FLORIDA MASTER GARDENER

Botany Basics

UF | IFAS Extension
UNIVERSITY of FLORIDA

What is Botany?

The science of plants, their classification and study

What is Horticulture?

The art and science of cultivating flowers, fruits, vegetables, and ornamental plants

What is a Plant?

- A plant is: photosynthetic, multicellular organism

- Capable of manufacturing its own food!

Plant Classification (Taxonomy)

There are many methods for identifying or grouping plants for communication

- There are lots of systems of classification
  - Which ones can you think of?

Life cycle

- **Annual**
  - Short-lived plant. The entire life cycle is completed in one growing season.
- **Biennial**
  - Two seasons to complete life cycle
- **Perennial**
  - Live from year to year, either woody or herbaceous.

Morphology or Appearance

- Evergreen, deciduous
- Woody, herbaceous
- Vines, trees, shrubs
- Opposite or alternate leaves
- Fruit, seed, etc. types

We'll get to more "mor-phology" in a minute!

Environmental

- Xerophyte, halophyte, hydrophyte
- Hardy, tender
- Temperate, tropical, subtropical
- Warm season, cool season

*When do you plant **cool** season crops in southern Florida?*

Usage

- fruit, vegetable, ornamental

What is the difference between a fruit and a vegetable?

Scientific nomenclature

Kingdom

Animalia

Others

Plantae

Division (several, those with horticultural interest-)

Pterodophyta - ferns

Spermatophyta – seed bearing plants

Class

Gymnospermae – naked seeds

Angiospermae

Subclass

Monocotyledonae (monocots) - 49,000 types

Dicotyledonae (dicots) - 237,000 types

And this is only half of it . . . .

Scientific Names cont.

Order

Family - 'aceae' usual ending

- First place you may start in identificatio

Genus

Species

- **Authority -**

- **Cultivar-** cultivated variety

Variety - botanical variety

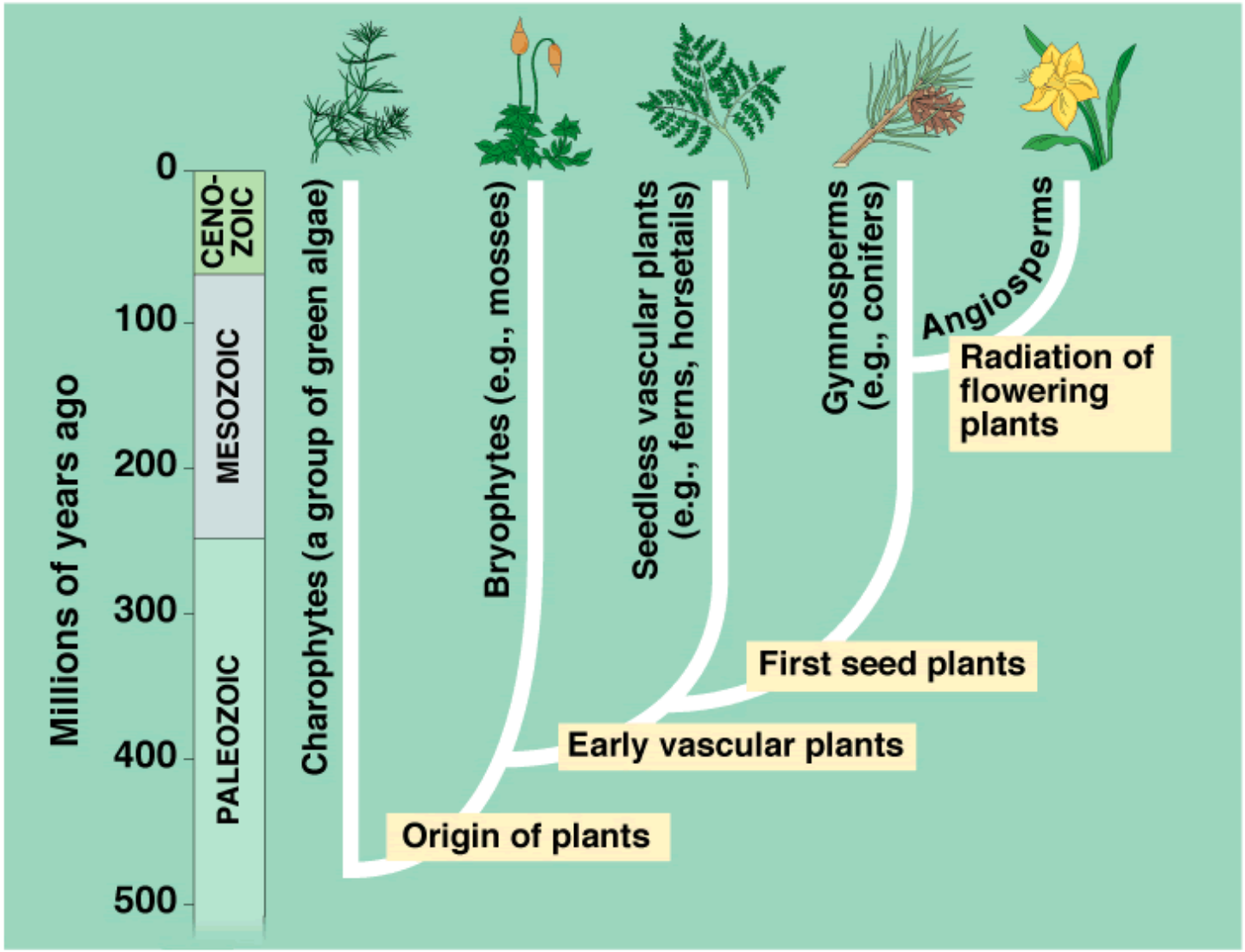
etc.

Binomial nomenclature

genus and *species*

You can thank Linnaeus for all this!

The Family Tree of Plants



Plant Groups in Landscape

- Spore-bearing plants
  - Ferns
- Seed plants
  - Gymnosperms: Cone-bearing plants
  - Angiosperms: Flowering Plants

- Botany Handbook http://edis.ifas.ufl.edu/MG012 (offline, being updated)

Gymnospermae

Gymno = naked spermae = seed

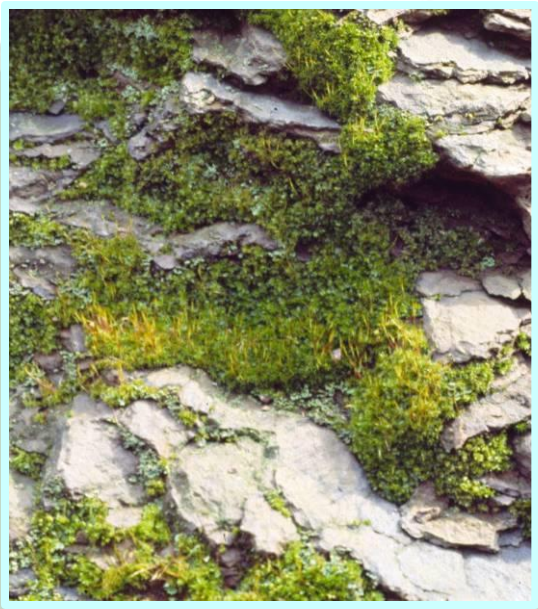
- Plant Family examples:
  - Cupressaceae
  - Cycadaceae
  - Ginkgoaceae
  - Pinaceae
  - Podocarpaceae
  - Taxaceae
  - Zamiaceae

Angiospermae

Angio = “container” Spermae = seed

- Flowering plants: (Tribe)
  - Monocotyledoneae
  - Dicotyledoneae

Plants without seeds



Seed Plants without Fruit

Cycads and Conifers

produce separate male & female cones =

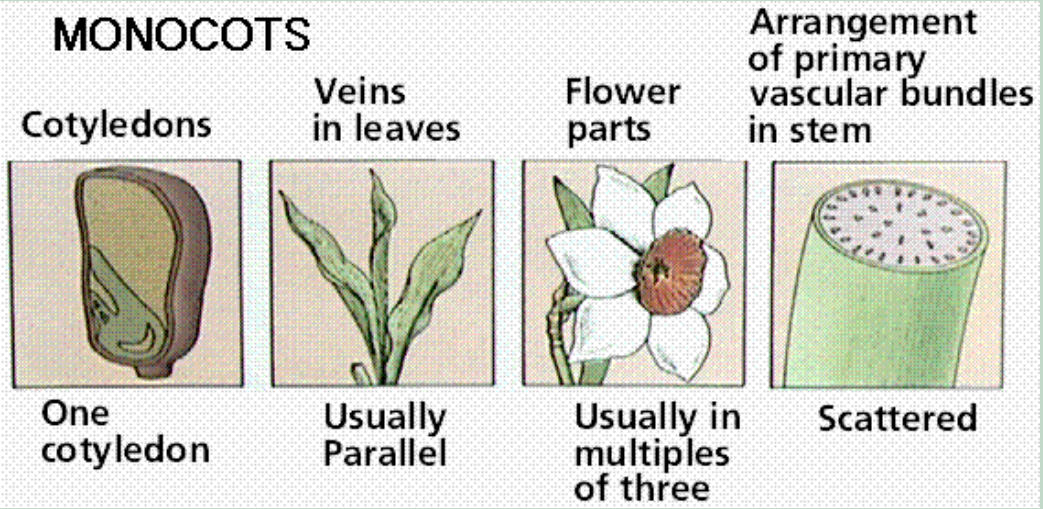
dioecious

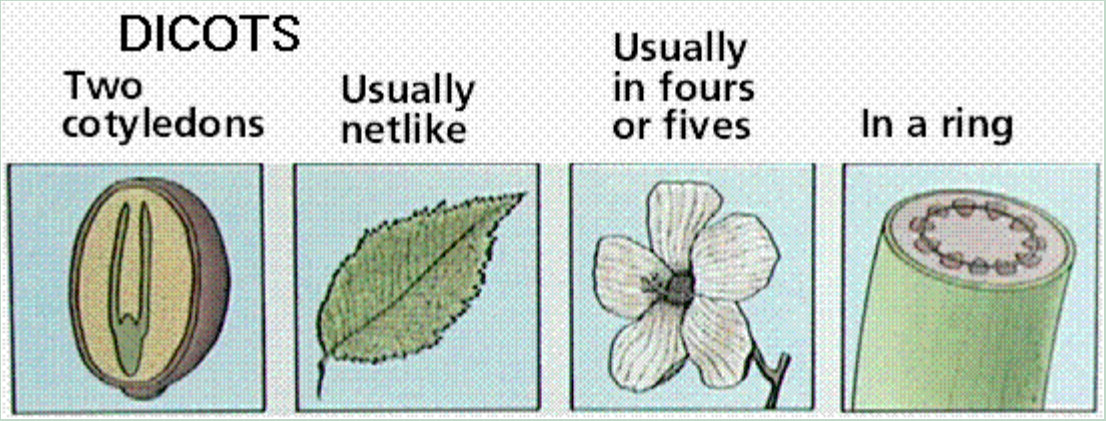
Plant ID by the numbers:

One or two, and threes or fours/fives

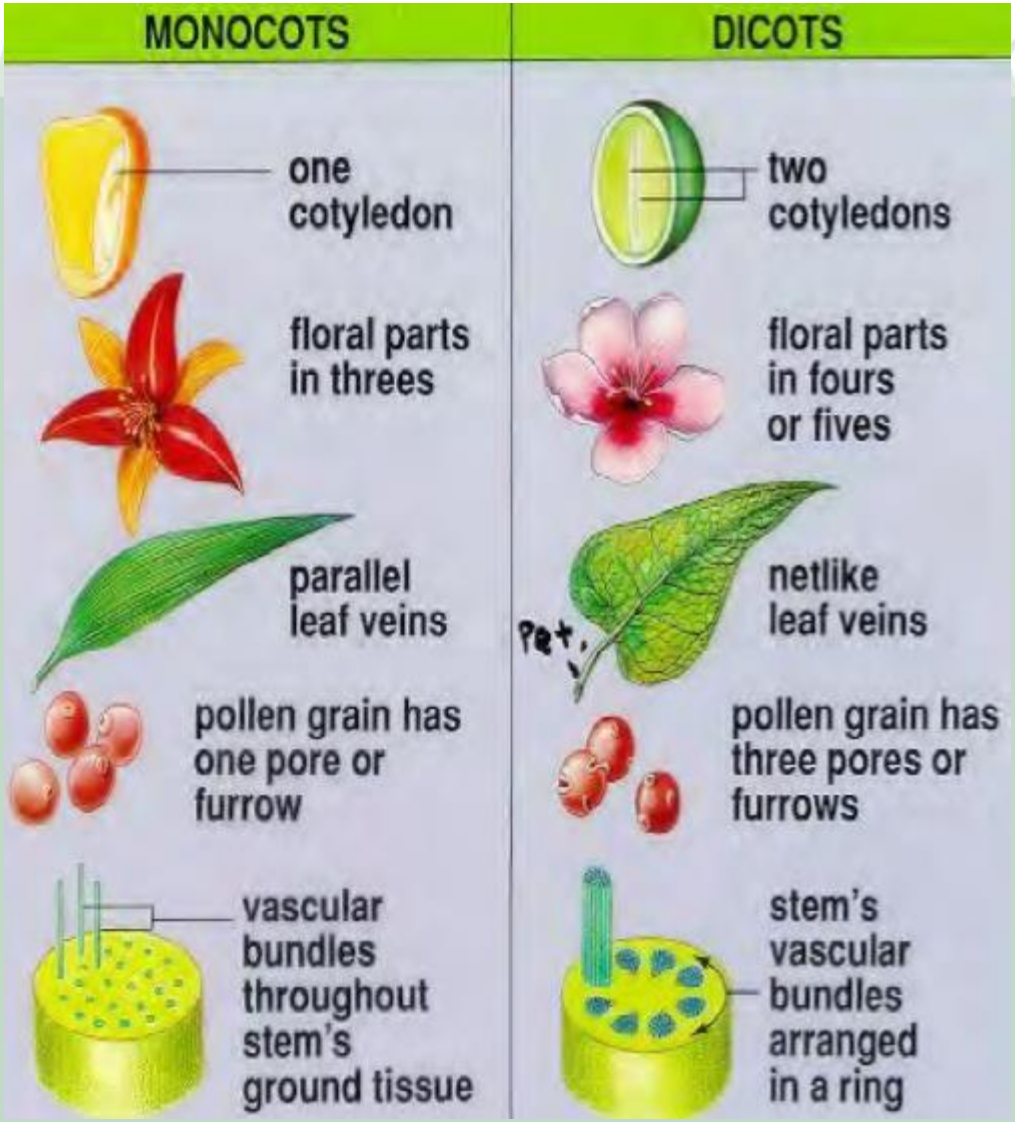
A big first step in plant ID is to determine if it is more like a palm or an oak,

i.e., a corn plant or a petunia

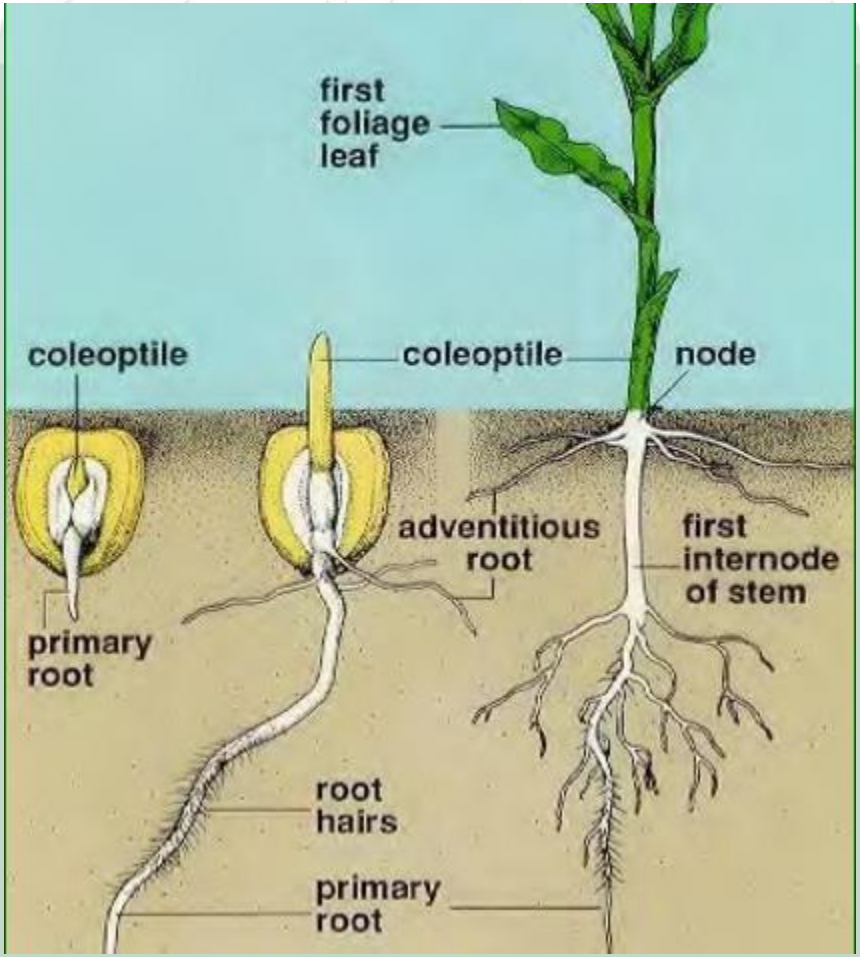


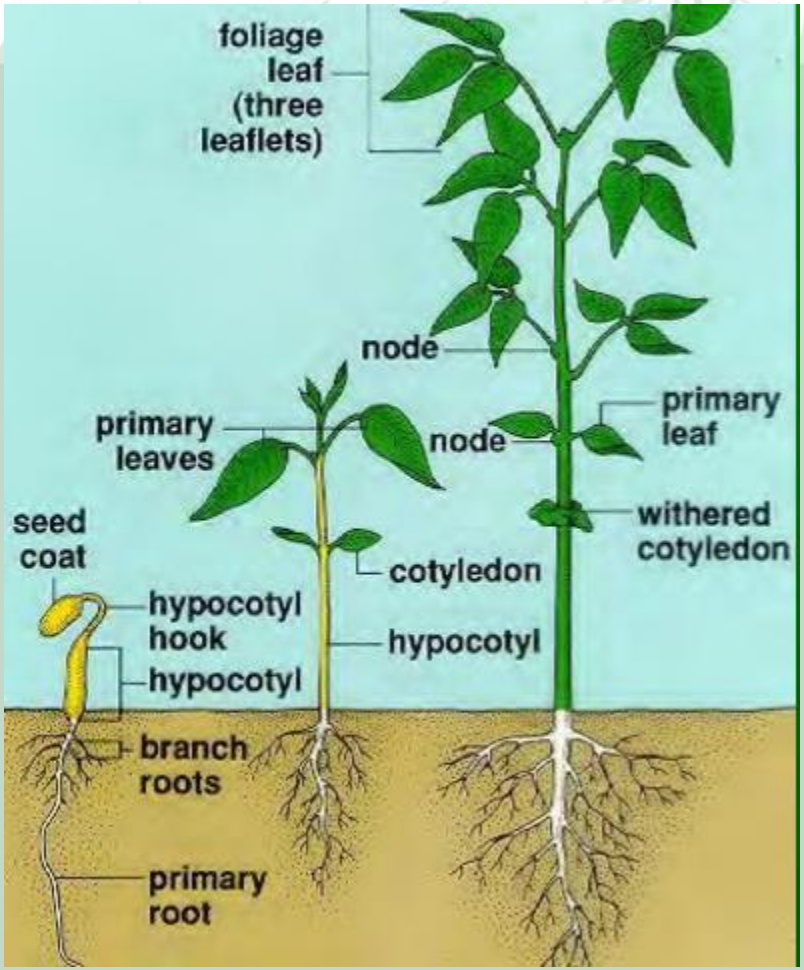


Is it a Monocot or Dicot ?



Monocot vs Dicot





CULTIVAR = CULTIVATED VARIETY

"Assemblage of cultivated plants which is clearly distinguished by any characters and which, when reproduced (sexually or asexually) retains its distinguishing characters."

- Liberty Hyde Bailey

- Botanical **varieties** naturally breed true from seed
- **Cultivars** are asexually cloned or by controlled sexual crossing of breeding lines

Even More on Scientific Nomenclature

- Most commonly used system of nomenclature
- System is not static
- As you move down though the sections, plants are more closely related
- Based on flower and plant morphology

It’s all in the Family

- Being able to identify an unknown plant to its family is a valuable skill
- Look at botanical characteristics and see if it reminds you of another plant
- Look at references under the name of the family to speed up your search

Common Plant Families

- Anacardiaceae
- Apocynaceae
- Cruciferae
- Fagaceae
- Gramineae
- Labiatae
- Leguminosae
- Rosaceae

The rose is a rose
and was always a rose;
But the theory now goes
That the apple's a rose,
And the pear is, and so's
The plum, I suppose.
The dear only knows
What will next prove a rose.
You, of course, are a rose,
but were always a rose.
- Robert Frost, "The Rose Family"

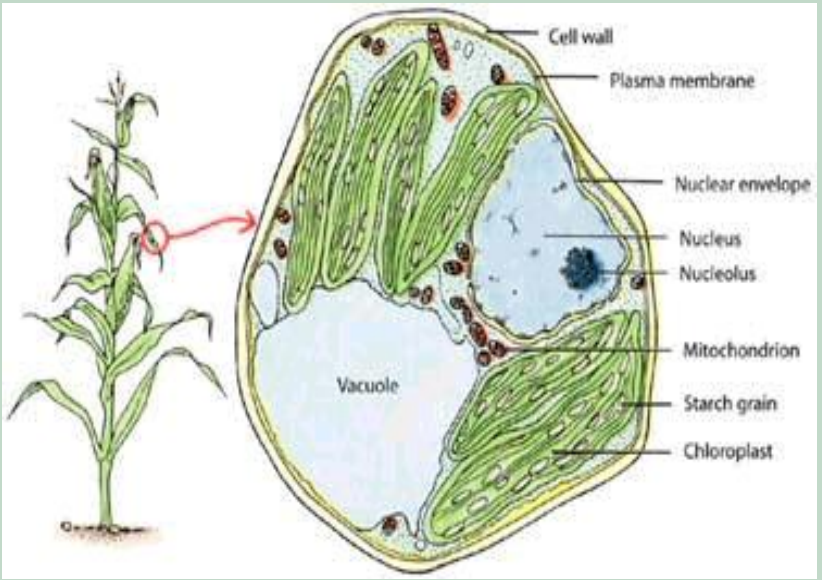
More Common Plant Families

- Aster**aceae**
- Brassic**aceae**
- Po**aceae**
- Clusi**aceae**
- Lami**aceae**
- Fab**aceae**
- Arec**aceae**
- Api**aceae**
- **Zamiaceae**

A Family Portrait

What makes a plant a plant and not an animal?

- Cell walls
- Ability to make own food
- Special kinds of anatomical (plant) parts



Plant Growth

- Plants make their own food - by converting energy from sunlight.
- All living things require energy, not just for growth and reproduction, but also for the maintenance of life.
- To produce food, plants require energy, carbon dioxide, water, and the essential nutrients.

Plants and energy (simplified)

- **Photosynthesis**
  - The process of turning light energy into energy that can be transported and stored by the plant

Why not just use the energy directly?

Eeek! Chemistry!

$6\ CO_2 + 12\ H_2O + \text{light} + \text{chlorophyll} =$

$C_6H_{12}O_6 + 6\ H_2O + 6\ O_2$

What does this mean to you?

Eeek! Chemistry! cont.

- $6\ CO_2 + 12\ H_2O + light + chlorophyll = C_6H_{12}O_6 + 6\ H_2O + 6\ O_2$

- $C_6H_{12}O_6$ is the general formula for carbohydrates
  - Sugars can be transported
  - Starches can be stored

Both are forms of carbohydrates – as anyone on the Atkins diet can tell you!

More Energy Stuff

- **Respiration**
  - Breaking the carbohydrates into a form of energy the plant can use

Although we think of ***respiration*** *in humans as breathing, breathing is really the gas exchange that supports respiration.*

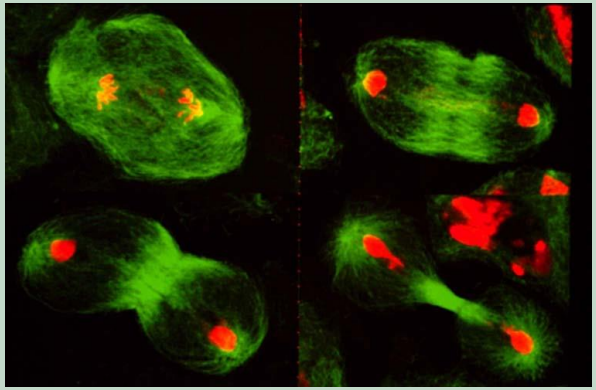
A Balance

- **Photosynthesis**
  - **Produces food**
  - **Energy is Stored**
  - **Occurs in Cells with Chloroplasts**
  - **Oxygen is released**
  - **CO_2 is used**
  - **Occurs in light**

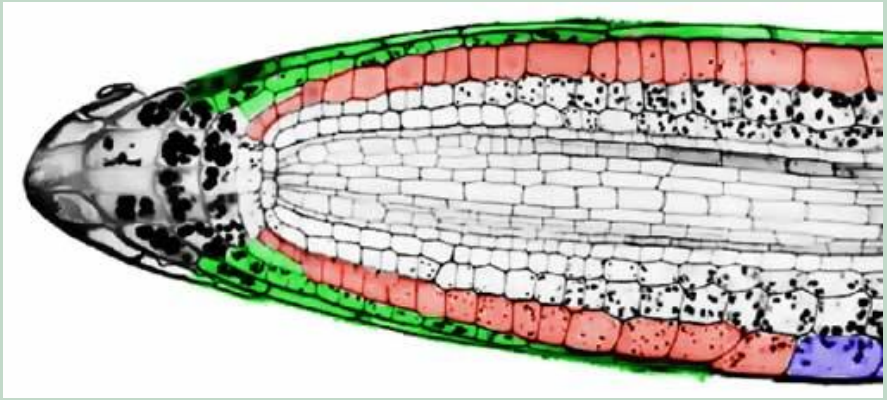
- **Respiration**
  - **Uses food for Energy**
  - **Energy is released**
  - **Occurs in all cells**
  - **Oxygen is used**
  - **Water is produced**
  - **CO_2 is produced**
  - **Occurs in Dark or Light**

What's all this used for, anyway?

- Plant growth and development
  - Cell division
  - Cell elongation



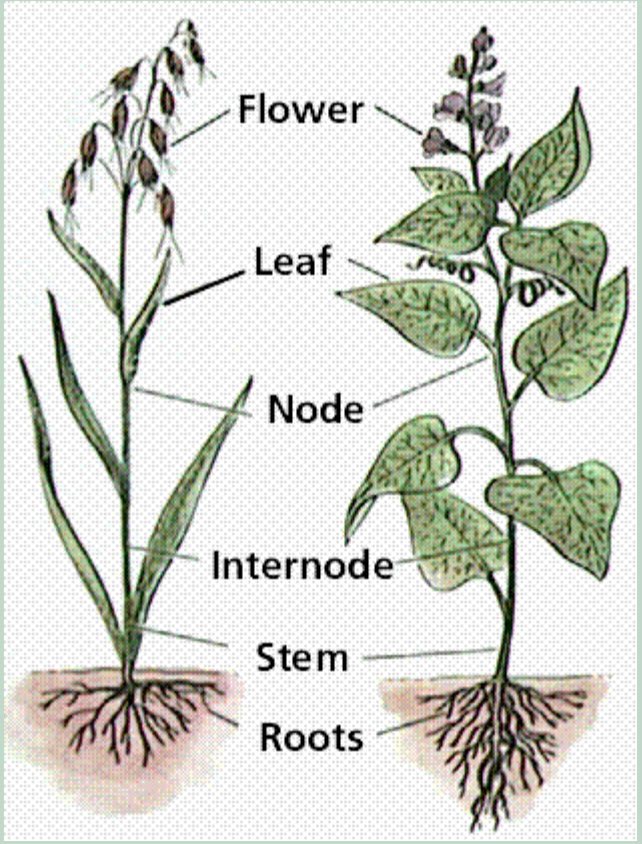
- Where does growth occur in plants?
  - Meristems



Gross Anatomy

Major plant organs include:

- roots
- stems
- leaves
- reproductive organs:
  - flowers or cones
  - fruits and seeds

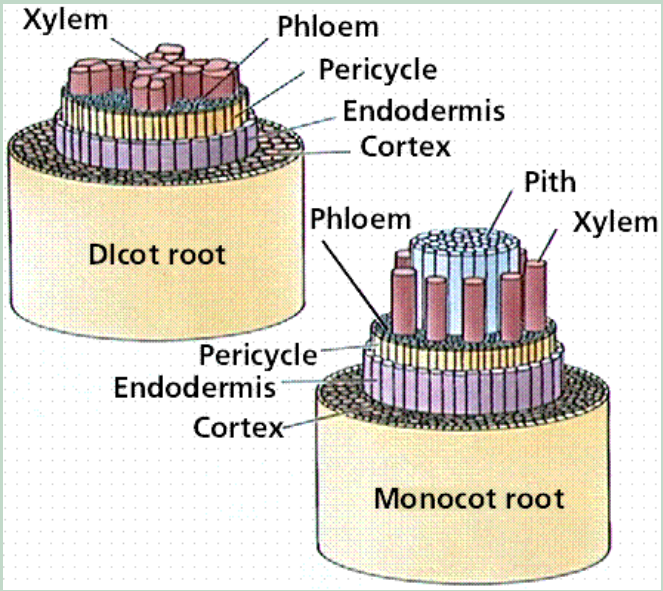


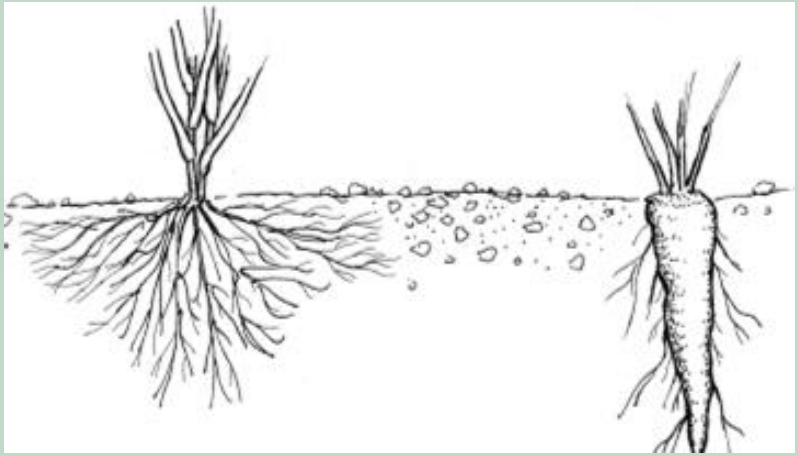
Know the Node!

Roots

Functions

1. Absorption of water & nutrients
2. Anchoring
3. Conductance
4. Storage





Fibrous roots Taproot

Roots cont.

Morphology

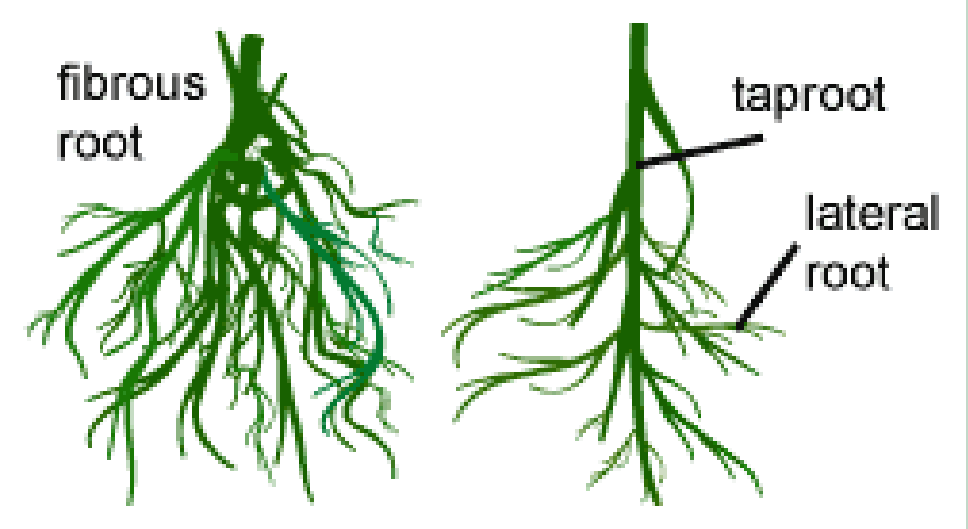
*primary roots/

secondary roots

*tap root/fibrous roots

*adventitious roots

*root hairs

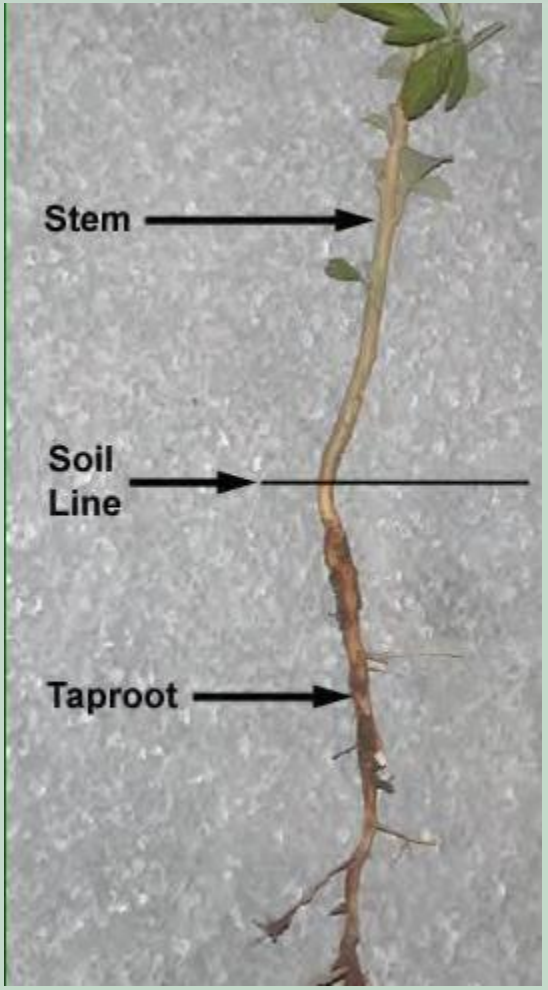



Primary
Root

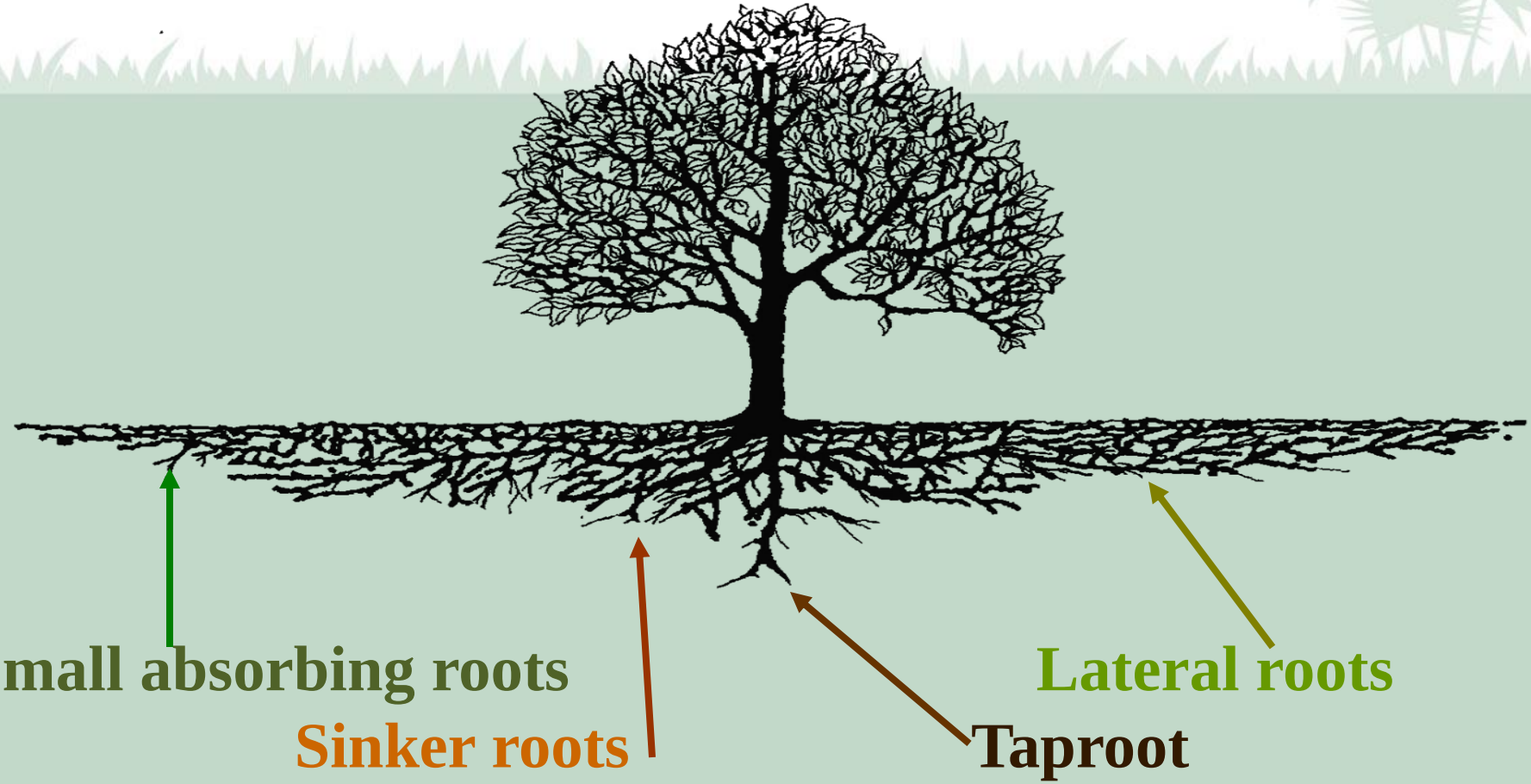

Secondary
Root


Adventitious
Roots

Tap Root

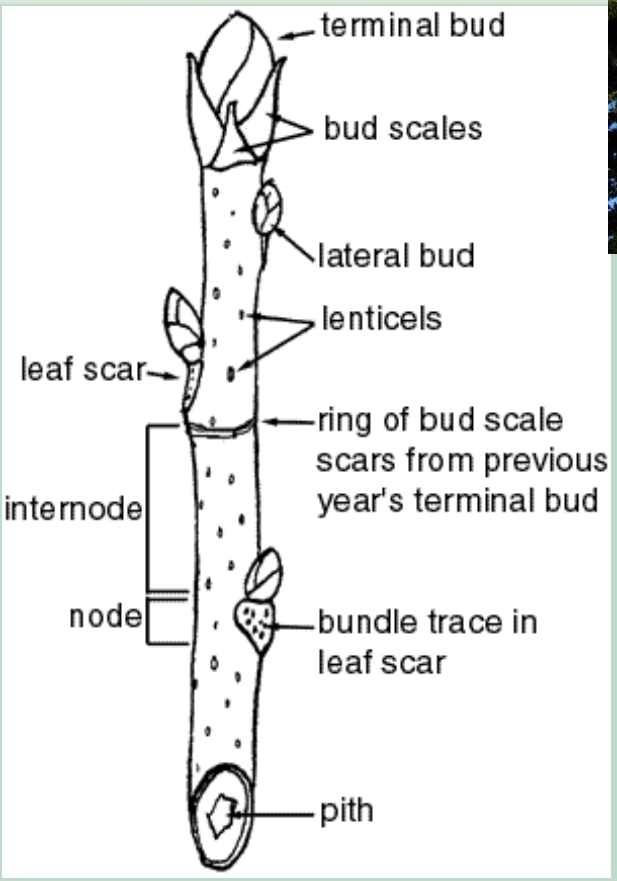


Types of Tree Roots



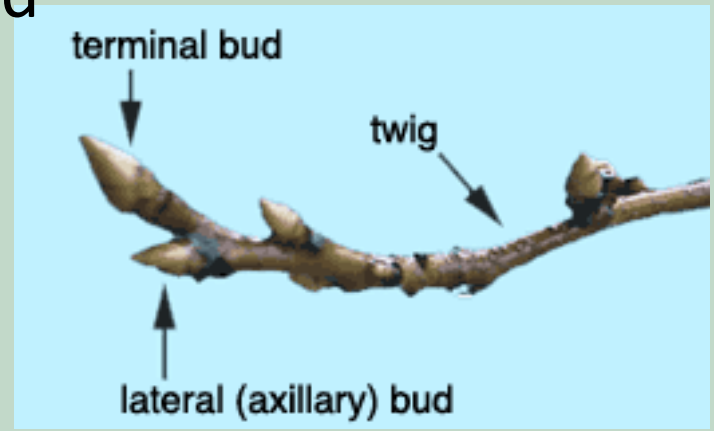
Stems

- **Functions**
  - Conductance
  - Support
  - Photosynthesis
  - Gas exchange
    - lenticels
- **Morphology**
  - Nodes/internodes
  - Modifications
    - tendril
    - thorn



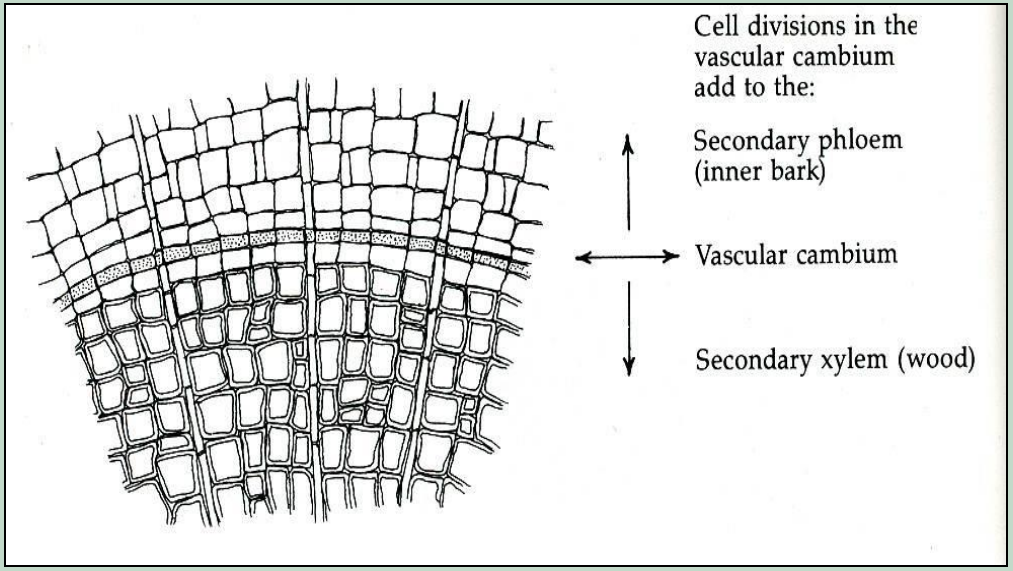
This Bud's for You!

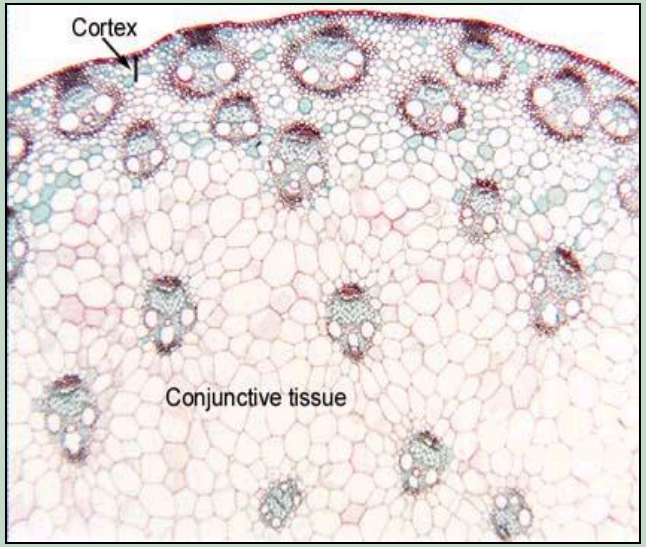
- Nodes
  - Points on a stem where a leaf or leaves are attached.
  - Spaces between nodes are called Internodes.
- Buds
  - Lateral buds at the base of leaves.
  - Terminal buds at the apex of stems.
  - Adventitious buds on stems.



Stem: *Movin' on up (and down)*

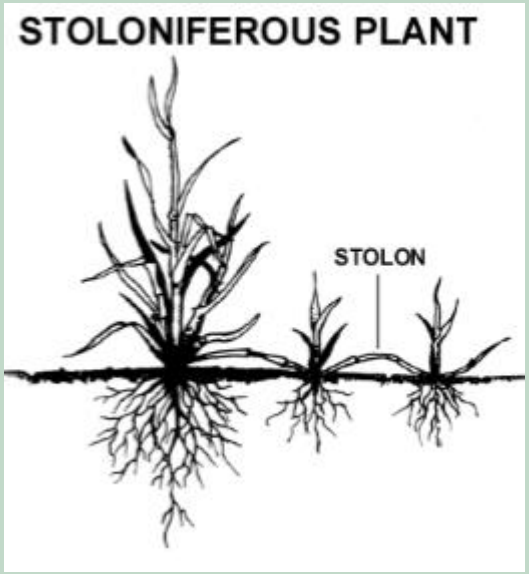
- **Phloem** – tubes that conduct food & hormones produced by the plant, from leaves to entire plant
- **Xylem** – tubes that conduct water and minerals from roots to entire plant
- These tissues are formed by the vascular cambium





Stem Types

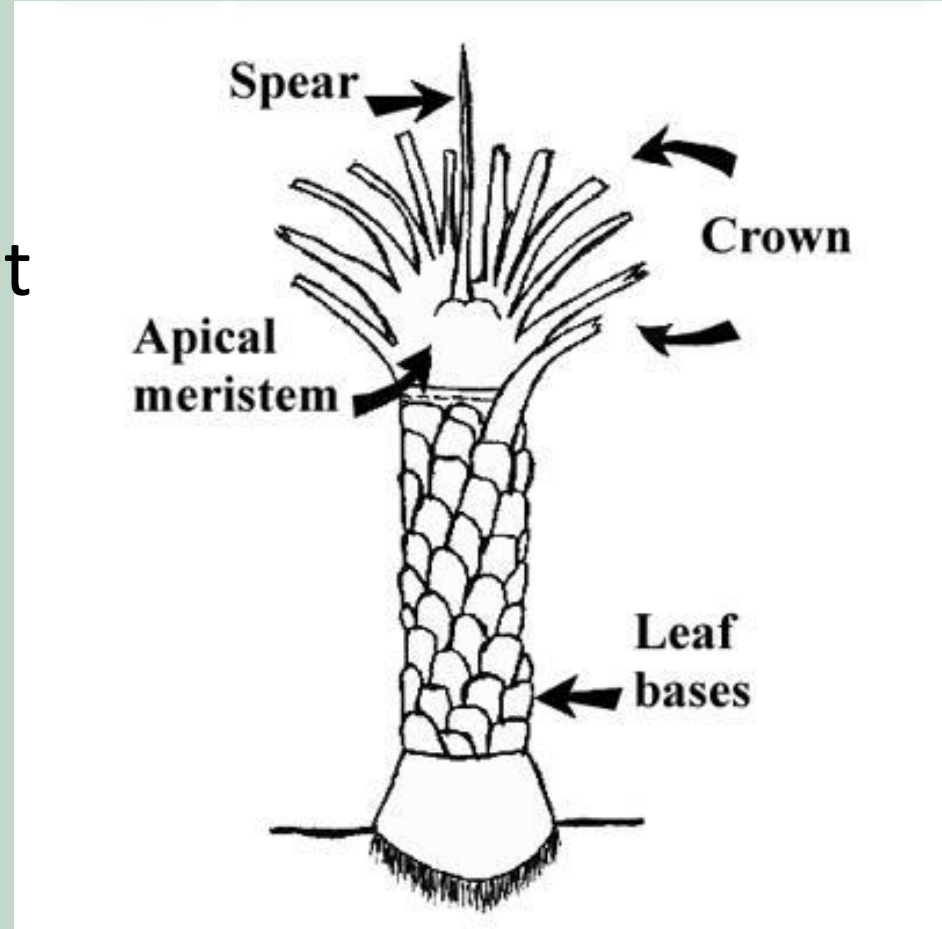
- Crowns
- Simple
- Branched
- Climbing
- Creeping
- Rhizomes
- Stolons



Palms are different!

*Palms only have one bud at the top of the stem

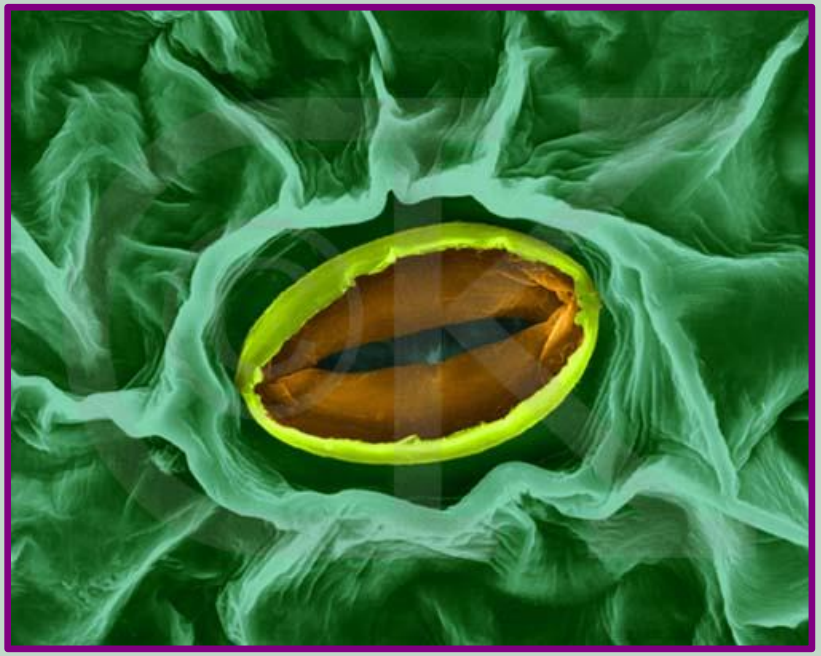
*Many palm roots do not have the ability to branch if they are cut



The Leaf

Functions

1. Collection of light
2. Photosynthesis
3. Gas exchange
4. Storage



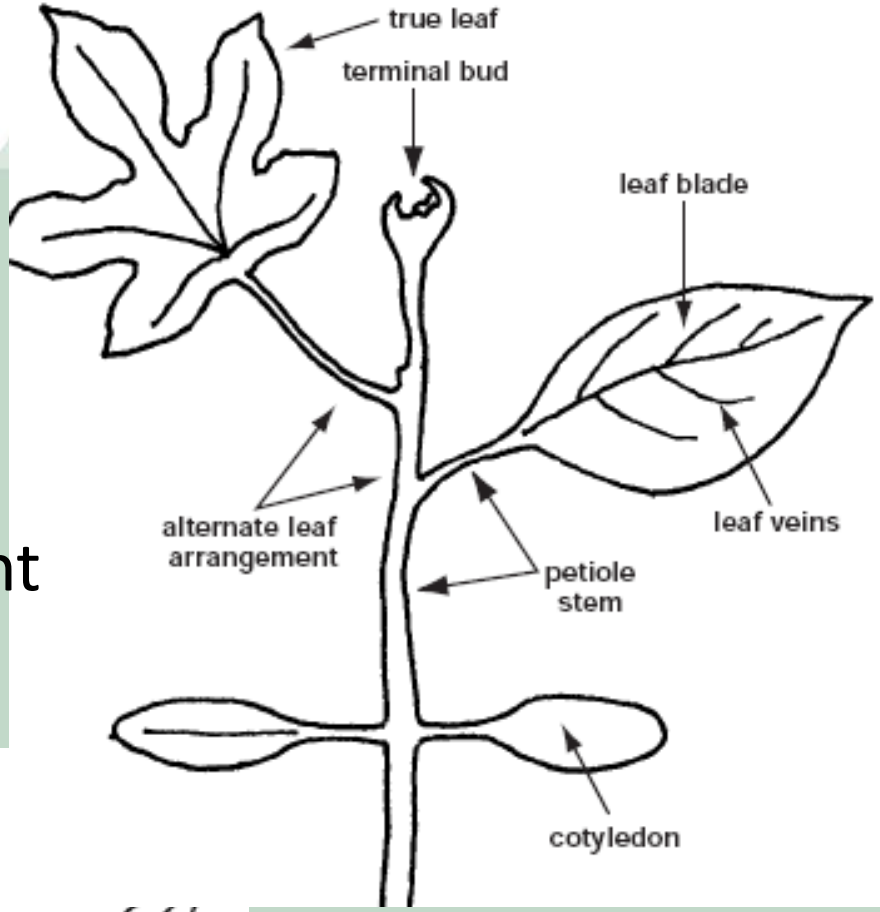
What's a C3 plant?

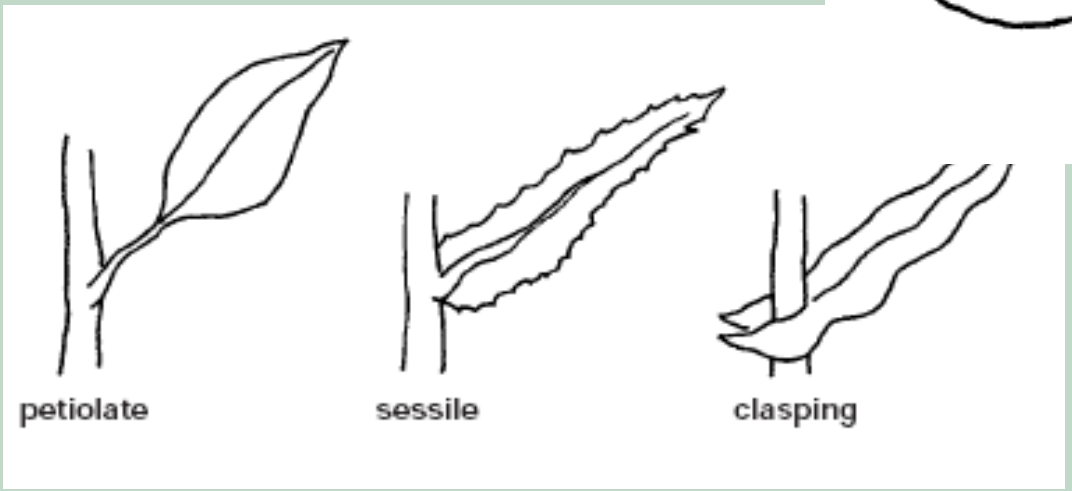
What's a C4 plant?

Leaf cont.

Morphology

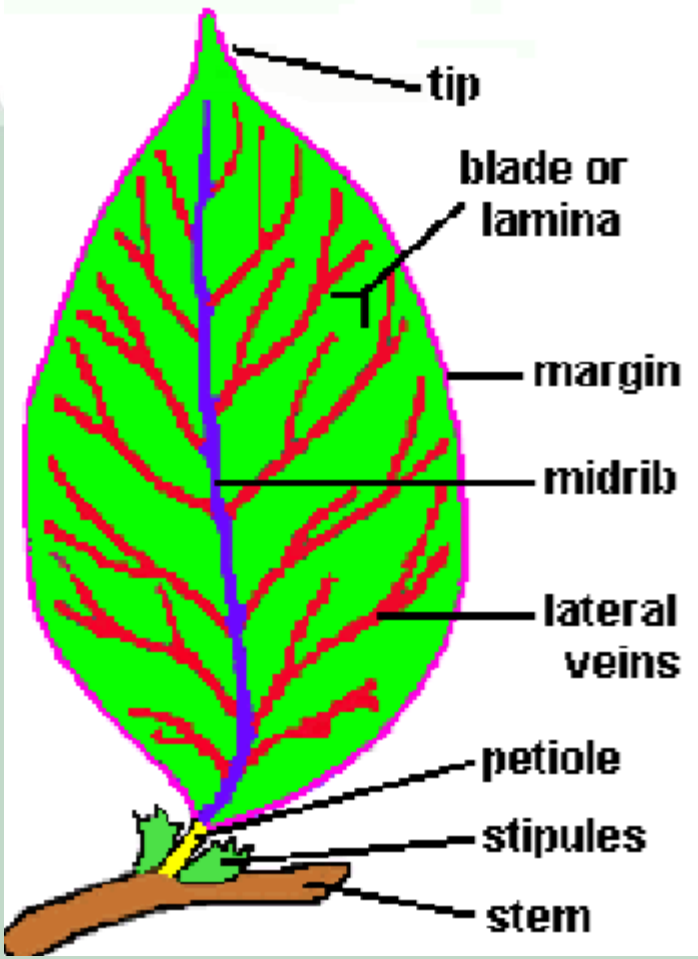
- Blade/petiole
- Shape of blade
- Margin
- Attachment to stem
- Number and arrangement of leaflets





Simple Leaf

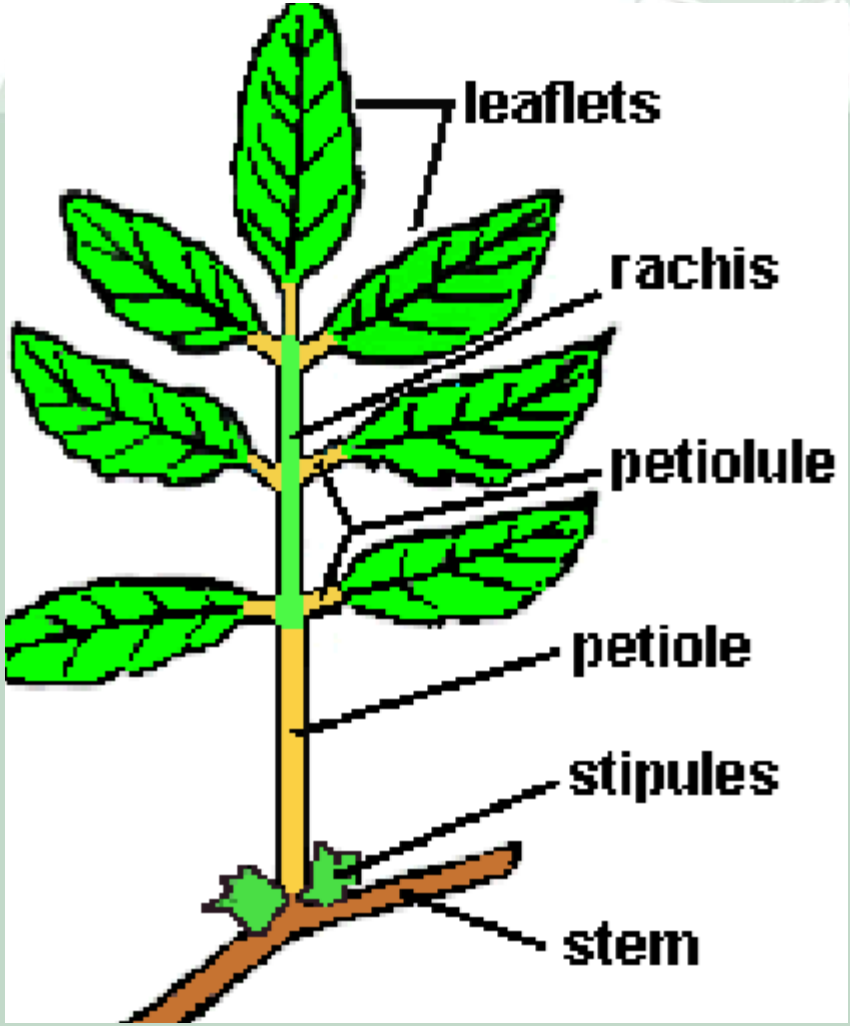
- tip- the terminal point of the leaf.
- blade-the flattened, green, expanded portion of a leaf.
- margin- edge of a leaf.
- midrib-the most prominent central vein in a leaf.
- lateral veins-secondary veins in a leaf.
- petiole-the leaf stalk (connects blade to stem).
- stipules-leaf-like appendages (at the base of petiole of some leaves).



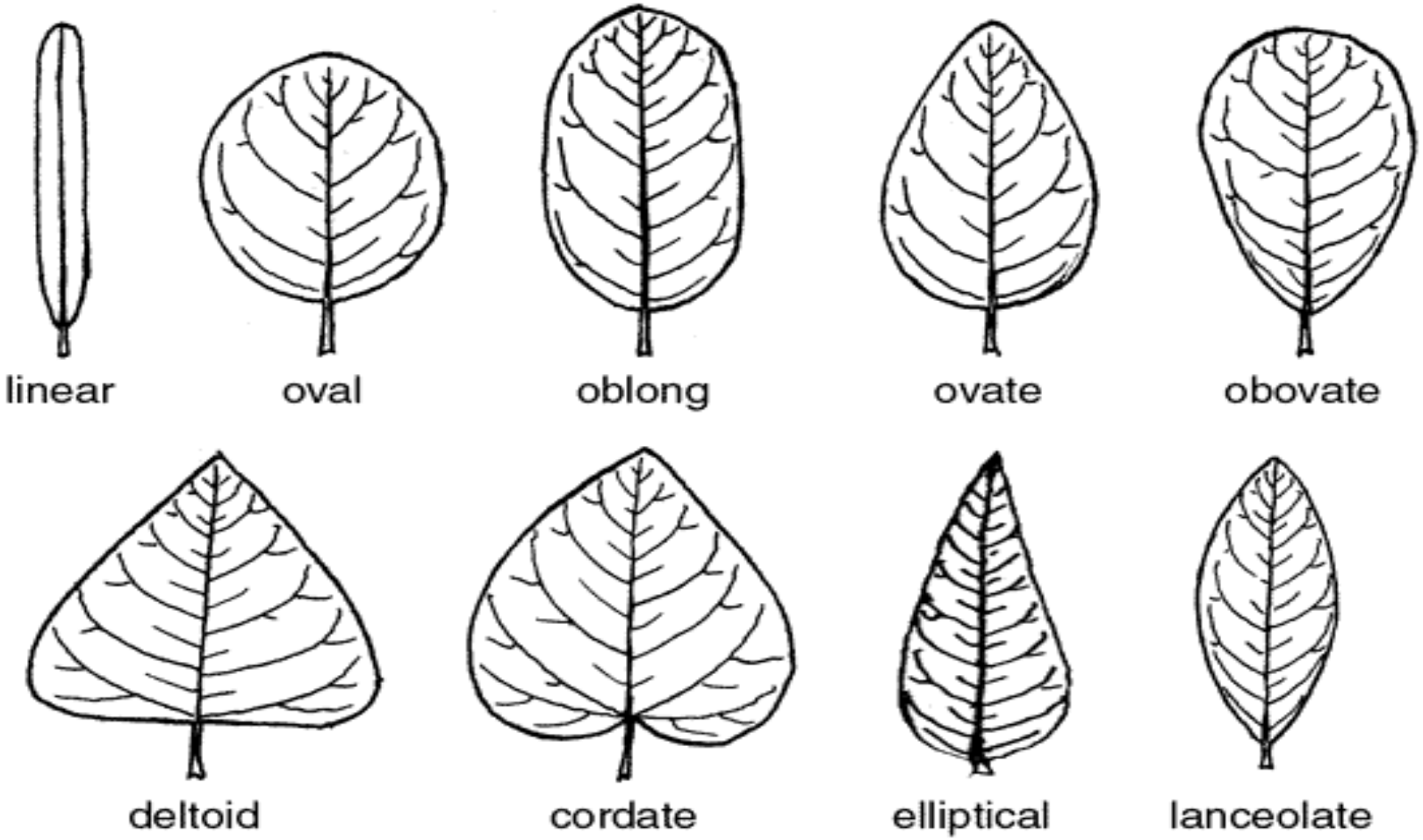
http://generalhorticulture.tamu.edu/h202/labs/lab2/index.html

Compound Leaves

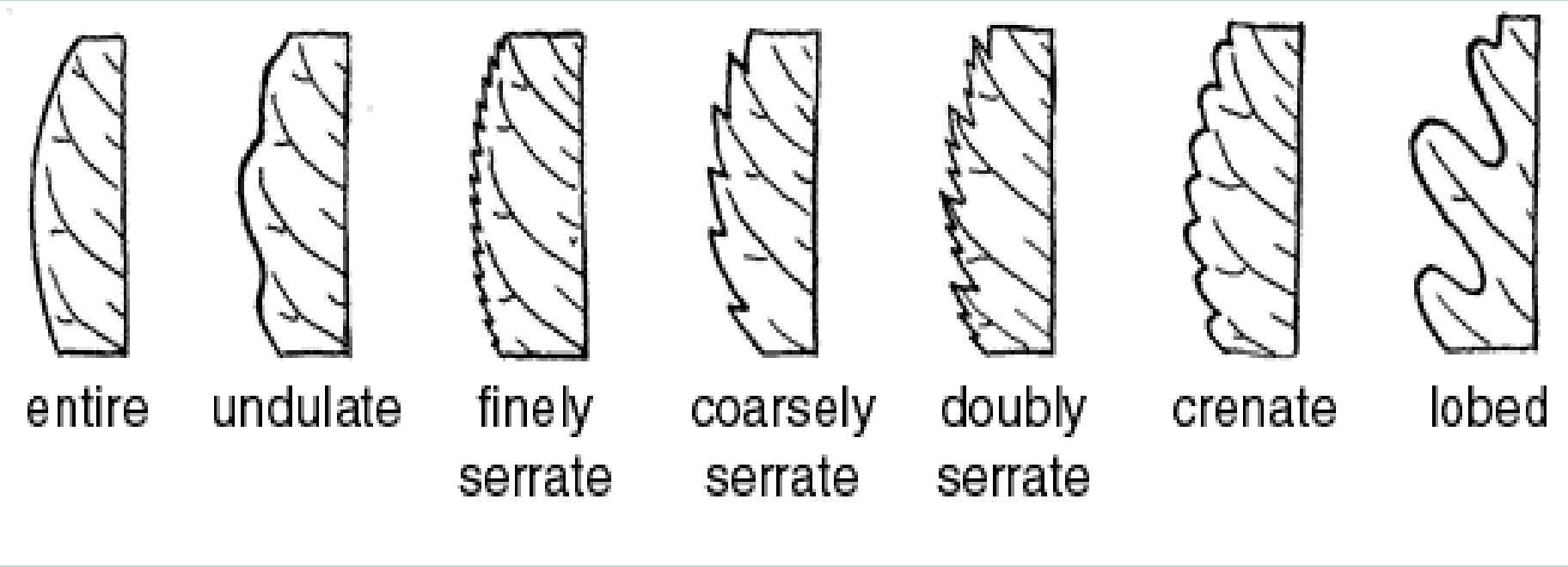
- leaflet- secondary leaf of a compound leaf.
- rachis- an extension of the petiole bearing leaflets.
- petiolule-the leaflet stalk.
- petiole-the leaf stalk
- lateral veins-secondary veins in a leaf.
- stipules-leaf-like appendages (at the base of petiole of some leaves).



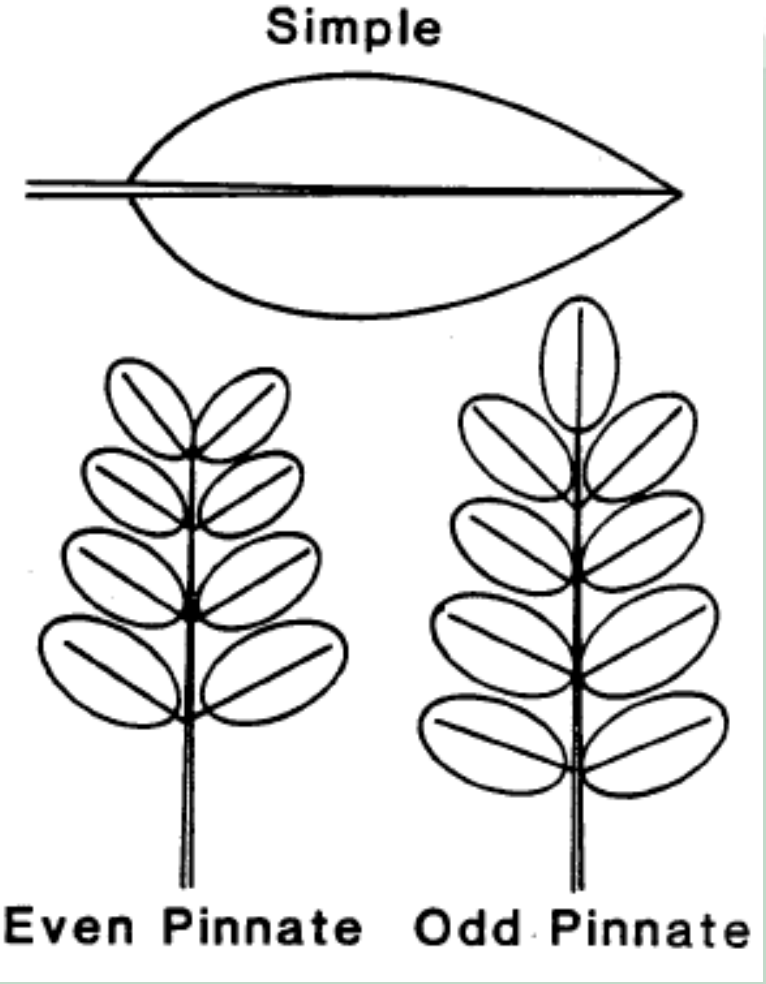
Common Leaf Shapes



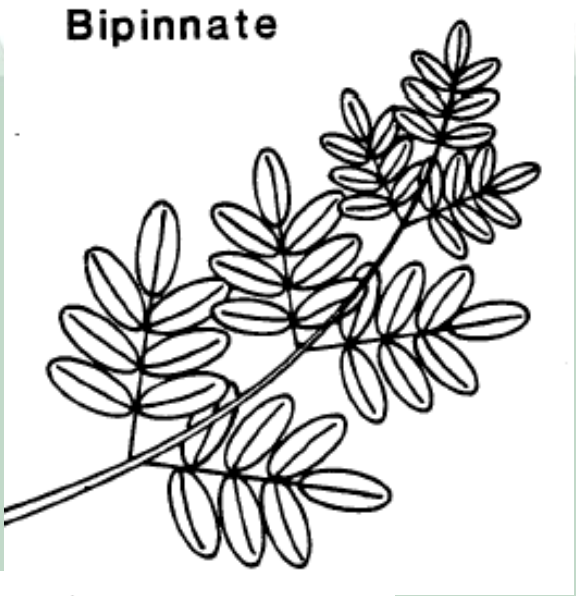
I’m Getting Edgy!

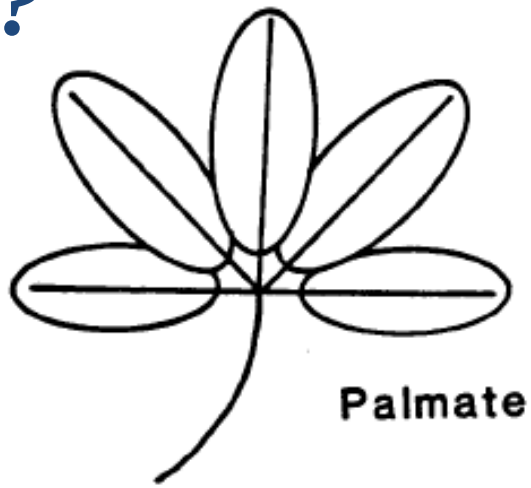


Leaf Me Alone!



How many leaves are on this slide?

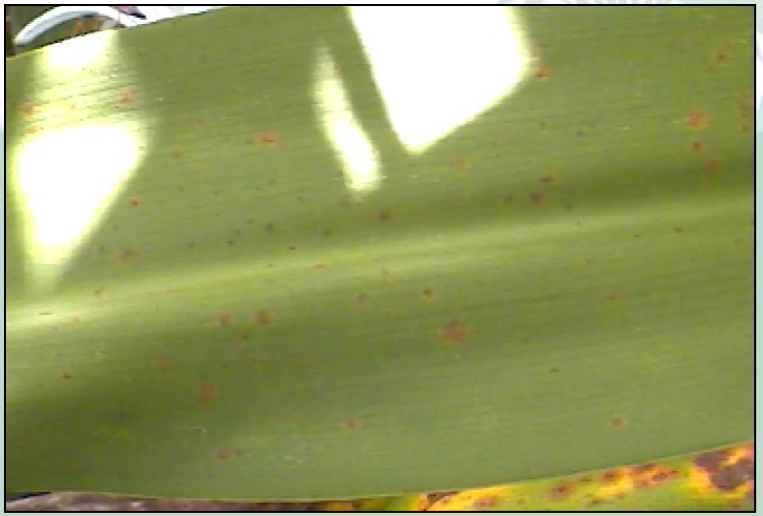




Leaves are different

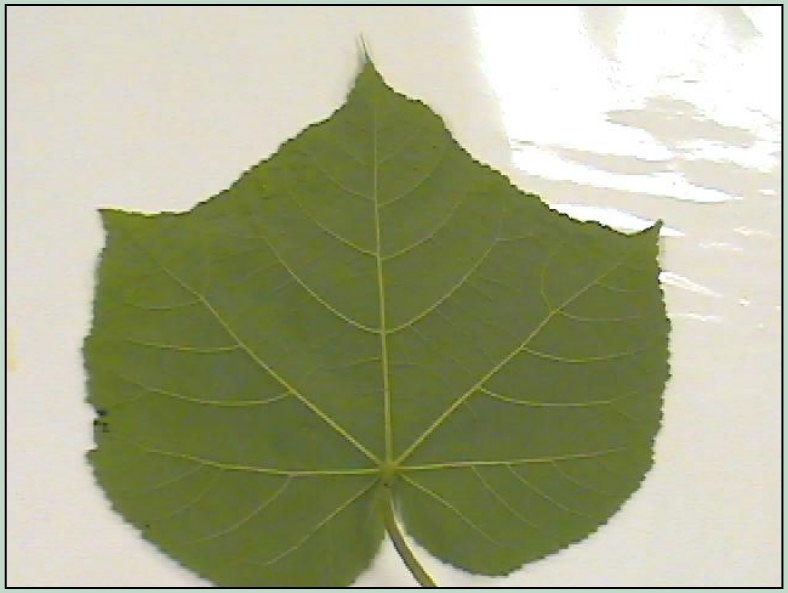
Monocot Leaf

- Chief veins are parallel or nearly so.
- Typically grasses, palms



Dicot Leaf

- Veins form a net-like pattern.
- Commonly referred to as “Broadleaves”.



Flowers

- **Function**
  - Control pollination
  - Develop into fruit and seed
- **Morphology**
  - We need many slides for this!

Remember – much of the classification of plants is based on *floral morphology*

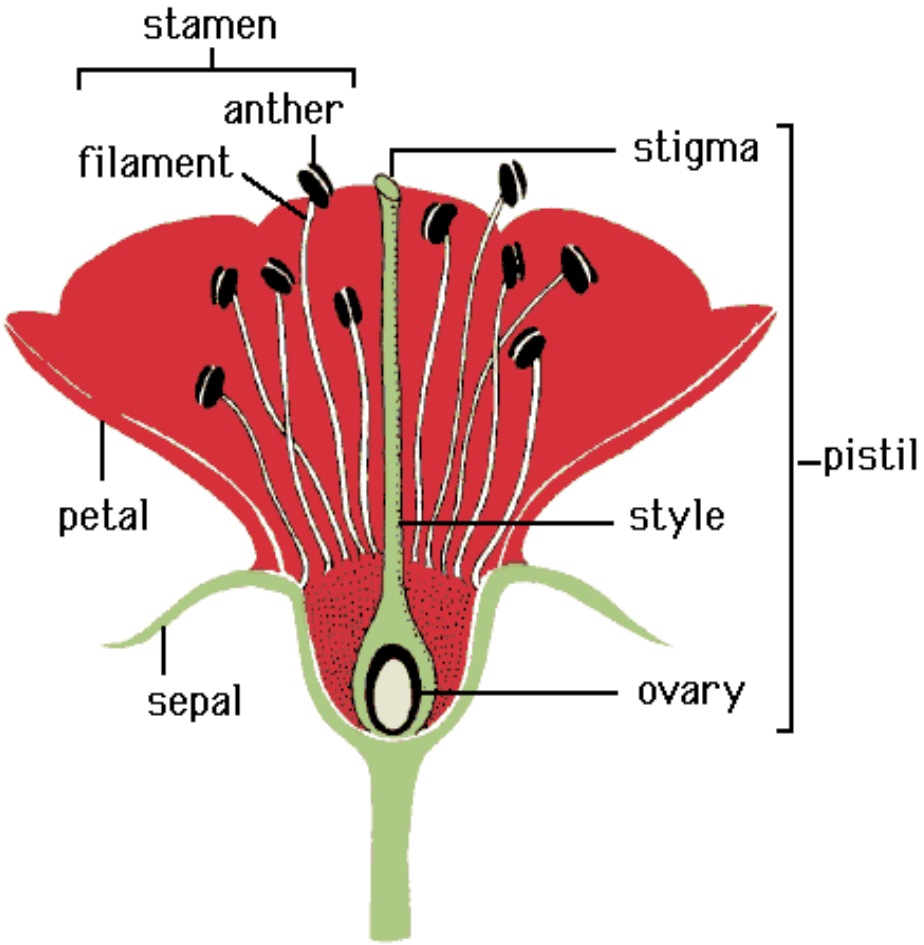
Flower Types

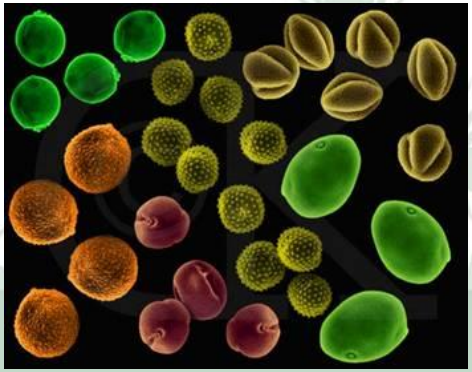
- Single
  - A solitary flower at the end of a peduncle (a stem supporting a flower or flower cluster). Ylang Ylang

- Cluster
  - Three or more flowers gathered closely together in simple or branched groups. Can be Racemose or Cymose. Pentas, Mango

Flower Morphology

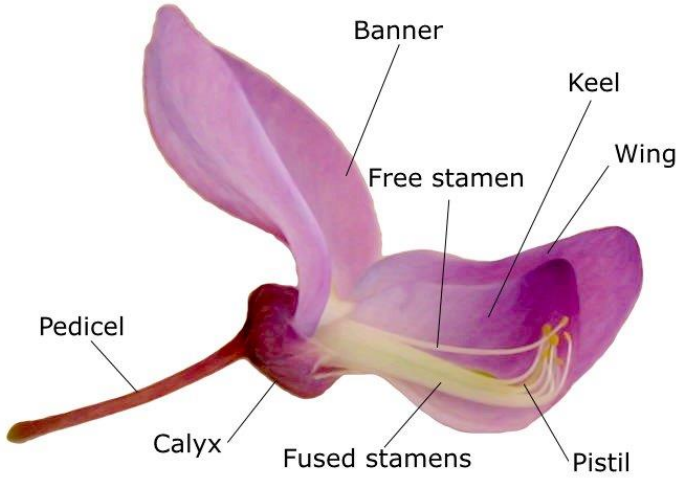
- **petals - corolla**
- **sepals - calyx**
- **receptacle**
- **pistil**
- **ovary/ovules**
- **style**
- **stigma**
- **stamen**
- **filament**
- **anther**
- **pollen**





Pollen Grains

Peas, if you please…



More-phology

- **Complete**
  - has petals, sepals, stamens and pistils
- **Perfect**
  - has both stamens and pistils
  - staminate
  - pistillate
- **Flower types**
  - monoecious
  - dioecious

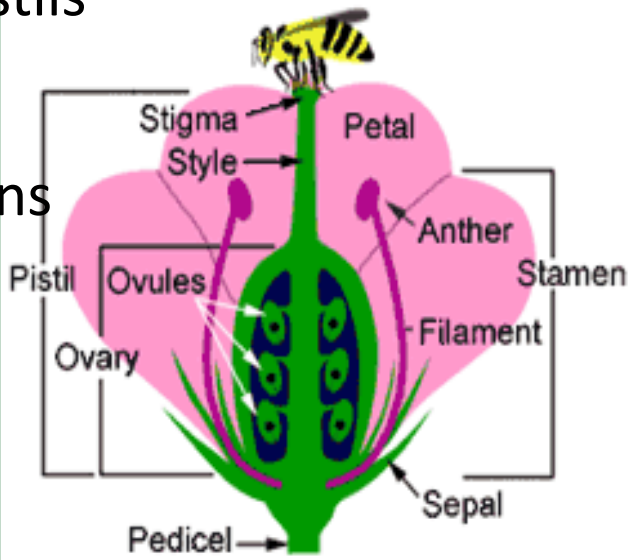
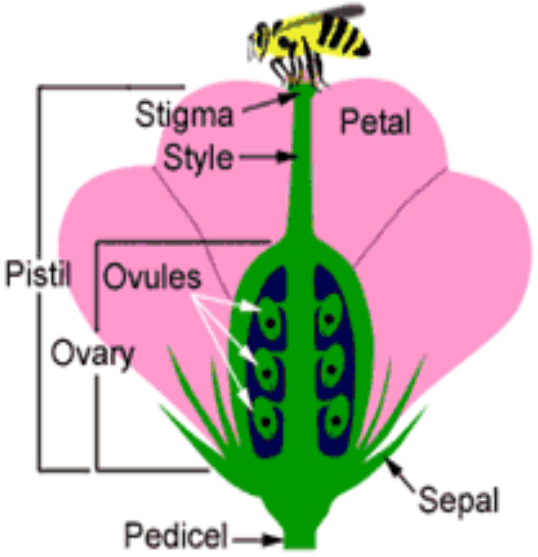


Figure 20. Complete flower structure



Imperfect (pistillate) flower structure

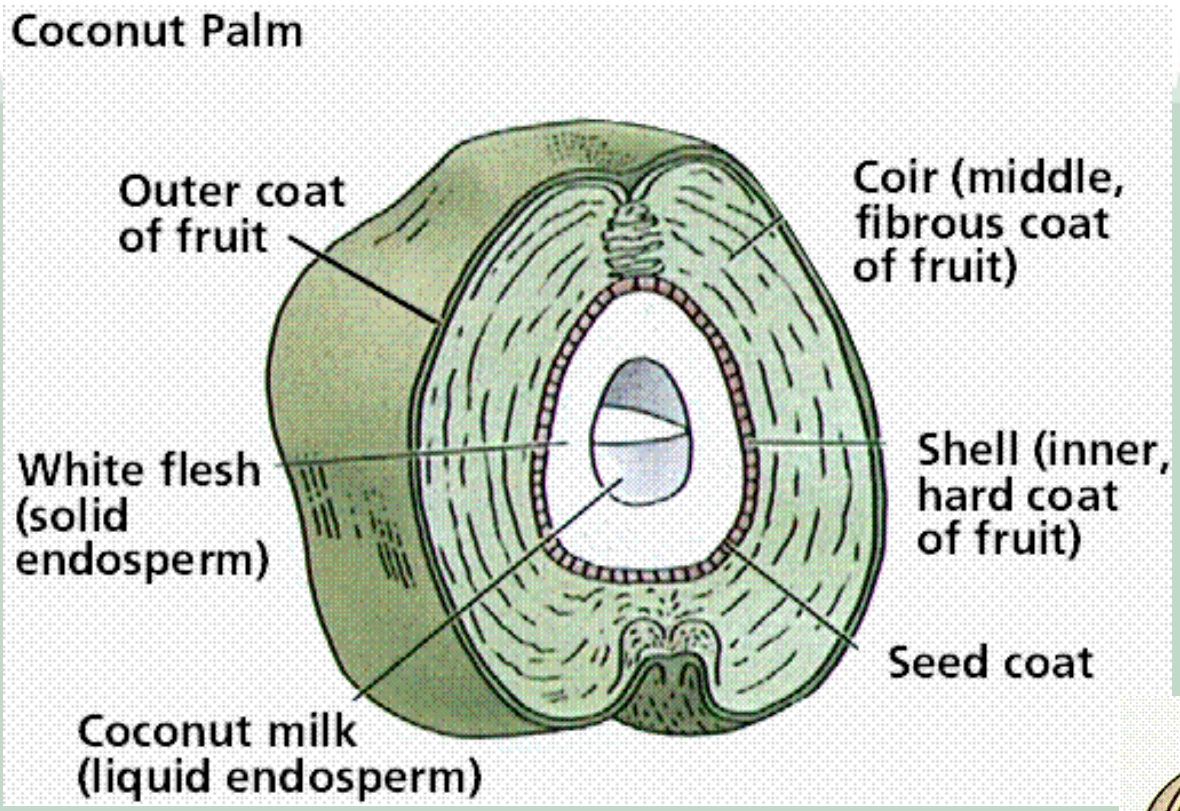
Fruits and Seeds

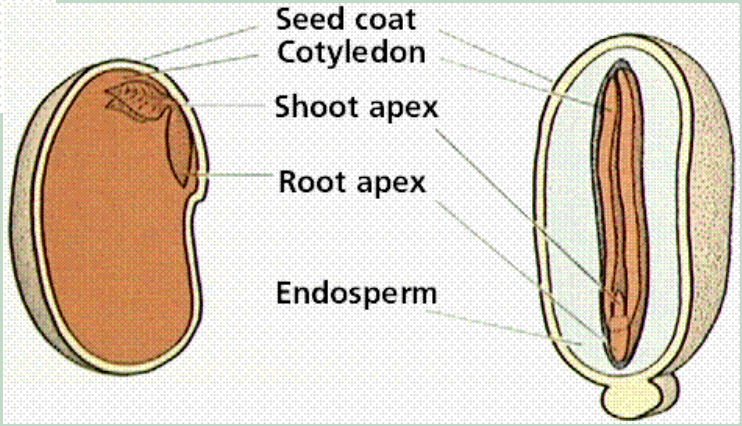
- Function
  - seed dispersal
  - seed protection
  - contain genetic information for next generation and structures to create new plant
- Morphology
  - Ovary development
  - Cotyledons/endosperm, embryo

Seeds

- Have an outer coat, usually tough (like an egg shell).
- Typically have endosperm (like egg white).
- Have one or two inner embryos (like egg yolk).
- Range in size from dust-sized to Avocado- sized.
- Contains one or two cotyledons, or seed- leaves.
  - Monocot - one cotyledon - grasses, sedges, palms.
  - Dicot - two cotyledons - broadleaves

Seed Parts


Coconut Palm
Outer coat of fruit
Coir (middle, fibrous coat of fruit)
White flesh (solid endosperm)
Shell (inner, hard coat of fruit)
Seed coat
Coconut milk (liquid endosperm)


Seed coat
Cotyledon
Shoot apex
Root apex
Endosperm

Fruits

- Ripened and seed-bearing ovaries of flowers.
- Nearly as varied in color, form, size, texture and number as are flowers.
- Can be used as the distinguishing characteristic of a species or variety.
- Divided into two large categories
  - Dry
  - Fleshy

Dry Fruits

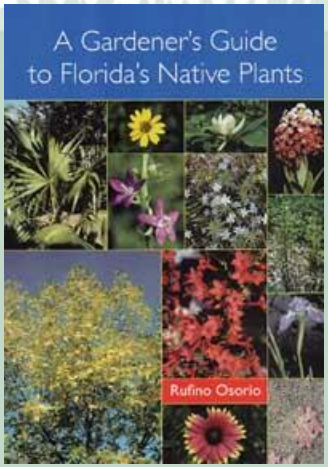
- Achene
- Samara
- Nuts
- Grain
- Capsule
- Silique
- Legume
- Follicle

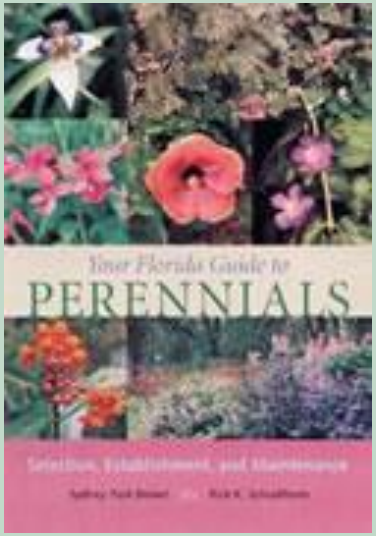
Fleshy Fruits

- Simple
  - Drupe
  - Berry
  - Pepo
  - Hesperidium
  - Pome
- Compound
  - Aggregate
  - Multiple

So when someone brings me a plant, how do I get to the scientific name?

- Dichotomous keys
- Plant ID books
- Glossaries of terms
- Websites





FloraGator

a multiple-entry key for flowering plant family identification

the key

the families

FAQs (frequently asked questions)

sources / credits

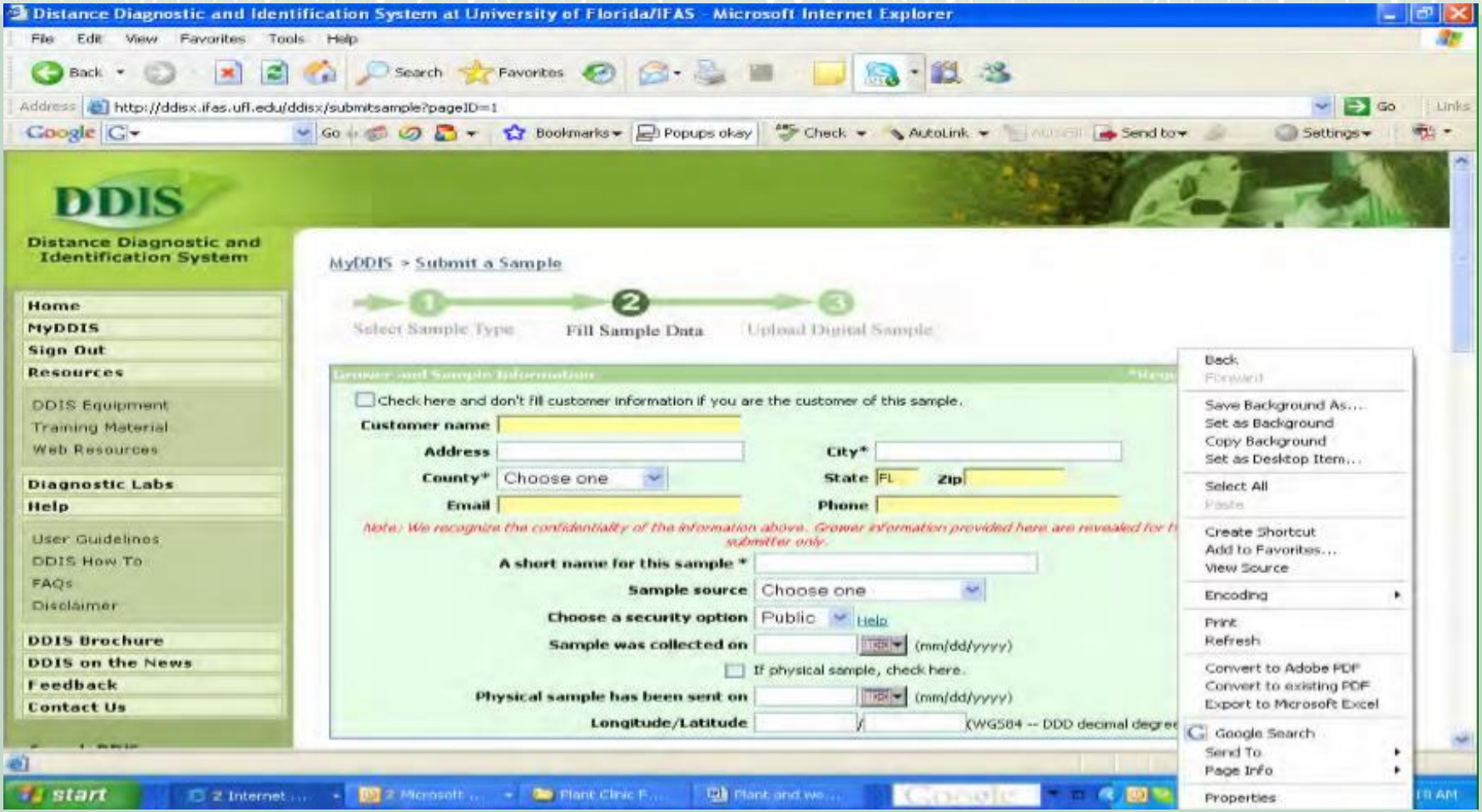
http://hort.ifas.ufl.edu/floragator/index.html

FloraGator is a multiple-entry key to the families of flowering plants as defined by the Angiosperm Phylogeny Group in 2009.

Users can identify an unknown plant to the correct family by reporting the visible details of the leaves, flowers, fruits, and other parts. The choice of information to report is entirely up to the user. The order in which information is entered does not affect the identification. Some families can be identified by a single feature. Other families may require up to 20 pieces of information.

We welcome your comments, feedback, and suggestions about this site.

DDIS Plant and Weed sample



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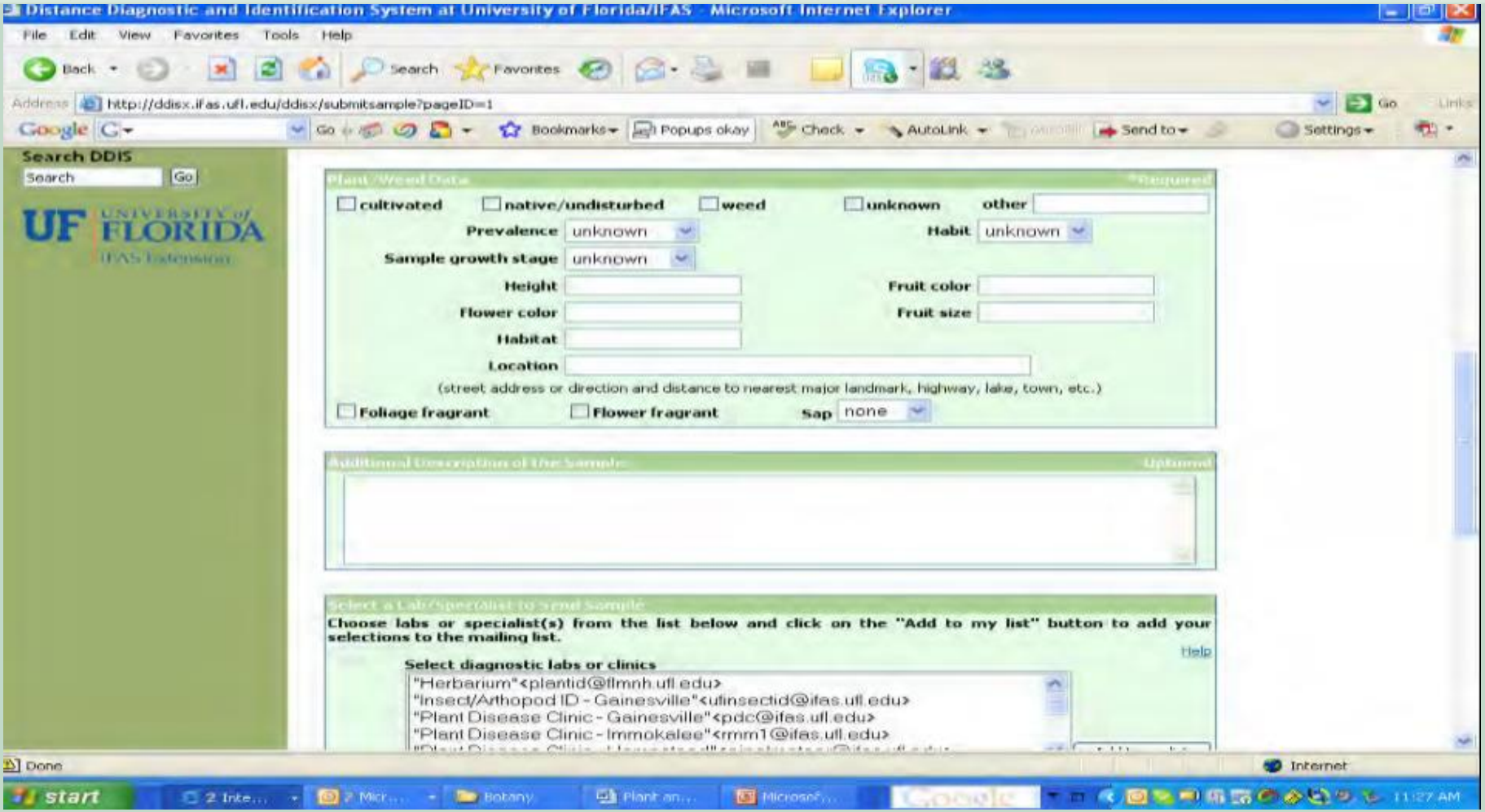
Distance Diagnostic and Identification System at University of Florida/IFAS - Microsoft Internet Explorer
File Edit View Favorites Tools Help
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Address http://ddisx.ifas.ufl.edu/ddisx/submitsample?pageID=1
Search DDIS
Search Go
UF UNIVERSITY of FLORIDA
IFAS Extension
Plant/Weed Data *Required
cultivated native/undisturbed weed unknown other
Prevalence unknown
Habit unknown
Sample growth stage unknown
Height
Fruit color
Flower color
Fruit size
Habitat
Location
(street address or direction and distance to nearest major landmark, highway, lake, town, etc.)
Foliage fragrant Flower fragrant Sap none
Additional Description of the Sample Optional
Select a Lab/Specialist to send Sample
Choose labs or specialist(s) from the list below and click on the "Add to my list" button to add your selections to the mailing list.
Help
Select diagnostic labs or clinics
"Herbarium"<plantid@flmnh.ufl.edu>
"Insect/Arthopod ID - Gainesville"<ufinsectid@ifas.ufl.edu>
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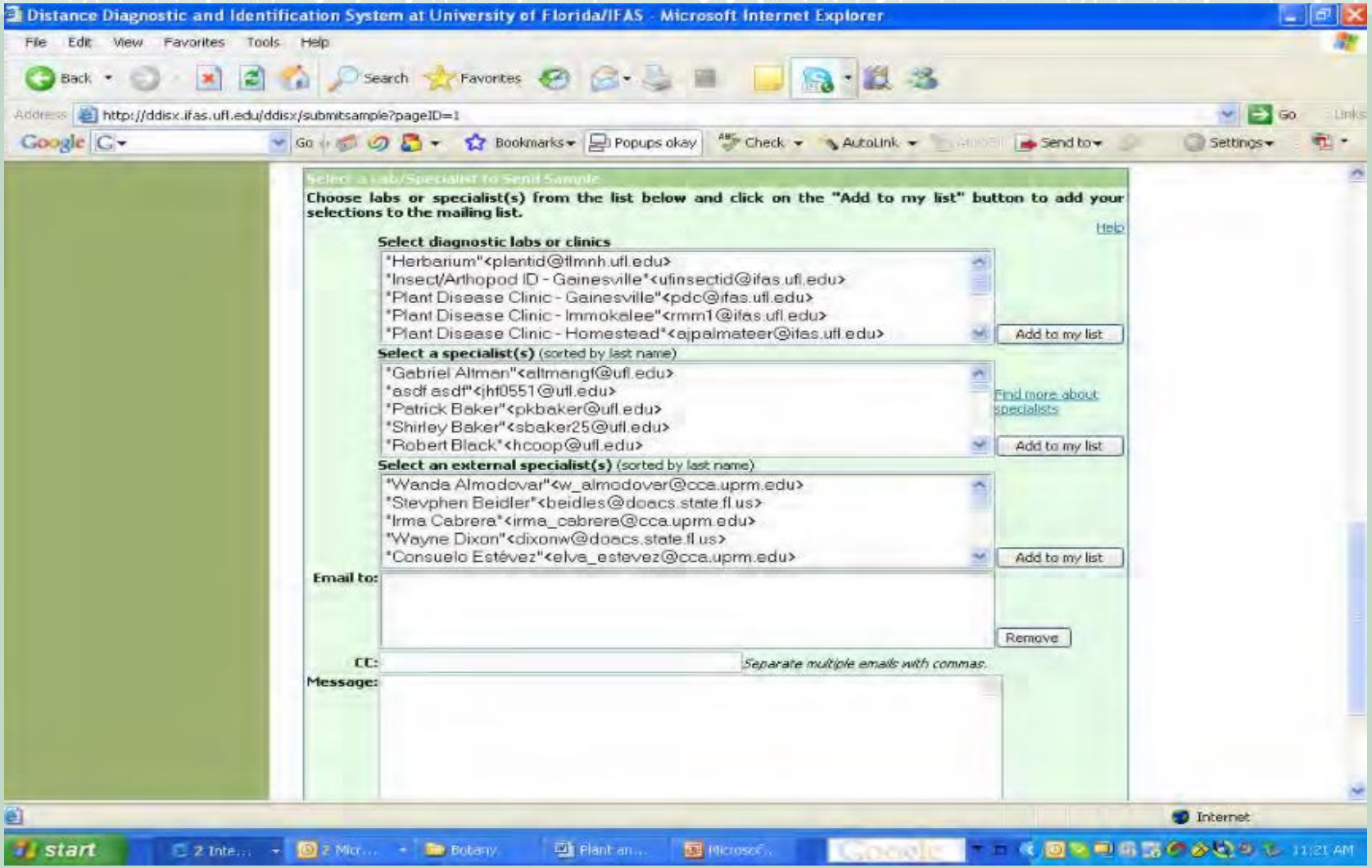
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File Edit View Favorites Tools Help
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Go
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Select a Lab/Specialist to Send Sample
Choose labs or specialist(s) from the list below and click on the "Add to my list" button to add your selections to the mailing list.
Help
Select diagnostic labs or clinics
*Herbarium"<plantid@flmnh.ufl.edu>
*Insect/Arthopod ID - Gainesville"<ufinsectid@ifas.ufl.edu>
*Plant Disease Clinic - Gainesville"<pdc@ifas.ufl.edu>
*Plant Disease Clinic - Immokalee"<rmm1@ifas.ufl.edu>
*Plant Disease Clinic - Homestead"<ajpalmateer@ifas.ufl.edu>
Add to my list
Select a specialist(s) (sorted by last name)
*Gabriel Altman"<altmangf@ufl.edu>
*asdf asdf"<jhf0551@ufl.edu>
*Patrick Baker"<pkbaker@ufl.edu>
*Shirley Baker"<sbaker25@ufl.edu>
*Robert Black"<hcoop@ufl.edu>
Find more about specialists
Add to my list
Select an external specialist(s) (sorted by last name)
*Wanda Almodovar"<w_almodover@cca.uprm.edu>
*Stevphen Beidler"<beidles@doacs.state.fl.us>
*Irma Cabrera"<irma_cabrera@cca.uprm.edu>
*Wayne Dixon"<dixonw@doacs.state.fl.us>
*Consuelo Estévez"<elva_estevez@cca.uprm.edu>
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Email to:
Remove
CC:
Separate multiple emails with commas.
Message:
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Botany
Plant an...
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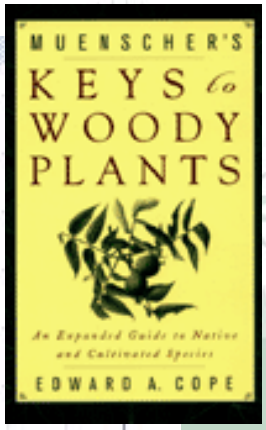
Plant Identification Learning Module

Distance Diagnostic and Information System

Key to Woody Plants by W.C. Muenscher



- A. Plants with leaves present
  - B. Plants with needles — go to Key I p. 6
  - B. Plants with broad leaves
    - C. Leaves opposite or whorled
      - D. Leaves simple — go to Key II p. 8
      - D. Leaves compound — go to Key III p. 12
    - C. Leaves alternate
      - E. Leaves simple — go to Key IV p. 13
      - E. Leaves compound — go to Key V p. 23
- A. Plants with leaves absent
  - F. Leaf-scars opposite or whorled — go to Key VI p. 26
  - F. Leaf-scars alternate — go to Key VII p. 30

Back to Plant ID:
Who ya gonna call?

- The first line of assistance is your county agent.
- Other local experts are available

Activity

Things you can do to learn more about plant ID:

(1) Practice using a Plant Key for Identification and regularly use the online Plant FlorIDa Learning Module. It is a great interactive tool to learn all of your Florida plants!

And/Or

(2) Start Your own Plant ID Notebook:

- **press a plant**
- **complete the Plant ID Note Sheet**

Let's take a field trip!

Acknowledgements:

This presentation was adapted from a PowerPoint originally developed by: Dr. Elizabeth Lamb, Cornell University IPM program – formerly @ UF/IFAS IRREC

Other contributors include:

- Adrian Hunsberger, Miami Dade Extension Agent
- Kim Gabel, Hort. Agent - Monroe County *(THE KEYS)*
- Stan Rosenthal, Extension Agent – Forestry, UF/IFAS Leon County Extension
- Jim Chatfield, Extension Specialist, the Ohio State University
- Paul Baumann, Weed Specialist – TAMU
- Oregon State Univ. Master Gardener Botany page: http://extension.oregonstate.edu/mg/botany/index.html