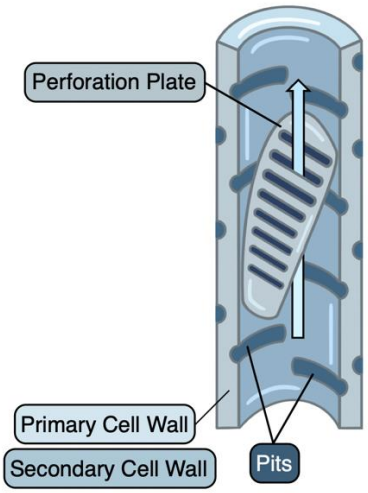
CONCEPT: VASCULAR TISSUE

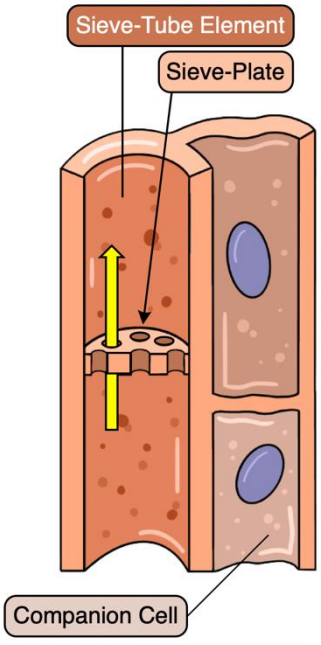
- Vascular tissue transports water, nutrients, and photosynthetic products great distances
  - □ ***Vascular bundles*** – vascular tissue grouped into strands that run the length of the stem
- ***Xylem*** – conducts water and dissolved nutrients up from the roots to the shoots
  - □ ***Tracheids*** – long, thin water-conducting cells found in all vascular plants
    - ***Pits*** – openings in secondary cell wall through which water flows, and only primary cell wall is present
  - □ ***Vessel elements*** – short, wide, water-conducting cells found in angiosperms and some other plants, have pits
    - ***Perforations*** – openings in both cell walls, allow vessel elements to conduct water better than tracheids
  - □ Xylem also contains fibers (sclerenchyma cells) and parenchyma cells for lateral transport

EXAMPLE:



- ***Phloem*** – conducts sugars, amino acids, and chemical signaling molecules between the roots and the shoots
  - □ ***Sieve tube elements*** – specialized parenchyma cells that transport sugars and other nutrients
    - ***Sieve plates*** – pores in cell walls that facilitate transport between cells
  - □ ***Companion cells*** – cells that support sieve tube elements metabolically and physically

EXAMPLE:



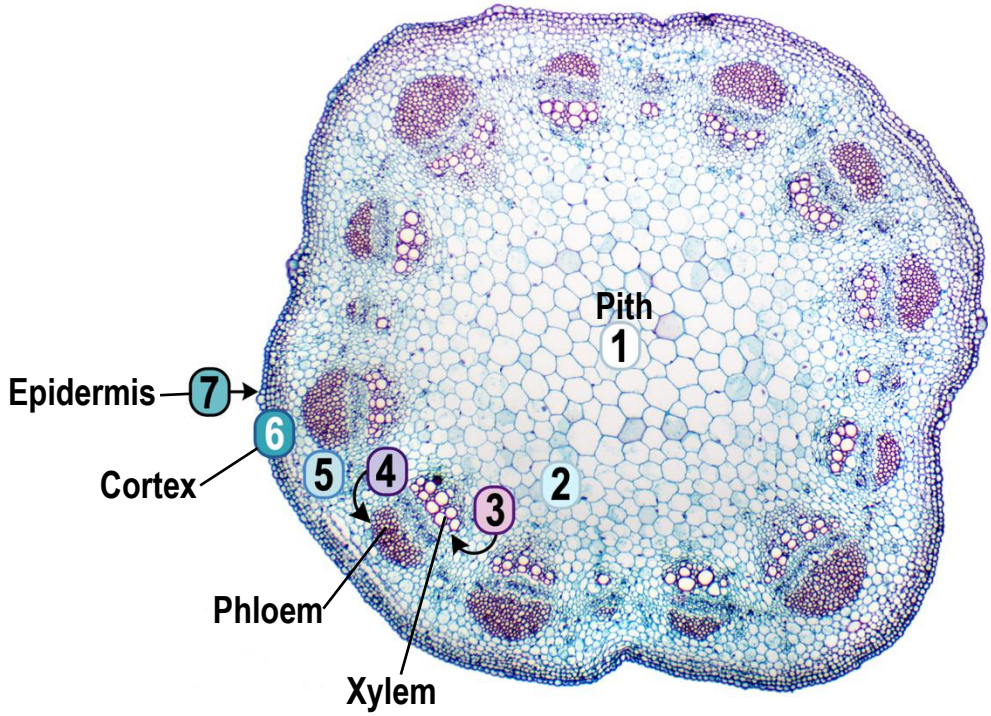
CONCEPT: EPIDERMIS AND GROUND TISSUE

- Epidermal cells secrete the cuticle that helps prevent water loss and defends against pathogens, similar to skin
    - □ ***Cuticle*** – waxy film covering the epidermis of many plants
    - □ ***Trichomes*** – hair-like structures made of special epidermal cells that carry out a wider range of functions
        - Functions include preventing water loss, defending against herbivores, and reflecting sunlight

EXAMPLE:

- Ground tissue is responsible for producing and storing important molecules for the plant
    - □ ***Pith*** – ground tissue inside vascular bundles
    - □ ***Cortex*** – ground tissue outside of vascular bundles
        - ***Endodermis*** – innermost layer of the cortex, forms cell boundary with the vascular tissue
        - ***Pericycle*** – thin layer of tissue between the endodermis and the phloem, derived from procambium

EXAMPLE:



CONCEPT: GROUND TISSUE

- Ground tissue system is made up of three types of cells:
- ***Parenchyma cells*** – most abundant plant cells, form pith and cortex of stems, cortex of roots, and mesophyll of leaves
    - □ Many are totipotent, allowing them to develop into any cell type, helps with healing and asexual reproduction
    - □ ***Callus*** – mass of unorganized parenchyma cells covering a wound
    - □ ***Rays*** – radiate through vascular tissue to transport water and nutrients laterally
- ***Collenchyma cells*** – provide structural support, especially in growing shoots and leaves
    - □ Long and thin in shape, with very thick primary cell walls, yet quite stretchy and flexible
- ***Sclerenchyma cells*** – provides structural support in places growth has ceased, dead at maturity
    - □ Thin primary cell walls with very thick secondary cell walls made of lignin and cellulose
    - □ ***Fibers*** – extremely long sclerenchyma
    - □ ***Sclereids*** – have thick lignin walls, and form protective coating of seeds and shells of nuts

EXAMPLE: