

## CHARACTERS USED TO PLACE PLANTS INTO MAJOR GROUPINGS

### BACKGROUND

Experts disagree on whether plants colonized land 700 million years ago (DNA evidence) or as late as 440 million years ago (fossil data). As early as 700 million years ago, a significant ozone layer had developed, allowing organisms to move on land in a milder global climate. By 440 million years ago, extensive shallow seas were formed. The first plants to attempt to colonize land faced considerable problems despite an inviting climate and ample land access. Solar radiation could still damage delicate tissues, desiccation could more easily occur, and new ways other than by swimming in water had to be found for plant sperm to find eggs for fertilization.

The solutions, or adaptations to life on land, reflect features that are still used for grouping organisms within the kingdom Plantae. The following characters/traits will help you familiarize yourself with the major changes in lifestyle, or adaptations, that took place within the kingdom.

### CHARACTERS IN KINGDOM PLANTAE FOR WATER-TO-LAND TRANSITION

**Cuticle:** A waxy layer found on the outer surface of some plant tissues that prevents water loss.

**Stomata:** Openings in a cuticle that allow for gas exchange in plants (note: stoma is the singular form). Think of the pores in your skin. See Figure 1.

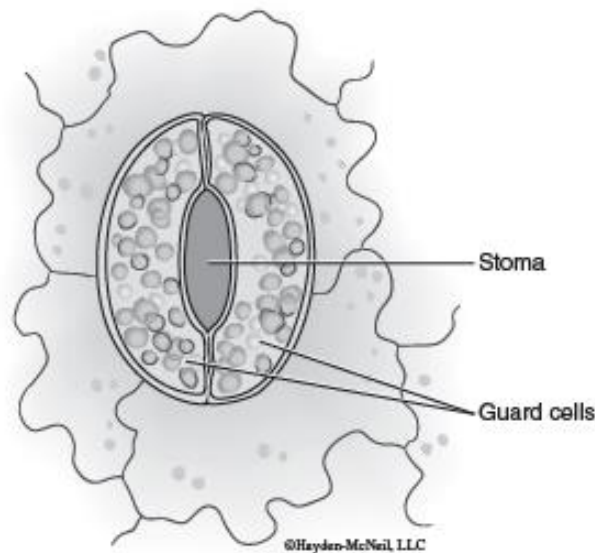


Figure 1. Plant Diagram of a Stoma and Associated Cells

**Vascular tissue or xylem:** Internal conducting tissue that functions to maintain and regulate water supply within plant. Xylem cells have thick, strong cell walls that provide strength and support for larger plant growth. Xylem cells can accumulate in some types of plants to form wood. Plants without vascular tissue rely on diffusion of water from the environment directly into the plant for required moisture. See figures 2 & 3.

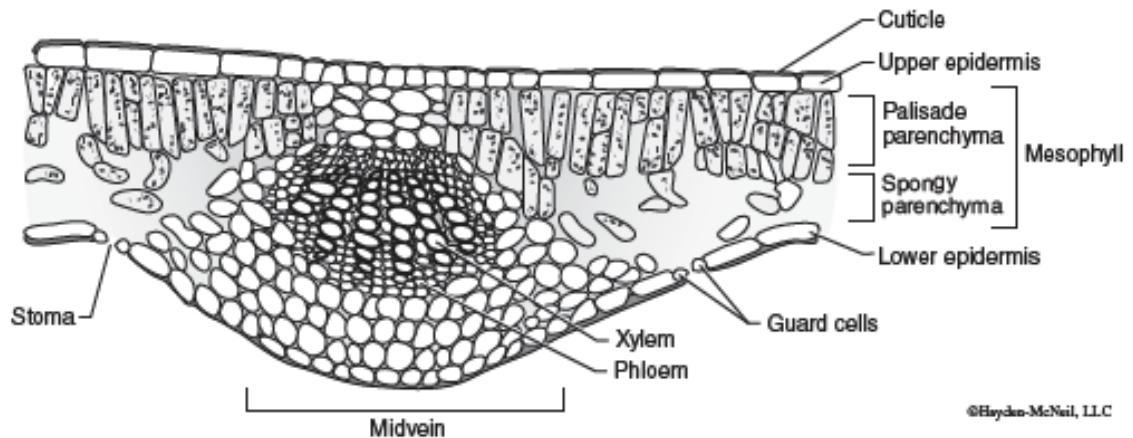


Figure 2. Cross Section of Lilac Leaf

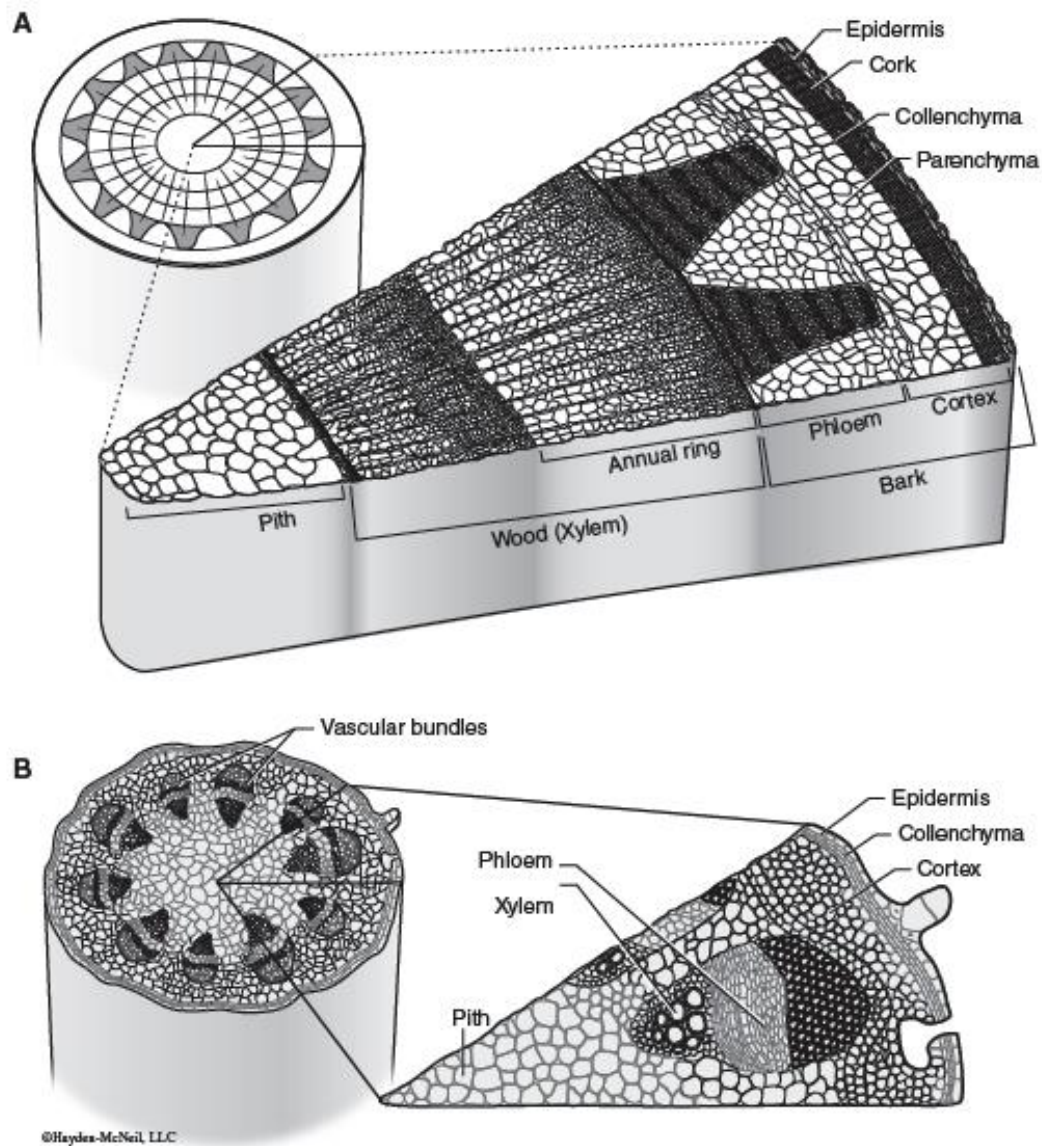


Figure 3. Cross Sections of Plants. (A) *Tilia sp.*, a Woody Dicot.  
(B) *Helianthus sp.*, a Herbaceous Dicot

**Dominant stage in the life cycle:** Plant life cycles involve an **alternation of generations**. Most plants have a diploid **sporophyte** stage and a haploid **gametophyte** stage that are multicellular. The relative sizes, forms, persistence, and photosynthetic abilities of the gametophyte or sporophyte stages constitute the differences between plant groups. The challenge that plants faced in order to colonize the land was to adapt alternation of generations to a drier environment. The result was the dominance of the sporophyte stage and the development of pollen. You should note the dominant stage for all plant groups investigated. Life cycle diagrams can be seen in the lab website and at the end of **Appendix F (the lab photo index)**.

**Motile sperm:** It may surprise you to know that some plants have motile sperm just like vertebrates. These plants require moist environments for the sperm to be able to swim to the egg.

**Pollen:** The immature male gametophyte stage that allows protection and transport of sperm. Plants with pollen do not require water in the environment to reproduce sexually. Pollen can be transferred from one plant to another by wind or by pollinators.

**Seeds:** Provide protection and often contain food for the developing embryo.

**Flowers and fruit:** Structures that increase fertilization efficiency and embryo dispersal. Flowers often exhibit features to attract pollinators such as shapes, colors, and rewards that have co-evolved with their pollinators. For example, moth-pollinated flowers bloom at night when moths are active. Fruits allow plants to increase their dispersal efficiency. For example, many seeds pass through animal digestive tracts where they are deposited at new locations. Some seeds with edible fruits require stomach acid scarring before they can germinate.

**Chlorophyll:** A green pigment protein molecule found in algae and plants for the absorption of light during the process of photosynthesis.

