

Chapters 31 & 32: **Plant Structure & Reproduction**

1. Flowering Plant Structure

2. Plant Reproduction & Development

1. Flowering Plant Structure

“Roots & Shoots”

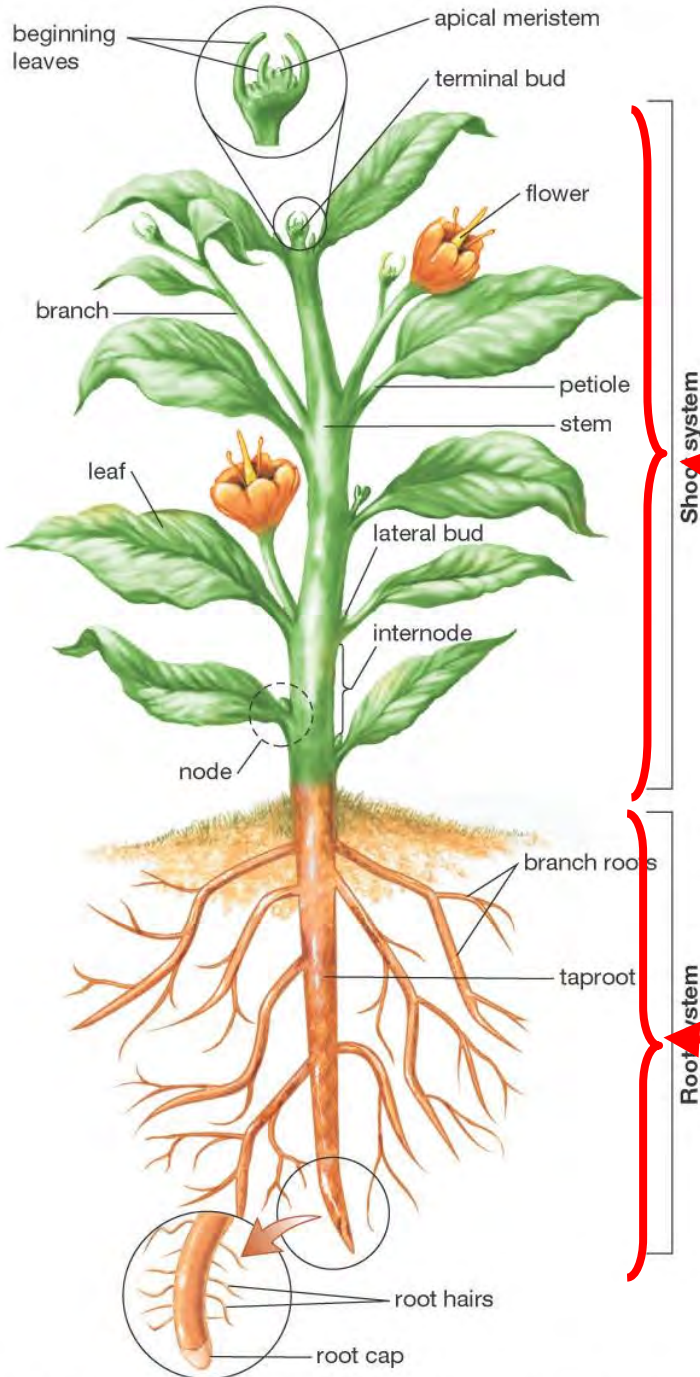
2 basic parts of flowering plants:

shoot system

- stems
- leaves
- flowers, fruits

root system

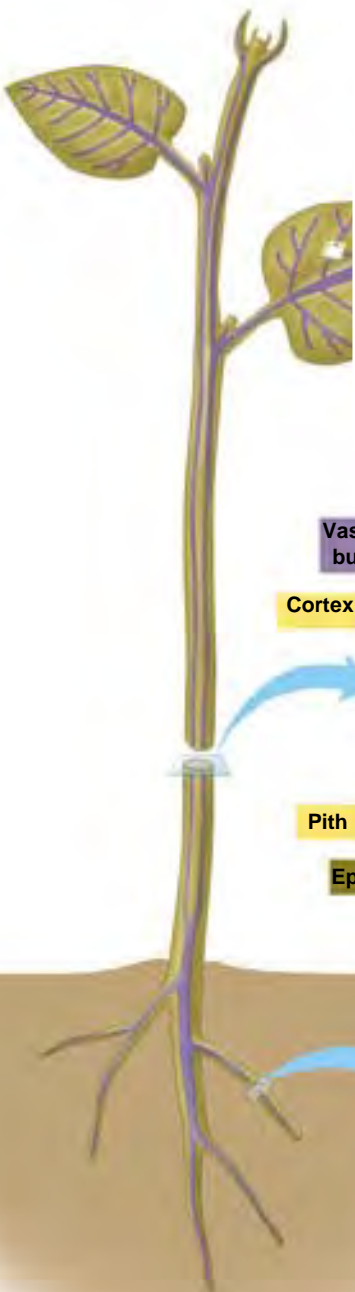
- taproot (dicots)
- roots



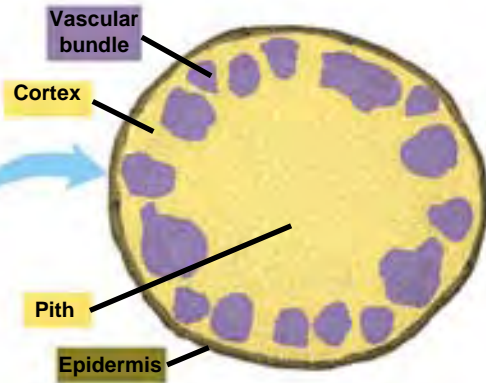
Plant Tissue Types

1) Dermal tissue

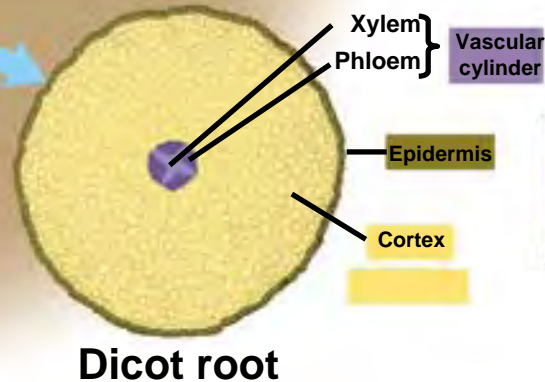
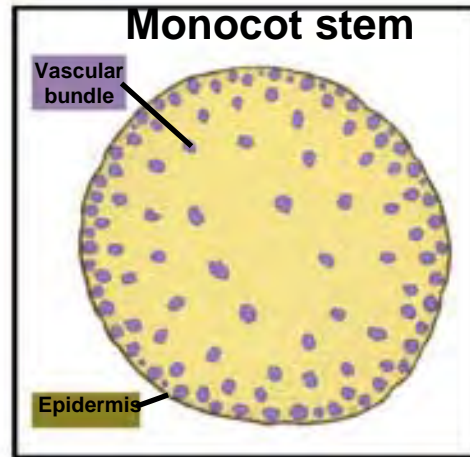
- outer, protective covering of the plant



Dicot stem



Monocot stem



Key	
	Dermal tissue
	Ground tissue
	Vascular tissue

2) Vascular tissue

- transport of fluids & structural support

3) Ground tissue

- everything else!

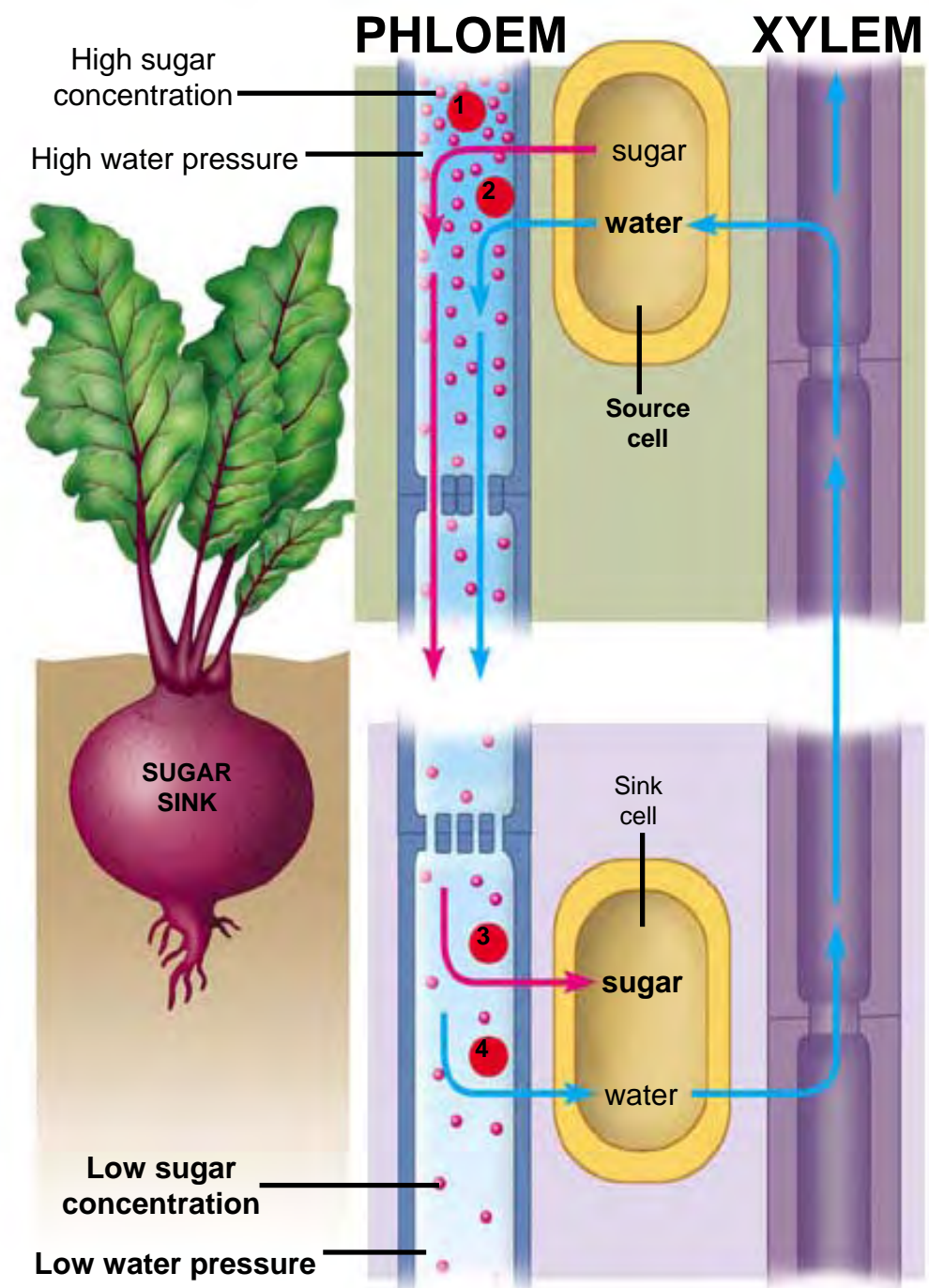
Vascular Tissue

Phloem

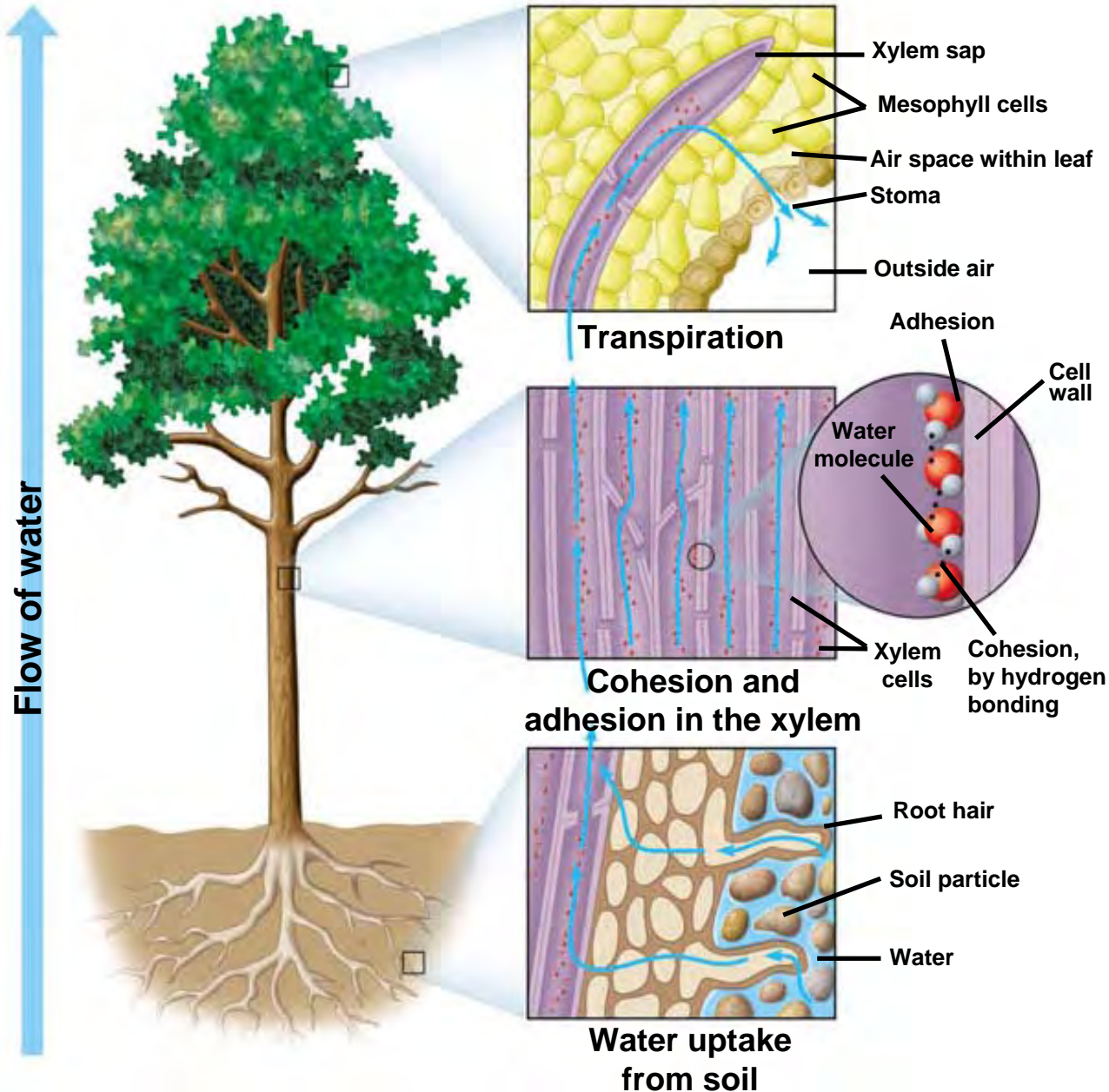
- transports products of photosynthesis (sugars) throughout plant from sugar sources to sugar sinks
- driven by osmosis, increased pressure due to more sugar solutes near source

Xylem

- transports water & minerals “upward” (towards shoots, leaves)



How is water moved “upward”?

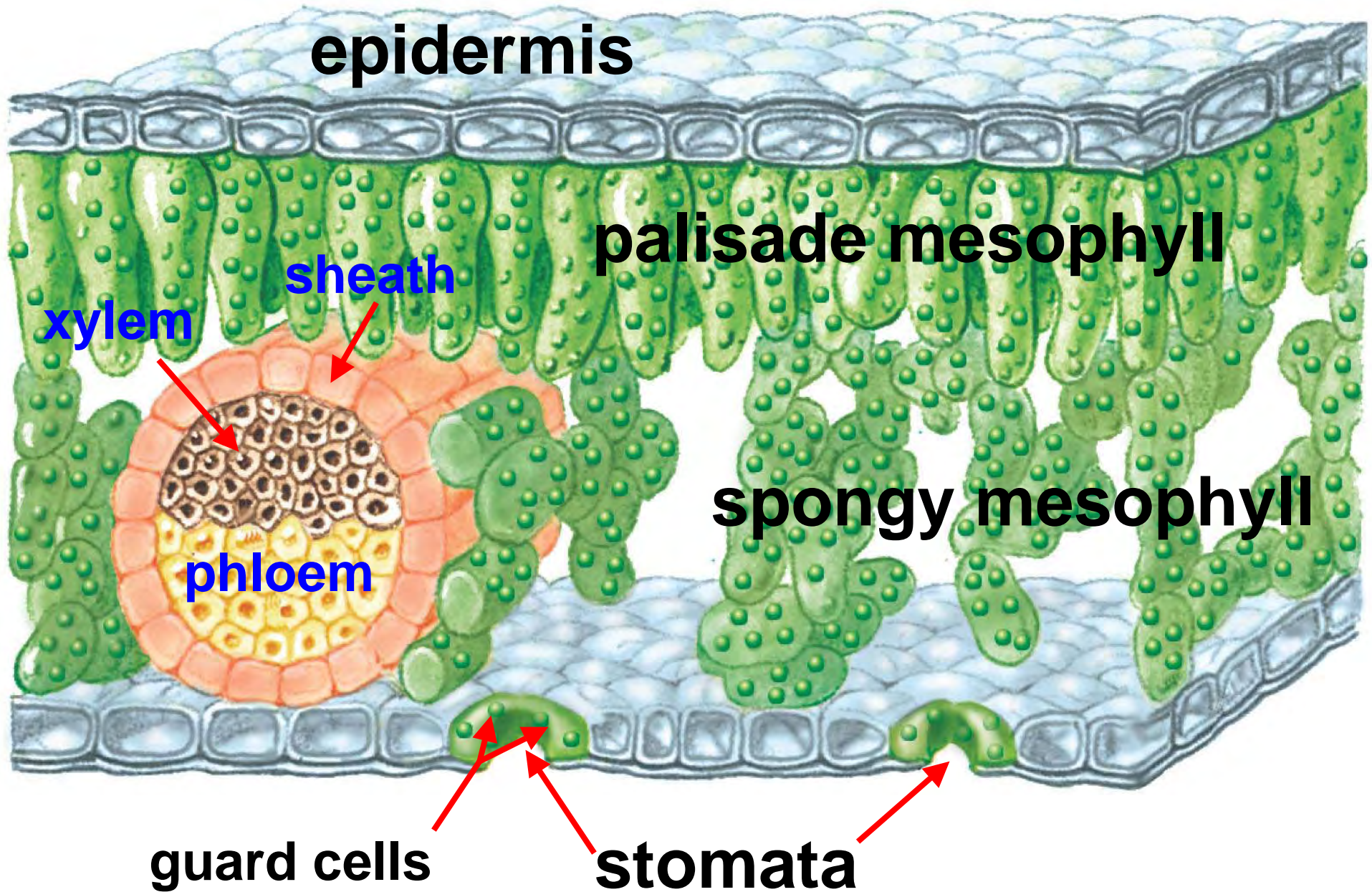


Water lost by transpiration from leaves “pulls” water upward through xylem to replace what was lost.

Depends on:

- cohesion due to H-bonding
- adhesion to xylem cells

Leaf Structure



Epidermis

- outer cell layer on both sides of leaf
- secrete waxy cuticle to waterproof the leaf

Mesophyll (ground tissue of leaf)

- loosely packed photosynthetic cells
- palisade or spongy arrangement

Vascular Bundles

- phloem & xylem
- surrounding sheath

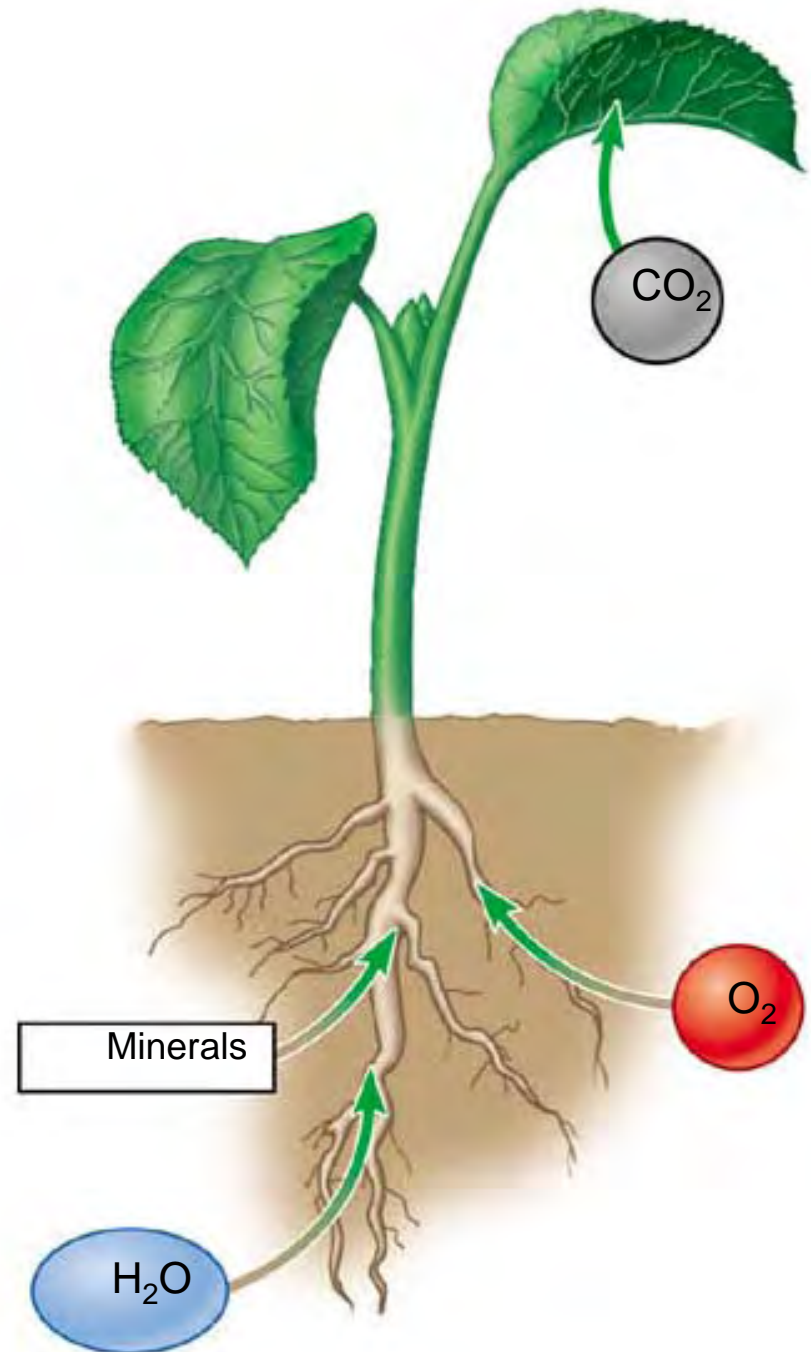
Stomata (singular = “stoma”)

- openings for gas exchange, transpiration
- regulated by guard cells

Root Function

Roots supply the plant with:

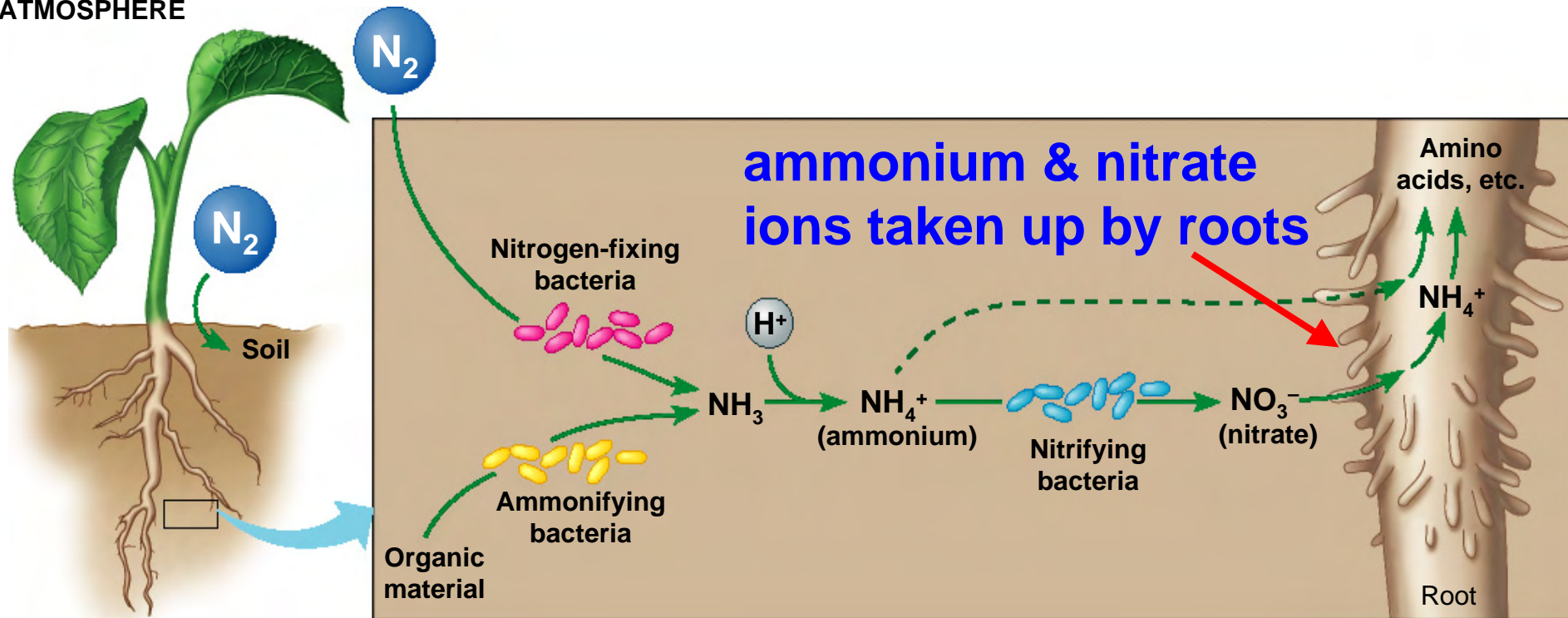
- anchorage in the soil
- water
- mineral nutrients
- oxygen (O_2)
 - for respiration since plants make ATP just as we do
 - over-watering can suffocate a plant!



Importance of Nitrogen Fixation

Plants require the element nitrogen in the form of ammonium (NH_4^+) or nitrate (NO_3^-) ions, however they **CAN'T** “fix” atmospheric nitrogen (N_2) into these forms.

ATMOSPHERE



Soil bacteria and some fungi **CAN** fix nitrogen, thus plants depend on these microbes for useable nitrogen.

Monocots vs Dicots

Flowering plants are of 2 basic types:

Seed Leaves

Leaf veins

Stems

Flowers

Roots

MONOCOTS



One cotyledon



Main veins usually parallel



Vascular bundles in complex arrangement

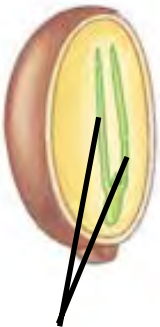


Floral parts usually in multiples of three



Fibrous root system

DICOTS



Two cotyledons



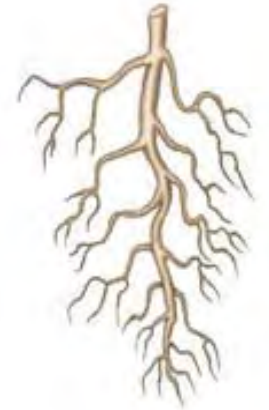
Main veins usually branched



Vascular bundles arranged in ring



Floral parts usually in multiples of four or five



Taproot usually present

Monocot vs Dicot Features

Cotyledons (embryonic “seed leaves”)

- nourish the seedling: monocots have 1, dicots have 2

Roots

- dicots have a central taproot, monocots do not

Stems

- dicots have a vascular structure organized into rings

Leaves

- monocots have narrow, smooth leaves w/parallel veins
- dicots have broader leaves w/branched vein patterns

Flowers

- monocots – layered flower parts come in groups of 3
- dicots – layered flower parts come in groups of 4 or 5

2. Plant Reproduction & Development

Basic Modes of Reproduction

Plants reproduce in 2 basic ways:

Asexually:

- **piece of parent plant gives rise to new plant**
- **involves mitotic cell division only**
- **offspring are genetically identical to parent**

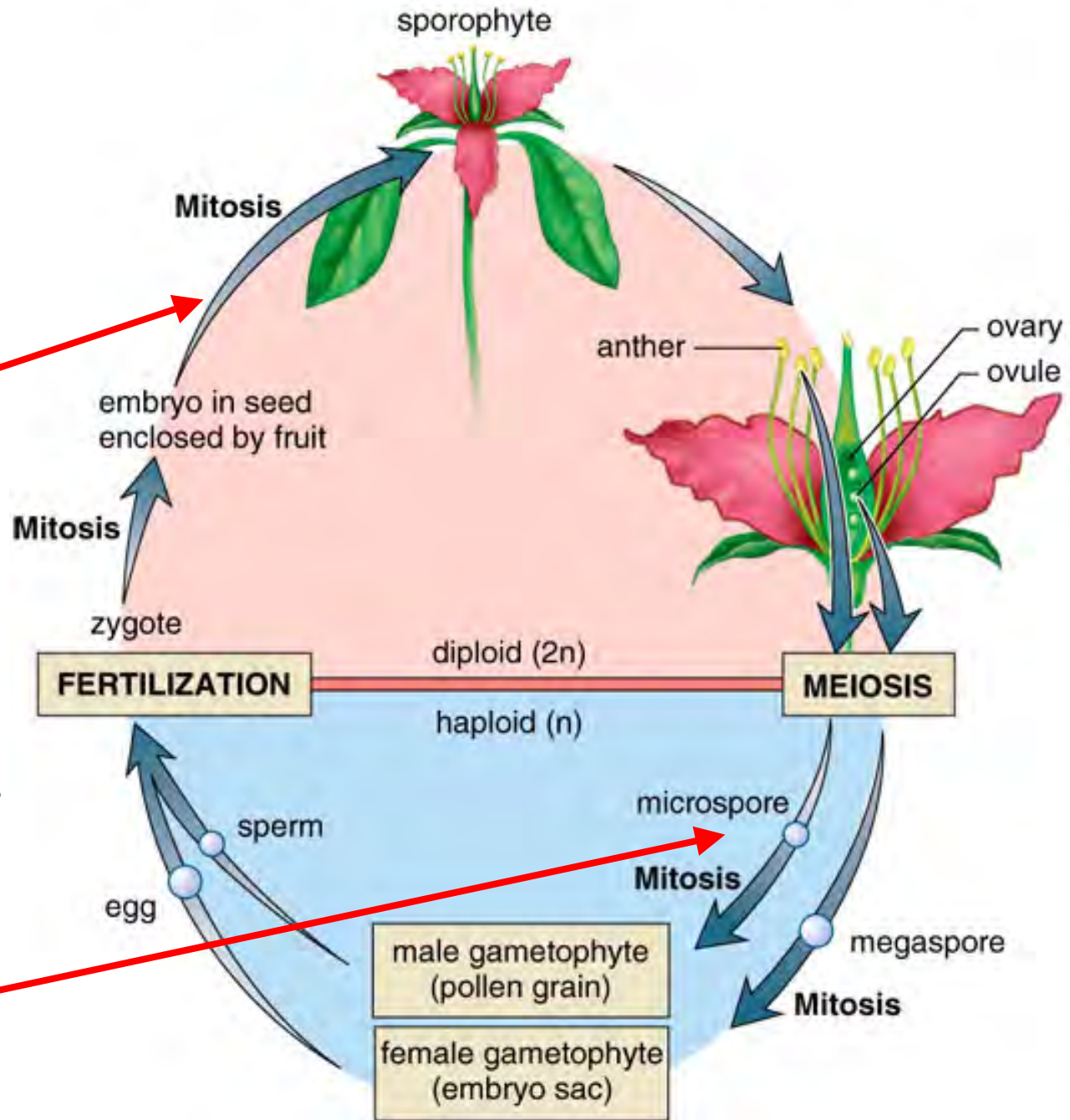
Sexually:

- **fusion of haploid gametes generates offspring**
- **offspring are genetically unique**

Life Cycle of Plants (sexual)

- fertilization produces a zygote that develops into a *diploid sporophyte*

- *haploid* spores produced by meiosis in flowers grow into multicellular *haploid* gametophytes, some cells of which are gametes



The Plant Sexual Life Cycle

The sexual life cycle of plants is unique, occurring by “Alternation of Generations”:

The sporophyte stage (diploid)

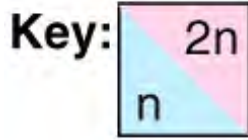
- the plant is made of diploid cells
- produces haploid spores by meiosis in the reproductive structures (e.g., flowers)

The gametophyte stage (haploid)

- grows from haploid spore (via mitosis)
- produces gametes (sperm and/or egg)
 - fertilization then produces a new diploid sporophyte!

Life Cycle in different Plant Phyla

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- gametophyte is more prominent in more primitive plant species
- in more advanced plant species, the sporophyte is much more prominent



Moss



Fern



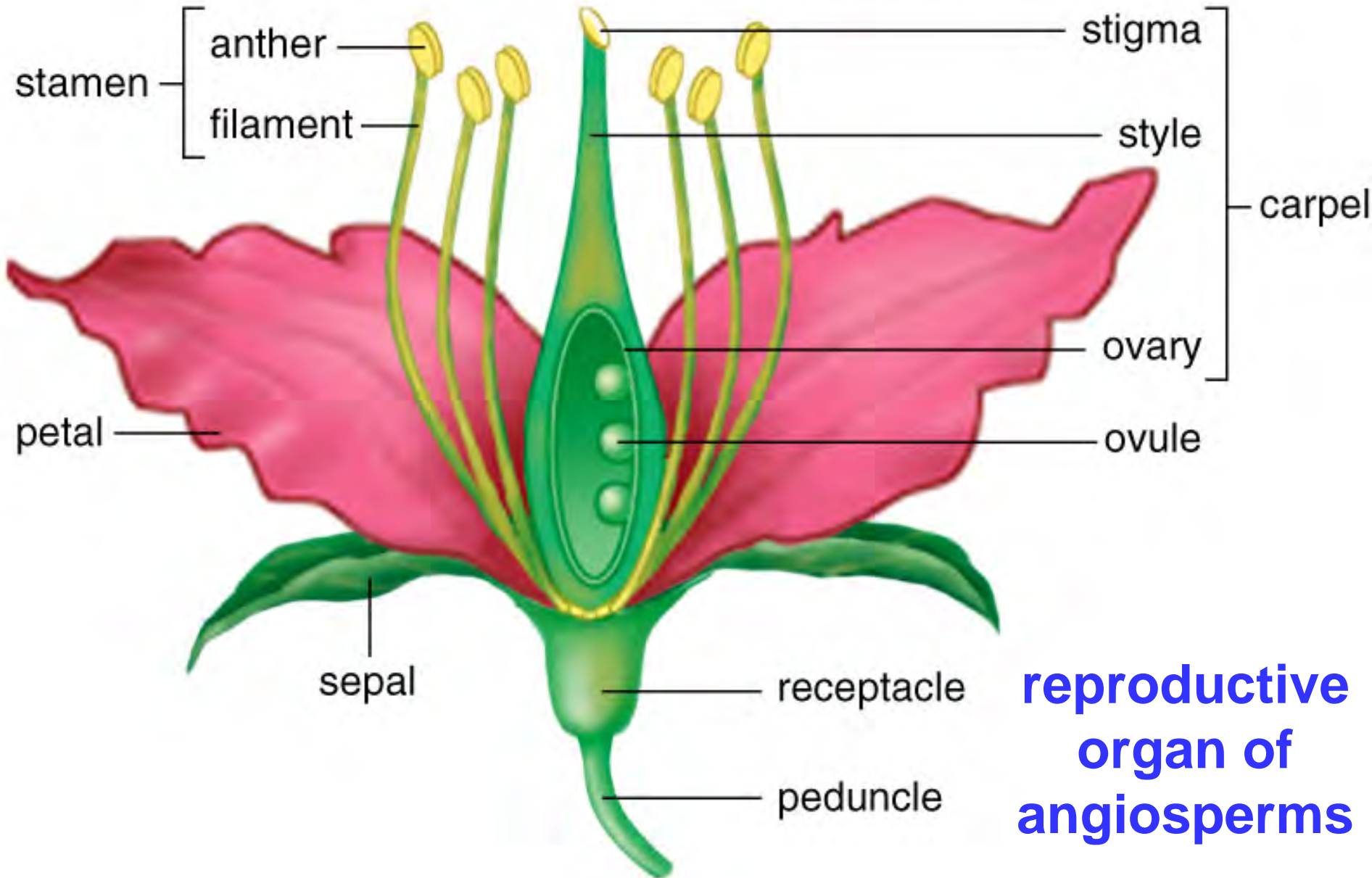
Gymnosperm



Angiosperm

The Structure of Flowers

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...more on Flower Structure

Flowers have 4 main parts:

Sepals

- **outermost structure (encloses flower bud)**

Petals

- **usually colored, inside sepals**

Stamen (anther & filament)

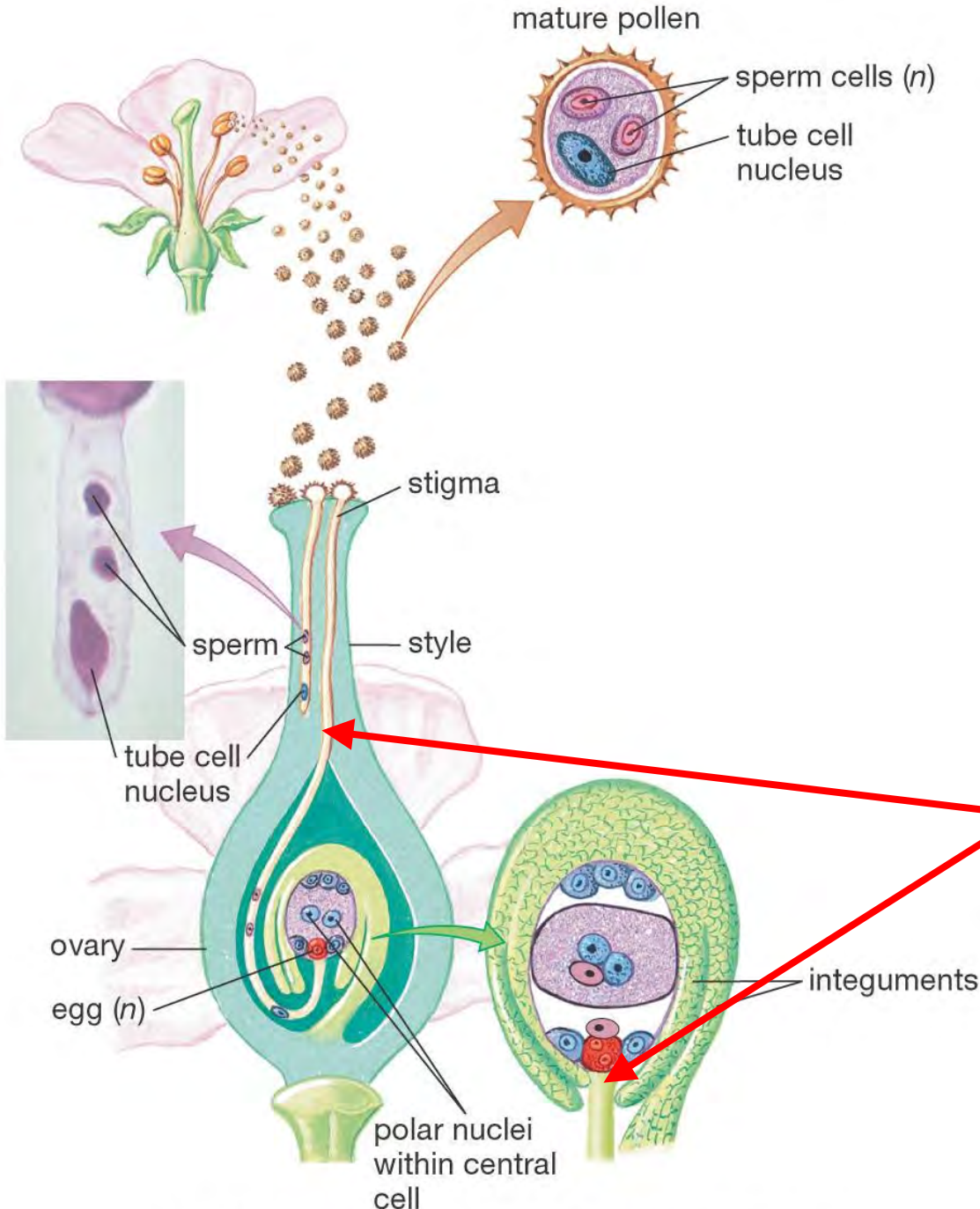
- **male reproductive structure**
- **anthers produce male gametophytes (pollen grains)**

Carpel (stigma, style & ovary)

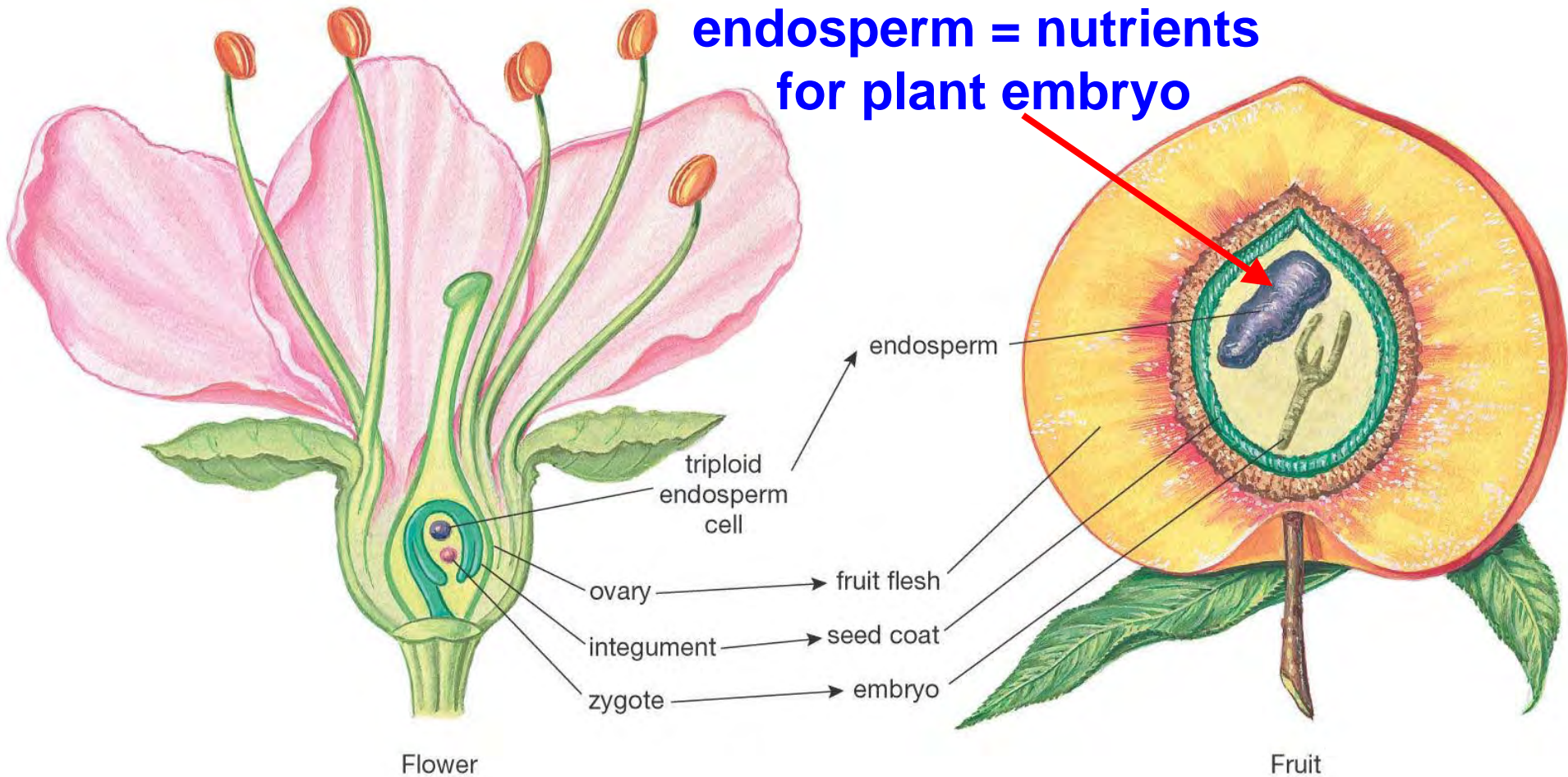
- **female reproductive structure**
- **produces female gametophytes (embryo sacs)**

Fertilization in Angiosperms

- pollen grains adhere to the stigma (pollination)
- tube cell in pollen elongates down style to penetrate ovule in ovary
- 2 sperm are released to fertilize the egg & fuse with a special diploid cell in ovule



Seed Production



- zygote develops into embryo, triploid cell forms endosperm
- seed coat derived fr. ovule wall encloses embryo, endosperm
- fruit develops from ovary wall to aid seed dispersal

Seed Dispersal

Seeds can be dispersed via fruits by:

Water

- **floating on water (e.g., coconuts)**

Air

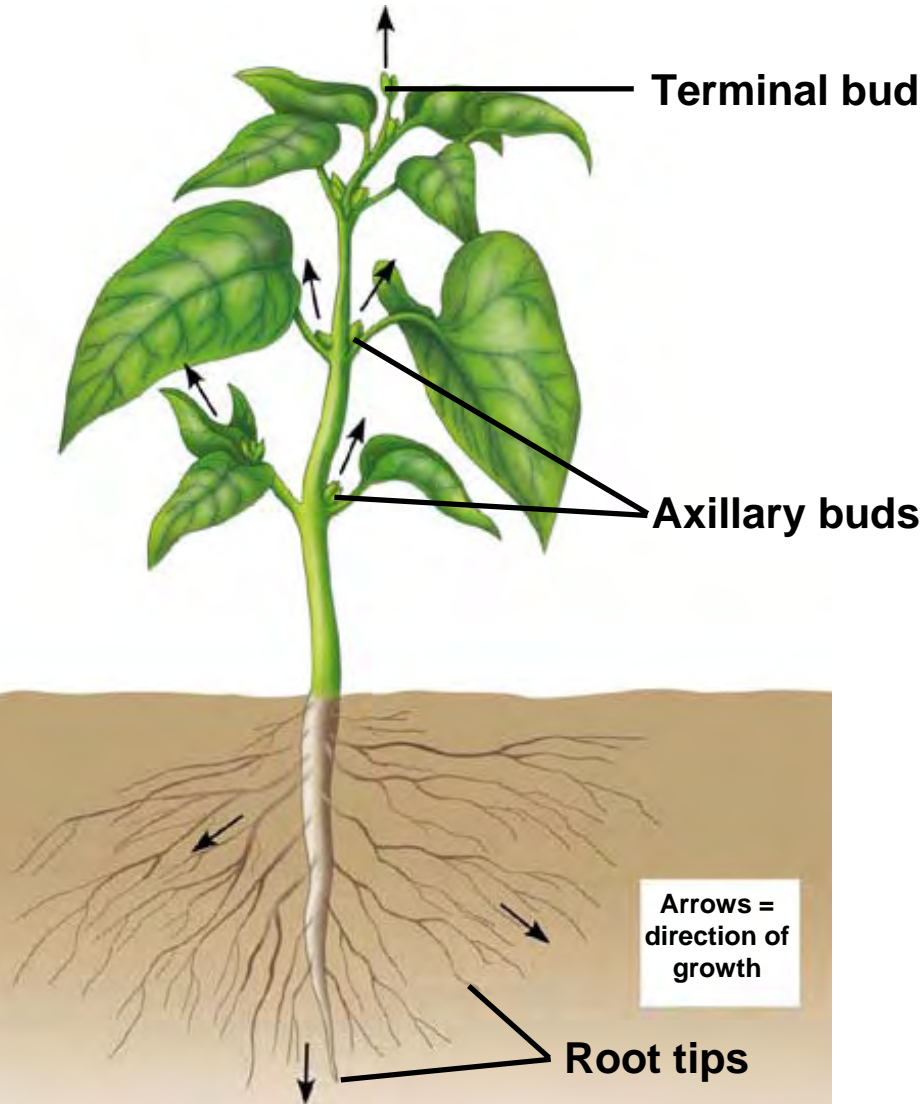
- **lightweight seeds can be transported by the wind (e.g., dandelion, maple)**

Animal

- **edible fruits entice animals to eat them**
- **“hitchhiker” fruits stick to animals**

Plant Growth

Plant growth occurs in 2 basic ways:



Primary growth

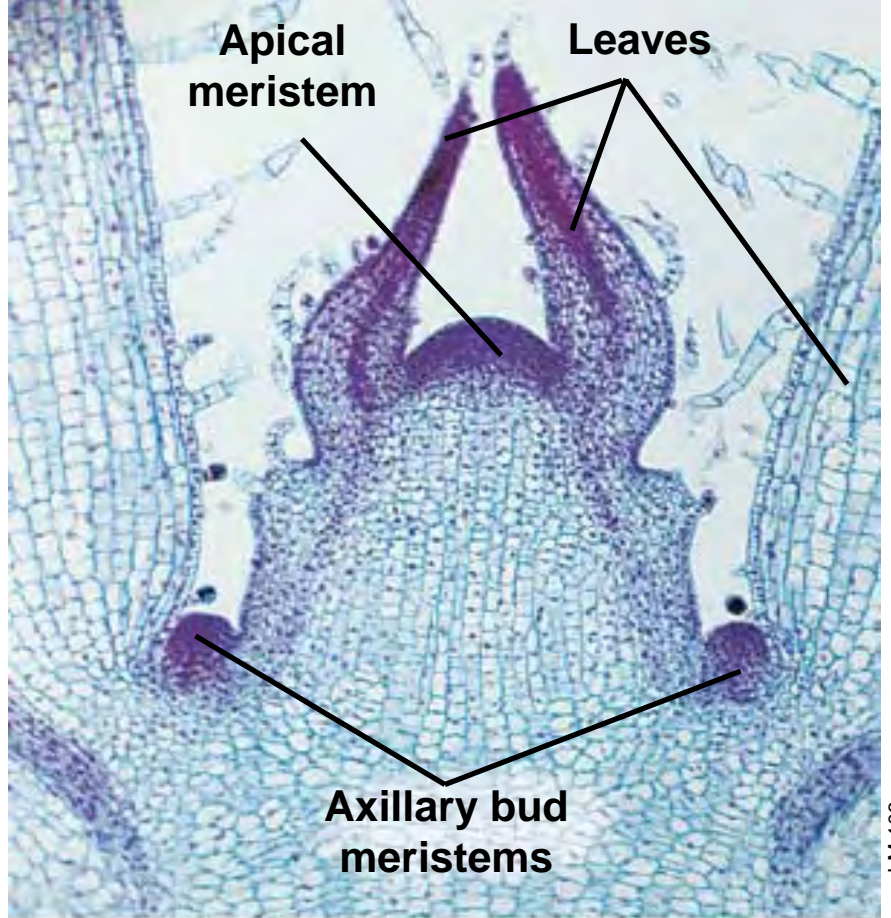
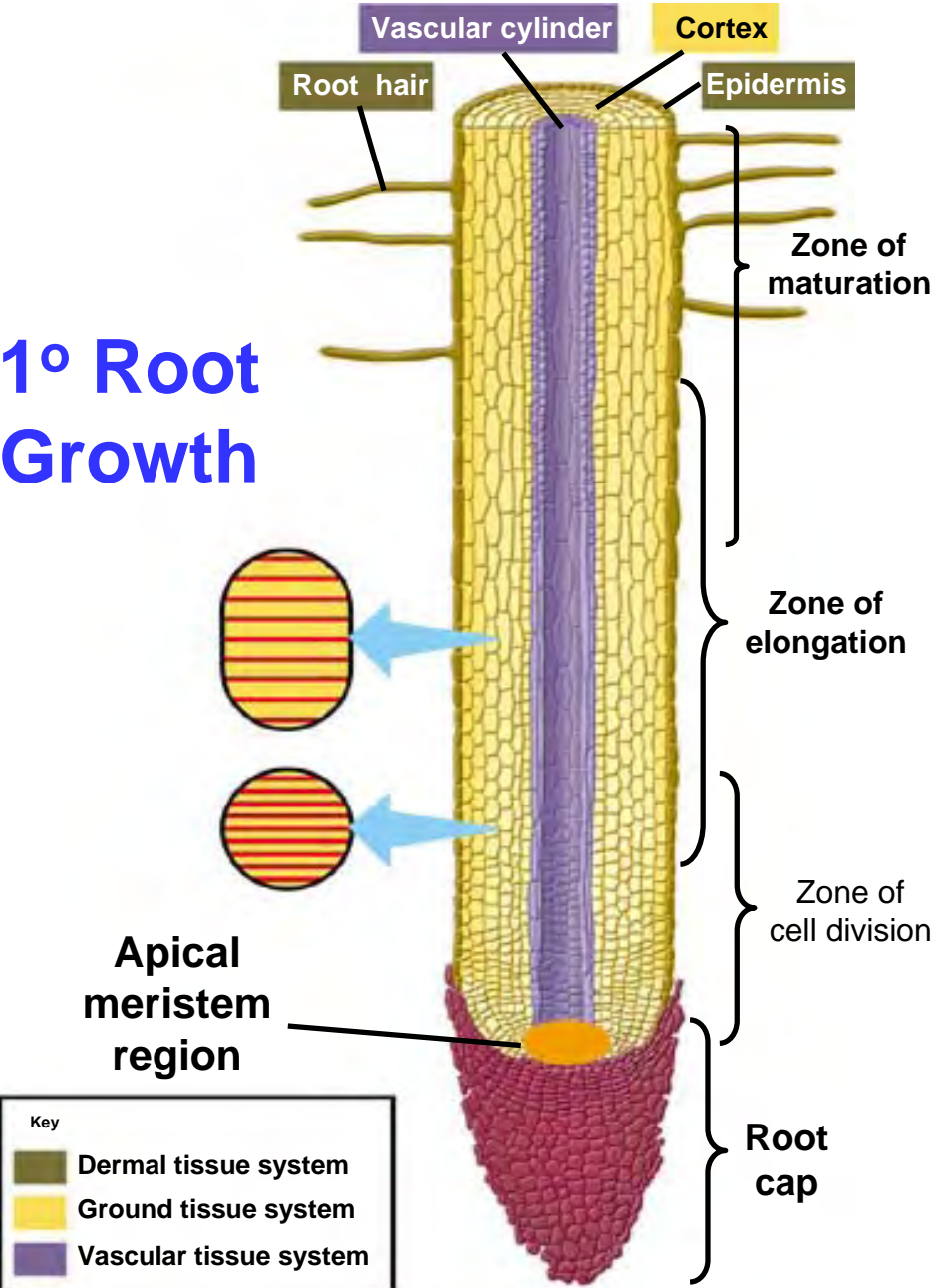
- growth in *length* of roots & shoots
- due to special “stem cell” tissue called apical meristem

Secondary growth

- growth in *width* due to lateral meristem
- occurs in “woody” perennial plants

Primary (1°) Growth

1° Root Growth



1° Shoot Growth

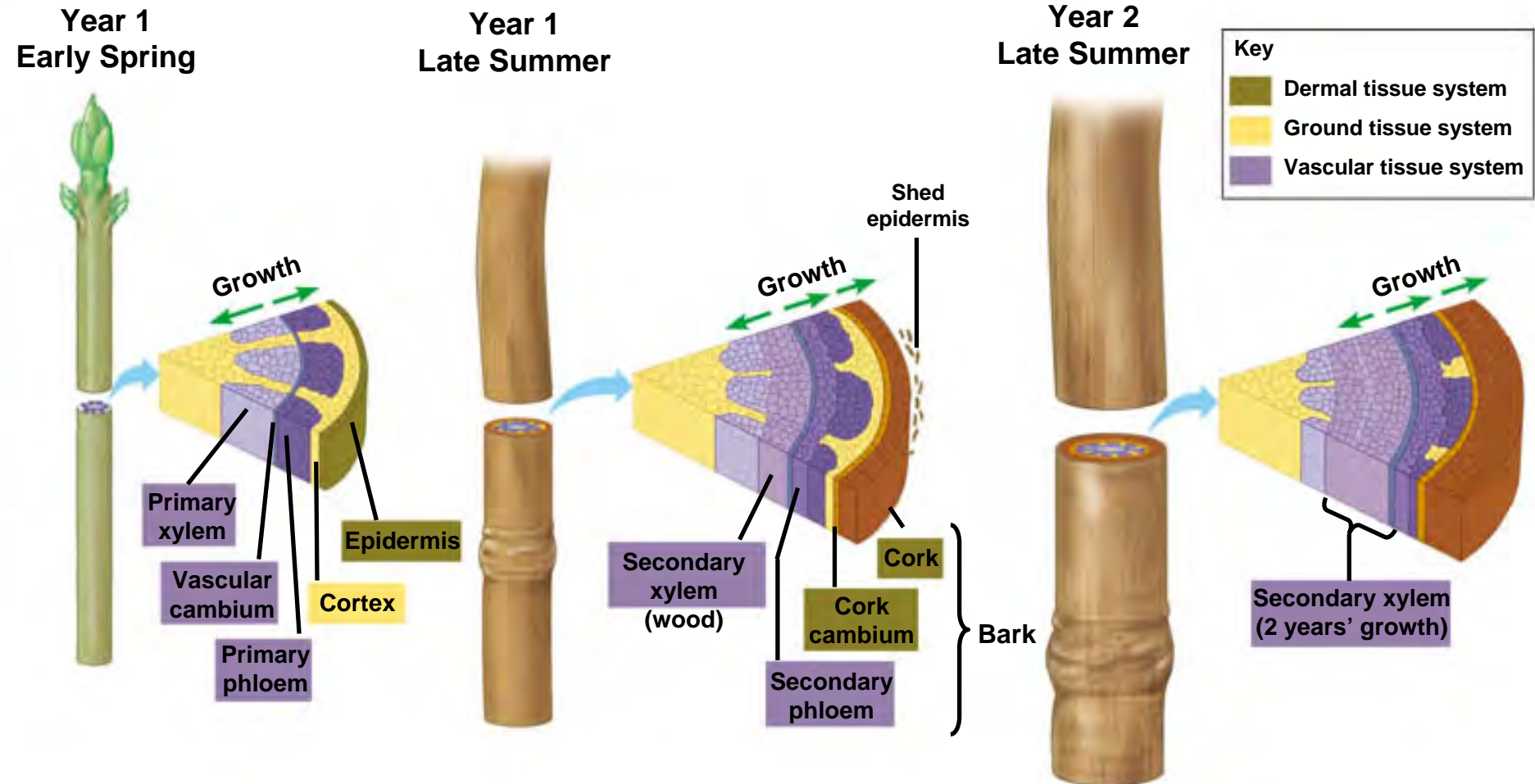


Secondary (2°) Growth

Due to *lateral* meristem tissue which consists of:

Vascular Cambium (new phloem & xylem)

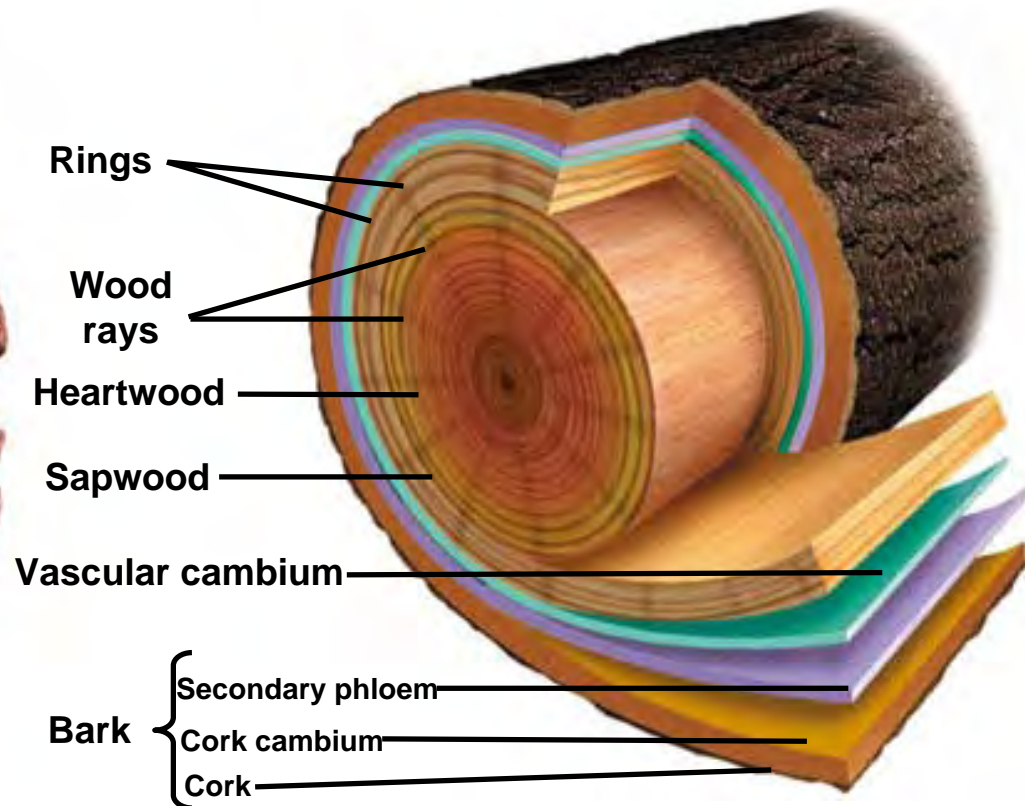
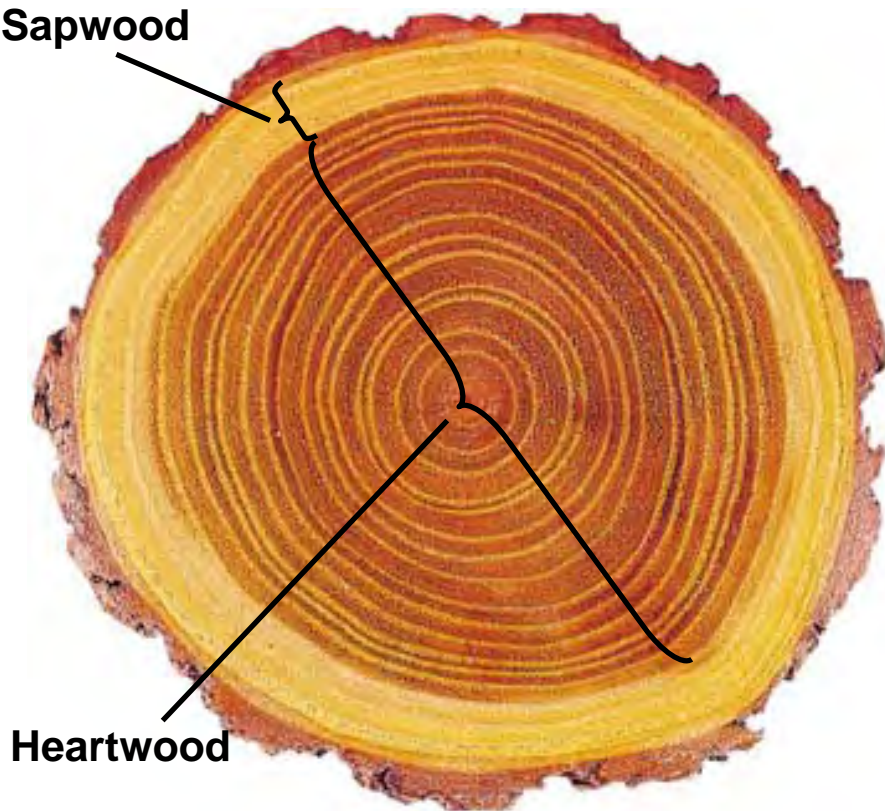
Cork Cambium (cork replaces the epidermis during 2° growth)



Secondary Growth in Woody Plants

Vascular cambium produces new phloem & xylem ea yr:

- spring & summer growth look diff., producing an annual ring



Heartwood

- old, dead xylem from previous years

Sapwood

- new, functioning xylem from most recent 2° growth

Key Terms for Chapters 31 & 32

- **mesophyll, stomata, phloem, xylem**
- **asexual vs sexual, “alternation of generations”**
- **sporophyte, gametophyte**
- **sepal, petal**
- **stamen – anther & filament (pollen, tube cell)**
- **carpel – stigma, style, ovary (ovule, embryo sac)**
- **monocot, dicot**

Relevant Review Questions:

Ch. 31 – 2-4, 6-11 Ch. 32 – 1, 3