

Plant Organization

Learning Objectives

1. List and give the major function of the three main types of plant tissues
2. Identify a monocot versus a eudicot plant by observing either root, stem, leaf, or flowers
3. Name and describe the various components and tissues within the root, both monocot and eudicot
4. Name and describe the various components and tissues within the stem, both monocot and eudicot
5. Name and describe the various components and tissues within the leaf, both monocot and eudicot
6. Identify various examples of stem diversity
7. Distinguish between simple and compound leaves

Angiosperms, or flowering plants are incredibly diverse. This group of plants contains between 250,000 and 400,000 different species. Although flowering plants are diverse in size, shape, color, and habitat, all angiosperms have the following four structures: the root, the stem, the leaf, and the flower. Each structure is comprised of one or more different types of tissues. In this lab activity we will learn more about angiosperm structures and tissues.

Angiosperm Tissues

Flowering plants contain three main types of tissues in the roots, stems, and leaves. Each tissue has a specific function as described below:

1. **Dermal tissue:** protects the outside of the plant
2. **Ground tissue:** used for photosynthesis and storage. An internal plant tissue.
3. **Vascular tissue:** used for transport of water and sugars. *Xylem* transports water and *phloem* transports sugars.

Unlike animals, angiosperms increase in size their entire life because of **meristematic tissue**. Meristematic tissue continues to divide and create new cells through photosynthesis increasing the height and width of flowering plants. Plants have two types of meristems, as described below:

1. **Apical meristem:** located at the tip of the shoot and the tip of the root. The apical meristem lengthens up and down. It is responsible for *primary growth*.
2. **Lateral meristem:** located at branches to increase plant girth. It is responsible for *secondary growth*.

Angiosperm Body Plan

View the representative plants on display in the lab. Notice that the plants have aboveground and belowground portions. The **shoot system** is aboveground. What components of the plant comprise the shoot system?

The **root system** is belowground. State two functions of plant roots.

Angiosperms are divided into two different groups, **monocots** and **eudicots**. These groups differ based on tissue organization in the seed, root, stem, leaf and flowers. For example, monocots have leaf veins that form a parallel patten and flower parts in multiples of threes. Eudicots have leaf veins in a net pattern and flower parts in multiples of fours or fives.

Using this information, identify the live plants on display as either monocots or eudicots filling in the table below.

Monocots	Eudicots

Root

There are two main root arrangements. Most monocots have a **fibrous root** system where all of the roots are about the same size. Many eudicots have a **taproot** system with one very large main root and smaller roots branching off. A carrot is an example of a taproot.

View the monocot and eudicot roots models on display and the cross section slides of the monocot and eudicot root. Identify the following structures:

- | | |
|-----------------------|------------|
| Root cap | Cortex |
| Root hairs | Endodermis |
| Zone of cell division | Pith |
| Zone of elongation | Pericycle |
| Zone of maturation | Epidermis |
| Xylem | Phloem |

Use the space on the next page to draw and label the cross section of the monocot and eudicot root slides.

Why is the root cap necessary?

How does the arrangement of xylem and phloem differ in the monocot versus the eudicot root?

Stem

The stem provides aboveground support for flowers and leaves. Some stems are **herbaceous** or nonwoody while others are **woody**. Herbaceous stems increase in length via the apical meristem but they do not increase in girth through secondary growth.

View the cross section slides of the eudicot herbaceous stem and the monocot herbaceous stem. Identify the following tissues in both slides and notice that they have different arrangements of the xylem and phloem.

- Cortex
- Xylem
- Phloem
- Pith
- Epidermis

In the eudicot stem, which vascular tissue is more external, the xylem or the phloem?

The vascular bundles in a monocot herbaceous stem are said to have a scattered arrangement. Explain why in your own words.

Use the space below to draw and label the cross section of the monocot and eudicot stem slides.

Many plants have modified stems to assist with food storage or for vegetative reproduction. Some examples include:

1. **Rhizome:** horizontal underground stem
2. **Corm:** underground fleshy stem, used for storage
3. **Stolon:** underground horizontal stem
4. **Runner:** aboveground horizontal stem
5. **Tuber:** underground storage stem
6. **Bulb:** underground storage stem with fleshy leaves

View the stems on display and identify which ones belong to the categories described above. You may see more than one example of some and no examples of others.

- 1.
- 2.
- 3.
- 4.

Leaf

The main function of the leaf is photosynthesis. Therefore, it contains many chloroplasts and is thin to facilitate gas and water transport. View the leaf model and the leaf cross section slide. Make sure you can identify the following components:

- | | |
|-----------------------------|--------------------------|
| Epidermis (upper and lower) | Xylem |
| Cuticle | Phloem |
| Spongy Mesophyll | Stomata (stoma singular) |
| Palisade Mesophyll | Guard Cells |

Use the space below to draw and label the leaf with all of the components listed above.

The main, flat portion of the leaf is called the **blade** and it attaches to the stem via the **petiole** stalk. There are two main arrangements for the leaf blade. Leaves can either be simple or compound. A **simple leaf** has a single blade. A **compound leaf** has a blade divided into leaflets. All of the leaflets share the same **auxiliary bud** which is the source of new growth. The auxiliary bud is located at the base of the petiole.

There are two arrangements of compound leaves. **Palmately compound leaves** have all leaflets attached at the same point at the end of the petiole. **Pinnately compound leaves** have leaflets attached at intervals along the petiole.

View the preserved leaf specimens. Choose six to identify as simple or compound. If the leaf is compound, state if it is palmately or pinnately compound. Fill in your findings in the table.

Name of Leaf	Simple or Compound	Palmate or Pinnate

Answer the questions below to review:

1. What cellular division process occurs in the apical meristem region?

2. The plant has two apical meristems. Identify the location of both.

3. If a plant had parallel leaf veins would you identify it as a monocot or a eudicot?

4. The tissue responsible for water transport is _____ and the tissue responsible for sugar transport is _____.

5. You look at a stem cross section and notice there is a ring of vascular bundles. Would you identify it as monocot or eudicot?

6. A potato is an example of what type of modified stem?

7. What is the function of the root hairs?

8. Vascular bundles contain what two tissues?

9. Are fibrous roots more common in eudicots or monocots?

10. State one structure that is part of the plant shoot system.

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