Laboratory work 2

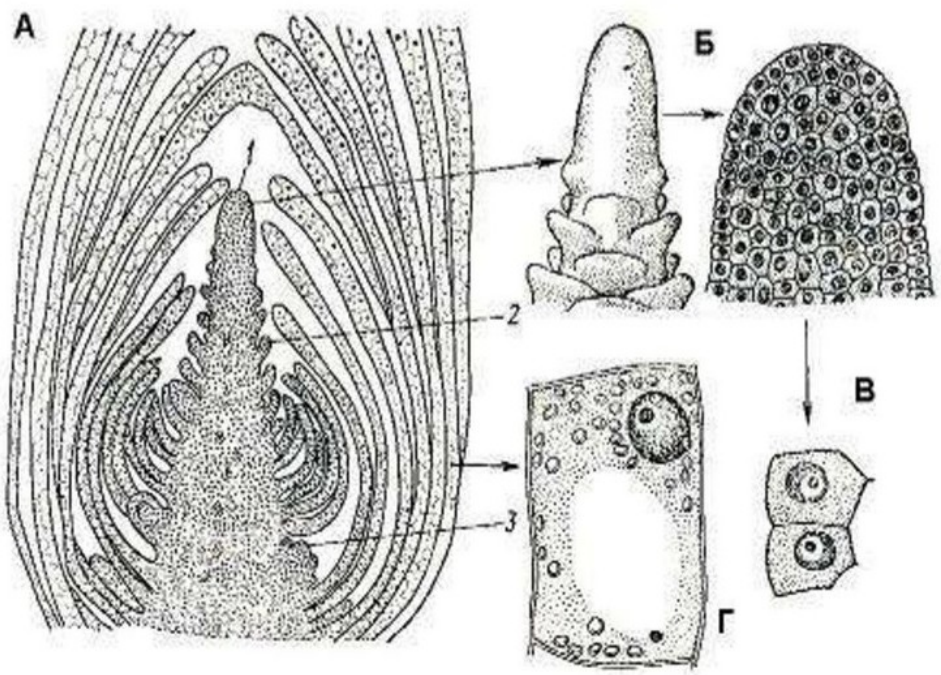
Meristems, Growth And Differentiation

Material:
Permanent mount of Elodea shoot apex (*Elodea canadensis*) and living plant of *Elodea (Elodea canadensis*), permanent mount of onion root (*Allium cepa*)
Objective: To investigate the structural features of meristematic tissue.
Tasks of work: to analyze the general features of the structure of the stem and root apex and distinctive features of the apical meristem.

Make wet mount of Elodea shoot apex. While observing with the microscope, remove the leaves from the shoot apex. Eventually you will uncover the apical dome surrounded by tiny leaf primordia. Notice the orderly arrangement of leaf primordia around the apical dome. Compare the three-dimensional shoot apex with a prepared slide of a longitudinal section of the *Elodea* shoot *apex.*

Draw picture of shoot tips of *Elodea* (living and sectioned). Label in the picture apical dome and leaf primordia.

Apex meristem of shrank of Elodea

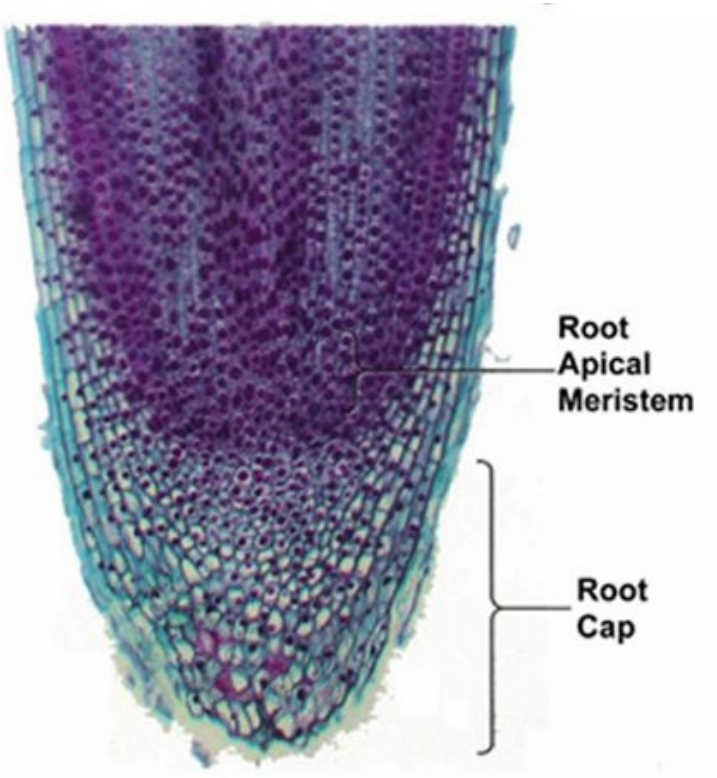


А – lateral cut; Б – lateral cut of cones of growing; В – cells of primary meristem; Г – parenchyma cell of leaf, finished differentiating; 1 – cone of growing; 2 – primordium of leaf; 3 – primordium of shrank

Longitudinal section of *Elodea* shoot apical meristem.

A shoot apical meristem is a dome-shaped mass of dividing cells at the shoot tip. Leaves develop from **leaf primordia** along the sides of the apical meristem. Axillary buds develop from meristematic cells left at the bases of leaf primordia

Now analyze a slide of onion that shows the apical meristem of the root in longitudinal section and note the prominent root cap, meristem. In contrast to the shoot apical meristem, the root apical meristem forms cells apically as well as basipetally. This type of organization is necessary to supply cells to the root cap, which constantly sloughs off cells as the root penetrates the soil. Another difference is that the root apical meristem does not give rise to lateral organs. Lateral roots arise from deep within mature regions of the root. Draw and label the root cap, meristem.



Apical meristem of the root

Dermal tissue system

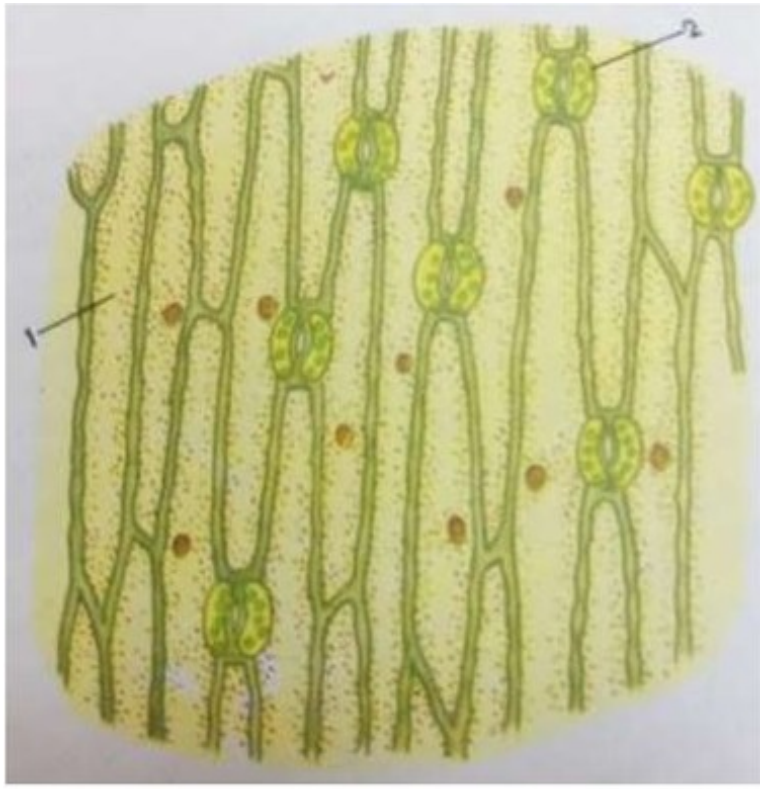
- Epidermis and Periderm

Material:
permanent mount of transverse cut of iris leaf (*Iris* sp.), leaf of geraniums (*Pelargonium)*, tradescantia leaf (*Tradescantia* sp.);
herbaceous leaf samples of the mullein (*Verbascum sp.*), nettle (*Urtica dioica* L.), permanent mount of cross-cut of the elderberry branch (*Sambucus racemosa* L.).

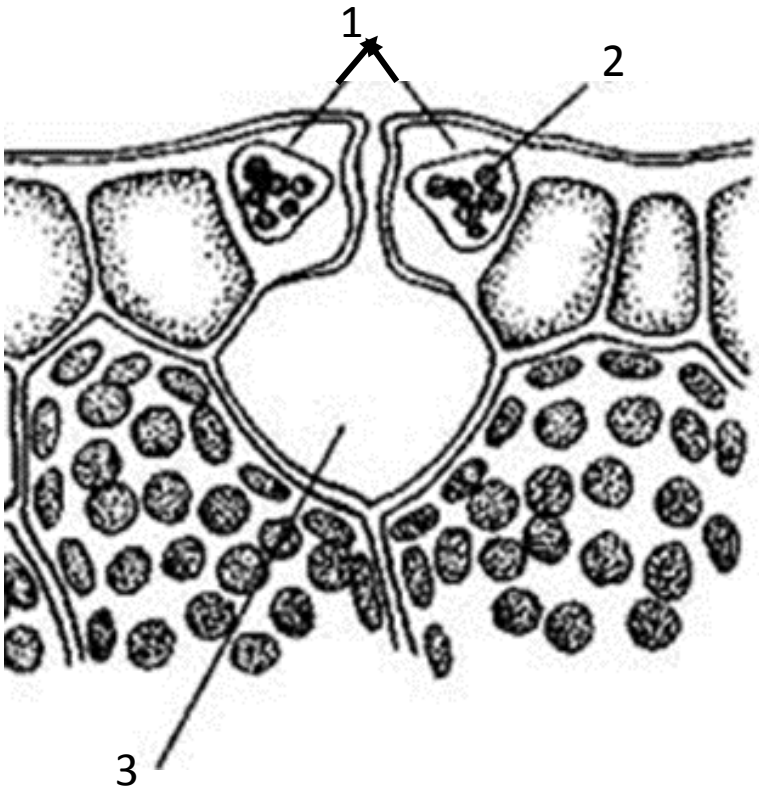
Objective: to investigate the features of the structure of dermal tissues: epidermis and periderm.

Tasks of work: to analyze a structure of dermal tissue; the main types of stomata apparatus; show that the epidermis and periderm are a complex tissue.

- Analyze the prepared slide of a leaf epidermis of iris. Draw and label the stomata, epidermal cells and guard cells.



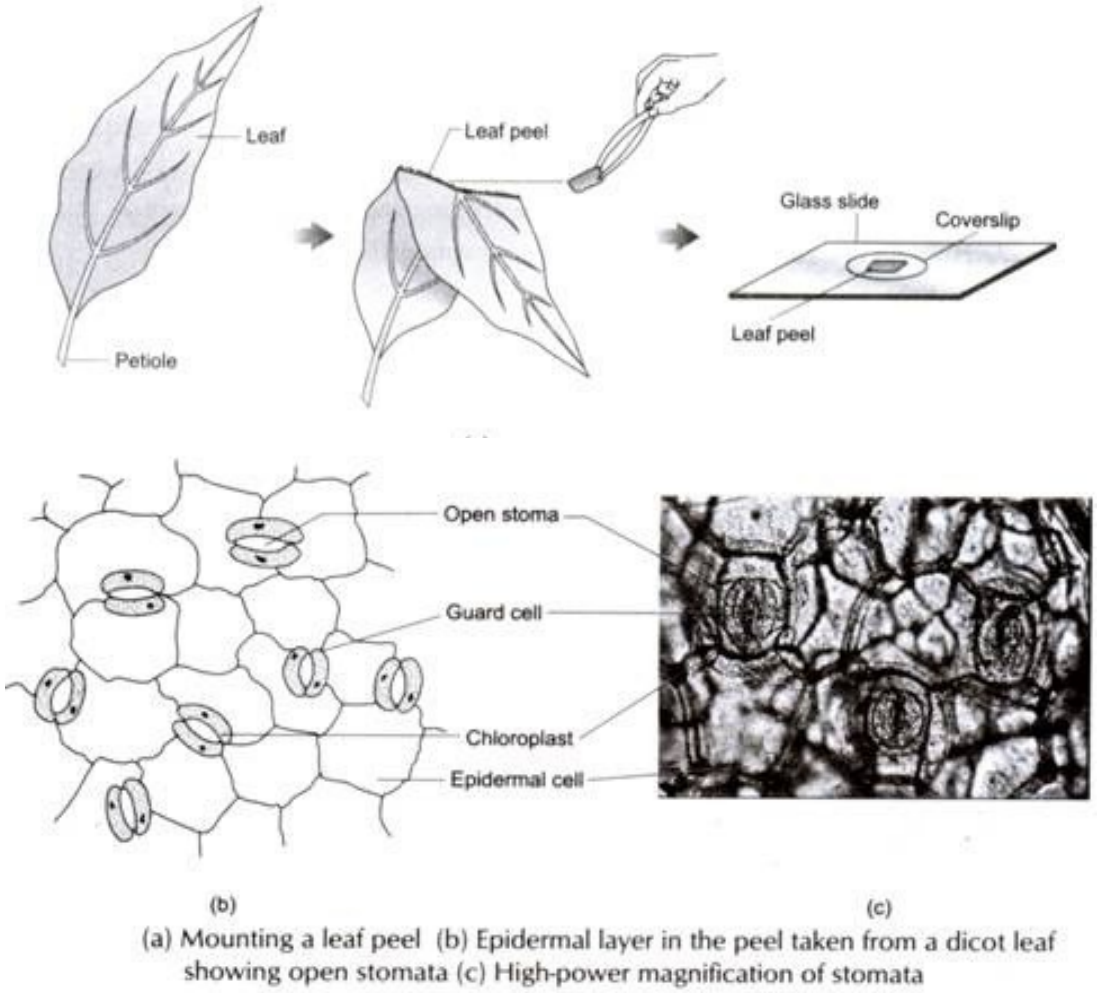
Leaf epidermis of iris:
1 – cells of epidermis
2 - stomata



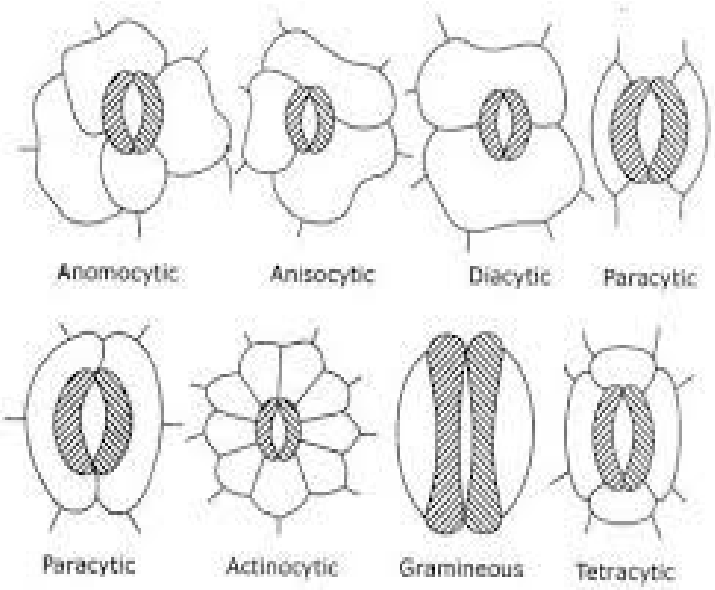
Transverse section of epidermis

1 - guard cells
2 - chloroplasts
3 - air cavity

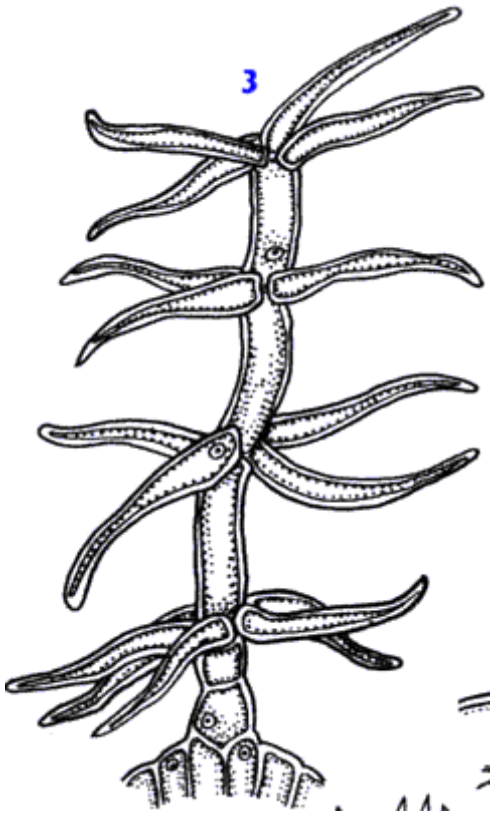
Make a preparation of the epidermis of a geraniums leaf, tradescantia leaf and consider various types of stomata apparatus. Draw a few cells of the epidermis and stomata apparatus. Label the stomata, epidermal cells and guard cells.

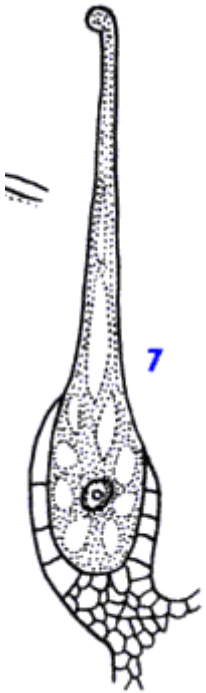


(a) Mounting a leaf peel (b) Epidermal layer in the peel taken from a dicot leaf showing open stomata (c) High-power magnification of stomata



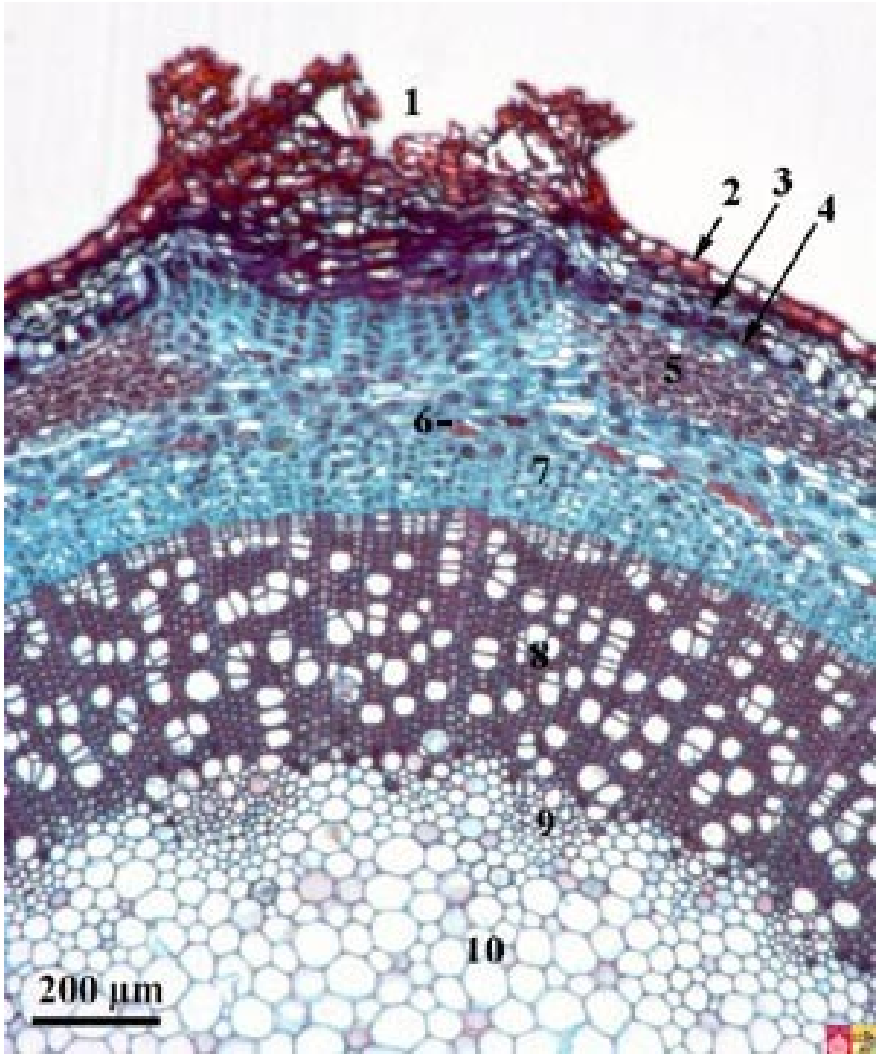
Analyze a preparation of the epidermis of a geraniums leaf. Draw and label the epidermal cells and trichomes. Analyze trichomes from leaves other plants: mullein, nettle. Draw and label.





3 - Trichomes from leaves of mullein
7 - Glandular trichomes from leaves of nettle

Analyze a permanent preparation periderm of elderberry. Draw and label.



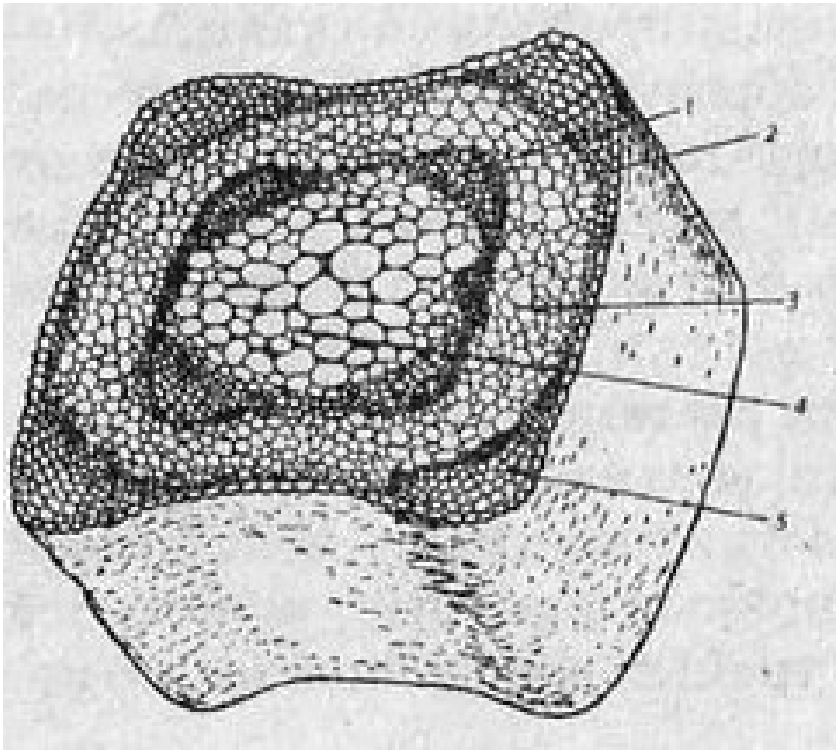
1 lenticel;
2 epidermis;
3 cork;
4 cambium;
5 collenchyma;
6 sclerenchyma;
7 phloem;
8 secondary xylem;
9 primary xylem;
10 pith

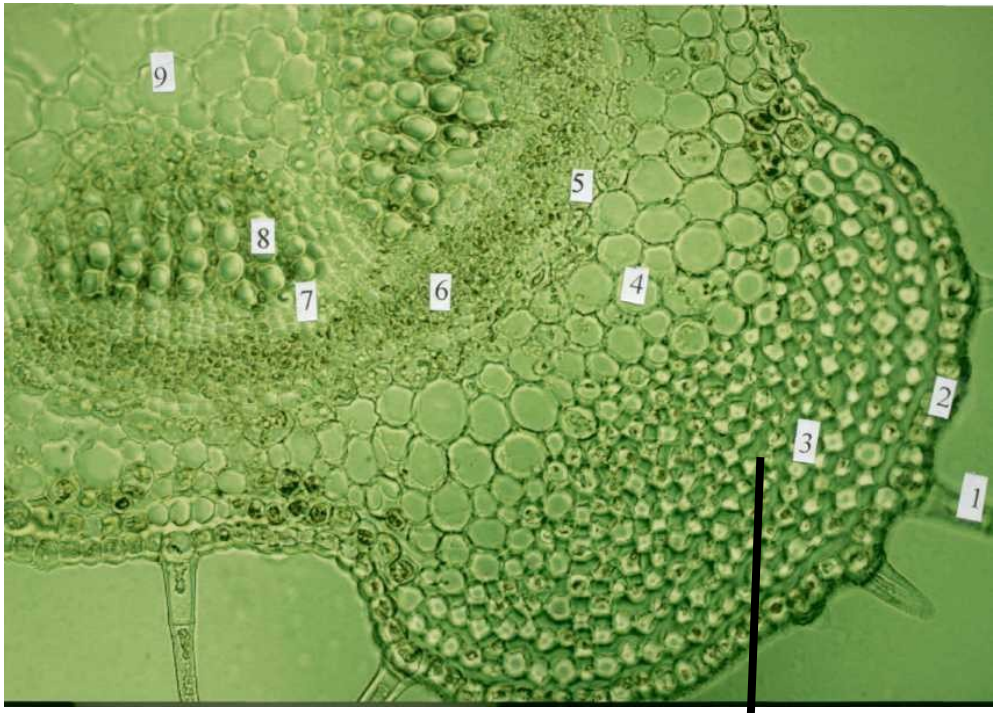
Supporting or mechanical ground tissues

- Collenchyma, Sclerenchyma, Sclereids

Material:
permanent mount of transverse cut of stem of spearmint (*Mentha* sp.), of flax (*Linum* sp.), fresh fruit of pear (*Pyrus* sp.).
Objective: to investigate the features mechanical tissues: Collenchyma, Sclerenchyma, Sclereids.
Tasks of work: analyze the structure of cells, of which the mechanical tissues are composed

Analyze a preparation of the stem of spearmint. Draw and label the cells of collenchyma .



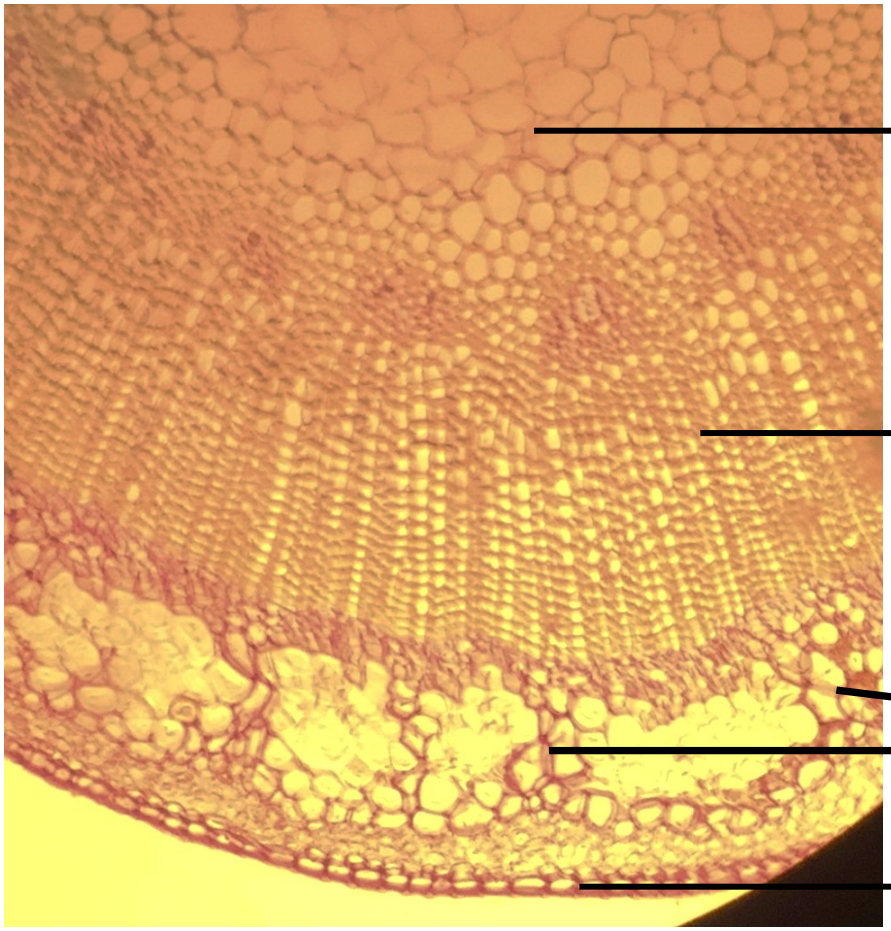


Collenchyma

Diagram of cross section of stem of spearmint

1 – vascular system
2 – epidermis
3 – cork
4 - pith
5 - collenchyma

- Collenchyma is often located in the growing organs of plants (young stems and petiole) under the epidermis. Its mature cells contain chloroplasts. Collenchyma is often located on the periphery of the stem and leaf
- Analyze a cross and longitudinal section of the stem of flax. Draw and label the cells of sclerenchima



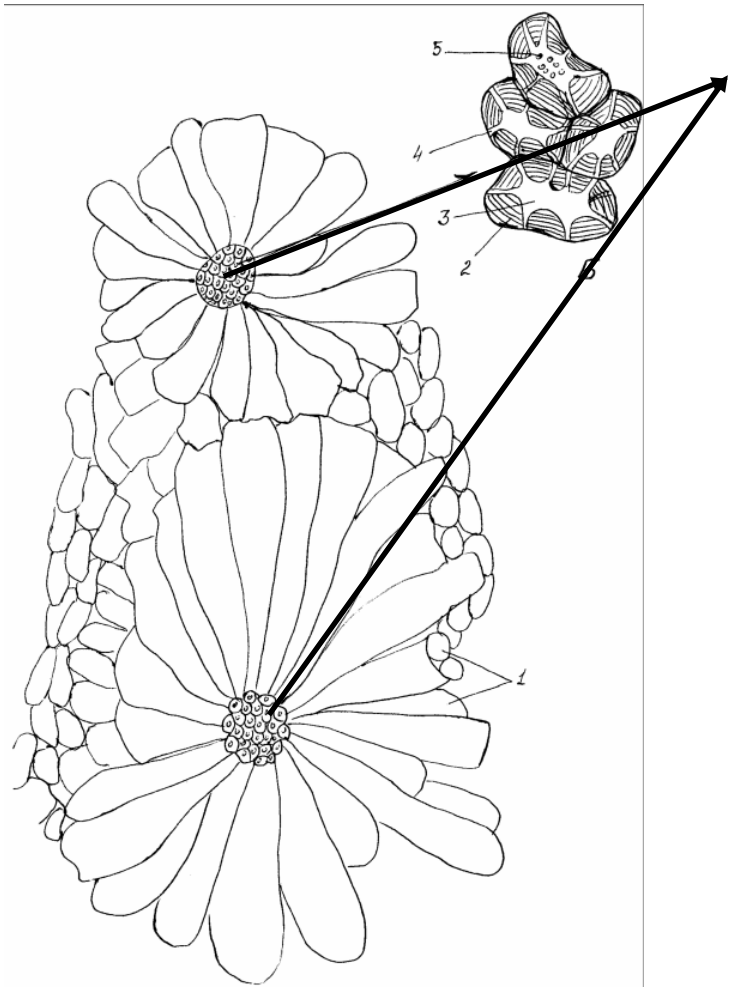
Cross section of the stem of flax

Xylem

Sclerenchima
(bast fibres)

Epidermis

- Obtain a small piece of pear flesh and place it on a slide**.** Place a coverslip over the material and press gently to spread the cells. Draw a diagram that distinguishes cells with primary cell walls only from those with secondary cell walls (Pear sclereid or stone cell).

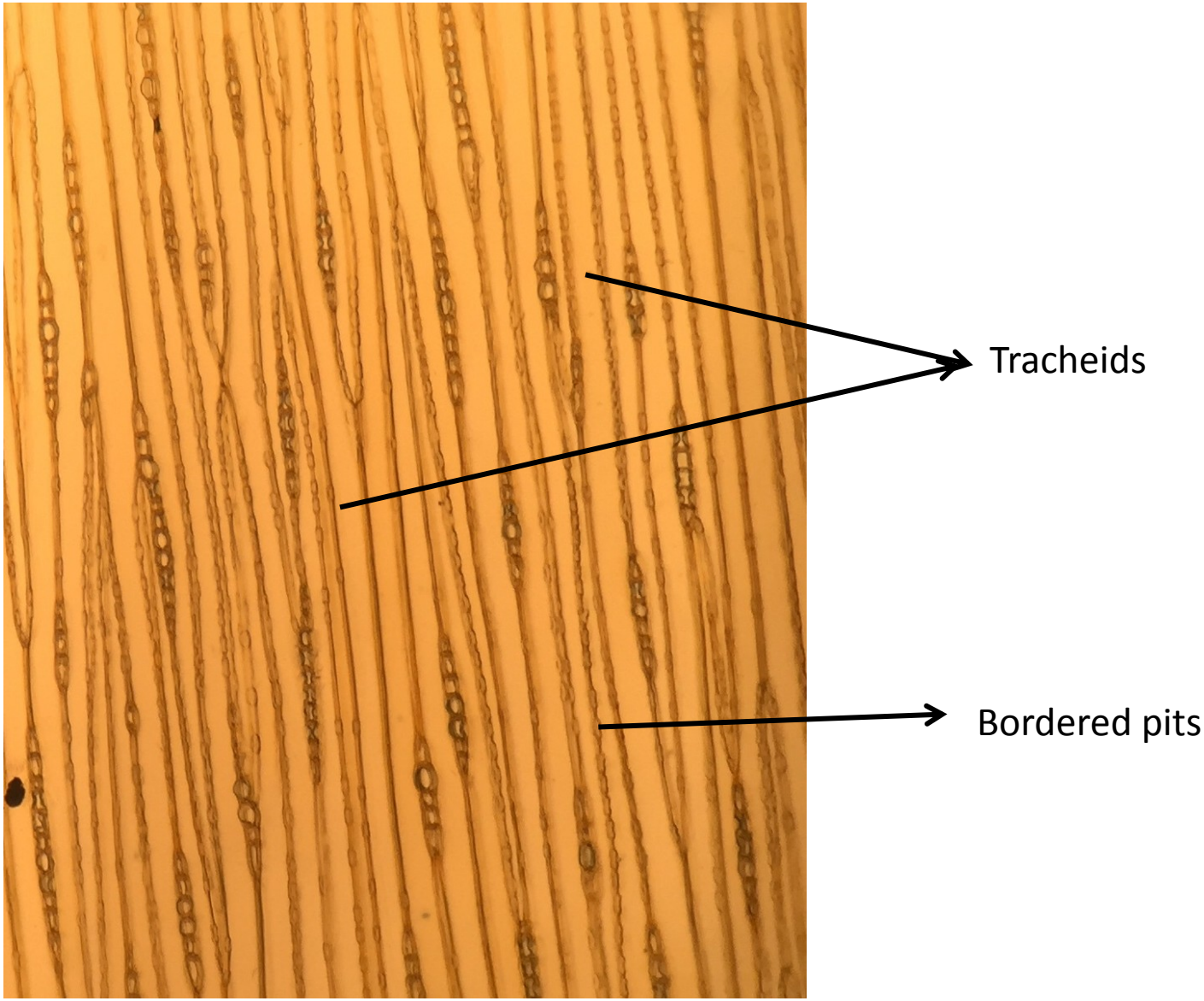


Pear sclereid or stone cell

Vascular tissue
Xylem, Phloem

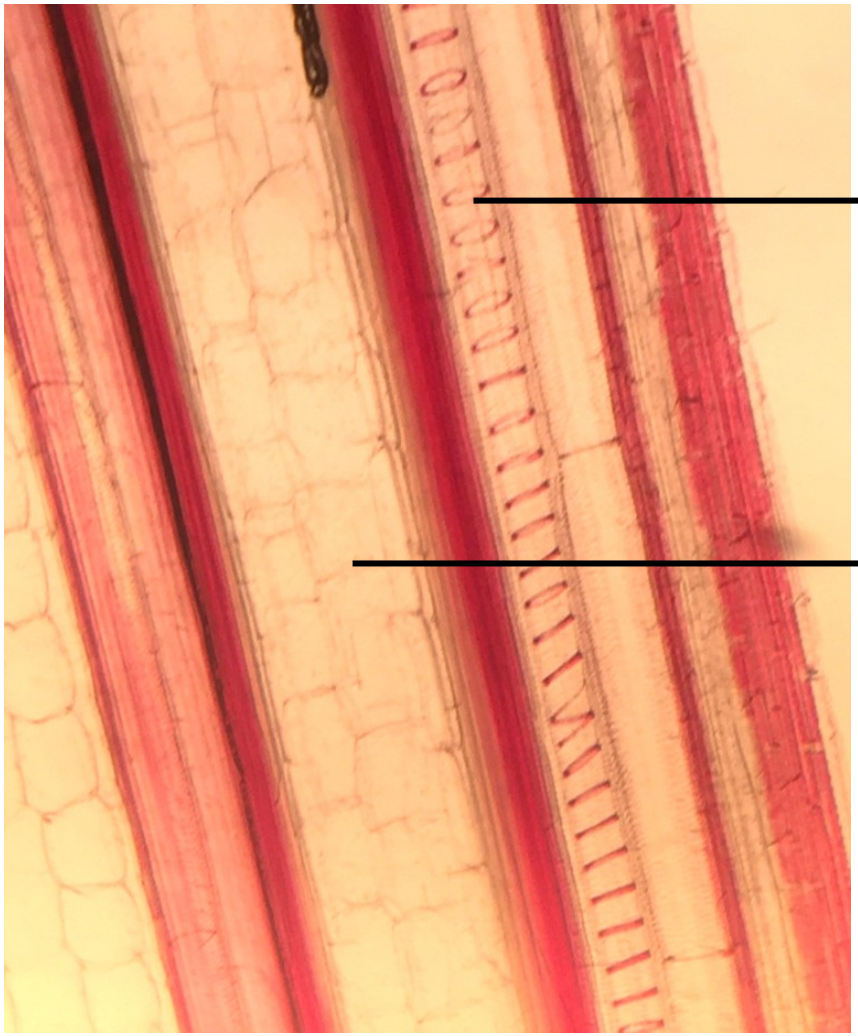
Material:
permanent mount of longitudinal sections of stem of rye (*Secale cereale*) and pine wood (*Pinus* sp.)
Objective: to investigate the features of Xylem and Phloem.
Tasks of work: analyze the structure of cells, of which the Xylem and Phloem are composed

Analyze a preparation of the pine wood. Draw elements of xylem - tracheids with a bordered pits .



The pine wood

Analyze a preparation of the stem of rye. Draw and label the vessels of xylem.



The stem of rye

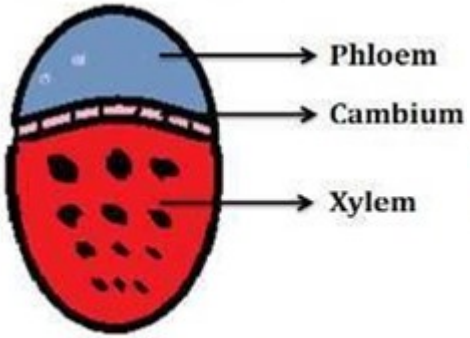
Vascular bundles

Material:
permanent mount of cross sections of stem of clover (*Trifolium* sp.), the stem of rye (*Secale cereale*), rhizome lily of the valley (*Convallaria majalis),* rhizome of fern (*Pteridium* sp.), root of iris (*Iris* sp.)
Objective: to investigate the features of different types of vascular bundles.
Tasks of work: analyze the structure of vascular bundle.

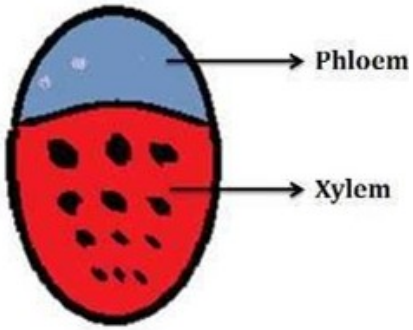
A vascular bundle is a part of the transport system in vascular plants. The transport itself happens in vascular tissue, which exists in two forms: xylem and phloem. Both these tissues are present in a vascular bundle, which in addition will include supporting and protective tissues.

The xylem typically lies adaxial with phloem positioned abaxial. In a stem or root this means that the xylem is closer to the centre of the stem or root while the phloem is closer to the exterior. In a leaf, the adaxial surface of the leaf will usually be the upper side, with the abaxial surface the lower side. This is why aphids are typically found on the underside of a leaf rather than on the top, since the sugars manufactured by the plant are transported by the phloem, which is closer to the lower surface.

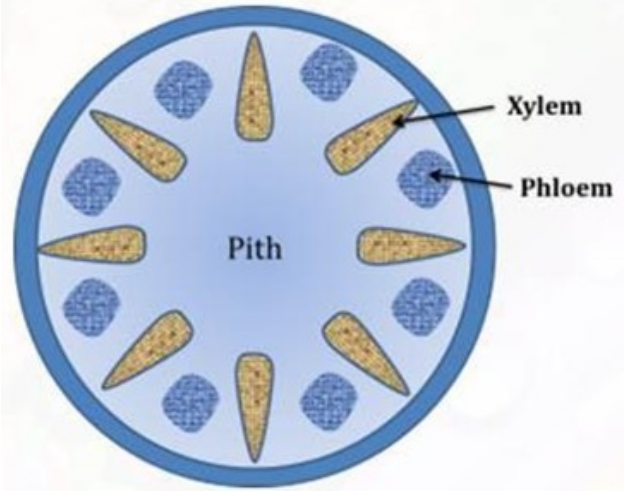
Classification of vascular bundles are based on presence of cambium/secondary growth: Open & Closed; on arrangement in the plant body: Radial & Conjoint; on arrangement individual components: Collateral, Bi-collateral, Concentric (Amphicribral and Amphivasal)



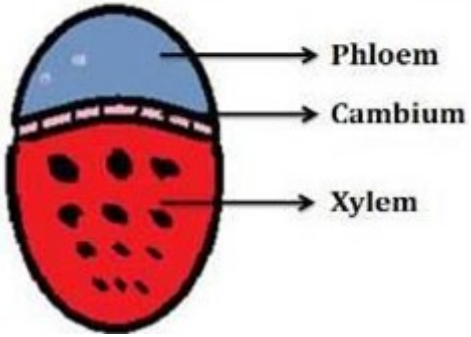
Open Vascular Bundle



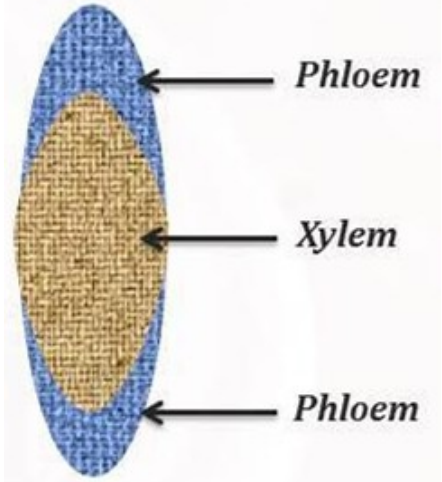
Closed Vascular Bundle



Radial Vascular Bundles

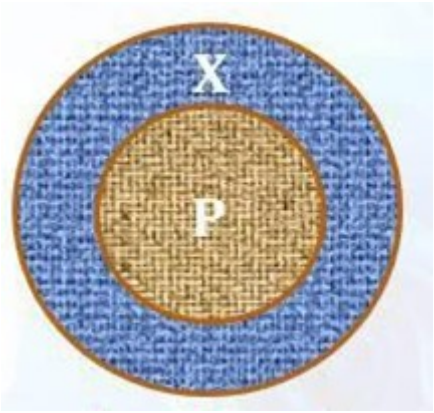


Conjoint Collateral Vascular bundles



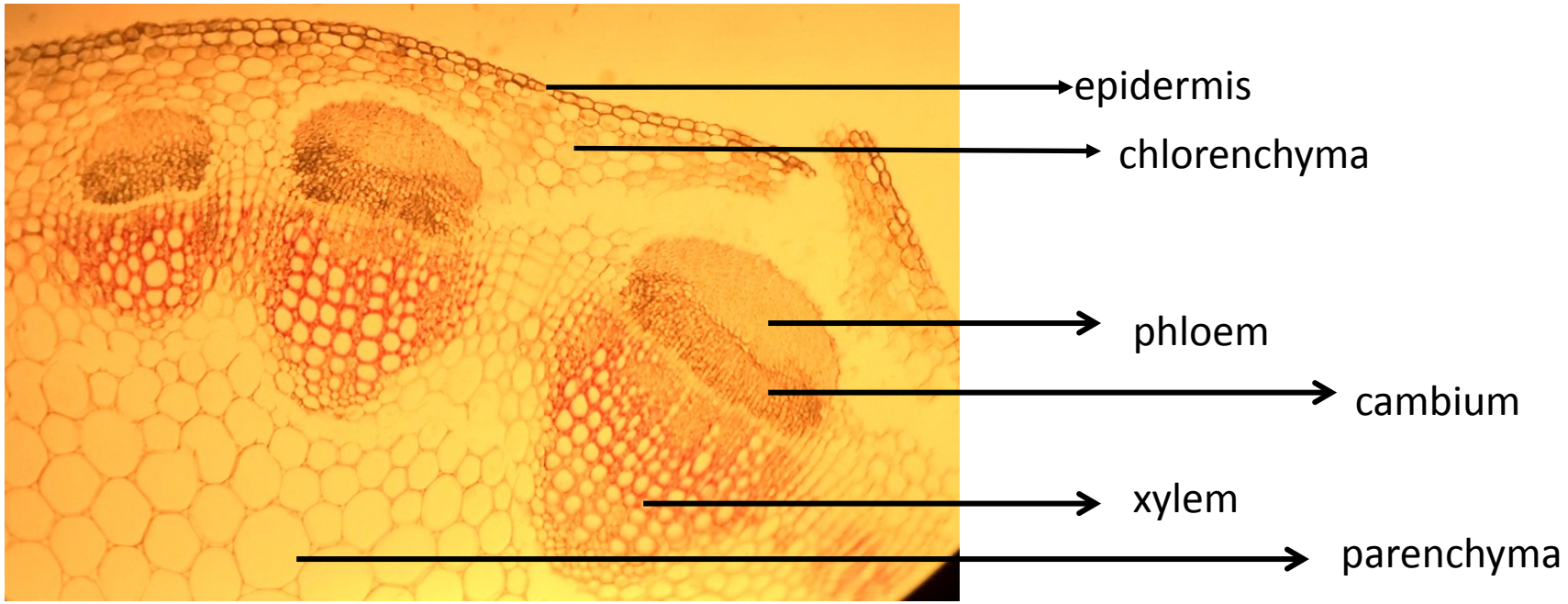
Conjoint Bi-collateral Vascular bundles

Concentric Amphicribral Vascular bundles



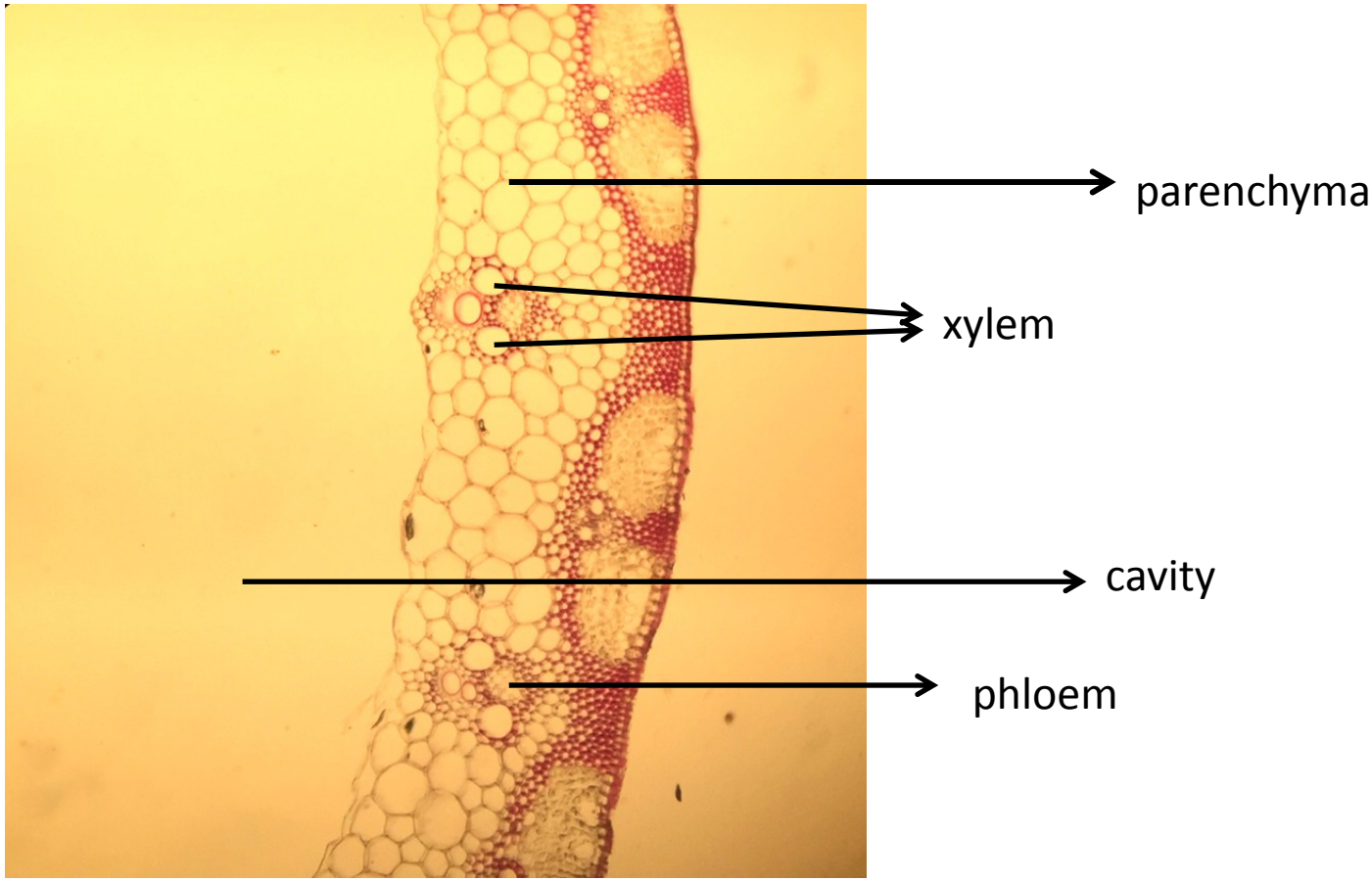
Concentric Amphivasal Vascular bundles

Analyze a preparation of the of stem of clover . Draw and label the elements of vascular bundles.



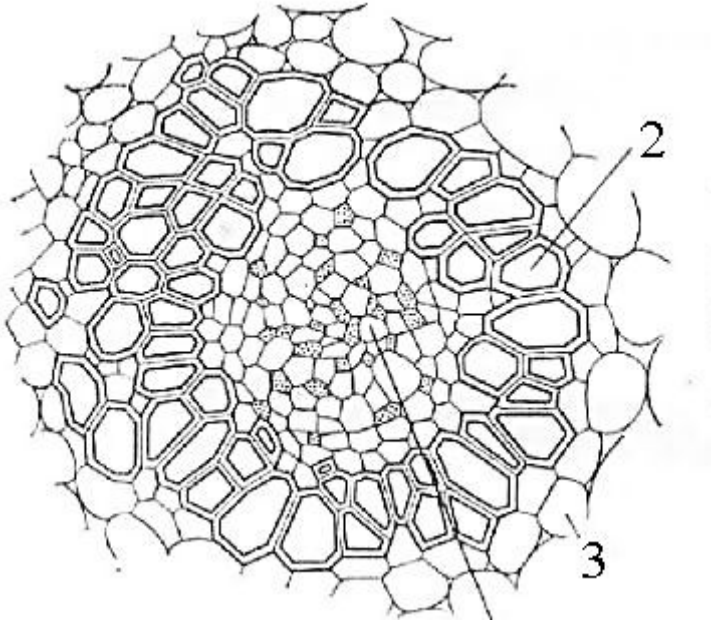
The stem of clover with vascular bundles.

Analyze a cross section of the stem of rye . Draw and label the elements of vascular bundles.

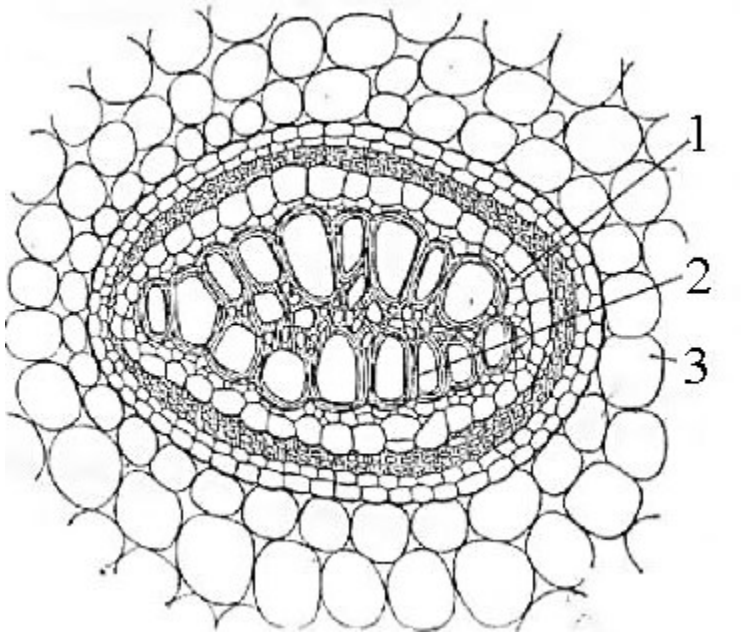


The stem of rye

Analyze a cross section of the rhizome lily of the valley . Draw and label the elements of vascular bundles.



A



1

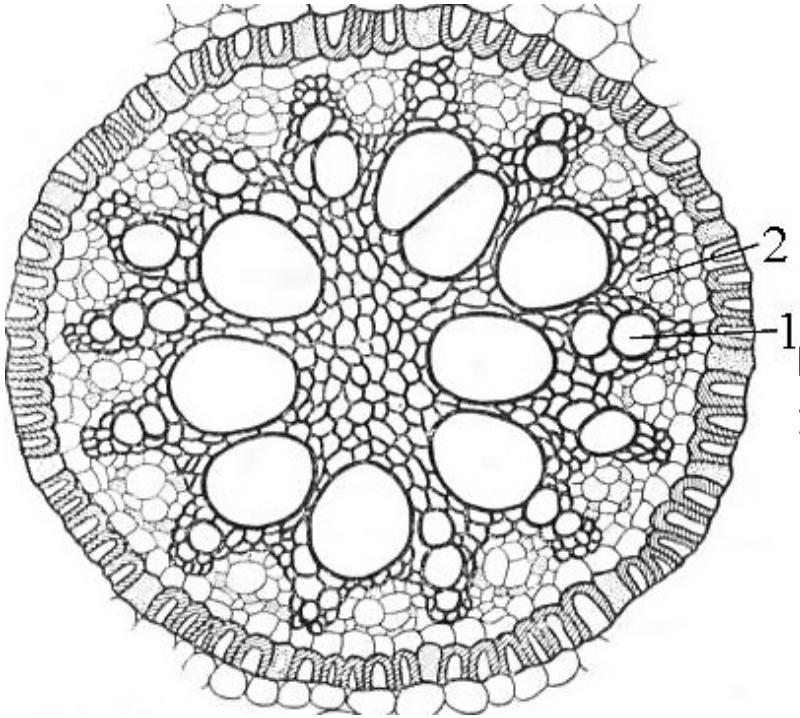
B

Concentric vascular bundles:

A - Amphivasal in the rhizome of the lily of the valley; B - Amphicribral in the rhizome of fern.

1 - phloem, 2 - xylem, 3 - the main parenchyma of the stem.

Analyze a cross section of the root of iris. Draw and label the elements of vascular bundles.



Radial vascular bundles
1 - xylem ray, 2 - phloem segment.

The root of iris.

Parenchyma Ground tissue system

Material:

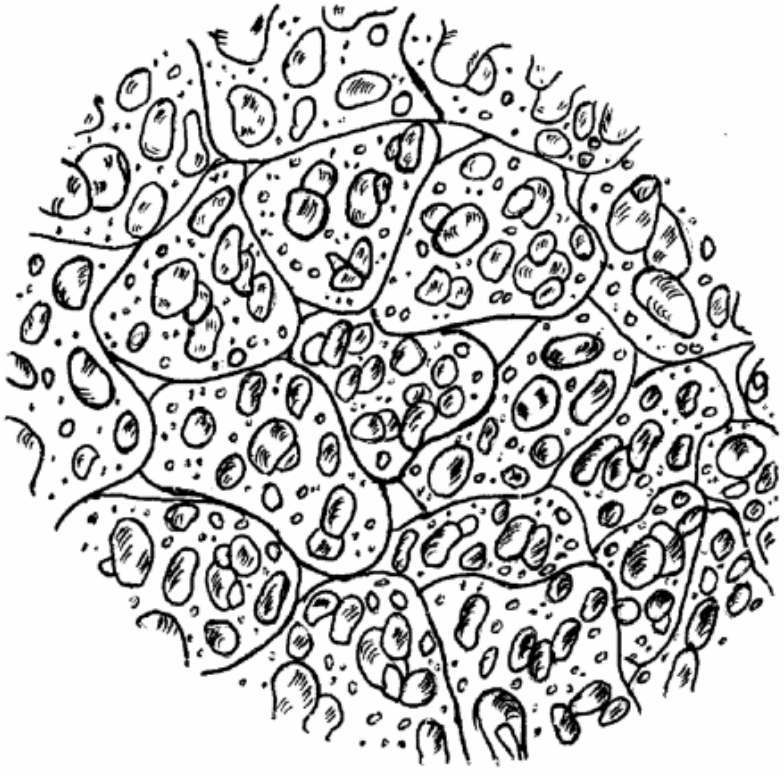
permanent mount of cross sections of stem of pondweed (*Potamogeton* sp.), leaf of tea (*Camellia* sinensis), fresh potato tuber (*Solanum tuberosum* L.).

Objective: to investigate the features of Parenchyma.

Tasks of work: analyze the structure of cells that form the parenchyma.

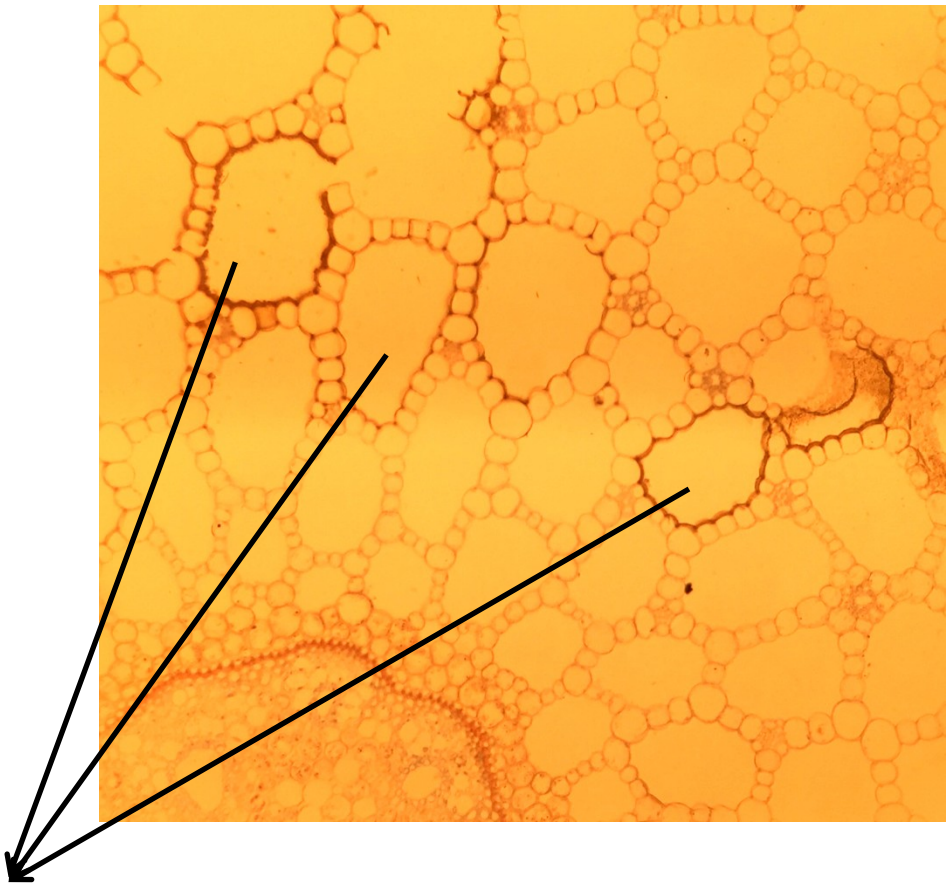
Make a wet mount a cross section from fresh potato tuber . Analyze a storage parenchyma of potato tuber . Draw and label.

Analyze a cross section of stem of pondweed. Draw and label the aerenchyma.



Storage parenchyma of potato tuber

Analyze a cross section of stem of pondweed. Draw and label the aerenchyma



intercellular spaces in parenchyma

Aerenchyma of pondweed stem

Analyze a cross section of leaf of camellia. Draw and label chlorenchyma.
Assimilatory parenchyma or **chlorenchyma**: parenchyma, containing chloroplasts, adapted for photosynthesis. Most typically, it constitutes the mesophyll of the leaf.