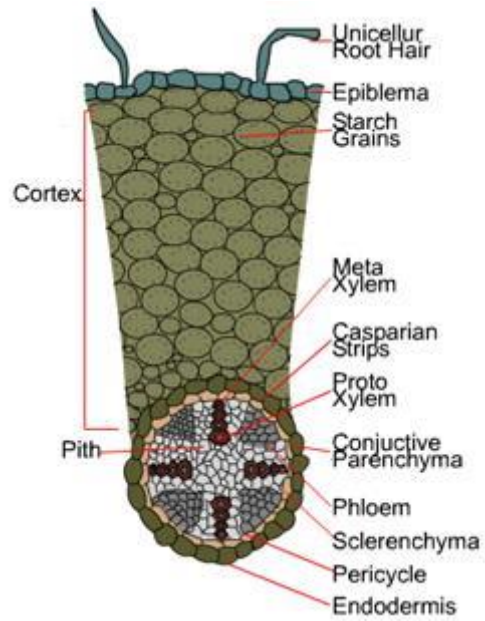


# Dicot root:



## Dicot Root

Dicot plants have the taproot system.

The outermost layer is called epidermis. The epidermal cells sometimes project out which appear as the root hairs.

The epidermis is followed by multi-layered cortex, loosely made of the parenchyma cells with intercellular spaces.

The inner layer of the cortex is called endodermis, which is tightly packed by the barrel shaped-cells.

Endodermis is followed by pericycle, which are a few layers of thick-walled parenchyma cells. In dicots, the central pith is inconspicuous.

The number of xylem and phloem are two to four.

The xylem and phloem are distinguished by a layer of parenchymatous cells called conjunctive [tissue](#).

During secondary growth, the cambium separates the xylem and phloem. Pericycle, vascular bundles and pith fuse to form stele in dicots.

**Epiblema or Epidermis** - It is the outermost unilayered with several unicellular root hairs. It consists of thin walled, compactly arranged living parenchymatous cells. Usually epiblema is characterised by absence of stomata and cuticle. Sometimes the epiblema may be less cuticularised. It provides protection to the roots due to presence of unicellular root hairs it also helps in absorption of water and minerals from soil.

**Cortex** - It is thin walled, multilayered region made from circular or polygonal parenchymatous cells. they usually have intercellular spaces. The cortical cells have no chloroplast but may contain leucoplast for storage of starch grains. The cortex is responsible for transportation of *water and salts* from the root hairs to the center of the root.

**Endodermis** - It is the innermost layer of cortex and covers the stele. It consists of compactly arranged barrel shaped parenchyma without intercellular spaces. Most of the cells are characterised by the presence of special thickening of suberin and lignin on their radial and tangential walls called **casparian strips**. Some endodermal cell near protoxylem has no casparian strips and called **passage cells** or transfusion cells. These cells allow radial diffusion of water and minerals through the endodermis.

**Pericycle** - It is the outermost layer of stele and composed of uniseriate layer of parenchymatous cells without intercellular spaces. Some dicots and hydrophytes do not bear pericycle. Several lateral roots and lateral meristem arise from pericycle region (hence lateral roots are endogenous in origin). At the time of secondary growth, it produces secondary cambium or phellogens.

**Vascular bundles** - They are 2-8 in number, radial and arranged in ring. Xylem and phloem bundles are separated from each other by parenchymatous cells called conjunctive or **complementary tissue**.

**Xylem** is exarch (i.e. protoxylem towards the periphery and metaxylem towards the centre) and consists of tracheids, vessels, xylem parenchyma and xylem fibres.

The **phloem** forms oval masses beneath the pericycle, alternating with xylem bundles. Phloem consists of sieve tubes, companion cells and phloem parenchyma. Usually phloem fibres are absent or reduced.

**6. Pith** - it is feebly developed and centrally located. It consists of thin walled, polygonal parenchyma cells with intercellular spaces. In dicots roots, it may be reduced or absent. It helps in storage of food materials.

Monocot plants have an adventitious root system.

As in the dicots, the epidermis forms the outermost layer, followed by cortex, endodermis, pericycle, vascular bundles (xylem and phloem) and pith.

Pith is large and conspicuous.

The number of xylem in a monocot is six or more.

Secondary growth is absent in the monocot plants.

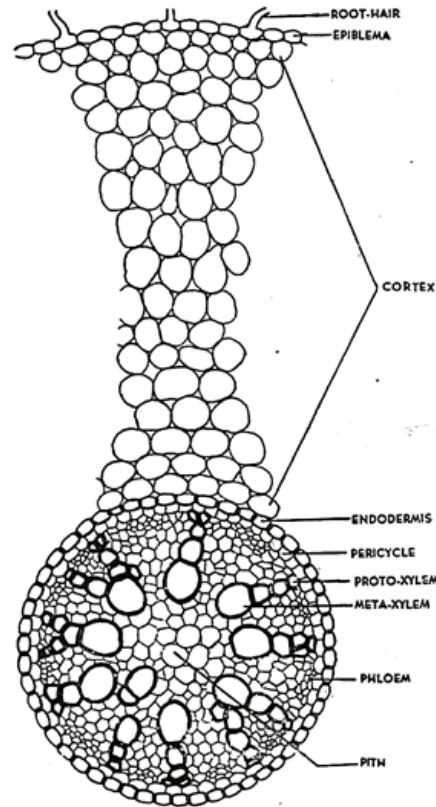


Fig. 154. Portion of transverse section of a monocotyledonous root (arum) showing the plan of arrangement of tissues.

## **Dicot Stem**

The dicotyledonous stem is usually solid. The transverse section of a typical young dicotyledonous stem consists of the following parts:

The epidermis is the outermost protective layer which is covered with a thin layer of cuticle.

Epidermis possesses trichomes and a few stomata.

Cortex is multi-layered cells sandwiched between epidermis and pericycle.

The outer layer, hypodermis (collenchymatous cells), the cortical layers (parenchymatous cells) and the inner layer, endodermis together make up the three subzones of the cortex.

Next to endodermis is the pericycle which is constituted of semi-lunar patches of sclerenchyma.

‘Circled’/ ‘ring’ arrangement of vascular bundles is present only in dicot stem.

The Vascular bundle is conjoint, open and with endarch protoxylem.

Pith is evident and is made of parenchymatous cells.

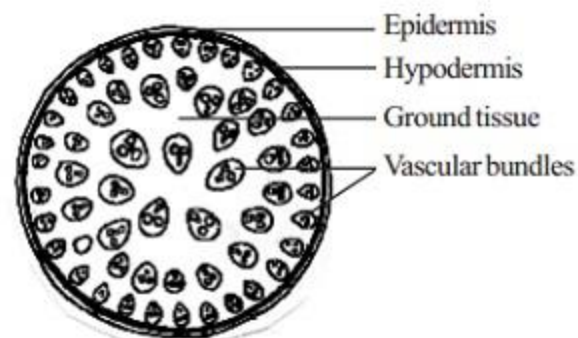
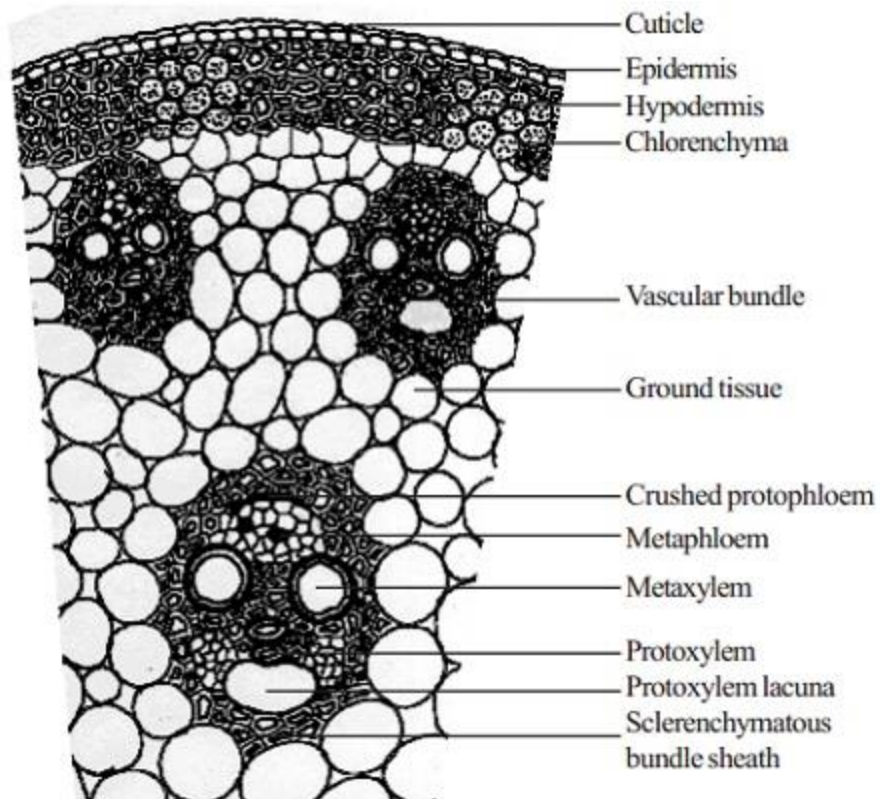
## **Monocot Stem**

Monocot stem is usually hollow with no secondary growth. The anatomy of monocot and dicot stem are similar, however, some notable differences are as follows:

The hypodermis of the cortex in monocots is made of sclerenchymatous cells.

Vascular bundles are numerous but scattered, conjoint and closed, surrounded by the ground tissue.

Phloem parenchyma is absent.

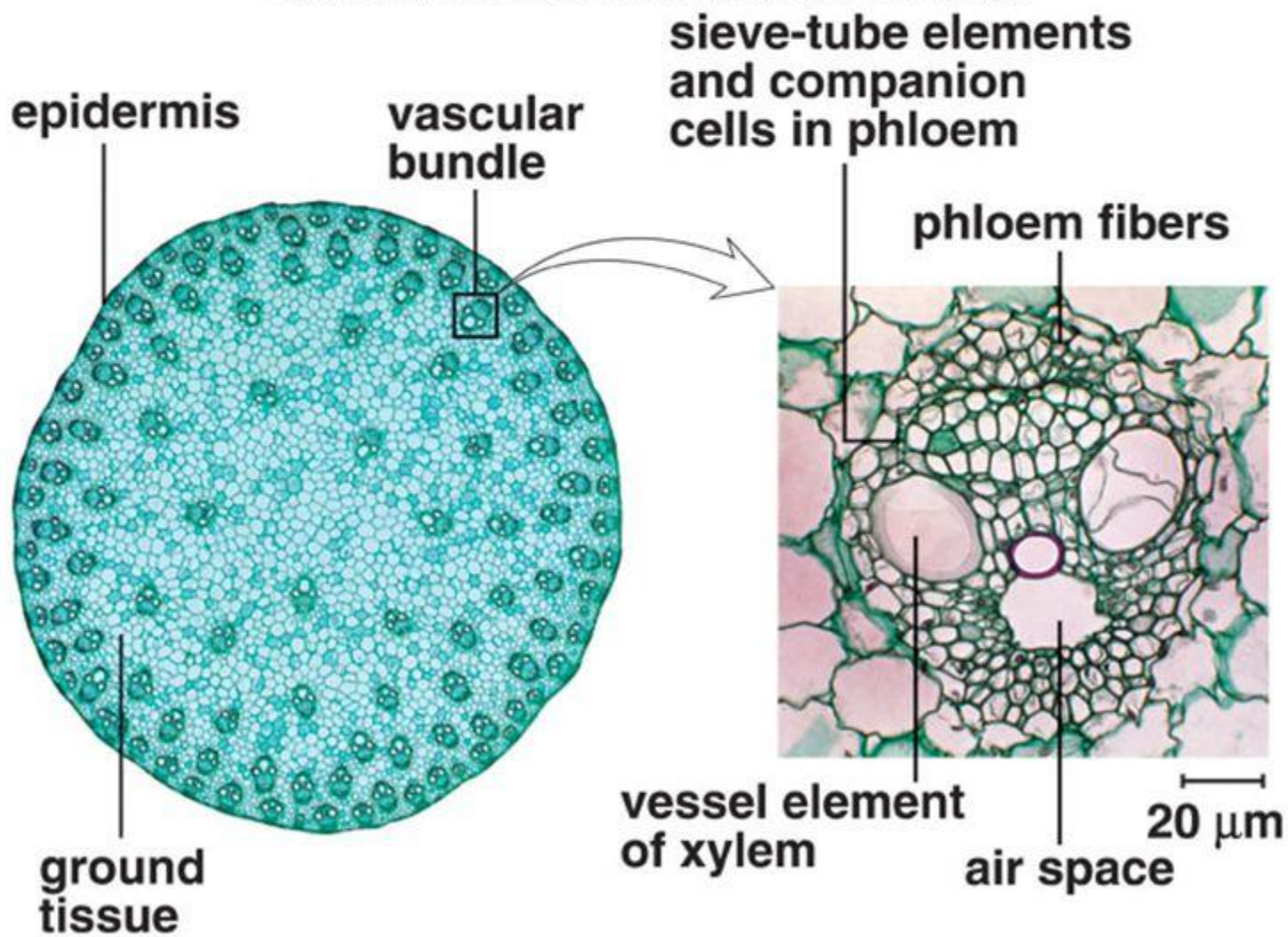


*Ground plan*

*A sector enlarged*  
**Fig. T.S. of a Maize stem**

# Monocot stem

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## **Dicot Leaf**

Dicotyledonous leaf shows reticulate venation.

Lamina consists of epidermis, mesophyll and vascular system.

The epidermis is covered by cuticle and stomata; abaxial epidermis (lower surface) possesses more stomata than adaxial epidermis (upper surface). Sometimes adaxial epidermis lack stomata.

Mesophyll, (parenchymatous cells) composed of the palisade and spongy parenchyma is present in between the adaxial epidermis and abaxial epidermis.

The [chloroplasts](#) present in mesophyll perform photosynthesis in leaves.

Vascular bundles are surrounded by bundle sheath cells and form the veins and midrib.

## **Monocot Leaf**

Monocotyledonous leaves are characterized by the parallel venation. The anatomy of a monocot leaf includes:

Both adaxial epidermis and abaxial epidermis bear stomata.

There is no differentiated palisade and spongy parenchyma of the mesophyll.

Bulliform cells are present which is developed from adaxial epidermal cells and the veins.

Bulliform cells are large, void cells which are responsible for the curling of leaves for minimal loss of water.

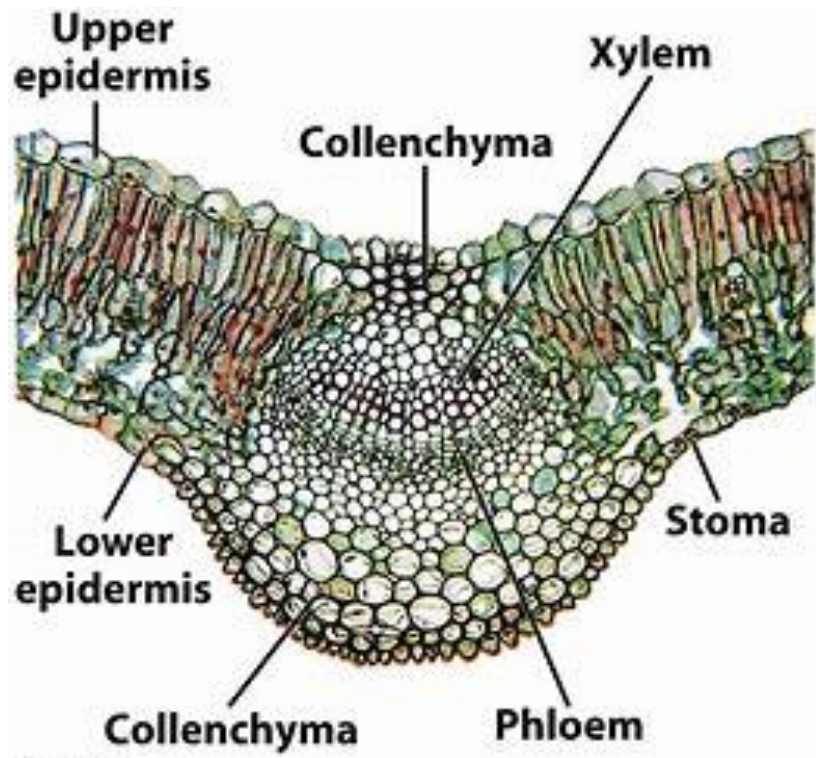
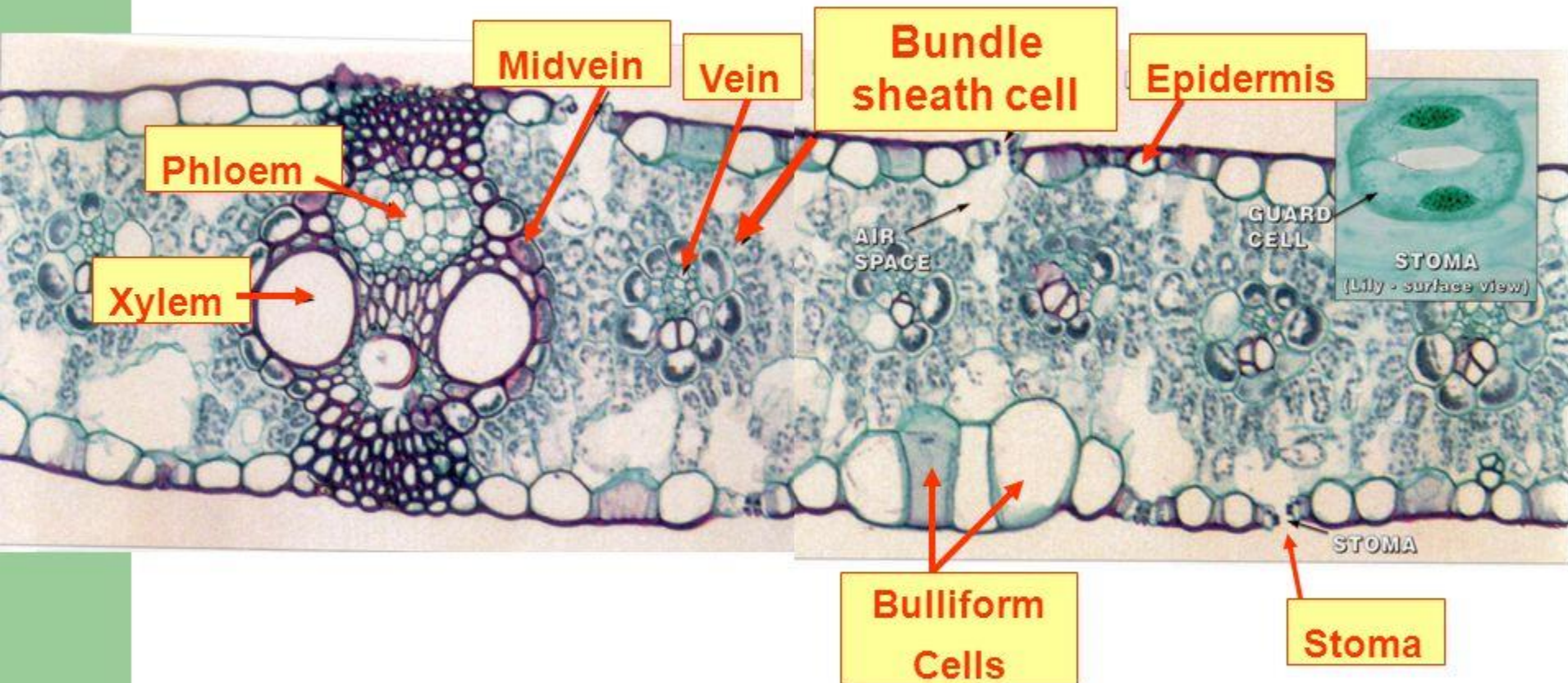
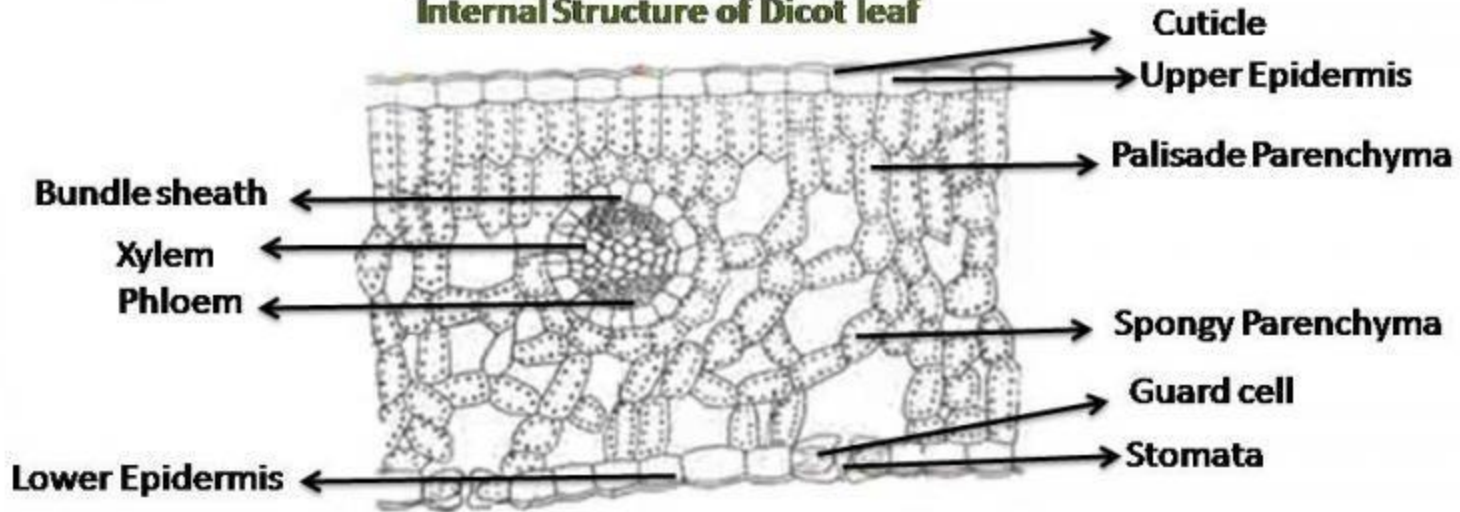


Figure 25-20a  
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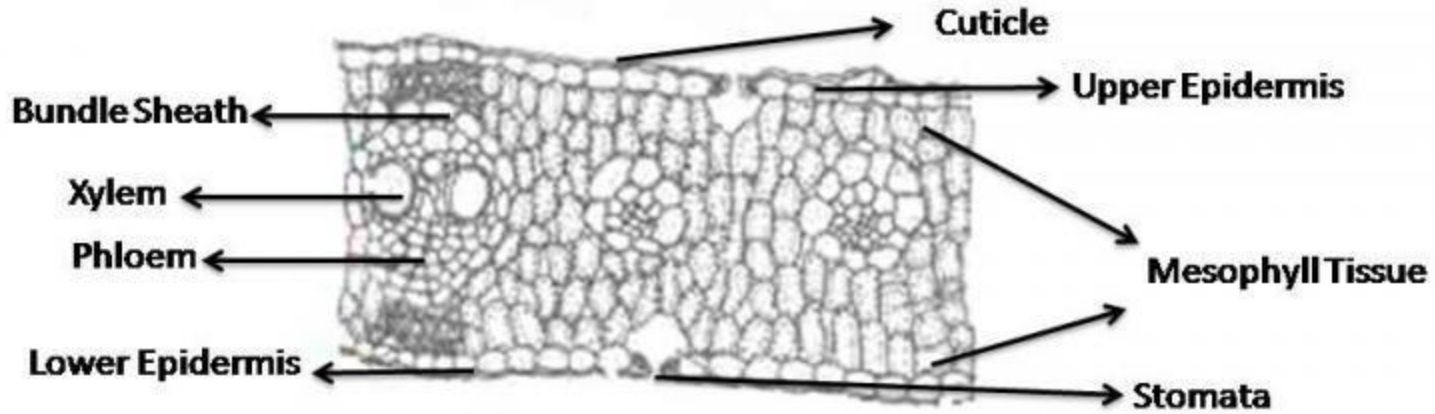
# Typical Monocot Leaf Cross-Section



### Internal Structure of Dicot leaf



### Internal Structure of Monocot leaf



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