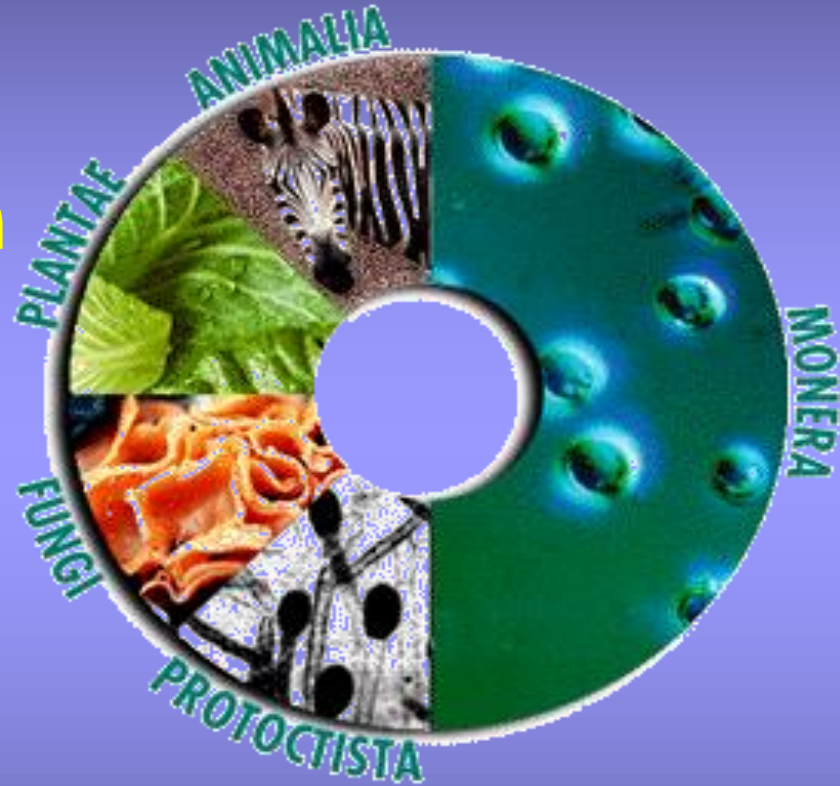


Topic

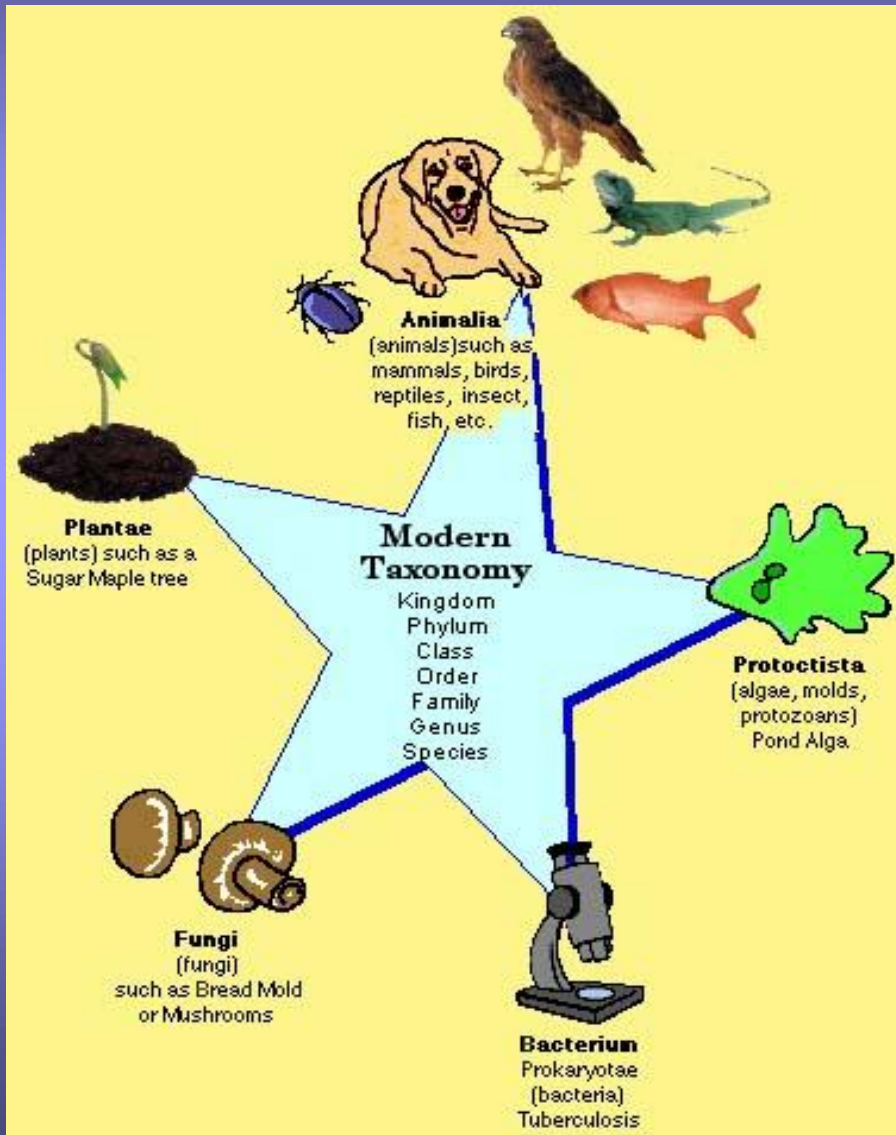
**Classification &**  
**Introduction to**  
**Taxonomy**

# Classification

- The grouping of objects or information based on similarities
- There are more than 1 million described species of plants and animals
  - Many millions still left undescribed

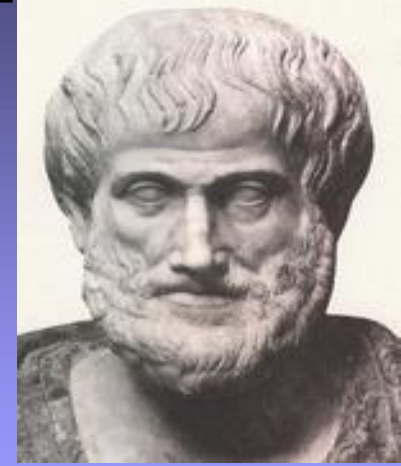


# Taxonomy

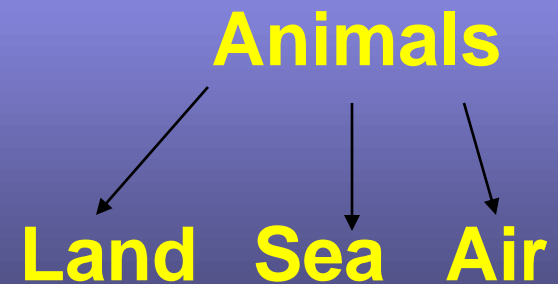
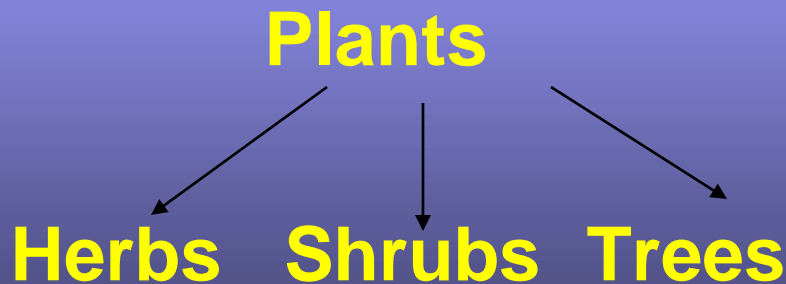


- Science of classification (grouping things)
  - Process of classifying biodiversity based on evolutionary relationships
  - Means to organize biological diversity
  - Groups and names organisms based on different characteristics

# Early Taxonomic Systems



- **Aristotle (350 B.C.)**
  - Developed the 1st widely accepted system of biological classification
  - Everything grouped as plant or animal



# Early Taxonomic Systems

- **Carolus Linnaeus (1753)- use of a species name**
- **Based on looking at physical and structural similarities**
  - **Revealed relationships of organisms**
- **Binomial nomenclature**
  - **Gave each species 2 names (scientific name)**
  - **Genus and species**
  - **Genus is a group of similar species**
- **Developed the modern system of taxonomy**



- Latin was the language used (no longer used and is not being changed)
  - Genus name → always capitalized
  - species name → always lowercase
  - both names **MUST** be underlined or italicized
  - Ex: Canis lupus (wolf)
  - Ex: Homo sapiens (human)





- Ex: Felis domesticus (housecat)
  - Felis domesticus var.
    - Indicates more than one variety

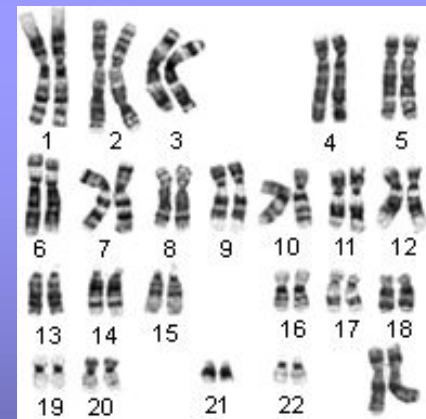


- **Scientific names are often:**
  - Descriptive (Acer rubrum → red maple)
  - Named after someone (genus → Linnea)
  - Descriptive of where an organism lives (D. californica)
  - Named after person who first described the organism (D. californica Torr)
- **Many organisms have common names**
  - Can be misleading
  - Can have more than 1 common name, depending on the area it is found in



# Modern Taxonomy

- Now based on evolutionary relationships
- Taxonomists study:
  - Structural similarities
  - Chromosomal structure (karyotypes)
  - Reproductive potential
  - Biochemical similarities
    - Comparing DNA and amino acids
  - Embryology/development
  - Breeding behavior
  - Geographic distribution



## 7 taxonomic categories:

**Kingdom** → largest, most general group

**Phylum** → called a division with plants

**Class**

**Order**

**Family**

**Genus**

**Species** → smallest,  
most specific group

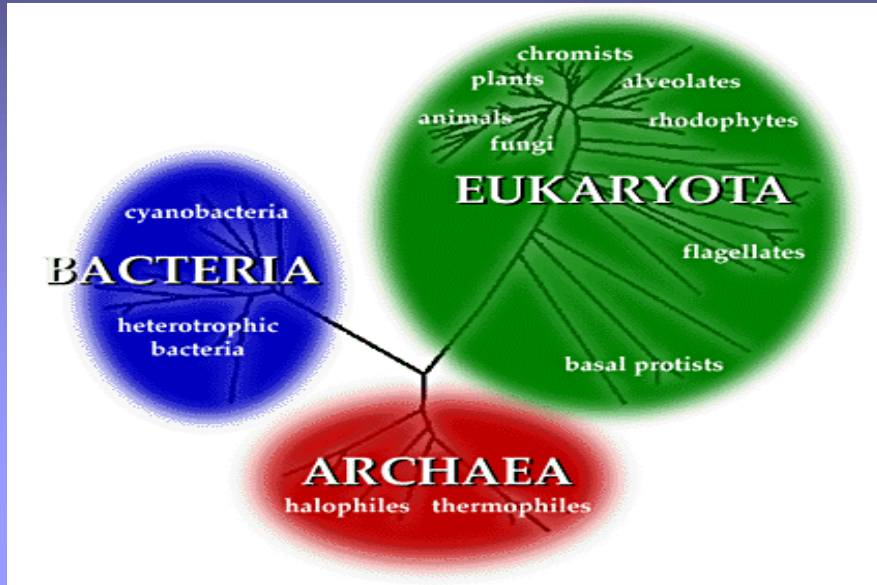
- Grouped genera into families, families into orders, orders into classes, classes into phyla, and phyla into kingdoms
- Species can interbreed with each other

# 1969: 5-Kingdom System

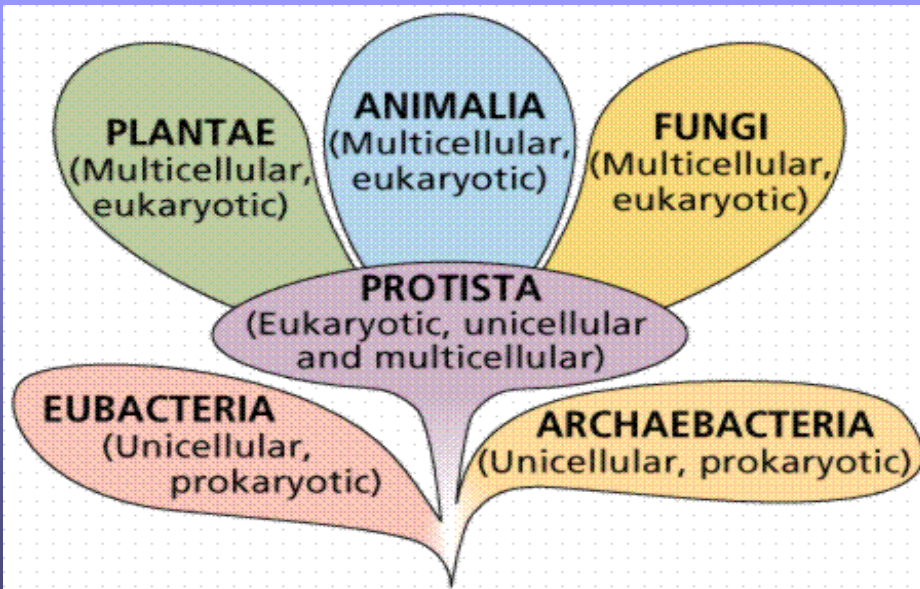
- Monera, Protista, and Fungi kingdoms added to the 2 established kingdoms
- Kingdoms defined based on 2 main characteristics
  - Possession of a true nucleus (prokaryote or eukaryote)
  - How it gets food
    - Heterotroph
    - Autotroph
    - Decomposer



# 1980's: 3-Domain System

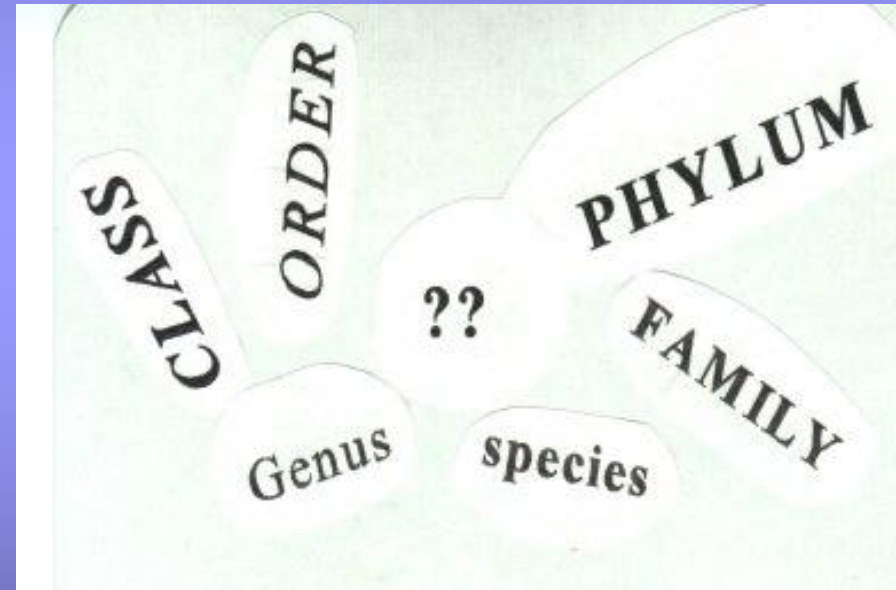


- Bacteria have distinct differences
- All eukaryotic kingdoms grouped into one domain (Eukarya)
- Monera kingdom split into 2 domains (Archaea and Eubacteria)

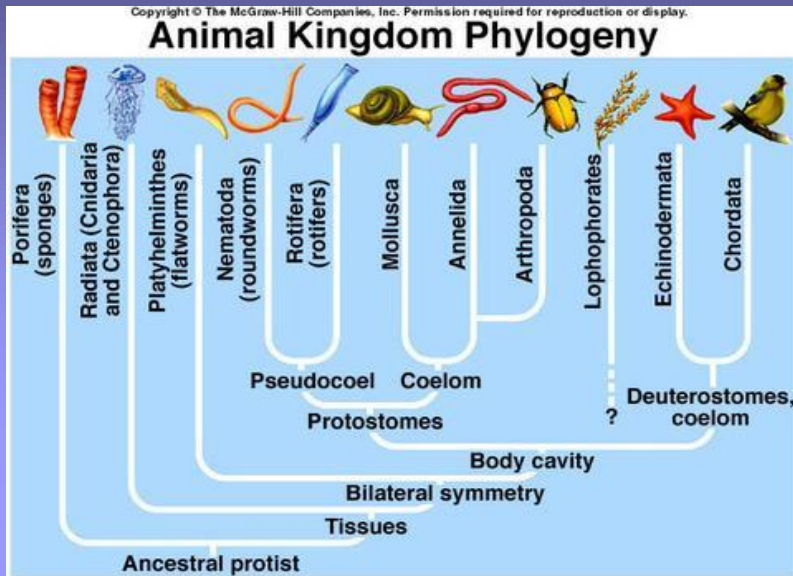


# How Living Things are Classified

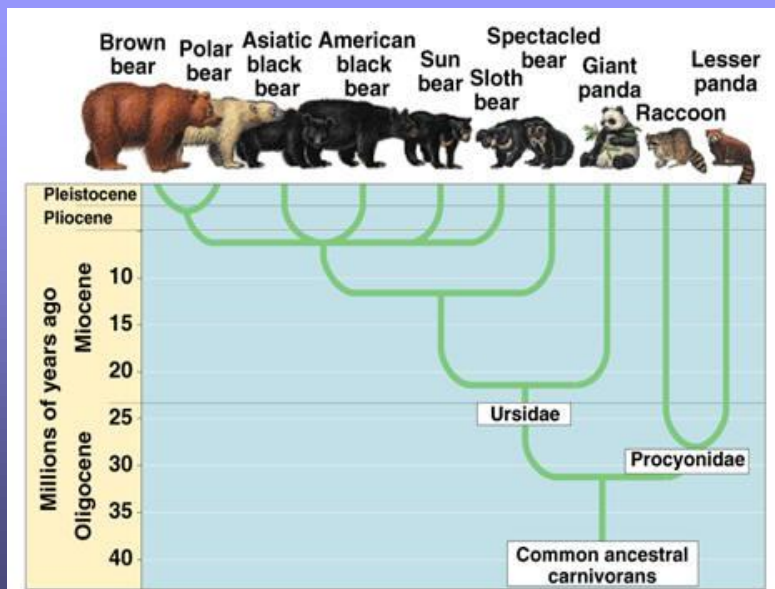
- Groups of organisms called taxa or taxons
- Organisms arranged in groups ranging from very broad to very specific characteristics
  - Broader taxons have more general characteristics and more species within it
  - Smallest taxon → Species
  - Largest taxon → Kingdom



# Phylogeny



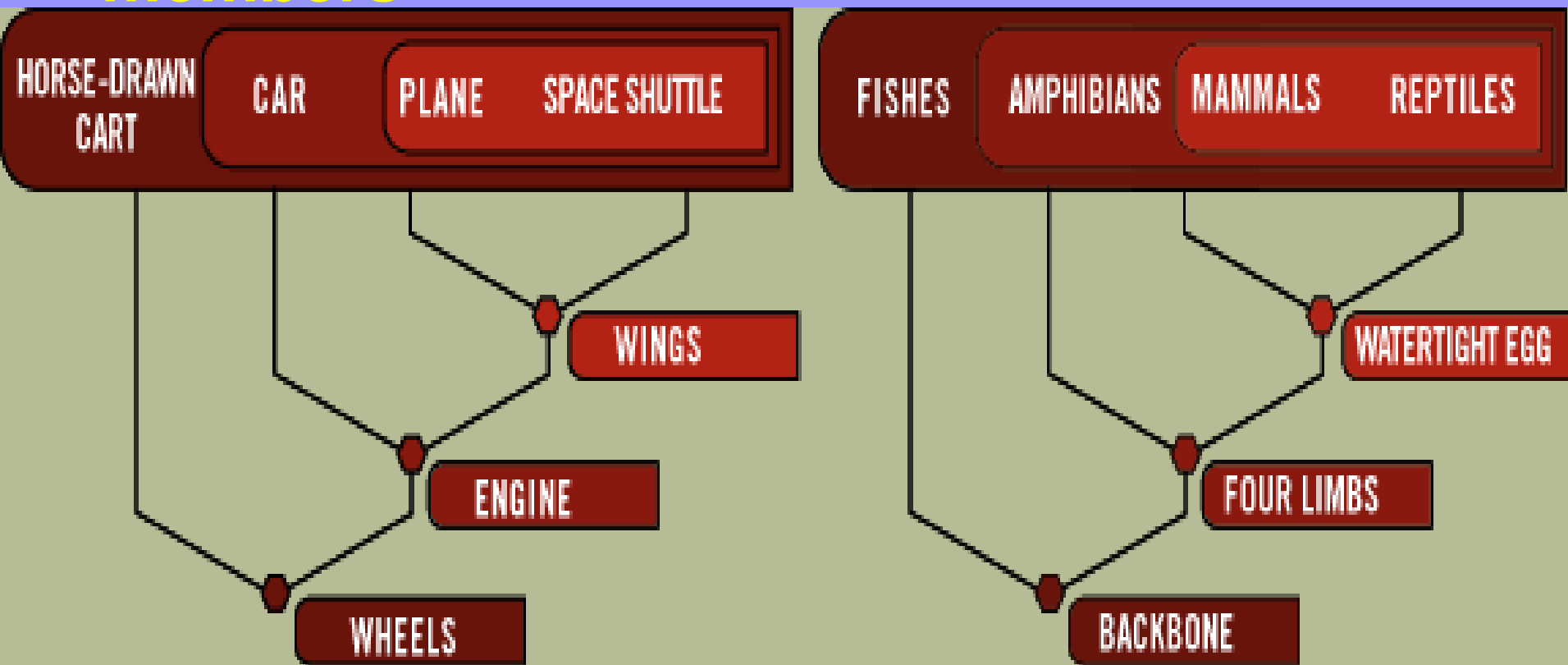
- a family tree for the evolutionary history of a species
  - The root of the tree represents the ancestral lineage
  - Tips of the branches represent descendents of the ancestor
  - Movement upward shows forward motion through time
  - Speciation: split in the lineage
  - Shown as a branching of the tree





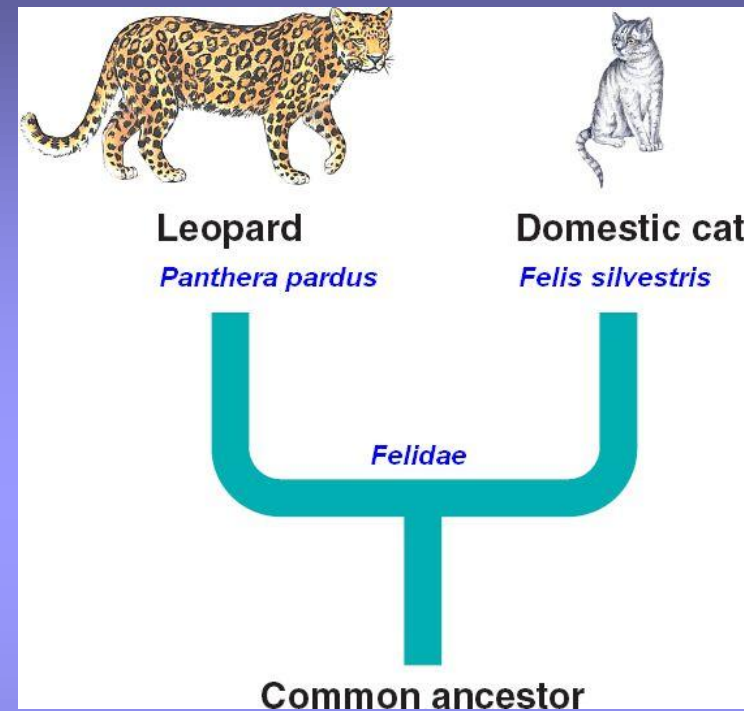
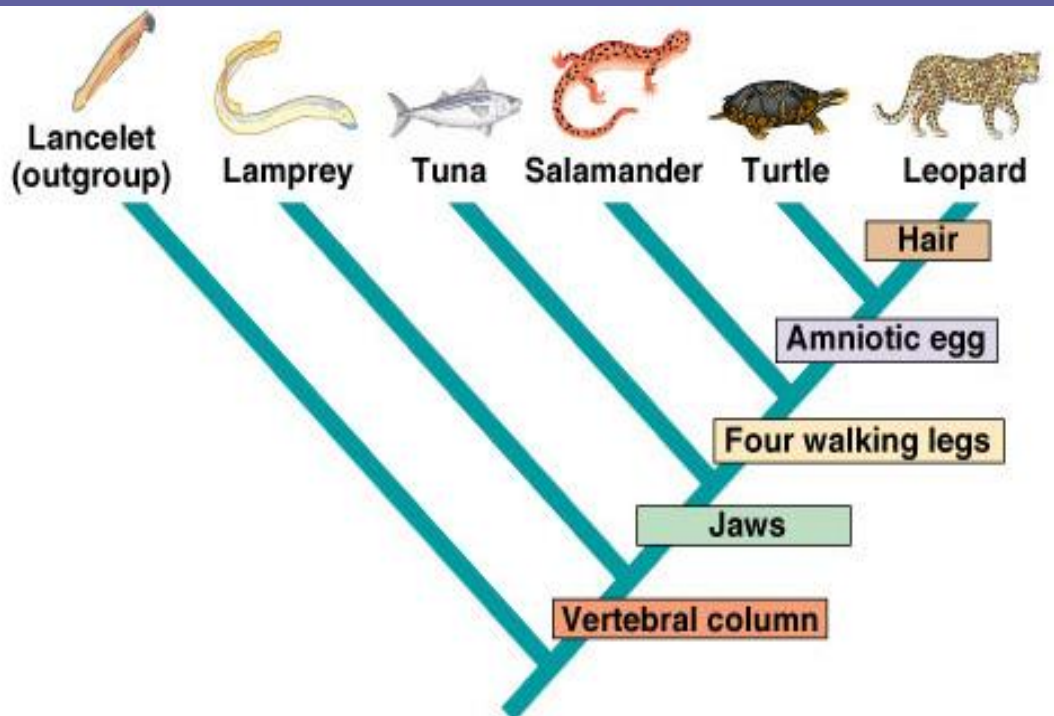
# Cladistics

- System of classification based on phylogeny
- Derived characteristics/traits: appear in recent parts of a lineage but not in older members





# Cladogram



- A branching diagram to show the evolutionary history of a species
- Helps scientists understand how one lineage branched from another in the course of evolution

# Dichotomous Key

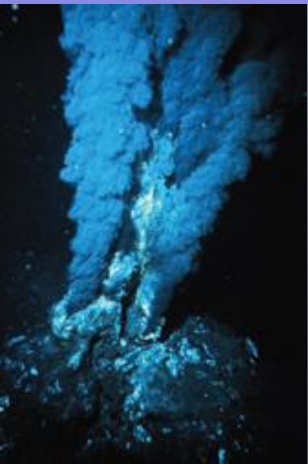
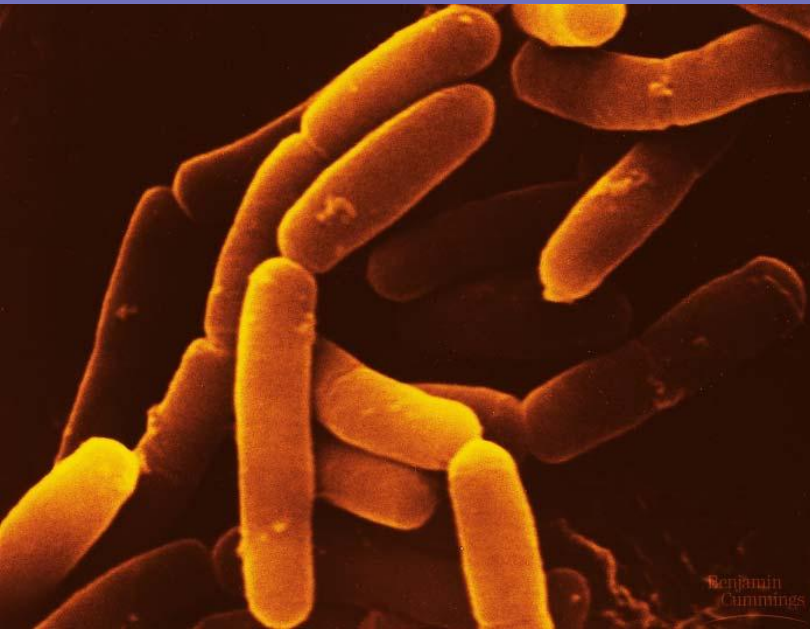
- Way of identifying organisms by looking at the physical characteristics
- Uses a series of questions to group into a hierarchy classification

1a	Gram-positive	Go to 2
1b	Not Gram-positive	Go to 3
2a	Cells spherical in shape	Gram-positive cocci
2b	Cells not spherical in shape	Go to 4
3a	Gram-negative	Go to 5
3b	Not Gram-negative (lack cell wall)	Mycoplasma
4a	Cells rod-shaped	Gram-positive bacilli
4b	Cells not rod-shaped	Go to 6
5a	Cells spherical in shape	Gram-negative cocci
5b	Cells not spherical in shape	Go to 7
6a	Cells club-shaped	Corynebacteria
6b	Cells variable in shape	Propionibacteria
7a	Cells rod-shaped	Gram-negative bacilli
7b	Cells not rod-shaped	Go to 8
8a	Cells helical with several turns	Spirochetes
8b	Cells comma-shaped	Vibrioids

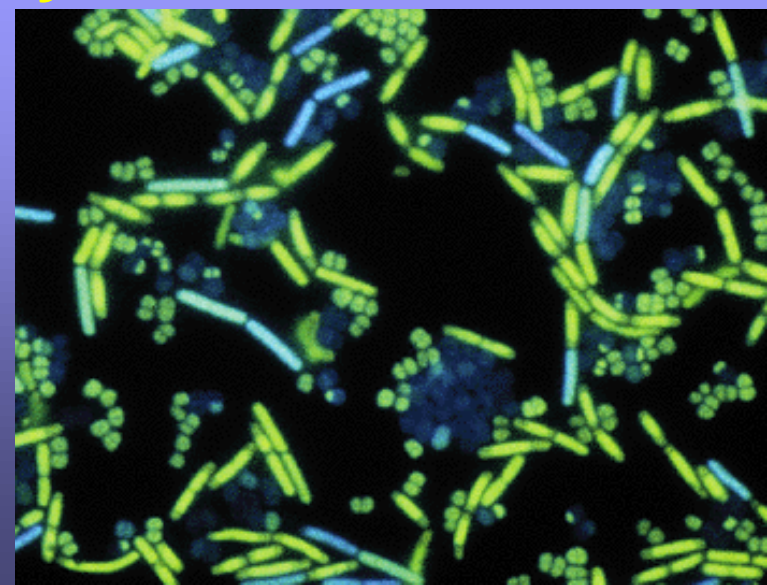
# The Six Kingdoms of Organisms

## Prokaryotes:

- Microscopic
- Prokaryotic (Lack a nucleus)
- Can be autotrophs (photosynthetic or chemosynthetic) or heterotrophs
- Unicellular



- 2 kingdoms (Archaeobacteria and Eubacteria)
  - Archaeobacteria live in extreme environments like swamps, deep-ocean hydrothermal vents (oxygen-free environments)
    - Cell walls not made of peptidoglycan
    - Ex: Methanogens, Halophiles
  - Eubacteria live in most habitats
    - Cell walls made of peptidoglycan
    - Ex: E. coli, Streptococcus, cyanobacteria





# The Six Kingdoms of Organisms

## Protista

- Eukaryotic (has a nucleus)
- Some have cell walls of cellulose
  - Some have chloroplasts
- Can be autotrophs or heterotrophs (some can be fungus-like)
- Most are unicellular; some are multicellular or colonial
- Ex: amoeba, paramecium, slime molds, euglena, kelp
- Lacks complex organ systems
- Lives in moist environments



# The Six Kingdoms of Organisms

## Fungi



- Eukaryotes
- Cell walls of chitin
- Heterotrophs
- Most multicellular; some unicellular
- Ex: mushrooms, yeast
- Absorbs nutrients from organic materials in the environment
- Stationary

# The Six Kingdoms of Organisms

## Plants

- Eukaryotes
- Cell walls of cellulose
- Autotrophs
- Multicellular
- Photosynthetic → contains chloroplasts
- Ex: mosses, ferns, trees, flowering plants
- Cannot move
- Tissues and organ systems





# The Six Kingdoms of Organisms

## Animalia

- Eukaryotes
- Do not have a cell wall or chloroplasts
- Heterotrophs
- Multicellular
- Ex: sponges, worms, insects, fish, mammals (nurse young)
- Mobile

