbaceous dicots and monocots
- Buttress roots looks
- Parasitic roots
- Symbiotic roots
 - mycorrhizae or “fungus roots”
 - Legumes (e.g., pea, beans, peanuts) and bacterium form root nodules.

Food Storage Roots



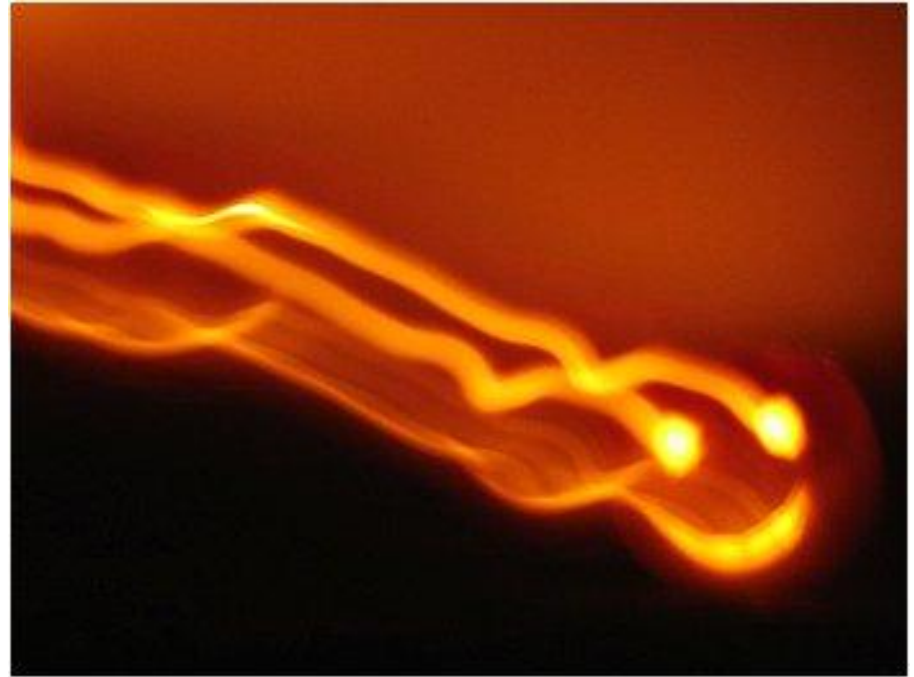
HISTORY OF THE JACK O' LANTERN



Jack-o'-lanterns from Turnips



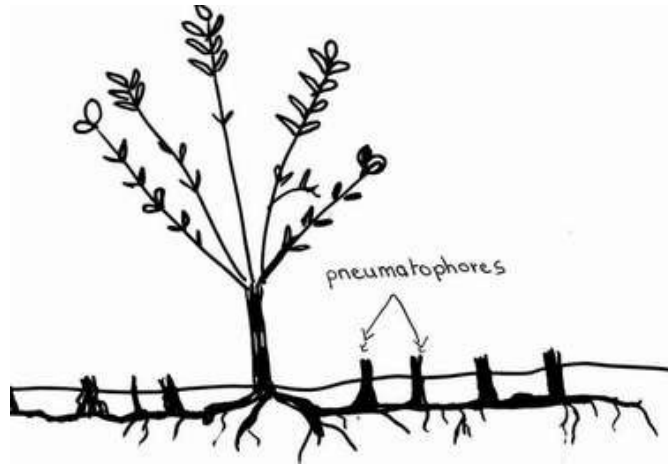
Jack-o'-lanterns from Turnips



Turnip + Cabbage = Rutabaga



Pneumatophores - black mangrow



Cypress Knees

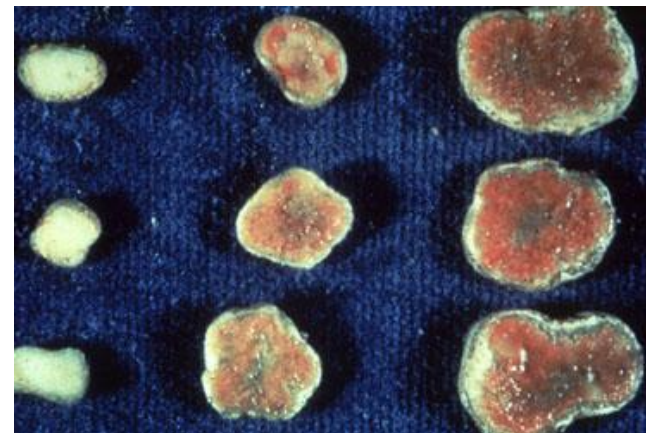


Buttress Roots



Symbiotic Roots

- Legumes (e.g., pea, beans, peanuts) form root nodules. Mutualism between a plant and bacterium which allows for the fixation of atmospheric nitrogen to form that the plant can utilized. The bacterium is reward with food and a place to live



Symbiotic Roots

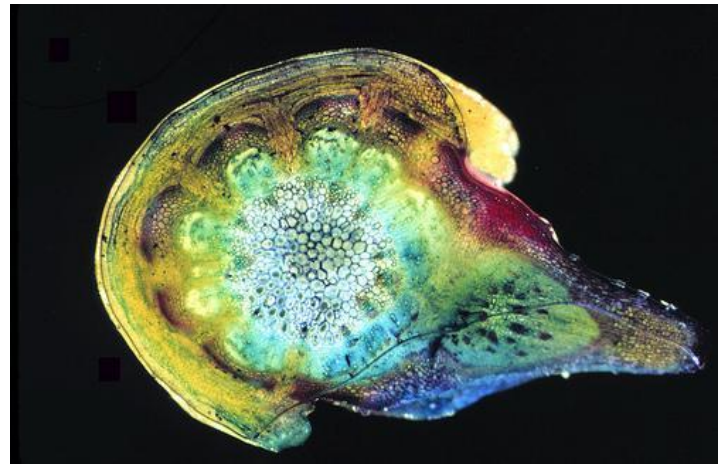
- Mycorrhizae or "fungus roots" where a symbiotic relationship forms between a plant and a fungus.
- In this partnership the fungus provides protection against some types of pathogens and increase the surface area for the absorption of essential nutrients (e.g. phosphorous) from the soil. The plant in return provides food for the fungus in the form of sugar and amino acids



Photosynthetic Roots



Parasitic roots - Dodder



Propagative Roots with Adventitious Buds/Stems

