

**Chapter 17  
Classification**

PLANTAE (Multicellular, eukaryotic)  
 ANIMALIA (Multicellular, eukaryotic)  
 FUNGI (Multicellular, eukaryotic)  
 PROTISTA (Eukaryotic, unicellular and multicellular)  
 EUBACTERIA (Unicellular, prokaryotic)  
 ARCHAEBACTERIA (Unicellular, prokaryotic)

## Classification

- Classification is the arrangement of organisms into orderly groups based on their similarities.
- Classification shows how organisms are related and different.

Grizzly bear, Black bear, Giant panda, Red fox, Abert squirrel, Coral snake, Sea star

**KINGDOM** Animalia

**PHYLUM** Chordata

**CLASS** Mammalia

**ORDER** Carnivora

**FAMILY** Ursidae

**GENUS** Ursus

**SPECIES** Ursus arctos

## Classification

**How organism are classified:**

1. Appearance
2. Behavior
3. Molecular structure (e.g., DNA)
4. Evolutionary relationships

- DNA is the most accurate method to classify

- Organisms that share more similarities are more closely related and are grouped together.

## Classification

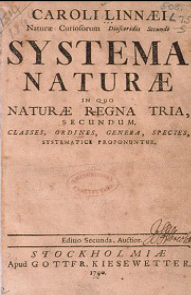

- Classification is also known as taxonomy.
- Taxonomy is the branch of biology that studies the grouping and naming of organisms.

Northern Cardinal  
*Cardinalis cardinalis*

## Carolus Linnaeus

1707 - 1778

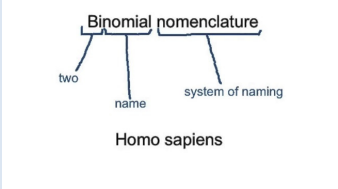
- Called the "Father of Taxonomy"
- Classified organisms by their physical and structure.
- Placed organisms into two Kingdoms: Plants & Animals
- Developed binomial nomenclature
  - (Two-word name: *Genus* and *species*)

## Binomial nomenclature

- The modern system of naming organisms
- Because scientists speak many different languages and common names for organisms may vary from place to place, a universal system for naming organisms is used.


### binomial nomenclature



## Binomial nomenclature

**Rules:**


- uses *Genus* and *species*
- Latin or Greek
- Italicized in print
- Capitalize genus, but NOT species
- Underline when writing



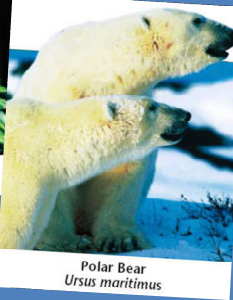
Common Name  
American Robin

Scientific Name  
*Turdus migratorius*


## Binomial Nomenclature



Giant Panda  
*Ailuropoda melanoleuca*



Polar Bear  
*Ursus maritimus*



Grizzly Bear  
*Ursus arctos*

**Which TWO are more closely related?**

**Example: Human Classification**

**Domain:** Eukarya  
**Kingdom:** Animalia  
**Phylum:** Chordata  
**Class:** Mammalia  
**Order:** Primate  
**Family:** Hominidae  
**Genus:** *Homo*  
**Specific:** *sapiens*

How would you write the scientific name?  
 a. *homo Sapiens*  
 b. *Homo sapiens*  
 c. *Homo Sapiens*

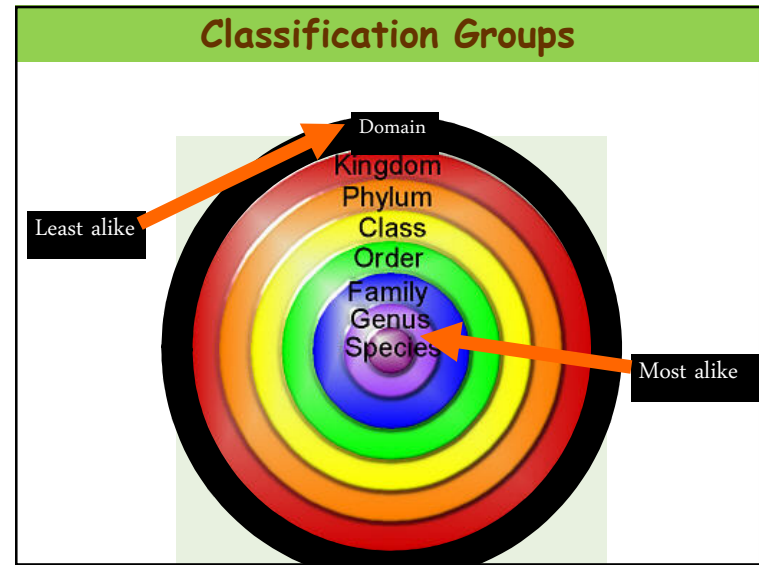
GROUP NAME	ORGANISM				
	HUMAN	CHIMPANZEE	HOUSE CAT	LION	HOUSEFLY
KINGDOM	Animalia	Animalia	Animalia	Animalia	Animalia
PHYLUM	Chordata	Chordata	Chordata	Chordata	Arthropoda
CLASS	Mammal	Mammal	Mammal	Mammal	Insect
ORDER	Primates	Primates	Carnivora	Carnivora	Diptera
FAMILY	Hominidae	Pongidae	Felidae	Felidae	Muscidae
GENUS	Homo	Pan	Felis	Felis	Musca
SPECIES	sapiens	troglodytes	domestica	leo	domestica
Scientific Name	<i>Homo sapiens</i>	<i>Pan troglodytes</i>	<i>Felis domestica</i>	<i>Felis leo</i>	<i>Musca domestica</i>

**Classification Groups**

• 8 levels of classification



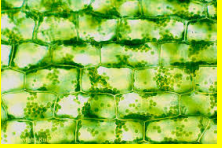
- Taxon is a category into which related organisms are placed.

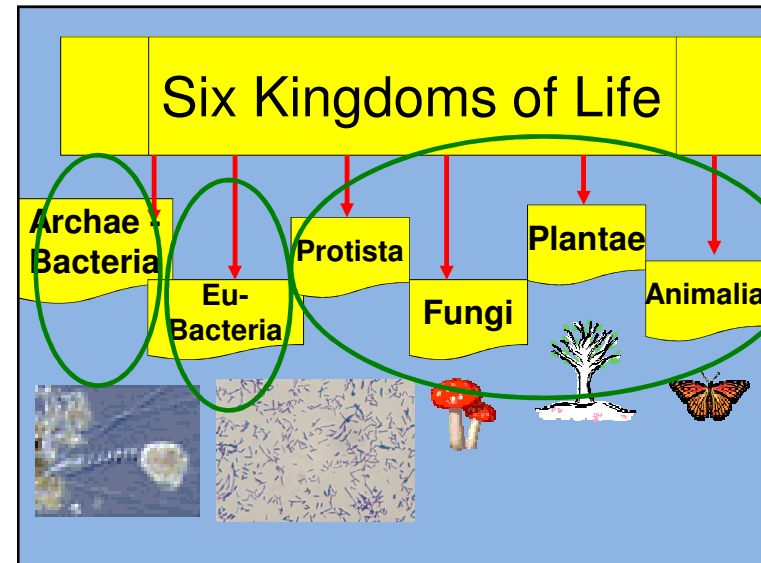
<ul style="list-style-type: none"> <li>• Domain</li> <li>• Kingdom</li> <li>• Phylum</li> <li>• Class</li> <li>• Order</li> <li>• Family</li> <li>• <i>Genus</i></li> <li>• <i>species</i></li> </ul>	<ul style="list-style-type: none"> <li>• Dumb</li> <li>• King</li> <li>• Phillip</li> <li>• Came</li> <li>• Over</li> <li>• For</li> <li>• Good</li> <li>• Spaghetti</li> </ul>
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### Classification Groups


- Domain-broadest, most inclusive taxon
- There are 3 domains:
  1. Archaea
  2. Bacteria
  3. Eukarya



### Prokaryotes

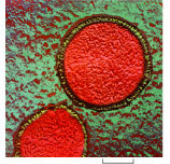
*Domain Bacteria*



3.8 µm

**Kingdom Bacteria**

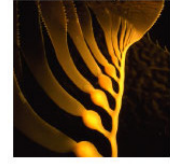
*Domain Archaea*



1.7 µm


**Kingdom Archaeobacteria**

*Domain Eukarya*




**Kingdom Protist**

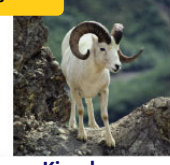
### Eukaryotes



**Kingdom Fungi**





**Kingdom Plant**




**Kingdom Animal**

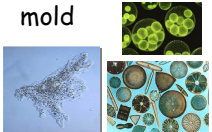
### Kingdom Archaeobacteria

Examples	Cell Type (Prokaryote or Eukaryote)	Unicellular, Multicellular, or Both
Methanobacteria, thermophiles, halophiles  	Prokaryote	Unicellular
Cell Wall Present or Absent	Nutrition (Autotroph, Heterotroph, or both)	Reproduction (Asexual, Sexual, or both forms)
Cell Wall Present	Both <small>- absorption, photo/chemosynthesis</small>	Asexual


### Kingdom Eubacteria

Examples	Cell Type (Prokaryote or Eukaryote)	Unicellular, Multicellular, or Both
E.Coli & Streptococcus 	Prokaryote	Unicellular
Cell Wall Present or Absent	Nutrition (Autotroph, Heterotroph, or both)	Reproduction (Asexual, Sexual, or both forms)
Cell Wall Present	Both - absorption, photo/chemosynthesis	Asexual


### Kingdom Protist

Examples	Cell Type (Prokaryote or Eukaryote)	Unicellular, Multicellular, or Both
Algae, diatom, & amoeba, mold 	Eukaryote	Both, but mostly unicellular
Cell Wall Present or Absent	Nutrition (Autotroph, Heterotroph, or both)	Reproduction (Asexual, Sexual, or both forms)
Cell Wall made of cellulose	Both - absorption, photosynthesis, ingestion	Both


### Kingdom Fungi

Examples	Cell Type (Prokaryote or Eukaryote)	Unicellular, Multicellular, or Both
Lichen, yeast, mushroom 	Eukaryote	Both, mostly multicellular
Cell Wall Present or Absent	Nutrition (Autotroph, Heterotroph, or both)	Reproduction (Asexual, Sexual, or both forms)
Cell Wall made of chitin	Heterotroph - absorption	Both

### Kingdom Plant


Examples	Cell Type (Prokaryote or Eukaryote)	Unicellular, Multicellular, or Both
Trees, flowers, grass 	Eukaryote	Multicellular
Cell Wall Present or Absent	Nutrition (Autotroph, Heterotroph, or both)	Reproduction (Asexual, Sexual, or both forms)
Cell Wall made of cellulose	Autotroph -photosynthesis	Sexual -pollination

## Kingdom Animal

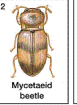
Examples	Cell Type (Prokaryote or Eukaryote)	Unicellular, Multicellular, or Both
Sponges, mammals, birds, fish, insects 	Eukaryote	Multicellular
Cell Wall Present or Absent	Nutrition (Autotroph, Heterotroph, or both)	Reproduction (Asexual, Sexual, or both forms)
Cell Wall Absent	Heterotroph -ingestion	Sexual -sperm & egg

## Dichotomous Key

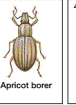
- A tool used to identify organisms
  - Characteristics given in pairs
  - Read both characteristics and either go to another set of characteristics OR identify the organism



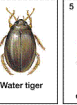
1  
Variegated mud-loving beetle



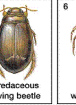
2  
Mycetoid beetle




3  
Apricot borer



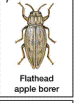
4  
Water tiger



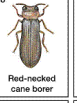
5  
Predaceous diving beetle



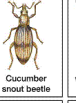
6  
Crawling water beetle




7  
Flathead apple borer



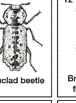
8  
Red-necked cane borer



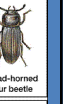
9  
Cucumber snout beetle



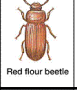
10  
Whirligig beetle




11  
Ironclad beetle



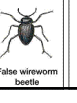
12  
Broad-horned flour beetle



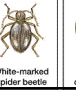
13  
Red flour beetle




14  
Blind ant-beetle




15  
False wireworm beetle



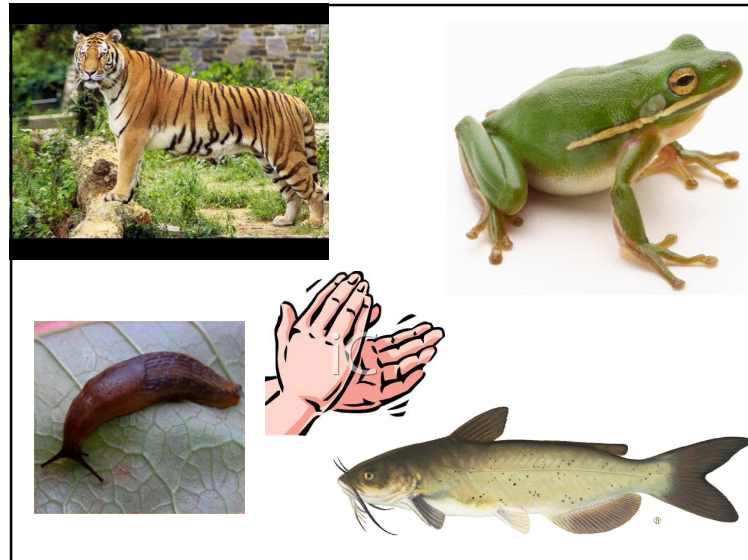
16  
White-marked spider beetle



17  
Monterey cypress beetle





18  
Drug store beetle



## Example of Dichotomous Key

- 1a Tentacles present - Go to 2
- 1b Tentacles absent - Go to 3
- 2a Less than 8 tentacles - Hydra
- 2b More than 8 tentacles - Go to 3
- 3a Tentacles hang down - go to 4
- 3b Tentacles upright - Sea Anemone
- 4a Balloon-shaped body - Jellyfish
- 4b Body NOT balloon-shaped - 5

## KEY CONCEPT

Modern classification is based on evolutionary relationships.




Pangolins

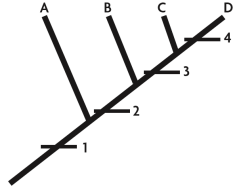
Genetically related to the raccoon and giant panda.

## Cladistics

- Classification based on common ancestry.
  - Species placed in order that they descended from common ancestor

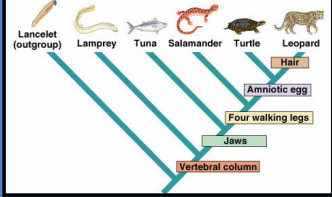


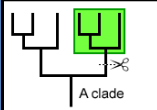
- **Phylogeny** is the evolutionary history for a group of species.
  - Shown with branching tree diagrams



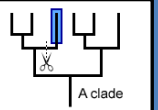
## Cladistics

- A **cladogram** is an evolutionary tree that proposes how species may be related to each other through common ancestors.

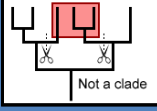




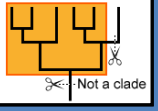
A clade



A clade



Not a clade

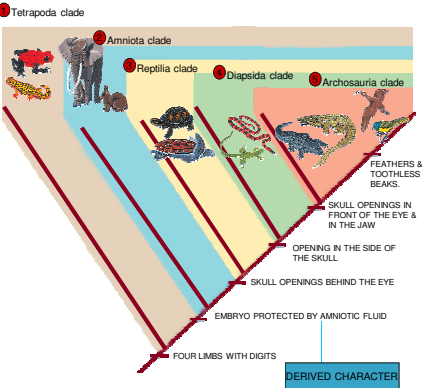


Not a clade

- A clade is a group of species that shares a common ancestor.

## Cladistics

- Derived characters are traits shared in different degrees by clade members.



- More closely related species share more derived characters
- Represented on cladogram as hash marks

DERIVED CHARACTER

## Cladistics

- Nodes represent the most recent common ancestor of a clade.

## Cladistics

Molecular evidence reveals species' relatedness.

- Molecular data may lead scientists to propose a new classification.

BEFORE

AFTER

DNA is usually given the last word by scientists.

Derived Characteristics

- Motor
- Passengers enclosed
- Wheels
- wings

Descendants

- Car
- Motorcycle
- Walking
- Airplane
- bicycle