# Forestry

Co-instructors: Tatiana Liang, Ellen Tang, Hayley Tang






# about this course

Welcome, SciOly padawans, to **Forestry** at ScioVirtual!

- The **main goal** of this course is to teach you guys as much **as we can about tree species.**
- The **secondary goal** is to see how much **fun** we can have while doing it.
- THIS IS NOT YOUR AVERAGE ZOOM CLASS.

Sure we will have to lecture, but we're going to make Forestry so fun that hopefully it will be your favorite Science Olympiad event :DDD

# Get to know your instructors!



Favorite movie(s): Crouching Tiger, Hidden Dragon and Finding Nemo
Favorite artist(s): twenty øne piløts, Fall Out Boy
Favorite Book: Six of Crows by Leigh Bardugo
Go-to Karaoke song: World Burn (Mean Girls)
Favorite thing to paint: Trees, misty forests
Aesthetic: cottagecore
Favorite Tree: Coast Redwood (Sequoia sempervirens), with Giant Sequoia (Sequoiadendron Giganteum) as a close second

## Tatiana Liang

- Rising Junior @Temple City High School in CA
- 4th year in Science Olympiad
- Disease Detectives, Anatomy, Codebusters, Elastic Launched Gliders, Herpetology (derogatory)
- Loves plants but is allergic to them (cries inside)
- Can often be found eating instant ramen out of her Naruto ramen bowl
- Has an art account she hasn't had time to update in a while T-T (go follow @tn_tati on insta)

Contact: tliang1769@tcusd.net

# Get to know your instructors!



Favorite TV shows: Supergirl, HSMTMTS
Favorite movies: Your Name, Crush, The Half of It, Saving Face
Favorite books: Any and all Rick Riordan series
Favorite artist(s): Taylor Swift, Olivia Rodrigo
Go-to Karaoke song: All Too Well (10-Minute Version) (Taylor's Version) (From the Vault)
Slightly Shameful Hobby: writing fanfiction
Favorite Tree: i'm indecisive

## ellen tang

- Has been in SciOly for like. Forever. (8 years and counting!)
- Events: Anatomy (A is for Anatomy, No Bones About It), Food Webs, Egg Drop, Barge Building, Pasta Mobile, Fossil Find/Fossils, Heredity/Designer Genes, **Write It Do It, Write It CAD It, Cell Biology, Codebusters**
- Passions truly lie in the tiny biologies, but trees are cool too
- Decorated medalist, but only in WIDI
- Will become your favorite #swiftie

Contact: etang0710@gmail.com

# Get to know your instructors!



Favorite movie soundtrack: How to Train Your Dragon, Forrest Gump
Favorite artist: Taylor Swift
Go-to Karaoke song: Long Live, Paper Rings (Taylor Swift)
Aesthetic: absolutely none i'm a mess
Favorite Tree: the peach tree in my backyard; gives the best peaches

## Hayley Tang

- I've officially been in Science Olympiad for half of my life as of yesterday (8 years, do the math)
- Events: **Anatomy, Write It, Do It, Write It, CAD It, Experimental Design**, Codebusters (div C), Anatomy, Write It, Do It, Solar System, Mission Possible (div B), A is for Anatomy, No Bones About It, Write It, Do It, Starry Starry Night, Egg Drop, Pasta Mobile, Mystery Box (div A)
- I play 6 instruments (and like to sing!)
- Human anatomy is my thing, but trees are cool too!
- Biggest SciOly flex: I have 1 of each of the 1st-6th place medals in Write It, Do It (and 2 3rd place medals from States!)

Contact: htang3945@tcusd.net



## Today's Attendance Code

***firstforest***

# 🏆 Score Points. Win Prizes. 🏆

🧠 Course challenges each Friday

✅ Attendance

🗣️ Active participation with video on

**Note**: Class scores are added to your team score (if you are in the team competition)

**Top 10 Players**

| | Player | Team | FC #1 | FC #2 | FC #3 | Attnd. | Bonus | Raw | Div |
|---|---|---|---|---|---|---|---|---|---|
| 1 | little B | *SoS* | 40 | -- | -- | 15 | 0 | **55** | -- |
| 2 | FieryRyan789 | *Fatal Minds* | 35 | -- | -- | 15 | 5 | **55** | 100 |
| 3 | arv | *Ishika's Team* | 35 | -- | -- | 10 | 0 | **45** | -- |
| 4 | josie | *Bio > All* | 25 | -- | -- | 15 | 0 | **40** | 95 |
| 5 | TG | *Independent* | 20 | -- | -- | 15 | 5 | **40** | 90 |
| 6 | micky | *Small Branes* | 20 | -- | -- | 15 | 5 | **40** | -- |
| 7 | vicky | *RedFoxes* | 25 | -- | -- | 15 | 0 | **40** | 100 |
| 8 | onericeboi | *The Cats* | 15 | -- | -- | 15 | 5 | **35** | 85 |
| 9 | Nitrostrider | *Gyrados Guys* | 10 | -- | -- | 15 | 5 | **30** | 95 |
| 10 | BL | *Independent* | 10 | -- | -- | 15 | 0 | **25** | -- |

More info at **sciovirtual.org/score**

# class structure

Typically our class is going to go something like this (all times are in EST):

- 6:00: welcome, fun intro activity, review “homework”
- 6:10: Kahoot or Quizlet Live competition on what we learned in the previous class (points will be given!)
- 6:30: lesson starts (we will try our best not to make it boring)
- 6:55: wrap up, assign “homework”

And the homework will usually be correlated to the material in some way, but it’s not required and it’s usually going to be something fun that we’ll discuss in the next class :)

Kahoot! Quizlet Live

# Material we will be covering:

Unit 1: Deep Roots - What is a tree?

- Lesson 1: History of plants, Types of trees, how to identify a tree
- Lesson 2: All about tree cells

Unit 2: With Trees Like These, Who Needs Enemies? (Conifers)

- Lesson 1: Redwoods (Taxodiaceae), Cypresses (Cupressaceae)
- Lesson 2: Pines/Firs/Larches/Spruce/Hemlock (Pinaceae)
- Lesson 3: Ginkgos (Ginkgoaceae), Yews (Taxaceae)

Unit 3: WEIRD Trees

- Lesson 1: Cacti (cactaceae, Palms (Palmae/Arecaceae)

This will probably change in the coming days, but it's just for us to have an idea of what we will be learning throughout the month! Sometimes we will go out of order depending on which one of us is available for each day.

Unit 4: Lots of Broccoli (Deciduous)

- Lesson 1: Oaks/Beeches (Fagaceae)
- Lesson 2: Willows (Salicaceae)
- Lesson 3: Birches (Betulaceae) and Walnuts (Juglandaceae)
- Lesson 4: Elms (Ulmaceae), Mulberries (Moraceae), Magnolias (Magnoliaceae)
- Lesson 5: Custard Apple (Annonaceae), Laurel (Lauraceae), Witch Hazel (Hamamelidaceae), Sycamore (platanaceae)
- Lesson 5: Rose (Rosaceae)
- Lesson 6: Legumes (Leguminosae), Maples (Aceraceae)
- Lesson 7: Rue (Rutaceae), Quassia (Simaroubaceae), Cashew (Anacardiaceae), Holly (Aquifoliaceae), Buckeye (Hippocastanaceae)
- Lesson 8: Myrtle (Myrtaceae), Dogwood (Cornaceae), Heath (Ericaceae), Ebony (Ebenaceae), Oleaceae (Olive), Bignonia (Bignoniaceae), Honeysuckey (Caprifoliaceae), Spurge (Euphorbiaceae)

# Class activities!!

- Kahoot!
- Quizlet Live
- Jeopardy!
- QOTD (Question of the Day)
- Class debates
- Google forms polls
- Spirit Days (dress in a theme)
- Trees in the Wild
- Google forms Competitions
- And much, much more!









# Additional resources

Every day after the lesson, we will post a slide with links on it that will take you to some websites or research papers that you can read if you have time. They will not only **reinforce** what you have learned in class, but also give you a more **comprehensive understanding** of the topic. Hopefully they will allow you to gain more insight into this subject. It is not required but definitely recommended for you to get used to reading more advanced material in preparation for your future Science Olympiad and High School career!

# Participation!

Even though we are your teachers, we are also students just like you! So **don't be afraid** to **participate** in class discussions and talk to us. We don't bite :) The more we talk to each other, whether it be in a debate (we will do that at some point) or in the chat answering questions, the easier it will be to learn the class material.

**Points will be given to students who participate!**

Feel free to talk in the chat, but there are some guidelines: **1)** no profanity. **2)** no bullying. **3)** be nice to each other. **4)** don't spam the chat with useless messages so that we can see everything clearly.

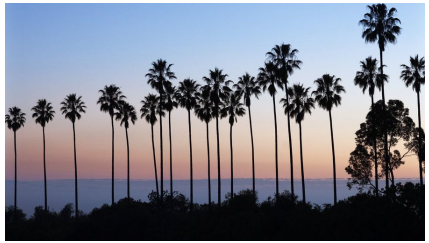
**And that's about it!**

# QOTD (Question of the Day):

Are palm trees actually trees?








# Is this a palm tree?







# Is this a palm tree?







No! These are funky lil dudes called Cycads, which emerged about 100 million years before palm trees. They are in completely different plant families!

Now let's see how this works…

# It's time for some Phylogeny!

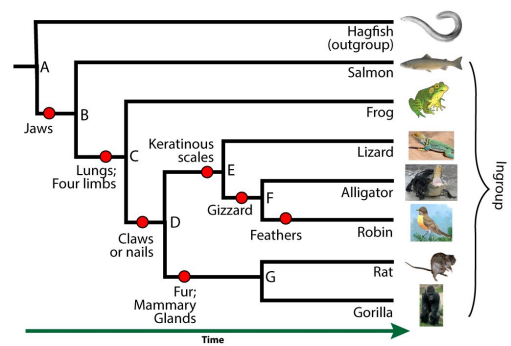
Since we're learning about trees, let's talk about phylogenetic trees!

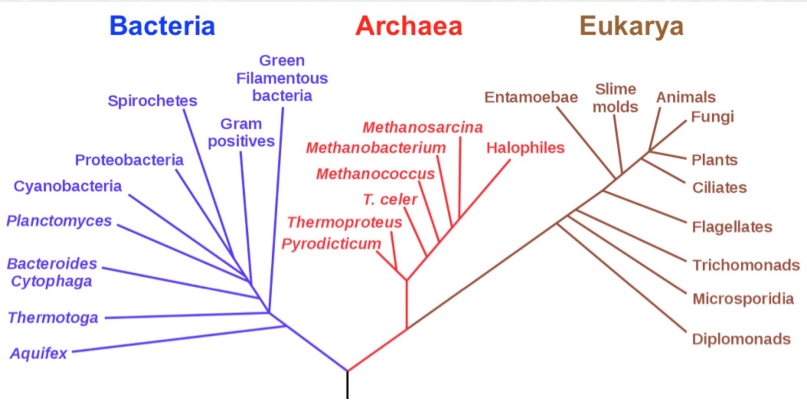


# It's time for some Phylogeny!

**Phylogeny:** the study of evolutionary relationships among biological entities – often species, individuals or genes.

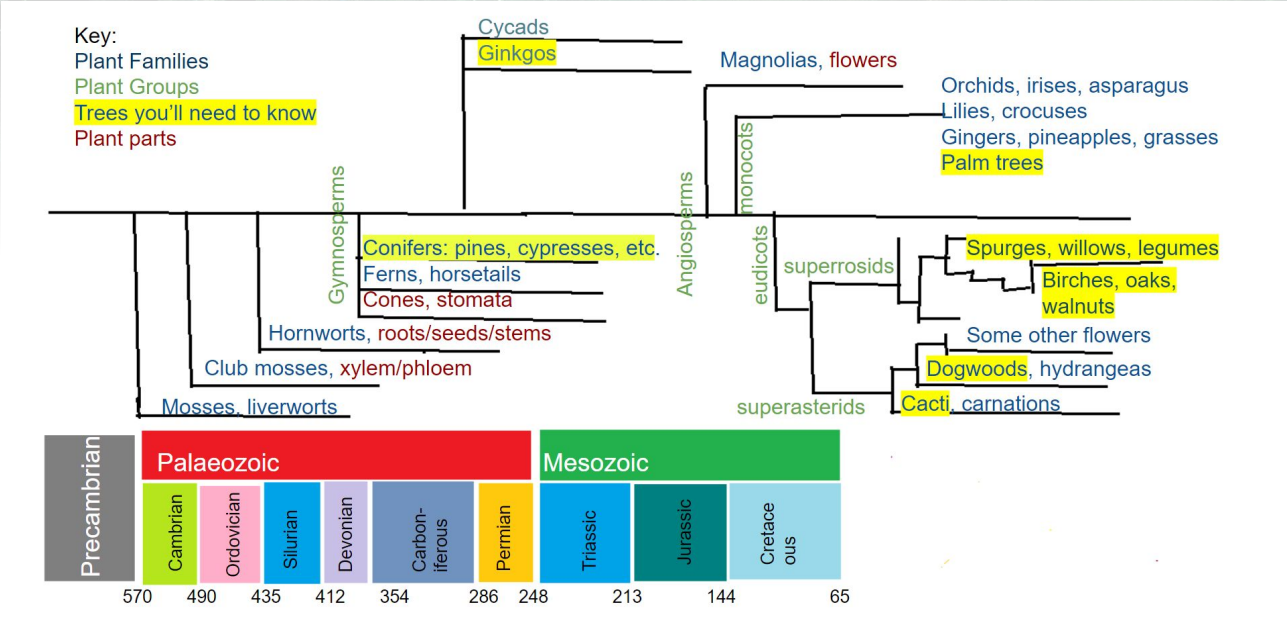
Phylogenetic trees:



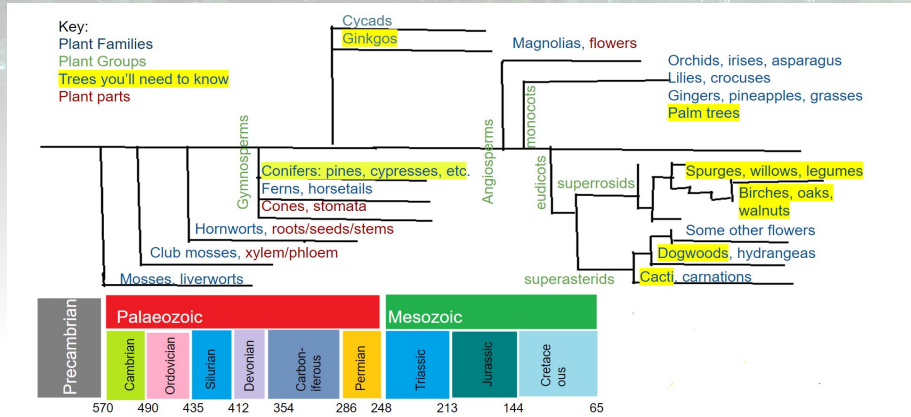



# The Plant Phylogenetic Tree

The Plant phylogenetic "tree" (so punny haha) - what do you notice?



# The Plant Phylogenetic Tree



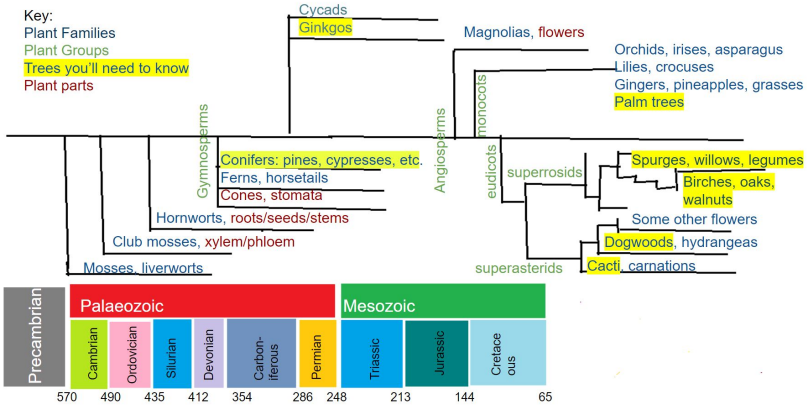

Phylogenetically, there is **no such thing as a tree.**

**Clade:** a group of organisms believed to have evolved from a common ancestor, according to the principles of cladistics

Look at this phylogenetic tree. There is NO clade of plants that is just for trees. Instead, what we know in the English language to be a "tree" is scattered across multiple different plant groups.

What you know to be an Oak tree is really more closely related to a Carnation than a Pine tree.

# The Plant Phylogenetic Tree




Scientifically, plants are not divided into "trees" "bushes" "fruits" and the other ways that we categorize them in our daily lives.

Instead, we have several different clades of plants and some species in those clades just so happen to be what we call "trees".

Evolution likes to turn different plant families into trees, for whatever reason. All of these different clades have evolved through hundreds of millions of years to arrive at the same destination: a tall, woody structure with a single trunk and multiple branches.

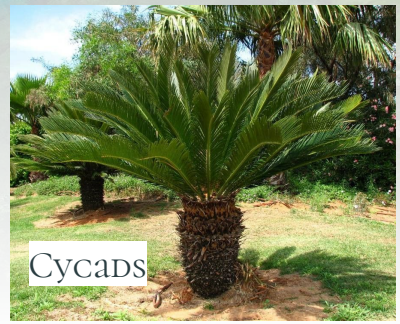
Because a tree is not a category. It is an evolutionary strategy.


Types of ~~trees~~ plants

# Gymnosperms

- Evolved during the Carboniferous period ~360 mya (million years ago)
- Earliest seed plants
- Have no flowers or fruits
- Seeds exist “naked” - on the surface of the reproductive structure instead of enclosed within it like in a fruit
- Four extant (not extinct) groups: Coniferophyta (conifers), Cycadophyta (the cycads), Ginkgophyta (the ginkgoes), Gnetophyta (the gnetophytes)
  - Two extinct groups: Pteridospermophyta and Cycadeoidophyta.


Conifers


Cycads


Ginkgo


Gnetophytes

# Conifers

- Largest group in gymnosperms
- Evolved ~310 mya
- Have cones - reproductive organs (most of the time)
- Are evergreen - do not drop leaves in the winter (most of the time)
- Include Redwoods (Taxodiaceae), Cypresses (Cupressaceae), Pines (Pinaceae), Yews (Taxaceae)



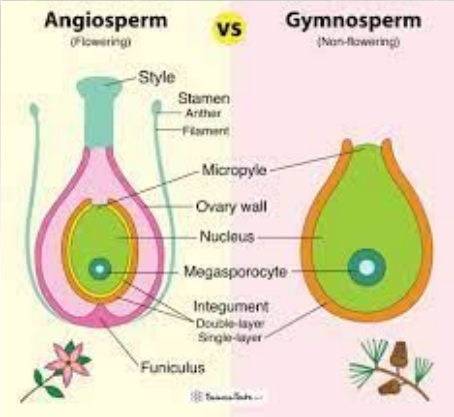




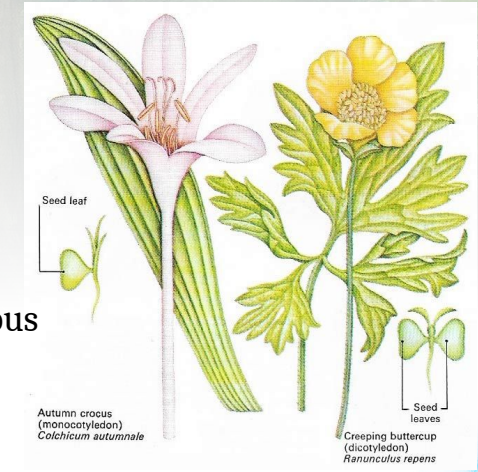





# Angiosperms




- We don't really know when exactly they first showed up
- Fossil record dates back to the early Cretaceous (145 - 100 mya)
- Could be as old as the late Permian (~270 mya)
- Did really well in the mid-Cretaceous and vastly outcompeted the gymnosperms (~140 mya)
- Have flowers, carpels, stamens, pollen
- Seeds are enclosed in a fruit
- Two types: monocotyledons and eudicotyledons



# Monocots

Diverged in the Early Cretaceous (~125 mya)
Not very many fossils because they mostly do not have wood and don't get preserved
15% of all angiosperms are monocots





Single cotyledon - embryonic leaf
Do not have a lateral meristem containing cambium (contains undifferentiated cells that can develop into specialized cells)

- This means that no matter how tall they get, they cannot get thicker to accommodate that height

Typically have narrow, linear leaves that sheath stem

- One leaf per node
- Leaves have parallel veins

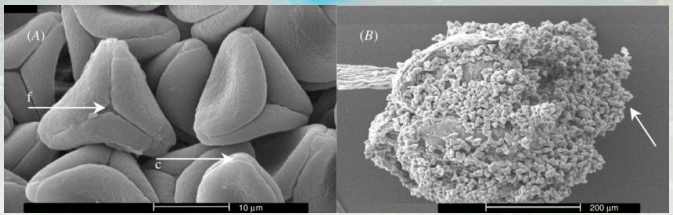




No difference between sepals and petals
Flower parts in multiples of three (3, 6, 9)
Fibrous roots
Scattered vascular bundles

# Eudicots

- Diverged around same time as monocots
- Used to be called “dicots”, term was later expanded to “eudicots” to include all plants that had more than one embryonic leaf
  - Over 70% of angiosperms
  - Two cotyledons
  - Net-like veins
  - Flowers in multiples of 4 or 5
  - Vascular bundles in a ring
  - Taproot
    - Tricolpate: pollen grains have three colpi - grooves paralleling polar axis












# Types of Plant Reproduction

Monoecious: separate male and female cones are present on the same plant

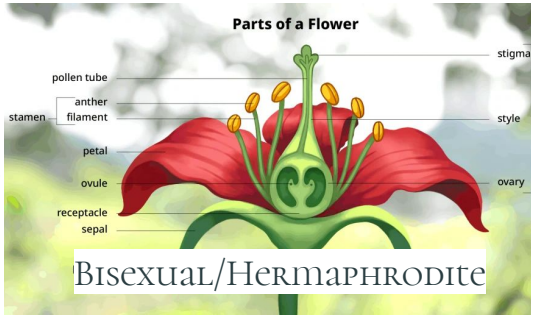
- 10% of all seed plant species, 7% of angiosperms

Dioecious: separate male and female plants

- 65% of gymnosperms, 6% of flowering plants
- No self fertilization - advantageous for avoiding genetic mutations and increasing diversity
- Downside: only 50% of all individuals can produce offspring

Bisexual: all flowers have both female and male parts
Can reproduce within the same flower



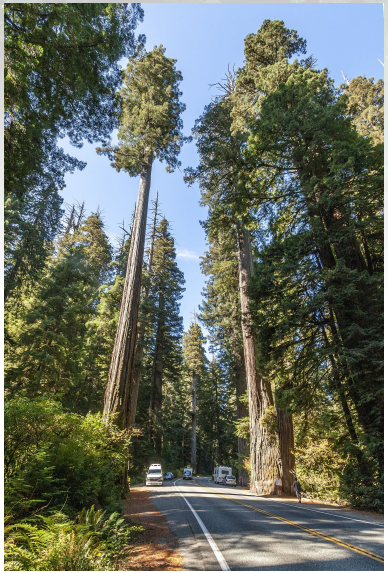
# What Type of Plant is This?

Rules: I am going to give you some random plant, and you are going to tell me in the chat which categories it belongs to based on its characteristics. Let's see how many of you were paying attention ;) and please try your best to answer without using google because you will not have google on the forestry test!

Participation points will be given to those who answer! You do not have to be correct, just try your best!

Categories: gymnosperm, conifer, angiosperm, monocot, eudicot, monoecious, dioecious, bisexual

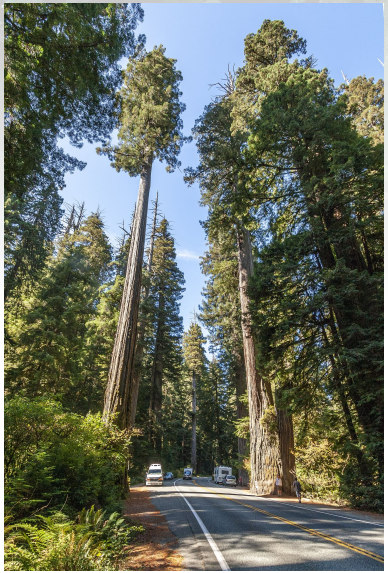
# Coast Redwood





Categories:
gymnosperm,
conifer,
angiosperm,
monocot,
eudicot,
monoecious,
dioecious,
bisexual

# Coast Redwood





Categories:
gymnosperm,
conifer,
angiosperm,
monocot,
eudicot,
monoecious,
dioecious,
bisexual

# Daffodil - narcissus





Categories:
gymnosperm,
conifer,
angiosperm,
monocot,
eudicot,
monoecious,
dioecious,
bisexual

# Daffodil - narcissus





Categories:
gymnosperm,
conifer,
angiosperm,
monocot,
eudicot,
monoecious,
dioecious,
bisexual

# Rosaceae





Categories:
gymnosperm,
conifer,
angiosperm,
monocot,
eudicot,
monoecious,
dioecious,
bisexual

# Rosaceae





Categories: gymnosperm, conifer, angiosperm, monocot, eudicot, monoecious, dioecious, bisexual

# Wheat







Categories: gymnosperm, conifer, angiosperm, monocot, eudicot, monoecious, dioecious, bisexual

# Wheat







Categories: gymnosperm, conifer, angiosperm, monocot, eudicot, monoecious, dioecious, bisexual

# Ginkgo Biloba









Categories: gymnosperm, conifer, angiosperm, monocot, eudicot, monoecious, dioecious, bisexual

# Ginkgo Biloba



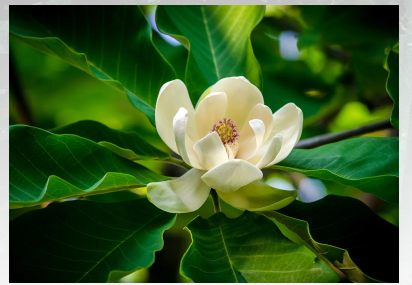






Categories: gymnosperm, conifer, angiosperm, monocot, eudicot, monoecious, dioecious, bisexual

# Magnoliaceae



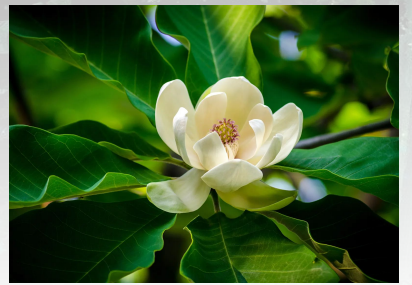






Categories:
gymnosperm,
conifer,
angiosperm,
monocot,
eudicot,
monoecious,
dioecious,
bisexual

# Magnoliaceae









This one is actually kind of a trick question (sorry about that guys). Magnolias are what we call basal angiosperms. They evolved before there was a clear distinction between monocots and eudicots, so they have some monocot characteristics like the petals in parts of three. But ultimately, they are classified as dicots because they have two cotyledons.

Categories: gymnosperm, conifer, angiosperm, monocot, eudicot, monoecious, dioecious, bisexual

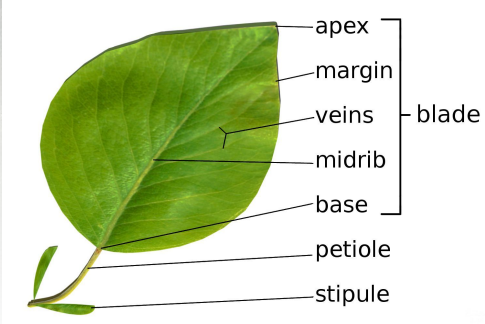


# Tree ID: The basics

# Leaf Shape

There are some parts of a leaf that you should know:

- Apex: tip of leaf blade
- Lamina: leaf blade
- Midrib: central/main vein of leaf
- Petiole: stalk that joins leaf to stem



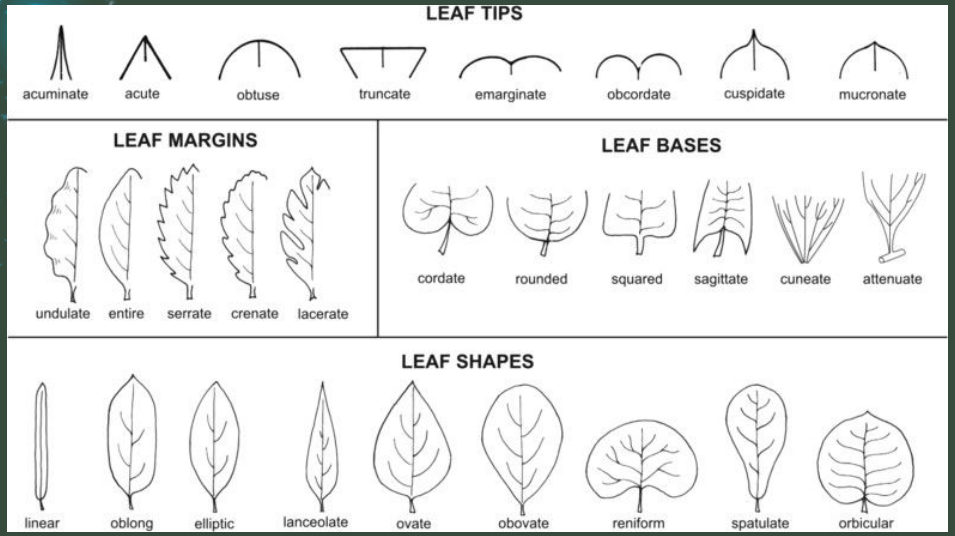

And when we look at leaves, we look for a few major things:

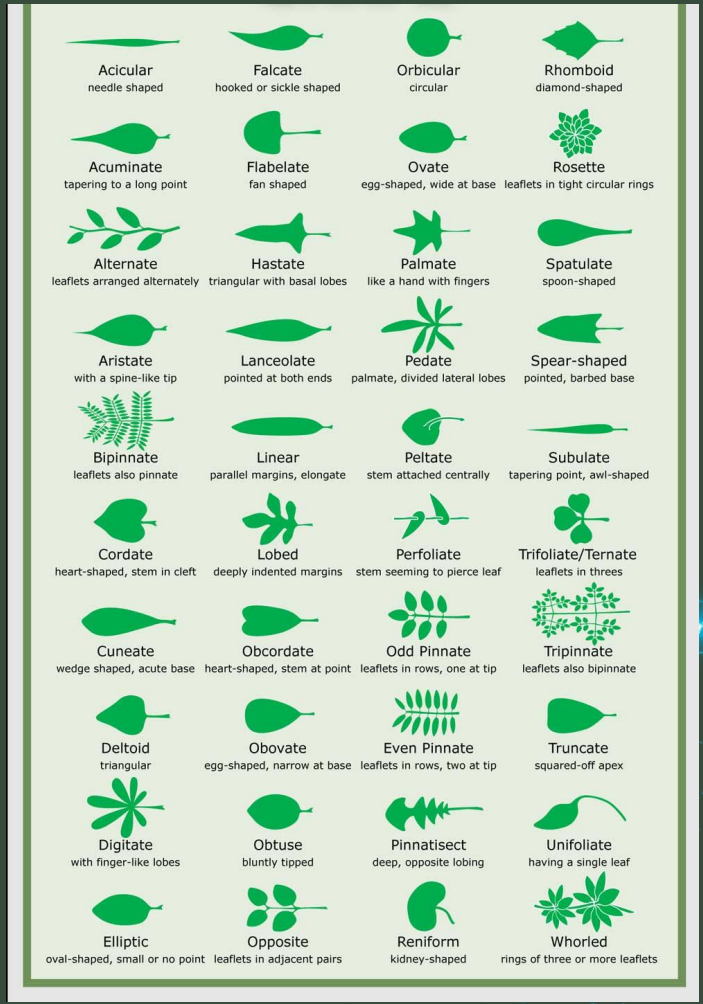
- What shape is this leaf? Is it long or short? Skinny or fat? Triangular or round?
- Do the sides have ridges or bumps? Are they curled?
- What does the tip look like? Is it pointed or blunt? Round?
- How do these leaves attach to the branch they're on?
- Do these leaves have any special characteristics that allow me to immediately match it to a certain family or genus?

These will give you major hints as to the identity of the tree.

# Leaf Shape

You don't have to memorize all these names, but it's a good idea to get acquainted with all the different shapes leaves can have



# Leaf Shape

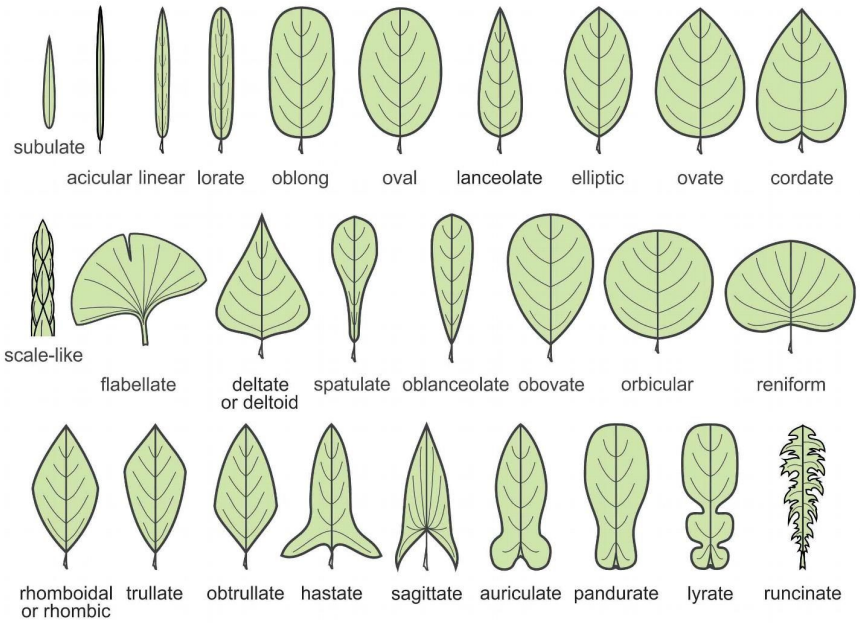
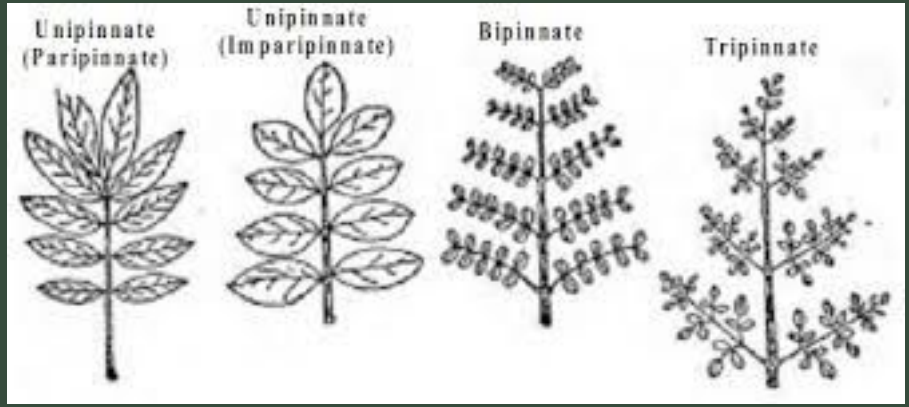


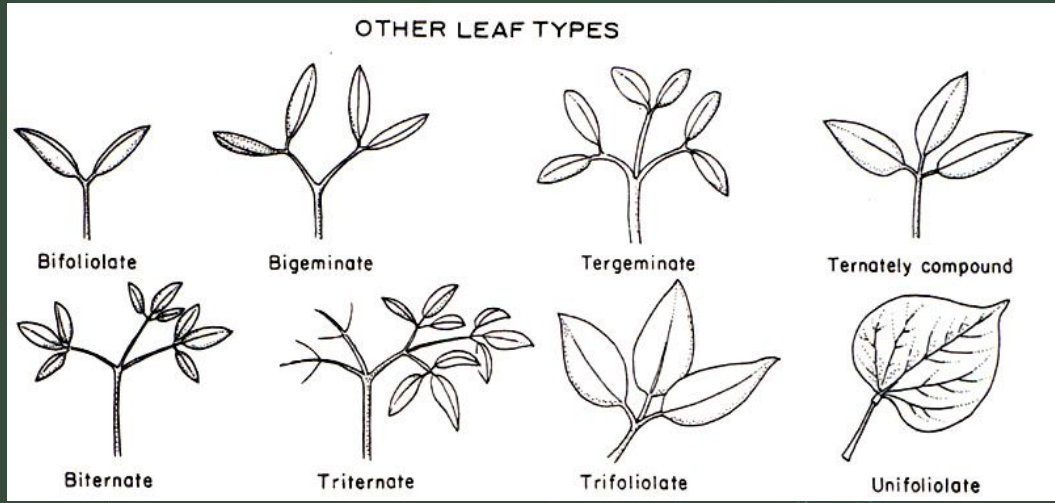

**Figure 6.** Basic Leaf Shapes.



# Leaf Arrangement

Leaf arrangement is especially important because a lot of times, leaves will look the same but the way they are arranged will give away their identity.

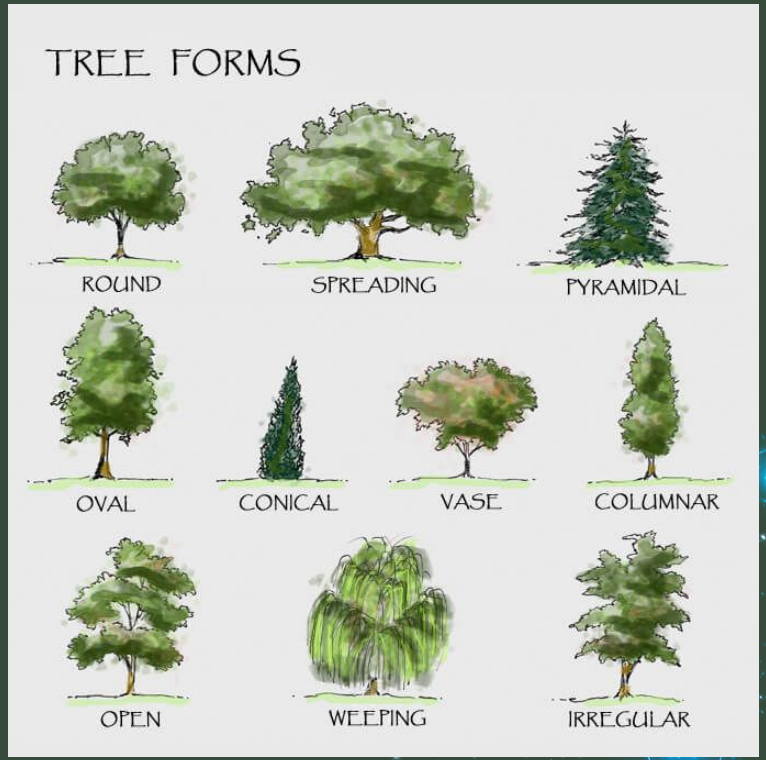


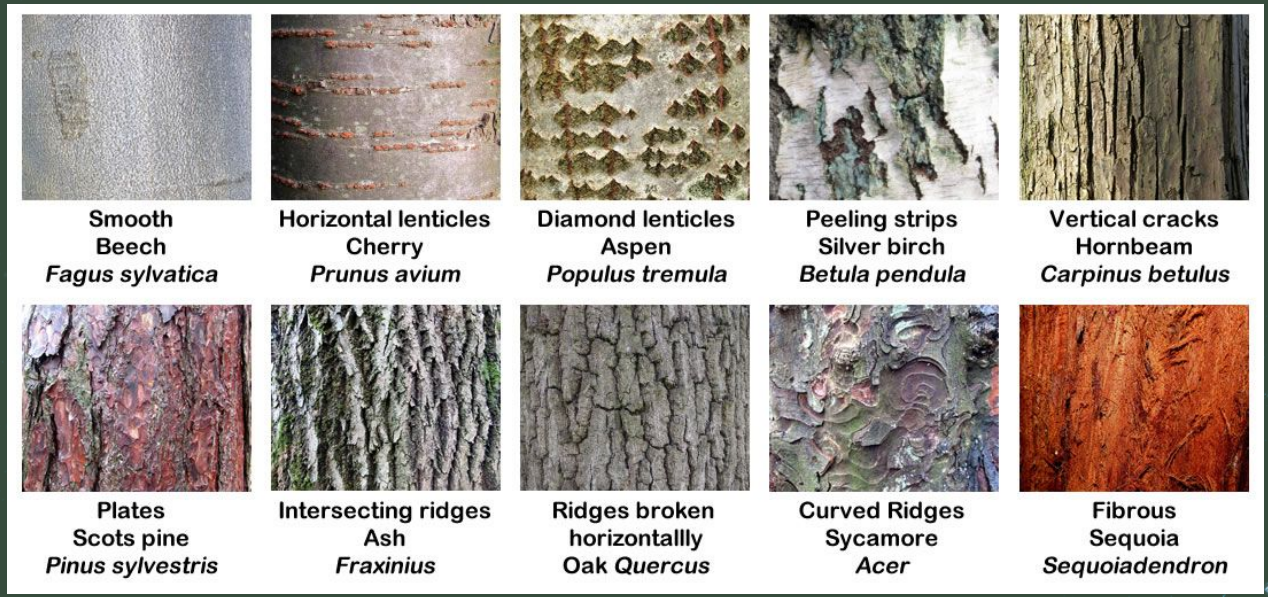
# Tree Shapes

It's important to recognize which tree families fall into which shapes, because the size and shape of the tree will be another huge factor in identification.

- Most pyramidal and conical trees are conifers (like "cone" as in conifer)
- Everything else that vaguely resembles a stem of broccoli is a deciduous tree



# Bark


Smooth
Beech
Fagus sylvatica
Horizontal lenticles
Cherry
Prunus avium
Diamond lenticles
Aspen
Populus tremula
Peeling strips
Silver birch
Betula pendula
Vertical cracks
Hornbeam
Carpinus betulus
Plates
Scots pine
Pinus sylvestris
Intersecting ridges
Ash
Fraxinius
Ridges broken
horizontallly
Oak Quercus
Curved Ridges
Sycamore
Acer
Fibrous
Sequoia
Sequoiadendron

# Activity: Write It Do It, Tree Edition

You will be put into breakout groups of two people. Figure out who wants to be the Writer and who wants to be the Drawer.

You will both have access to the previous five slides to use as reference points.

.Here's how it works:

- The "writer" is not actually writing, they are going to get an image of a tree and describe it verbally using the characteristics we learned.
- The "drawer" will share their screen with the "whiteboard" feature and draw the tree as the writer describes it to them.
- You will have five minutes
- When you are done, take a screenshot of your drawing and send it to me privately in the chat. We will look at everyone's drawings and see how similar they are!

# Your Homework

- We will email you a google form later tonight, please complete it by the next lesson
- Walk around in your neighborhood and pick up 5 different leaves. See if you can categorize their shapes and characteristics. Email us a picture of your leaves with a description of their characteristics for 5-10 points.
    - Look at all the trees around you. Notice them. Think about everything they do for you. You will be surprised with how many different trees exist right in your backyard :)

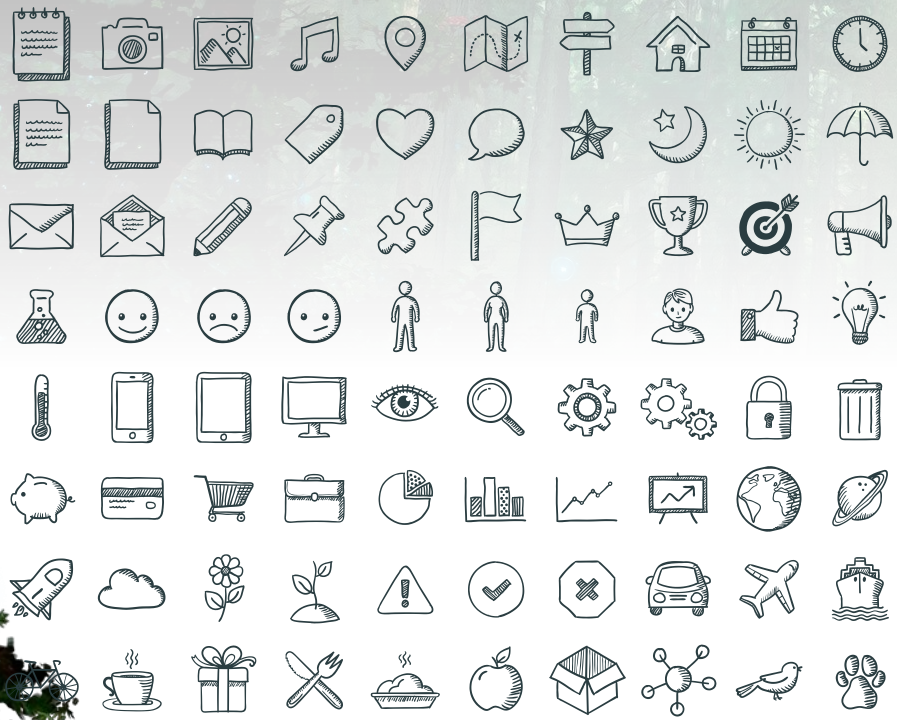
# Additional Information

Emergence of Angiosperms may be Earlier than We Thought - We talked about how scientists weren't exactly sure when angiosperms diverged because of their limited fossil record. New technology can help us discover what the fossil record cannot. Go ahead and skip to the discussion portion.

Trees Don't Exist (Phylogenetically) - This blog post makes for much easier reading and includes information about phylogenetic trees and plant evolution.

The Decline of Conifers - Learn about why angiosperms might have caused the decline of Coniferous plants from the Cretaceous period to the present day.

Darwin's abominable mystery - Where did angiosperms come from? Learn about Darwin's struggle with tracing the evolutionary history of this clade of plants.



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This means that you can:

- Resize them without losing quality.
- Change fill color and opacity.
- Change line color, width and style.

Isn't that nice? :)

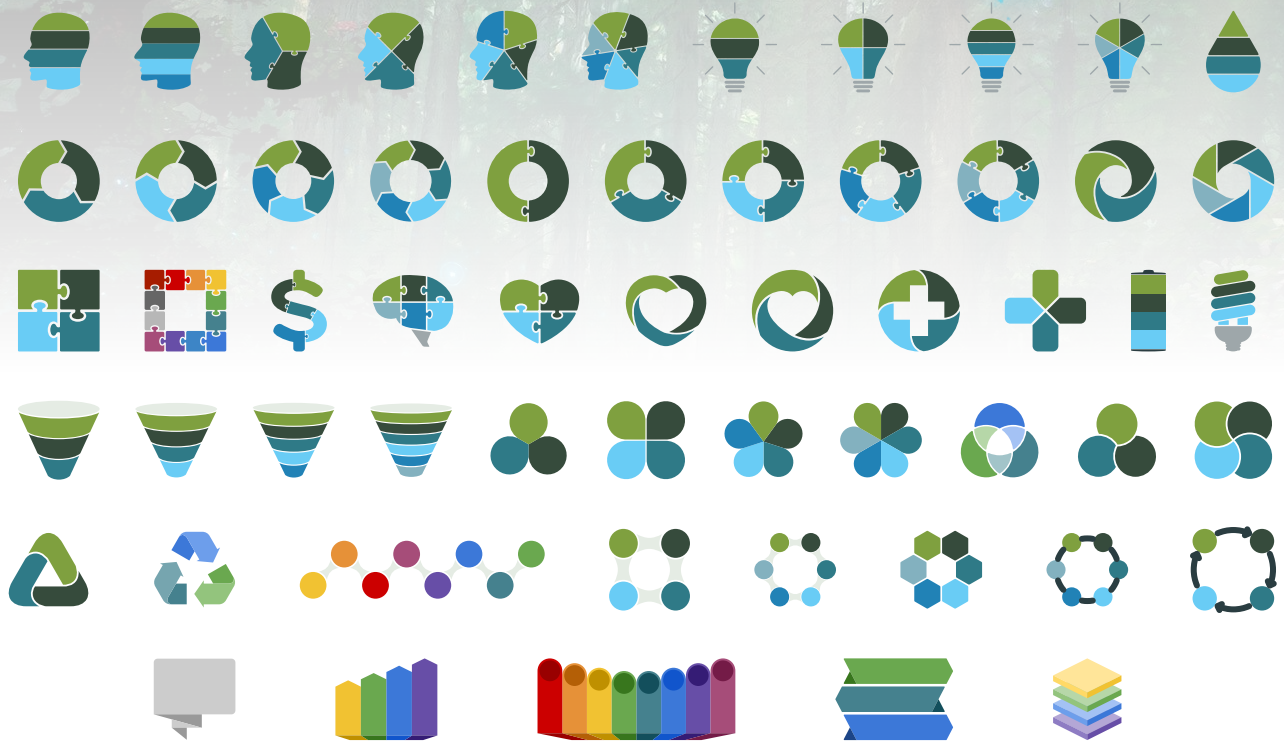
Examples:





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# Diagrams and infographics



**You can also use any emoji as an icon!**

And of course it resizes without losing quality.

How? Follow Google instructions
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and many more...