

Name:

Date:

Biology Lab Activities: Monocot and Dicot Plant Structure

Last updated: 04/22/25

> **Background Questions**

Read through the Monocot and Dicot Overview article on the Visible Body Biology Learn Site (<https://www.visiblebody.com/learn/biology/monocot-dicot/overview>).

Based on what you've learned in class, in your textbook, from the Biology Learn Site article, and from using Visible Body, answer the following questions about the structures that make up flowering plants.

1. What are the three main parts of plants?
2. There are three types of tissue found in each part of the plant: dermal, vascular, and ground tissue. Answer the following questions about the structure and functions of these tissues.
 - a. Dermal tissue is composed of a single layer of _____, and it forms the outer tissue layer of the plant.
 - b. What are the two main functions of dermal tissue?
 - c. Vascular tissue is primarily composed of _____ and _____, which form vascular bundles throughout the plant's interior.
 - d. What is the main function of vascular tissue?
 - e. Ground tissue can be composed of three types of cells: _____, _____, and _____. It makes up the majority of the plant's interior.

- f. What are the two main functions of ground tissue?
3. There are two main types of flowering plants, monocots and dicots (also known as eudicots). Complete the following sentences to compare these two plant types.
- Monocots usually have _____ cotyledon(s), whereas dicots usually have _____cotyledon(s). This structure is important because it supplies _____to the plant embryo.
 - The leaves of monocots are usually _____, with _____veins. On the other hand, the leaves of dicots are more varied in shape and size, usually with _____ veins.
 - In monocots, the vascular bundles in the stem are _____, whereas in dicots, they are arranged in a _____.
 - Monocots have flower parts in groups of _____, whereas dicots have flower parts in groups of _____.
 - Monocots are monosulcate, meaning their _____. Dicots are trisulcate, meaning their _____.

Name:

Date:

Lab 1: Monocot and Dicot Plant Roots

> Activity 1: Label a monocot plant root

1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search function to view the Monocot Root model.
2. Label the image below
 - Explore the 3D model of the monocot root to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Word List:

Cortex ____

Pericycle ____

Root hair ____

Endodermis ____

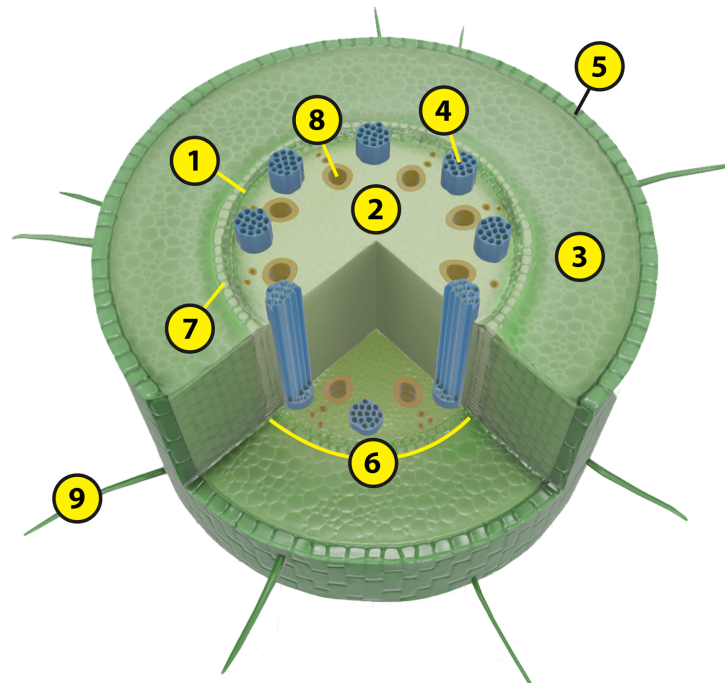
Phloem ____

Stele ____

Epidermis ____

Pith ____

Xylem ____



Name: _____

Date: _____

Lab 1: Monocot and Dicot Plant Roots

> Activity 2: Label a dicot plant root

1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search function to view the Dicot Root model.
2. Label the image below
 - Explore the 3D model of the dicot root to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Word List:

Cambium ____

Epidermis ____

Stele ____

Connective tissue (parenchyma) ____

Pericycle ____

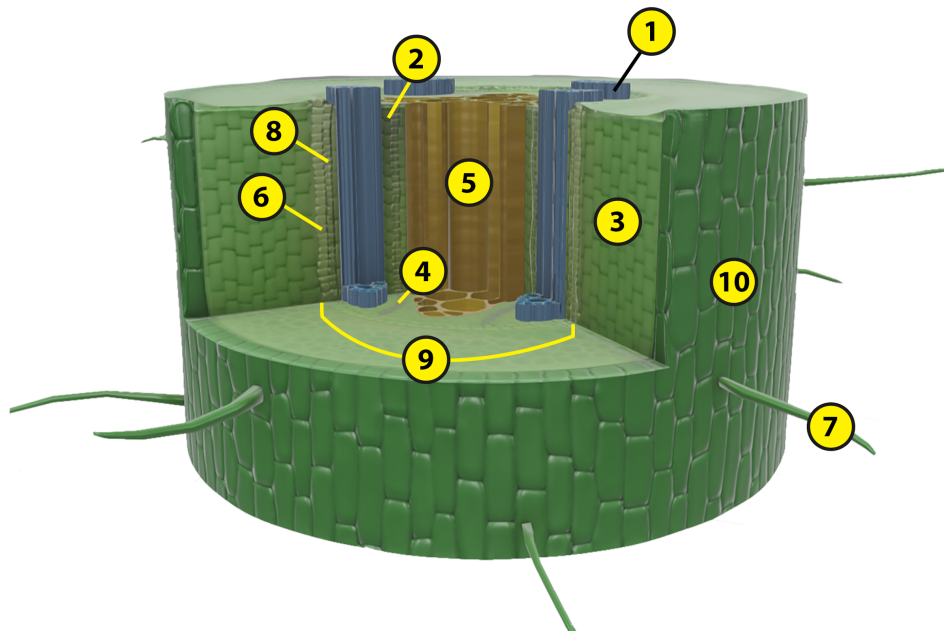
Xylem ____

Cortex ____

Phloem ____

Endodermis ____

Root hair ____



Name:

Date:

Lab 1: Monocot and Dicot Plant Roots

> Activity 3: Compare monocot and dicot plant roots

As you've learned from labeling monocot and dicot plant roots in Activities 1 and 2, they share most of the same structures, but those structures are arranged differently within each type of root. Refer to your labeled images and the content in Visible Body to answer the following questions, comparing monocot and dicot plant roots.

1. Based on your labeled monocot and dicot roots, match the following root structures with their descriptions.
 - a. Root hairs
 - b. Endodermis
 - c. Pericycle
 - d. Epidermis
 - e. Stele

___ A single layer of parenchyma cells that forms the boundary between the cortex and the stele

___ The central part of the root where the xylem and phloem develop

___ The protective outer layer that prevents damage to the root

___ Structures that enhance the root's total surface area to maximize water and mineral absorption

___ The outermost layer of the stele, composed of parenchyma cells that can divide and give rise to lateral roots

2. How would you describe the overall shape and structure of monocot vs. dicot roots, in 2–3 sentences?
3. The root's ground tissue can be found in a region called the _____. In this region, monocot and dicot roots both have _____, but monocot roots can also have _____.
4. Monocot and dicot roots both have vascular cylinders. Complete the following sentences about how the vascular structures differ in monocot and dicot roots.

- a. _____ roots have a larger number of vascular structures than _____ roots.
- b. In monocot roots, the vascular structures are arranged in a _____ between the outer cortex and the central _____.
- c. In dicot roots, the vascular structures are located in the _____ of the root. Dicot steles contain an additional component called _____, which is located between the xylem and phloem. The meristem cells within this structure facilitate secondary growth, dividing to create new xylem and phloem cells, and thus widening the root's girth.

Name:

Date:

Lab 2: Monocot and Dicot Plant Stems

> Activity 1: Label a monocot plant stem

1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search function to view the Monocot Stem model.
2. Label the image below
 - Explore the 3D model of the monocot stem to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Word List:

Epidermis ____

Phloem ____

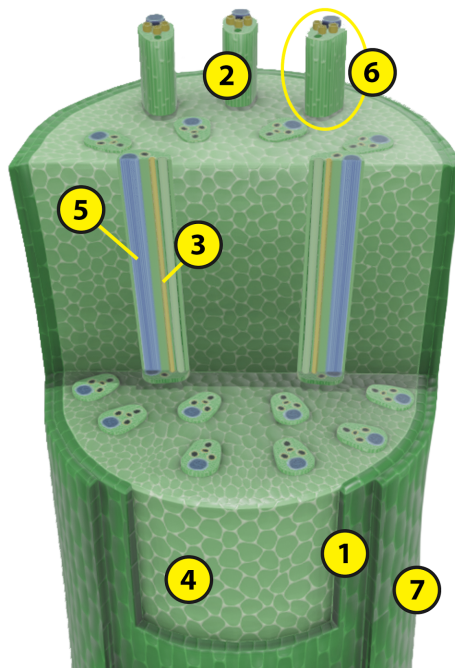
Xylem ____

Ground tissue ____

Sclerenchyma ____

Hypodermis ____

Vascular bundle ____



Name: _____

Date: _____

Lab 2: Monocot and Dicot Plant Stems

> Activity 2: Label a dicot plant stem

1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search function to view the Dicot Stem model.
2. Label the image below
 - Explore the 3D model of the dicot stem to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Word List:

Cambium ____

Pith ____

Vascular bundle ____

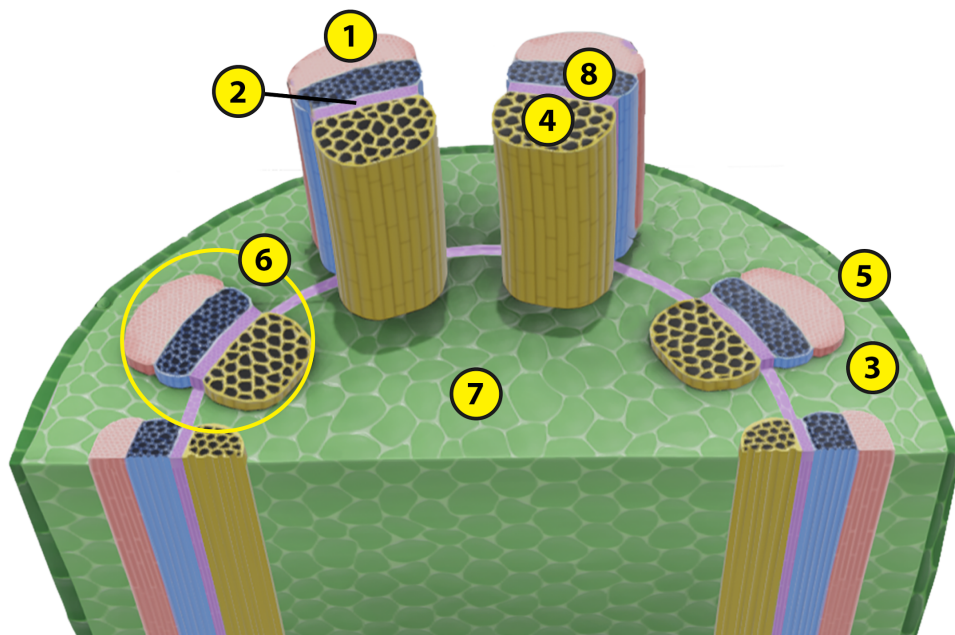
Cortex ____

Phloem ____

Xylem ____

Epidermis ____

Sclerenchyma ____



Name:

Date:

Lab 2: Monocot and Dicot Plant Stems

> **Activity 3: Compare monocot and dicot plant stems**

As you've learned from labeling monocot and dicot plant stems in Activities 1 and 2, they share several of the same structures, but those structures are arranged differently within each type of stem. Refer to your labeled images and the content in Visible Body to answer the following questions, comparing monocot and dicot plant stems.

1. The majority of the stem is composed of ground tissue, which can include parenchyma, sclerenchyma, and collenchyma cells. In most ground tissue, the cells are loosely arranged and there is space between them. Briefly explain why this space is important to the function of the plant stem.
2. As you can see in your labeled monocot and dicot stems, they both contain several vascular bundles. However, these vascular structures are arranged differently within the stem's ground tissue. Complete the following sentences about the structure and location of these vascular bundles.
 - a. The interior of the vascular bundles is composed of _____. and the exterior is composed of _____. Dicot stems have an additional component called _____, which is located between the xylem and phloem. The meristem cells within this structure facilitate secondary growth, dividing to create new xylem and phloem cells, and thus widening the stem's girth.
 - b. Monocot stems have vascular bundles that are _____.
 - c. Dicot stems have vascular bundles that form a _____, separating the stem's ground tissue into an outer _____ and a central _____.

Name: _____

Date: _____

Lab 3: Monocot and Dicot Plant Leaves

> Activity 1: Label a monocot plant leaf

1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search function to view the Monocot Leaf model.
2. Label the image below
 - Explore the 3D model of the monocot leaf to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Word List:

Bulliform cell _____

Lower epidermis _____

Sclerenchyma _____

Bundle sheath _____

Mesophyll _____

Stoma _____

Cuticle _____

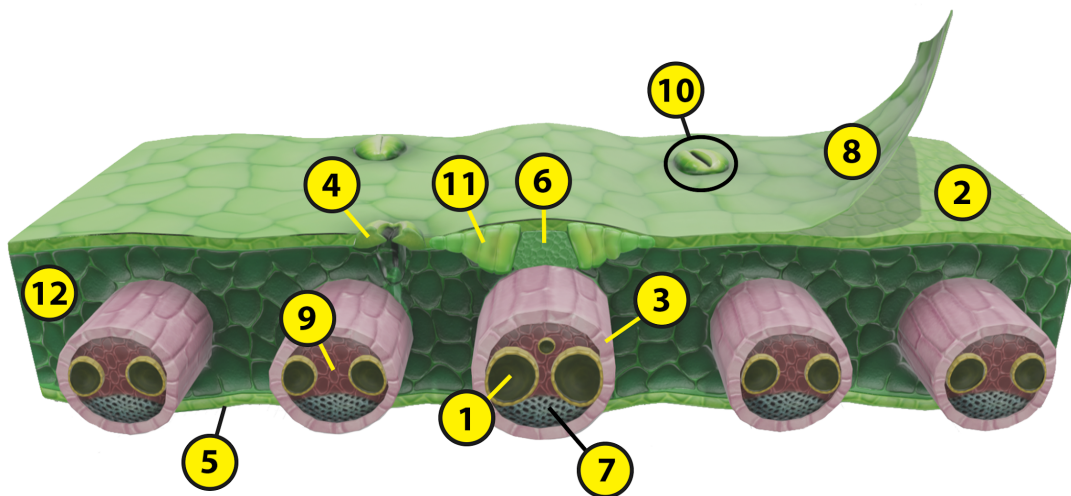
Parenchyma _____

Upper epidermis _____

Guard cell _____

Phloem _____

Xylem _____



Name: _____

Date: _____

Lab 3: Monocot and Dicot Plant Leaves

> Activity 2: Label a dicot plant leaf

1. Launch the view
 - Launch Visible Body.
 - Browse or use the Search function to view the Dicot Leaf model.
2. Label the image below
 - Explore the 3D model of the dicot leaf to find the structures you need to label.
 - Fill in the blanks to label the structures from the list below.

Word List:

Bundle sheath ____

Palisade mesophyll ____

Upper epidermis ____

Collenchyma ____

Phloem ____

Vascular bundle ____

Cuticle ____

Spongy mesophyll ____

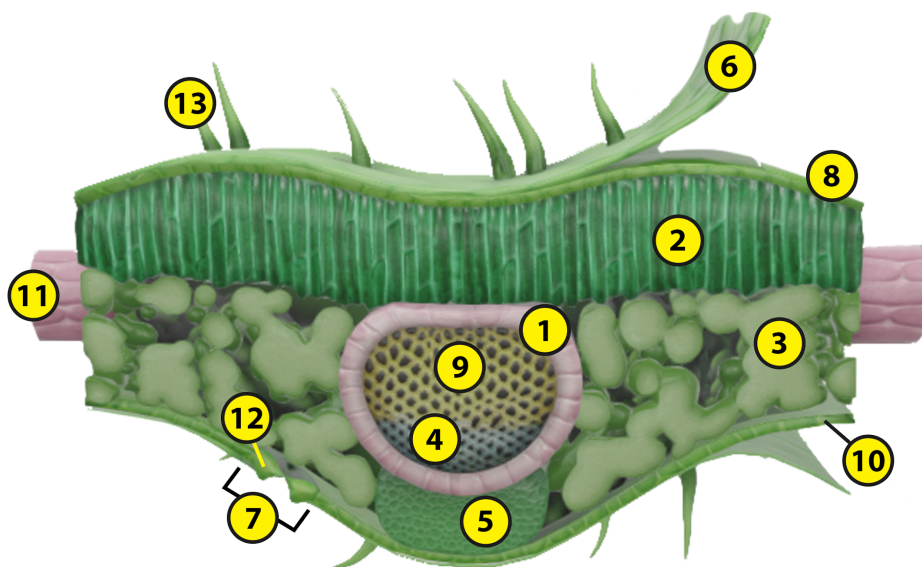
Xylem ____

Guard cell ____

Stoma ____

Lower epidermis ____

Trichome ____



Name:

Date:

Lab 3: Monocot and Dicot Plant Leaves

> Activity 3: Compare monocot and dicot plant leaves

As you've learned from labeling monocot and dicot plant leaves in Activities 1 and 2, they share many of the same structures, but those structures are arranged differently within each type of leaf. Refer to your labeled images and the content in Visible Body to answer the following questions, comparing monocot and dicot plant leaves.

1. Complete the following sentences on the dermal tissue of leaves.
 - a. The leaf's dermal cells secrete a waxy substance that forms the _____. This structure forms a protective covering and helps the leaf _____.
 - b. The leaf's epidermis has several small pores, called _____, which facilitate _____ and allow water vapor to exit the leaf. Each pore is surrounded by two _____, which open and close the pore.
 - c. In _____, stomata are found on the upper and lower surfaces of the leaves. In _____, most stomata are on the bottom surface. This allows dicot leaves to _____ while having most stomata open.
2. Complete the following sentences on the ground tissue of leaves.
 - a. The leaf's ground tissue, called _____, separates the upper and lower _____.
 - b. The ground tissue is mostly composed of parenchyma cells that carry out _____ within the leaf.
 - c. Unlike most monocot leaves, which have only one type of mesophyll, the ground tissue of dicot leaves is often arranged into two distinct types, the _____ and the _____.
3. As you've probably noticed in your labeled monocot and dicot leaves, the vascular structures form parallel veins in monocot leaves and net-like veins in dicot leaves. The xylem and phloem in these veins are connected to the stem's vascular structures. In 2–3 sentences, explain why this structure is important to the functions of the leaf and the rest of the plant.

Name:

Date:

Lab 4: Dermal, Vascular, and Ground Tissue in Plants

> **Activity 1: Dermal Tissue**

As you've learned from labeling monocot and dicot plant roots, stems, and leaves in Labs 1–3, all these plant parts are composed of dermal, vascular, and ground tissues. Refer to your labeled images, as well as the 3D models in Visible Body, to answer the following questions on the dermal tissue of plants.

1. What dermal tissue structure is present in roots, stems, and leaves?
2. How would you describe the basic structure of this dermal tissue?
3. Although this dermal structure is shared by all three plant parts, what is unique about its structure in leaves?
4. Match each of the following dermal tissue structures with its function.
 - a. Cuticle
 - b. Root hair
 - c. Stoma
 - d. Guard cell

___ Allows gases and water vapor to move between the interior plant structures and the surrounding air

___ Helps the plant retain water and prevents pathogens from entering the plant

___ Opens and closes a pore

___ Absorbs water and minerals from the ground

Name:

Date:

Lab 4: Dermal, Vascular, and Ground Tissue in Plants

> Activity 2: Vascular Tissue

As you've learned from labeling monocot and dicot plant roots, stems, and leaves in Labs 1–3, all these plant parts are composed of dermal, vascular, and ground tissues. Refer to your labeled images, as well as the 3D models in Visible Body, to answer the following questions on the vascular tissue of plants.

1. What are the two main types of vascular tissues that are present in roots, stems, and leaves?
2. Complete the following sentences about the main functions of these vascular tissues.
 - a. The _____ carries water and dissolved minerals from the _____ to the other plant parts.
 - b. The _____ carries dissolved sugars and organic compounds from the _____ to the other plant parts.
 - c. Xylem cells have _____ walls, and they are _____ at maturity. Phloem cells have _____ walls, and they are _____ in the mature plant.
3. Vascular tissue is arranged differently in each part of the plant. Complete the following sentences to compare the arrangement and structure of the vascular tissue in roots, stems, and leaves.
 - a. In roots, the vascular structures are contained within a _____ that is located in the root's _____.
 - b. In stems, the vascular structures are contained in several _____. In monocot stems, they are _____. In dicot stems, they form a _____ between the outer _____ and the inner _____.
 - c. In dicot leaves, the vascular structures are contained in a network of _____ veins. In monocot leaves, the veins are _____.
4. How would you explain the cambium in 2–3 sentences?

Name:

Date:

Lab 4: Dermal, Vascular, and Ground Tissue in Plants

> Activity 3: Ground Tissue

As you've learned from labeling monocot and dicot plant roots, stems, and leaves in Labs 1–3, all these plant parts are composed of dermal, vascular, and ground tissues. Refer to your labeled images, as well as the 3D models in Visible Body, to answer the following questions on the ground tissue of plants.

1. What are the three main types of ground tissue cells?
2. Complete the following sentences about the main functions of each type of ground tissue cell.
 - a. The most abundant type, _____ cells, perform vital plant functions that include photosynthesis, respiration, gas exchange, and water and starch storage.
 - b. _____ cells provide elastic support that facilitates stem and leaf growth.
 - c. _____ cells provide inelastic support that maintains the rigid structure of plant parts that are done growing.
3. Which parts of roots, stems, and leaves are composed of ground tissue?