DICOTYLENDONOUS STEM

Function:

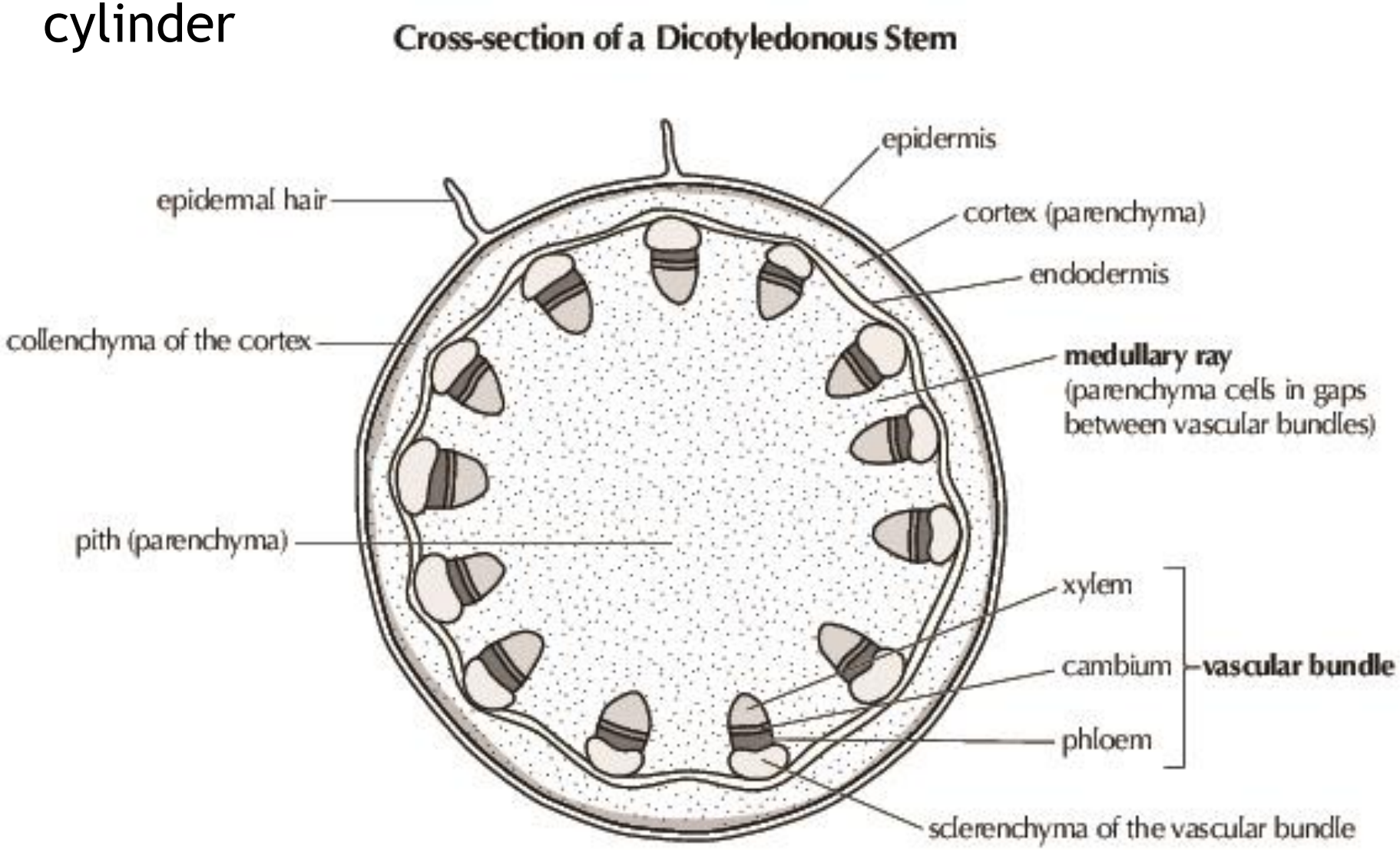
- bears the leaves in a favourable position to absorb light
- bears flowers for pollination
- bears fruits for distribution of seeds
- transports water and mineral salts from roots
- transports organic substances
- stores reserve nutrients

External structure:

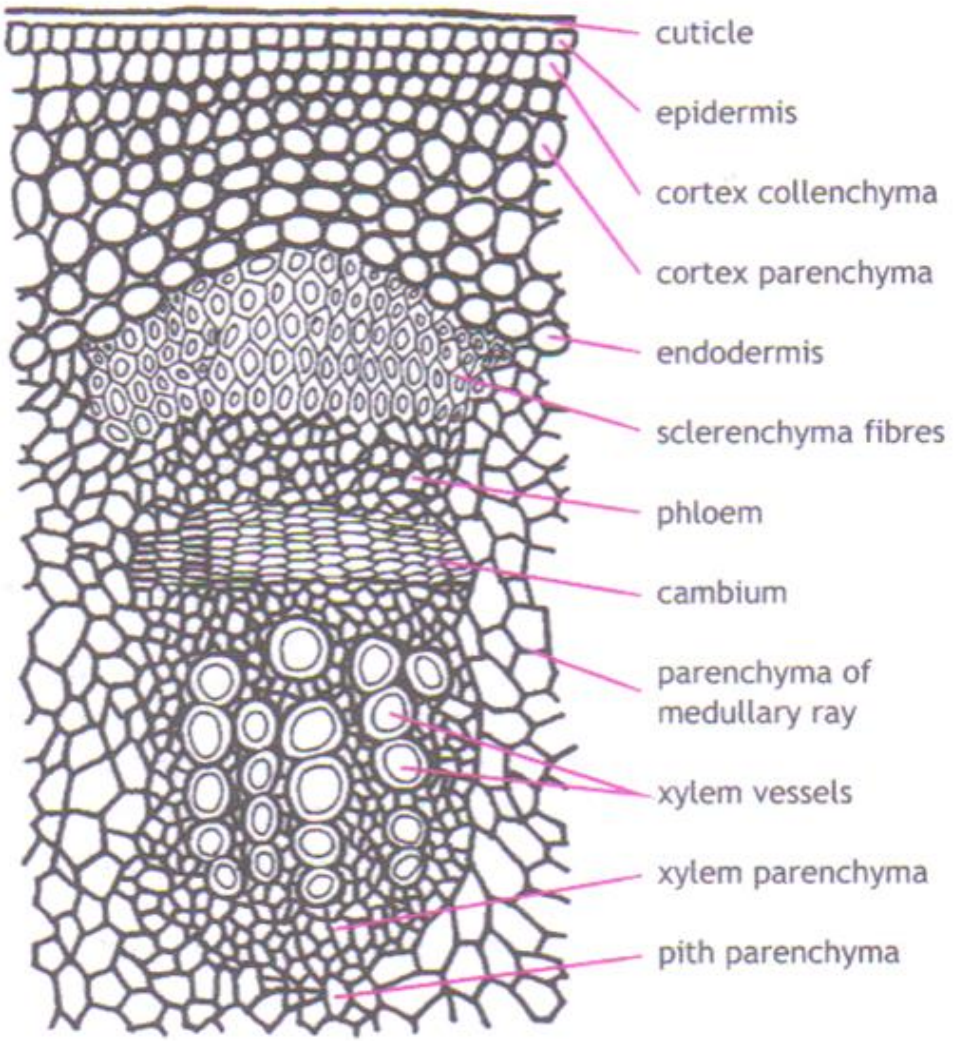
- stem consists of nodes and internodes
- node is where the leaves and side branches develop
- internode is the region between two nodes
- terminal bud occurs at the tip of the stem
- terminal bud consists of meristematic tissue which continuously divides and forms new cells and results in primary growth.
- Axillary buds occurs in the axils between the petiole and stem and develop into lateral branches of flowers

Internal structure:

- Three regions – Epidermis, cortex, central cylinder



Transverse section of a young dicot stem in detail



T/S of a portion of a young dicotyledonous stem in detail

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Epidermis:

- outer layer of the stem
- single layer of thin walled brick shaped cells
- some epidermal cells form a stomata
- outer walls covered with cuticle
- multicellular hairy outgrowths may occur

Cortex:

- region directly under the epidermis
- Collenchyma, Parenchyma, Endodermis

Central cylinder:

- in the stem the vascular tissue occurs in vascular bundles
- vascular bundles are arranged in a circle
- xylem on the inside
- phloem on the outside
- sclerenchyma fibres occur as cap on the outside of the phloem
- cambium occurs between xylem and phloem
- cambium makes secondary thickening possible
- central region is the pith and it consists of large thin walled parenchyma cells
- medullar rays transport substances between the pith and the cortex

Functions:

- Epidermis protects tissues
- cuticle prevents loss of moisture
- stomata – gas exchange
- collenchyma strengthens stem
- parenchyma stores organic substances
- endodermis stores starch
- sclerenchyma fibres protect vascular bundles
- xylem transports water and mineral salts
- phloem transports manufactured substances
- cambium makes secondary thickening possible

CLASS ACTIVITY - DICOTYLENDONOUS STEM

1. What are the functions of the internodes and nodes.

2. What caracteristics of a dicotyledonous stem will help you identify a microscope slide of a cross section through a stem.

3. What is a vascular bundle that contains cambium known as?

SECONDARY THICKENING

Formation of secondary xylem and phloem:

- The cambium that occurs in the vascular bundles between xylem and phloem is known as **fasicular cambium**
- Layers of parenchyma cells in the medullar rays, between vascular bundles and in line with fascicular cambium become meristematic and are known as **interfasicular cambium**
- The fasicular and interfasicular cambium join up to form an unbroken cambium tissue

- Active cell division takes place in the cambium ring
- New xylem tissue known as secondary xylem is formed towards the inside while new phloem tissue known as secondary phloem is formed towards the outside

- The secondary xylem forms a continuous ring on the inside of the cambium ring and the secondary phloem forms a continuous ring on the outside
- Each year the cambium forms a new ring of secondary xylem and secondary phloem
- As the secondary tissue is formed year after year the primary xylem an primary phloem is pushed further away from each other.

- In some places the cambium does not form secondary xylem or phloem, but parenchyma cells.
- These parenchyma cells forms rays that extend from the middle of the stem and are known as pith rays
- Pith rays are visible in the secondary xylem and phloem

ANNUAL RINGS

- Concentric rings are visible in a cross section of a woody dicot stem.
- These rings are secondary xylem that consists of xylem vessels and tracheids with thickened walls and are known as **annual rings**
- Each annual ring consists of two parts
  - Broad light coloured part – spring wood
  - Narrow dark coloured part – autumn wood
- During spring growth occurs faster because conditions are favourable for growth
- In the autumn growth occurs more slowly because the conditions are less favourable for growth

- The age of a tree can be determined by counting the annual rings
- Each annual ring (light and dark band) represents one year
- The secondary xylem that is the youngest and more active lies closest to the cambium
- This region is also known as the **sapwood**
- The inner older secondary xylem is blocked, appears darker and is known as the **heartwood**
- The heartwood provides support and strengthens the trunk of the tree

FORMATION OF CORK

- The outer layer of cortex becomes meristematic and is known as the cork cambium
- It divides to form cork cells on the outside
- Cork cells have no living contents and are dead cells surrounded by thickened walls of suberin
- The cork layer makes the stem impermeable to water and prevents the inner tissues from drying out
- Epidermis and stomata are cut off from the cortex by the cork layer
- The epidermis receives no water/nutrients, dies and flakes off.
- The bark of a tree includes all the tissues outside the cambium ring, the secondary phloem, primary phloem, cortex, cork layer, and flaking epidermis

- In young stems gaseous exchange takes place through stomata
- In a woody stem stomata cannot function due to the cork layer
- In some areas the cork cells separate from each other, with large intercellular air spaces that break through the epidermis to form small pores on the surface
- These pores are known as **lenticels** and are responsible for gaseous exchange

CLASS ACTIVITY - SECONDARY THICKENING

1. Explain the process of secondary thickening

2. When you look at year rings in a cross section of a perennial woody stem. Why would the width of the rings be an indication of rainfall during a specific year?

3. What do bark consist of?