Leaves, physical factors, and adaptations Lab.

Today's lab has three main parts, all of which have to do with a plant's various ways of adapting to their environments and the pressures, both biotic and abiotic, that they encounter.

- **<u>Part one</u> is about leaves-types and internal structure.**
- **<u>Part two</u> is about adaptations to living in wet, salty, and dry habitats.**
- **<u>Part three</u> is about allelopathy and secondary compounds – you'll have to tell me the answer here.**

PART I. LEAVES

In this part of the Lab today, you will be doing the following

- Internal structure of a mature leaf
- External morphology of a leaf
- Leaf types
- Specialized leaves

NOTE the following:

- Vascular bundles with xylem and phloem
- The midrib
- Cuticle (is there one?)
- Epidermis (upper and lower)
- Guard cells and stomata
- *Spongy* parenchyma (mesophyll) and *palisade* parenchyma (mesophyll), and air spaces
- *Where are the stomata located? Why?*
- Collenchyma cells
- Trichomes
- What is different about a conifer (pine) leaf?
- <u>External morphology</u>: know how to classify type of leaf as well as if it isd monocot or eudicot:
  - Petiole
  - Blade
  - Branch buds
  - Simple leaves: palmate, pinnate
  - Compound leaves: pinnate, palmate, double compound
- Types of specialized leaves

Internal structure of a mature leaf

1. Obtain a living Eudicot leaf and look at it under the *dissecting* microscope. Where are the stomata? On the upper or lower surface? Or both? Try several different kinds of plants/leaves.

2. Examine a slide of a cross section of a lilac leaf under the low power. Note the **vascular bundles** throughout and the difference in size from the very large central **midrib** cut across to lesser sized bundles cut both across and longitudinally.

3. At a higher power locate the **cuticle**, **upper** and **lower epidermis**, **guard cells**, **palisade parenchyma** (or palisade mesophyll), **spongy parenchyma** (or spongy mesophyll) with **air spaces**. In a vascular bundle locate the **xylem** and **phloem** and in the midrib the surrounding and reinforcing **collenchyma**. The smaller bundles also have a small **bundle sheath**. The epidermis bears mushroom shaped "hairs" called **trichomes**. Do not confuse them with guard cells. Some trichomes are hairs, while others specialize in secretory functions (like salvias – smelly!)

4. Study the slide of a cross section through a pine needle (there are often two together on the slide) and note the heavily cutinized **epidermis**, the sunken **stomata**, (What are these adaptations for?) the **cortex**, (equivalent of mesophyll) and the central vascular bundle of xylem and phloem. The vascular bundles are surrounded by a layer of heavy–walled cells called **endodermis** which prevents excess water loss from the vascular bundle.

External morphology and leaf types

1. Examine the various leaves provided and note the **petiole** or stalk of each and the expanded **blade** or lamina. At the base of the petiole there may be leaf-like stipules. Some will have **branch buds** in the axils (between the leaf and the stem). Note that some are **simple**, that is, one blade per petiole, others are **compound** and have several **leaflets** per petiole. Each leaflet is attached by a **petiolule**. The compound leaves may have the leaflets arranged on either side of the petiole and are said to be **pinnately compound** or the leaflets may radiate out in several directions from the tip of the petiole and be **palmately compound**. The vascular tissue in the leaf is visible as **veins** throughout the leaf. Note the different patterns of venation. Most monocots have **parallel venation** and most eudicots have **netted venation** which may predominantly be **palmate** or **pinnate**. Note that leaves are arranged differently on the stem in different species. They may be opposite, alternate or whorled. The arrangement is called **phyllotaxis**.

2. <u>Specialized Leaves</u>

Note the following:

- "Needles" of Pine trees which are typically borne in bundles on very short branches
- Needles of other kinds of conifers
- Scale-like leaves of the Cypress which overlap
- Bud scales
- Leaves reproducing the plant asexually in the Kalanchoe
- The leaves of the insectivorous plant which digest small insects
- The red "flower" of the Poinsettia are really showy red leaves or bracts around the small inconspicuous flower. The same is true of the "petals" of the dogwood "flower". These white structures are leaves.

Part II. PLANT ADAPTATIONS: IDENTIFYING XEROPHYTES, MESOPHYTES AND HYDROPHYTES

Water is one of the basic raw materials of photosynthesis. It is the major component of plant tissues, making up 90% of the plant body. Water is the substance in which most materials enter and leave the cells of plants, and it is the solvent for the biochemical reactions which occur in living cells.

The amount of water used by plants is much greater than that used by animals because of **transpiration**. Over 90% of the water waken in by the root system is evaporated into the air as water vapor. Consequently, plants have developed extensive and efficient transport systems and numerous morphological adaptations to conserve water. In this exercise, you will work with a partner to try to determine the habitat of various "mystery plants."

Many types of habitats can be found in nature with respect to water supply. These can be divided into **xeric, mesic, and hydric** habitats. The plants that are adapted for living in these habitats are called *xerophytes, mesophytes,* and *hydrophytes*, respectively. **Xerophytes** include a number of species that live in habitats where the supply of water is deficient. **Mesophytes** inhabit regions of average water conditions, and include the majority of wild and cultivated plants. **Hydrophytes** form an extensive flora living on the surface of water or submerged at various depths.

In this exercise, you will examine prepared slides of plant tissues and attempt to determine whether a plant is a xerophyte, a mesophyte, or a hydrophyte based on its visible characteristics. You should base your decisions on the following list of adaptations.

The following categories are not always sharply defined….

Mesophytes are plants that generally grow in regions of moderate water supply. They are the common plants of temperate forests, grasslands and medows. Sometimes they are differentiated into ‘sun’ and ‘shade’ forms.

Halophytes are plants that grow in salty soils or water where the high salt concentrations make water osmotically unavailable to them. They live in essentially physiologically ‘drought’ conditions, and resemble xerophytes.

Hydrophytic adaptations (aquatic plants, either floating or submerged): The chief modifications exhibited by hydrophytes are an increase in leaf surface, the presence of air chambers (will look like empty spaces), and a reduction in protective, supportive, and conductive tissues. Stomata, if present, are on upper surfaces only as that is the surface exposed to air. These are plants that grow in wet habitats.

Xerophytic adaptations (desert plants, including cacti and succulents): The chief modifications exhibited by xerophytes are sunken stomata, hairy leaves, thick protective cutin, very well developed supporting tissues. Some have leaves capable of rolling up tightly and others possess large amounts of water storage tissues. (These are called fleshy xerophytes.)