

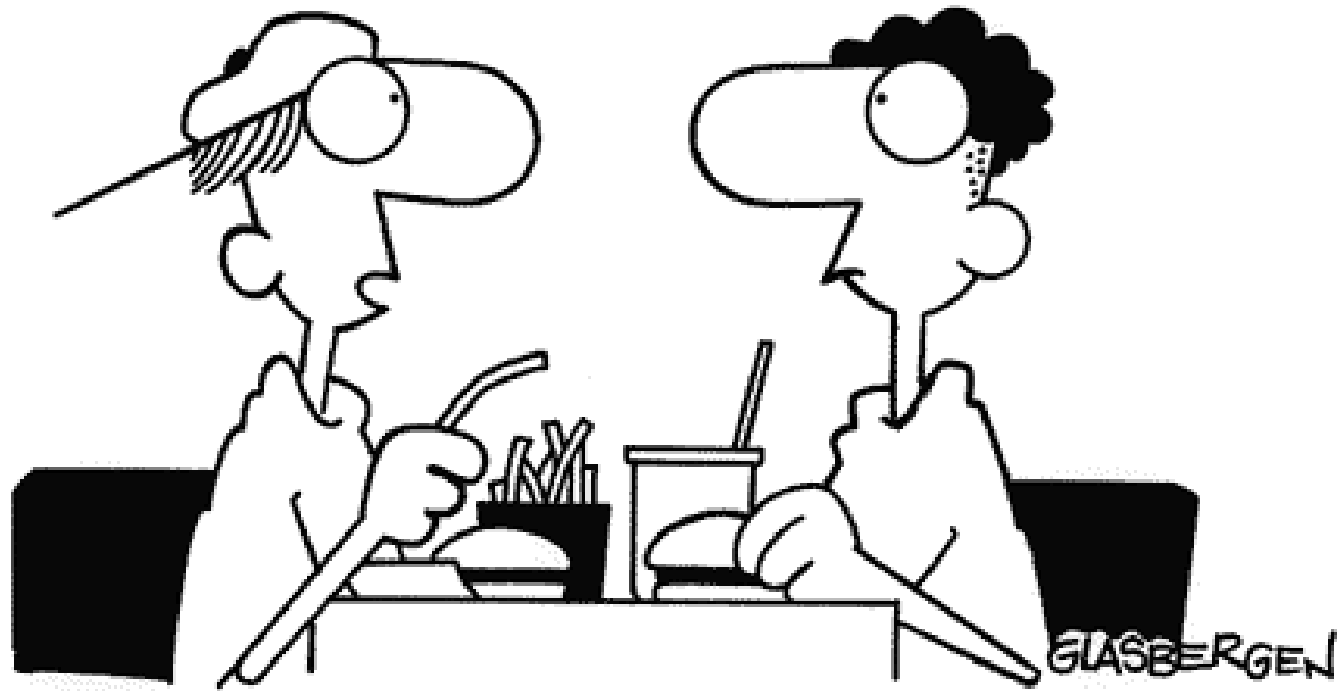
CHAPTER

1

Plant Form and Function

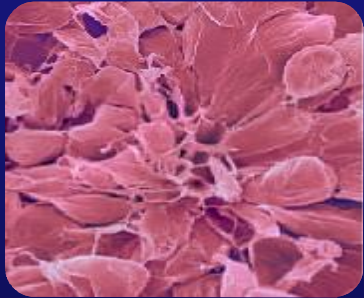


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**“I forgot to make a back-up copy of my brain,
so everything I learned last semester was lost.”**

Don't let this happen to you!!



Plant Tissues and Cell Types

- Meristems
- Permanent Tissues



Anatomy of a Plant

- Root
- Stem
- Leaf



Secondary Plant Growth

- Vascular Cambium
- Cork Cambium

Plant Tissues and Cell Types

- What is a tissue?
- A *tissue* is an organized group of cells that have features in common and that work together as a structural and functional unit.

Plant Tissues and Cell Types

- How many types of plant tissue are there?

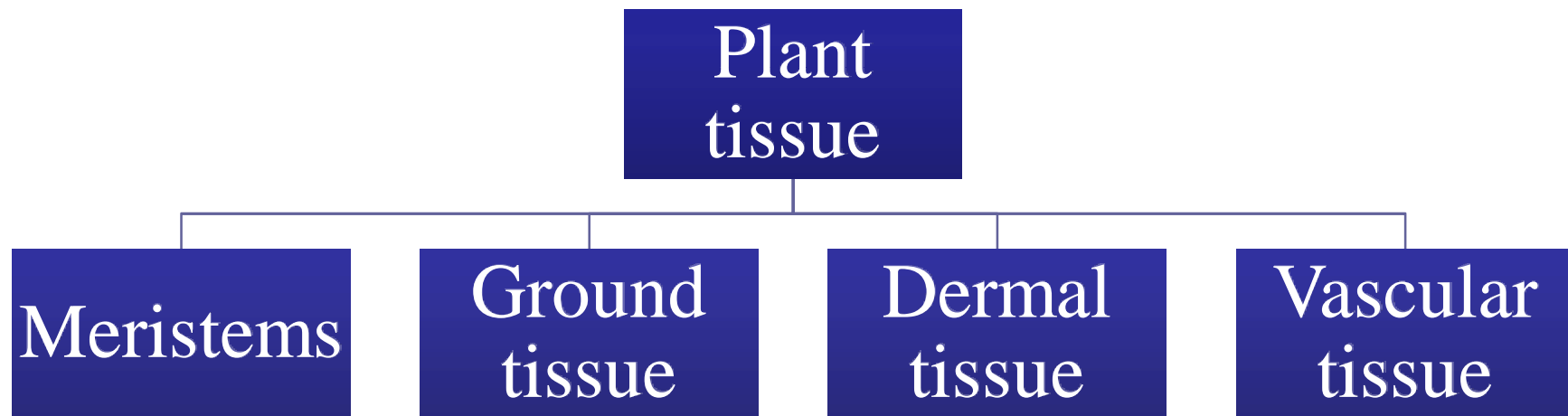


Fig. 1

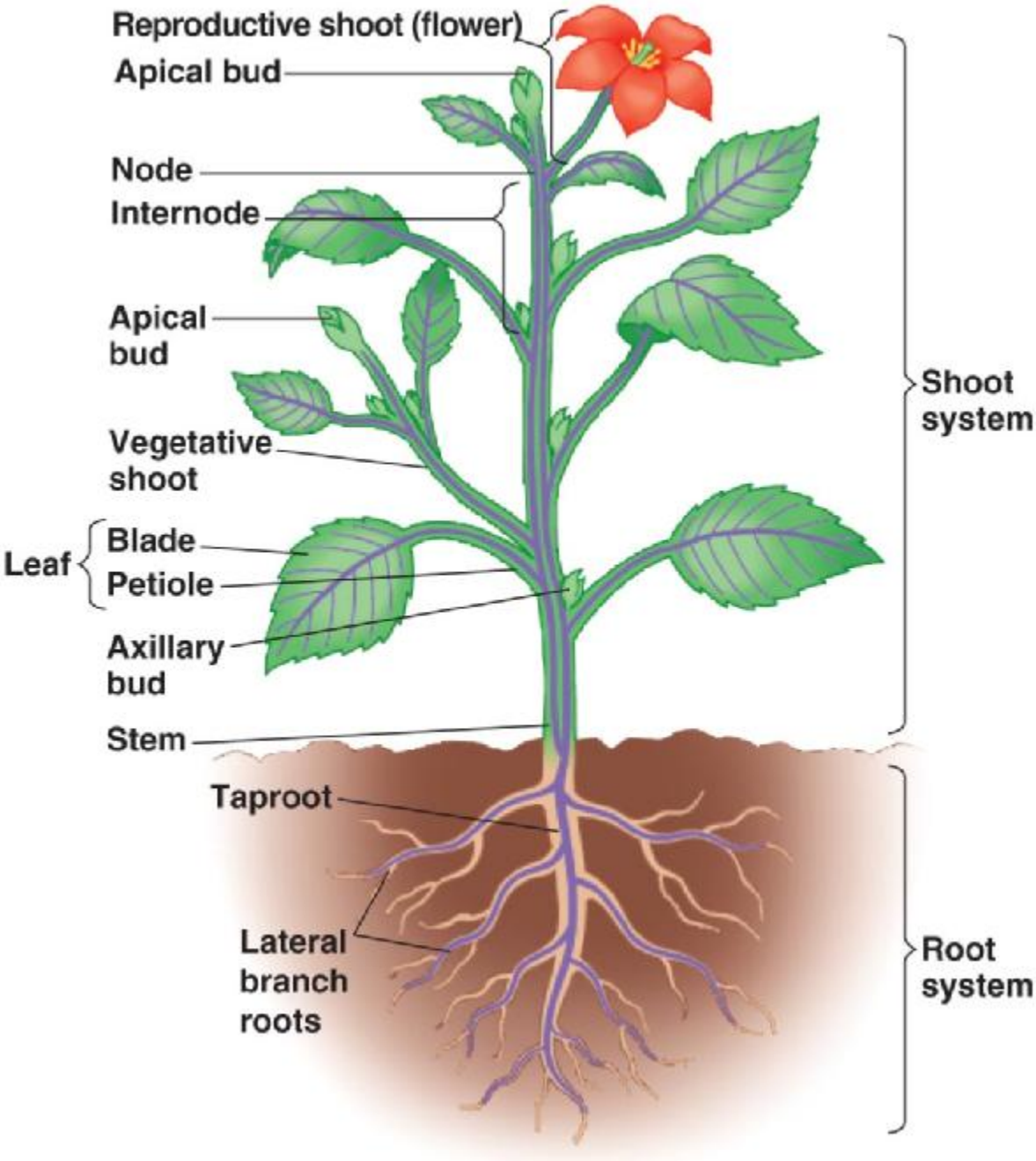
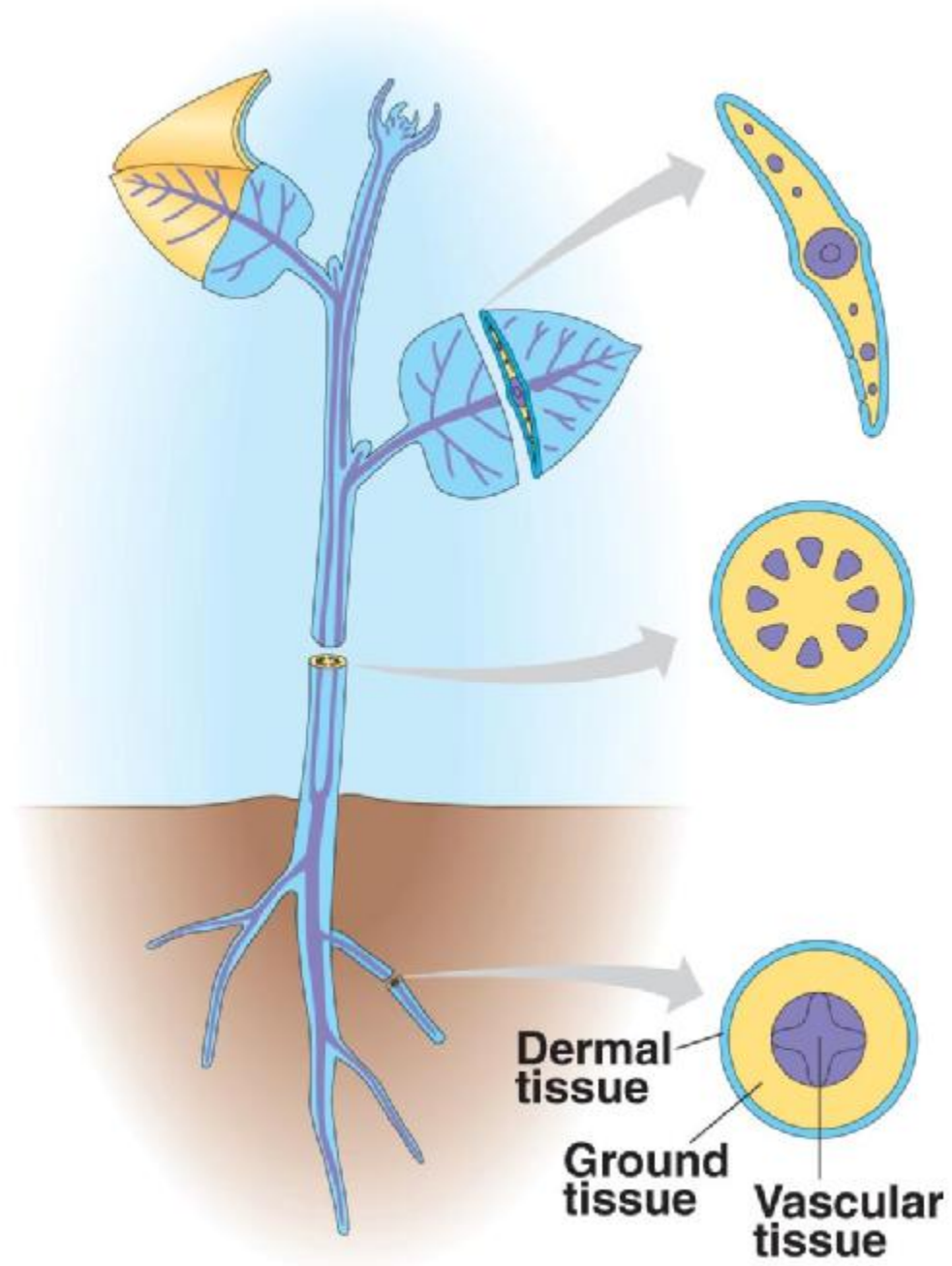


Fig. 2



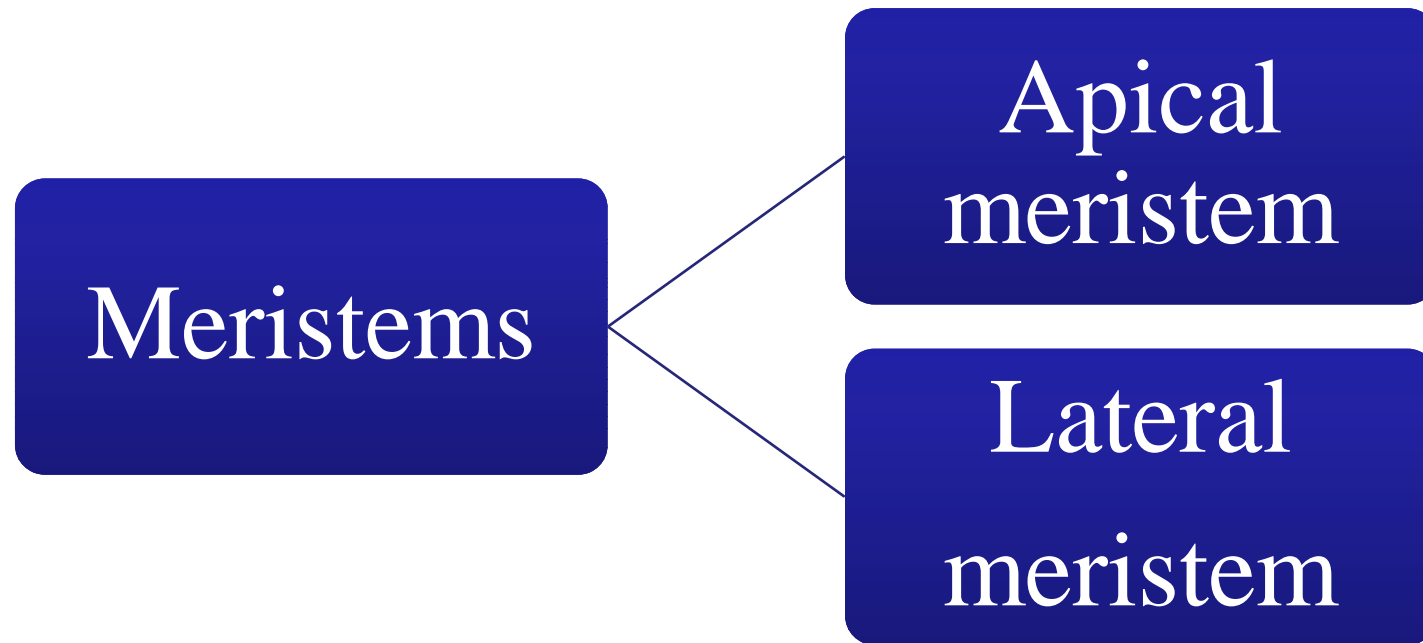
Meristems

- **Meristems**

- are localized regions in a plant that undergo(chịu) mitotic(phân bào) cell division
- are the ultimate(cơ bản) source of all the cells in a plant.

- **Function:** accounting for

- the elongation of root and stem tips
- the growth of buds
- the thickening(dày đặc) of some stems and roots.



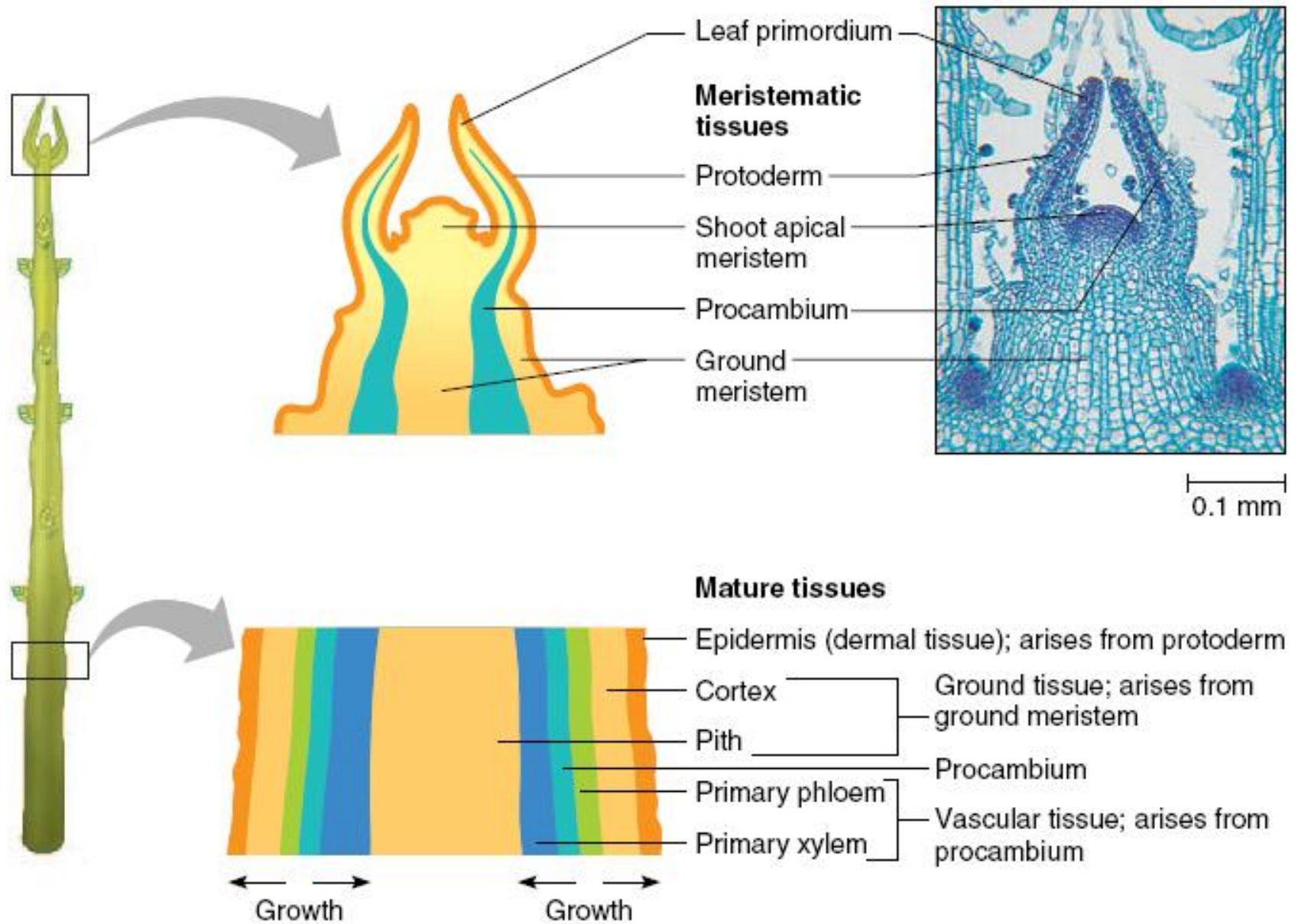
Apical(đỉnh) meristem

- Are near the tips of roots and shoots in all plants.
 - Cells in the apical meristems are small and unspecialized.
 - When the meristematic cells divide, the root or shoot tip is lengthen " *primary growth*.
- Give rise to three other types of meristems:
 - Ground meristem(mô phân sinh)
 - Protoderm
 - Procambium(tiền tầng sinh gỗ)

Lateral(bên) meristem

- Also called *cambium*
- Grow outward(bề ngoài) to thicken the plant. This process:
 - called *secondary growth*
 - does not occur in all plants.

Primary Growth of a Dicot's Shoot



Ground Tissue

- Making up most of the primary body of a flowering plant
- Filling much of the interior(phía trong) of roots, stems, and leaves.
- Functions:
 - Storage
 - Support
 - Basic metabolism.

Ground tissue

- Three cell types:

parenchyma

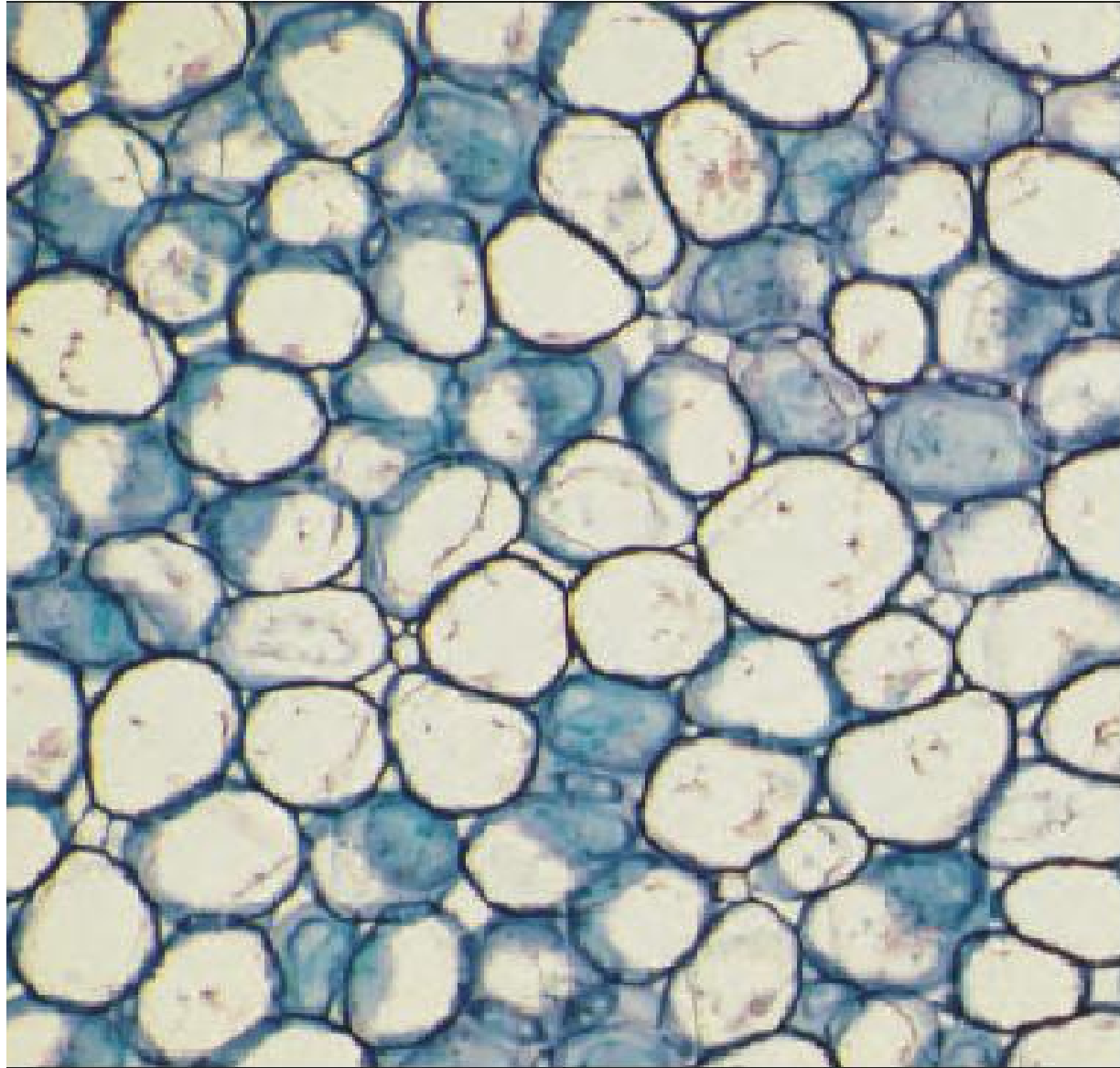
collenchyma

sclerenchyma

Parenchyma(nhu mô)

- The cells:
 - relatively unspecialized
 - enable the tissue to become specialized in response to injury or a changing environment.
 - are living cell
 - have thin primary cell walls.
- Functions:
 - store the edible(thức ăn) biochemicals, fragrant(thơm) oils, salts, pigments(chất màu), and organic acids.
 - Conduct(điều khiển) vital functions(chức năng sống), such as photosynthesis, cellular respiration, and protein synthesis.

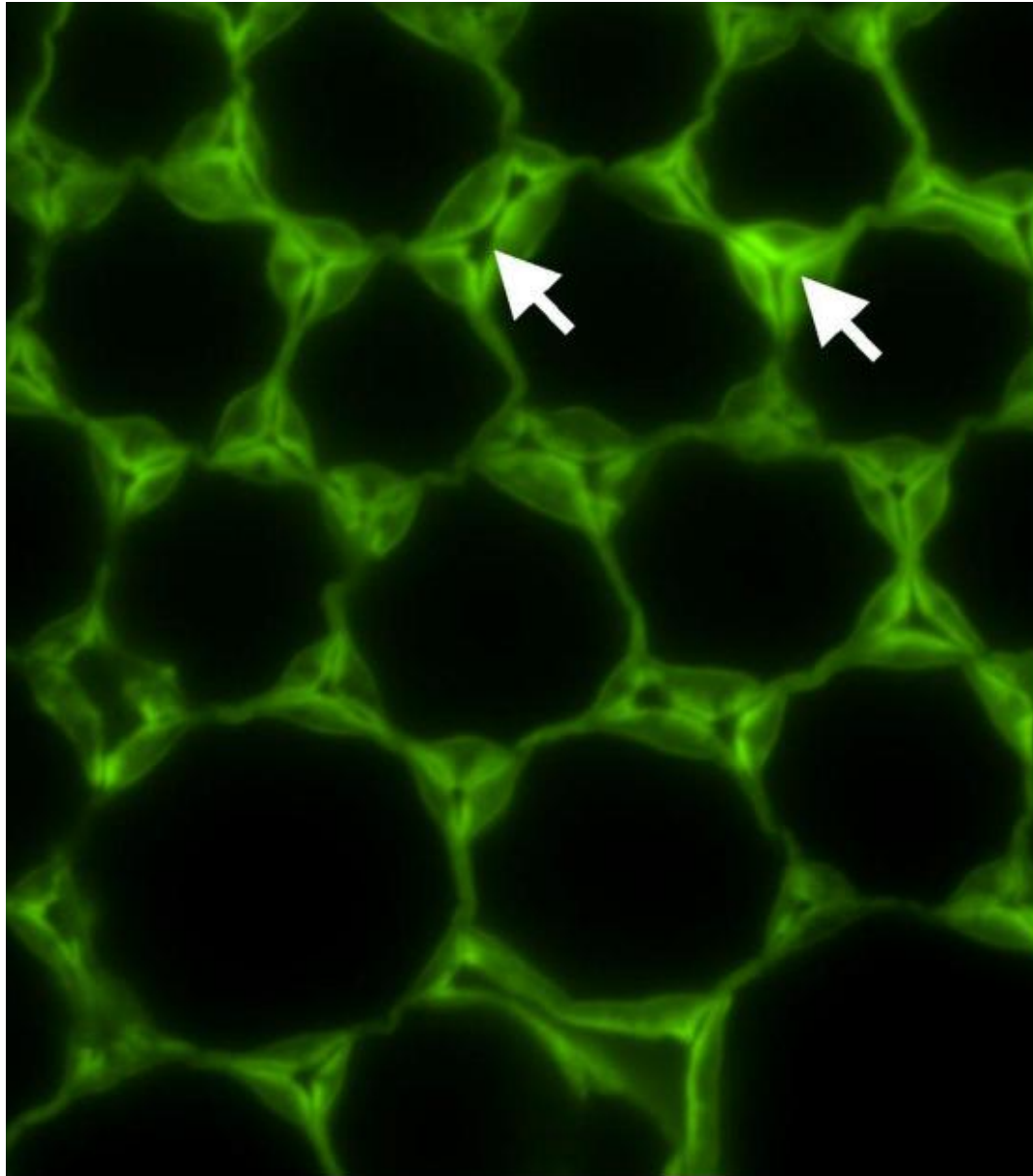
Parenchyma



Collenchyma(mô giũa)

- Are elongated living cells that differentiate from parenchyma and support the growing regions of shoots(chồi)
- Have unevenly thickened primary cell walls that can stretch(căng) and elongate with the cells.
- Provides support without interfering(quấy rầy) with the growth of young stems or expanding(giãn nở) leaves.

Collenchyma Tissue



Sclerenchyma(cương mô)

- Cells have thick, rigid(cứng) secondary cell walls.
- Lignin(chất gỗ) strengthens(tăng cường) the walls.
- Are usually dead at maturity(trưởng thành).
- Supporting parts of plants that are no longer growing.

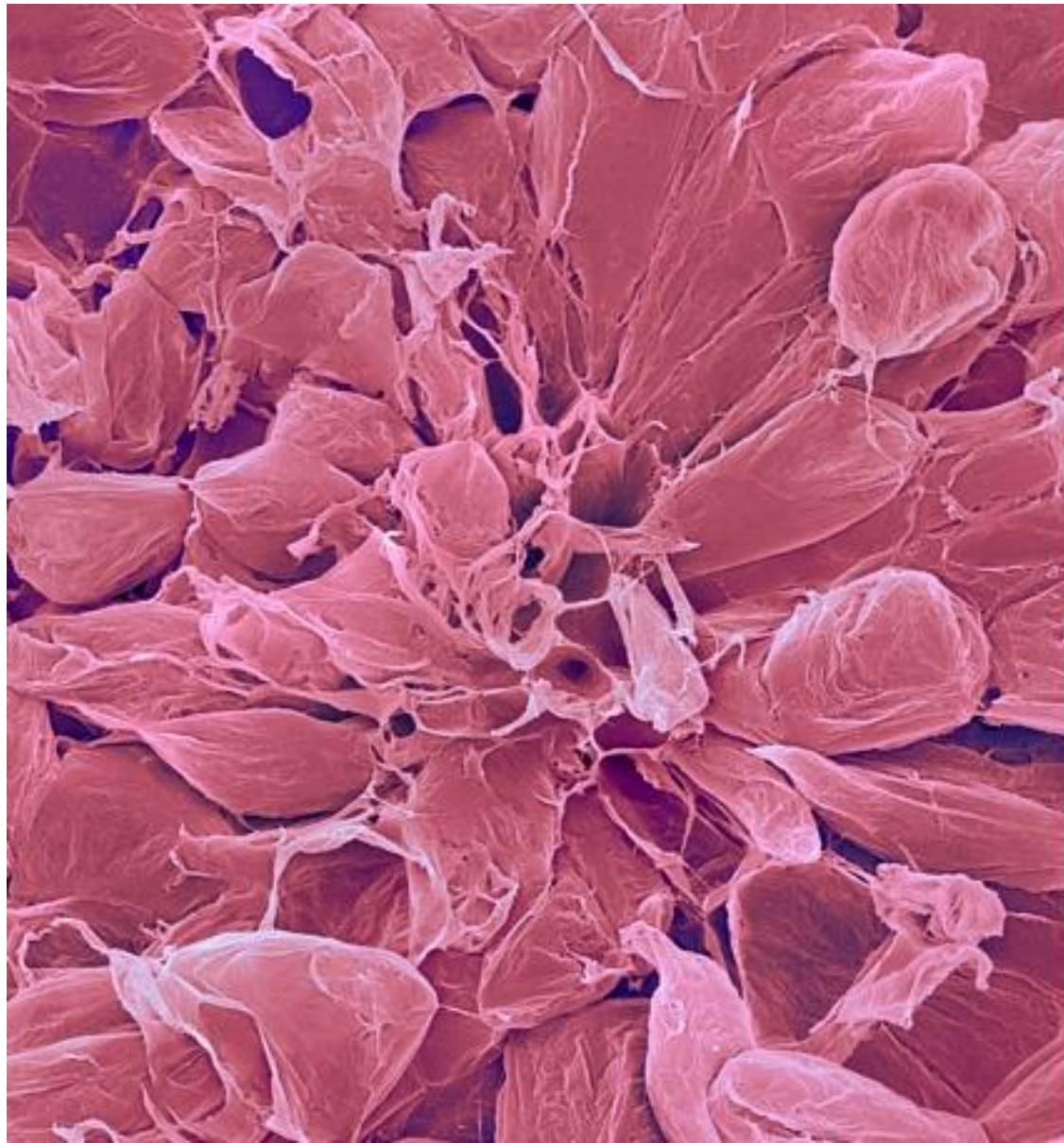
Sclerenchyma

- Two types:
 - Sclereids(tế bào đá)
 - Fibers.(chất xơ)

Sclereid

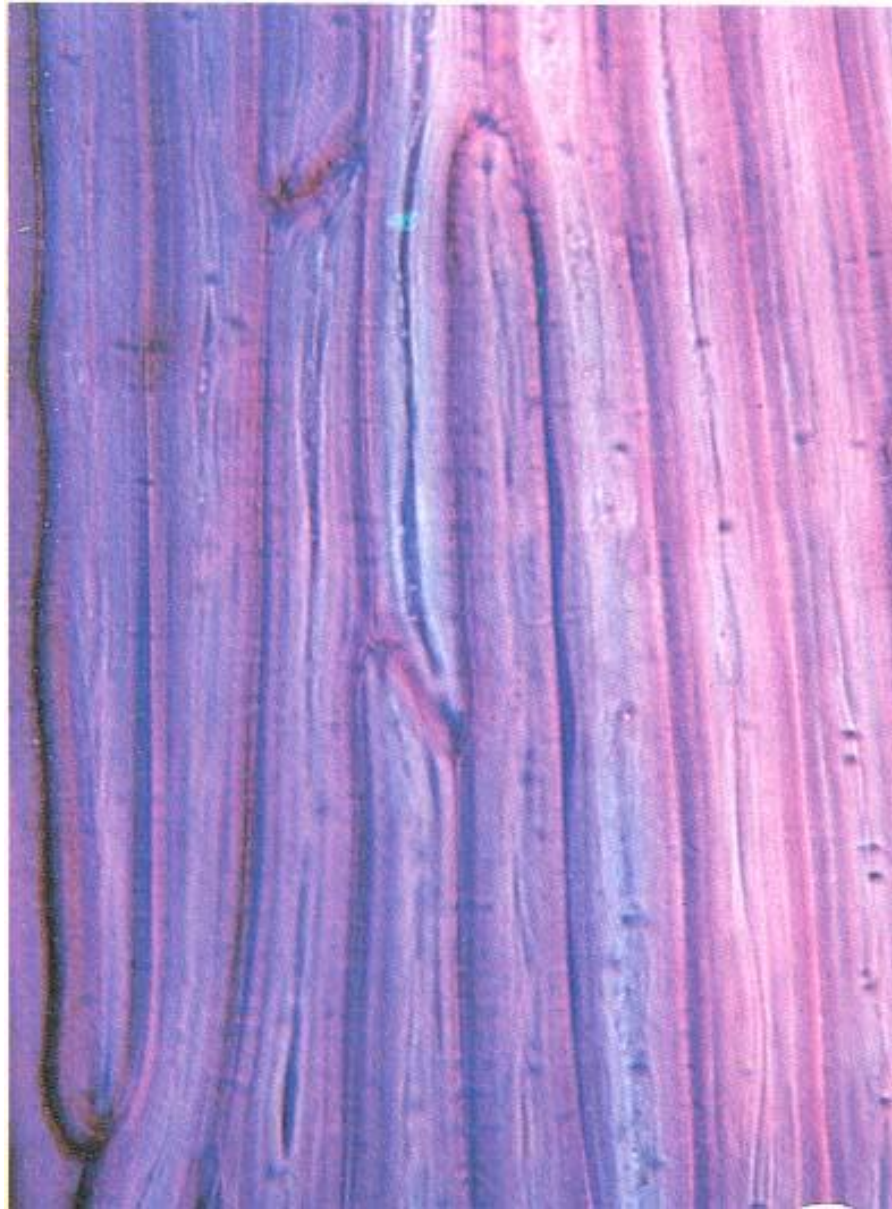
- Also call stone cell
- Have many shapes and occur singly or in groups.
- Form hard(cứng) layers:
 - in the hulls of peanuts(cây đào).
 - In the pulp(lõi) of guava, pear

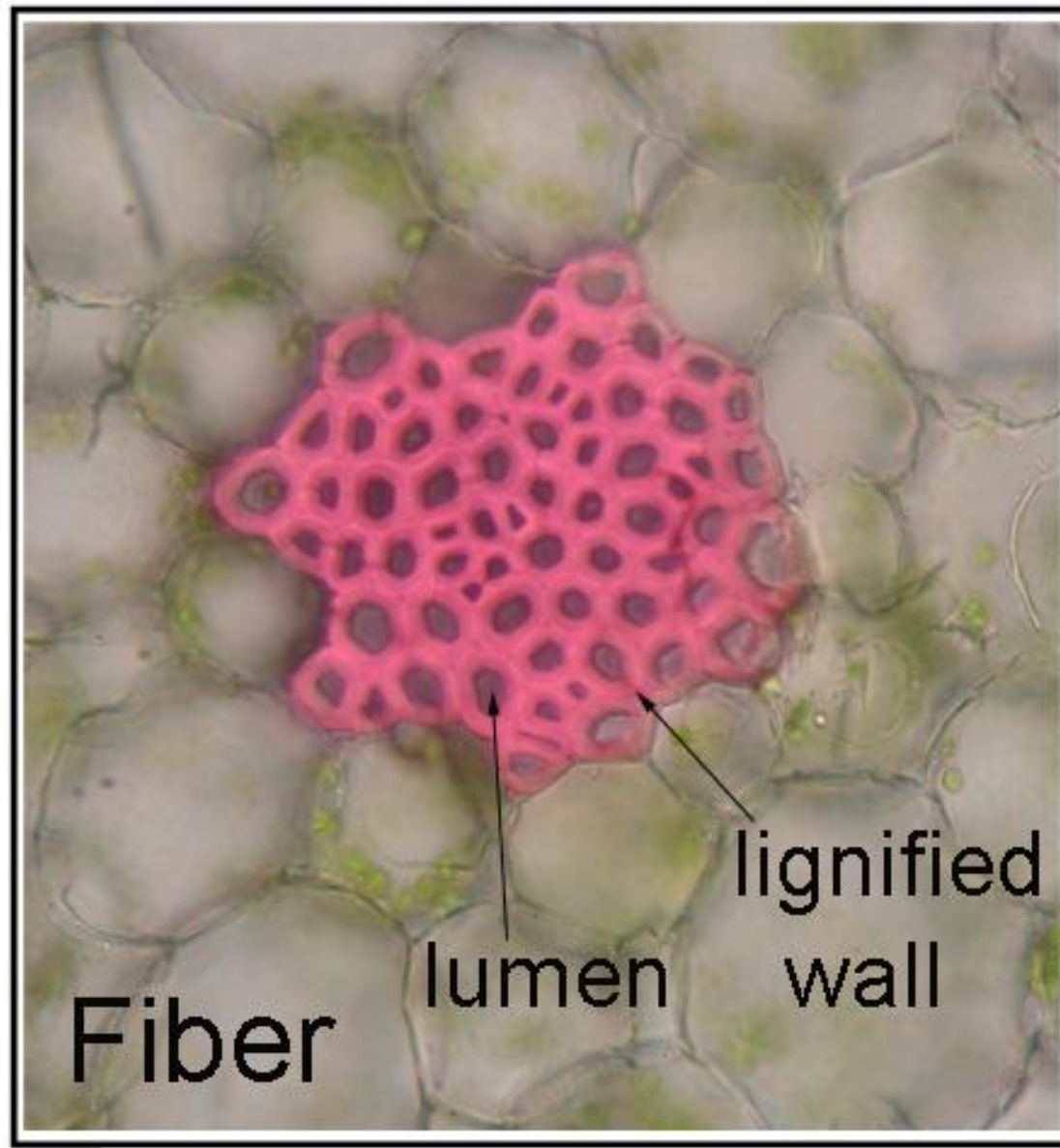




Fibers

- Are elongated cells
- Usually occur in strands(mạch).
- The uses:
 - Paper includes wood fibers
 - Century plant used to make twine(bện chặt)
 - Linen(vải lanh) comes from flax(cây lanh) (*Linum usitatissimum*)





Dermal Tissue

- Also called surface tissue, covers the plant.
- Distinguish(chia thành)
 - Epidermis
 - Cuticle
 - Stomata
 - Trichome

Dermal Tissue

- The *epidermis*
 - usually only one cell layer thick, covers the primary plant body.
 - cells are flat(phẳng), transparent(trong suốt), and tightly packed.(kết chặt)
- The *cuticle*
 - is an extracellular covering over all the aerial(trên không) epidermis of a plant
 - protects the plant and conserves water.

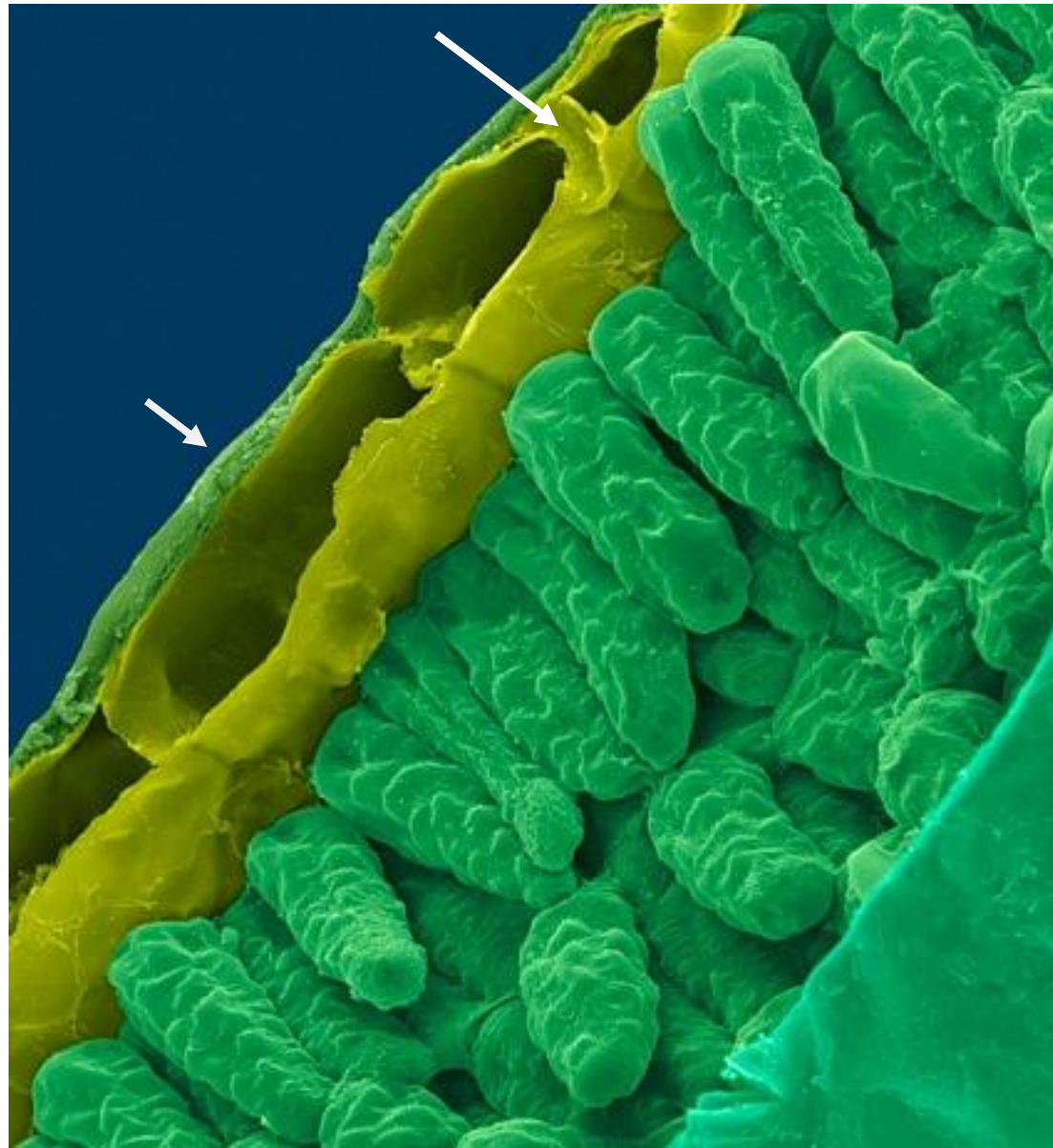
Dermal Tissue

- Plants exchange water and gases with the atmosphere through specialized pores, called *stomata*.
- *Guard(bảo vệ) cells* surround the pores and control their opening and closing, which regulates gas and water exchange.

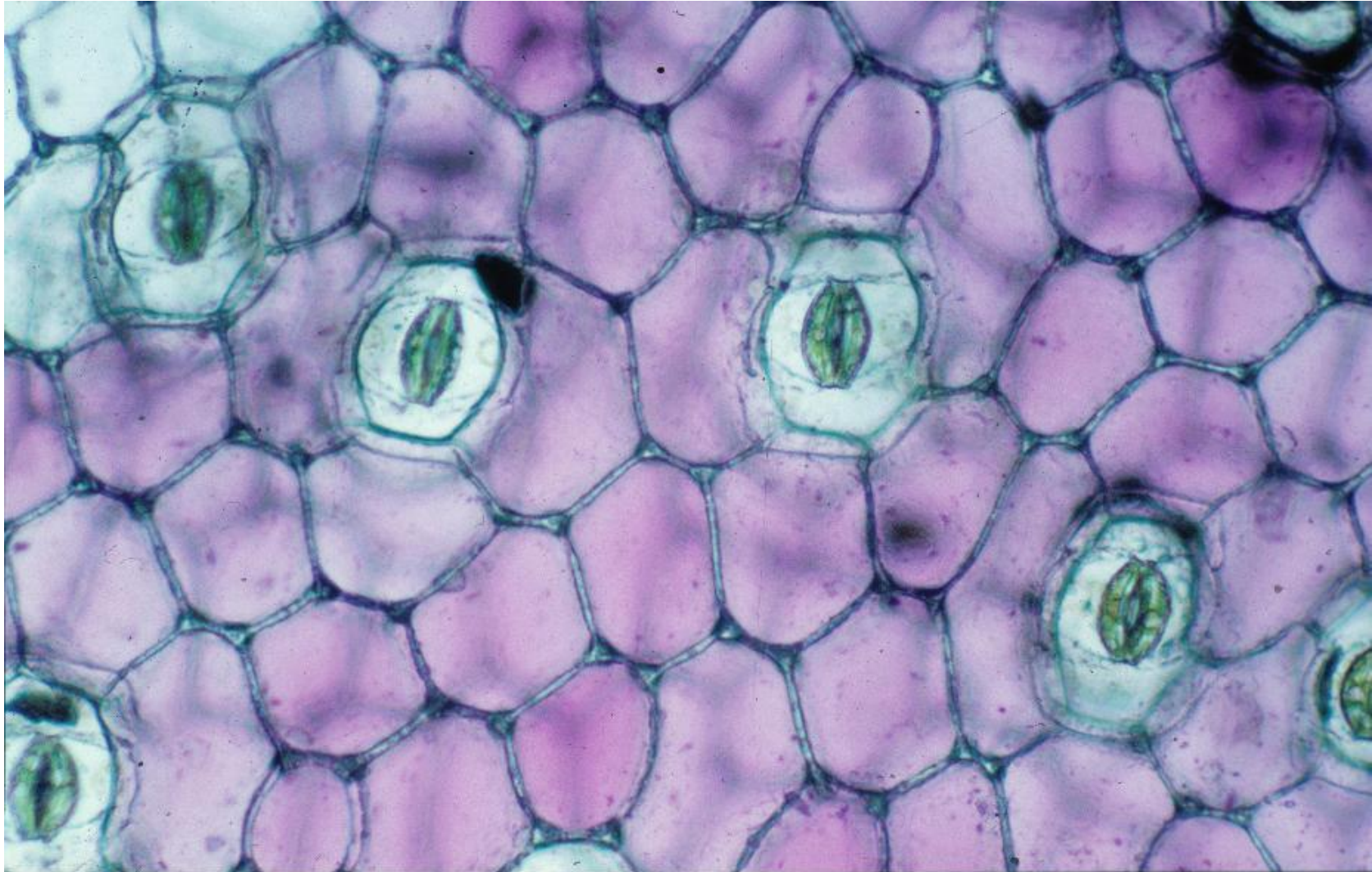
Dermal Tissue

- *Trichomes* are outgrowths of the epidermis present in nearly all plants.
 - **Root hairs:**
 - increase the root surface area for absorbing water and minerals(khoáng chất).
 - **Leaf hairs:**
 - slow the movement of air over the leaf surface

Epidermis and cuticle



Stomata



Trichome



Root hairs



Leaf hairs



Vascular Tissue

- Are specialized conducting(dẫn) tissues
- Transport water, minerals, carbohydrates, and other dissolved compounds throughout the plant.
- Two types:
 - Xylem
 - Phloem

Xylem (wood)

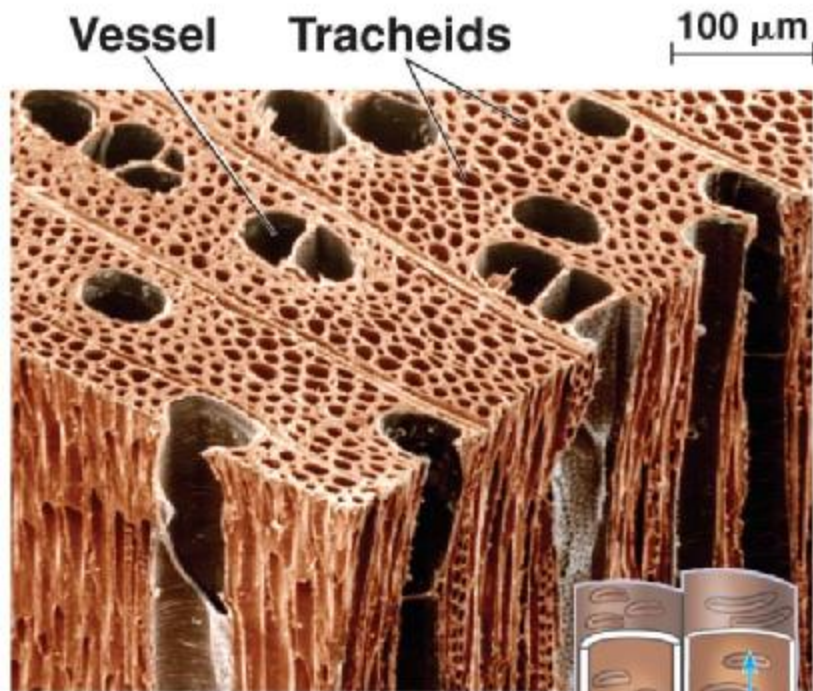
- Transports water and dissolved minerals from the roots to all parts of the plant.
- The two kinds of conducting cells:
 - Tracheids(tb ống)
 - Vessel(mạch) elements.
 - Both are elongated, dead at maturity, and have thick secondary walls.

Tracheids

- The cells are
 - the least specialized
 - long and narrow
 - Overlapping(phủ lên) at their tapered(thon) ends.
- Water moves from tracheid to tracheid through thin areas in cell walls called pits.

Vessel elements

- Vessel elements are
 - short, wide, barrel(thùng)-shaped cells.
 - like cellulose pipes.
- Water in them moves much faster than in the narrower tracheids.

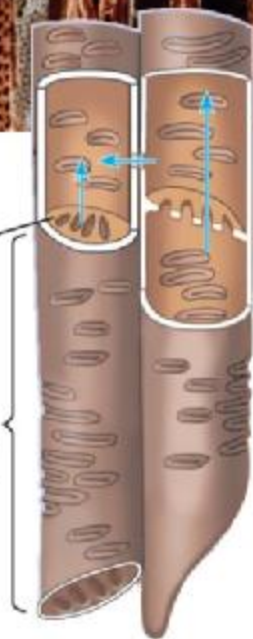


**Tracheids and vessels
(colorized SEM)**

**Perforation
plate**

**Vessel
element**

**Vessel elements, with
perforated end walls**



Pits

Tracheids



Phloem

- The cells of phloem are alive at maturity.
- Transports dissolved organic compounds, primarily carbohydrates, throughout a plant.
- Phloem sap (nhựa) also contains hormones, alkaloids, viruses, and inorganic ions.
- Water and dissolved sugars can move through phloem in all directions..

Types of phloem

- **Sieve(rây) cells**

- Are long, tapering(thon) cells with overlapping ends.
- usually found in gymnosperms(cây hạt trần) and seedless(ko có hạt) vascular plants.

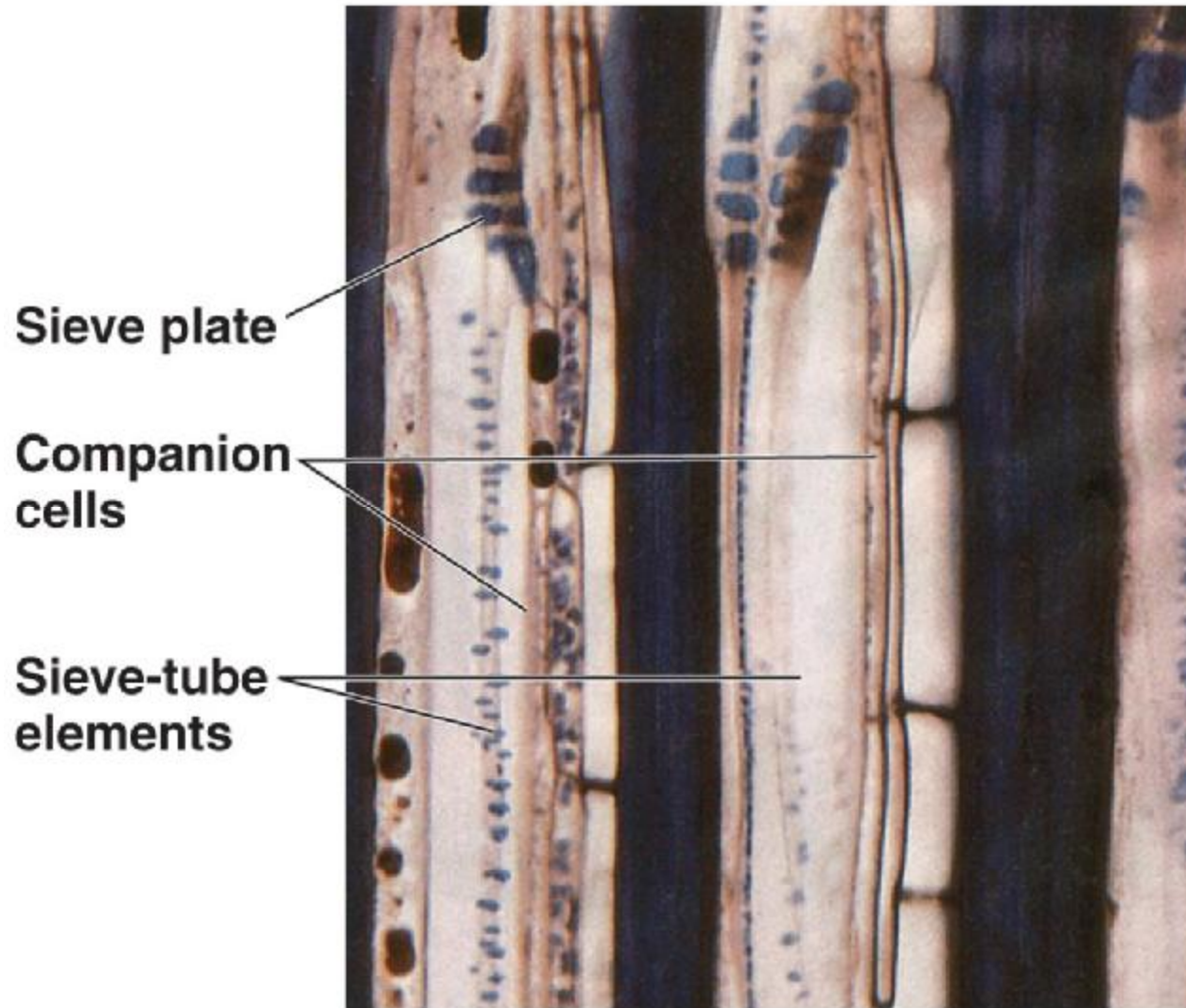
- **Sieve tube members**

- are mostly in angiosperms(TV hạt kín).
- are more specialized than sieve cells.
- the pore areas are aggregated(tập hợp) into **sieve plates(bản)**, usually at the ends of the cells.

Types of phloem

- **Companion(kế cận) cells**
 - are near sieve tube members.
 - help transfer carbohydrates into and out of the sieve tube members.

Sieve-tube elements: longitudinal view (LM)



Sieve plate

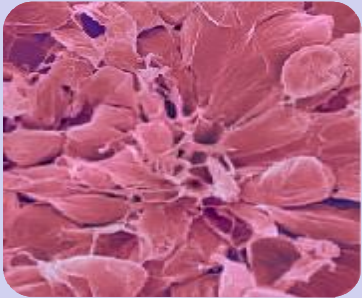
Companion
cells

Sieve-tube
elements

30 μm

Mastering Concepts

1. What is the function of meristematic tissue?
2. What cell types make up ground tissue?
3. How does dermal tissue protect a plant and enable gas exchange to occur?
4. What are the functions of the two types of vascular tissue in plants?
5. What types of cells make up each of the two types of vascular tissue?



Plant Tissues and Cell Types

- Meristems
- Permanent Tissues



Anatomy of a Plant

- Root
- Stem
- Leaf



Secondary Plant Growth

- Vascular Cambium
- Cork Cambium

Anatomy(giải phẫu học) of a plant

- Flowering plants:
 - possess three kinds of vegetative organs: roots, stems, and leaves.
 - belong to one of two major lineages(giống):
 - *Monocots* are generally narrow-leaved flowering plants such as grasses, lilies, orchids, and palms.
 - *Eudicots* are broad-leaved flowering plants such as soybeans, roses, sunflowers, and maples.

Monocots and Dicots Compared

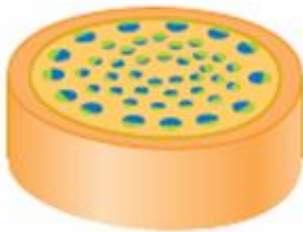
Monocotyledons (monocots)



Flower parts usually in threes (or multiples thereof)



Leaves usually have parallel veins



Usually no secondary growth

Dicotyledons (dicots)



Flower parts usually in fours or fives (or multiples thereof)



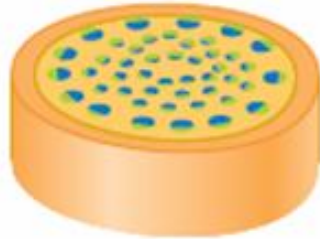
Leaves usually have netted veins



Secondary growth common, arises from vascular cambium

Monocots and Dicots Compared

Monocotyledons (monocots)



Vascular bundles distributed in ground tissue in stem

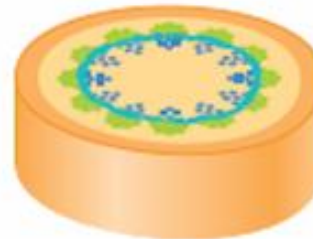


Fibrous root system



Seeds have one cotyledon ("mono" is one)

Dicotyledons (dicots)



Vascular bundles distributed as a ring in stem



Usually taproot system



Seeds have two cotyledons ("di" is two)

Stems

- Functions:
 - support leaves
 - produce and store sugars
 - transport nutrients and water between roots and leaves.

Stems

- Morphology(hình thái học):
 - **Nodes:** areas of leaf attachment
 - **Internodes:** portions(phần chia) of the stem between the nodes
 - **Leaf axil(nách lá):** the angle between the stem and leaf stalk (petiole).
 - **Axillary buds** are undeveloped shoots that form in leaf axils.

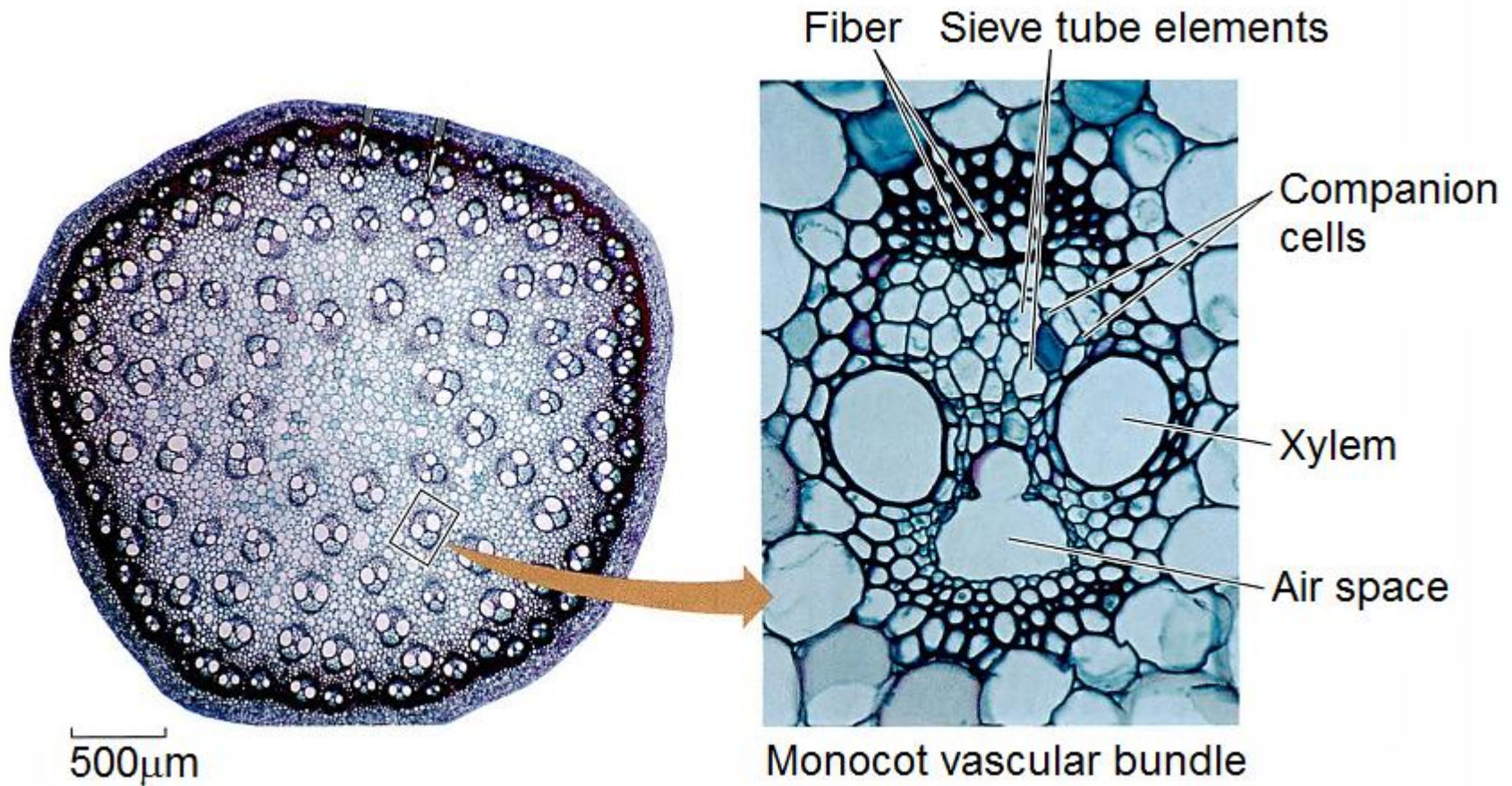
Stems

- Stems grow and differentiate at their tips, with new cells originating at the shoot's apical meristem.
- The shoot elongates as cells divide, grow, and become specialized into ground tissue, vascular tissue, or dermal tissue.

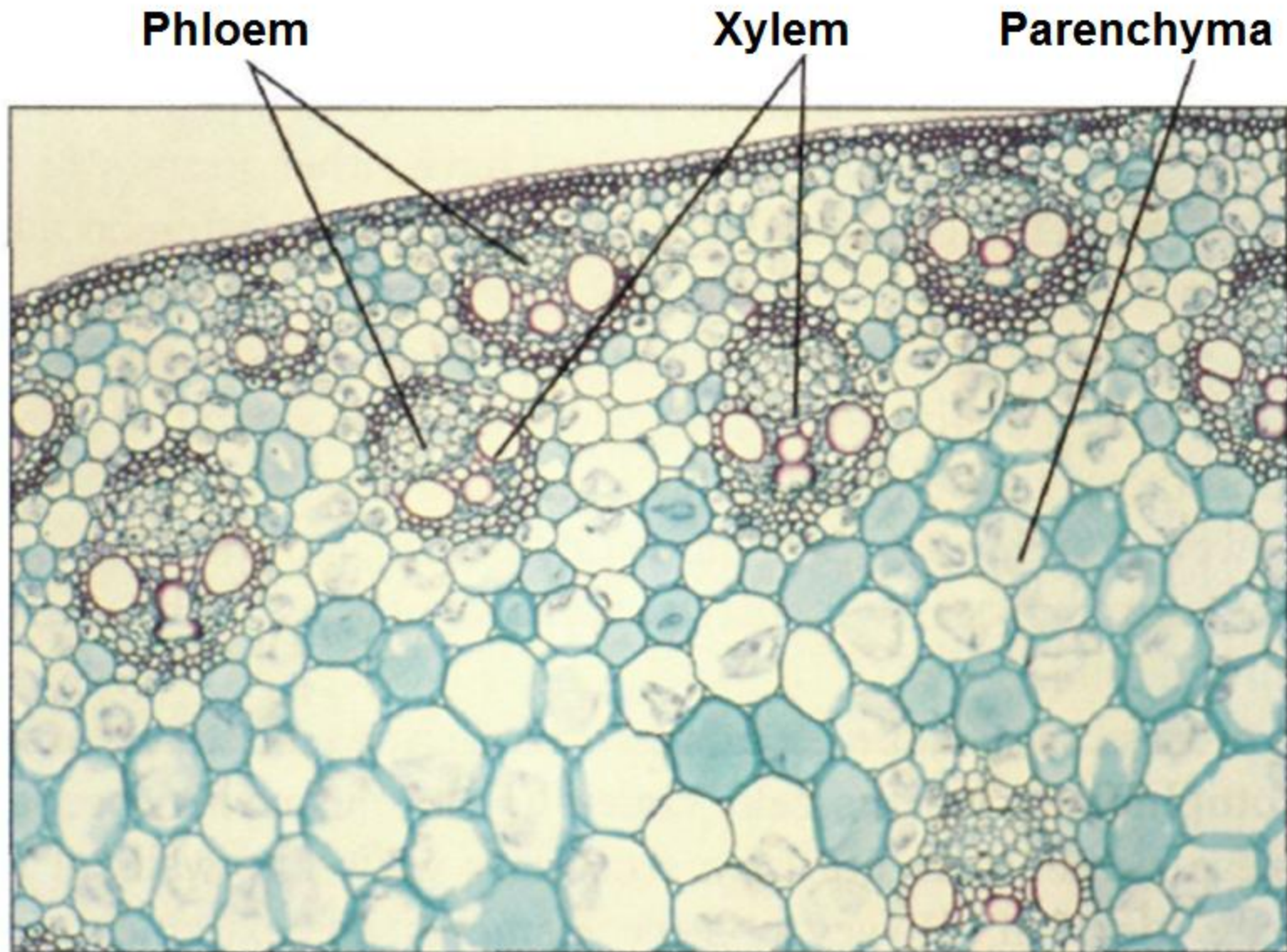
Stems

- Two types:
 - Nonwoody stem (herbaceous(cỏ) stem)
 - Woody stem

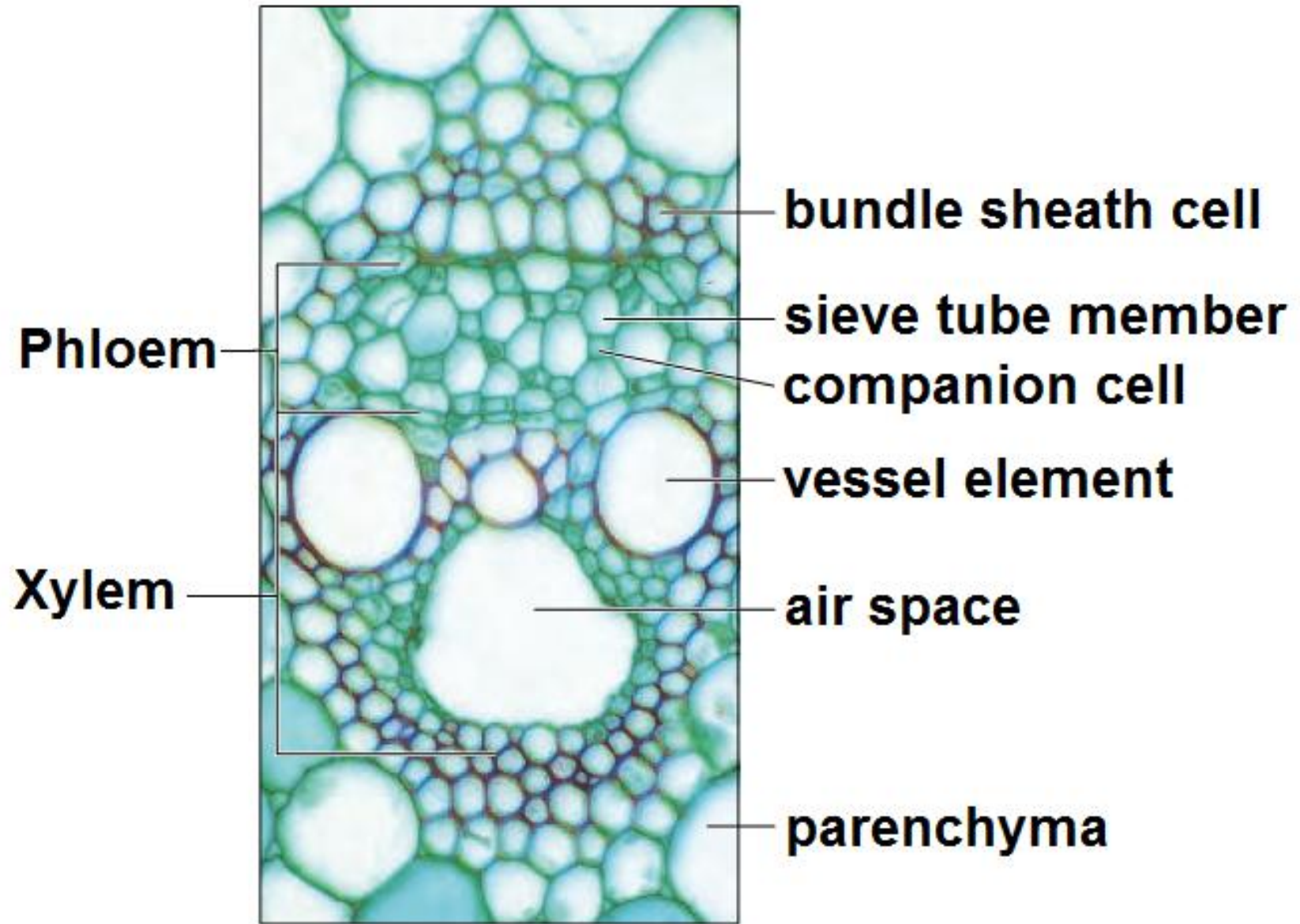
Monocot stem



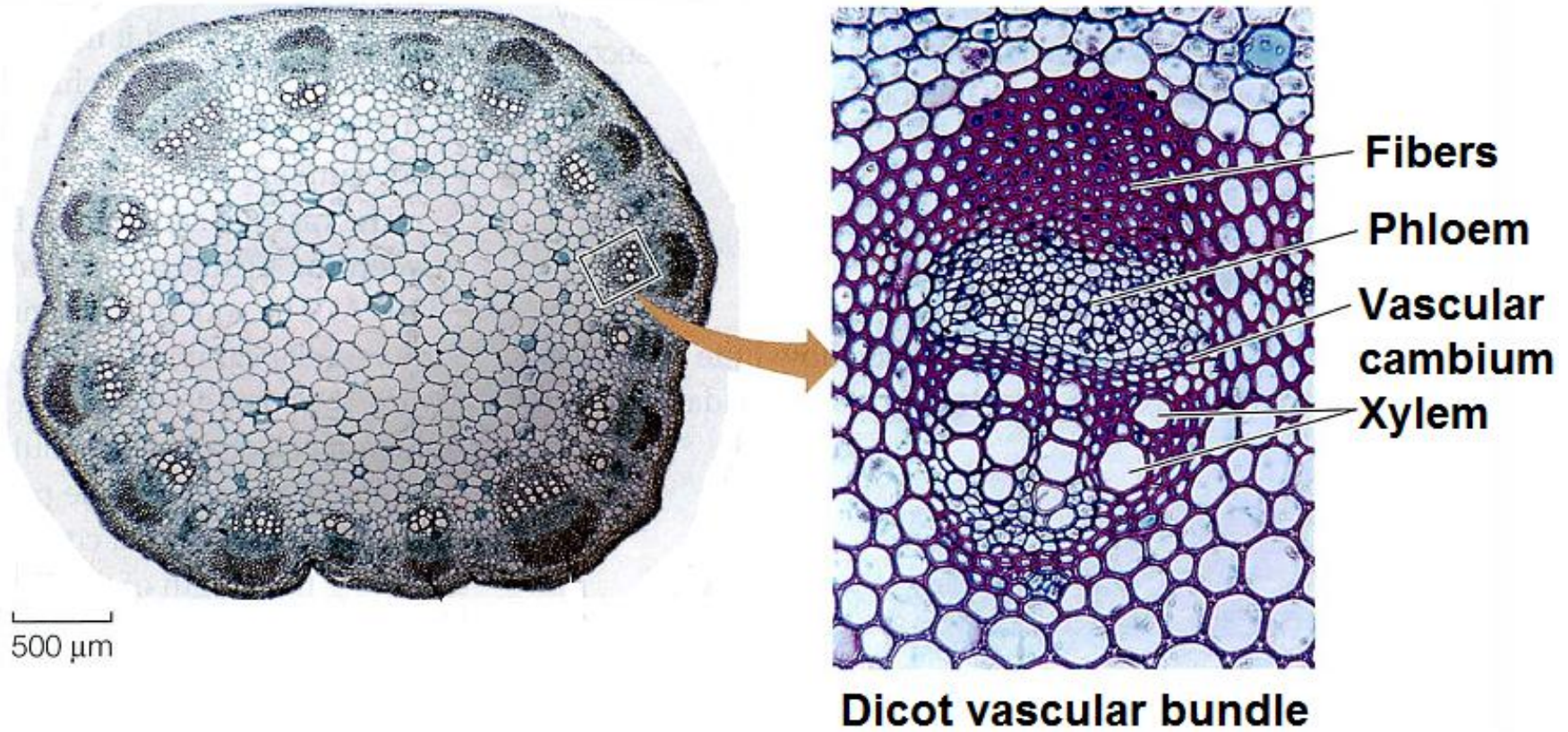
Monocot stem



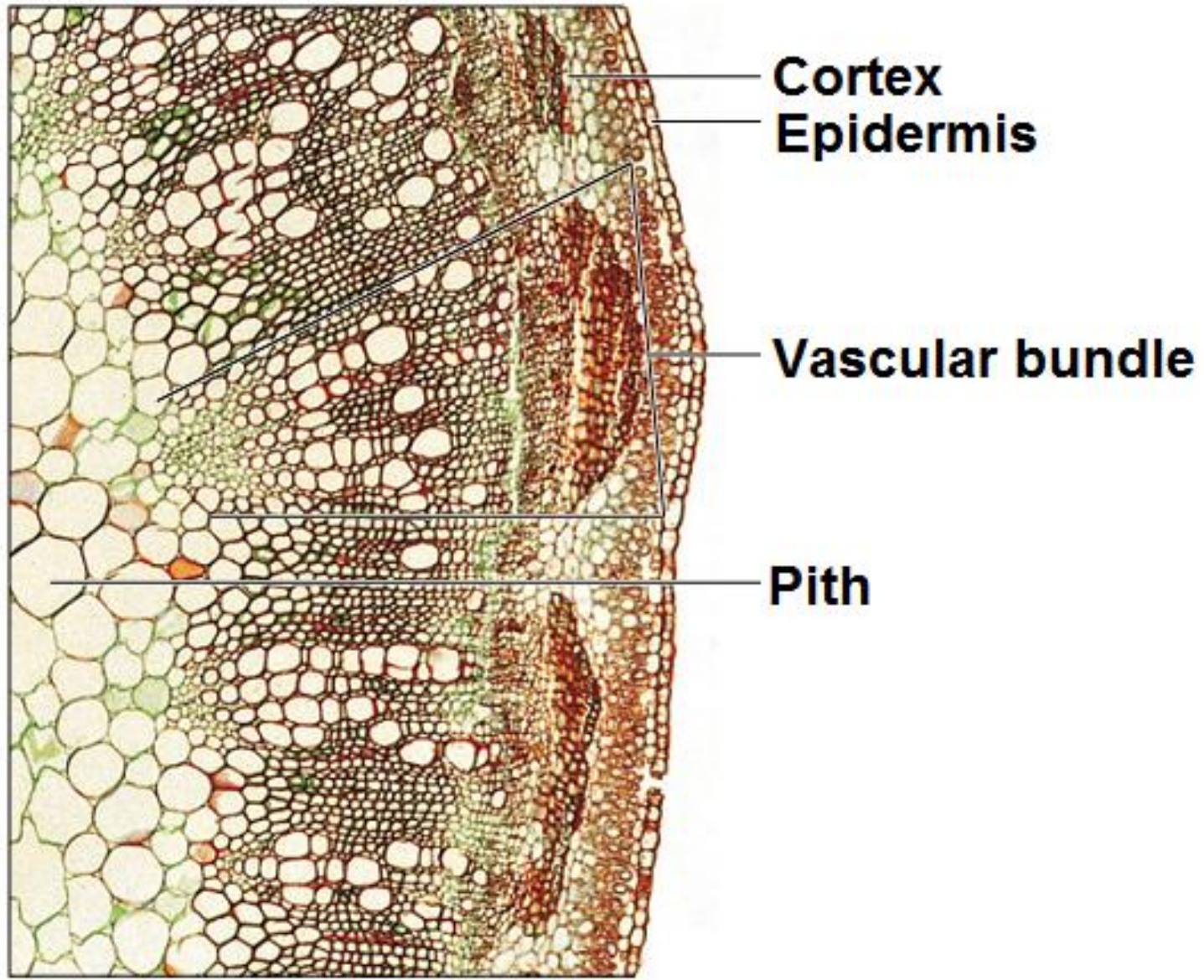
A single vascular bundle of corn



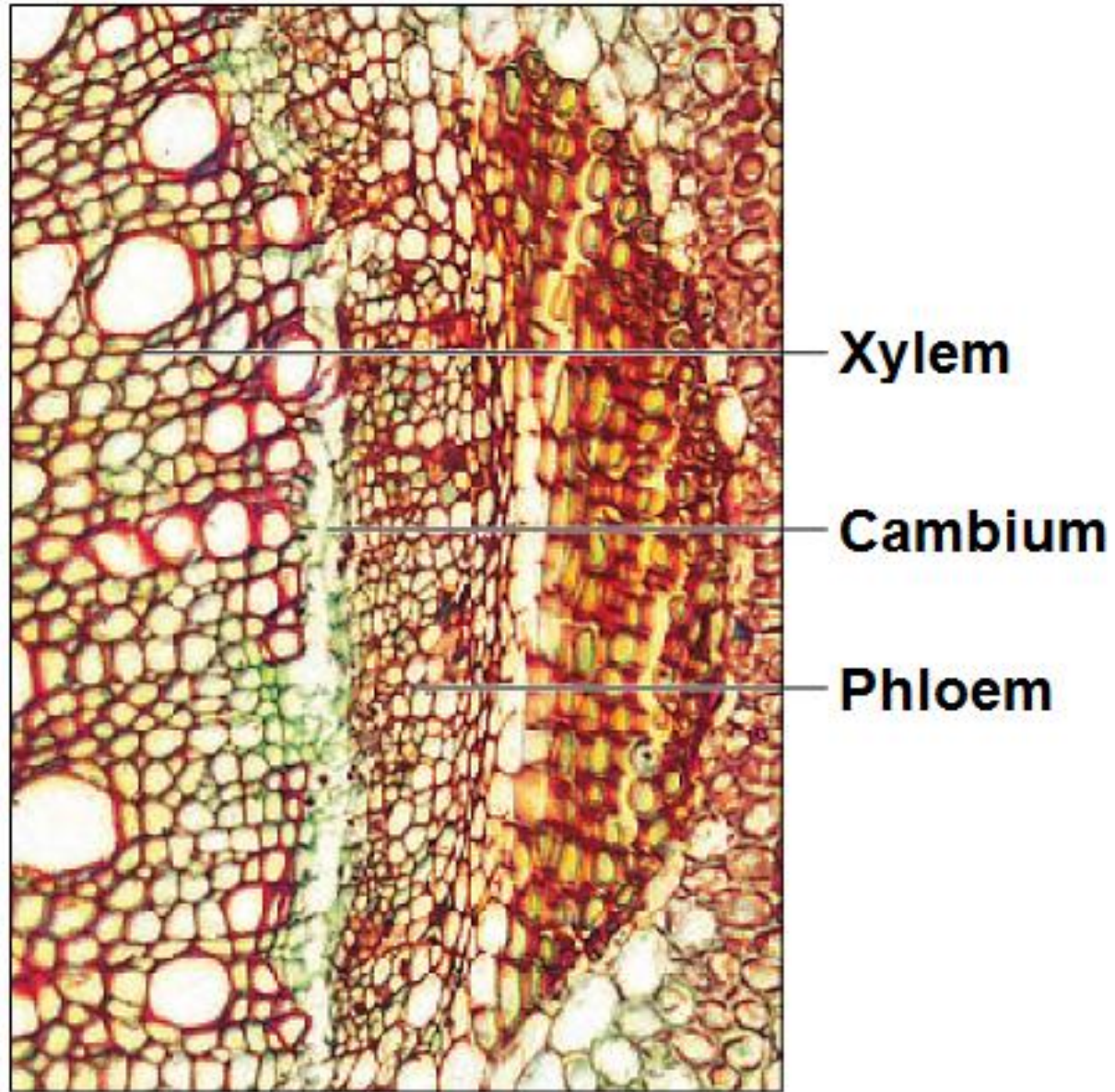
Dicot stem



Herbaceous dicot stem



Outer part of a stem



Modified Stems

- **Stolons** (thân bò) of the beach strawberry (*Fragaria chilensis*) run parallel to the ground



Modified Stems

- The **thorns(gai)** that protect this honey locust are outgrowths of the stem



Modified Stems

- The stem of the fishhook barrel cactus is highly modified to store water (Succulent(mọng nước) stems)



Modified Stems

- **Tendrils(tua)** may be stems modified to coil around objects, supporting and anchoring(neo) plants



Modified Stems

- The potato is a **tuber(củ)**. Sprouts grow from its “eyes” and form new plants



Modified Stems

- The **rhizome(thân rễ)** of an iris is an underground



Leaves

- Leaves consist of:
 - Epidermal
 - Vascular
 - Ground tissues.
- Their functions:
 - The primary photosynthetic organs
 - Support
 - Protection
 - Nutrient procurement(thu) and storage

Leaf Types

- Broad leaves



Leaf Types

- Needle leaves



Feathery(nhỏ) Leaves



Needlelike Leaves



Waxy(có sáp) leaf



Smooth leaf



Hairy leaf



Leaf Arrangement (Phyllotaxy)

- Alternate



Leaf Arrangement (Phyllotaxy)

- Opposite



Leaf Arrangement (Phyllotaxy)

- Whorled



Leaf forms

Simple leaf

Compound leaf

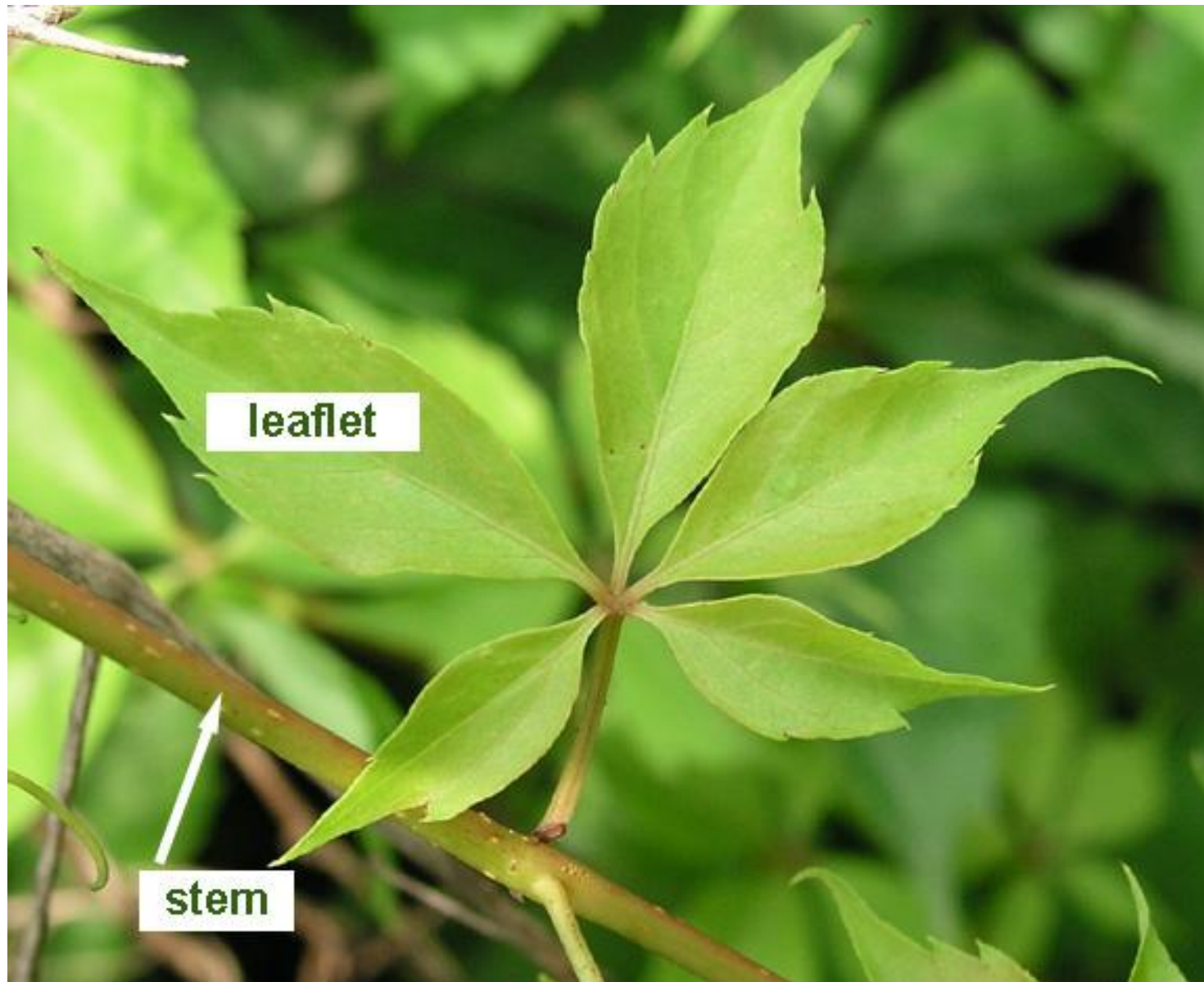
- *Pinnate*(hình lông chim)
compound leaf
- *Palmate* compound leaves

Simple leaf

- Attaches to the stem by its short petiole



Palmately compound leaf



Pinnately compound leaves



Bi-pinnately compound leaves



Leaf veins

- Most dicots have **netted veins**, with minor veins branching off from larger, prominent midveins.
- Many monocots have **parallel veins**, with several major parallel veins connected by smaller minor veins.

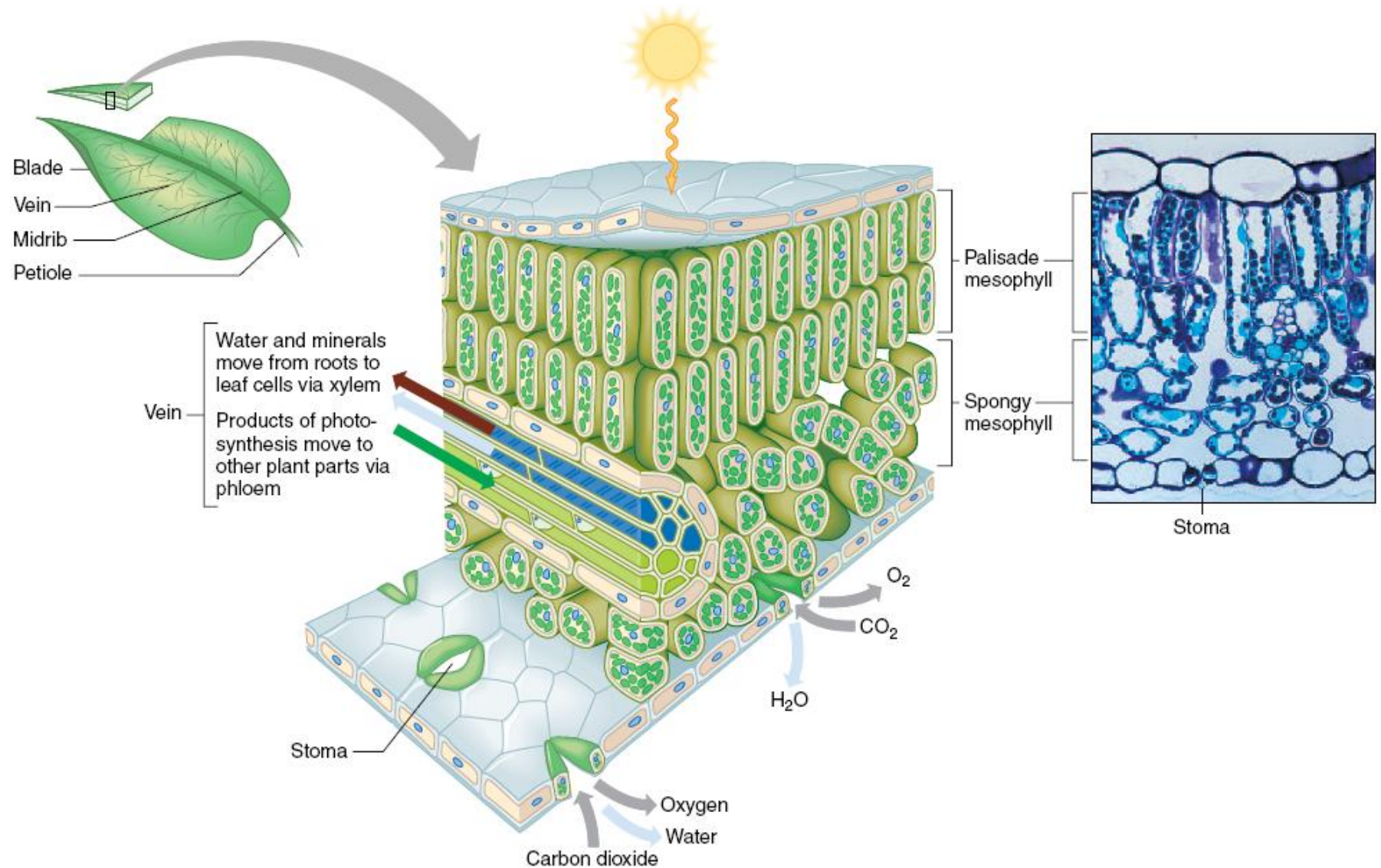
Netted veins



Parallel veins



Anatomy of a leaf



Modified Leaves

- **Floating(nổi) leaves** of a giant water lily (*Victoria Amazonica*)



Modified Leaves

- The **spines** of this barberry (*Berberis*)



Modified Leaves

- **Thorn** produced in the axils of leaves



Modified Leaves

- A flower-pot leaves of *Dischidia*



Modified Leaves

- A poinsettia (*Euphorbia pulcherrima*) “flower”



Modified Leaves

- Clary's annual sage (*Salvia viridis*)



Modified Leaves

- Insect-trapping leaves



Modified Leaves

- Insect-trapping leaves of *Nepenthes northiana*



Modified Leaves

- A Venus' flytrap plant (*Dionaea muscipula*)



Modified Leaves

- Sundew (*Drosera*) leaves



Modified Leaves

- Sundew (*Drosera*) leaves



Root types

Two principal types of root systems:

- *Taproot system:*
 - a single, large, deep-growing primary root accompanied by less prominent lateral roots.
- *Fibrous root system:*
 - compose of numerous thin roots that are all roughly equal in diameter.

Root types



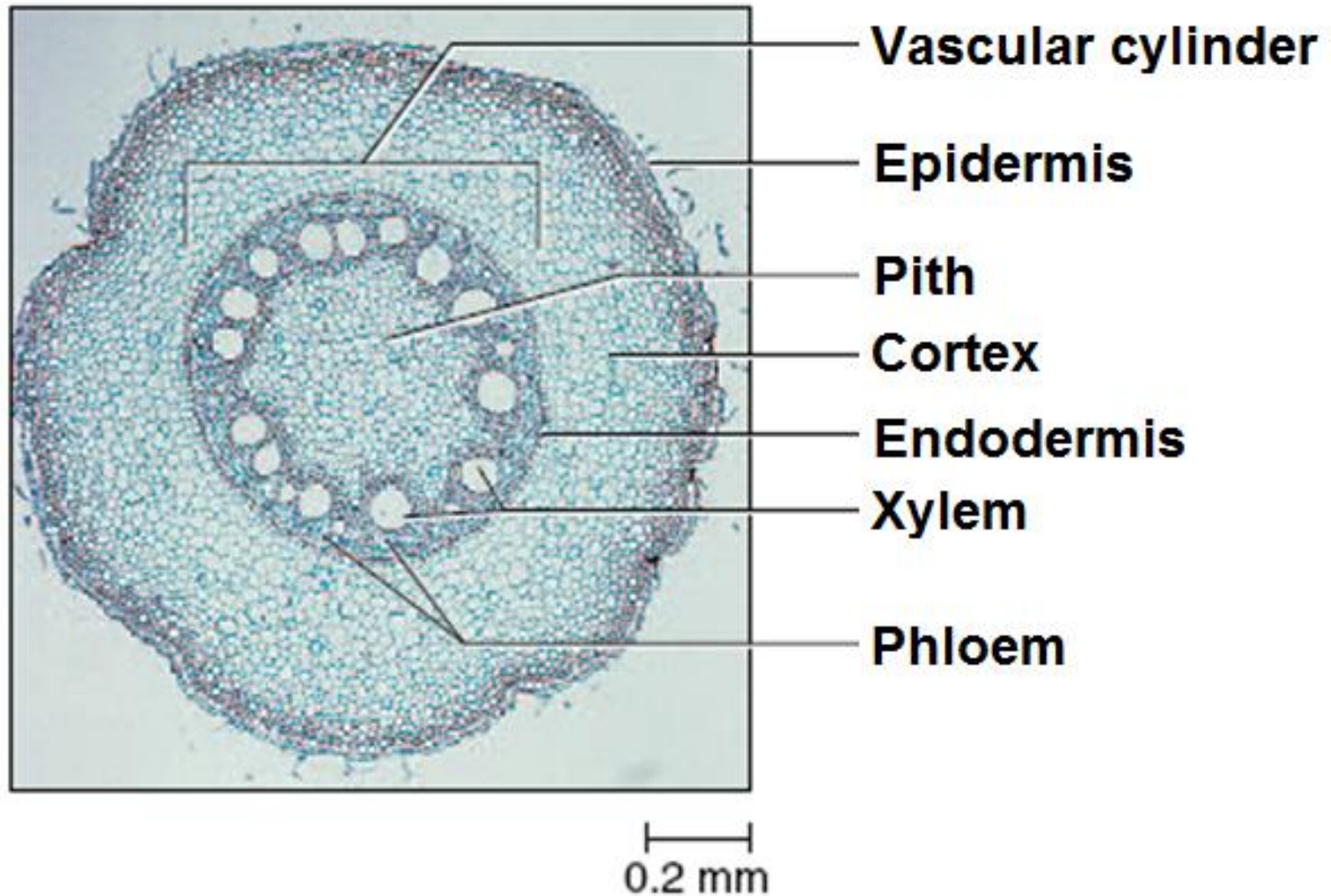
Taproot system (Carrot)



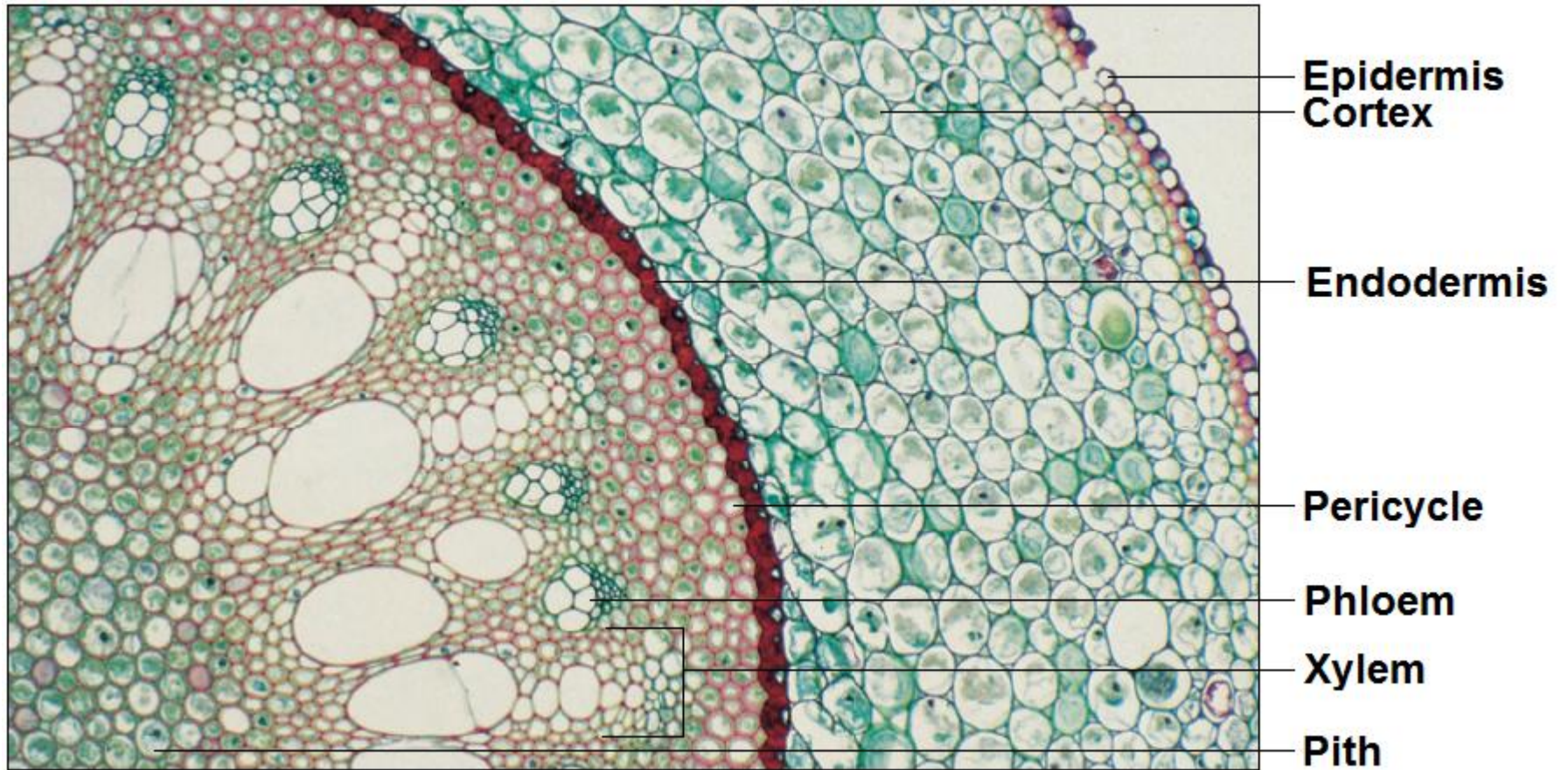
Fibrous root system (Leek)

Anatomy of a Primary Root

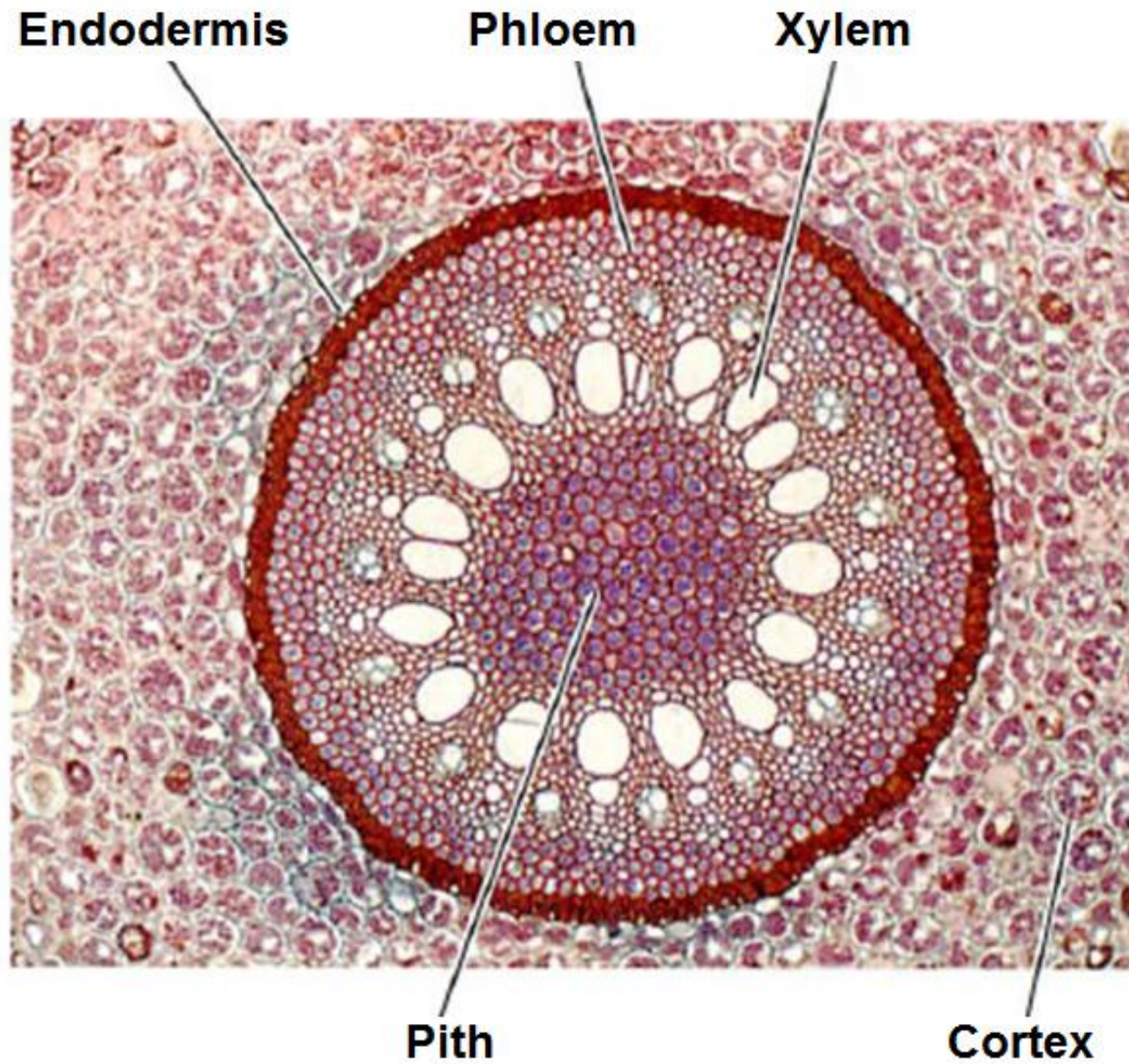
- Cross sections of a monocot root (corn)



Cross sections of a monocot root

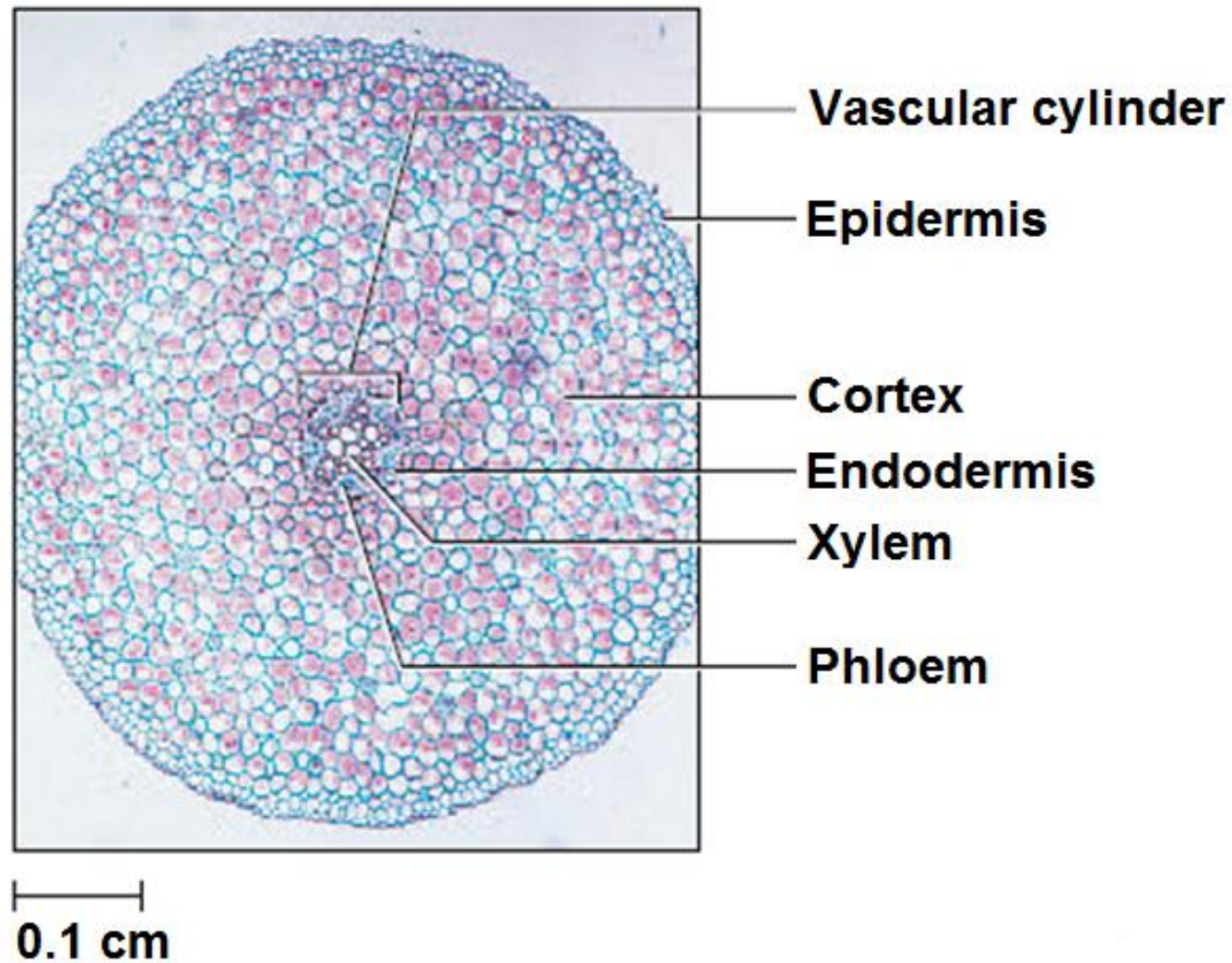


Monocot stele

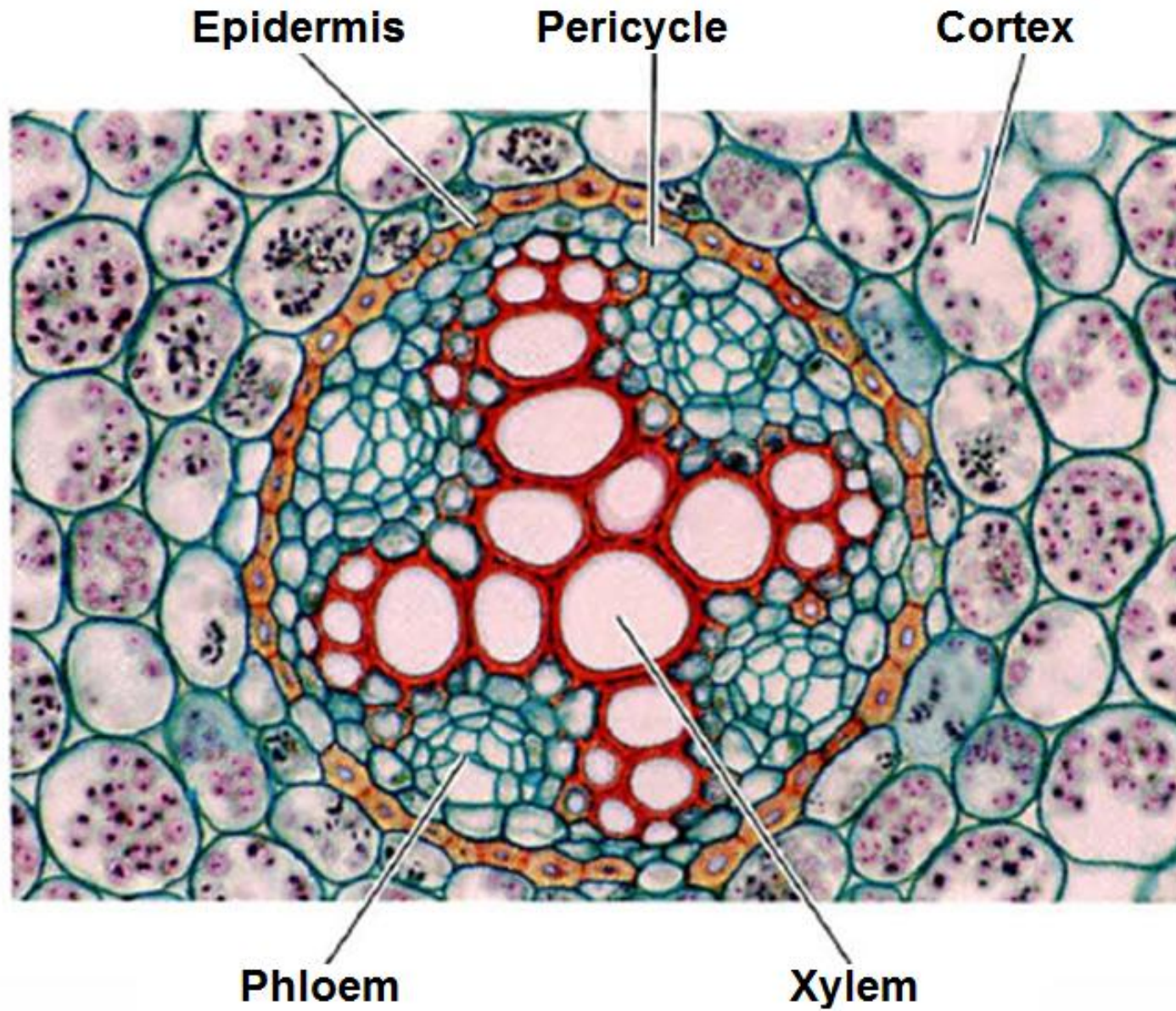


Anatomy of a Primary Root

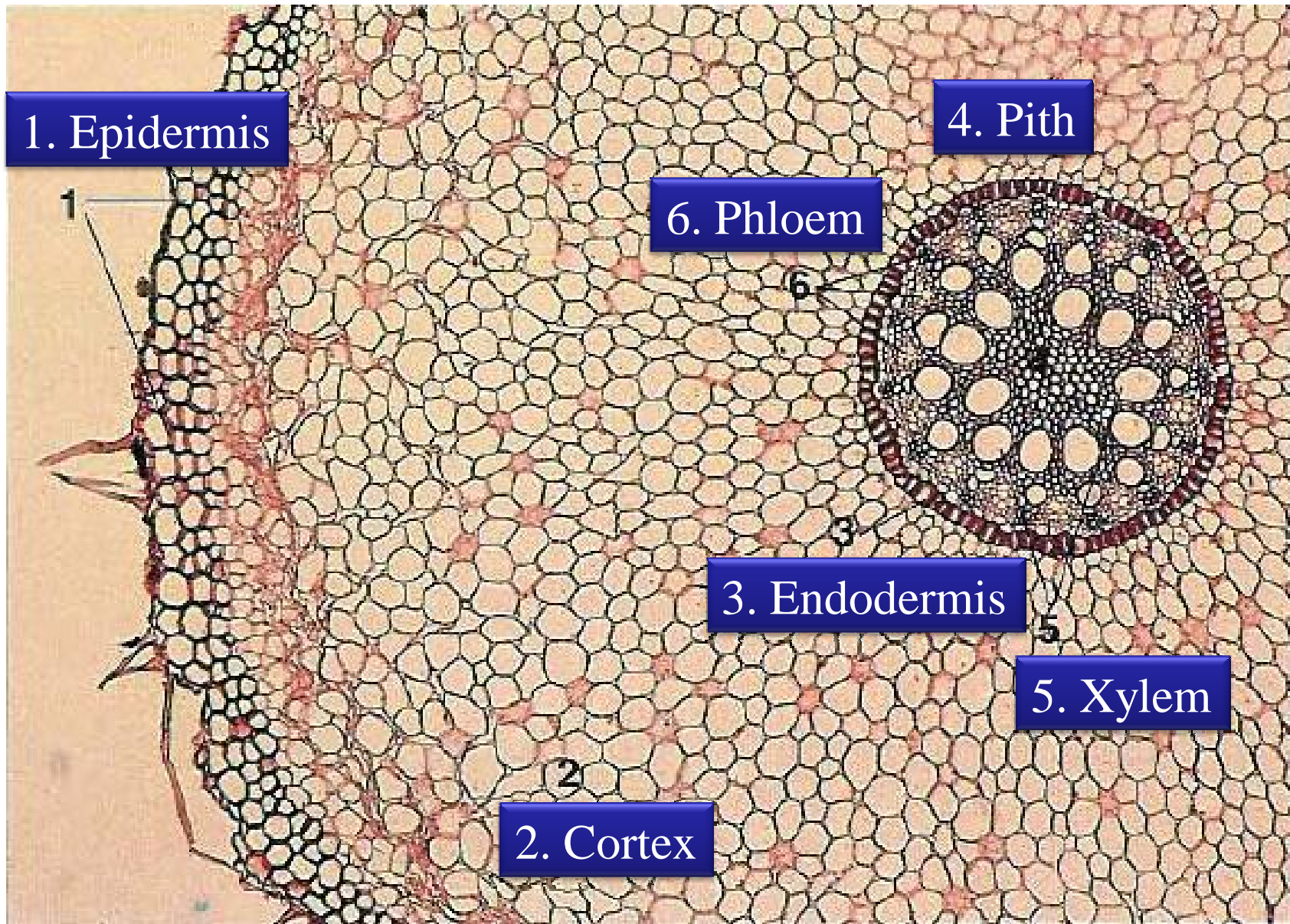
- Cross sections of a dicot root (buttercup)



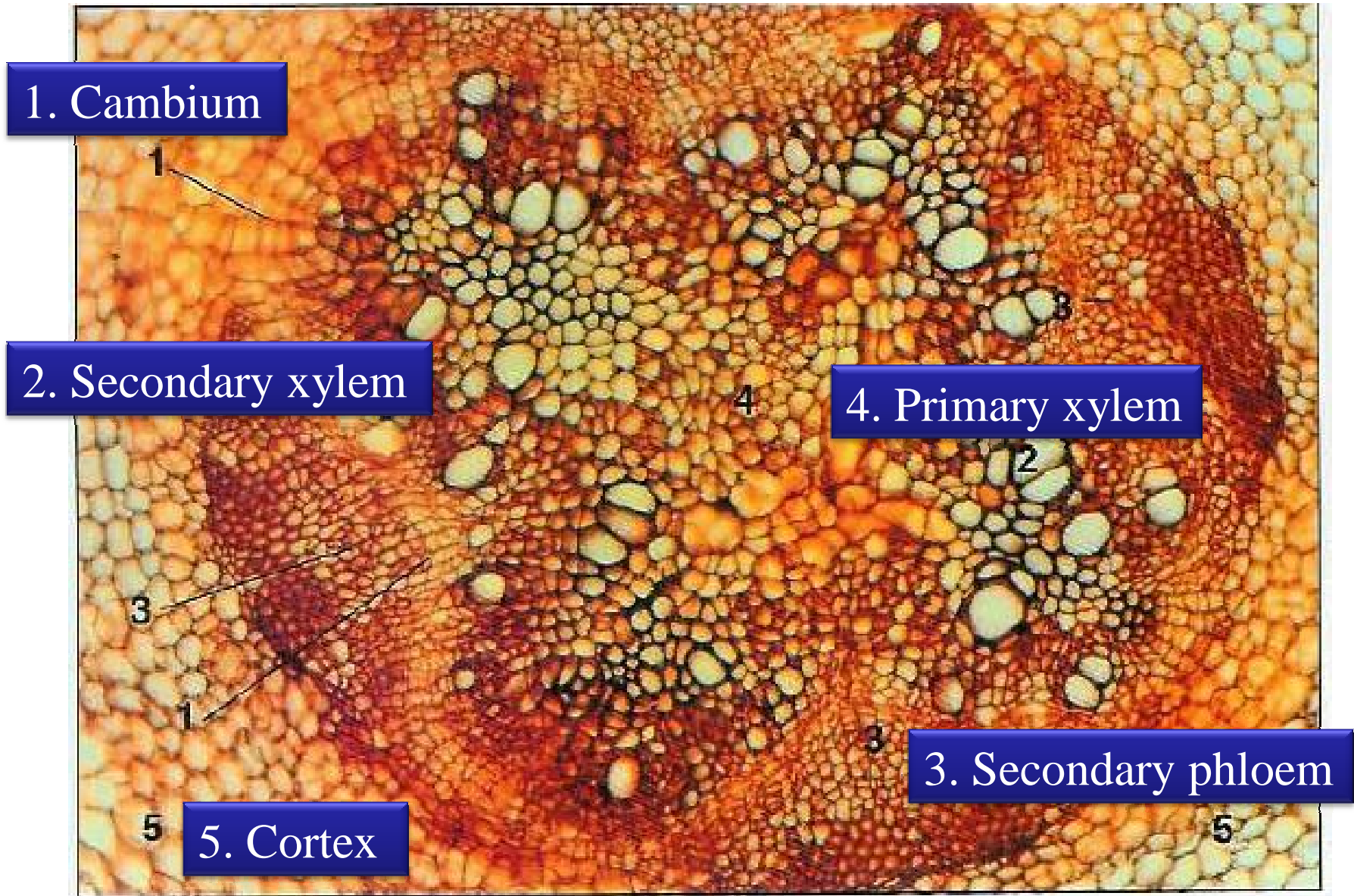
Dicot stele

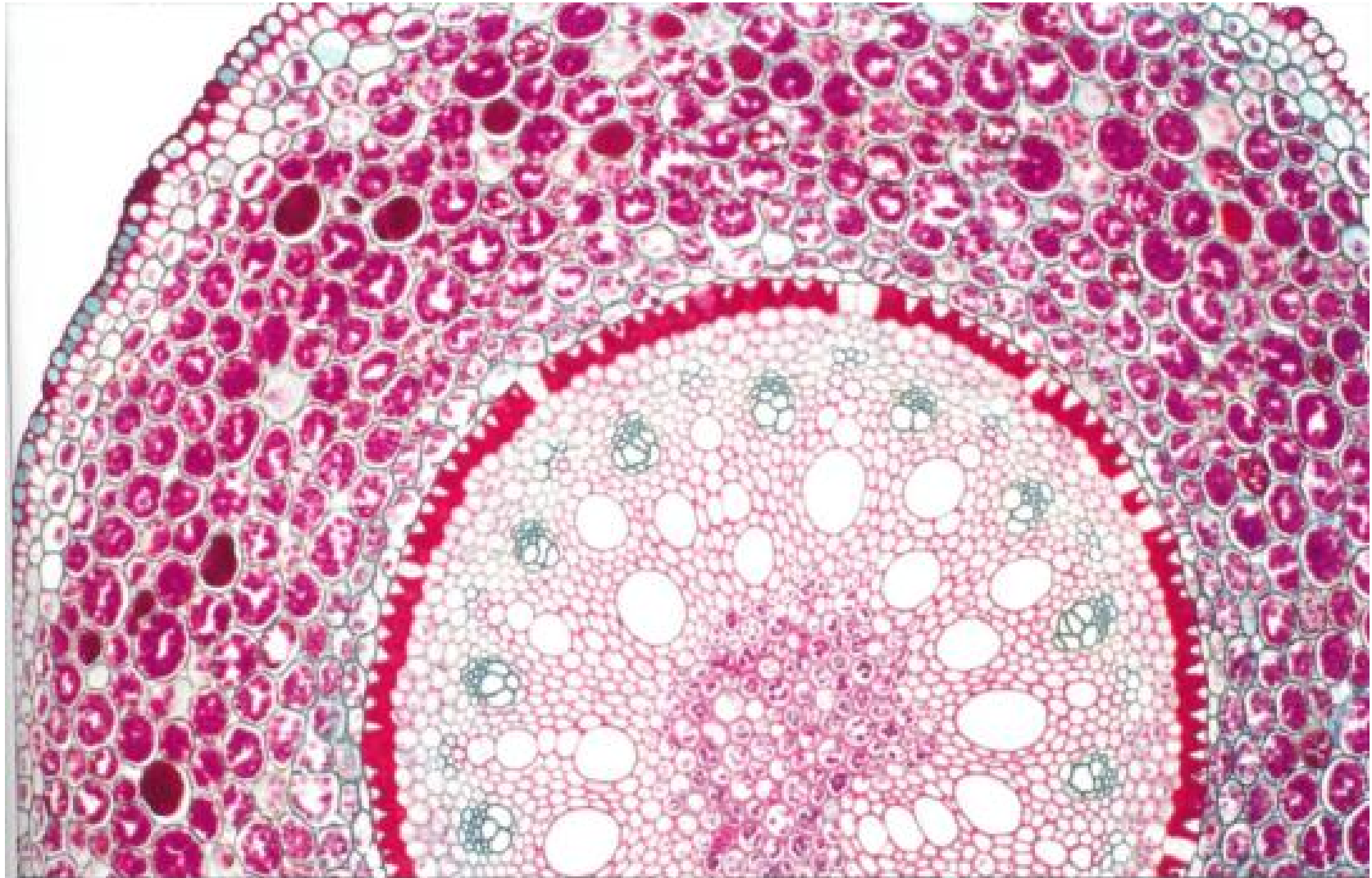


Monocot or Dicot root?

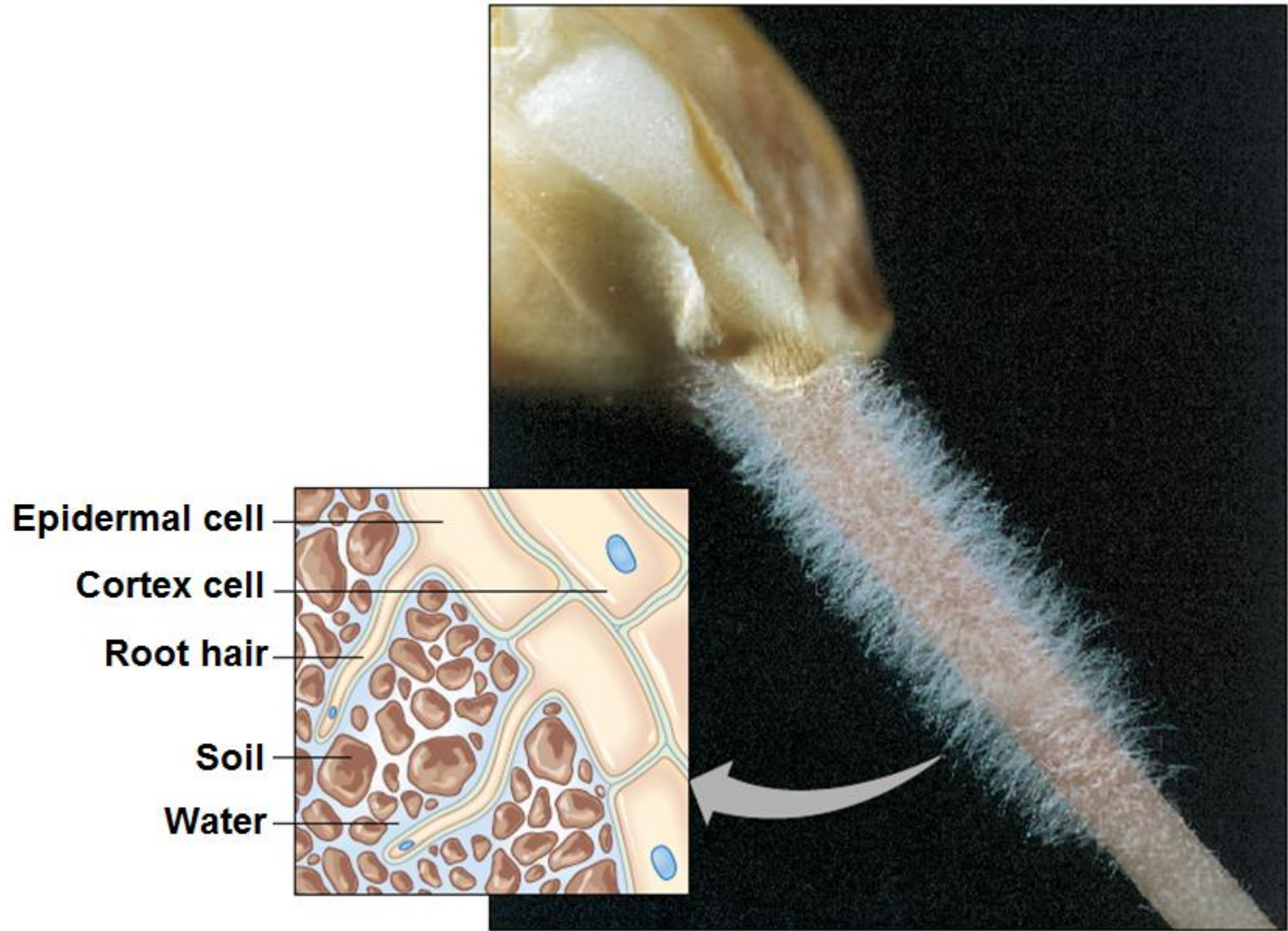


Monocot or Dicot roor?

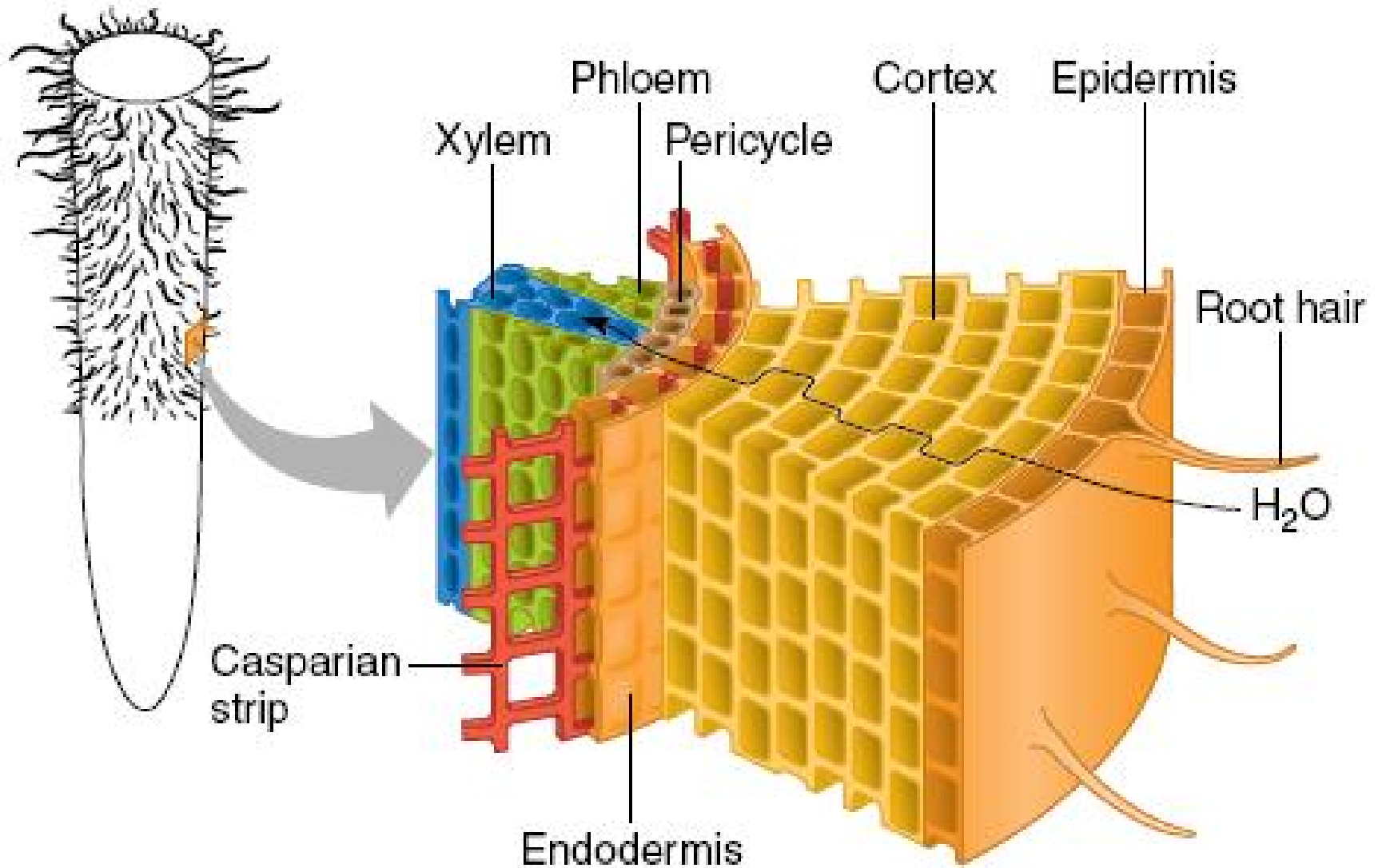




Root hairs



Casparian Strip

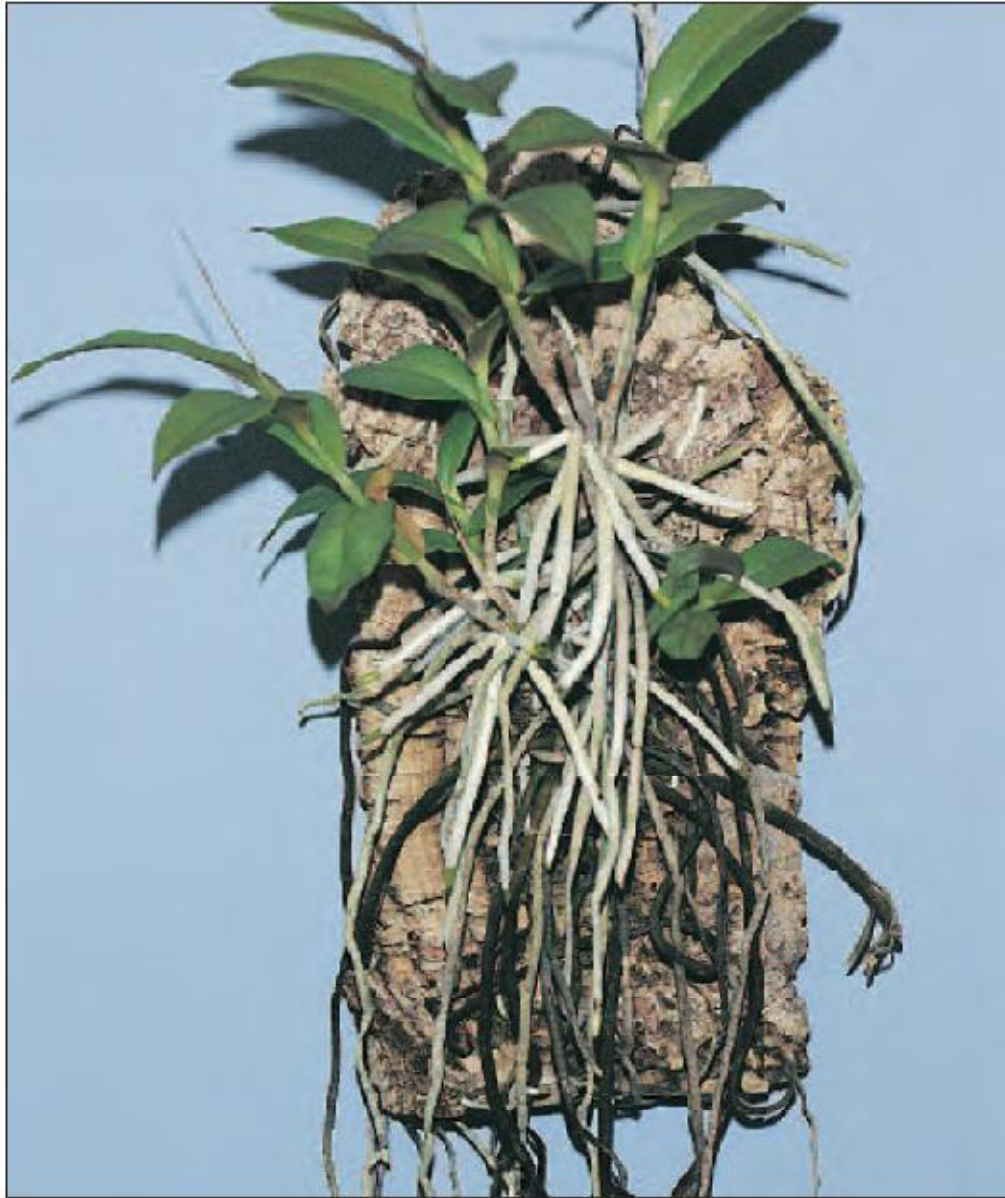


Modified Roots

- **Buttress roots** of a tropical fig tree



Aerial roots of Orchids



Pneumatophores(phao boi) (tropical mangroves)



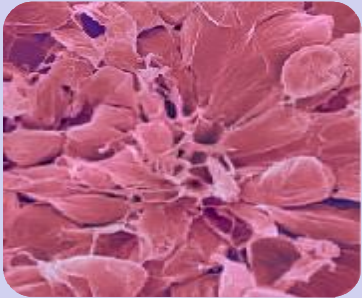
Modified Roots

- A banyan (*Ficus*) tree with many large **prop roots**



Mastering Concepts

1. What are the parts and tissues of a stem?
2. What are the functions of stems?
3. What are the structures and functions of leaves?
4. How do the two types of root systems differ?
5. What are the regions and structures of a root?
6. What are some special modifications of stems, leaves, and roots?



Plant Tissues and Cell Types

- Meristems
- Permanent Tissues



Anatomy of a Plant

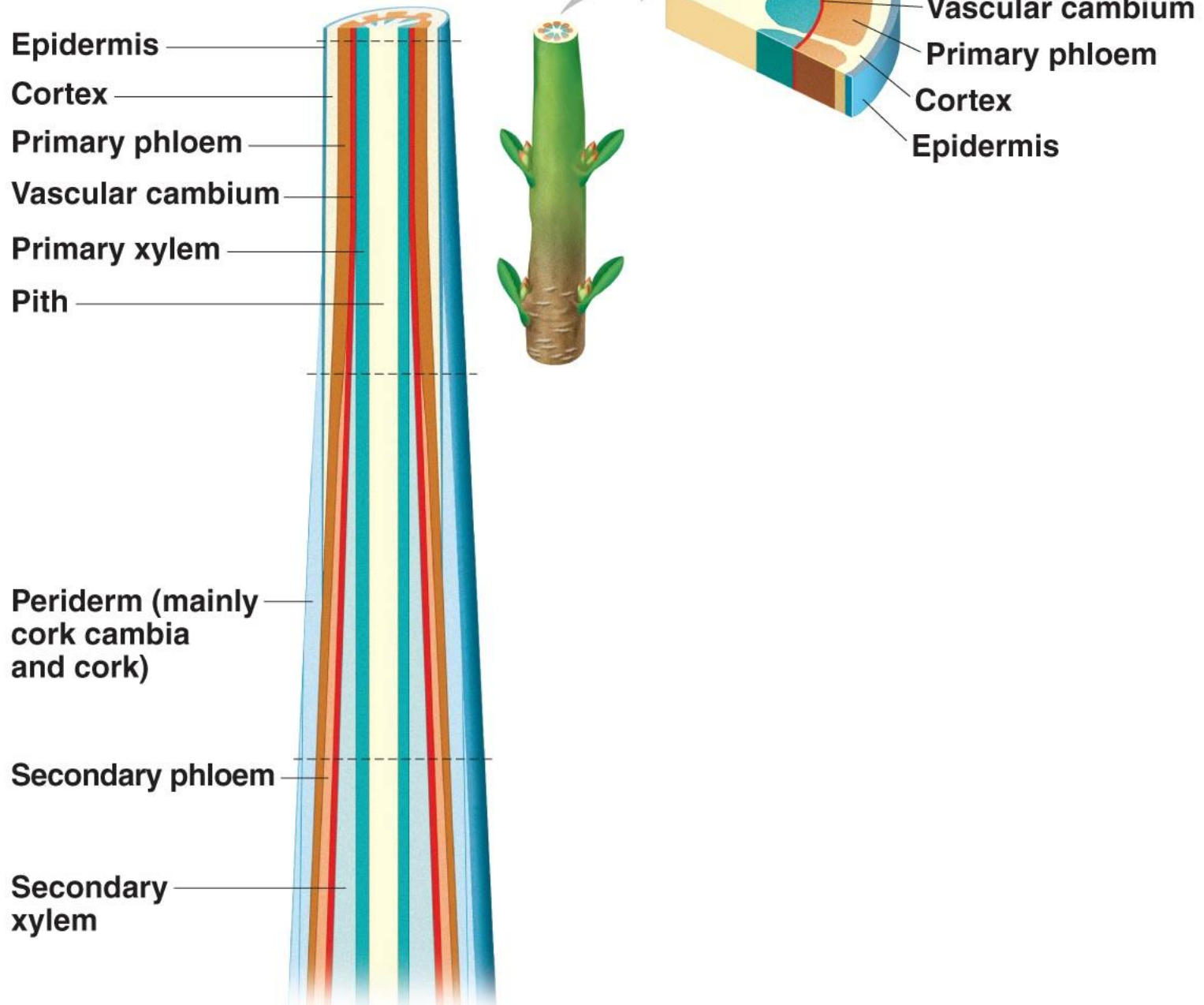
- Root
- Stem
- Leaf



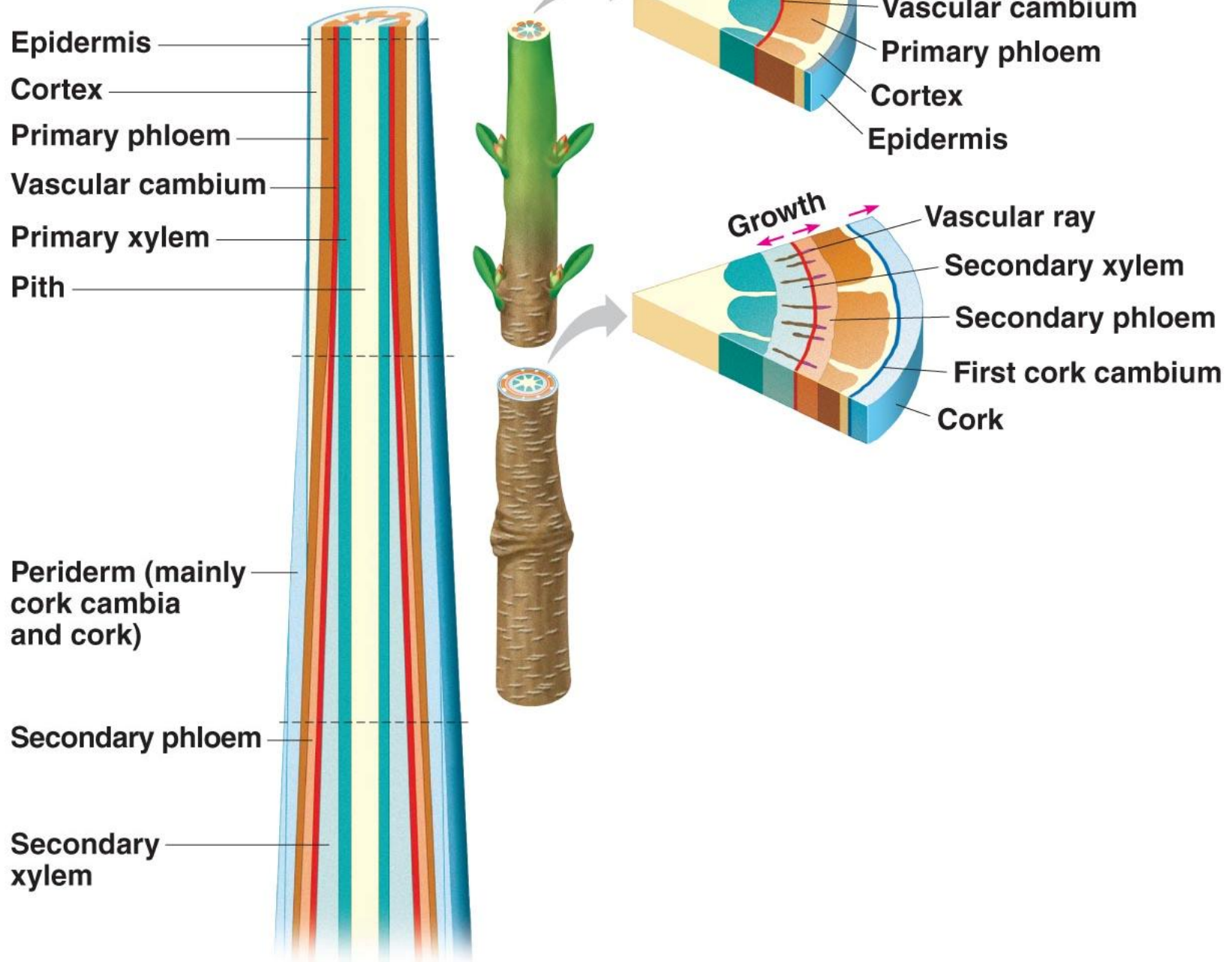
Secondary Plant Growth

- Vascular Cambium
- Cork Cambium

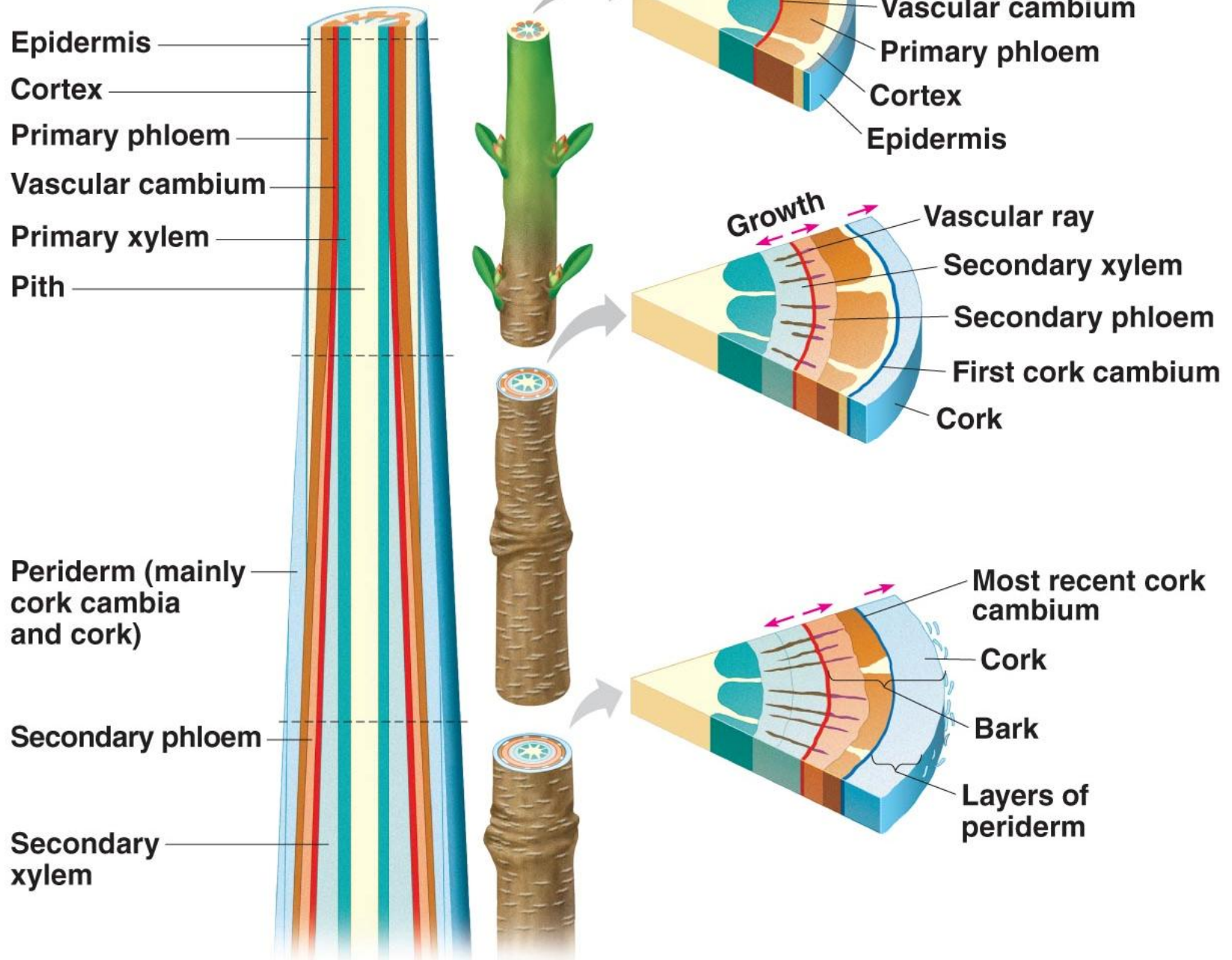
(a) Primary and secondary growth in a two-year-old stem

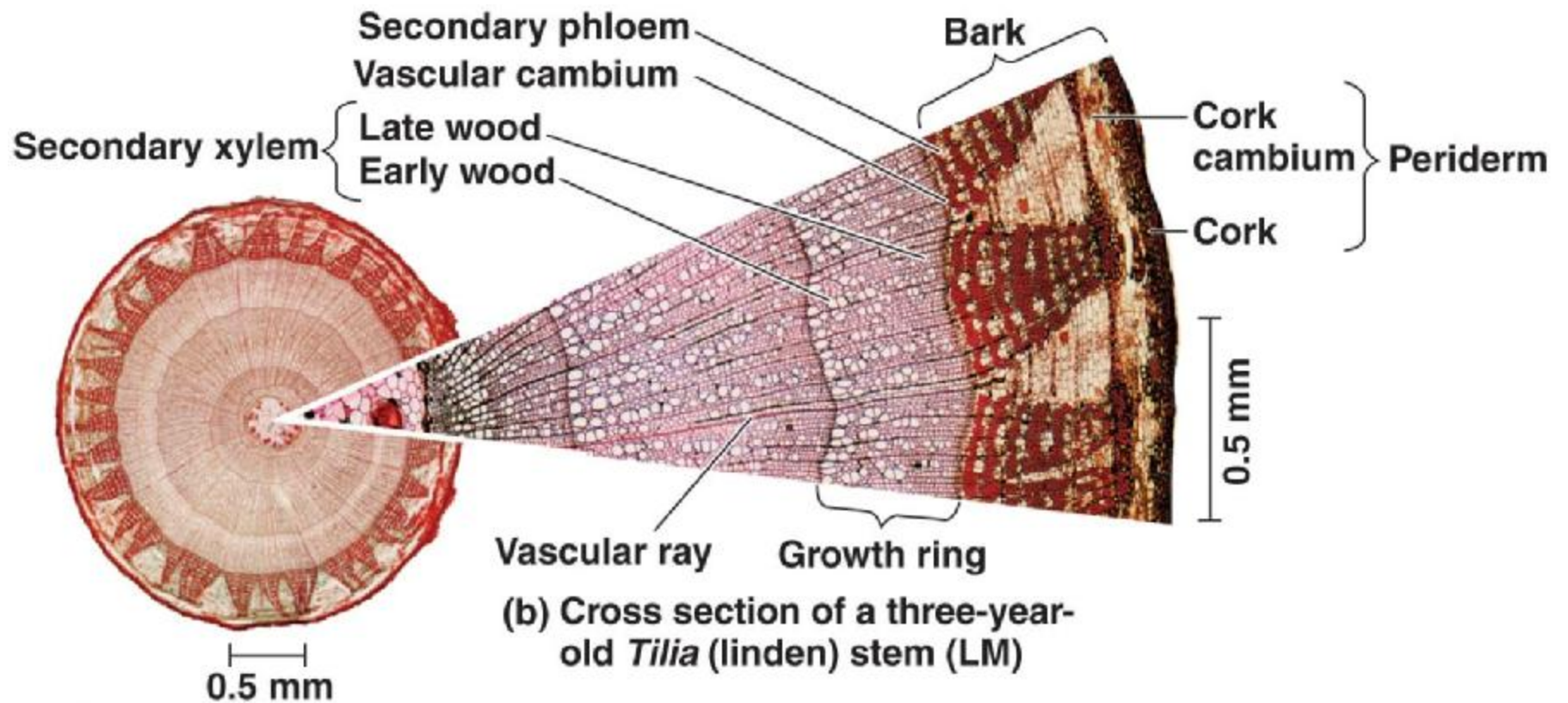


(a) Primary and secondary growth in a two-year-old stem



(a) Primary and secondary growth in a two-year-old stem





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