

Plant structure and function:

Basic plant anatomy [**OVERHEAD, fig. 31.3, p. 624**]:

- Roots:
- anchor plant
 - absorbs minerals & water
 - stores foods
- have root hairs that increase the surface area and allow water & mineral absorption.
- Shoots:
- stems, leaves & reproductive parts
 - stems: above ground, support leaves & flowers
 - leaves: main site of photosynthesis
- associated structures include:
- nodes - point where leaves are attached to stem
 - internodes - areas between nodes
 - terminal bud - at tip of stem, has developing leaves, etc.
 - axillary buds - between the leaf & stem. Usually dormant, but can start to grow if influence of terminal bud wears off (terminal bud prevents axillary buds from growing).

Roots & shoots can be highly modified by different plants [**Fig. 31.4 p. 625**]:

- Carrots & sugar beets have an enormous root that stores energy.
- strawberries have horizontal stems that run along the ground
- potatoes have tubers, enlarged areas at the ends of roots where food is stored.

Leaves can be highly modified as well.

- have many different shapes
- some are even modified as tendrils (see fig. 31.4C)

Basic plant cells:

Basic structures are familiar: nucleus, chloroplasts, vacuoles [**Fig. 31.6A, p. 628**]

May have one or two cells walls (primary & secondary).

Plant cells come in three (five?) basic types [**Figs. 31.6B - 31.6F, pp. 628 - 629**]:

- parenchyma - abundant, perform many different function:
 - food storage/photosynthesis/aerobic respiration & more

- can differentiate into other types of cells (e.g. the types below).
- collenchyma - resemble parenchyma, but have thicker primary walls.
- sclerenchyma - very thick & rigid secondary walls filled with lignin. This is the “woody” component of plants.
 - some examples of sclerenchyma cells include:
 - fibers - long slender supportive cells, often in stems.
 - sclereid - shorter, irregular, shells of nuts, etc.
- water conducting cells (generally, “xylem”) - move water around. Both have thick secondary cell walls (add structural support). Dead at maturity:
 - tracheids (long porous cells with tapered ends)
 - vessel elements (wider, shorter).
 - chaining together tracheids or vessels can make long tubes to move water long distances
- food conducting cells (generally, “phloem”) - move food around. Alive at maturity:
 - sieve tube members - only a primary cell wall.
 - companion cells assist the sieve tubes.

Plant tissue systems **[Fig. 31.5A, p. 627]**:

- Epidermis - outside covering of the plant
 - protects the plant, acts as a barrier
- vascular tissue - made up of xylem and phloem
- ground tissue - everything else. Photosynthesis, storage, support, etc.

Monocots vs. Dicots

Before continuing, we need to know the difference. Both have all the above structures, but they arrange them in different ways **[Fig. 31.2, p. 623]**.

- named for the number of seed leaves (one vs. two)
- in lab you’ll see that the arrangement of vascular tissue in the two plants

is different:

- leaves have different shapes (parallel veins vs. branched)
- # of flower parts are different (in multiples of 3 for monocots, 4 or 5 for dicots).
- the overall structure of the root is different (tap root for dicots, fibrous for monocots).

Leaves [**Fig., not in text & 31.5, p. 627**]:

petiole - the “stem” of the leaf.

blade - the leafy part of the leaf.

Leaves have many of the different tissue types in them:

- Epidermis -protects the leaf (covered by a cuticle)
- To allow air to move in or out, the epidermis is covered with stomata
 - the size of this opening is controlled by guard cells that can close or open the stomata.
 - can help prevent water loss by closing off during dry conditions.
- the ground tissue system is represented mostly by mesophyll.
 - consists of parenchyma cells specialized for photosynthesis
- running through the leaf are veins. These are bundles of vascular tissue that move fluids and nutrients around the leaf.

Plant growth:

- in general, plants grow throughout their lives (don't stop growing).
- plants are either annuals, biennials, or perennials:
 - annuals - live one year (wheat, corn, some wildflowers)
 - biennial - live two years (beets & carrots)
 - perennials - live more than two years (e.g. trees, etc.)
- plants can get old. Some giant sequoias are over 3000 years old. Some Bristlecone pines over 4000 years [**Fig., not in text**]. Most don't live that long.
- meristem are unspecialized cells that cause growth. When this makes new

branches, roots, or makes existing branches or roots longer, this is “primary growth” [Fig. 31.7A, p. 630].

- “apical” meristem is usually found at the tips of branches & roots, or at the axillary buds.

- Secondary growth - this is the widening of woody plants (e.g., how you get a trunk from a twig) [Fig. 31.8A, p. 632].

Two layers of meristem:

- vascular cambium - makes secondary xylem (more xylem) on the inside, and secondary phloem on the outside.

- the secondary xylem is composed of fibers, tracheids & vessels, and so is very strong (woody).

- over the years, it’s the secondary xylem that makes the “wood” in a tree.

- the secondary phloem never gets much thicker - it stays on the outside, and excess cells are sloughed off.

- cork cambium - makes cork. A thick outside layer that protects the tree (basically bark). As the tree grows, older cork is also sloughed off like the secondary phloem.

- Tree trunks [Fig. 31.8B, p. 633]

- dark center is heartwood. Non functioning xylem, filled with stuff to prevent rotting.

- lighter circle - sapwood. Functioning xylem

- Rays running through wood - parenchyma cells that move nutrients around.

- then the outside layers discussed above:

- vascular cambium

- bark (secondary phloem, cork cambium, cork)

- Secondary xylem cells are much larger in the spring; this gives trees in temperate climates rings (the cells put down during the rest of the year are much smaller).