

Unit B: Plant Anatomy

Lesson 3: Understanding Stem Anatomy

Vocabulary

- Apical meristem
- Bud scales
- Bud scale scar
- Bulb
- Cambium
- Corm
- Internode
- Lateral bud
- Leaf scar
- Lenticels
- Node
- Phloem
- Rhizome
- Stolon
- Terminal bud
- Tuber
- Xylem

What Are the Functions of a Stem?

- Stems have many important jobs in a plant
- They are responsible for the size and shape of a plant
- Some are made of wood and some are herbaceous
- There are four functions of the stem

Functions of a Stem

- 1. Stems support the leaves
 - Able to stretch the leaves into the best positions for catching sunlight
- 2. Move water, minerals and food through the whole plant
- 3. Can also produced food through photosynthesis
 - Not its main job, but will occur in plants with small or no leaves
- 4. Store food that has been manufactured by the plant



Stems of bamboo plant

What Are Some of the Structures on the Outside of a Stem?

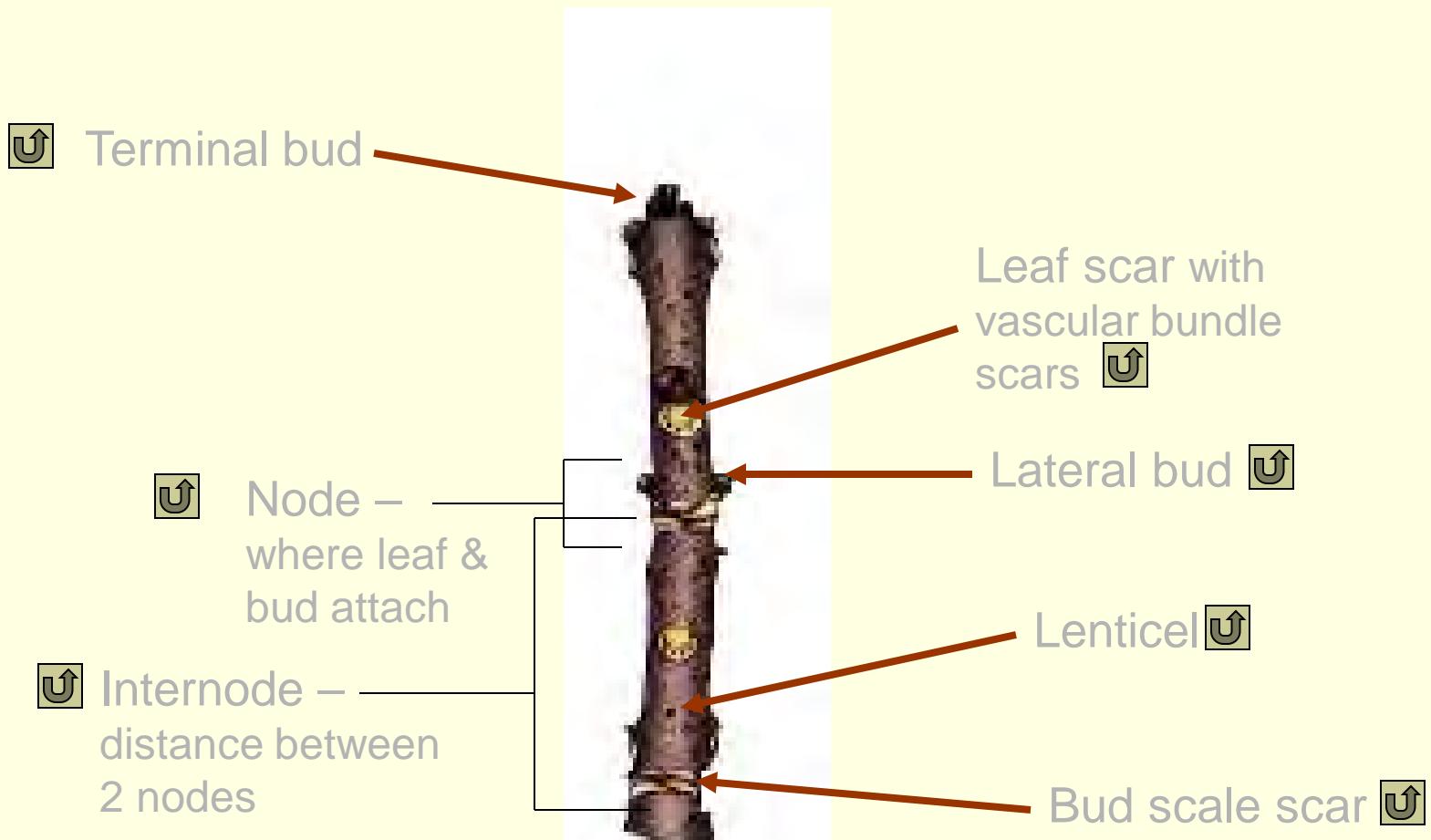
- There are many structures on the stem which are very useful to us in identifying plants
 - Sometimes it is easier to identify a plant by its stem rather than its leaves
- There are eight structures found on the outside of a stem:
 - 1. ***Terminal bud*** – contains apical meristem; found at the tip of a stem; it increases the length of a stem 

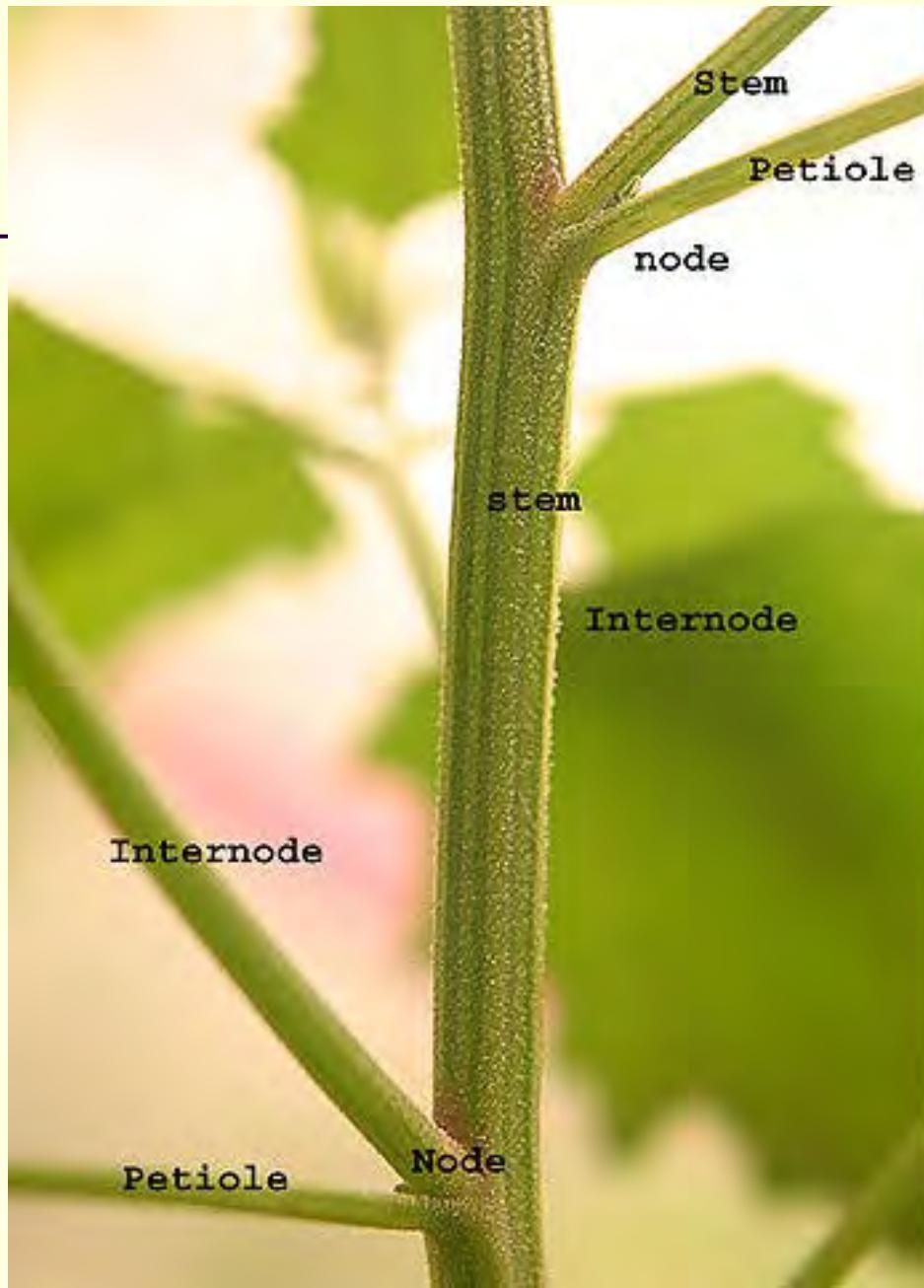
- 2. **Node** – where the leaf and bud attaches to the stem
- 3. **Internode** – distance between two nodes; tells how much the tree grew in one season 
- 4. **Lateral bud** – also called the axillary bud; develops into a leaf or flower 
- 5. Lateral and terminal buds are protected by **bud scales** – helps the bud survive harsh climate changes; when the bud opens in the spring, the scales fall off leaving a **bud scale scar** 

- 6. ***Leaf scar*** – is the remains of the leaf after it has fallen off of the tree; it is just below the lateral bud 
- If you look closely at the scar, you can see the remains of the vascular tissue (xylem & phloem)

- 7. ***Lenticels*** – are small spots on the stem that allow a stem to exchange gases (oxygen & carbon dioxide) with the environment 

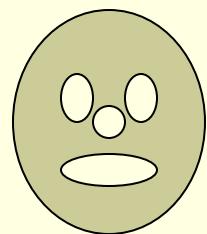
External Parts of a Stem



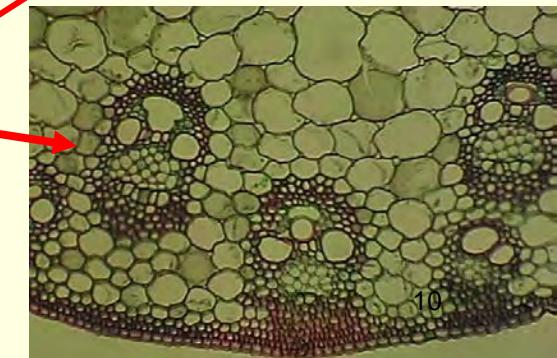


What Are Some of the Internal Structures of a Stem?

- Inside of the stem, there are tissues that are used for transport of materials through the plants
- Stem tissues are organized in one of the following ways:
 - They are found in small bundles scattered throughout the stem
 - They look like smiley faces
 - Characteristic of monocots



Monocot bundle

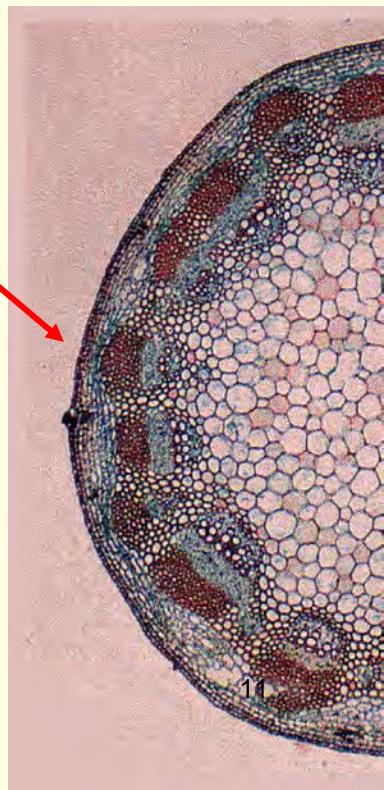
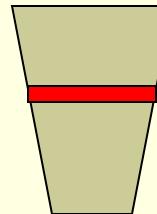


Courtesy of Corinne Banowski

- They are also found in rings around the stem

- They look like candy-corns
- Characteristic of dicots
- This is what gives the plant annual rings
 - Determines the age of a plant

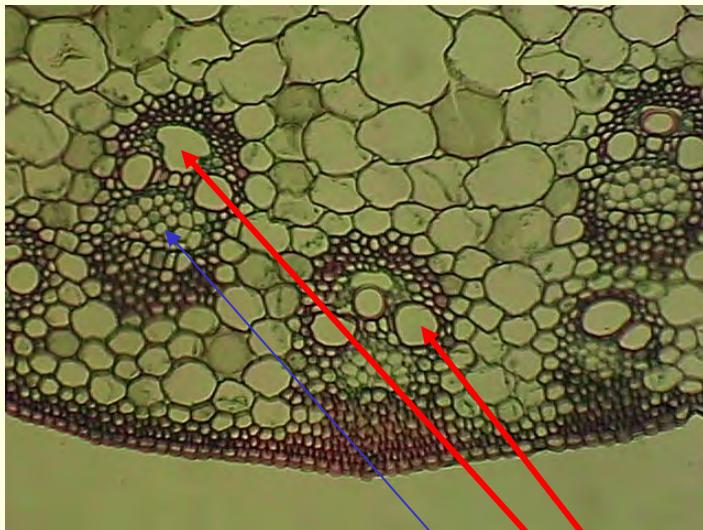
Dicot bundle



- There are three important tissues found inside the stem:
 - A) **xylem** – conducts the water and minerals upward throughout the plant
 - Made of tube-like cells which grow together to conduct liquids
 - Tends to be found closer to the center of the stem
 - B) **phloem** – conducts the food that is produced in the leaf downward to the rest of the plant
 - These cells also form tubes
 - Tends to be found towards the outside of the stem

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- C) ***Cambium*** – the tissue responsible for the production of new xylem & phloem
 - Also increases the girth (width) of a stem
 - Generally found between the xylem and phloem

Location of Vascular Tissues

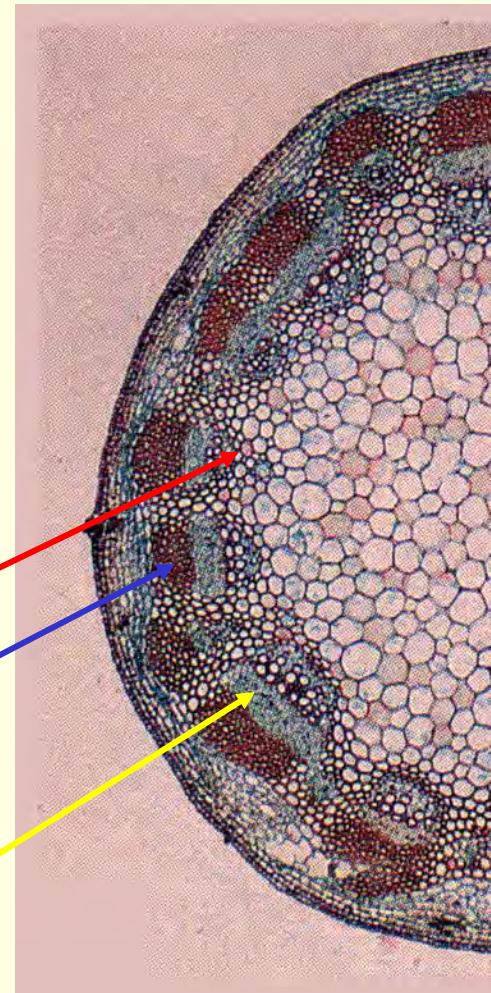


Notice that
monocots do not
have cambium

Xylem

Phloem

Vascular Cambium



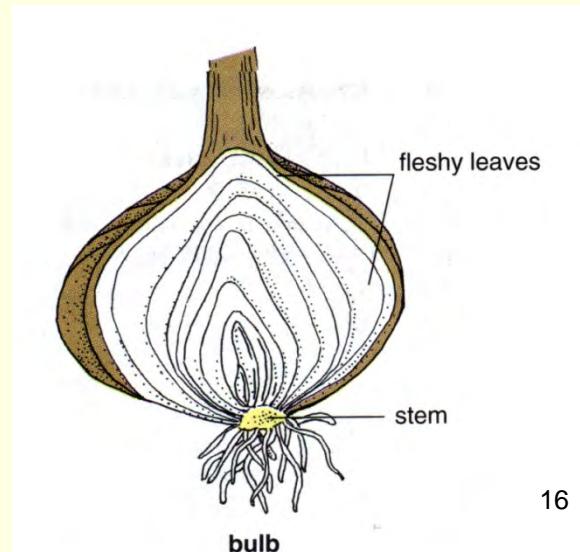
What Are Some Different Kinds of Specialized Stems?

- We generally expect stems to be upright and above ground; however there are many stems that do not fit this mold
- Some stems are modified to store food or help the plant reproduce
- Some stems grow beneath the soil instead of above it
- There are five types of specialized stems

Five Types of Specialized Stems

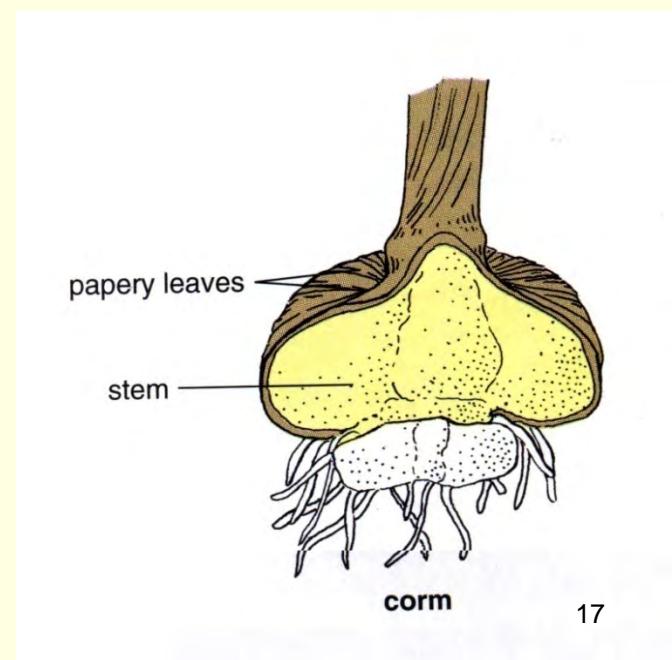
■ 1. **Bulb**

- A very short, flattened stem
- Has several fleshy leaves
- Tend to be found beneath the soil
 - Ex. Onion, garlic



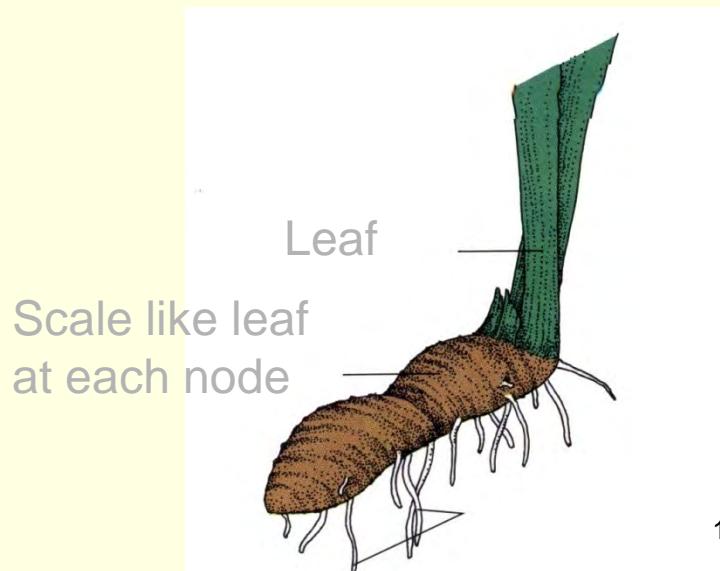
■ 2. ***Corm***

- A spherical structure similar to a bulb
- Most of the corm is stem (unlike the bulb which is mostly leaves)
 - Ex. Gladiolus (flower)



■ 3. *Rhizome*

- A thick underground stem
- Lies horizontally
 - Ex. Iris (flower)



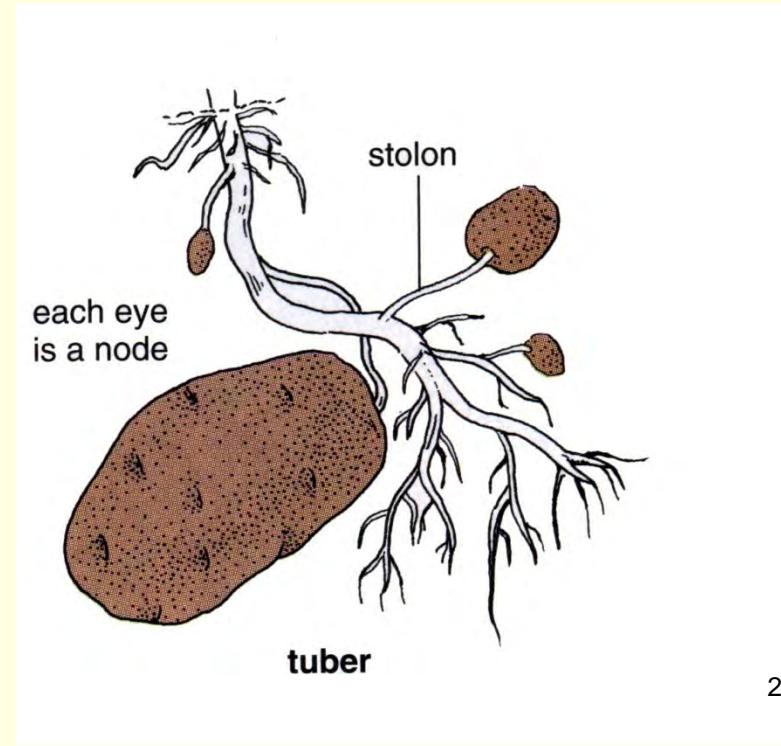
■ 4. ***Stolon***

- A horizontal stem
- Lies above ground
- Sometimes called runners
- Tend to be involved in spreading the plant
 - Ex. Strawberries



■ 5. *Tuber*

- A rhizome with a tip that is swollen with stored food
 - Ex. Potatoes



Recognize the economical importance of roots.

- There are thousands of species whose stems have economic uses.
- Stems provide a few major staple crops such as potato and taro. Sugarcane stems are a major source of sugar. Maple sugar is obtained from trunks of maple trees. Vegetables from stems are asparagus, bamboo shoots, cactus pads or nopalitos, kohlrabi, and water chestnut. The spice, cinnamon is bark from a tree trunk. Cellulose from tree trunks is a food additive in bread, grated Parmesan cheese, and other processed foods. Gum arabic is an important food additive obtained from the trunks of *Acacia senegal* trees. Chicle, the main ingredient in chewing gum, is obtained from trunks of the chicle tree.

- Medicines found around the world that are obtained from stems include quinine from the bark of cinchona trees, camphor distilled from wood of a tree in the same genus that provides cinnamon, and the muscle relaxant curare from the bark of tropical vines.
- Wood is used in thousands of ways, e.g. buildings, furniture, boats, airplanes, wagons, car parts, musical instruments, sports equipment, railroad ties, utility poles, fence posts, pilings, toothpicks, matches, plywood, coffins, shingles, barrel staves, toys, tool handles, picture frames, veneer, charcoal and firewood.

- Wood pulp is widely used to make paper, cardboard, cellulose sponges, cellophane and some important plastics and textiles, such as cellulose acetate and rayon.
- Bamboo stems also have hundreds of uses, including paper, buildings, furniture, boats, musical instruments, fishing poles, water pipes, plant stakes, and scaffolding.
- Trunks of palm trees and tree ferns are often used for building. Reed stems are also important building materials in some areas.

- Cork is obtained from the bark of the cork oak.
- Rubber is obtained from the trunks of *Hevea brasiliensis*.
- Rattan, used for furniture and baskets, is made from the stems of tropical vining palms.
- Bast fibers for textiles and rope are obtained from stems include flax, hemp, jute and ramie

- Amber is fossilized sap from tree trunks; it is used for jewelry and may contain ancient animals. Resins from conifer wood are used to produce turpentine and rosin. Tree bark is often used as a mulch and in growing media for container plants.

Review

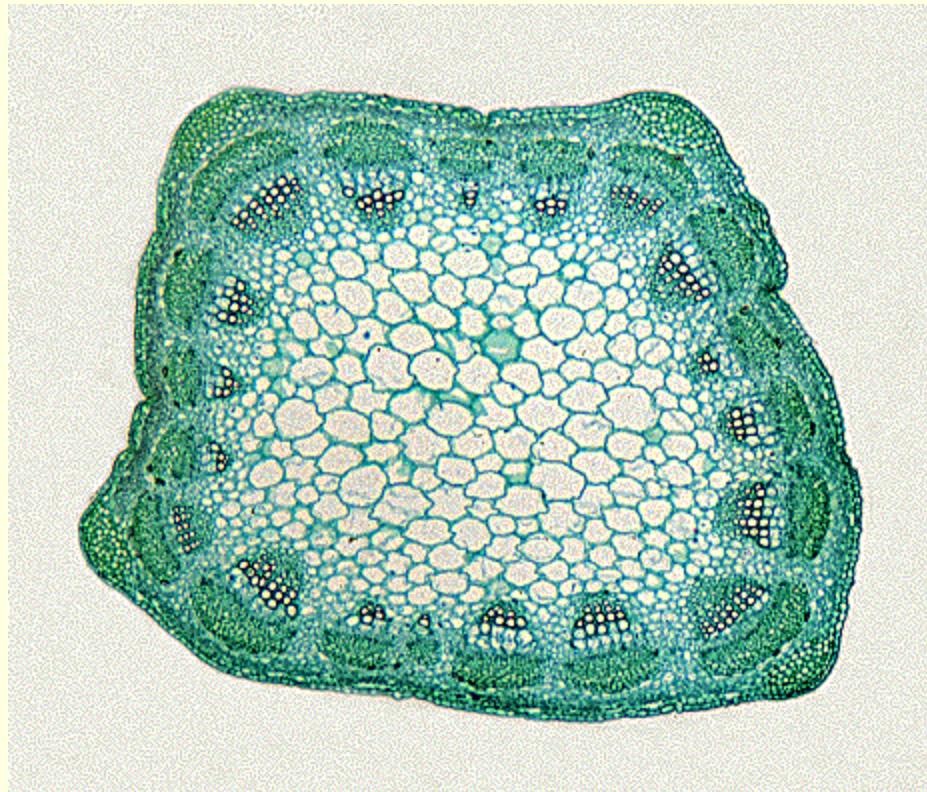
- Identify the following regions: xylem, phloem, and fiber bundles.



Stem x.s. of *Helianthus* (sunflower).

Review

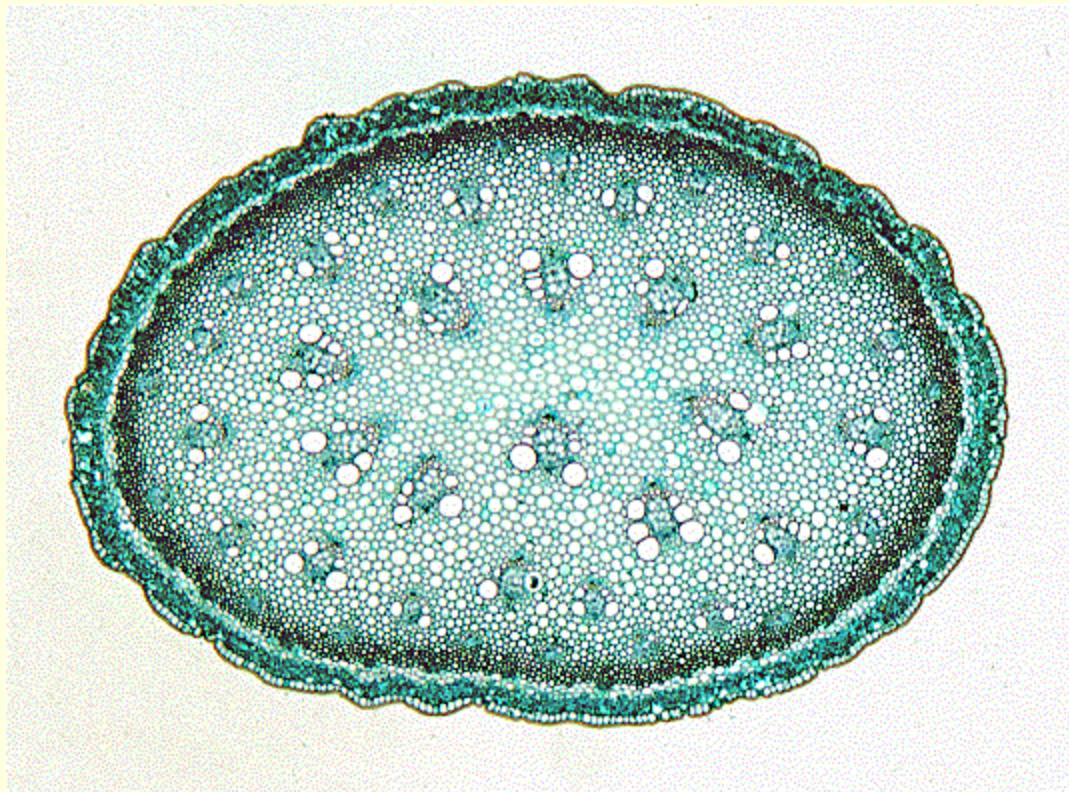
- Based on the bundle structure, is this plant a monocot or dicot?



Stem cross section of *Medicago*

Review

- Based on the bundle structure, is this plant a monocot or dicot?



Stem cross section of *Asparagus*

Summary

- Name the four functions of the stem.
- What is the tip of the external stem called? What kind of tissue does it have inside that allows it to grow?
- Where does a leaf and bud attach to the stem?
- When a leaf or bud falls off, what is left behind?
- Name the three types of internal tissues and their functions.

Summary continued

- In what directions do the xylem and phloem conduct materials?
- What increases the girth of a plant?
- Where does gas exchange occur on a stem?
- Name the five types of modified stems and give an example of each.