

Lab #1 – Angiosperm Morphology (part 1)

Main objective for this lab: To learn the different vegetative and reproductive parts of plants.

angiosperm – one of a group of plants whose seeds are borne within a mature ovary (fruit)

morphology – the study of form and its development

Lab #1 deals with the **vegetative** parts of a plant - the roots, stems, and leaves.

Objectives for this lab include:

- to learn the type of plant based on its duration of life and its seasonal changes
- to learn to recognize and name:
 - various plant **growth forms**
 - the different types of **roots**
 - basic **stem anatomy**
 - different **stem modifications**
 - various characters of **leaves** such as:
 - leaf arrangement
 - leaf complexity
 - parts of a leaf
 - leaf venation
 - leaf shape
 - leaf apices and bases
 - leaf margins
 - leaf surface
- to learn the various structural plant defenses

Type of plant based on duration of life, seasonal changes, and class:

- annual – a plant that germinates from seed, flowers, sets seed, and dies in the same year
- perennial – a plant that lives for several years; they may be woody with stems that persist above ground over the winter or they may be herbaceous with stems that die back to the ground each year
- biennial – a plant that lives for two years; usually it forms a basal rosette of leaves the first year, then flowers and fruits the second year
- evergreen – having leaves that persist for two or more seasons
- deciduous – having leaves that die or fall off in the cold or the dry season
- monocotyledon (monocot) – any of various flowering plants, such as grasses, orchids, or lilies, having a single cotyledon (embryonic leaves) in the seed
- dicotyledon (dicot) – flowering plant having two cotyledons in the seed

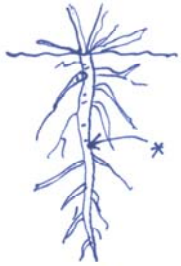
Plant growth forms (habit):

- herb – (herbaceous, *adj.*) a plant lacking woody stems
- shrub – a perennial woody plant of relatively low stature, typically with several stems arising from or near the ground
- tree – a large woody plant, usually with a single main stem or trunk

- vine – plant with a climbing or twining, woody or herbaceous stem; plants can climb by one of these methods:
 - twining – the stem wraps around an object for support
 - tendrils – modified shoots or leaves that coil around the support
 - aerial roots – small roots, often with sucker-like tips (ex. poison ivy, Virginia creeper)
- epiphyte – a plant that grows on another plant, but it does not get food or water from it
- parasite – a plant that grows on another plant and obtains some food or water from it

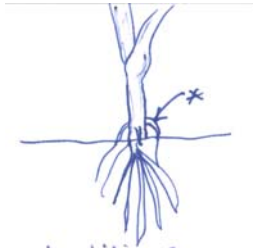
✿ Roots:

- tap root – the main root axis from which smaller root branches arise
 - fibrous roots – a root system with all of the branches of approximately equal thickness
 - adventitious roots – roots originating from sites on the plant other than their usual sites



taproot

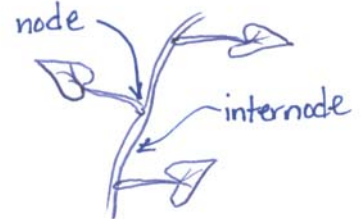
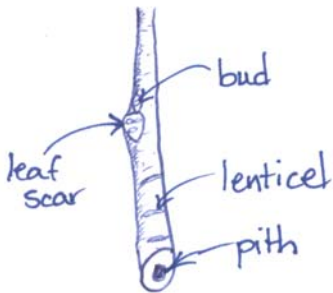
fibrous roots



adventitious roots

✿ Stem Anatomy:

- bud – a compressed, undeveloped shoot or flower; may be lateral or terminal
 - node – position on the stem where leaves or branches originate
 - internode – the portion of a stem between two nodes
 - leaf scar – mark left on the stem (or twig) after a leaf falls
 - pith – the spongy central tissue in some stems and roots
 - lenticel – slightly raised, spongy areas in the skin or bark of a stem that allow interchange of gases between internal tissues and the atmosphere



✿ Stem Modifications:

- tuber – underground stem modified for food storage; bears nodes and buds (ex. potato)
 - stolon – an elongate, horizontal, above-ground stem that roots at the nodes or tip giving rise to a new plant (like “runners” on a strawberry plant)
 - rhizome – a horizontal underground stem (ginger)
 - bulb – an underground bud with thickened fleshy scales (ex. onion)

tuber



stolon



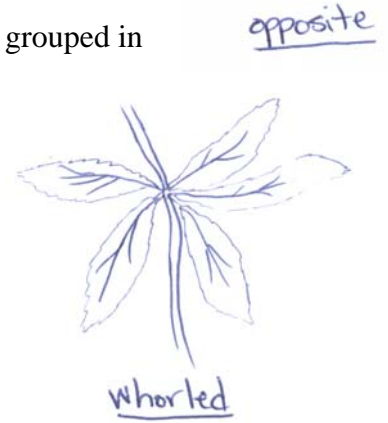
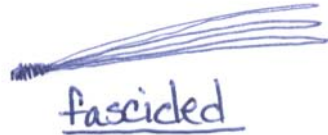
rhizome



bulb

Leaf Characters: leaf arrangement

- alternate – leaves arranged one per node
- opposite – leaves arranged across from one another at the same node
- whorled – leaves arranged with three or more at a node
- basal – leaves positioned at the base of the stem
- fascicled – leaves (usually the needles of an evergreen) grouped in small, tight bundles



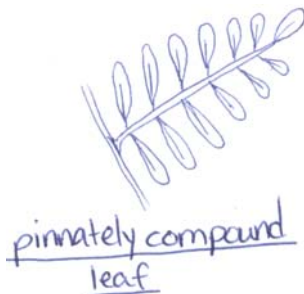
whorled

Leaf Characters: leaf complexity

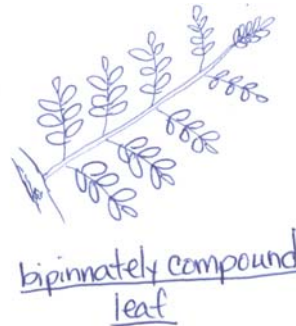
- simple – the blade is complete and undivided though it may be lobed or toothed
- compound – leaf separated into two or more distinct leaflets
- trifoliate / trifoliolate – leaf separated into three leaflets
 - pinnately compound – leaflets arranged along one undivided main axis
 - bipinnately compound – twice pinnate; the leaflets are arranged on axes twice removed from the main stem
 - palmately compound – leaflets arising from one point at the base of the leaf

Simple leaf

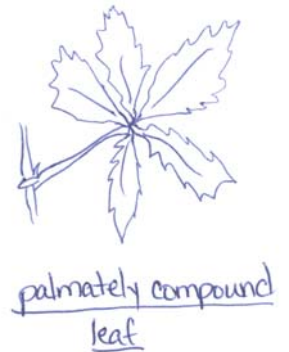
Hint: When trying to decide where a leaf begins, look for the axillary bud. The entire structure beyond the axillary bud is considered **one leaf**.



pinnately compound leaf



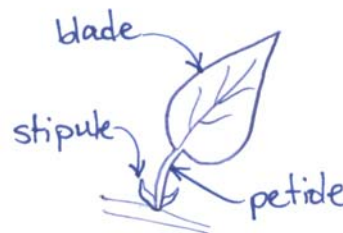
bipinnately compound leaf



palmately compound leaf

Leaf Characters: parts of a leaf

- petiole – the leaf stalk
- blade – the broad, flat, extended portion of the leaf
- stipule – one of a pair of leaf-like appendages found at the base of the petiole in some leaves
- midvein – the central vein
- rachis – the main axis of a compound leaf
- petiolule – the stalk of a leaflet of a compound leaf
- axillary bud – a bud in the axil (the angle between the leaf and the stem)



 **Leaf Characters: leaf venation (arrangement of the veins)**

- pinnate – having a main vein with secondary veins parallel
- reticulate – having a main vein with secondary veins netlike
- palmate – having main veins all arising from one point at the base of the leaf
- parallel – having all main veins (virtually) parallel to each other and usually to the sides of the leaf

pinnate
venation

reticulate



 **Leaf Characters: overall leaf shape**

- ovate – egg-shaped with the widest end at the base
- obovate – egg-shaped with the widest end the apex
 - elliptic – in the shape of an ellipse or a narrow oval; broadest at the middle and narrower at the two equal ends
 - oblong – two to four times longer than wide with nearly parallel sides
- lanceolate – lance-shaped; much longer than wide, with the widest point below the middle



- linear – resembling a line; long and narrow with more or less parallel sides
 - orbicular – nearly circular in outline
 - cordate – heart-shaped, with the notch at the base
 - peltate – shield-shaped; borne on a stalk attached to the lower surface rather than to the base or margin



orbicular

cordate



 **Leaf Characters: leaf apices**

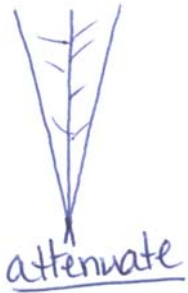
- acute – tapering to an angle less than 90 degrees
 - obtuse – having a blunt or rounded apex
 - acuminate – gradually tapering to a sharp point with concave sides along the edges
 - mucronate – having a short, sharp, abruptly pointed tip



mucronate

 **Leaf Characters: leaf bases**

- attenuate – tapering gradually to a narrow base
- rounded – having a rounded base
- oblique – having unequal sides



oblique

 **Leaf Characters: leaf margins**

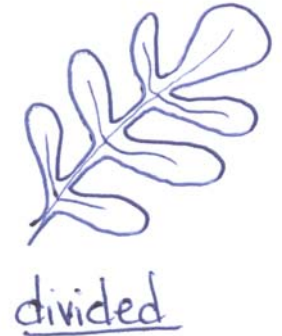
- entire – smooth; not toothed or notched
 - serrate / dentate – toothed along the margin



serrate / dentate

 **Leaf Characters: leaf margins (cont.)**

- crenate – rounded teeth
- lobed (sinuate) – having lobes that are cut less than half way to the base or mid-vein
- pinnatifid – deeply lobed beyond the half-way point
- divided – lobed almost completely to the mid-rib

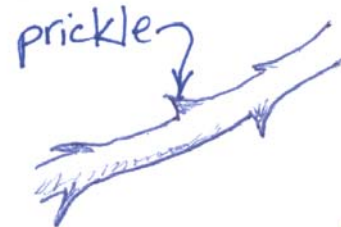
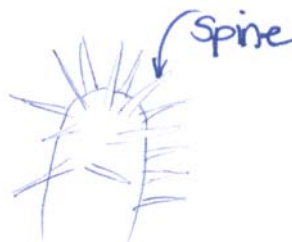
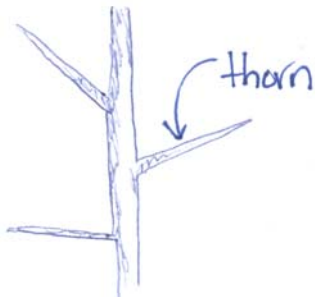


 **Leaf Characters: leaf surface**

- glabrous – smooth; hairless
- pubescent – covered with short hairs (many varieties)

 **Structural plant defenses:**

- thorn – stiff, woody, modified stem (as on a honey locust)
- spine – stiff, slender, sharp, modified leaf (as on a cactus)
- prickle – small, sharp outgrowth of the epidermis or bark (as on a rose plant)



Summary of Vegetative Morphology Terms

LIFE SPAN

annual
perennial
biennial
evergreen
deciduous
monocot
dicot

HABIT

herb
shrub
tree
vine
epiphyte
parasite

ROOTS

tap root
fibrous roots
adventitious roots

STEM ANATOMY

bud
node
internode
leaf scar
pith
lenticel

STEM MODIFICATIONS

tuber
stolon
rhizome
bulb

LEAF ARRANGEMENT

alternate
opposite
whorled
basal
fascicled

LEAF COMPLEXITY

simple
trifoliolate / trifoliolate
pinnately compound
bipinnately compound
palmately compound

PARTS OF A LEAF

petiole
blade
stipule
midvein
rachis
petiolule
axillary bud

LEAF VENATION

pinnate
reticulate
palmate
parallel

LEAF SHAPE

ovate
obovate
elliptic
oblong
lanceolate
linear
orbicular
cordate
peltate

LEAF APEX

acute
obtuse
acuminate
mucronate

LEAF BASE

attenuate
rounded
oblique

LEAF MARGIN

entire
serrate
dentate
crenate
lobed
pinnatifid
divided

LEAF SURFACE

glabrous
pubescent

STRUCTURAL DEFENSES

thorn
spine
prickle