

OVERVIEW: Beginning with Chapter 14, you will be applying your knowledge of *plant cells* (Chapter 3) and *tissues* (Chapter 12, 13) to the study of the three major plant organs--*leaves, stems, and roots*. Thankfully, you already have the bulk of the "vocabulary" of plant anatomy necessary to appreciate the anatomy and physiology of these *organs*. Therefore, this *Study Guide* will switch to a less detailed outline format with more emphasis on study questions to foster a "problem-solving approach."

PROCEDURE: Chapter 14 discusses "Stems", and then "Leaves" in the second part. Skip to page 313 and begin with "Leaves." As you read, recall your laboratory experiences with leaves (Lab #1, Field Botany; and the recent lab on "Leaves"). Study the Outline on the next page, then answer the questions below in preparation for lecture. Write out answers to each of them.

THEMES: Leaves come in an incredible variety of shapes and sizes depending upon their functions. They function primarily as solar collectors and converters of light to chemical energy. Leaves develop from leaf primordia, outgrowths from the stem axis at the apical meristem.

LECTURE DISCUSSION QUESTIONS:

1. Given the variety of MORPHOLOGY and FUNCTION (see Outline, next page), is it possible to have a consistent definition of a "leaf?" If so, can you define "leaf?"
2. What morphological features of leaves favor light interception and CO₂ absorption? What other physiological reality do leaves of land plants encounter which is "at odds" with light interception and CO₂ absorption?
3. In light of your answer to #2, discuss how the various tissues of a typical mesomorphic leaf such as *Syringa* (lilac) function to handle the "physiological dilemma."
4. *Zea mays* and other grass leaves, and *Pinus* sp. leaves (refer to lab manual) are a bit more drought-adapted, or xeromorphic, than *Ligustrum* or *Syringa* leaves. What particular anatomical features of grass and pine leaves improve fitness to arid conditions?
5. What is *abscission*? Why is formation of an *abscission layer* important? What purposes are fulfilled by abscission?

SLIDES: At the BIO 134 Home Page, click on "Botany Laboratory Slides", then "PLANT ANATOMY/MORPHOLOGY" slides.

STUDY OUTLINE

L E A V E S

III. LEAVES COME IN THE FOLLOWING INCREDIBLE VARIETY:

A.. SPECIALIZED IN **FUNCTION**: [Complete the following from your reading.]

1. Insect-trapping – Examples: _____
 NOTE: Provides nitrogen from animal protein in low-nitrogen bog communities
2. Flowerpot leaves (“tank epiphytes”) -- Water- and debris-trapping; no roots to soil
3. "Grabbing leaves" – tendrils stabilize vines, etc. Examples: _____
4. "Prickling" – spines (modified pointed leaf) ; *e.g.* barberry;
 or stipules (outgrowths at base of leaf petioles) *e.g.* black locust
5. "Reproducing Leaves" -- "pregnant plant" (*Kalanchoe*); plantlets in margins (asexual)
6. "Storing Leaves" -- *e.g.* *cotyledons* are embryonic leaves that store energy
7. "Impalatable Leaves" -- *e.g.* willow leaves release volatile signals to neighboring trees when caterpillars attack, causing neighbors to produce compounds to reduce digestibility
8. "Life cycle-Altering Leaves" -- insect ingests compounds that affect development

B. OTHER **MORPHOLOGICAL** VARIATIONS:

1. SHAPE -- SIMPLE *versus* COMPOUND
 -- TOOTHED or LOBED *versus* ENTIRE
2. VENATION -- Monocots (parallel) *versus* Dicots (net venation) [See Netsites]
3. ATTACHMENT -- OPPOSITE *versus* ALTERNATE *versus* WHORLED
4. ENVIRONMENT
 - a. AERIAL *versus* AQUATIC LEAVES
 - b. SUN *versus* SHADE LEAVES
 - c. HYDROMORPHIC *versus* MESOMORPHIC *versus* XEROMORPHIC
 (adapted to wetlands) (adapted to moist soil) (adapted to dry soil)
 (*e.g. Elodea*) (*e.g. Syringa*) (*e.g. Pinus* and *Ammophila*)
 - d. SEASONAL -- DECIDUOUS *versus* EVERGREEN LEAVES

II Use your text, Chapter 14, and your Laboratory Notes/Illustrations to answer LECTURE DISCUSSION QUESTIONS and master some of the topics of “LEAF ANATOMY AND PHYSIOLOGY”