

# PLANT TAXONOMY

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**Why classify??**



# Plant Systematics and Taxonomy

- ❖ **Why classify?**
- ❖ **History of plant classification systems**
- ❖ **Some issues in plant systematics**
- ❖ **How to use botanical nomenclature**
- ❖ **Resources**
- ❖ **Some Latin definitions**

# Why classify??

## Definitions

**Taxonomy** -- the naming of groups (*taxa*, singular *taxon*)

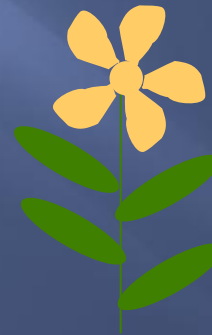
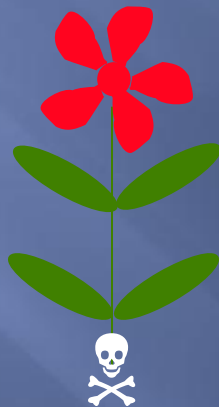
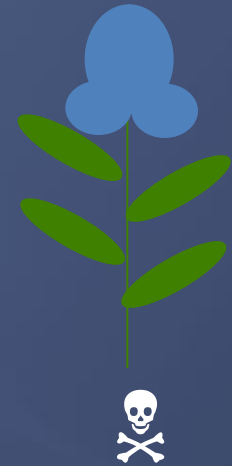
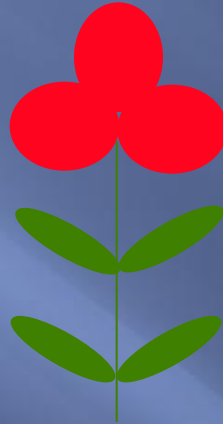
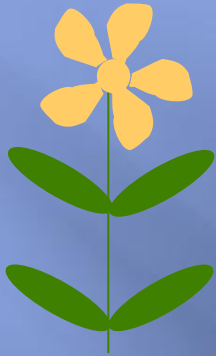
**Systematics** -- a method (or system) for classifying organisms into groups

## Goals of Classification

- Simplify
- Communicate
- Predict



# How to classify plants?



Lumpers vs. Splitters

# Functional classifications

- ❖ Based on function or overall similarity
- ❖ No assumption of evolutionary relationship



# History - Functional classification systems

*All cultures classify plants in ways meaningful to them*

## Examples of early plant classifications

- ❖ 2000 BC - Indian (Ayurvedic) texts described medicinal plants
- ❖ 1000-1700 AD - “Age of Herbals” in Europe



# History - Evolutionary classification systems

## Botanical tradition

- ❖ **Carolus Linneaus (*Systemae naturae*, 1732)**
  - defined groups based on sexual characters
  - developed binomial system of plant nomenclature
  
- ❖ **Engler, Bessey, Cronquist etc. (1800 - 1980s)**
  - sought to define evolutionary groups of plants
  - published many regional floras (still in use)

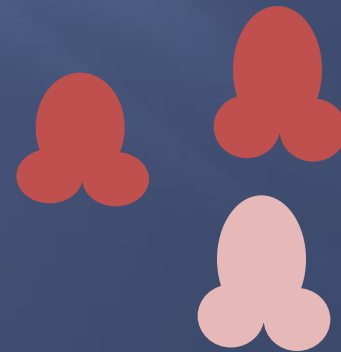
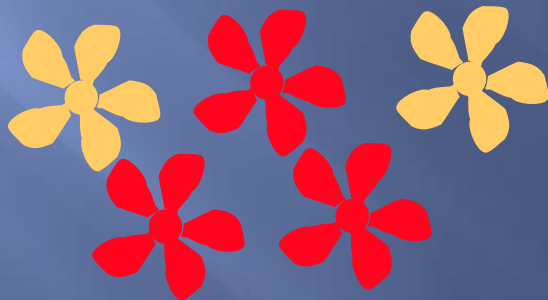


# Evolutionary classification

(includes both traditional systematics and modern phylogenetics)

## Reasoning

1. Living species are related to one another by descent from common ancestors
2. Shared character states are clues to relatedness

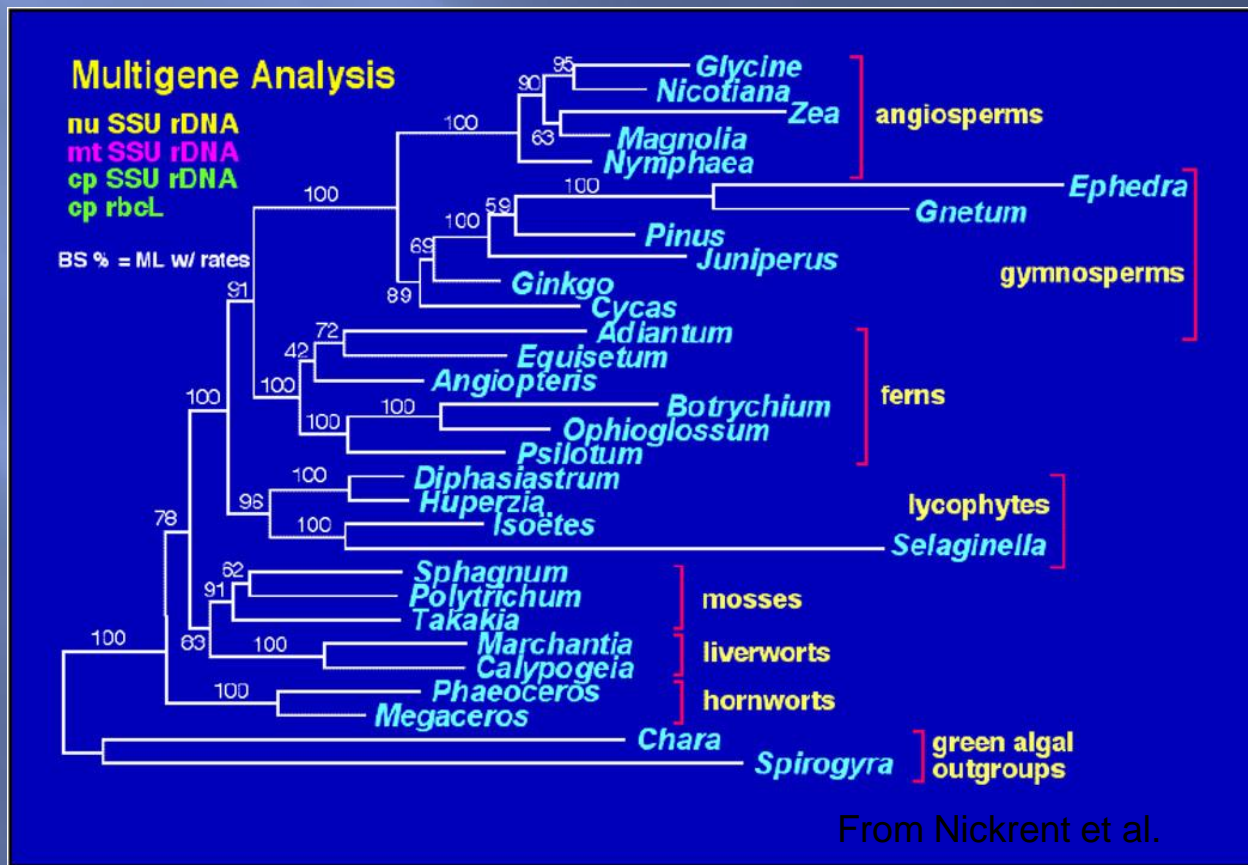


# What about convergent evolution??

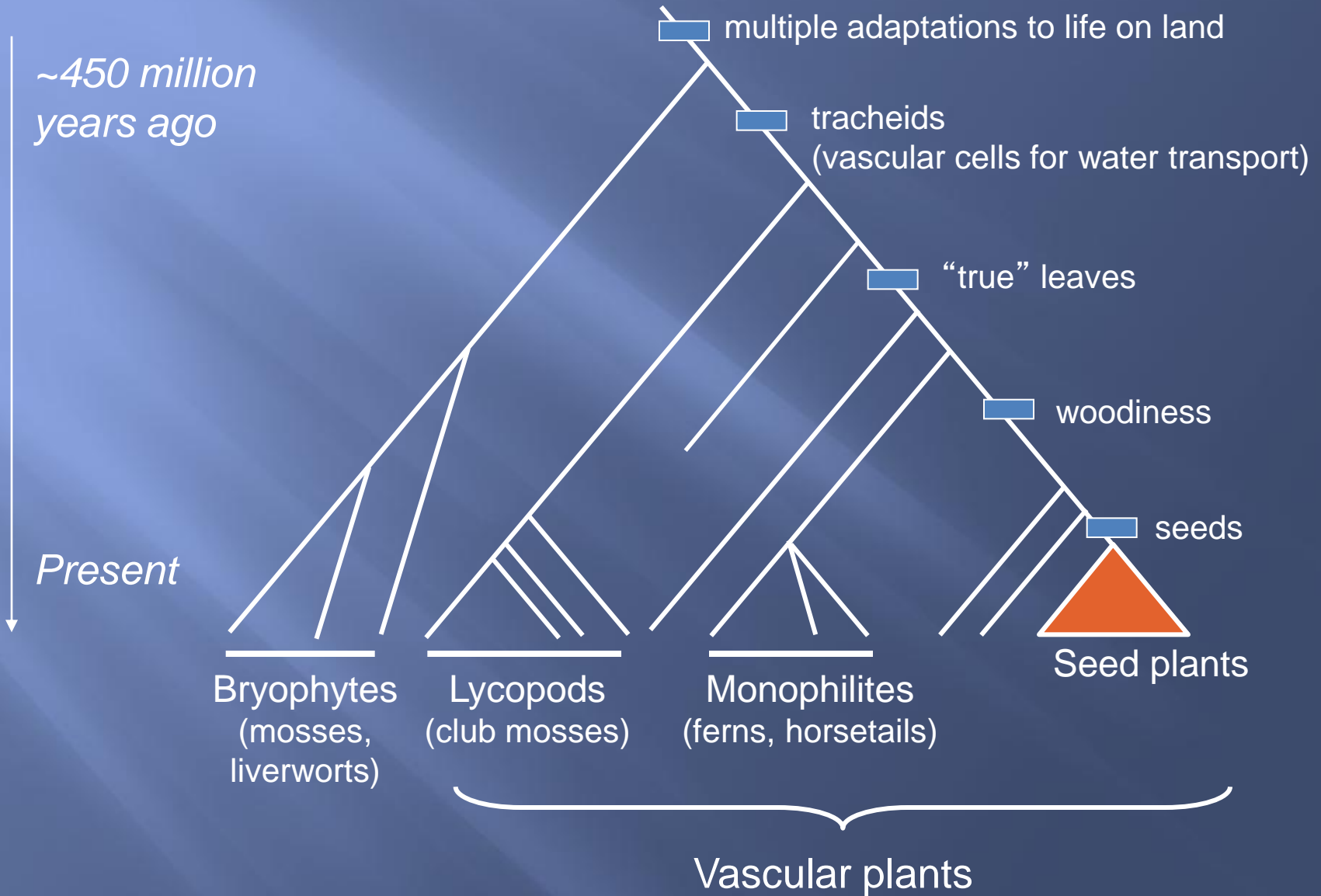


# Modern solution: Phylogenetic systematics

- ❖ Reconstructs relationships using lots of characters
- ❖ Now, primarily uses DNA sequence data



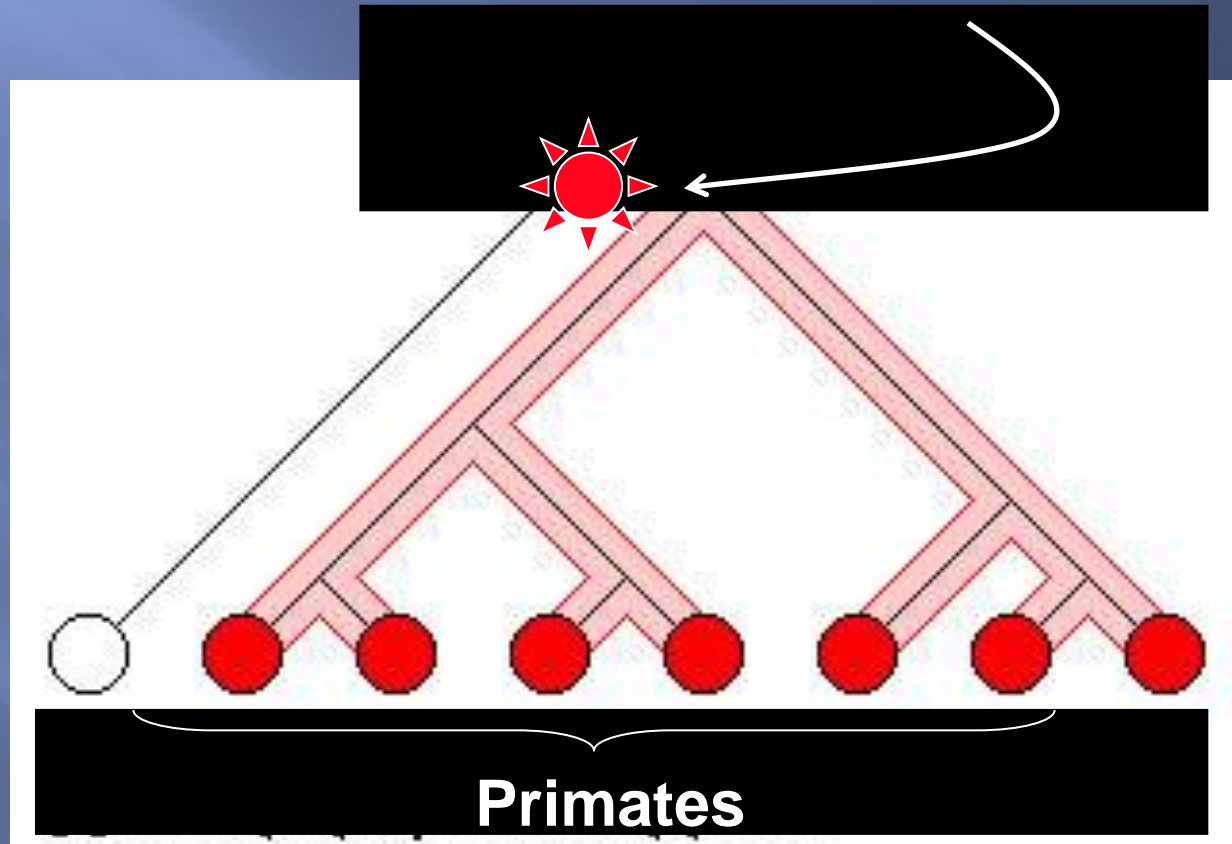
# Land plants (Embryophytes)



Usually gene trees and older taxonomy agree . . .

Monophyly (“*one class*”)

Named group shares an exclusive common ancestor

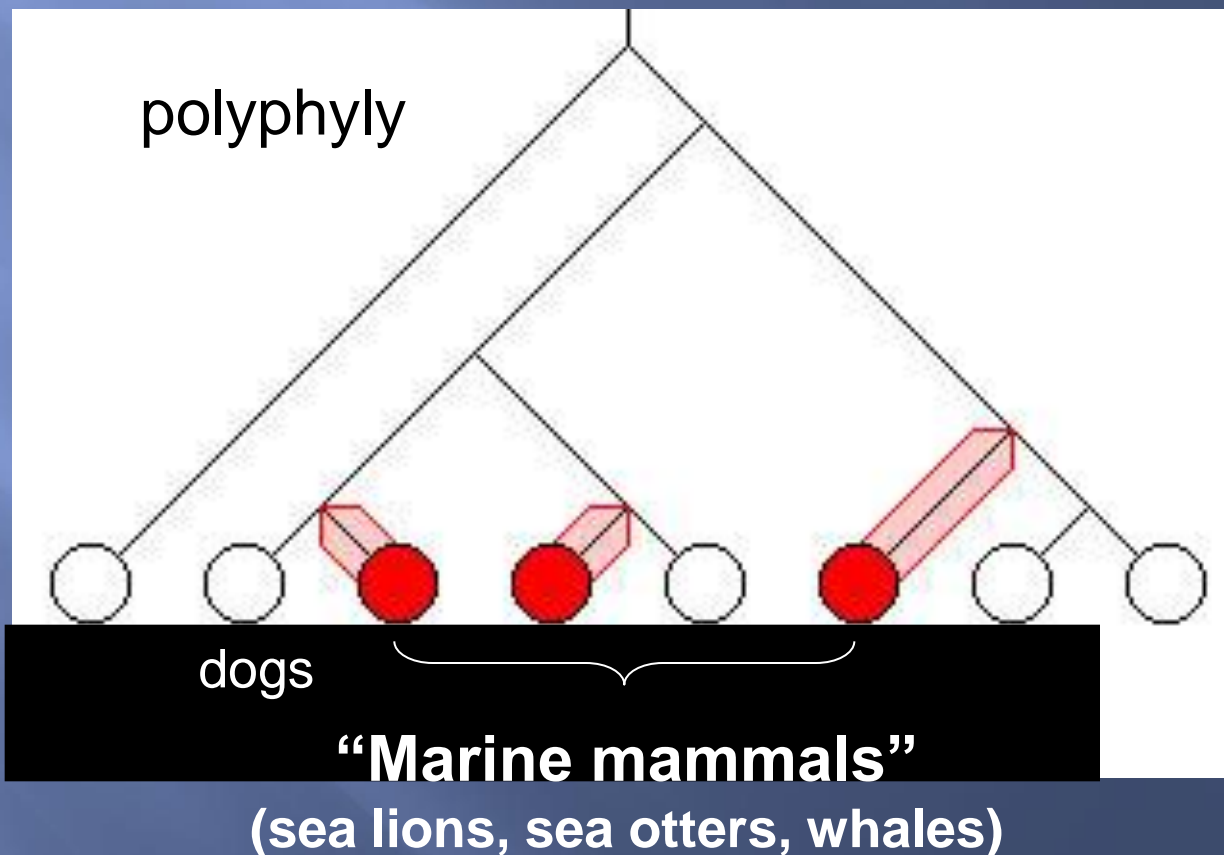


**Primates**  
(humans, great apes, old world monkeys,  
new world monkeys, lemurs)

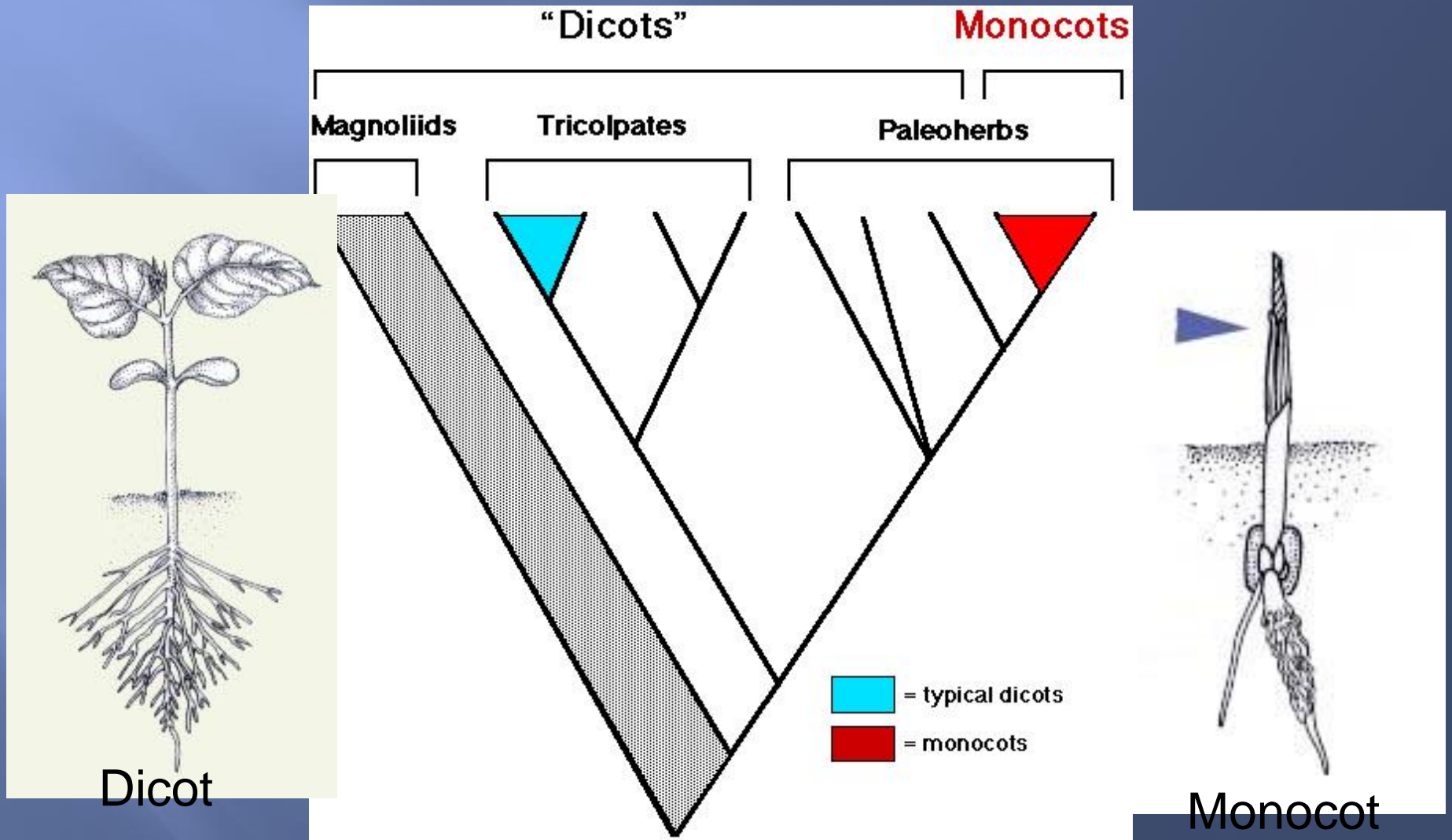
# But sometimes named groups are not “natural”

## Polyphyly and Paraphyly

Named group is not an exclusive set of closest relatives



# Paraphyly within flowering plants



# Plant nomenclature in practice

## Kingdom

Viridiplantae (green plants)

## Phylum/Division

Embryophyta (land plants)

## Subphylum

Tracheophytina (vascular plants)

## Class

Angiospermopsida (angiosperms)

## Subclass

Caryophyllidae

## Order

Caryophyllales

## Family

Portulacaceae (Purslane family)

## Genus

*Lewisia*

## Species

*Lewisia rediviva*



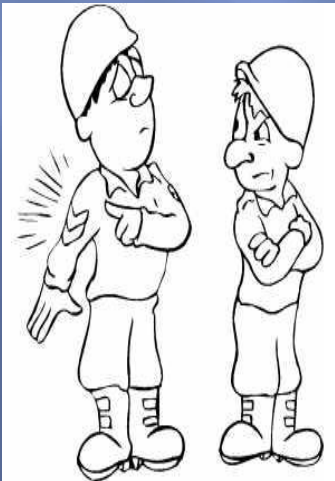
*Lewisia rediviva* (Bitterroot)



# Plant nomenclature in practice

## Higher ranks

- Each rank has a characteristic ending  
(ex. -idae for subclasses, -ales for orders)
- Ideally, all taxa are monophyletic, but ranks are arbitrary
- we'll focus on lower taxonomic levels
  - > **subclass** (ex. Rosidae vs. Asteridae)
  - > **family** (ex. Salicaceae vs. Betulaceae)
  - > **genus** (ex. *Populus* vs. *Salix*)
  - > **species** (ex. *P. tremuloides* vs. *P. deltoides*)



# Plant nomenclature in practice

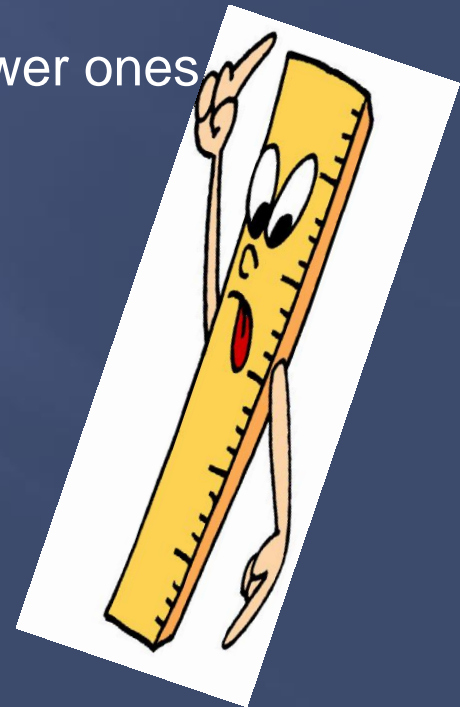
## ICBN (International Code of Botanical Nomenclature)

### **Goal: Standardization of scientific names for plants**

- First adopted in 1903; includes fungi, lichens and algae

### Basic rules

- Every taxon must have a type specimen
- Names of higher ranks must be based on names of lower ones
- Priority of publication determines “correct” name
- Only 1 name is allowed per taxon, 1 taxon per name



# Plant nomenclature in practice

## Families

- All end in -aceae (easiest to pronounce a-cee-ee)
- Older alternate names also allowed for 8 families
  - examples: Crucifereae = Brassicaceae (mustard family)
  - Umbellifereae = Apiaceae (carrot family)
  - Compositae = Asteraceae (sunflower family)
- Always capitalize family names

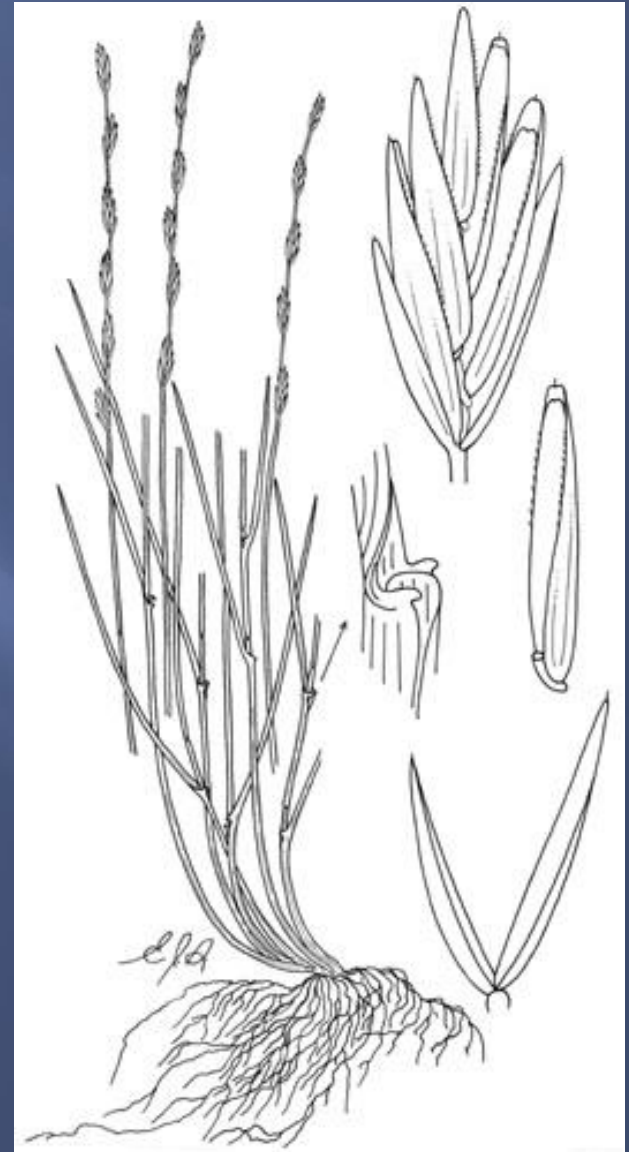


# Plant nomenclature in practice

## Why do names change?

- New evolutionary data
- Rediscovery of older names
- Lumpers vs. splitters

*Agropyron spicatum*  
*Elymus spicatus*  
*Psuedoroegneria spicata*  
Bluebunch wheatgrass



# Why not just use common names?



# Why not just use common names?



# Plant nomenclature in practice

Species names (“scientific names”) are Latin binomials

## *Lewisia rediviva* Pursh.

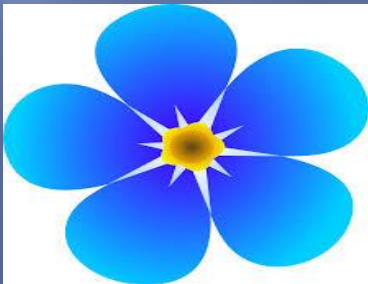
- Genus (pl. genera)
- Always capitalized
- Abbreviated on 2<sup>nd</sup> use  
(*L. rediviva*)

- Specific epithet
- Not capitalized
- Often a descriptive adjective

- Authority

➤ Always underline or *italicize* species names (genus + specific epithet)

- By using the binomial system of nomenclature, plant names are the same in all languages!
- Every plant has a “first and last name” where the last name is written first.
- Genus (plural genera)
  - A group of plants which are closely related, definable group of plants exhibiting similar characteristics (flowers, fruit, stems, leaves, or roots) and genetic affinity





# The genus describes one of the following:

- A plants appearance- *Hemerocallis* (day and beauty)
- Supposed medicinal qualities- *Pulmonaria* (lungwort)
- Resemblance to body parts- *Hepatica* (liver)
- Honors a person by using their name – *Kalmia* (Peter Kalm)



# Specific epithet

- ▣ The second word in a scientific plant name, not capitalized and usually an adjective used to describe size, color, leaf shape, growth habit, origin of the plant or to commemorate a person.

- ▣ Gives us hints:

*Cotoneaster horizontalis*

*Coreopsis gigantea*

*Cistus x purpureus*

*Chionanthus virginicus*



# Writing Plant Names by the Rules

- ❑ Scientific names should always be underlined or in italics
- ❑ The genus is capitalized, the specific epithet is not
- ❑ The name is only complete if it is followed by the name of the person who first described or named it.

❑ Red Oak: Quercus rubra Linnaeus

❑ Or Quercus rubra L.



# Plant species can be divided more specifically into:

- ▣ Cultivar
- ▣ Variety
- ▣ Hybrid



# Cultivar

- Have distinguishing characteristics from the other plants in the species, but cultivars do not transfer those characteristics to offspring through sexual reproduction
- Names written with a single quote
- A cultivar of red maple is written as:
- *Acer rubrum*, 'October Glory'
- *Acer rubrum* cv. October Glory

# Variety

▣ A subdivision of a species that has a difference and breeds true to that difference

▣ Apples

- -McIntosh
- -Cortland
- -Red Delicious
- -Jonathon
- -Liberty



Written in lower case and italicized or underlined ex.

*Pinus contorta* var. *latifolia* Lodgepole Pine

# Hybrid

- ❑ Two closely related but distinct species will be interbred to form a hybrid
- ❑ Are often sterile and produce no seed or fruit
- ❑ Ex. seedless watermelon




Written in lowercase and italicized or underlined an “x” is placed between the genus and hybrid epithet :  
*Plantanus x acerifolia*

Cross between *Platanus occidentalis* and *Plantanus orientalis*

# Integrated Approach to Plant Identification

- ❑ Visual inspection of plant characteristics
- ❑ Photographic references
- ❑ Plant Classification keys
- ❑ Expert Advice



Name \_\_\_\_\_  
Date \_\_\_\_\_

### Let's Learn to Use and Build a Dichotomous Classification Key

**Why classify?** Classification is important in understanding the world of living organisms around us. The life on Earth can be organized into a sort of family tree, which helps us to see the similarities and differences that exist in the living things all around us.

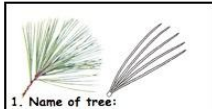
**What is a dichotomous key?** A dichotomous key is a guide for classification and identification of a living organism. By asking a series of questions to which there are only two possible answers with respect to the object to be identified, the key leads users toward the proper identification.

**Directions for using a dichotomous key:**

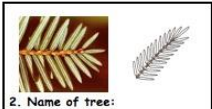
1. On the following pages, you will find pictures of the leaves of 7 different conifers or cone bearing plants. You will use the dichotomous key below to identify each one.
2. Study the characteristics of the leaf you want to classify.
3. In the key below, read the first choice given.
4. Decide which choice is correct for the leaf you are classifying.
5. Follow the directions to lead you to the next choice.
6. Continue making choices until you reach the name of the tree.

#### Dichotomous Key to the Conifers


1. Leaves are long and needlelike.
  - a. Yes. Go to line 2.
  - b. No. Go to line 8.
2. Needles are in clusters of 2 or more.
  - a. Yes. Go to line 3.
  - b. No. Go to line 5.
3. Needles are in clusters of 2, 3, or 5.
  - a. Yes. Pine tree.
  - b. No. Go to line 4.
4. There are many needles in clusters on a short stem.
  - a. Yes. Larch.
  - b. No. Go back to line 1.
5. Needles are single, sharp, and grow all around the stem.
  - a. Yes. Spruce.
  - b. No. Go to line 6.
6. The needles are soft and flat in two rows along the stem.
  - a. Yes. Bald Cypress.
  - b. No. Go to line 7.
7. The needles are stiff and flat in 2 or 3 rows along the stem.
  - a. Yes. Hemlock.
  - b. No. Go back to line 1.
8. The leaves are scale like and flat and hug the stem.
  - a. Yes. White cedar.
  - b. No. Go to line 9.
9. The needles are sharp and are both needlelike and scale like.
  - a. Yes. Juniper.
  - b. No. Go back to line 1.




1. Name of tree:




2. Name of tree:




3. Name of tree:




4. Name of tree:



5. Name of tree:



6. Name of tree:



7. Name of tree:



# Plant nomenclature in practice

How to pronounce scientific names? However works!!

## *Some guidelines:*

1. Pronounce 1 syllable for every vowel

*Anemone* = A-ne-mo-ne

*Cardamine* = Car-da-mi-ne

2. But, pronounce proper names more-or-less normally

*Carex jonesii* = *Carex jones-ee-ee*

3. Weird double consonants are usually silent

*Pseudotsuga* = Su-do-(t)su-ga



# Some Basic Latin Definitions

Acorus= herbaceous marsh plant

Alata= winged

Altus= tall

Amarum=bitter

Bifida= twice cut or cleft

Biflora= double flowered

Biloba= double lobed

Brachyloba= short lobed

Breviflora= short flowered

Brevicapus= short stemmed



## Resources

The Pronouncing Dictionary of Plant Names -  
American Nurseryman

Virginia Cooperative Extension MG Manual 2009

UME 2008 University of Maryland Extension MG Manual

# Questions?

