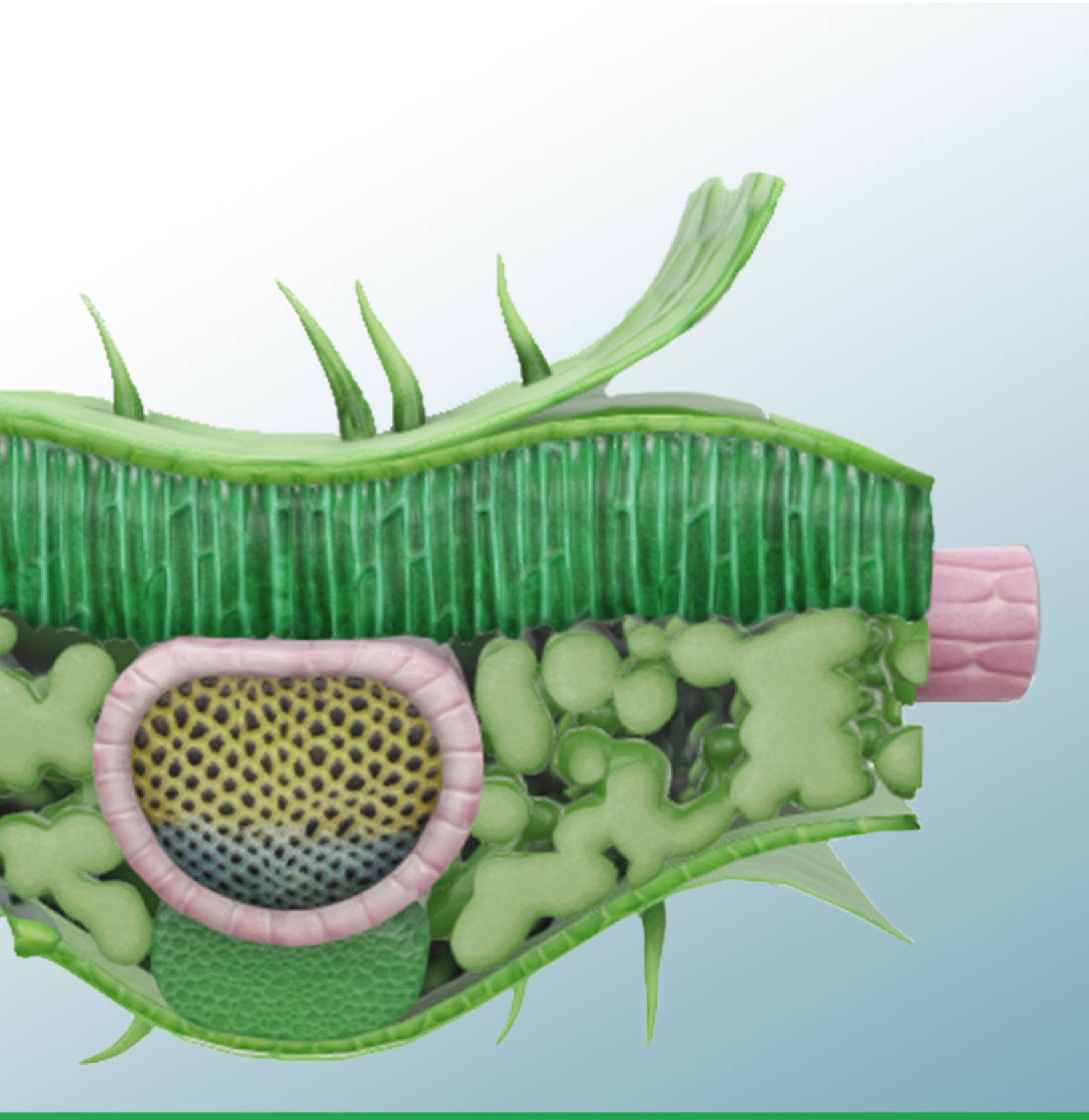


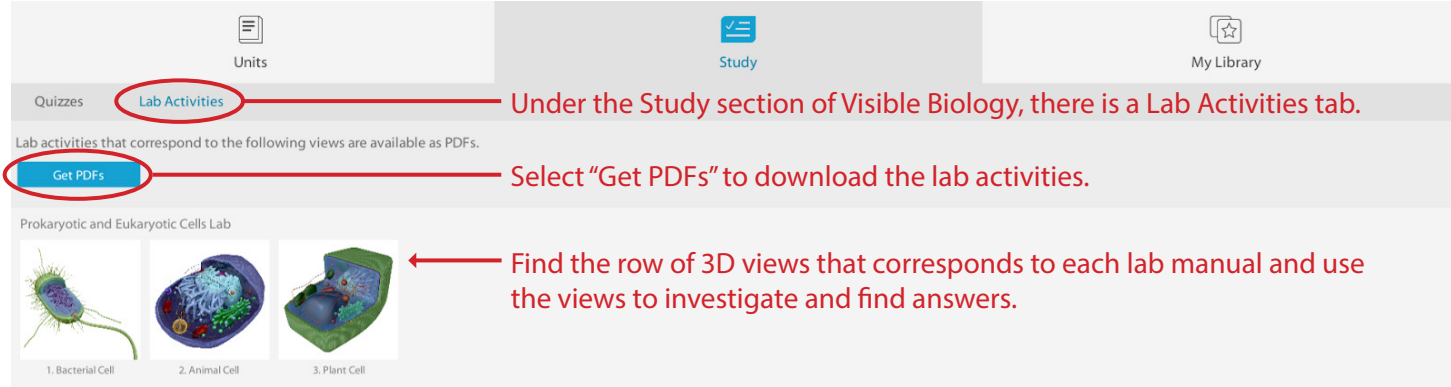
Biology Lab Activities: Monocot and Dicot Plant Structure

Adrienne Devlin, Executive Editor at Visible Body

How to use this manual

This lab manual is intended for use with the Visible Biology product.

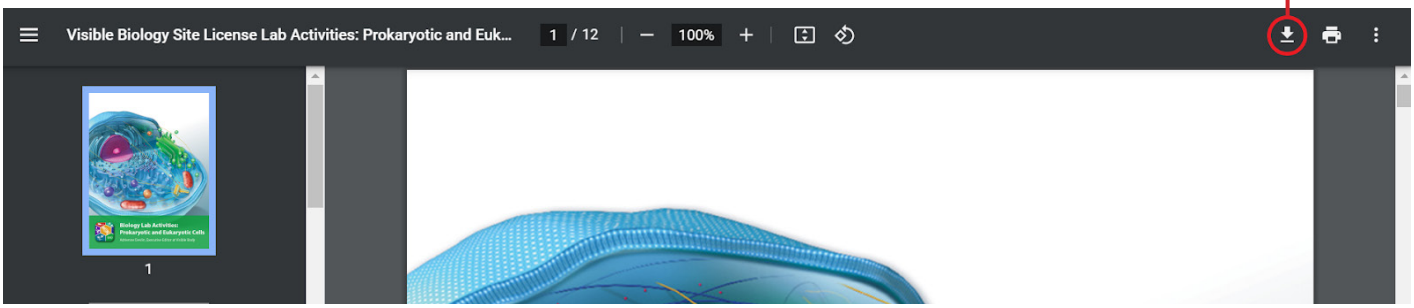
Where to find 3D models



How to save answers

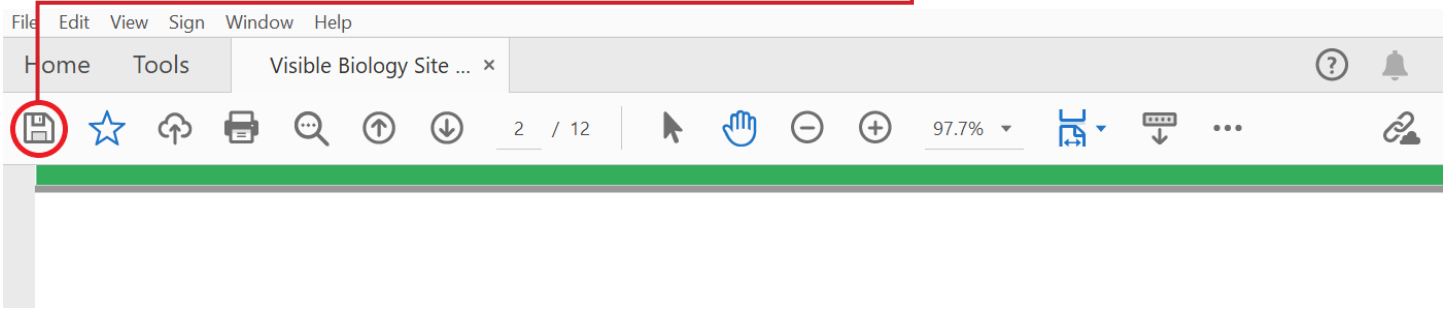
1. Have Adobe Reader installed on your computer.
   Windows: https://get.adobe.com/reader/
   Mac: https://helpx.adobe.com/acrobat/kb/install-reader-dc-mac-os.html

2. Download each lab file to your computer.



3. Open the downloaded file in Adobe Reader.
   Right-click on the file. In the menu that appears, go to "Open with..." and select Adobe Reader from the submenu.

4. Type your answers into the boxes to complete the lab and select the "Save" icon to save the lab.



5. Submit your saved version of the lab to your instructor via email, dropbox, Google Drive, or however your instructor has requested.

Any questions?
visiblebiology.com

Name: Date:

Biology Lab Activities: Monocot and Dicot Plant Structure

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 Biology, 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?
        i.
        ii.
    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?
        i.
        ii.

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.
    a. Monocots usually have _____ cotyledon(s), whereas dicots usually have _____ cotyledon(s). This structure is important because it supplies _____ to the plant embryo.
    b. 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.
    c. In monocots, the vascular bundles in the stem are _____, whereas in dicots, they are arranged in a _____.
    d. Monocots have flower parts in groups of _____, whereas dicots have flower parts in groups of _____.
    e. Monocots are monosulcate, meaning their _____. Dicots are trisulcate, meaning their _____.

Name: Date:

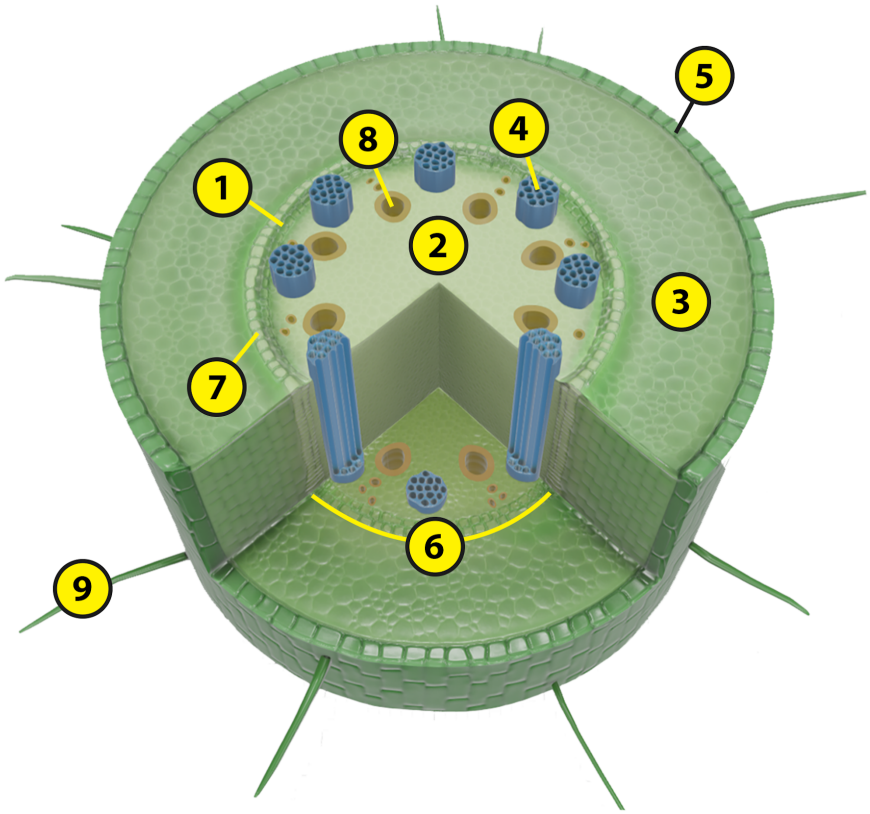
Lab 1: Monocot and Dicot Plant Roots

Activity 1: Label a monocot plant root

1. Launch the view
   - Launch Visible Biology.
   - Navigate to Study/Lab Activities, and find the Monocot and Dicot Plant Structure Lab section.
   - Select view 1. Monocot Root.
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:

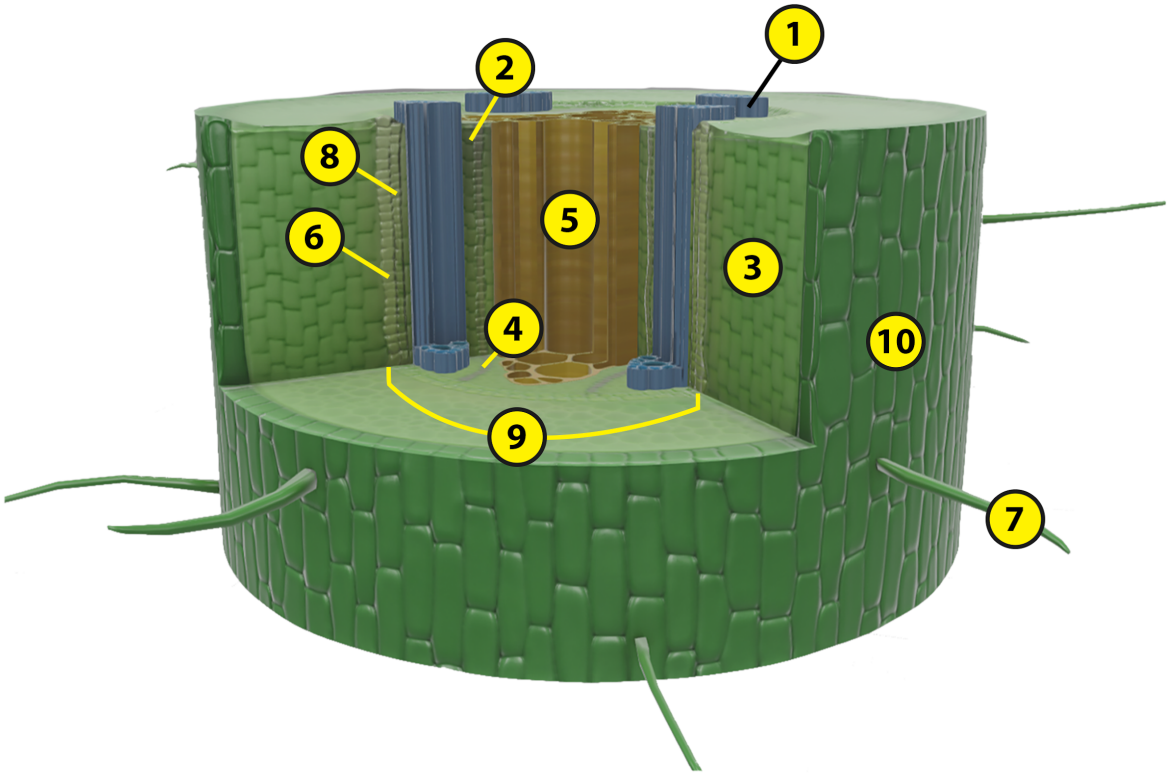
Lab 1: Monocot and Dicot Plant Roots

Activity 2: Label a dicot plant root

1. Launch the view
   - Launch Visible Biology.
   - Navigate to Study/Lab Activities, and find the Monocot and Dicot Plant Structure Lab section.
   - Select view 2. Dicot Root.
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 Biology 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:

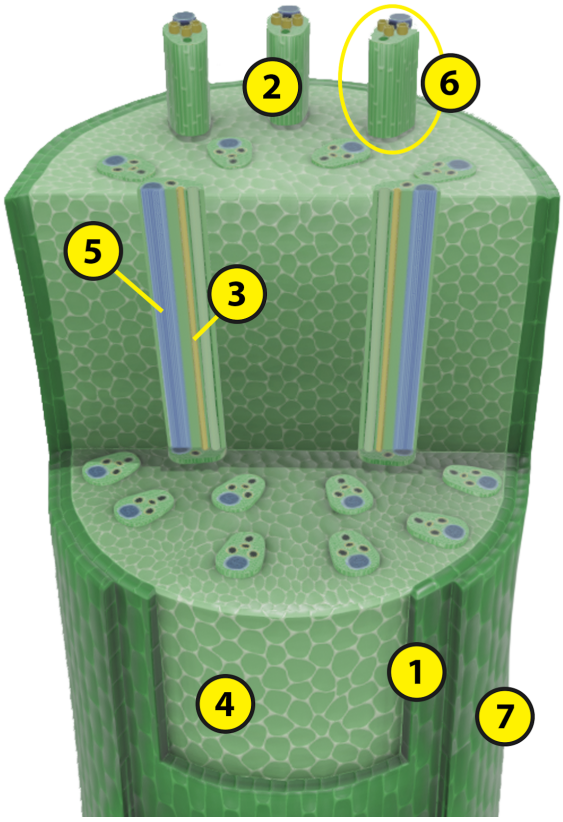
Lab 2: Monocot and Dicot Plant Stems

Activity 1: Label a monocot plant stem

1. Launch the view
   - Launch Visible Biology.
   - Navigate to Study/Lab Activities, and find the Monocot and Dicot Plant Structure Lab section.
   - Select view 3. Monocot Stem.
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:

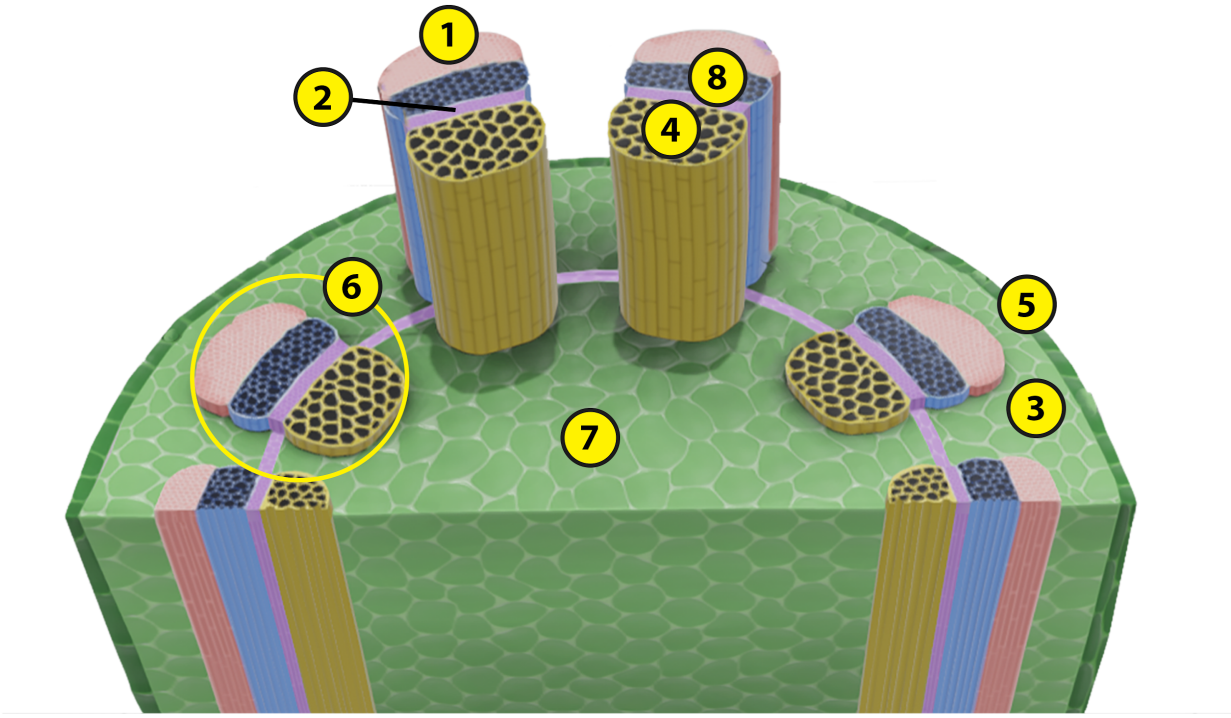
Lab 2: Monocot and Dicot Plant Stems

Activity 2: Label a dicot plant stem

1. Launch the view
   - Launch Visible Biology.
   - Navigate to Study/Lab Activities, and find the Monocot and Dicot Plant Structure Lab section.
   - Select view 4. Dicot Stem.
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 Biology 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:

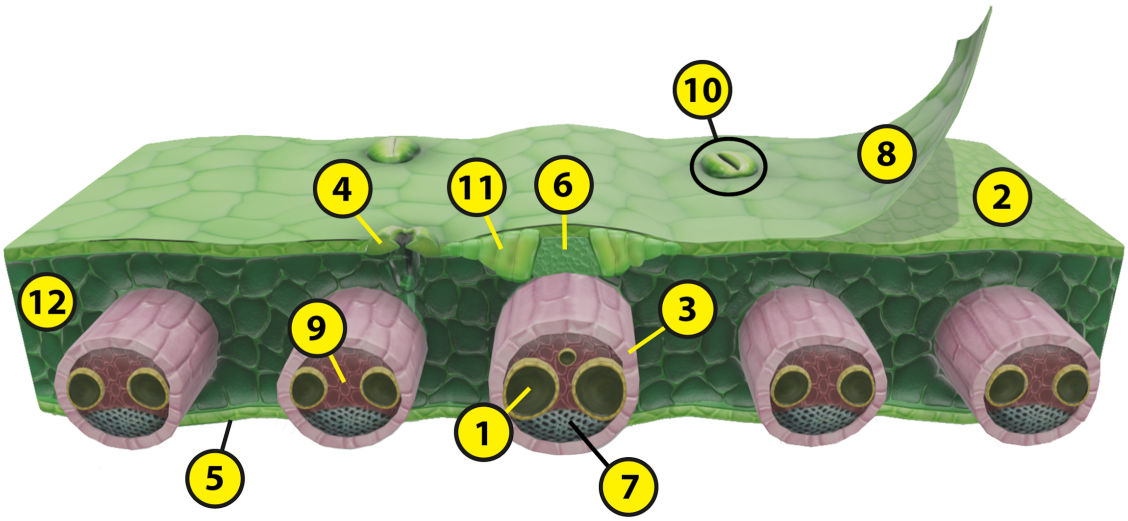
Lab 3: Monocot and Dicot Plant Leaves

Activity 1: Label a monocot plant leaf

1. Launch the view
    - Launch Visible Biology.
    - Navigate to Study/Lab Activities, and find the Monocot and Dicot Plant Structure Lab section.
    - Select view 5. Monocot Leaf.
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	___	Guard cell	___	Sclerenchyma	___
Bundle sheath	___	Lower epidermis	___	Stoma	___
Collenchyma	___	Mesophyll	___	Upper epidermis	___
Cuticle	___	Phloem	___	Xylem	___



Name: Date:

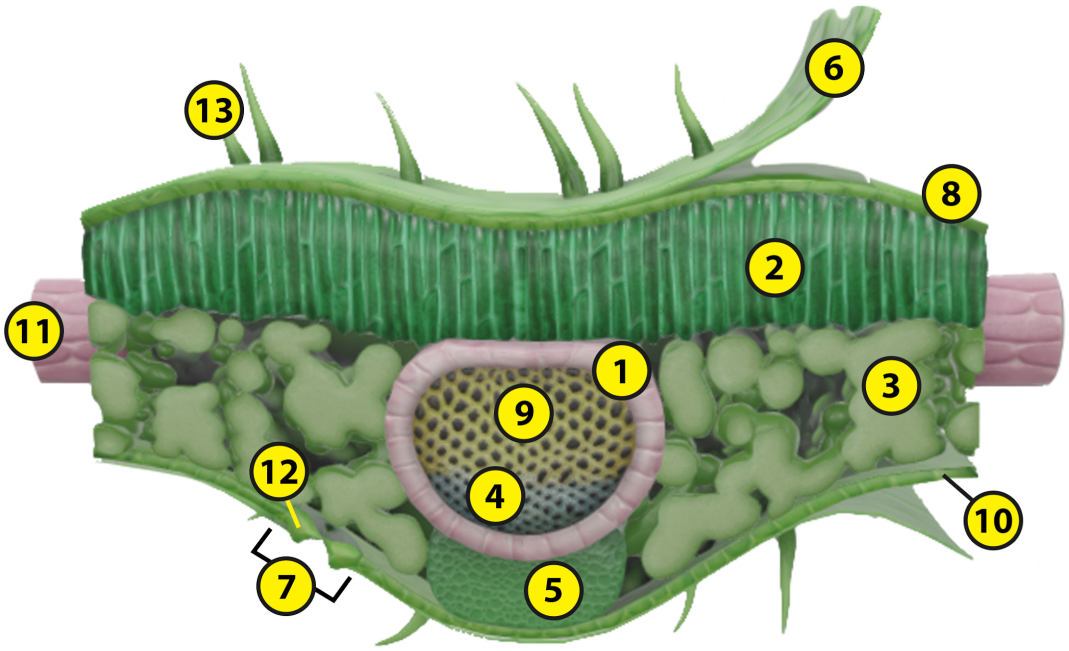
Lab 3: Monocot and Dicot Plant Leaves

Activity 2: Label a dicot plant leaf

1. Launch the view
   - Launch Visible Biology.
   - Navigate to Study/Lab Activities, and find the Monocot and Dicot Plant Structure Lab section.
   - Select view 6. Dicot Leaf.
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 Biology 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 Biology, 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 Biology, 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 Biology, to answer the following questions on the ground tissue of plants.

1. What are the three main types of ground tissue cells?

1. 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.

2. Which parts of roots, stems, and leaves are composed of ground tissue?