Liverworts:
- Leafy structures are lobed and round; one cell thick without midribs
- They overlap and attach to the stem at a slanted angle
- Have oil bodies that secrete oils, possible for defense against herbivores
- Very thin or non-existent cuticle – dry up and rehydrate
- Leafy liverworts flourish in humid, shaded habitats and are often pioneers on rocks, tree trunks, decaying logs, stumps, and soil by streams, ponds, footpaths, and roads
- Reproduce by spores
- One-celled rhizoids (root-like structures)

Mosses:
- Small, under 7 cm in height
- Leaf-like tissue arranged spirally or alternately around a stem-like axis.
- Flattened blade and slightly thickened midrib
- “Stems” can conduct water only short distances.
- Small rhizoids (root-like structures) made of several cells that absorb water
- Reproduce by spores

Club mosses:
- Leaves are microphyls, meaning the leaf contains one unbranched strand of conducting tissue
- Individual plants connected by horizontal stems: either runners or rhizomes
- Stems are solid with simple vascular tissue
- Shallow roots
- Have vascular system, thus can grow taller, up to 25 cm.
- Reproduce by spores

Horsetails:
- Stems are jointed and photosynthetic; hollow in the center with ring of vascular tissue
- Photosynthetic branches arise from joints
- Whorls of tiny scale-like, non-photosynthetic leaves arise at each joint
- Spread by underground running stems (rhizomes) with roots at nodes
- Vascular system allows them to grow between 1-3 meters tall
- Reproduce by spores

Ferns:
- Well developed, proper complex leaves with more complex vein system
- Reproduces by spores; water dependent for sperm cell
- Spores often found on back of leaves as small brown “dots” – sori
- Vegetative reproduction as well via rhizomes that develop roots and fronds
- Some frond “stems” are hairy or scaly
- Have vascular system
Ginkgo:

- 2 lobe, fan shaped leaves with evenly forking veins; 2-3 inches long and wide
- Leathery, bright green leaves cluster at tips of short shoots along branch
- Seed resemble small plum with fleshy, ill-scented outer covering (NOT a fruit!)
- Male and female reproductive structures are produced on separate trees.
- Common urban tree because it is resistant to air pollution

Conifer: Pine

- Needles arranged in clusters of 2, 3, or 5 along stem
- Dark green, flexible needles, with lighter color on underside
- Thick cuticle and recessed stomata (look for a white line on the underside of needle)
- Male reproductive structures contain pollen; female cones contain ovules that when fertilized become seeds
- Woody stem/branch

Angiosperm: Stewartia

- Woody stem/branch
- Flowers hold reproductive structures: stamen, with pollen, and pistil, with an enclosed ovary
- Fertilization mostly through animals (insects, birds, mammals) and also wind
- Fruit containing seeds for next generation
- Seed dispersal aided by animals, wind, water, and mechanical structures

Angiosperm: Bamboo and Grasses

- Segmented, jointed stems (called culms) with nodes and internodes
- Internodes are hollow; vascular bundles throughout “ring” of culm
- Leaves grow at the nodes
- Spreads mainly through underground rhizomes/roots, with fibrous root system
- Small, inconspicuous flowers with wind pollination and wind seed dispersal
Examine the plant specimens at each station, and make a labeled sketch of what you notice. What plant features stand out the most? What plant type does it represent? What is your evidence? BIG IDEA TO CONSIDER: What evolutionary innovations do these features represent?

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CAN YOU IDENTIFY THESE MAJOR GROUPS OF PLANTS?
ARNOLD ARBORETUM, AUGUST 21, 2017

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