Introduction

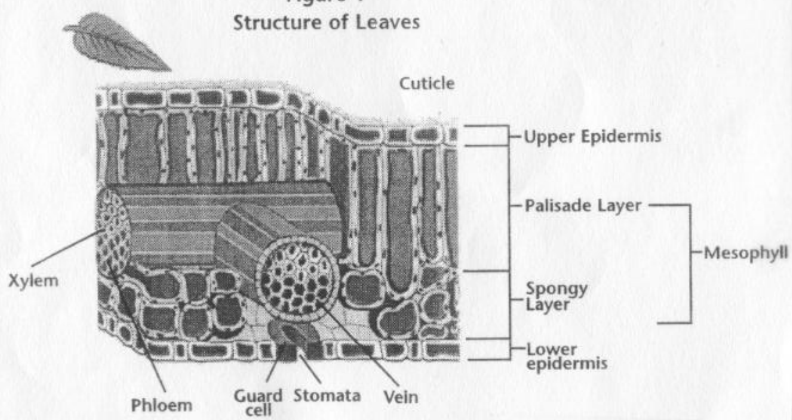
The Plant kingdom is divided into two major groups: bryophyta and tracheophyta. The major distinction between these two groups is the presence of specialized vascular tissue for the transport of water and food. While bryophytes, such as moss, lack conductive tissues, tracheophytes utilize specialized cells – xylem and phloem – for the transport of water and nutrients.

The evolution of vascular tissues and the subsequent ability to transport water and food over greater distances has contributed to the evolution of larger plants with specialized tissues and organs: roots for support and the uptake of water and minerals, stems for support of leaves, and flowers and leaves for photosynthesis. These adaptations have allowed tracheophytes to become the dominant form of terrestrial plant.

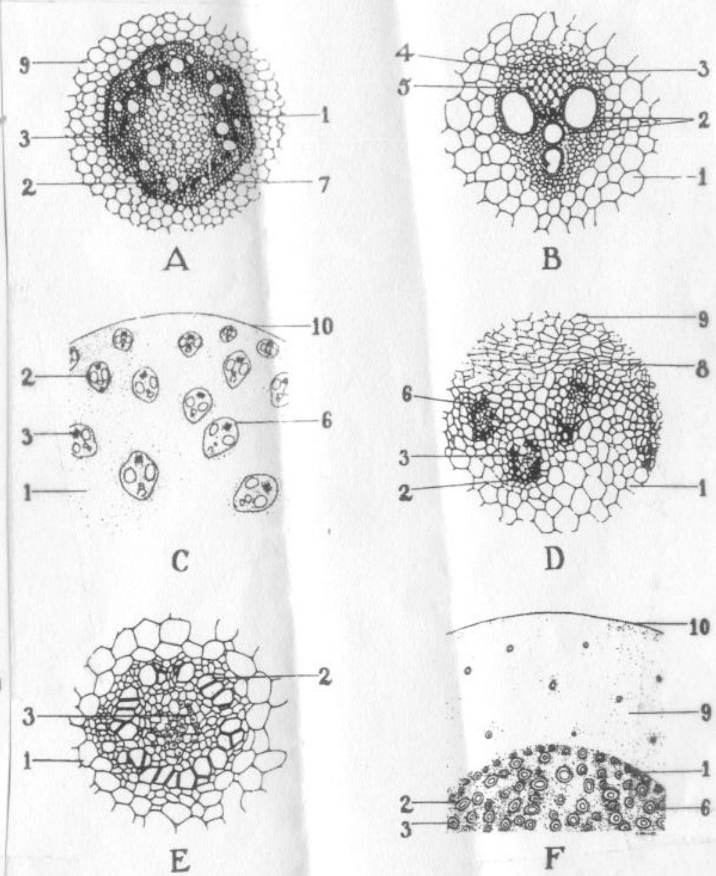
Transpiration, which is the evaporation of water into the atmosphere, occurs when the stomata opens to allow gas exchange for photosynthesis and respiration. Transpiration contributes to the transportation of minerals and nutrients, the cooling of the plant through evaporation, and the maintenance of turgor pressure.

In plants, water moves along a gradient of decreasing water potential. According to the generally accepted cohesion-tension theory, water is pulled up to the leaves of a plant by transpirational pull. When stomata are open, water transpires from the higher water potential in the mesophyll spaces to the lower water potential in the air. Decreasing water potential in the air spaces pulls water from nearby mesophyll cells, which in turn pulls water from xylem vessels in nearby veins of the leaf. Due to the cohesive nature of water molecules, when one water molecule is pulled from the xylem, more and more follow close behind in a chain of water molecules pulled upward from the roots to the leaves. The tension, or negative pressure, caused by the upward pull of the water column is so strong that the diameter of a stem actually decreases when the rate of transpirational pull is very high. This allows water absorbed by roots 60 feet deep to be transported to the leaves of the tallest redwood trees.

Figure 1
Structure of Leaves



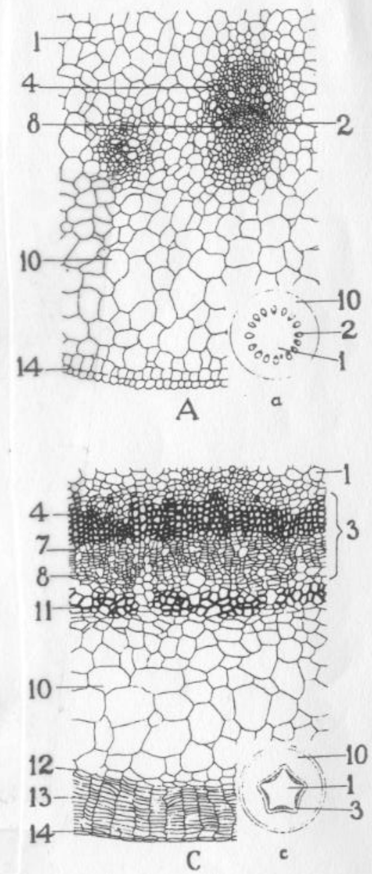
Monocot Stem Anatomy
Figure 2



A. Stele of basal internode (transition region) of corn
B. Bundle from mature corn stem
C. Part of mature corn stem showing position of bundles in typical monocot stem
D. Portion of aloe stem showing growth ring
E. Bundle of acorus

1. Ground parenchyma
2. Xylem
3. Phloem
4. Sieve tube
5. Companion cell
6. Bundle
7. Endodermis
8. Cambium
9. Cortex
10. Epidermis

Dicot Stem Anat
Figure 3



A. **Ranunculus, detail of portion of stem showing bundle**
a. Complete stem
B. **Cucurbita, detail of portion of stem showing bundle**
b. Complete stem
C. **Pelargonium, detail of portion of stem showing part of stele**
c. Complete stem
D. **Tilia, detail of portion of stem showing part of stele**
d. Complete stem

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