23–3 Stems

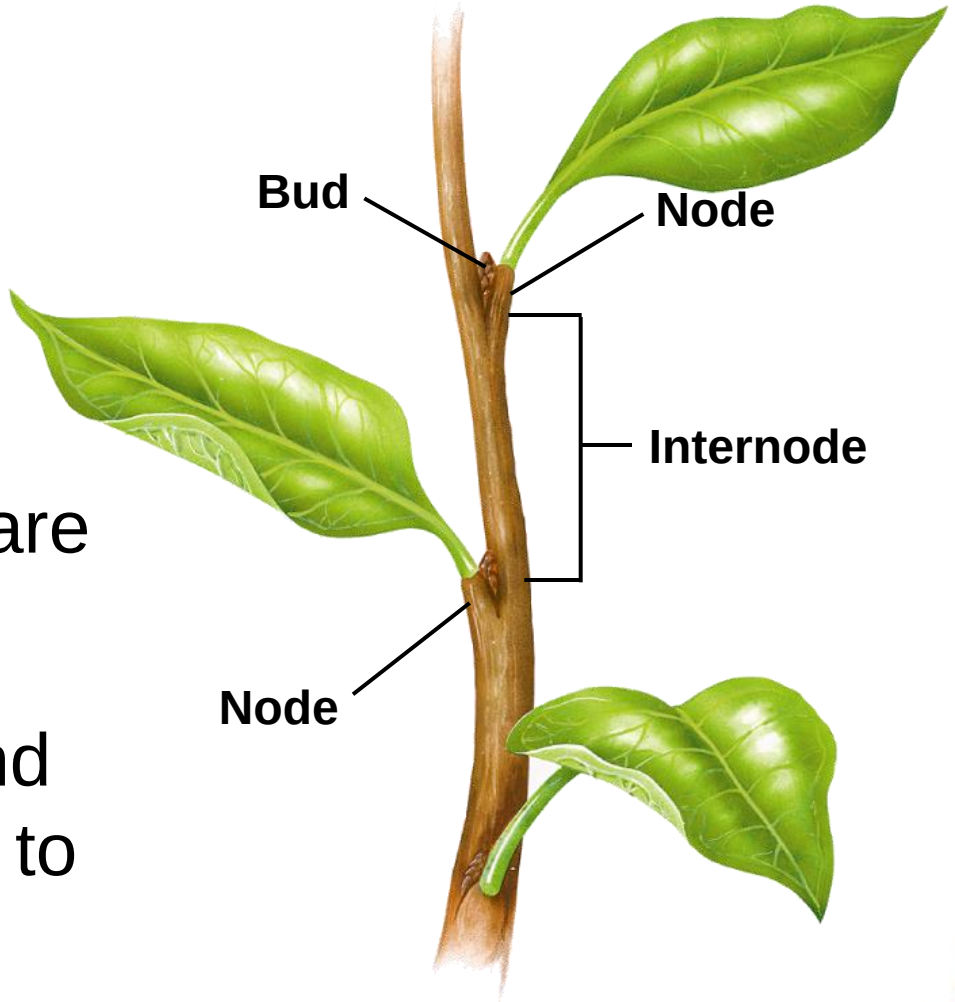
Stems have two important functions:

- they hold leaves up to the sunlight
- they transport substances between roots and leaves

Leaves attach to the stem at structures called **nodes**.

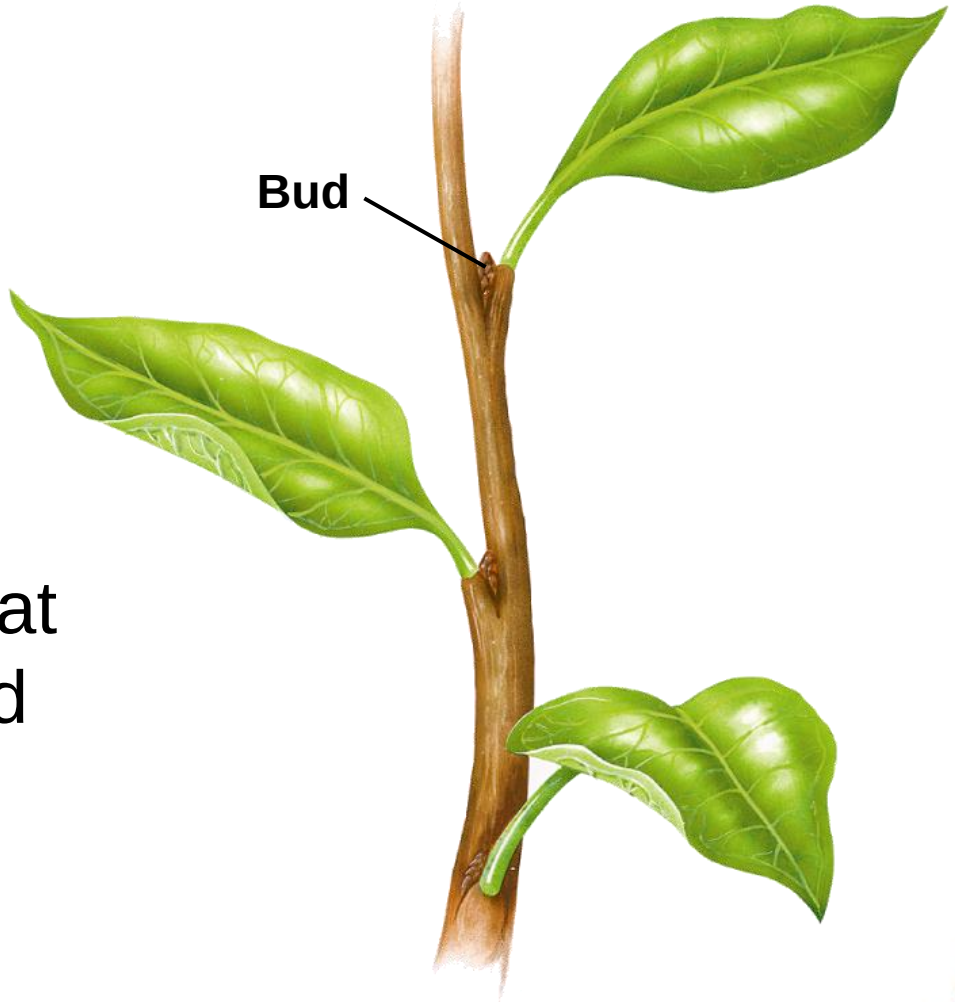
The regions of stem between the nodes are **internodes**.

Small **buds** are found where leaves attach to nodes.



Buds contain undeveloped tissue that can produce new stems and leaves.

In larger plants, stems develop woody tissue that helps support leaves and flowers.

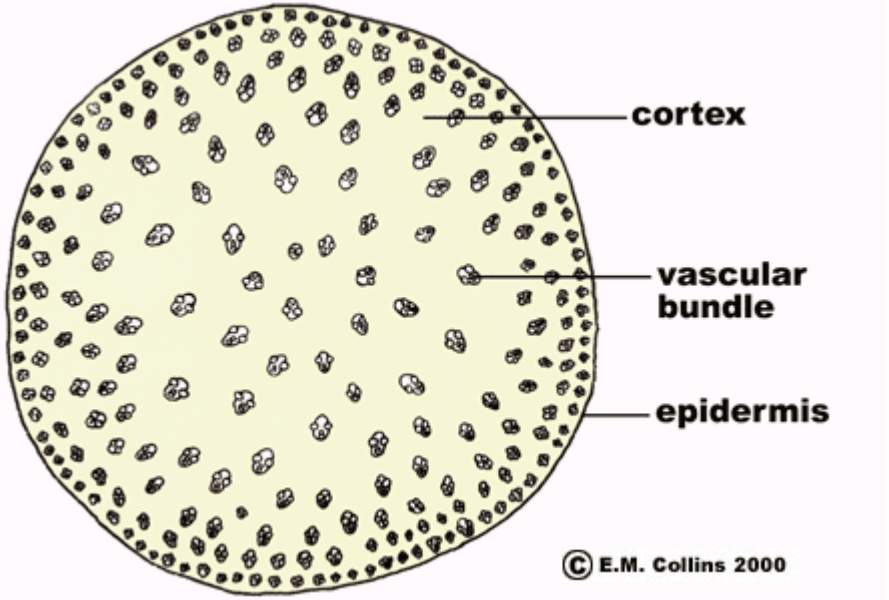


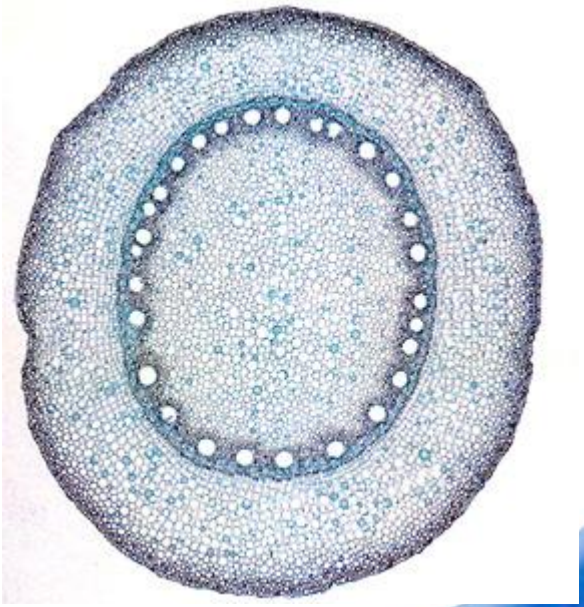
Monocot and Dicot Stems

The arrangemnet of tissues in a stem differs among seed plants.

How do monocot and dicot stems differ?

In monocots, vascular bundles are scattered throughout the stem. In dicots and most gymnosperms, vascular bundles are arranged in a ringlike pattern.





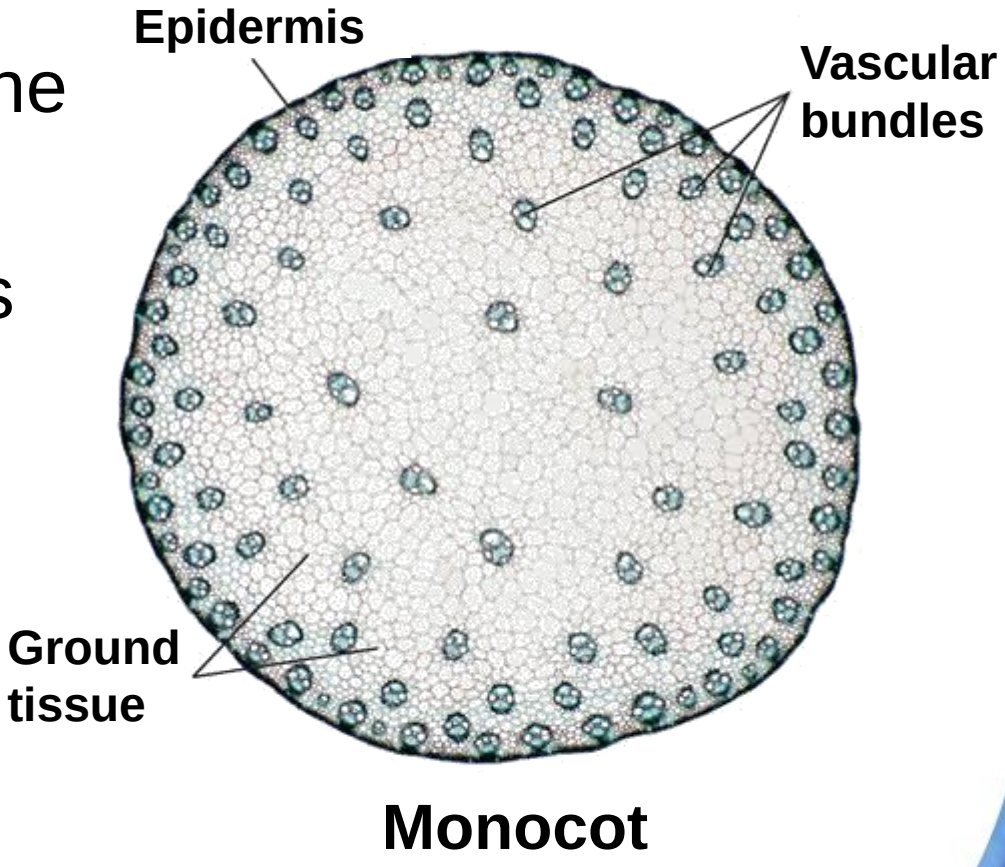
Monocot Stems

Monocot stems have a distinct epidermis, which encloses **vascular bundles**.

Each vascular bundle contains xylem and phloem tissue.

Vascular bundles are scattered throughout the ground tissue.

Ground tissue consists mainly of parenchyma cells.

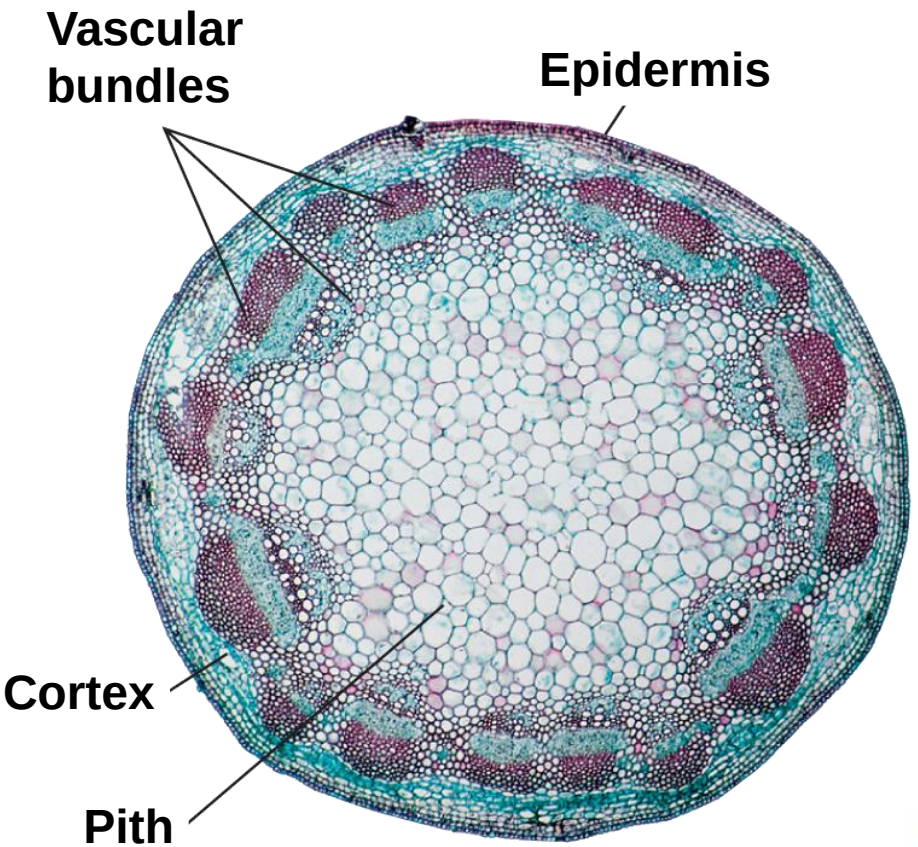


Monocot

Dicot Stems

Dicot stems have vascular bundles arranged in a ringlike pattern.

The parenchyma cells inside the vascular tissue are known as **pith**.

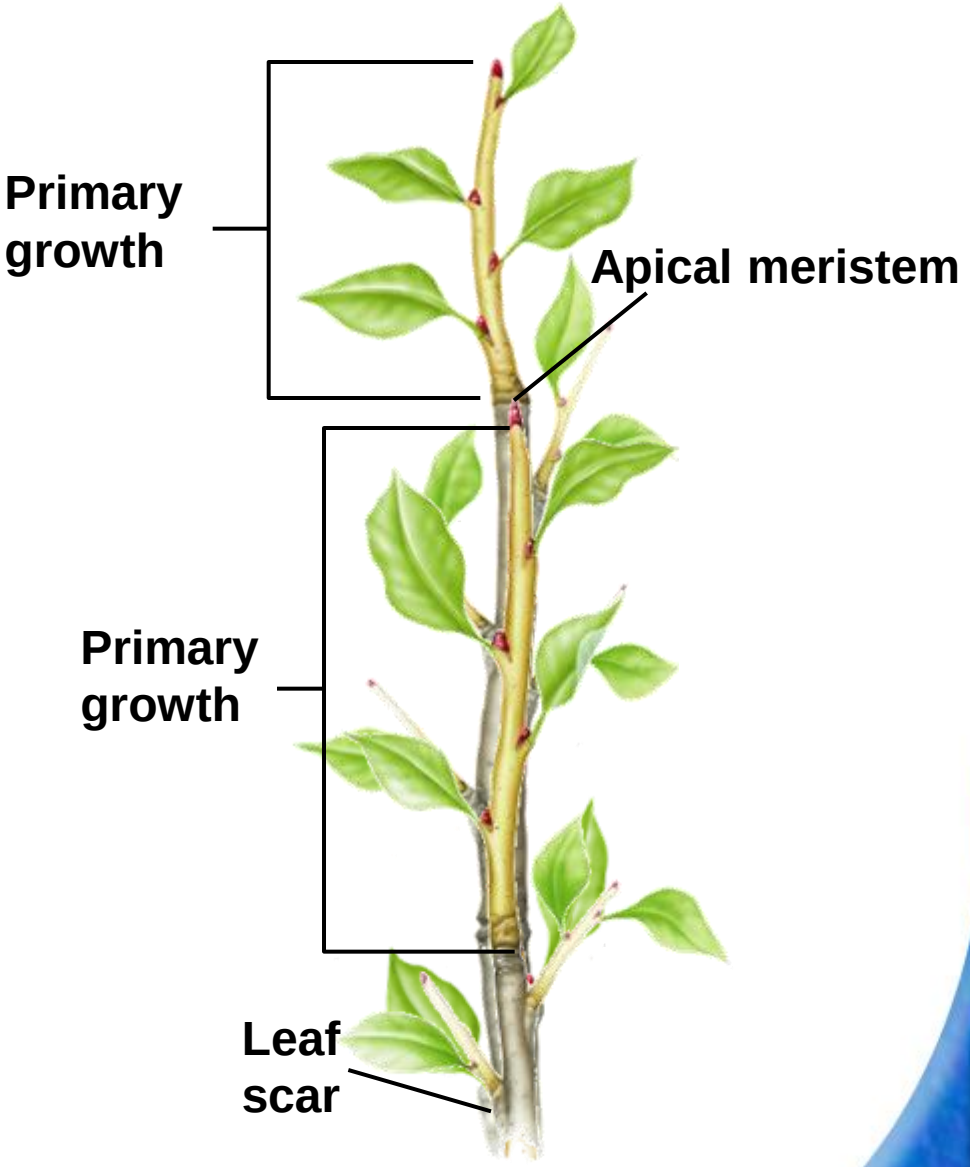


Dicot

Primary Growth of Stems

All seed plants undergo **primary growth**, which is an increase in length.

For the entire life of the plant, new cells are produced at the tips of roots and shoots.



Primary growth of stems is produced by cell divisions in the apical meristem. It takes place in all seed plants.

Secondary Growth of Stems

The method of growth in which stems increase in width is called **secondary growth**.

In conifers and dicots, secondary growth takes place in the vascular cambium and cork cambium.

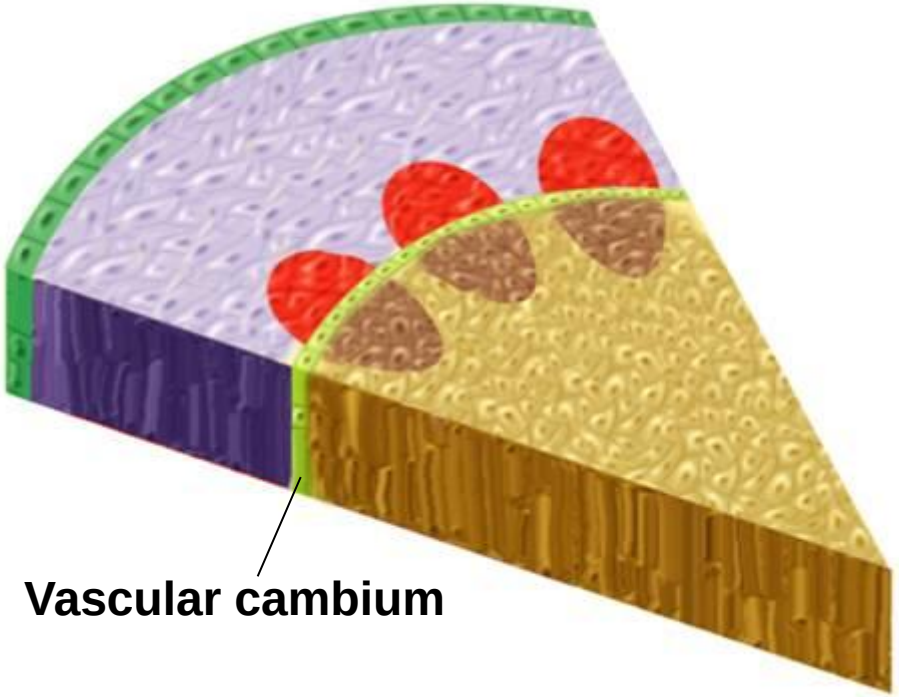
Vascular cambium produces vascular tissues and increases the thickness of stems over time.

Cork cambium produces the outer covering of stems.

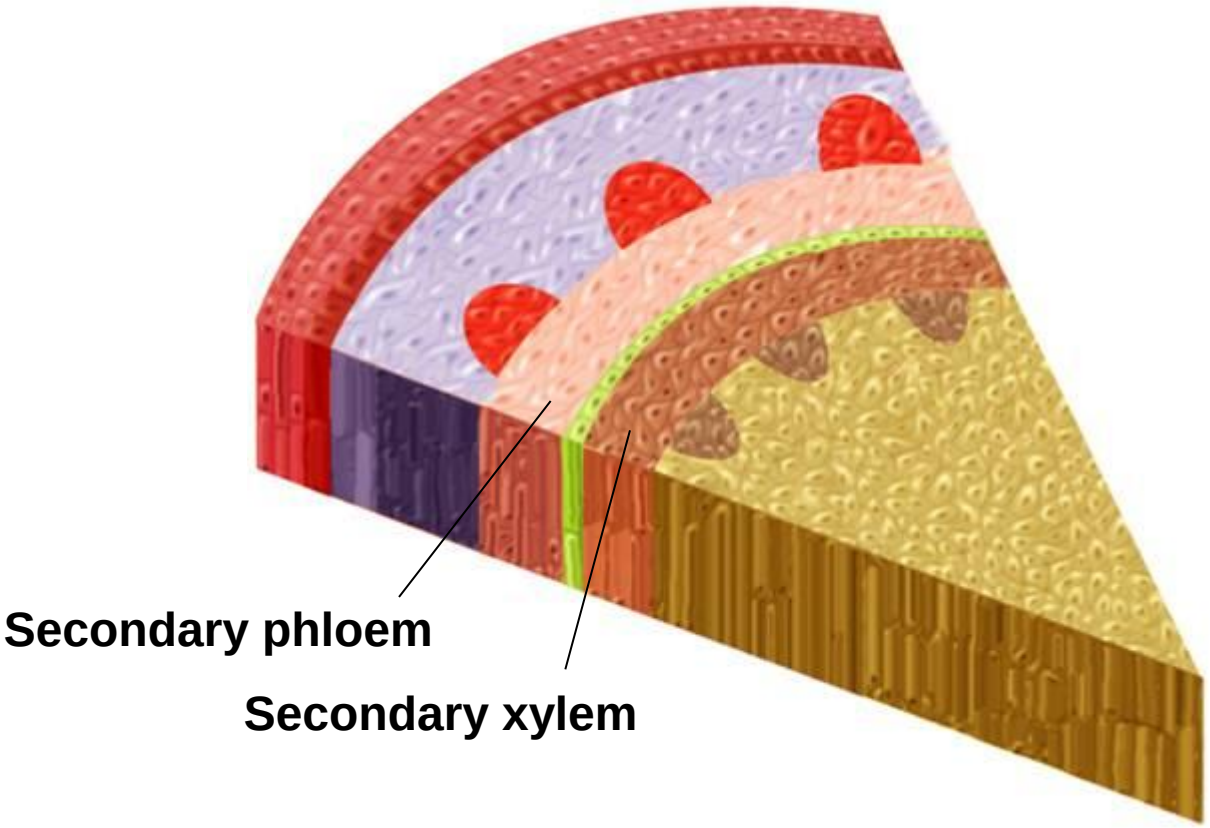
The addition of new tissue in these cambium layers increases the thickness of the stem.

Formation of the Vascular Cambium

Once secondary growth begins, the vascular cambium appears as a thin layer between the xylem and phloem of each vascular bundle.

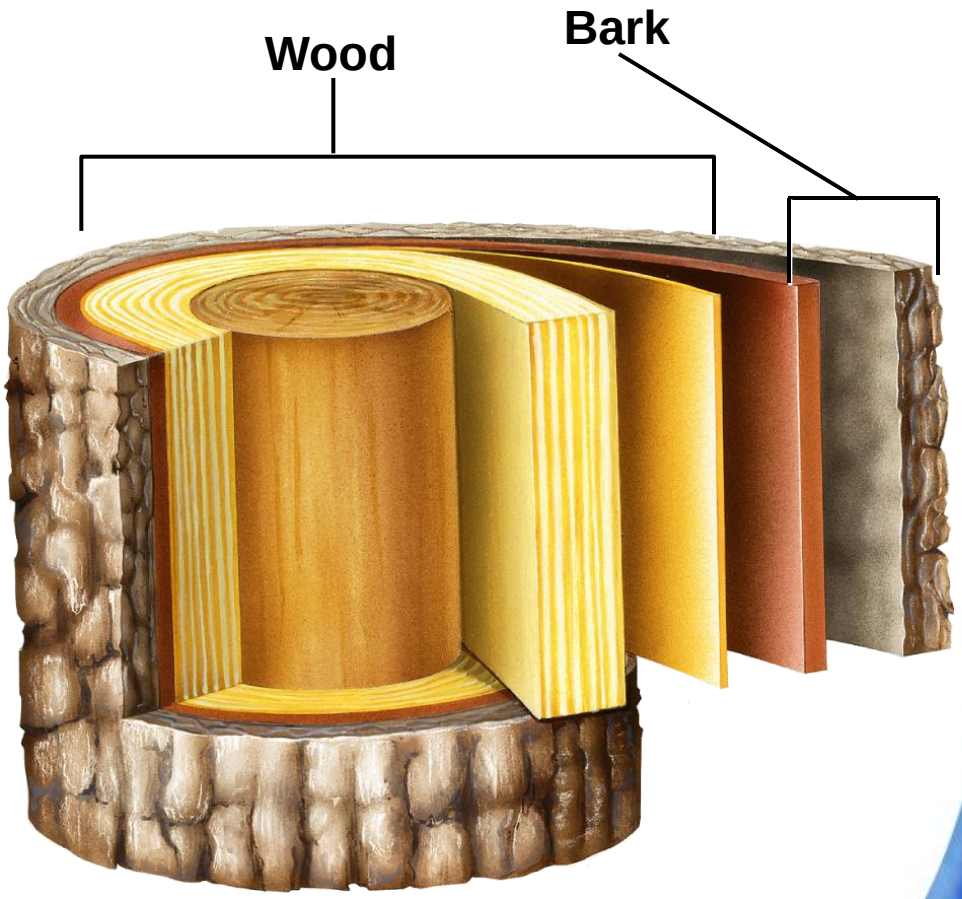


The vascular cambium divides to produce xylem cells toward the center of the stem and phloem cells toward the outside.



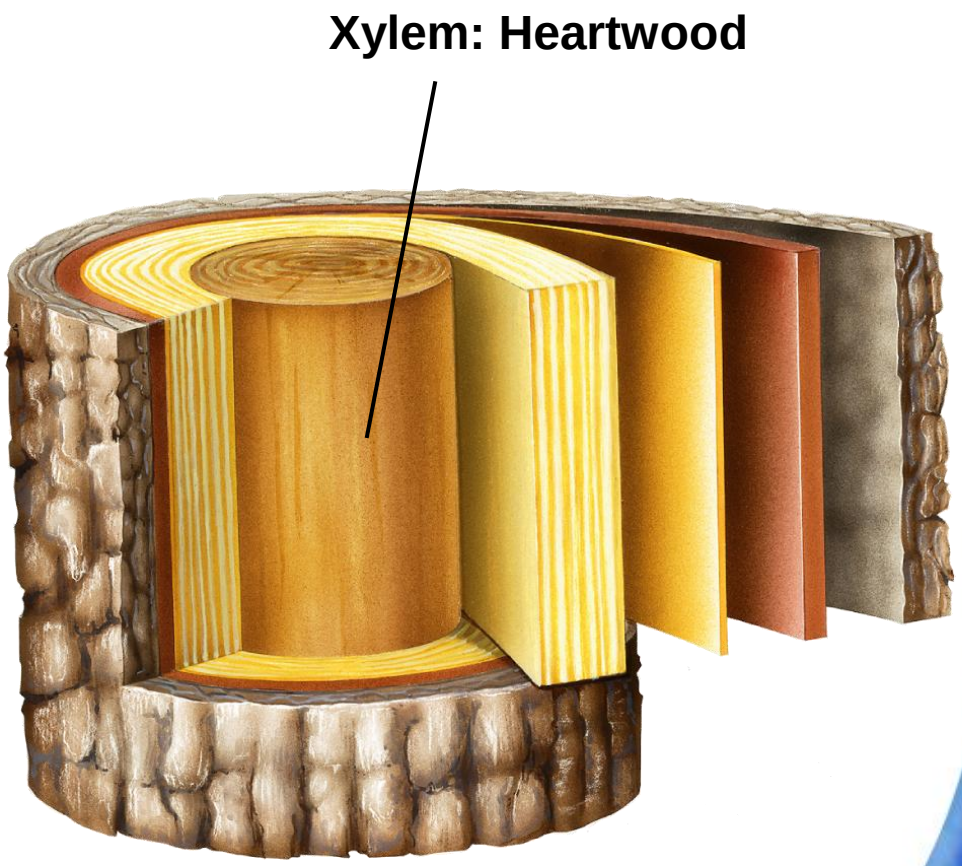
Formation of Wood

Wood is actually layers of xylem. These cells build up year after year.



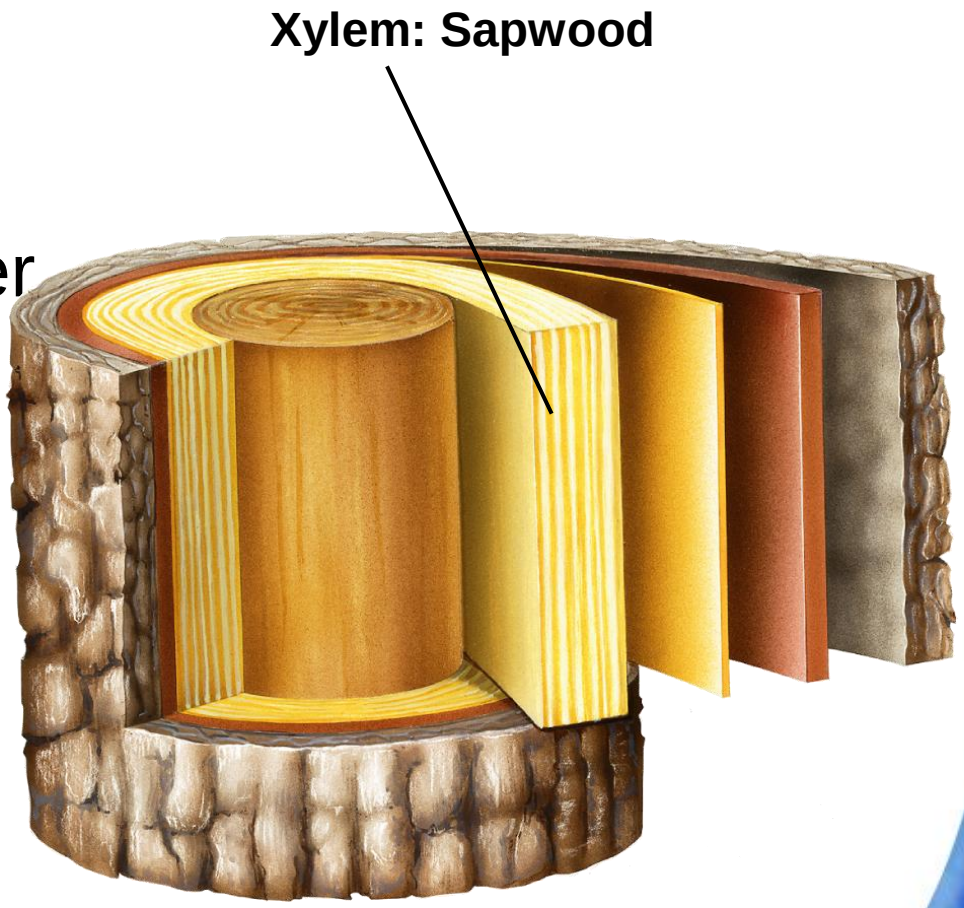
As woody stems grow thicker, older xylem cells near the center of the stem no longer conduct water.

This is called **heartwood**. Heartwood supports the tree.



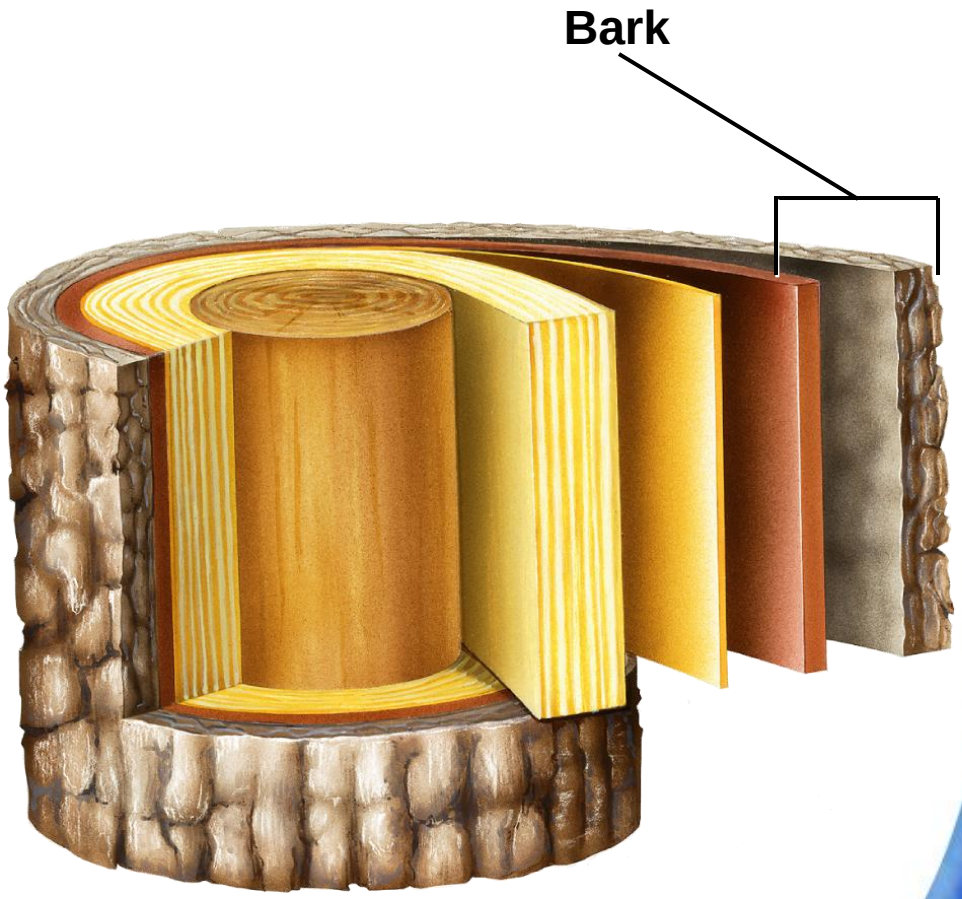
Heartwood is surrounded by **sapwood.**

Sapwood is active in water and mineral transport.

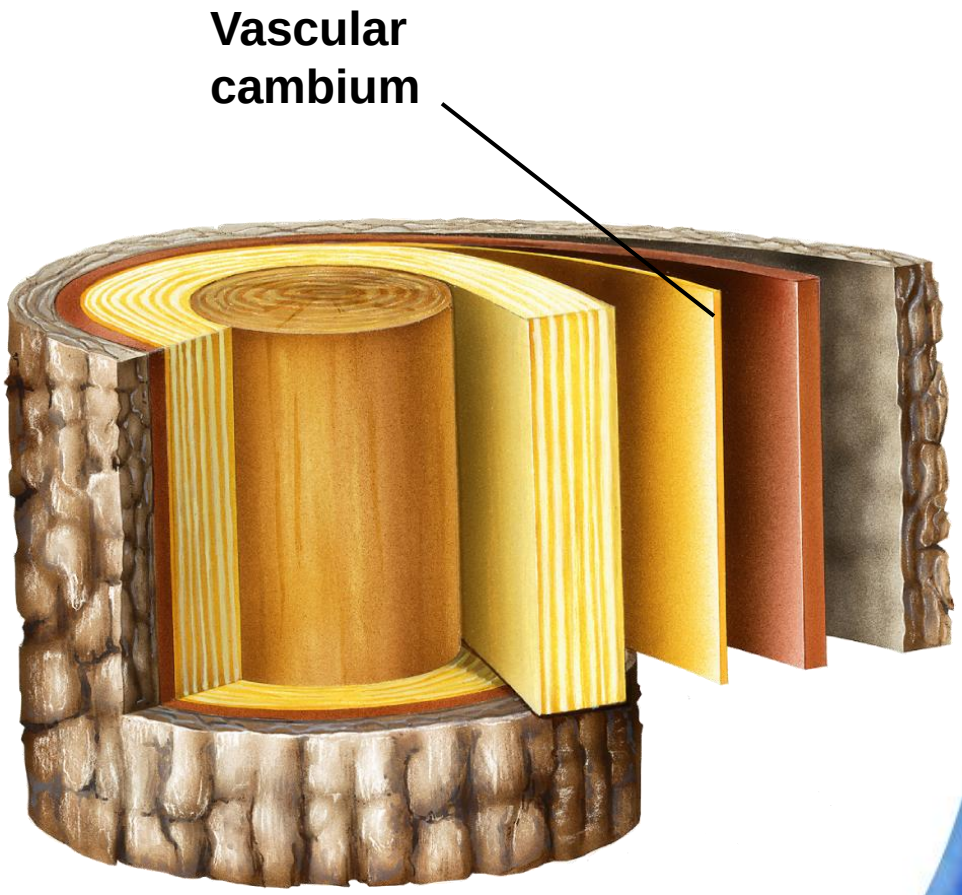


Formation of Bark

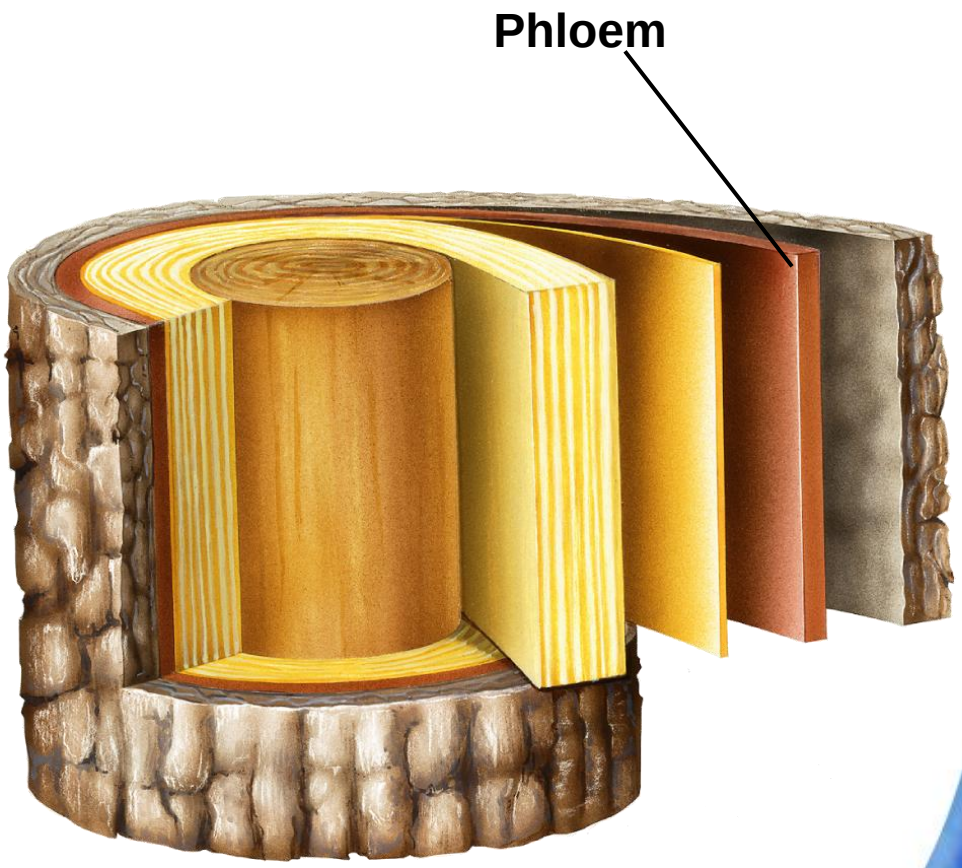
On most trees, **bark** includes all of the tissues outside the vascular cambium — phloem, the cork cambium and cork.



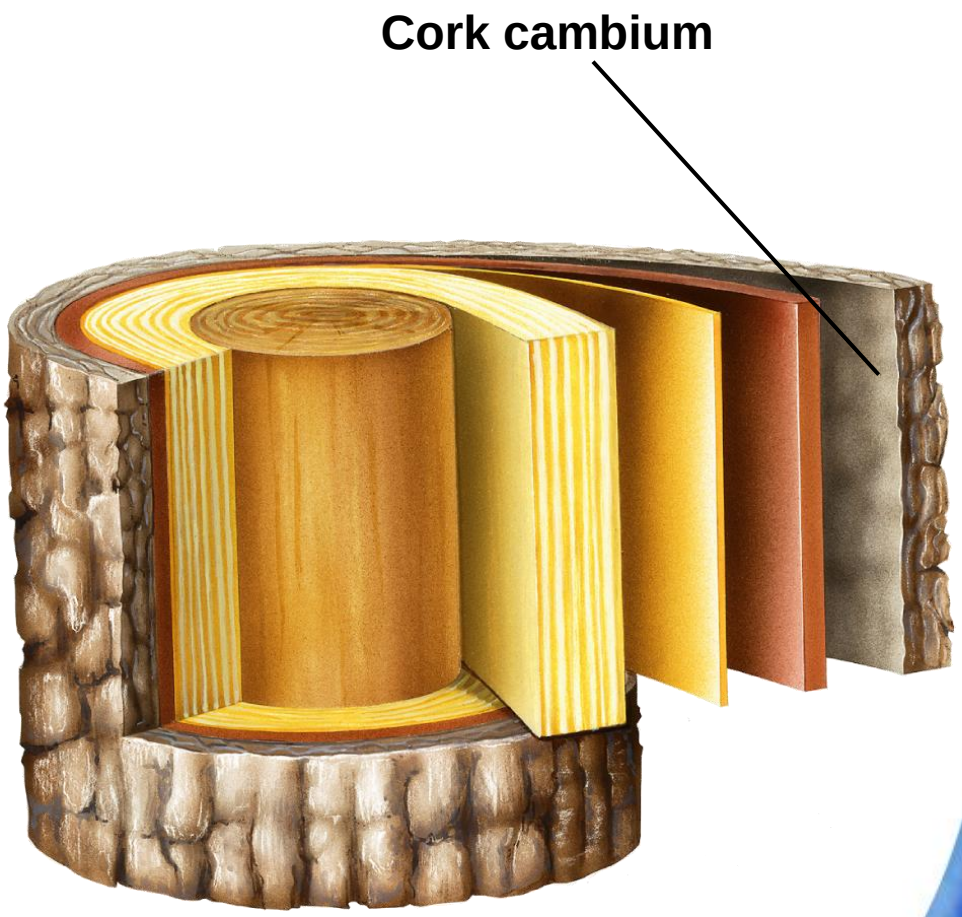
The vascular cambium produces new xylem and phloem, which increase the width of the stem.



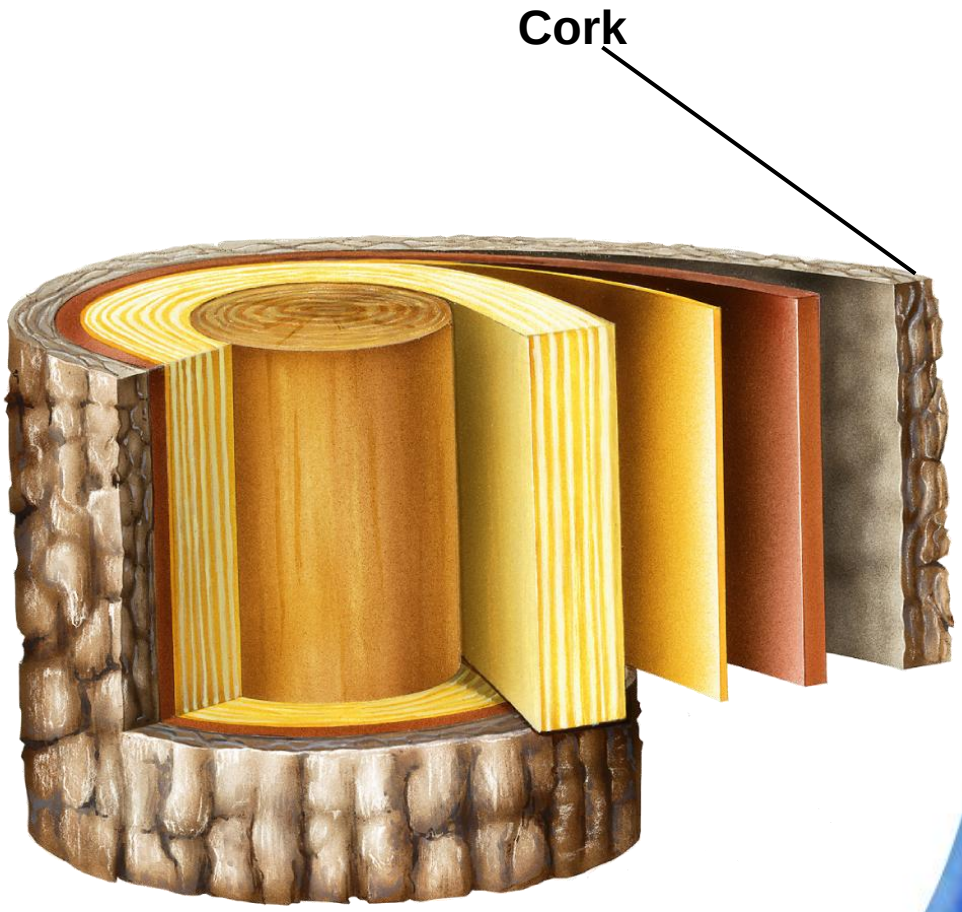
The phloem transports sugars produced by photosynthesis.



The cork cambium produces a protective layer of cork.



The cork contains old, nonfunctioning phloem that protects the tree.



23–3 Section QUIZ

Continue to:

Section QUIZ

- or -

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23–3 Section QUIZ

1 Structures on a stem that can produce new stems and leaves are called

a. nodes.

b. internodes.

c. buds.

d. branches.

2 The vascular bundles in a monocot stem

a. form a cylinder, or ring.

b. are scattered throughout the stem.

c. form concentric rings.

d. separate into xylem bundles and phloem bundles.

3 The outermost layer of a tree that contains old, nonfunctioning phloem is

a. bark.

b. cork.

c. pith.

d. apical meristem.

4 Xylem and phloem are contained in

a. the epidermis.

b. vascular bundles.

c. the pith.

d. cork cambium.

5 In stems, secondary growth results in

a. growth at the tips of roots.

b. growth at the tips of shoots.

c. an increase in the width of stems.

d. an increase in the length of stems.