Laboratory 1: Vegetative Morphology

**Purpose:** The purpose of this lab is to familiarize you with general plant morphology and anatomy and to introduce, or perhaps refresh, some basic terms that are used to describe the vegetative (non-reproductive) features of vascular plants. (Next session we will have a similar lab covering reproductive morphology.) It is not necessary at this point to consider the taxonomy of the specimens you will be examining. Rather, the lab is designed to show you some of the diversity in vascular plant structure and to discuss some of the terminology that plant systematists use to describe that diversity. Despite all of the variation in form, it is important to remember that plants are composed of only three organs: leaves, stems and roots. All of the structural diversity that exists among vascular plants is based on modifications of each of these three organs.

**Procedure:** As you examine the material on display be sure to note the differences in the vegetative portions of the shoot of different specimens. Additionally, you should be able to identify and briefly characterize those structures/features in **BOLD** print. This lab focuses on leaves, but you should also pay attention to the overall stem morphology as well.

Examine each of the specimens on display for the features discussed below. Be sure to note whether the leaves are simple or compound, and if compound if they are pinnately or palmately compound. Also note their shape and how they are inserted along the stem.

*Tips:* At this point you do not need to memorize the plant names, as we are only concerned with the general morphology of plants as a whole. Take the time to draw examples of the features in bold below – even if you do not consider yourself a good artist, drawing is probably the best way to learn the material in this class. Not all of the terms are defined for you below, so be sure to be clear on their definitions before you leave lab. See Chapter 9 (p.347-407) in Simpson for additional assistance.

**Basic Structure** - The leaves are typically the major photosynthetic organ in the majority of vascular plants and, in most cases, can be divided into two distinct regions: the **blade** or lamina (the expanded portion of the leaf), and the **petiole** (the stalk which attaches the leaf to the stem). The blade can also be divided into the **leaf base** (towards the petiole) and the **apex** (away from the petiole). If a petiole is absent (i.e. the blade is attached directly to the stem) the leaf is said to be **sessile** on the stem. If a petiole is present, the leaf is said to be **petiolate**.

**Division** - **Simple** leaves are those in which there is only a single blade. When more than one blade is present the leaf is **compound** and each blade is called a leaflet or **pinna** (pl. pinnae). These leaflets can arise from a common
point at the tip of the petiole (i.e. a **palmately compound leaf**) or they can be arranged along an extension of the petiole, called the **rachis**, in a pinnate fashion (i.e. **pinnately compound leaf**). Additionally, pinnately compound leaves can be once, twice or even three times pinnately-compound (see fern specimen on display).

**Vasculature** - Leaves, or leaflets as the case may be, also have characteristic arrangements of vascular tissue, the so-called "veins" of the leaf. Most dicotyledonous plants (dicots) have either a **pinnate venation** in which secondary or lateral veins arise from a primary vein or midvein running the length of the leaf or a **palmate venation** in which several (or more) major veins originate from a common point. A third type of venation pattern, **parallel venation**, is typical of many monocotyledonous plants (monocots) such as grasses.

**Morphology** - Leaves also exhibit differences in the overall shape of the blade ranging from **scale** or **needle-like** (as in many conifers) to **linear to lanceolate to elliptic and orbicular**. The leaf blade base can be **acute, obtuse, rounded, cordate or peltate**. Yet another important feature of leaf blades is the type of **margin** (leaf edge) they possess. If there are no indentations of any kind along the margin the blade is said to be **entire**. Alternatively, the margin may be variously toothed (i.e. **serrate, dentate or crenulate**). Leaf blades may be **pinnately-lobed**, such as in many Oaks (**Quercus**), or **palmately-lobed** as in Maples (**Acer**) or Sweetgum (**Liquidambar**).

**Arrangement** - Leaves can be inserted along the stem in either an **alternate, opposite or whorled** fashion. The point at which a leaf (or leaves) attaches to the stem is called a **node** and the region of the stem between two adjacent nodes is an **internode**. In many, but not all flowering plants there is oftentimes an additional structure, called a **stipule**, at each node along the stem. Depending on the particular plant, the stipule may be attached either to the leaf base or directly to the stem. Stipules vary greatly in shape and size and can be minute and deciduous (i.e. falling away) or persistent and enlarged, sometimes to such an extent that they become the major photosynthetic organ. Also associated with each leaf/node an **axillary** or **lateral bud**. These buds may be either exposed (i.e. "naked") or surrounded by two or more **bud scales**. In addition to lateral buds, there are also **terminal buds** at the tip of the shoot. Both types of buds are **meristematic**, that is they contain a region of actively dividing, undifferentiated cells that produce new (primary) growth. In the case of lateral buds, their growth results in new branches (and possibly flowers) being formed.

**Questions:**

- What might be some problems of trying to use words such as **lanceolate** or **elliptic** to describe a character such as leaf shape?
- The features listed above are just a few that vary prominently between taxa. What are some other features of leaves and stems that may differ significantly?