Chapter 23 **Roots, Stems, and Leaves** **Name ________________**

Lab Leaf Structures

Pre-Lab Discussion

Leaves are specialized organs found on the stems of plants. The most important function of the leaf is to carry out the process of photosynthesis. All of the necessary raw materials for photosynthesis come together in the leaf. The xylem conducts water to the leaf. Carbon dioxide in the air enters through the stomata (singular, stoma), or pores, in the leaf. The chloroplasts in the leaf capture the light energy needed to convert water and carbon dioxide into RuBP, PGAL, and ultimately, glucose.

Most leaves have large, thin, flattened sections called blades. The blade is attached to the stem by a thin structure called the petiole. Leaf blades occur in a variety of shapes and sizes. Simple leaves have only one blade and one petiole. Compound leaves have several blades, or leaflets, that are joined together and to the stem by a single petiole. The leaflets of some compound leaves spread out like fingers on a hand. The leaflets of others grow in pairs along a long central petiole. The leaflets of still others are arranged on petiole-like structures, which, in turn, are arranged around a long central petiole.

In this investigation, you will identify some of the specialized structures of a leaf. You will also see how leaves vary in size and shape.

Problem

What are some structures of a leaf?

Materials (per group)

Dicot leaf	Monocot leaf
Conifer (pine) leaf	12 different leaves or a commercial set of different leaves
Prepare slide of a cross section of lilac leaf	Microscope

Procedure

Part A. Observing External Leaf Structure (optional activity)

1. Obtain a dicot leaf, a monocot leaf, and a conifer leaf.

2. Begin with the dicot leaf. Its main veins will have a net-like appearance. Note the color of the upper and lower surfaces of the dicot leaf.

3. Identify the blade and the petiole. Observe the midrib, or large central vein that ruins the length of the leaf. Look for smaller veins that branch out from the midrib to all parts of the blade. In the appropriate place in Observations, sketch the dicot leaf and label the blade, petiole, midrib, and smaller veins.

4. Observe the shape of the monocot leaf. Examine the leaf veins. The main veins will appear to be parallel to each other. Note that the lower edge of the leaf blade surrounds the stem, forming a sheath. In the appropriate place in Observations, sketch the monocot leaf and label the blade, sheath, stem, and veins.

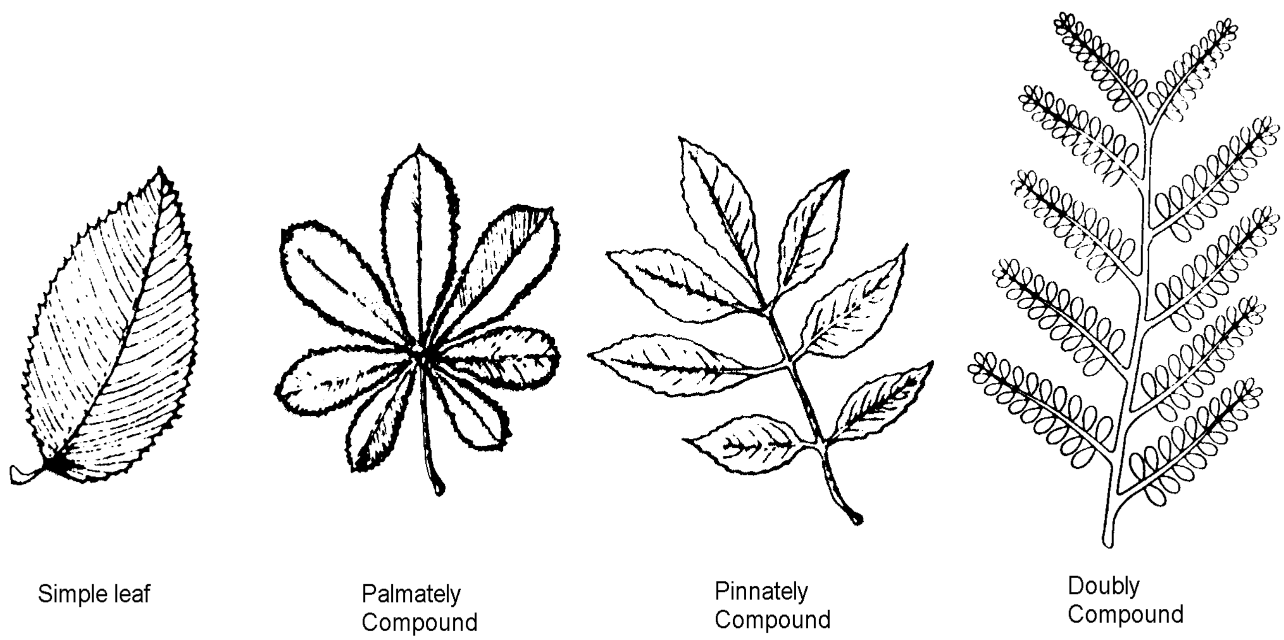
5. Examine the shape of the conifer leaf. If its from a pine, the leaves are found in clusters that are enclosed by a scaly sheath. Pine needles grow in groups of two, three, or five, depending on the species you have selected. In the appropriate place in Observations, sketch the pine leaf and label the blades and the sheath.

Part B. Classifying Leaves

1. Use a commercial set of leaves that your teacher will provided. Find the common name for each of the 12 different leaves. Record each leaf name in the appropriate place in the Data Table 1.

2. Classify each leaf as simple or compound. Compound leaves may be further classified into palmately compound leaves, which have several leaflets that arise from the tip of the petiole, and pinnately compound leaves, which have leaflets that run along opposite sides of an extension of the petiole. Use Figure 1 to identify each leaf type. Record the leaf type for each leaf in the appropriate place in the Data Table 1.

Figure 1 Leaf Types



3. Observe the venation, or vein pattern, of each leaf. In parallel venation, several main veins run the length of the leaf. Most monocots have parallel venation. In net venation, a net-like pattern of veins spreads throughout the leaf. Most dicots have net venation. Record the type of venation for each leaf in the Data Table 1.

4. Observe the pattern of the leaf margins. The margin refers to the edge of a leaf. Use Figure 2 to identify the types of leaf margins. Record the type of leaf margin in Data Table 1.

5. Figure 3 shows the different arrangements for leaf attachment. In an opposite arrangement, the leaves are arranged opposite each other on the stem. In an alternate arrangement, the leaves are attached at alternate positions on the stem. In a whorled arrangement, several leaves arise together around one part of the stem. In the blanks beneath each stem in Figure 3, identify the type of leaf arrangement each stem displays.

Figure 2 Leaf Margin Types

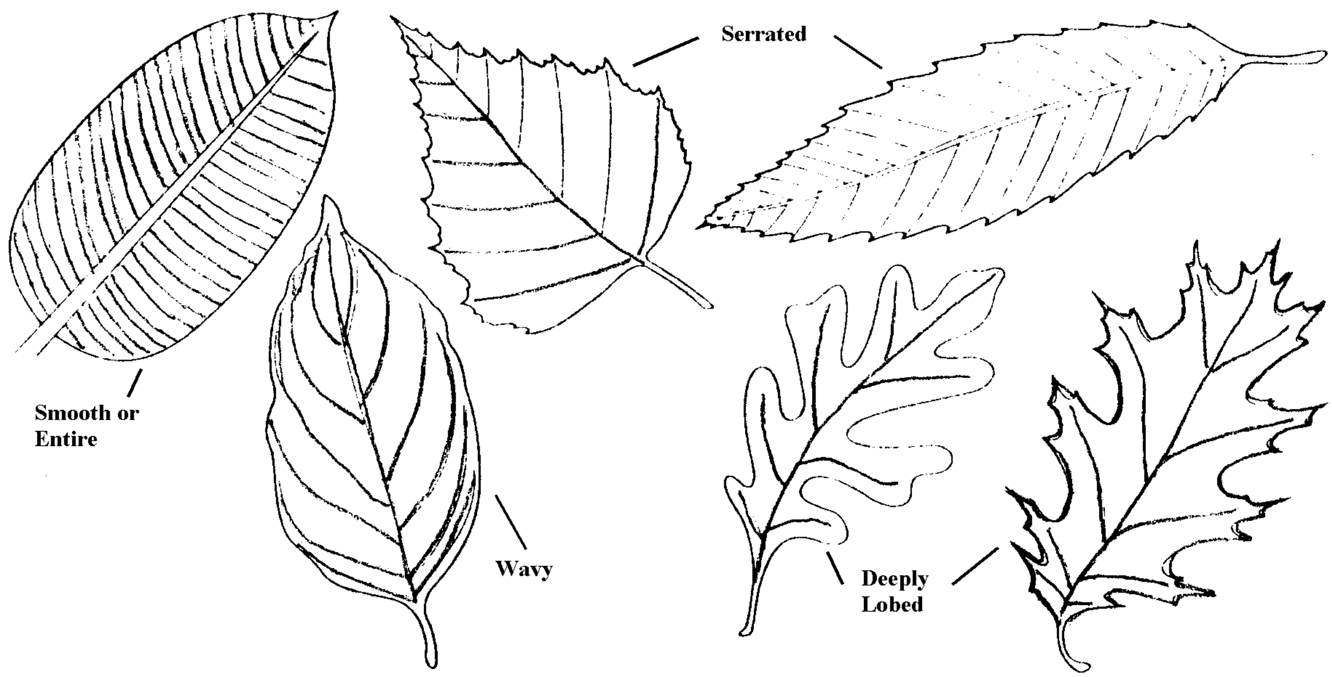


Figure 3 Leaf Arrangements

A. ______________________ B. ______________________ C. ______________________

Part C. Examining a Cross Section of a Dicot Leaf

1. Examine a prepared slide of a privet or lilac leaf cross section under the low power objective of the microscope. Notice the arrangement of the various layers of the leaf. Identify the upper epidermis, or the top layer of the leaf. Locate the lower epidermis, or bottom layer of the leaf. Epidermal hairs, which cut down the intensity of bright light and slow down water evaporation, may be present. These hairs may make the leaf surface feel fuzzy.

2. Switch to the high power objective. **CAUTION**: When switching to the high power objective, always look at the objective from the side of the microscope so that the objective does not hit or damage the slide. Locate the upper and lower epidermis. Note the size of the epidermal cells. Cells in the epidermis secrete a waxy substance which covers the entire leaf and prevents the leaf from drying out. Label the upper and lower epidermis and the cuticle on the leaf diagram in Observations.

3. Move the slide so that you can focus on the lower epidermis. Look for stomata, or pores, in the epidermis. Locate some guard cells that border each stoma. These specialized cells control the opening and closing of the stomata. On the leaf diagram in Observations, label a stomata and its guard cells.

4. Locate a layer of elongated rectangular cells just below the upper epidermis. These cells are called palisade mesophyll cells. They contain many chloroplasts, which appear as tiny green bodies in the cells. Label a palisade mesophyll cell and a chloroplast on the leaf diagram in Observations.

5. Observe the irregularly shaped spongy mesophyll cells just below the palisade cells. Spongy mesophyll cells contain fewer chloroplasts than the palisade mesophyll cells. The spongy cells form a honeycomb pattern with intercellular air spaces, which connect with the stomata in the lower epidermis. Together, the palisade and spongy mesophyll cells make up the mesophyll layer. Label a spongy mesophyll cell, and an air space on the leaf diagram in Observations.

6. Move the slide sideways and locate the circular structure called a vascular bundle in the mesophyll layer. Label a vascular bundle on the leaf diagram in Observations.

7. Locate some xylem and phloem cells within the vascular bundles. Xylem cells generally have thick walls and are bunched near the top of a leaf vein. Phloem cells are thinner and are located near the bottom of a leaf vein. Surrounding and supporting a vascular bundle are cells forming the bundle sheath. Label the xylem, phloem, and bundle sheath on the leaf diagram in Observations.

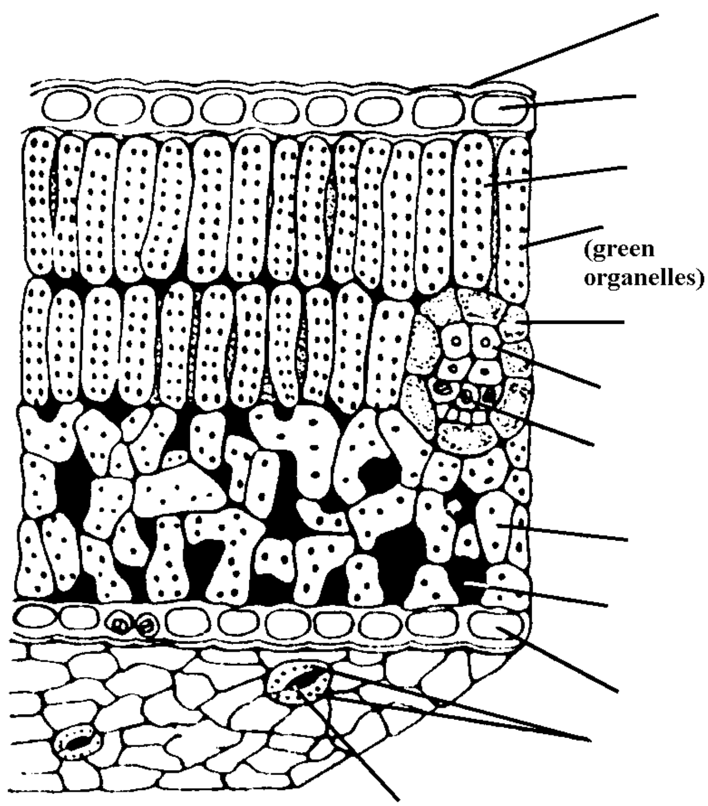
Observations

Dicot Leaf	**Monocot Leaf**	**Conifer Leaf**

Data Table 1

Number	Plant Name	Leaf Type (simple or compound)	Leaf Venation (pinnate, palmate, or parallel)	Leaf Margin (smooth, wavy, serrated, or lobed)
1	Virginia Creeper			
2	Willow			
3	Rose			
4	Honeysuckle			
5	Maple			
6	Smartweed			
7	Cottonwood			
8	Morning Glory			
9	Magnolia			
10	Elm			
11	Ginkgo			
12	Oak			

Diagram of a Dicot Leaf



Analysis and Conclusions

1. Which surface of the leaf, upper or lower, contains the most chlorophyll? Explain why.

2. How is the structure that attaches the leaf to the stem different in monocots as compared to dicots?

3. How are the veins important to the leaf's function?

4. How does the conifer (pine) leaf differ from the dicot leaf?

5. Consult Data Table 1. How many dicot leaves did you examine?

6. How do the stomata and air spaces in the spongy mesophyll work together to help the leaf perform photosynthesis?

Critical Thinking and Application

1 A cross section of a pine leaf would show a thickened cuticle and a thickened epidermis. How does this design help the pine leaf survive in the northern parts of the United States?

2. Some people mist their house plants with water. Do you think the plant can absorb the water through its leaves? Explain your answer.

3. The gypsy moth, *Lymantria dispar*, is an insect that is responsible for damaging millions of kilometers of trees in northeastern United States. The larval stage of this insect is a caterpillar that feeds on the leaves of trees, particularly oak and apple. How do you account for the fact that after a few years of repeated defoliation by these insects, trees often die?

4. In order to keep your house plants healthy, why should you periodically remove dust from their leaves?