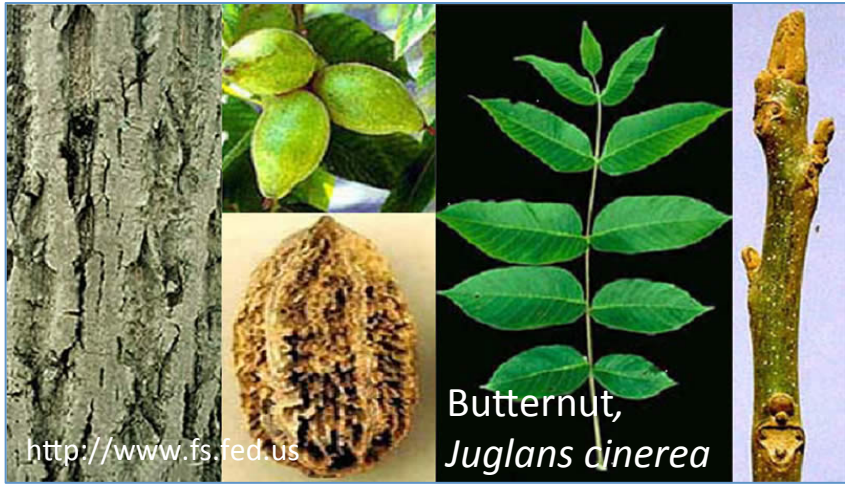
Chapter 3: The Plant Body, Part II



<u>Lecture Outline</u>:

Hierarchical organization of multicellular organisms (cells → whole organism)

Tissues are groups of cells that perform a common function

Flowering plants are made up of three basic ***tissue types***: dermal, ground, and vascular tissues

Secondary growth and the ***lateral meristems*** (vascular and cork cambia)

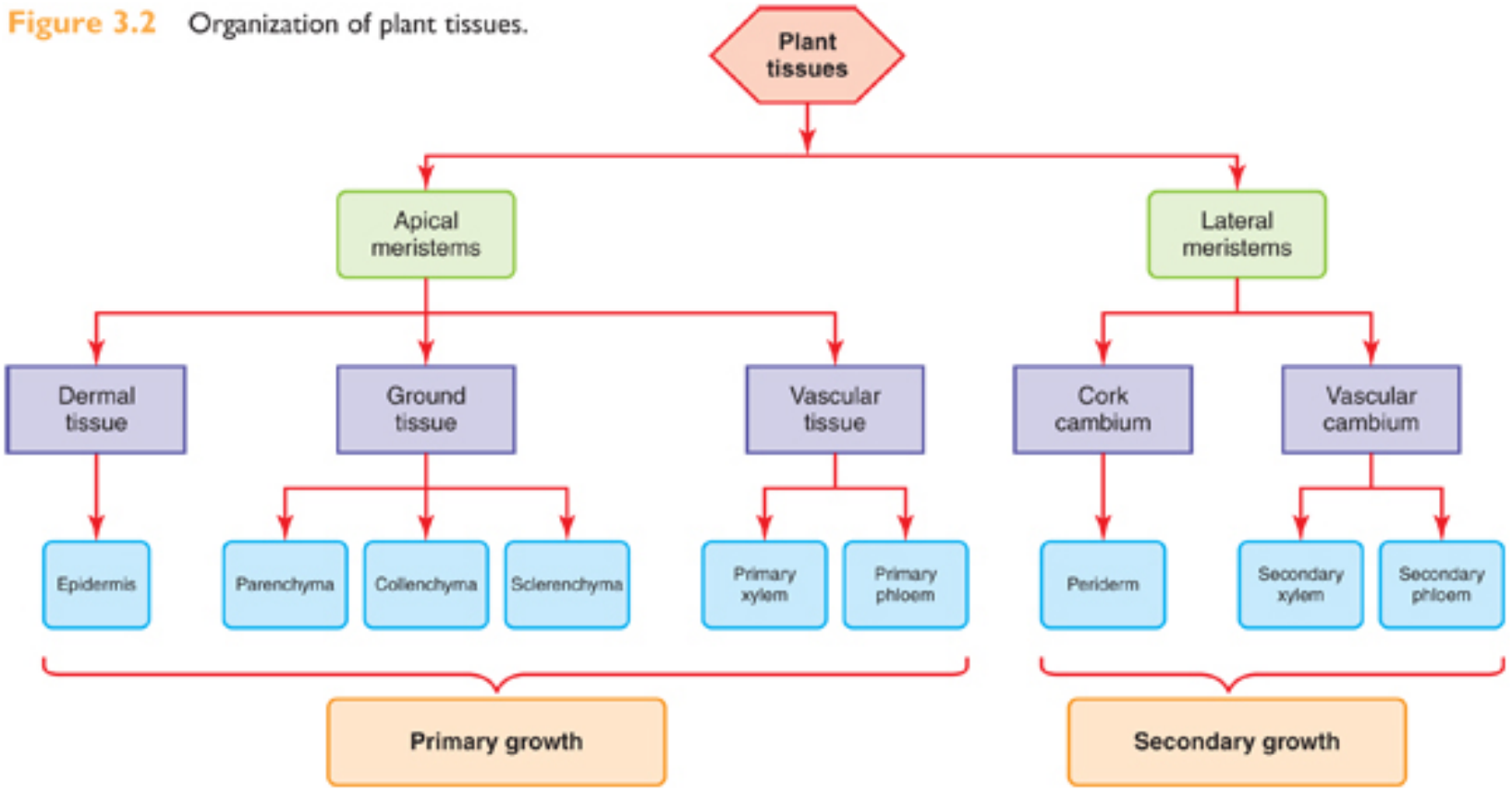
The organization and anatomy of major ***plant organs***: stems, leaves, and roots

Flowering plants are categorized as either ***monocots*** or ***eudicots***

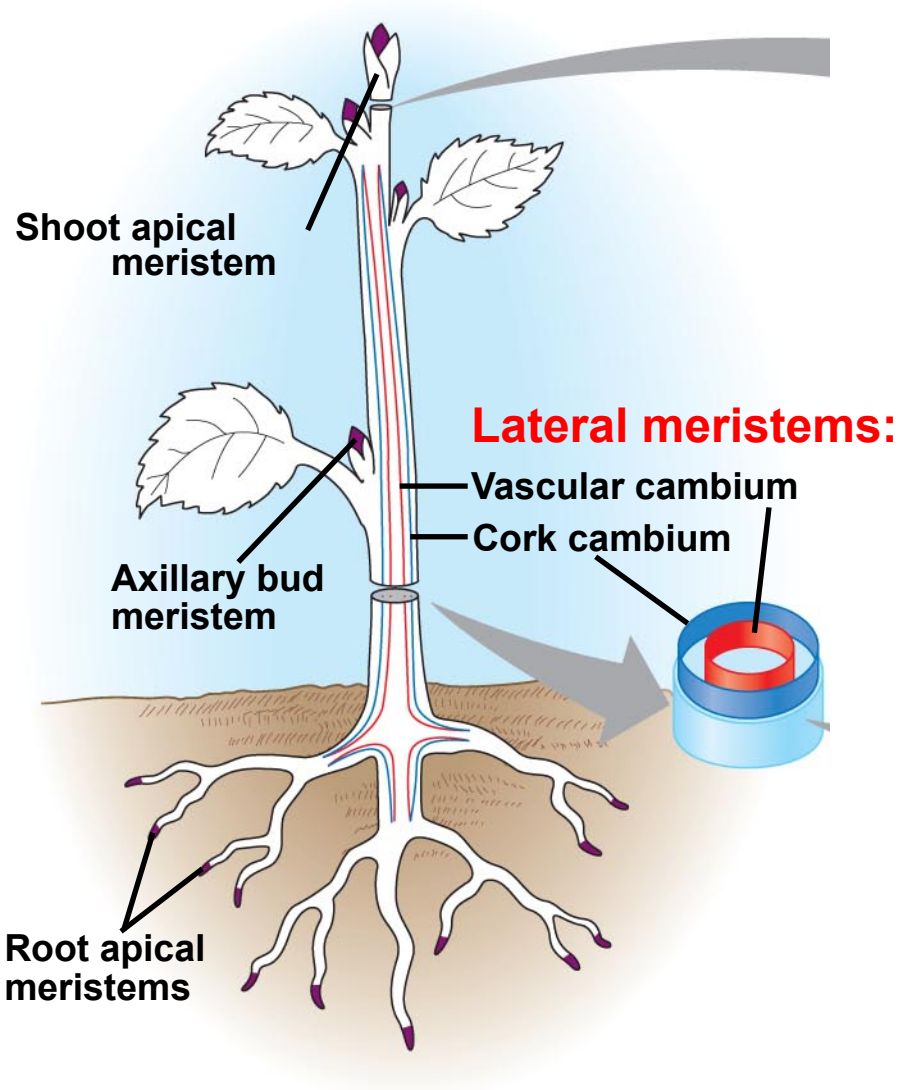
Anatomical differences in the stems, leaves, and roots of monocots and dicots

Structure and ***function*** are correlated at all levels (cells to whole organism)

Figure 3.2 Organization of plant tissues.



An overview of ***primary*** and ***secondary growth***



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The ***cork cambium*** produces a tough, thick covering for stems and roots that replaces the epidermis and constitutes the outer bark

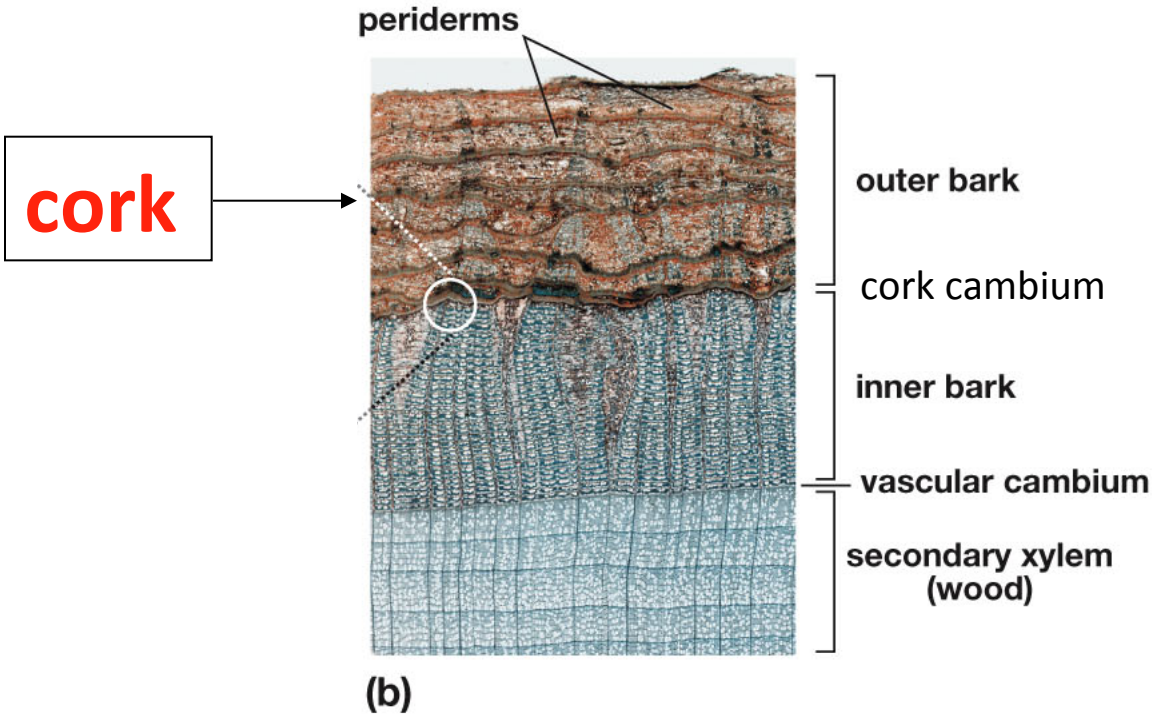

Figure 9.24 Plant Biology, 2/e

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The ***vascular cambium*** produces secondary vascular tissues (xylem and phloem) that constitutes the wood and inner bark in woody plants

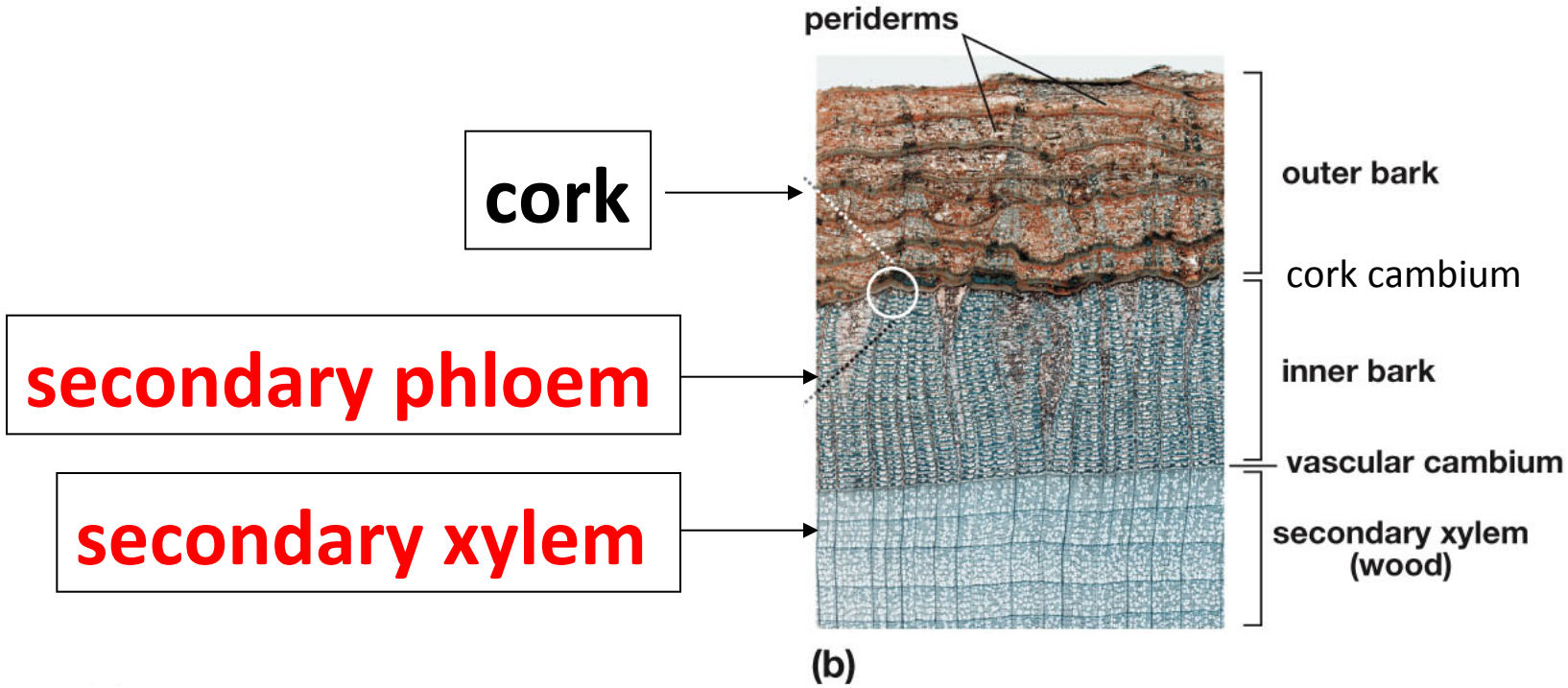

Figure 9.24 Plant Biology, 2/e

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Examples of bark

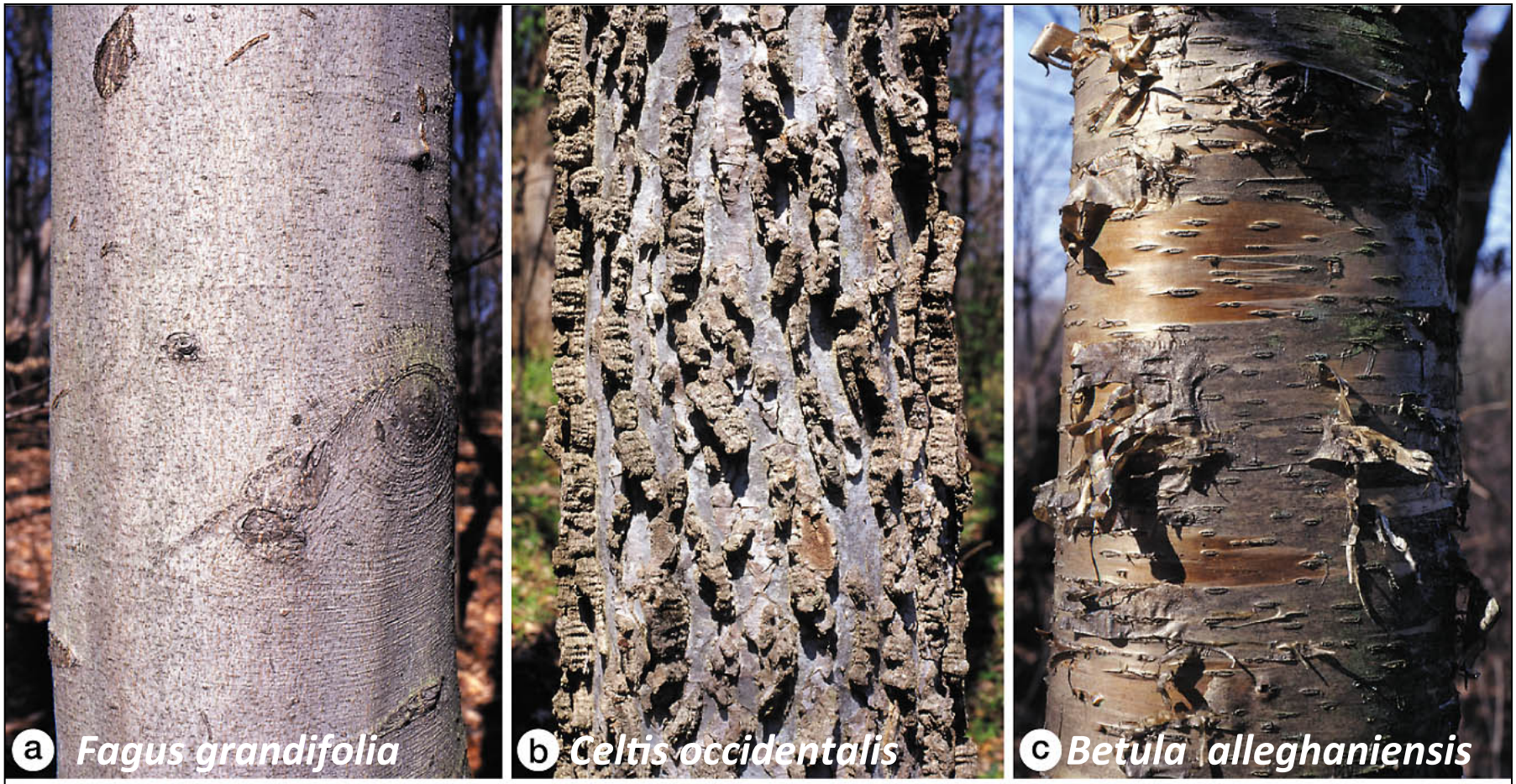

Figure 9.25 Plant Biology, 2/e

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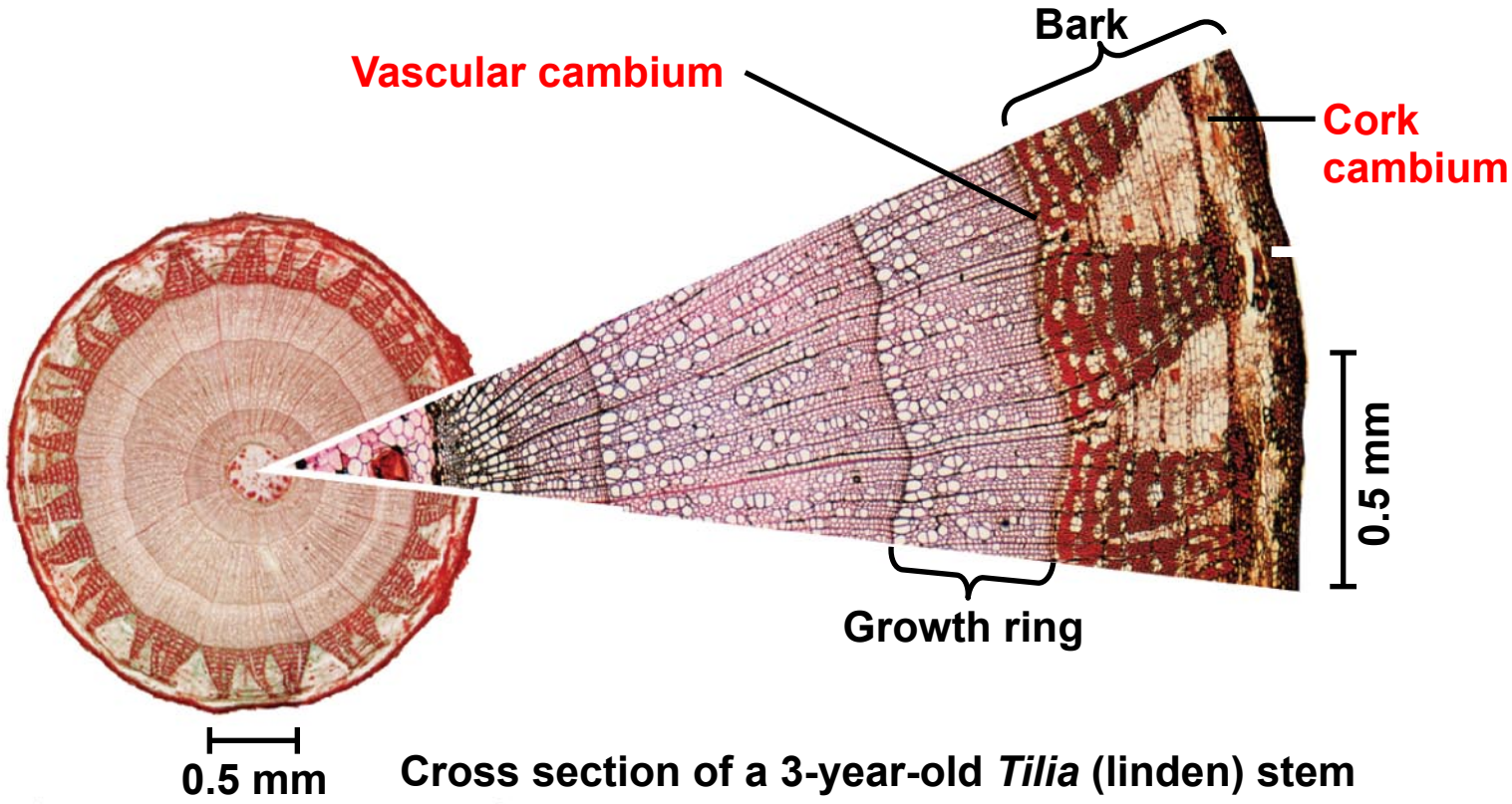
Secondary growth & lateral meristems



Cross section of a 3-year-old *Tilia* (linden) stem

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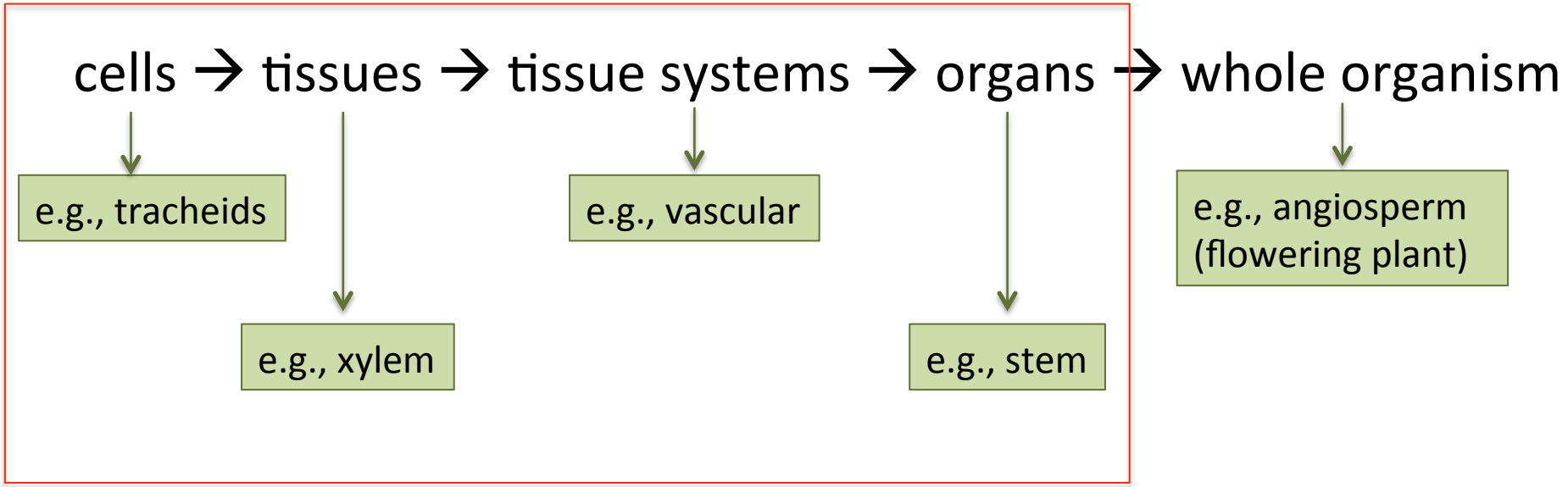
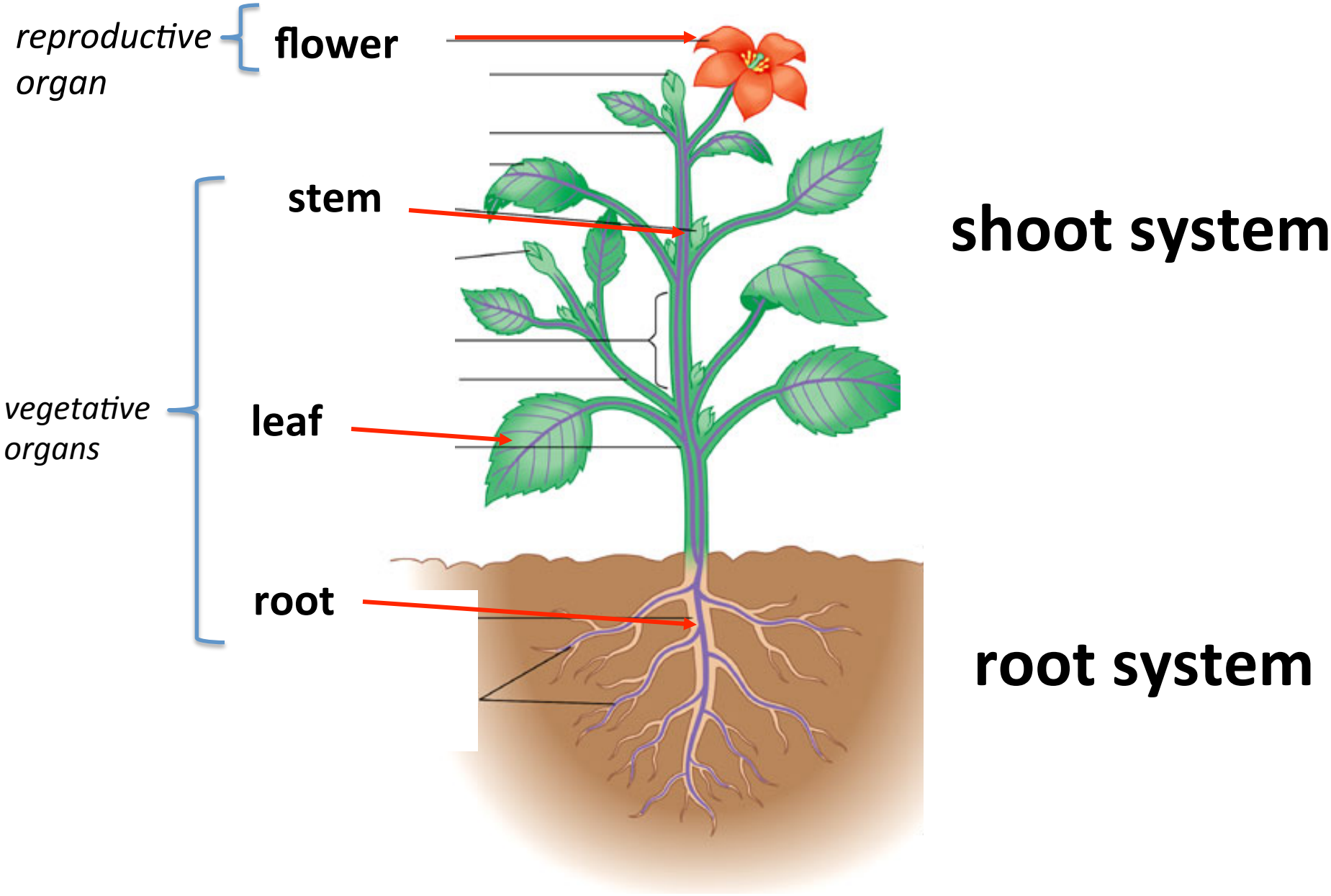
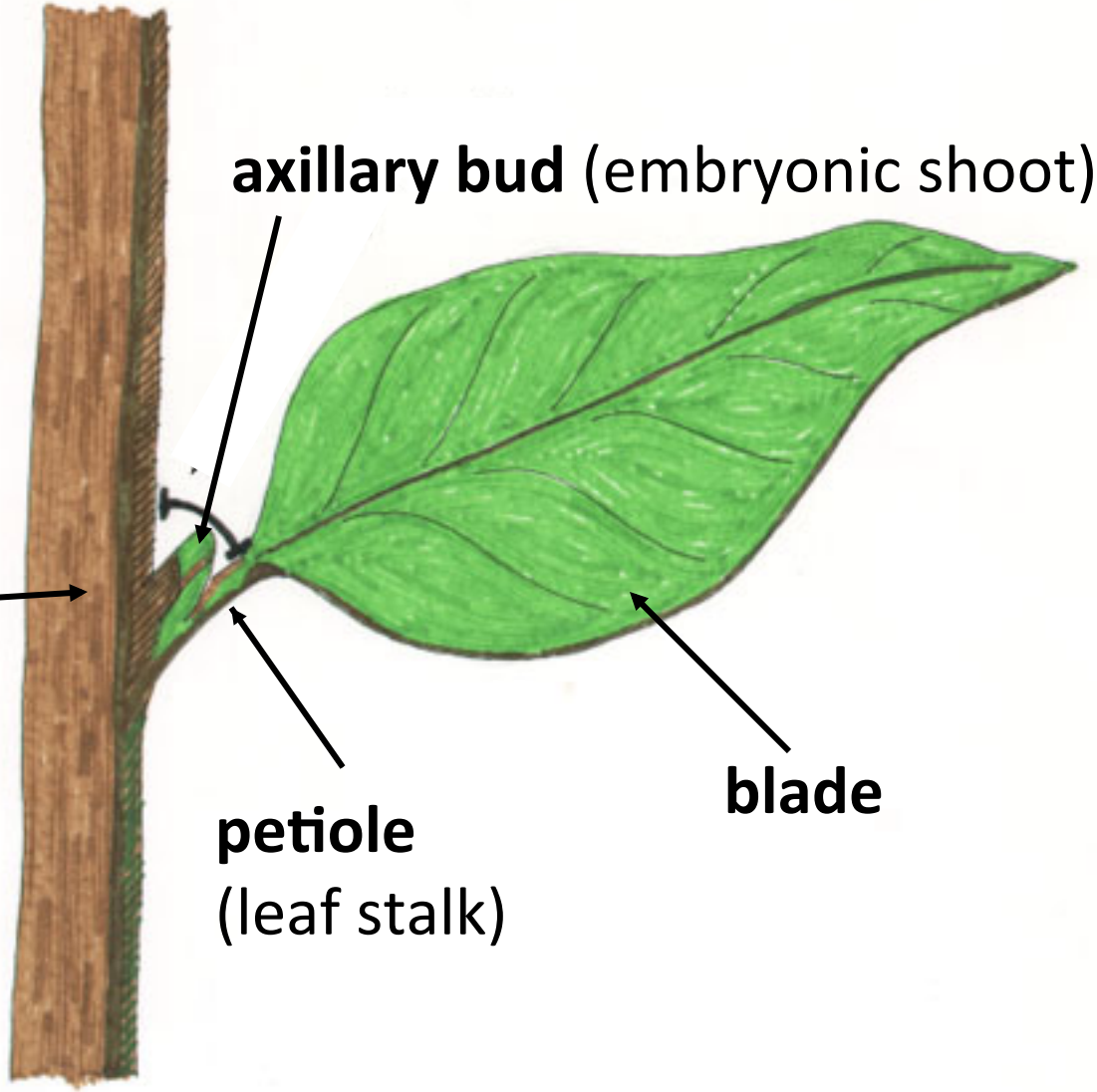
Hierarchical organization of ***multicellular*** organisms (e.g., plants, animals)





Plant organs and organ systems

Organization of a leaf



Anatomy of a leaf

The **mesophyll** (i.e., cells in the middle of the leaf) is composed of 2 types of parenchyma cells *(palisade and spongy).*

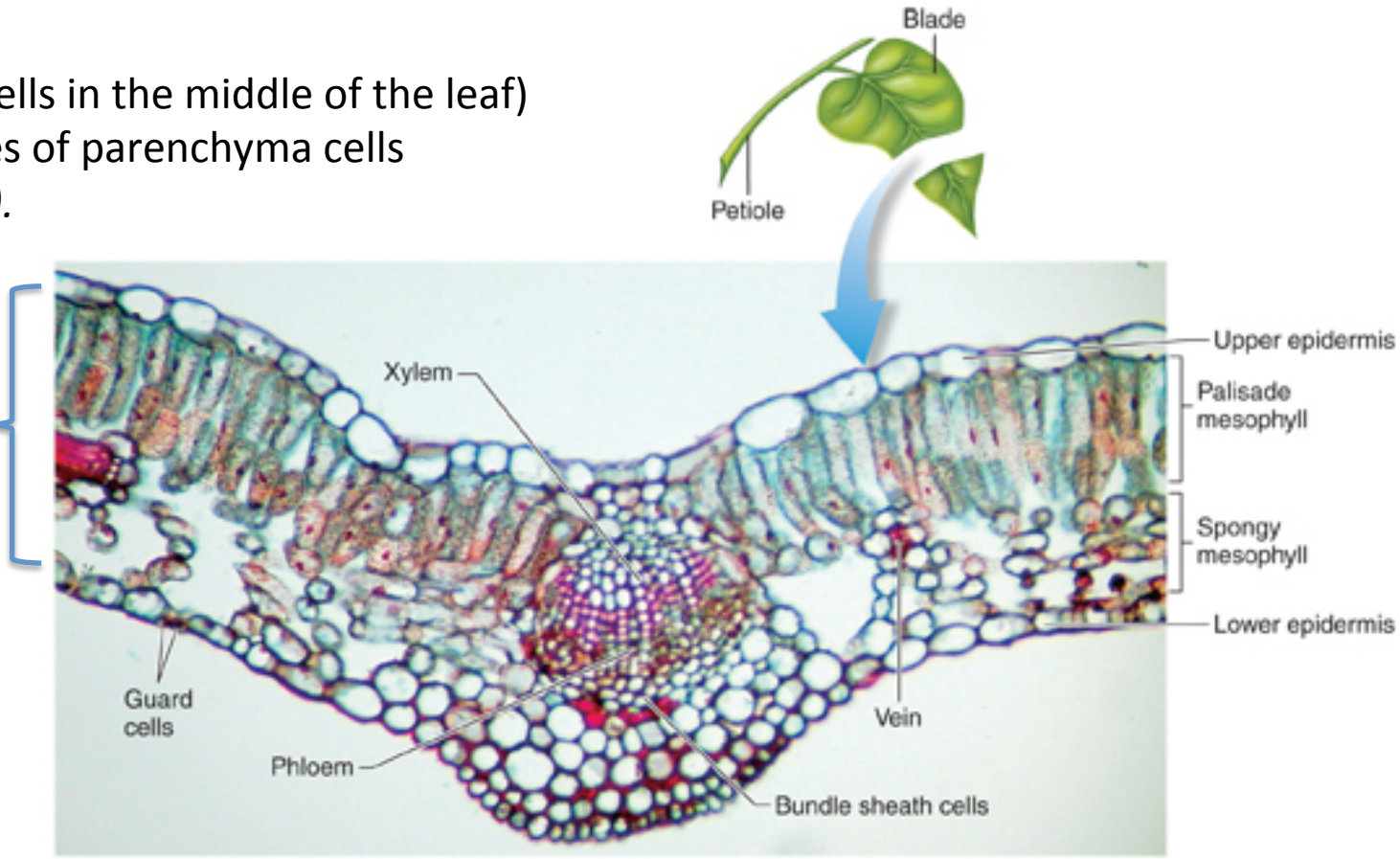


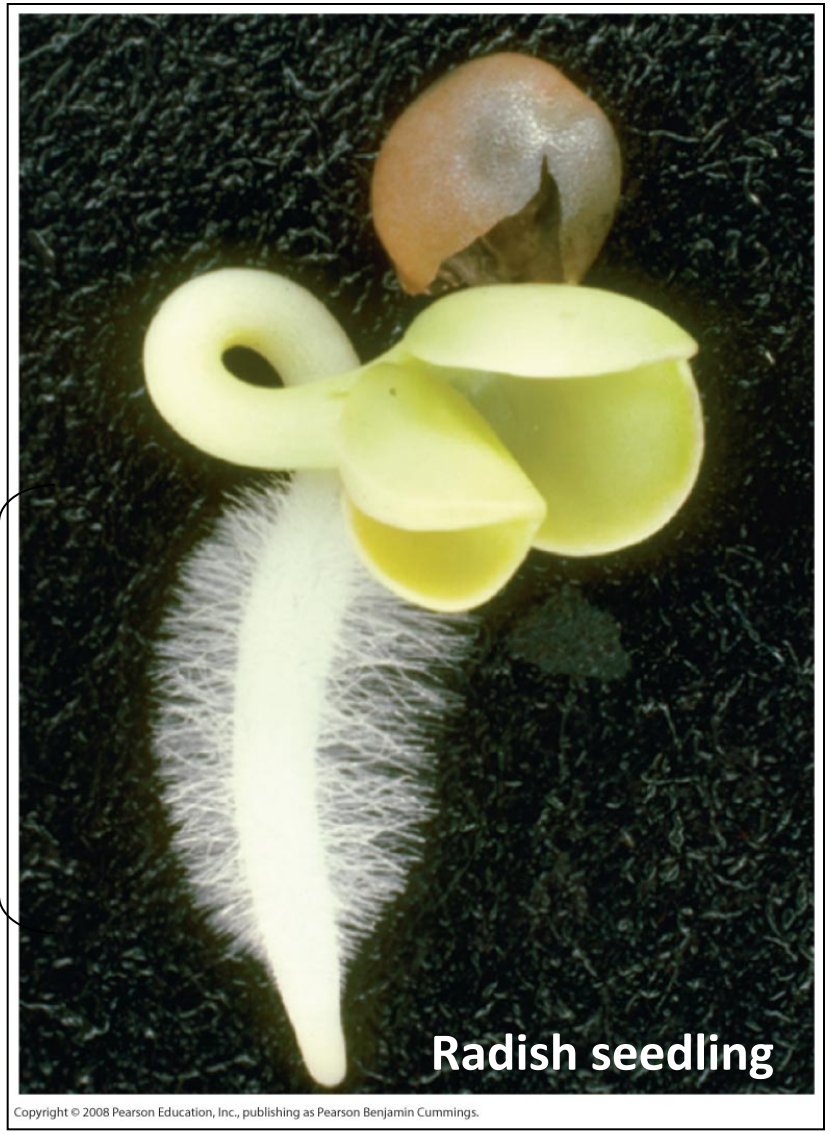
Figure 3.12 Leaf anatomy. Cross section of a leaf illustrates that palisade and spongy cells make up the mesophyll.

Function of roots

Roots…

- anchor a plant in the soil
- absorb minerals and water
- often store carbohydrates

Root hairs increase absorption of water and minerals



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Leaf morphology: composition, arrangement and venation

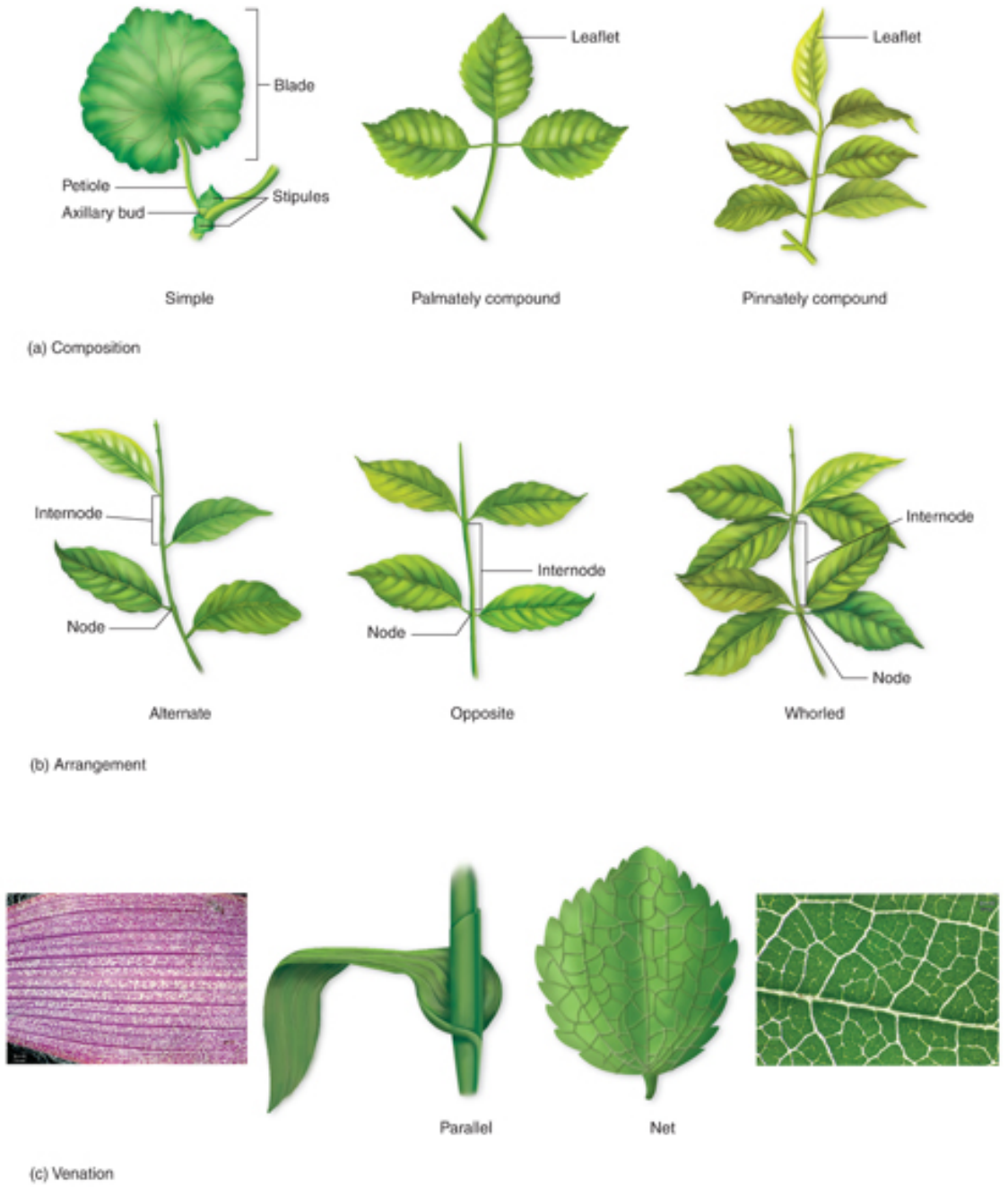


Figure 3.11 Leaf morphology. (a) Leaf composition. Leaves may be simple, consisting of a single undivided blade, or compound, in which the blade is subdivided into leaflets. (b) Leaf arrangement. Alternate, opposite, or whorled indicates the number of leaves coming off a node. (c) Leaf venation. The venation pattern is commonly parallel in monocot leaves and net in dicot leaves.

Plant Classification

PLANTS

non-flowering plants

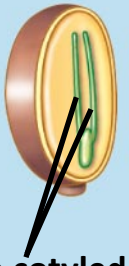
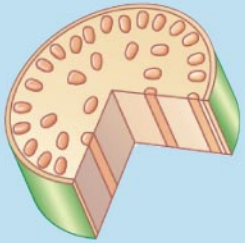
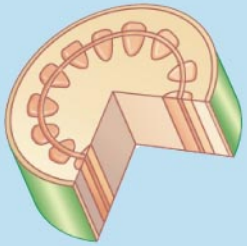
flowering plants (angiosperms)

monocots

e.g., trilliums (& other lilies), grasses, palms, tulips, orchids

eudicots

e.g., roses, oaks, peas, buttercups, maples, sunflowers

Monocot Characteristics		Eudicot Characteristics
 One cotyledon	Embryos	 Two cotyledons
 Veins usually parallel	Leaf venation	 Veins usually netlike
 Vascular tissue scattered	Stems	 Vascular tissue usually arranged in ring

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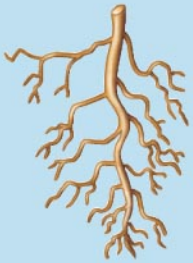
Monocot Characteristics		Eudicot Characteristics
 Root system usually fibrous (no main root)	Roots	 Taproot (main root) usually present
 Pollen grain with one opening	Pollen	 Pollen grain with three openings
 Floral organs usually in multiples of three	Flowers	 Floral organs usually in multiples of four or five

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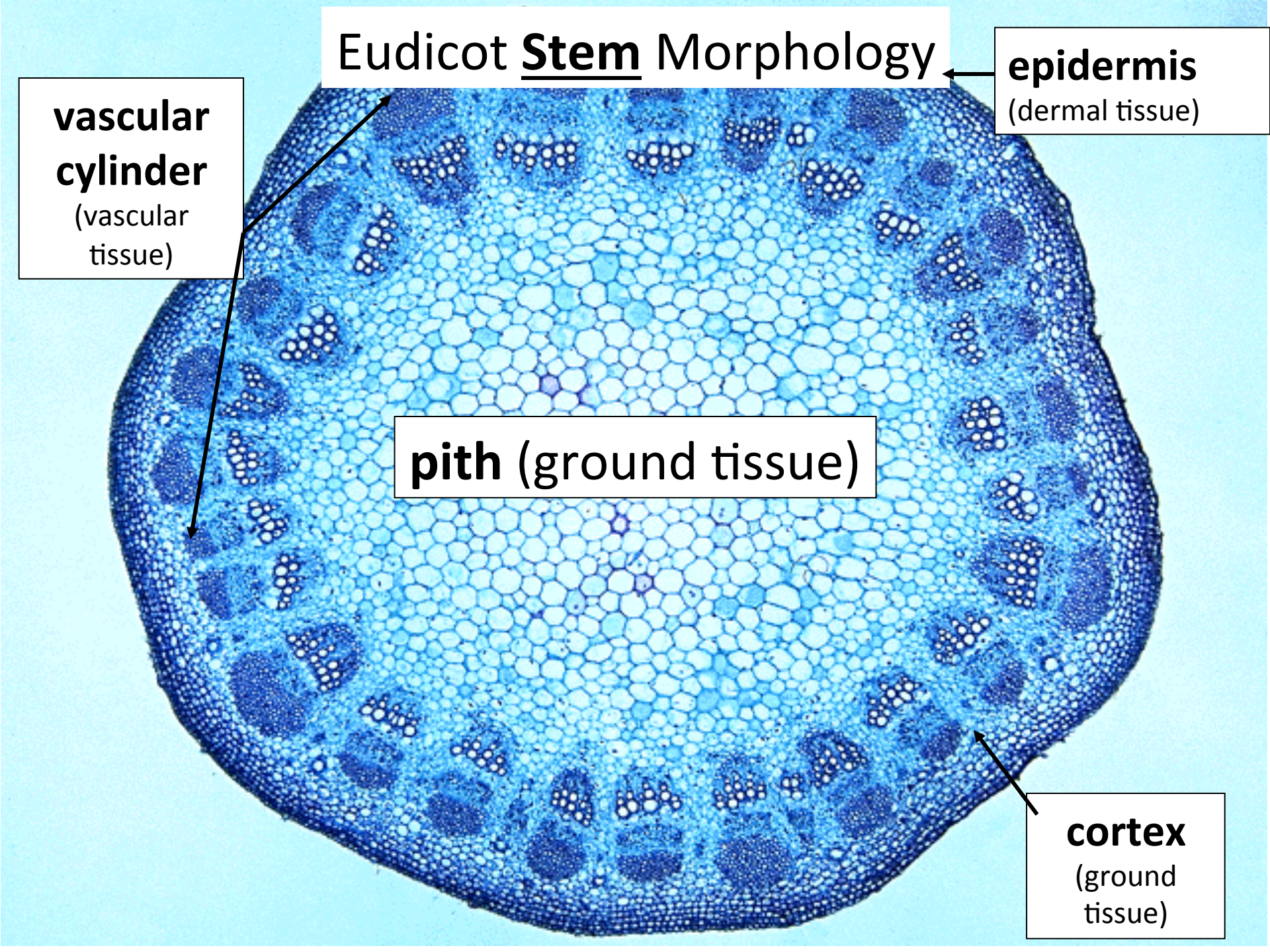
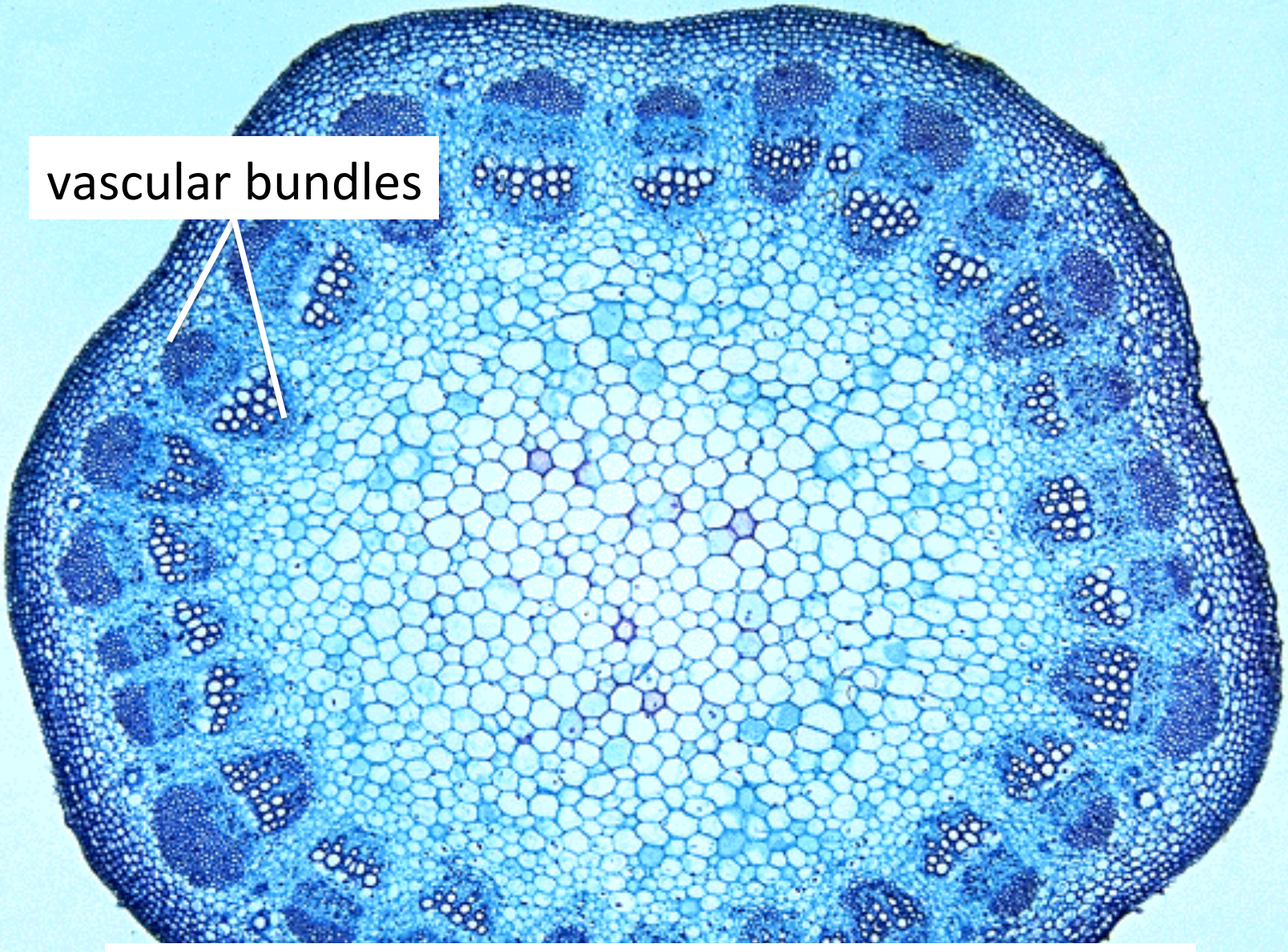
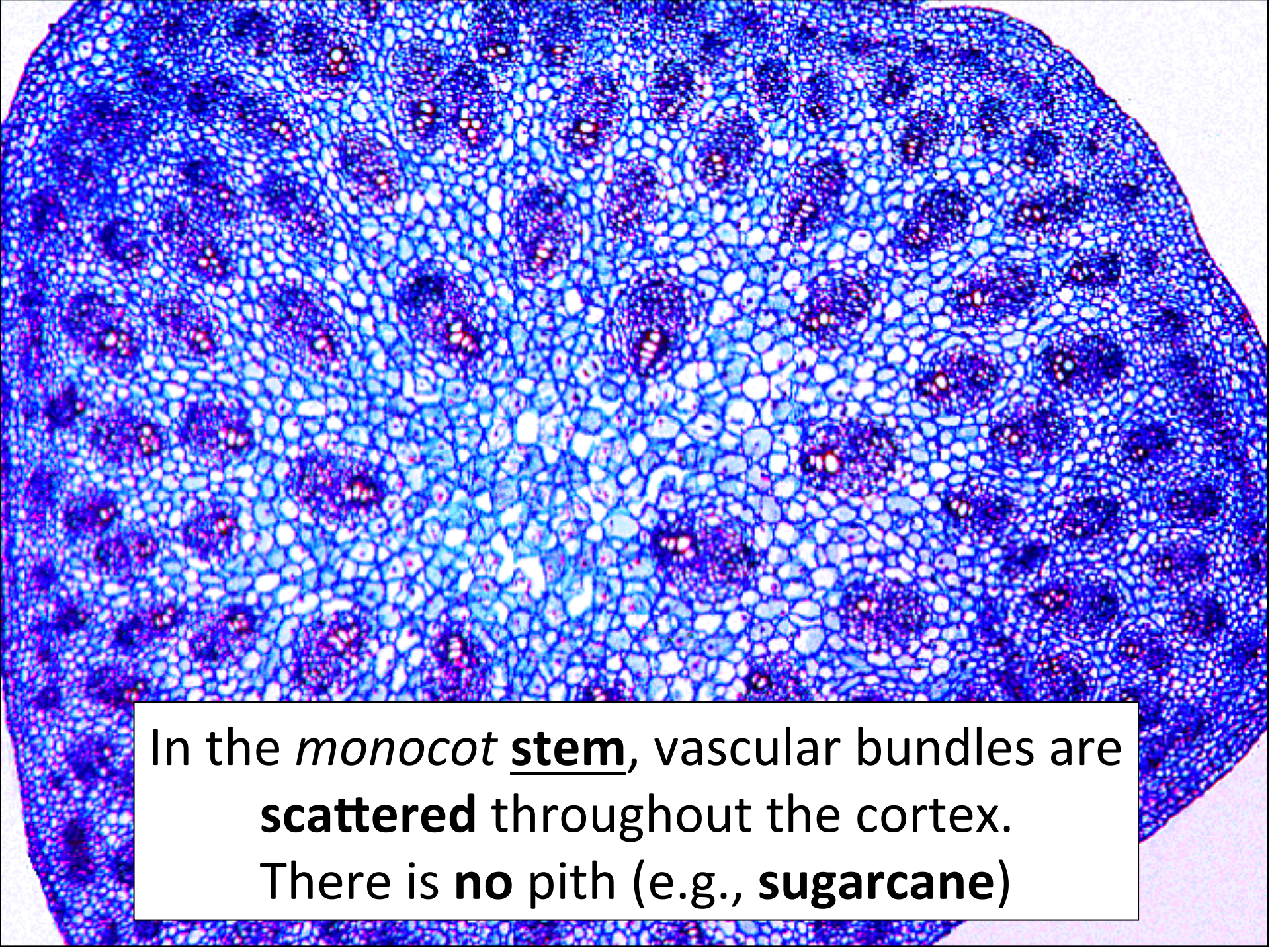

Eudicot **Stem** Morphology
epidermis (dermal tissue)
vascular cylinder (vascular tissue)
pith (ground tissue)
cortex (ground tissue)

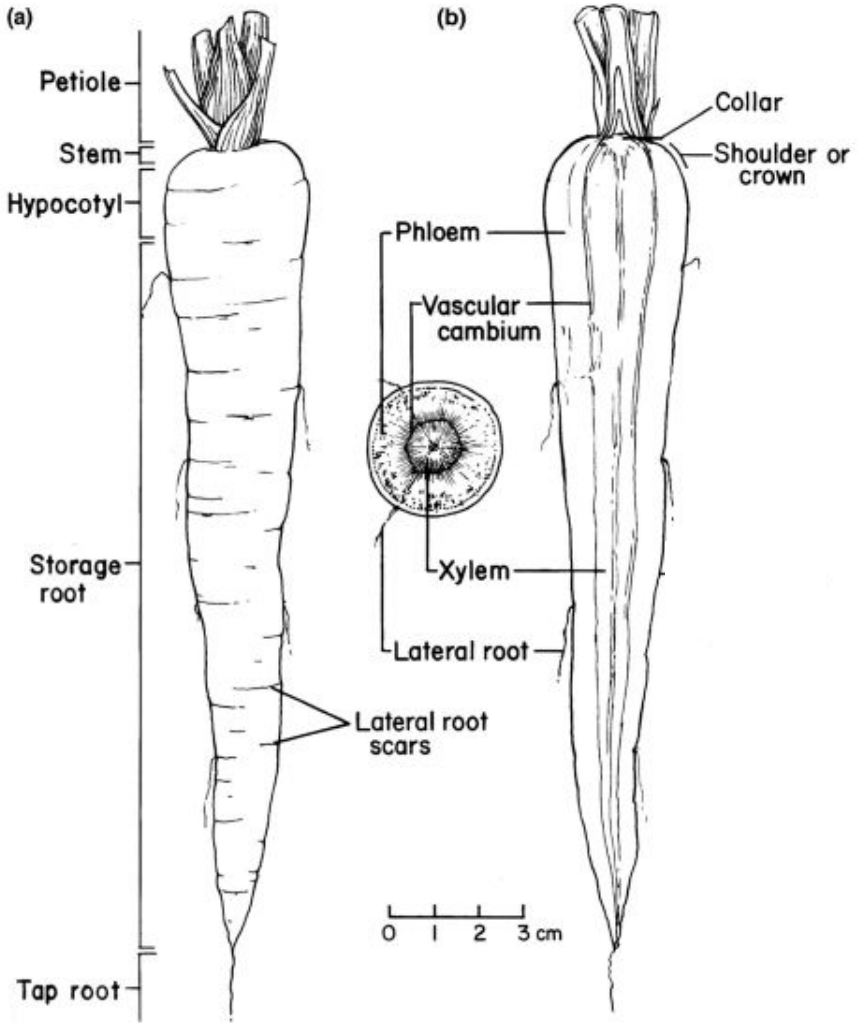


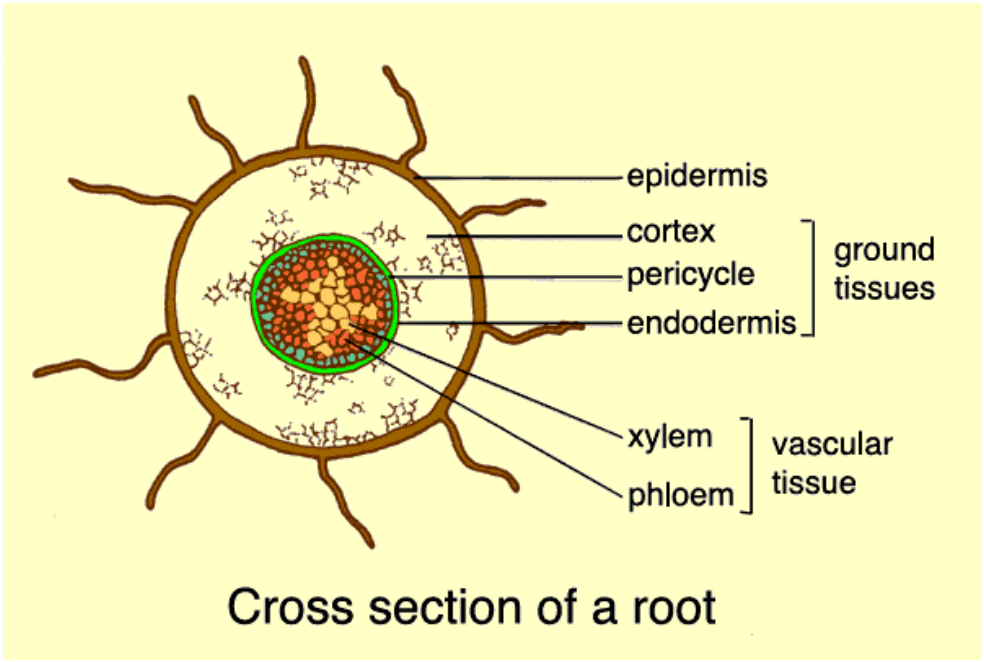
In the *eudicot* **stem**, vascular bundles are arranged in a ring (e.g., *Coleus*)



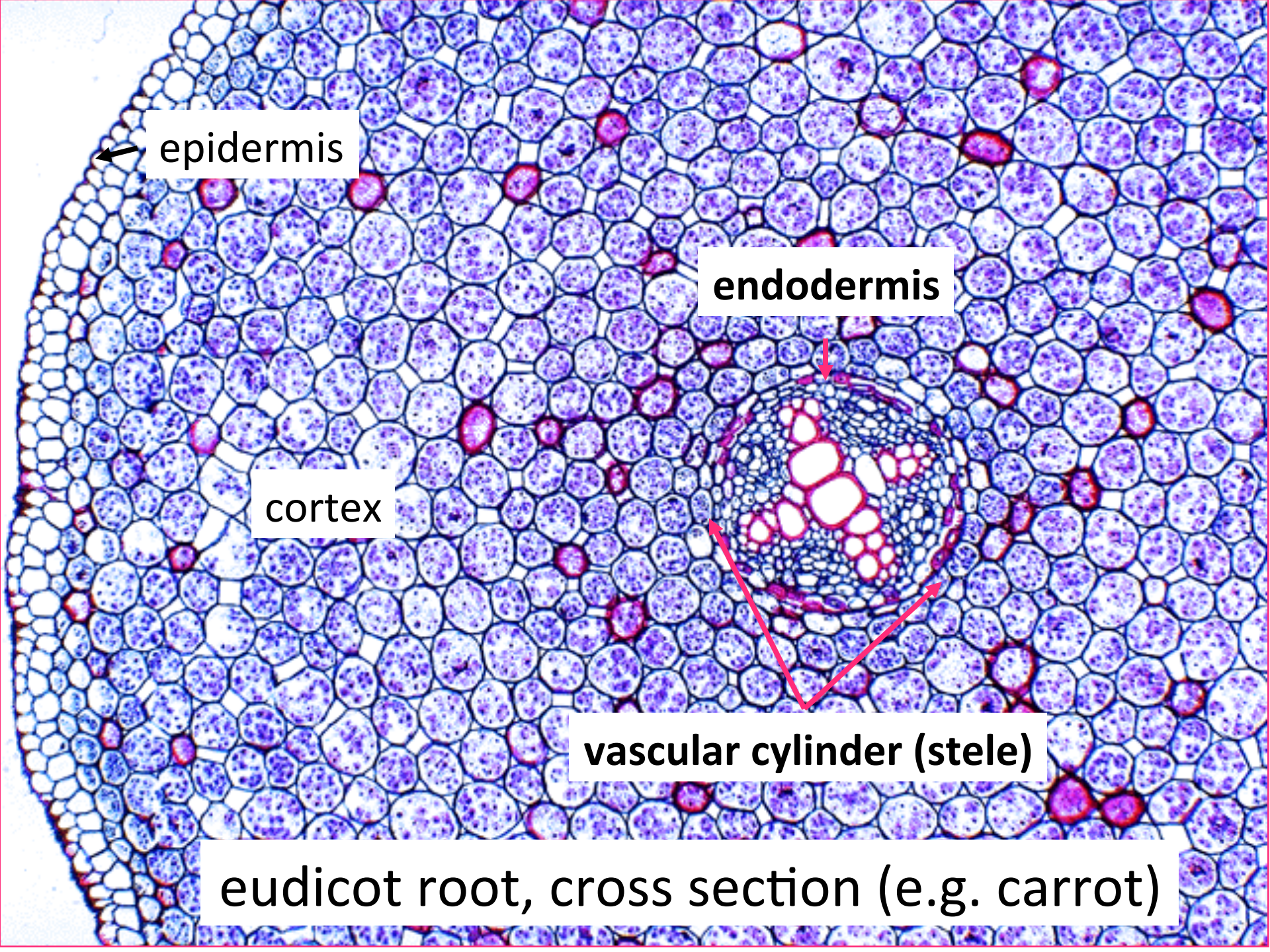
In the *monocot* **stem**, vascular bundles are **scattered** throughout the cortex. There is **no** pith (e.g., **sugarcane**)

Carrot root anatomy

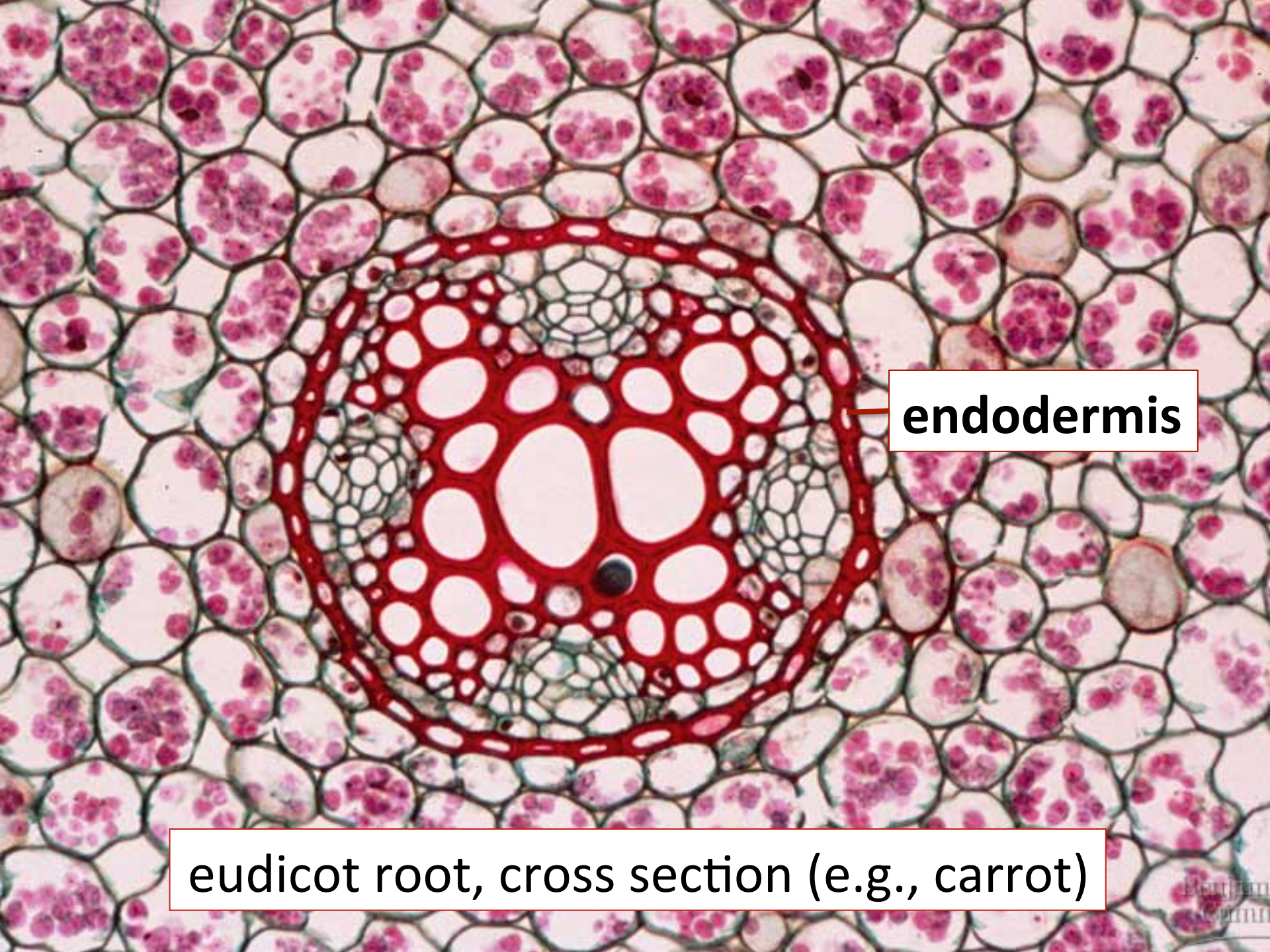




http://www.carrotmuseum.co.uk

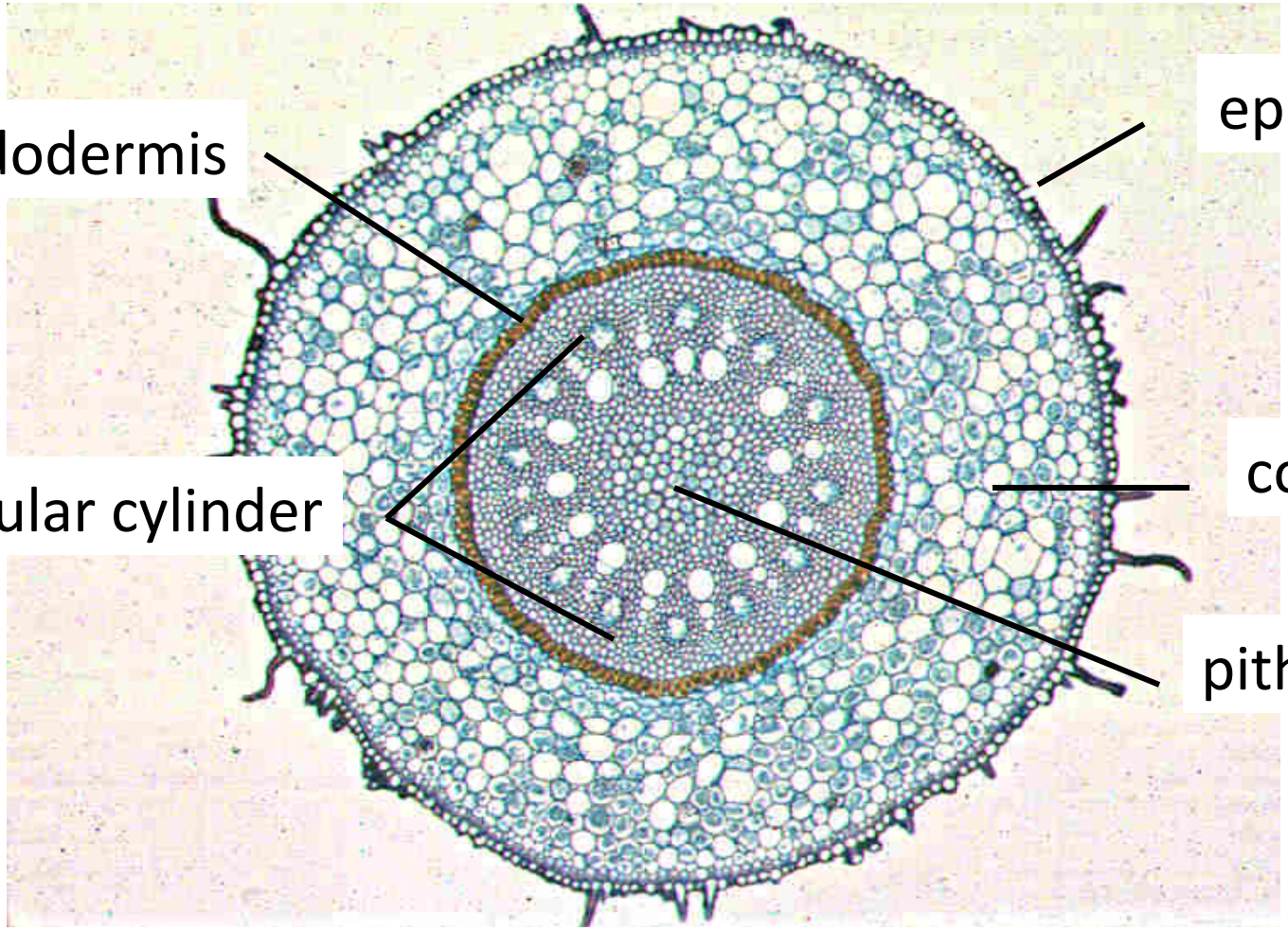


eudicot root, cross section (e.g. carrot)



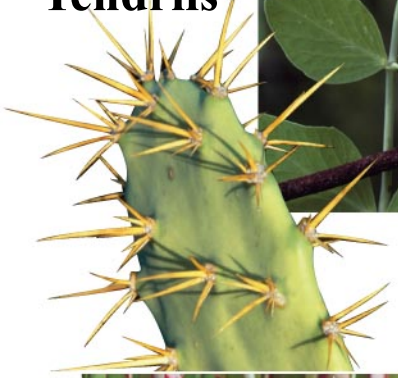
eudicot root, cross section (e.g., carrot)

monocot root, cross section



Modified leaves

Tendrils



Spines

Storage leaves

Reproductive leaves

Bracts

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Carnivorous plants have *modified leaves* that trap insects

Box Figure 3.2 Carnivorous plants. (a) Venus flytrap has guard hairs to prevent prey from escaping. (b) Glandular hairs of the sundew produce a sticky glue. (c) Pitcher plants. (d) Pitcher of *Nepenthes*.

Pitcher plant (*Sarracenia* spp.)

Venus flytrap (*Dionaea muscipula*)

Pitcher plant (*Nepenthes* spp.)

Sundew (*Drosera* spp.)

Modified leaves

Tendrils

Spines

Storage leaves

Reproductive leaves

Bracts

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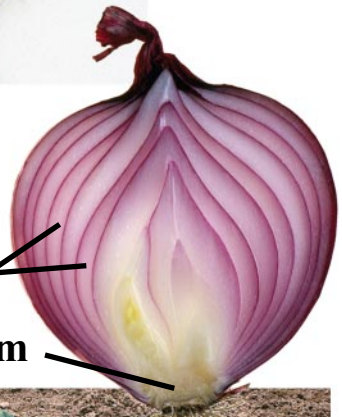
Modified stems

Rhizomes

Bulbs



Storage leaves

Stem

Stolons

Tubers

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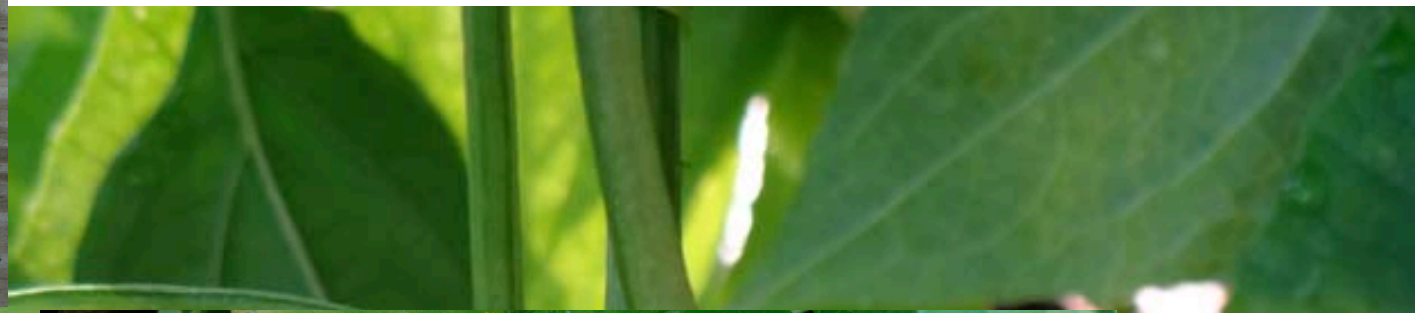
Grocery store botany



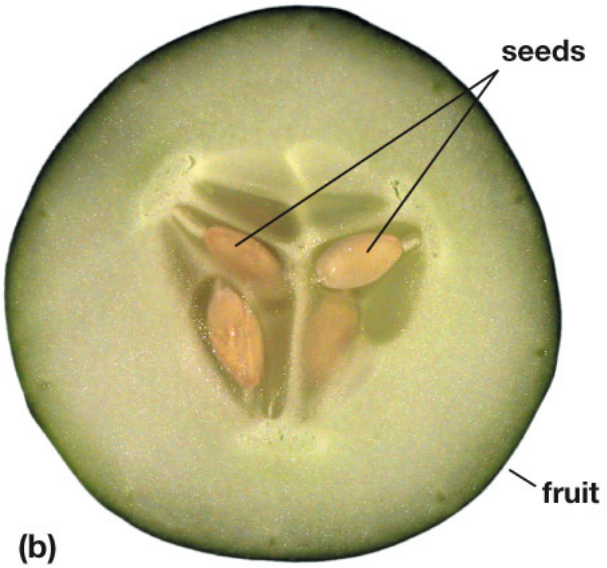


Figure 22.3 Plant Biology, 2/e © 2006 Pearson Education

Seeds enclosed in a fruit of an *angiosperm* (flowering plant)

Lecture Review, Chapter 3

- Describe the major events in the history of life on Earth, starting at Earth's origin 4.5 billion years ago and continuing until present time.
- Define meristem. Compare and contrast the apical meristem and lateral meristem. What kind of plants have apical meristems? lateral meristems?
- Describe the action of the cork and vascular cambia in woody plants. What types of cells does each produce? Draw the organization of a cross section of a woody stem in a cell, labeling the cambia and cell layers.
- List the major plant organs and briefly describe the function of each.
- What 3 tissue systems does the apical meristem produce? What is the main function of each?
- List the cells types that make up each of the tissue systems.
- What major plant families are monocots? Which are eudicots?
- How do monocots and eudicots differ in stem, leaf, and root morphology? Draw and diagram the stem and root morphology of both a monocot and a eudicot.