

# Tuesday 2/26/19 – Taxonomy

By the end to the period today, I can –

- Classify organisms using a dichotomous key
- Discuss the need for a standardized naming system
- Define Taxonomy
- Describe how taxonomic groups are organized





Bird W



Bird X



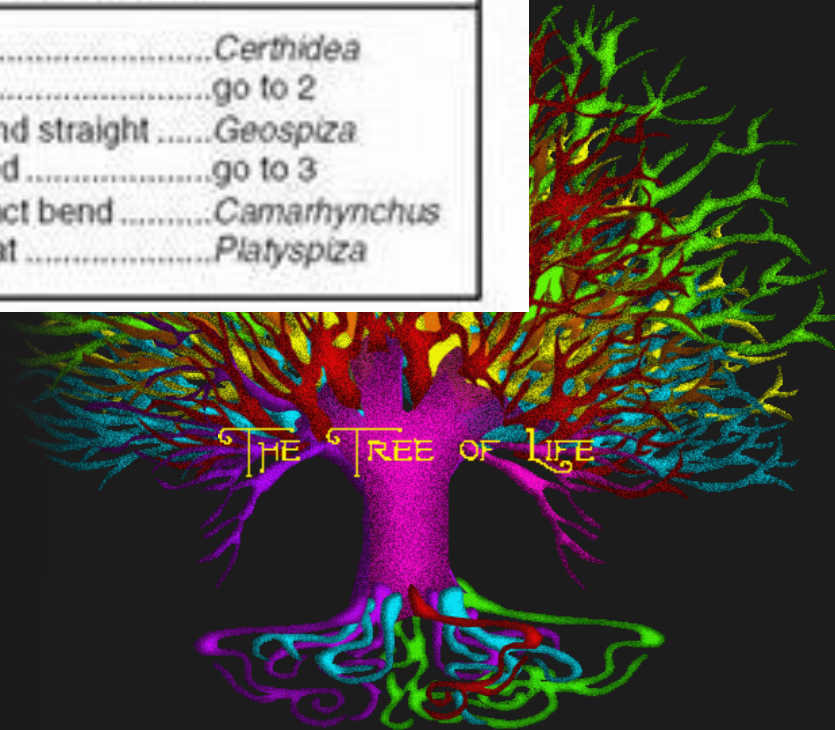
Bird Y



Bird Z

### Dichotomous Key to Representative Birds

1. a. The beak is relatively long and slender.....*Certhidea*  
 b. The beak is relatively stout and heavy.....go to 2
2. a. The bottom surface of the lower beak is flat and straight .....*Geospiza*  
 b. The bottom surface of the lower beak is curved .....go to 3
3. a. The lower edge of the upper beak has a distinct bend .....*Camarhynchus*  
 b. The lower edge of the upper beak is mostly flat .....*Platyspiza*



# Taxonomy

Naming and classifying  
organisms



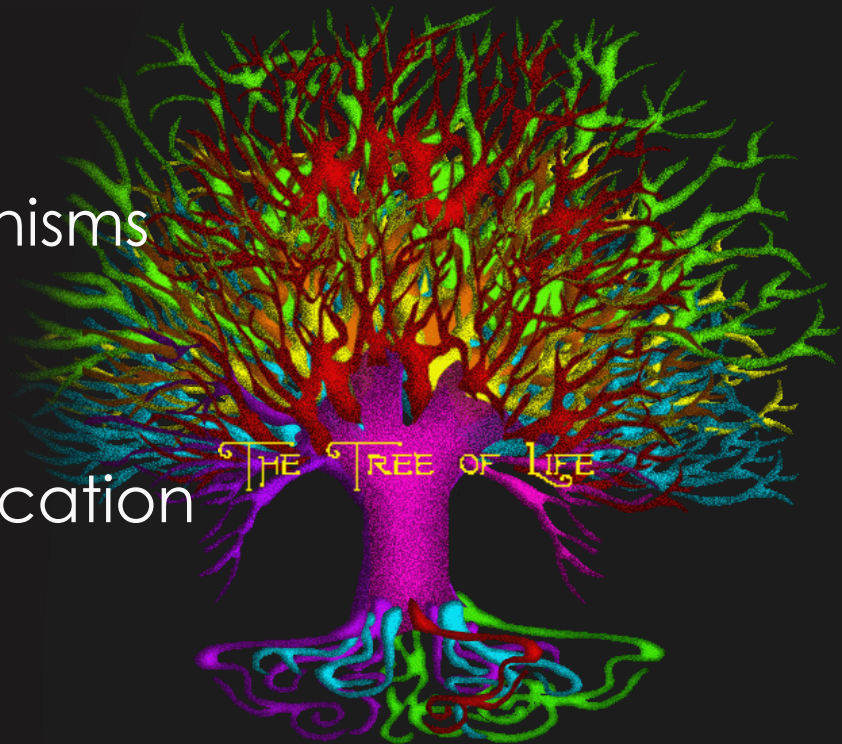
# Classification – WHY?





# Classification

- : Finding Order in Diversity
  - How living things are organized
  - Binominal Nomenclature
  - Linnaeus's System of Classification
- : Modern Evolutionary Classification
  - Evolutionary relationships
  - Cladistics
  - Comparing dissimilar organisms
- : Kingdoms and Domains
  - 6 kingdoms of Life
  - 3 Domain system of classification



# Finding Order In Diversity

- What is a **species**?
  - A population of organisms that share similar characteristics and can interbreed freely and produce fertile offspring
- Biologists have identified **1.5** million species, and they estimate **2-100** million species have yet to be identified
- Order out of chaos?
- **Classification**
  - A system to name and group organisms in a logical order, used to study diversity of life
- **Taxonomy**
  - Classifying organisms and giving them a universally accepted name



# Scientific Name? Common Name?



Grrrrrr..

- Using common names is confusing
  - Mountain lion, cougar, catamount, puma, Florida panther
- 18<sup>th</sup> century scientists agreed to use a single name for each species, and to use Latin as the common language
- Carolus Linnaeus- a Swedish botanist (mid 1700's) who developed the binominal nomenclature system of naming organisms

– Binominal Nomenclature =  
2 word naming system we still use today



Say my name,  
say my name.

Carolus Linnaeus





# Rules of the Binomial Nomenclature System

1. Written in italics or underlined
2. First word is Genus which is capitalized, second word is species which is lower case

Panthera leo

Lion

*Drosophila melanogaster*

Fruit fly

Canis lupus

Wolf

*Puma concolor*

Cougar





# Scientific Names

All bears are NOT alike- but they are all bears.

Scientific Names of bears:



**Common Name: Grizzly Bear**  
**Scientific Name: *Ursidae*  
*Ursus arctos***



**Common Name: Polar Bear**  
**Scientific Name: *Ursidae*  
*Ursus maritimus***



**Common Name: Black Bear**  
**Scientific Name: *Ursidae*  
*Ursus americanus***

What are the reoccurring words?



**Common Name: Panda Bear**  
**Scientific Name: *Ursidae*  
*Ailuropoda melanoleuca***



**Common Name: Sloth Bear**  
**Scientific Name: *Ursidae*  
*Melursus ursinus***



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# Scientific Names

Roar  
(loudly).



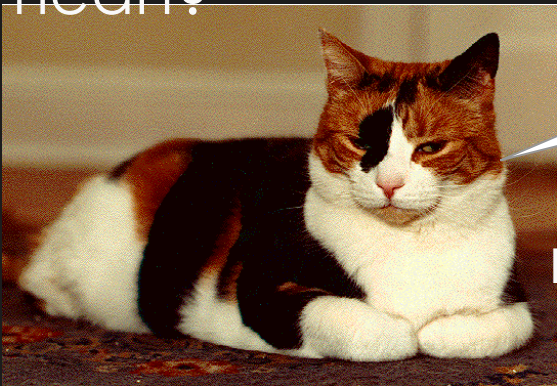
Common Name: Grizzly Bear  
Scientific Name: *Ursus arctos*

- For a grizzly bear, *Ursus* is the **genus** name and *arctos* is the **species** name
- **Species** names are unique to that individual group of organisms and are usually a description of an important trait or an indication of where that organism lives



Common Name: Polar Bear  
Scientific Name: *Ursus maritimus*

- *Ursus maritimus*, where does he live?
    - Maritim means to live near the sea
- Felis domesticus*, cat  
what does “domesticus” mean?



Meow

Domesticus = “of the house”







# QUIZ



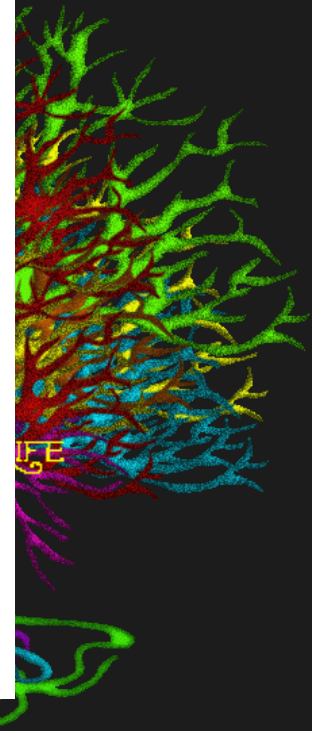
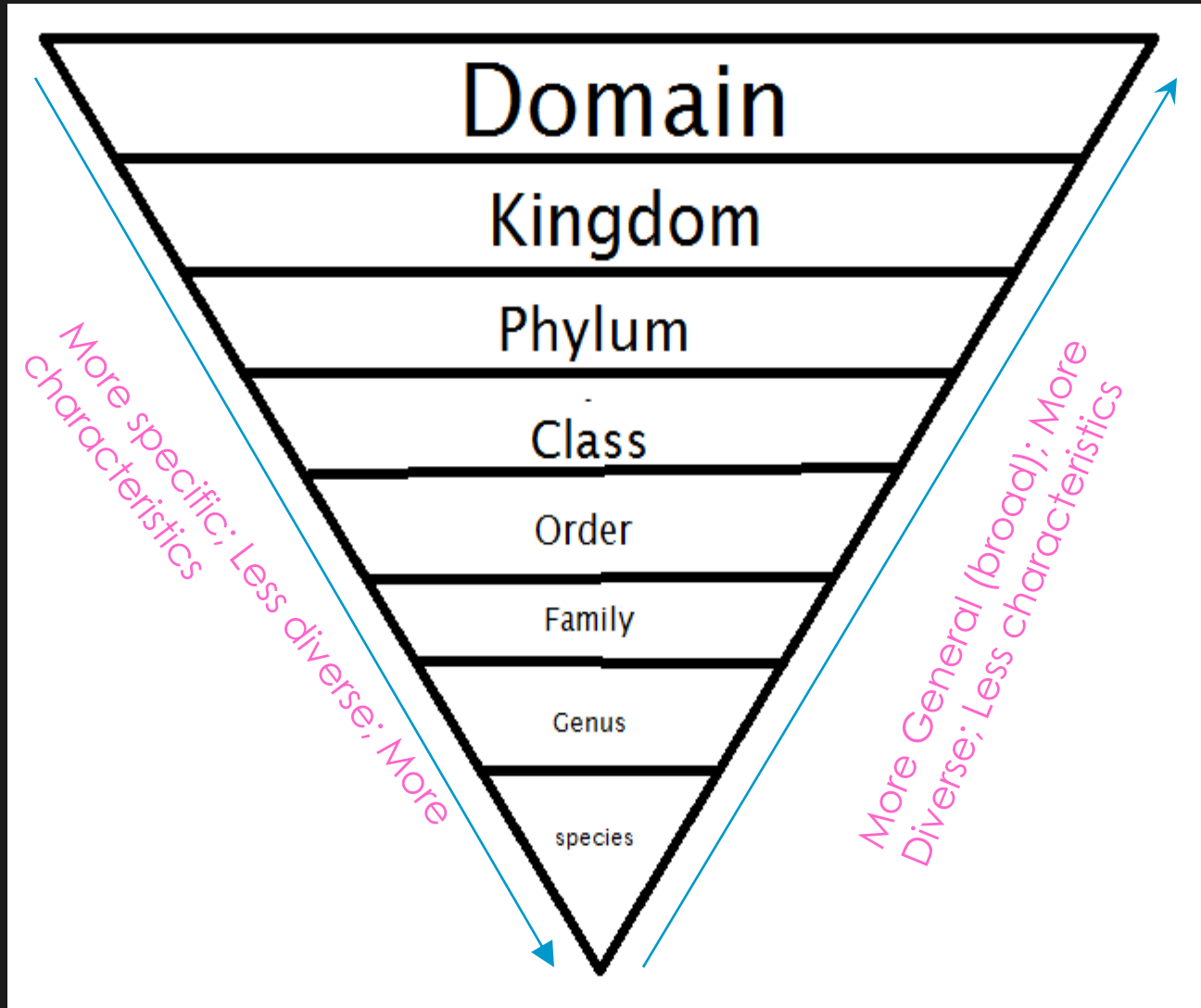
**The Wood Lice, *Armadillidium vulgare*, is most closely related to the**

- A Head Lice,  
*Pediculus humanus*
- B Wood cockroach,  
*Parcoblatta pennsylvanica*
- C Roly Poly,  
*Armadillidium pallidum*



# 8 taxa of classification

- Linnaeus's system is hierarchical, it now includes 8 levels (largest to smallest)

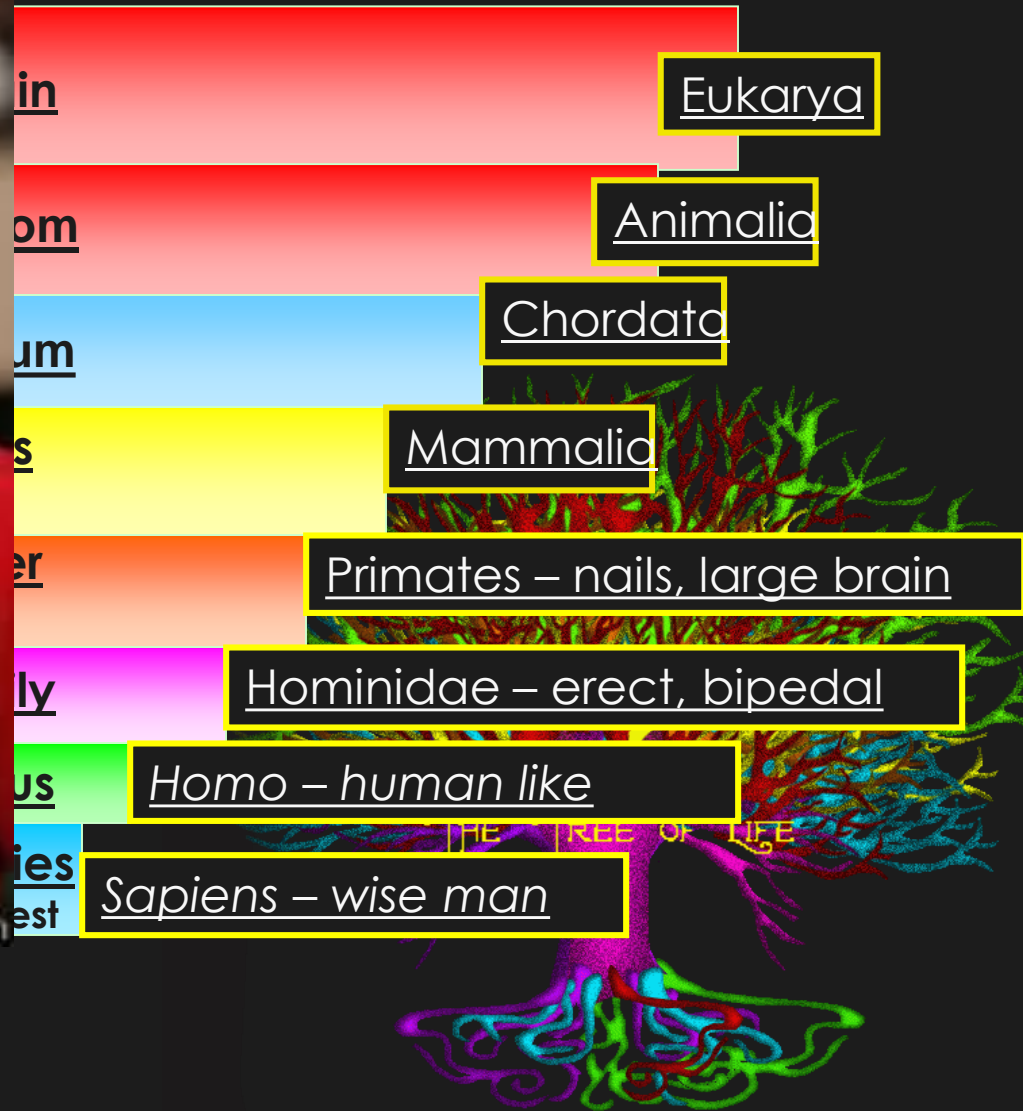




# Linnaeus's System of Classification

**GIRL, YOUR NAME  
MUST BE PHYLUM,**

**BECAUSE YOU ARE  
ABOVE CLASS.**

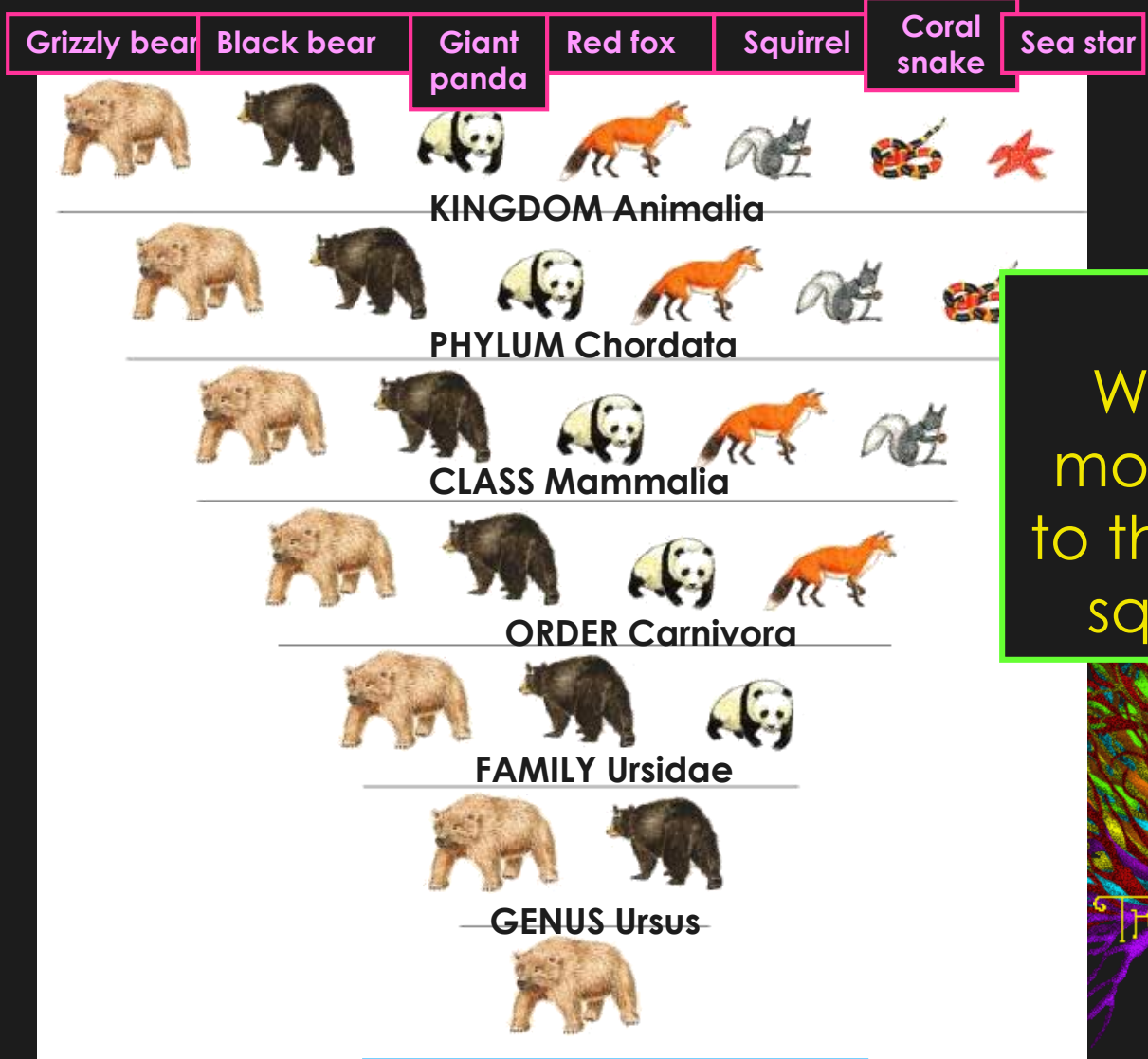


Singing:  
FUN!

quickmeme.com

# Bear Classification as an Ex

Duh, it's the fox.



**SPECIES *Ursus arctos***

Question:  
Which organism is more closely related to the grizzly bear, the squirrel or the fox?



# How Can You Remember the 8 Taxon levels?

- **D**umb **K**ing **P**hilip **C**ame **O**ver **F**or **G**ood **S**oup
- **D**iva **K**aty **P**erry **C**an **O**rder **F**resh **G**reen **S**alad

Or you can combine the two OR

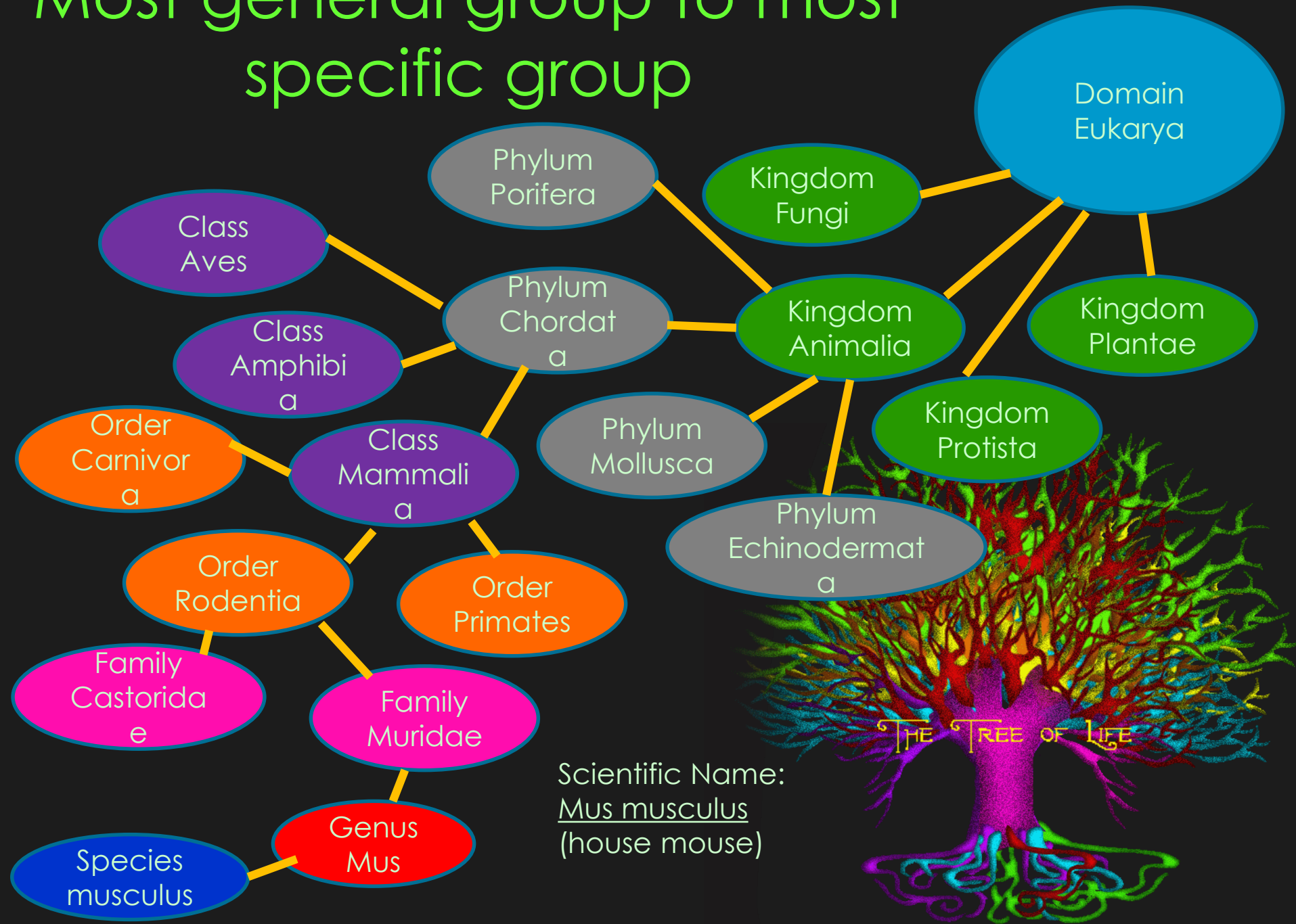
☺ you come up with your own mnemonic

**D?** **K?** **P?** **C?** **O?** **F?** **G?** **S?**





# Most general group to most specific group





# Evolutionary Classification

- Linneaus grouped organisms based on physical similarities, but Darwin's concept of Descent with Modification changed all that
- **Phylogeny** = grouping organisms into categories that represent lines of evolutionary descent instead of physical similarities



Barnacles

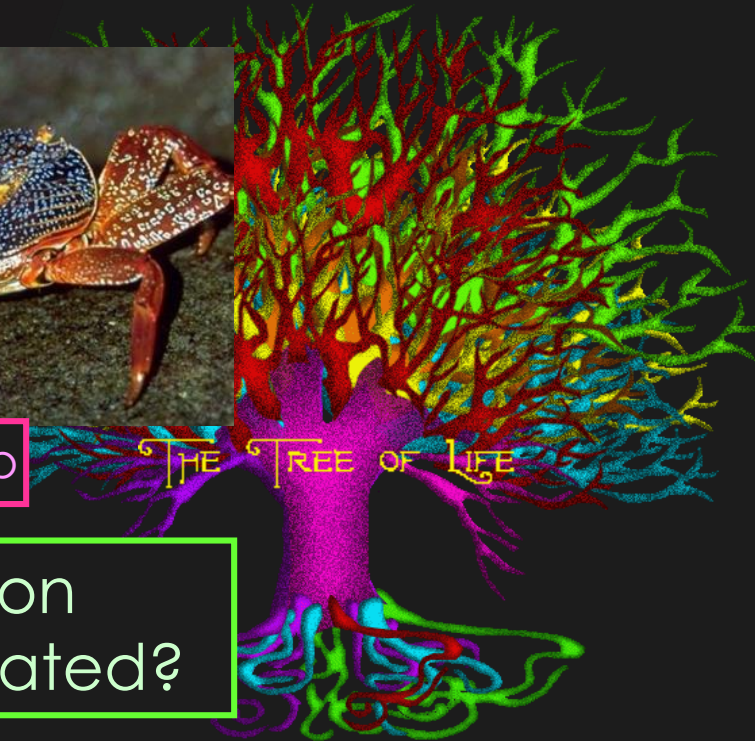


Limpet



Crab

If you had to group these 3 based on what they look like, who is more related?



Barnacles



Crab



Limpet

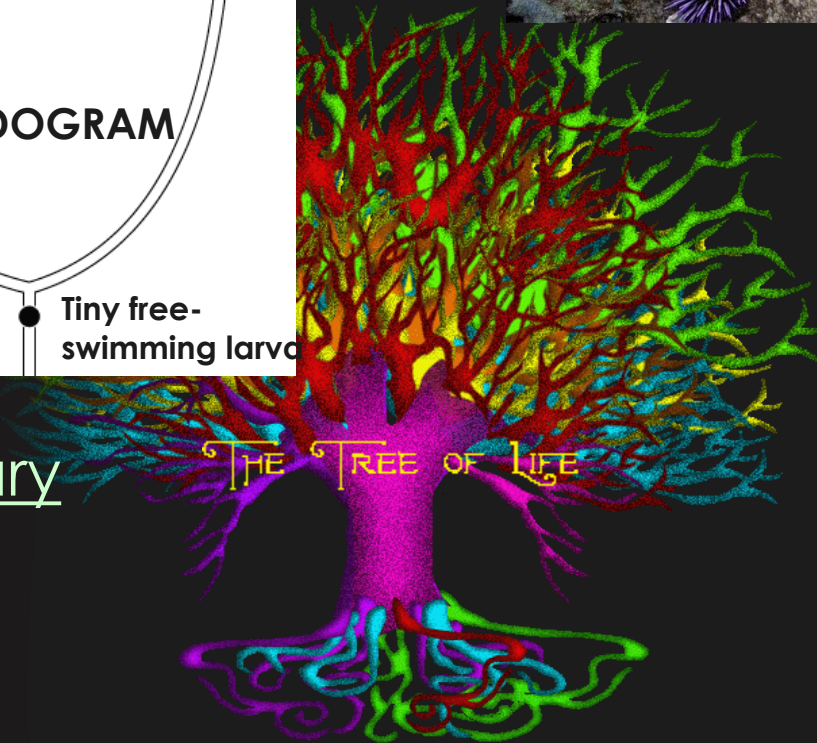
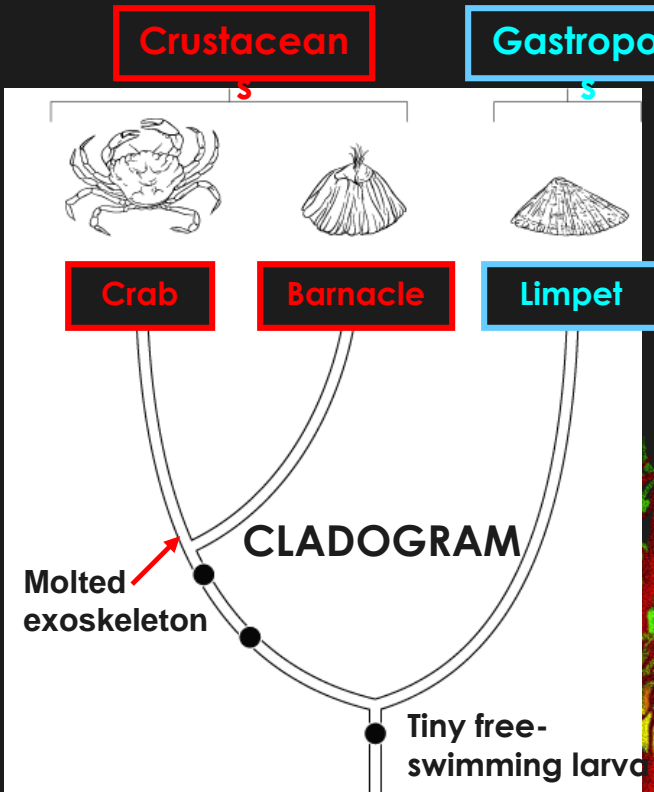


# Evolutionary Classification

Actually, crabs and barnacles are more closely related evolutionarily.

This branching shows that crabs and barnacles share a more recent common ancestor.

Derived characteristics in crustaceans =  
-Segmented bodies  
-Hard external skeleton shed during growth



THE TREE OF LIFE

**Cladogram** = shows the evolutionary relationships among a group of organisms



# QUIZ



Which of these classifications is most specific?

- A Family
- B Genus
- C Phylum
- D Order





Common Name	Human	Common Chimpanzee	Grey Wolf	Tiger Snake	Monarch Butterfly
Domain	Eukaryota	Eukaryota	Eukaryota	Eukaryota	Eukaryota
Kingdom	Animalia	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata	Chordata	Arthropoda
Class	Mammalia	Mammalia	Mammalia	Reptilia	Insecta
Order	Primates	Primates	Carnivora	Squamata	Lepidoptera
Family	Hominidae	Hominidae	Canidae	Elapidae	Nymphalidae
Genus	Homo	Pan	Canis	Notechis	Danaus
Species	Homo sapiens	Pan troglodytes	Canis lupus	Notechis scutatus	Danaus plexippus

Classify a common dog, *Canis familiaris*







Organism A	Organism B	Organism C
Animalia	Animalia	Animalia
Insecta	Mammalia	Mammalia
Diptera	Carnivora	Carnivora
<i>Musca domestica</i>	<i>Canis lupus</i>	<i>Felis domestica</i>



The chart above shows the classification of three organisms. Certain categories are not shown. Which two organisms are most closely related?

- A A and B
- B B and C
- C C and A
- D Not enough information is given.



# Similarities in DNA and RNA

- Genes of many organisms share important similarities at the molecular level
- Similarities in DNA and RNA can help determine classification and evolutionary relationships (*who are the vultures most closely related to?*)

American vulture



African Vulture



Storks



Falcon



# Molecular Clocks

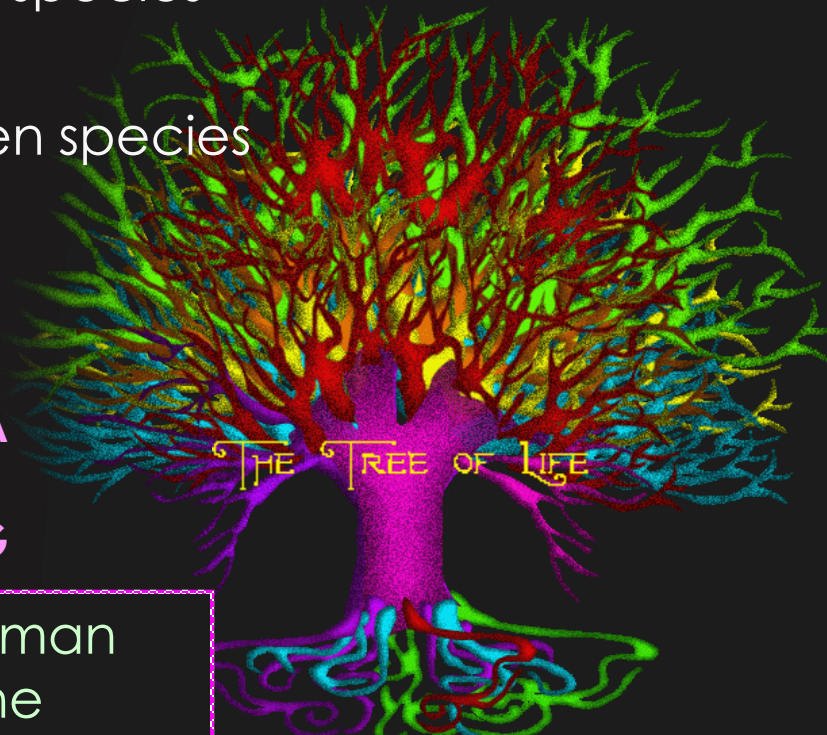
- DNA comparisons can also be used to mark the passage of evolutionary time
- Molecular Clock model uses DNA comparisons to estimate the length of time that 2 species have been evolving independently
  - Looks for mutations that separate 2 species
  - Other changes in DNA
  - Compares DNA sequences between species

Which organisms are more closely related?

Why?

Human: ←	CCA	TAG	CAC	CTA
Pig:	CCA	TGG	AAA	CGA
Chimpanzee: →	CCA	TAA	CAC	CTA
Cricket:	CCT	AAA	GGG	ACG

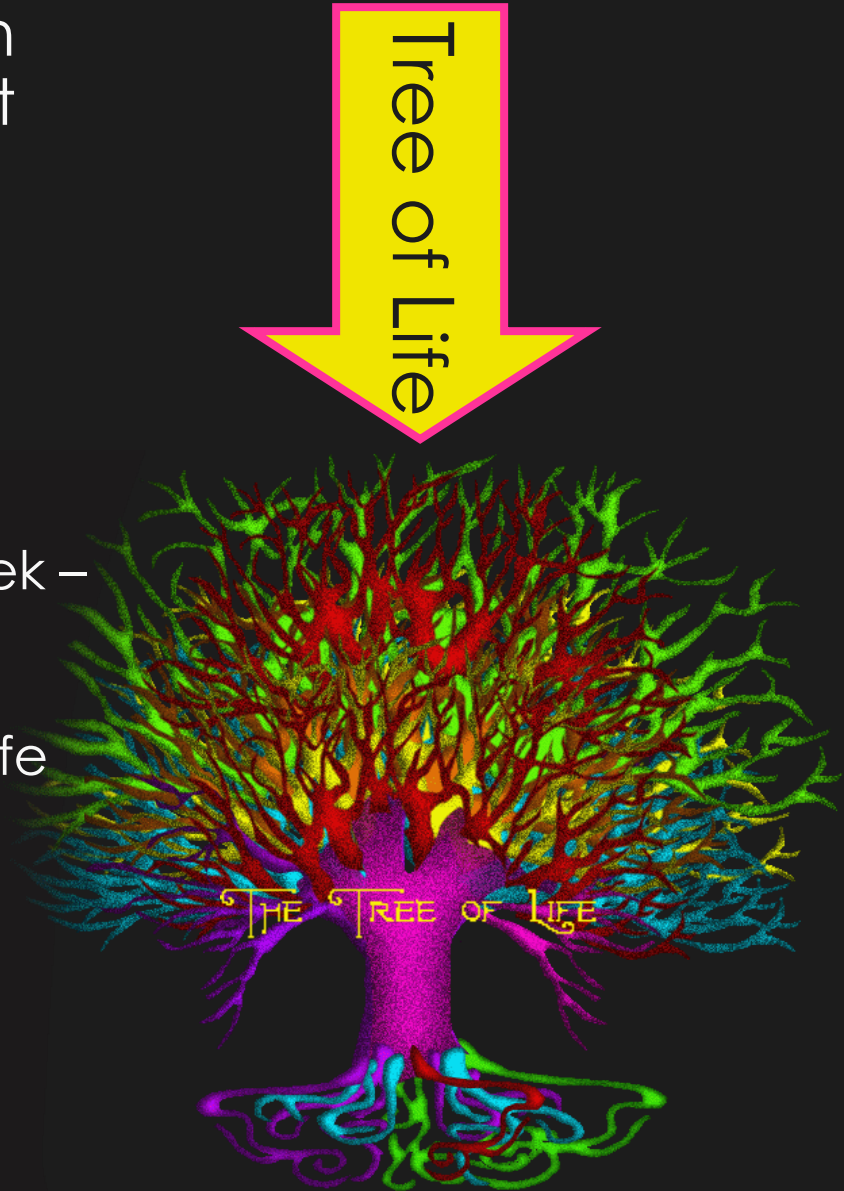
Only 1 mutation separates human and chimp in this portion of the





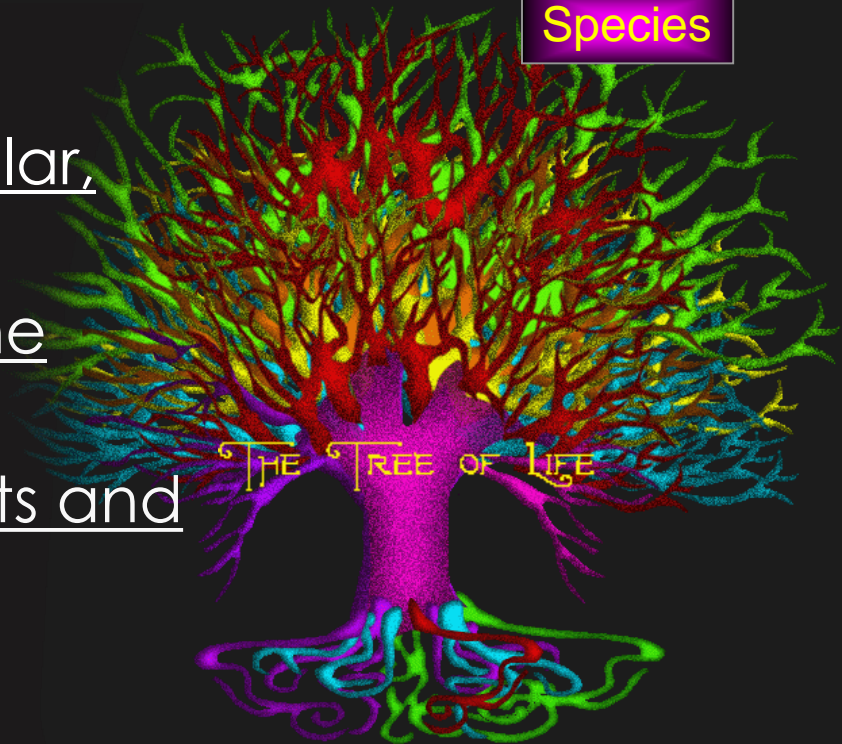
# Kingdoms and Domains

- In Linnaeus's time, life was much simpler. Either you were a plant or an animal.
- Today, classification is more complicated.
  - Protists? Bacteria? Viruses?
- Life is full of Diversity
  - Robert Hooke and Van Leewenhoek – showed us the microscopic world, bacteria, protists, microorganisms
  - Discovering all these microscopic life forms, added branches to the Tree of Life



# Three Domain System

- Using a **molecular clock**, scientists group organisms according to how long they have been evolving independently
- Linnaeus's 7 level system became 8 levels when Domain was added
- Today, we have **3** Domains
  - **Bacteria** = all bacteria in the kingdom Eubacteria, unicellular, members are Prokaryotes
  - **Archaeobacteria** = includes the kingdom Archaeobacteria
  - **Eukarya** = protists, fungi, plants and animals



# Domain Bacteria

- Members of Kingdom Bacteria are **Prokaryotes**
- **Prokaryotes** = lack a nucleus, no membrane-bound organelles (HAVE RIBOSOMES)

– So, no mitochondria, chloroplasts, endoplasmic

Some microbes live on our skin and protect us from many harmful agents. The drier areas, like the back, have few microbes; moist areas, such as under the arm, have many

## Examples of Bacteria:

***Lactobacillus bulgaricus*** helps turn milk into cheese, yogurt, and other dairy products. Lactose intolerant anyone?

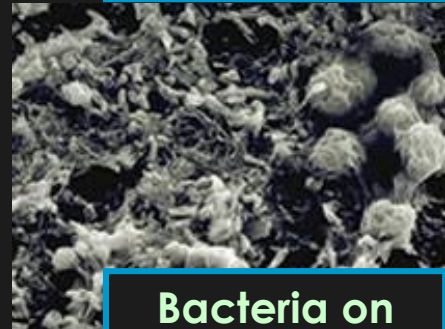
***Mycobacterium tuberculosis*** causes tuberculosis

***Staphylococcus*** (a.k.a. **staph**) can cause serious infections and is one of the most drug-resistant bacteria

***Escherichia coli*** (a.k.a. **E. coli**) lives in the gut, where it helps digest food



Bacteria on a contact lens



Bacteria on your teeth





Yellow Springs  
Yellowstone Park



© W.P. Armstrong 2003



Owen's Lake, NV



Black Smoker

# Domain Archaea

- Archaeobacteria are **CRAZY** bacteria
- Unicellular, Prokaryotic
- Live in the most extreme environments, where only crazy things live
  - Would you live in a swamp or marsh?
  - Or in the boiling water of a hot spring (over 163 °F)?
  - Or in a “black smoker” (deep sea air vents (very hot!))
  - Or in brine (water with **9X** amount of salt as the ocean) and in salt crust?

1. Methanogens (methane-producers)--responsible for swamp gas and farts.
2. Extreme Thermophiles--live in hot springs and black smokers.
3. Extreme Halophiles--live in saturated brine and salt crust

Archae- Bacteria,  
anyone?

THE TREE OF LIFE

<https://www.youtube.com/watch?v=pcXdfofLoj0> (2:11)

Martian

# Domain Eukarya

Eu = You, get it?

- All organisms whose cells have a nucleus
- Everything that is NOT a bacteria- including YOU!
- Now we get to the last 4 kingdoms in the 6 Kingdom system

3. **Protista** – if it's not a bacteria, plant, fungi or animal, it's a protist, remember that! Live in moist places, like ponds


Keywords: eukaryote, lives in moist places, hard to classify

<https://www.youtube.com/watch?v=0-6dzU4gOJo> (3:12)

4. **Fungi** – heterotrophs that feed on dead or decaying organic matter (**organic** = from living **organisms**), saprophytes – they secrete enzymes that digest and then absorb (not eat) the smaller food molecules, cell walls of chitin

Keywords: heterotroph, saprophyte

(feeds on dead or decaying matter), secretes enzymes, chitin cell walls

  
THE TREE OF LIFE  
<https://www.youtube.com/watch?v=70LA0mijzCM> (2:28)

# Plantae and Animalia

You have so much food! We have only crazy bacteria on Mars!

5. **Plantae** – multicellular, photosynthetic autotrophs, that don't move, have cell walls with cellulose

Keywords: autotroph,  
photosynthesis, cell walls,  
cellulose

<https://www.youtube.com/watch?v=gJrOATCtV-k>



6. **Animalia** – multicellular and heterotrophic, do not have cell walls, motile (can move), can live almost everywhere

Keywords: multicellular,  
heterotrophic, motile, no cell walls





# Domains through species

- <https://www.youtube.com/watch?v=DVouQRAKxYo> (7:41)



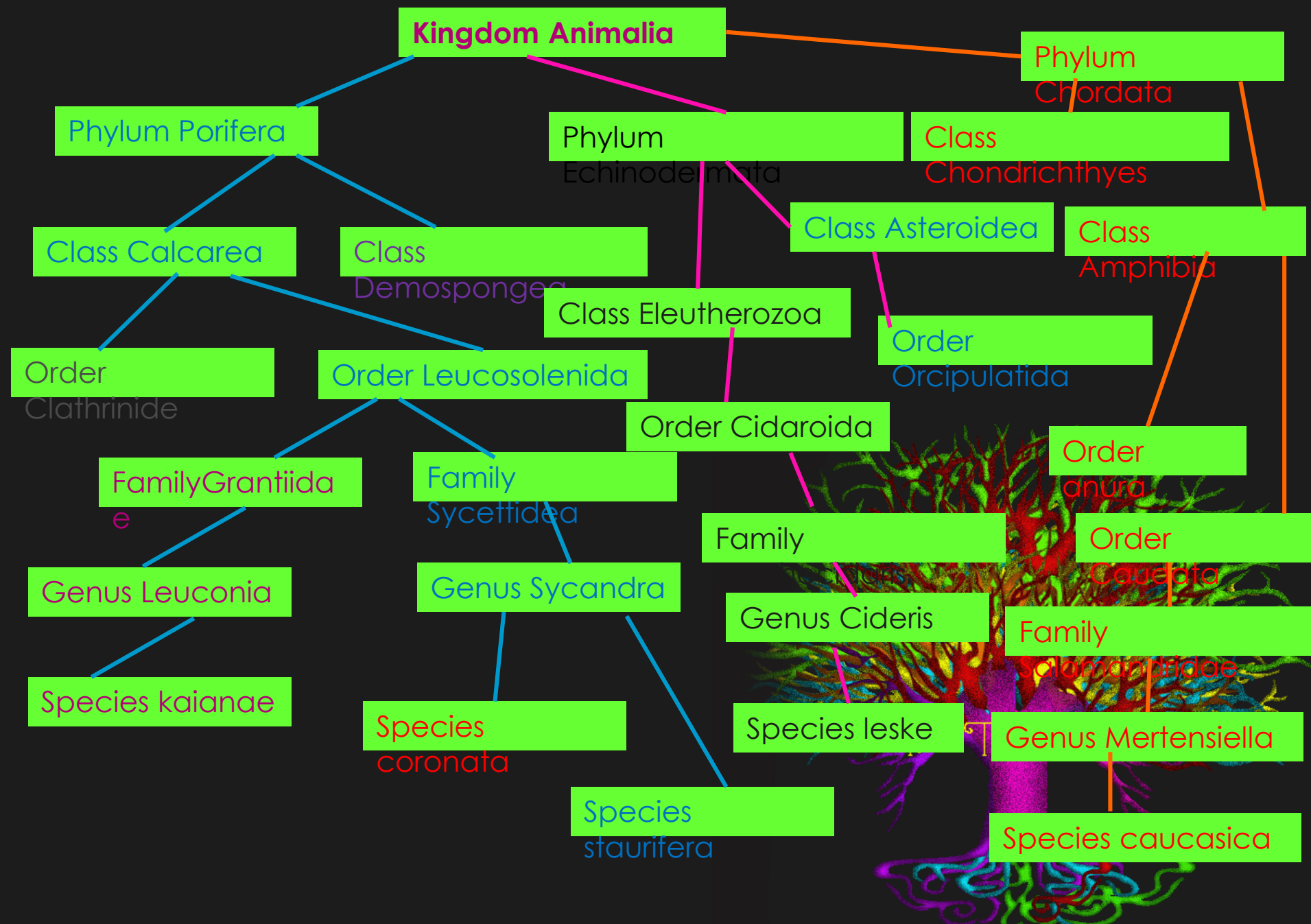
# Key Characteristics of Kingdoms and Domains

## Fill in the table Classification of Living Things



DOMAIN	Bacteria	Archaea	Eukarya			
KINGDOM	<u>Eubacteria</u>	<u>Archaeobacteria</u>	<u>Protista</u>	<u>Fungi</u>	<u>Plantae</u>	<u>Animalia</u>
CELL TYPE	<u>Prokaryote</u>	<u>Prokaryote</u>	<u>Eukaryote</u>	<u>Eukaryote</u>	<u>Eukaryote</u>	<u>Eukaryote</u>
CELL STRUCTURES	Cell walls with peptidoglycan has ribosomes	Cell walls without peptidoglycan (wall differs for each type) has ribosomes	Some have cell walls of cellulose and/or chloroplasts	Cell walls of chitin	Cell walls of cellulose; chloroplasts	No cell walls or chloroplasts
NUMBER OF CELLS	<u>Unicellular</u>	<u>Unicellular</u>	Most unicellular; some colonial; some multicellular	one unicellular; most multicellular	<u>Multicellular</u>	<u>Multicellular</u>
MODE OF NUTRITION	<u>Autotroph or heterotroph</u>	<u>Autotroph or heterotroph</u>	Autotroph or heterotroph	<u>Heterotroph (saprophyte)</u>	<u>Autotroph</u>	<u>Heterotroph</u>
EXAMPLES	<i>Streptococcus, Escherichia coli</i>	Methanogens, halophiles, thermophiles	<i>Amoeba, Paramecium, algae, giant kelp</i>	<u>Mushrooms, yeasts, molds</u>	<u>Mosses, ferns, flowering plants</u>	<u>Sponges, worms, insects, fishes, mammals</u>







# Bacteria

# Archaea

# Eukaryota

