What is a Vertebrate?

Vertebrates are animals with a vertebral column (backbone). The vertebrae extend from the head to the tail and form the main skeletal axis of the body.

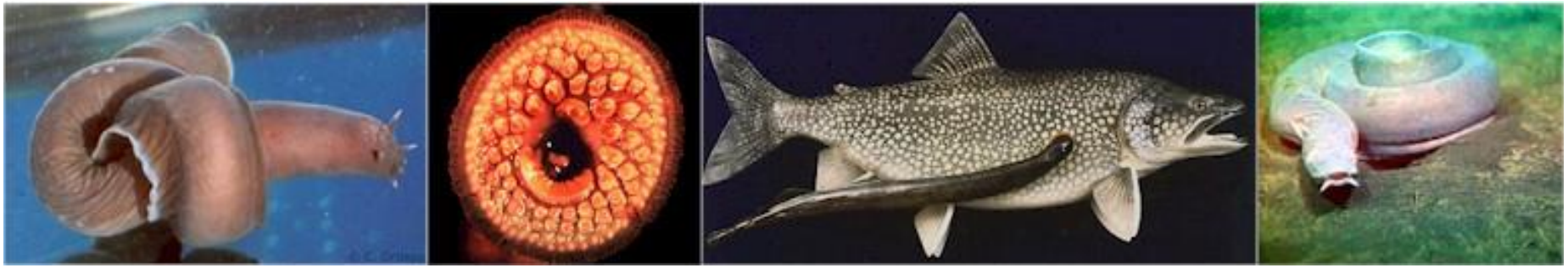
Traditionally 7 Classes of Vertebrates

Many taxonomists recognize more classes

- Agnatha → Hagfish (Class Myxini), Lampreys (Class Hyperoartii)
- Chondrichthyes
- Osteichthyes → Ray-finned (Class Actinopterygii); Lobe-finned (Class Sarcopterygii)
- Amphibia
- Reptilia → Turtles (Class Chelonia)
- Mammalia
- Aves

There are slightly over 66,000 described vertebrate species

Agnatha – Lampreys and Hagfish



1. Jaws are absent

2. Paired fins are generally absent

3. In most cases the skeleton is cartilaginous

4. The embryonic notochord persists in the adult

5. The digestive system lacks a stomach

Chondrichthyes – Sharks, Skates & Rays

1. Skeleton is entirely cartilage

2. No swim bladder or lung

3. Respiration by five to seven pairs of gills no operculum

4. Sharks have a heterocercal tail

Shark Breaching!

Osteichthyes – Boney Fish

1. Skeleton made of true bone

2. Skin with mucous glands and most are covered by scales

3. Paired fins

4. Jaws present, most with teeth

5. Respiration by gills and covered by an operculum.

6. Most have a homocercal tail

Amphibia- Frogs & Salamanders

1. Aquatic and terrestrial stage
2. Moist, glandular skin…no scales, feathers or hair
3. Lack claws on toes
4. Ectothermic

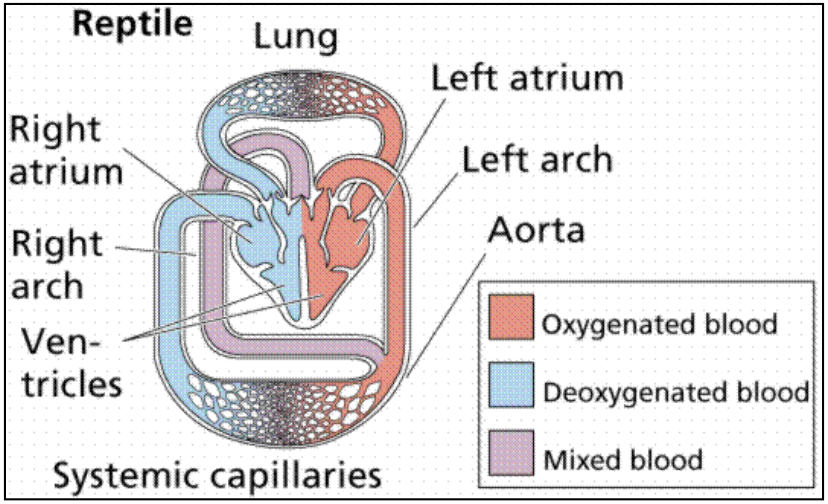
Reptilia –Snakes, Lizards & Turtles

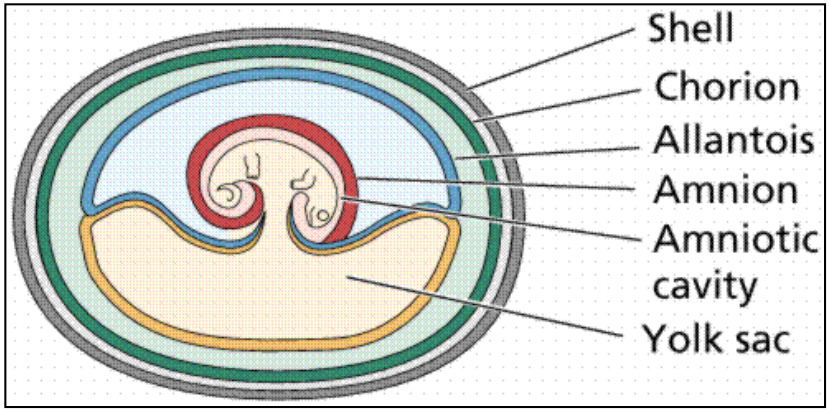
1. Scale covered skin

2. Most with a 3-chambered heart

3. Amniotic egg

4. Ectothermic





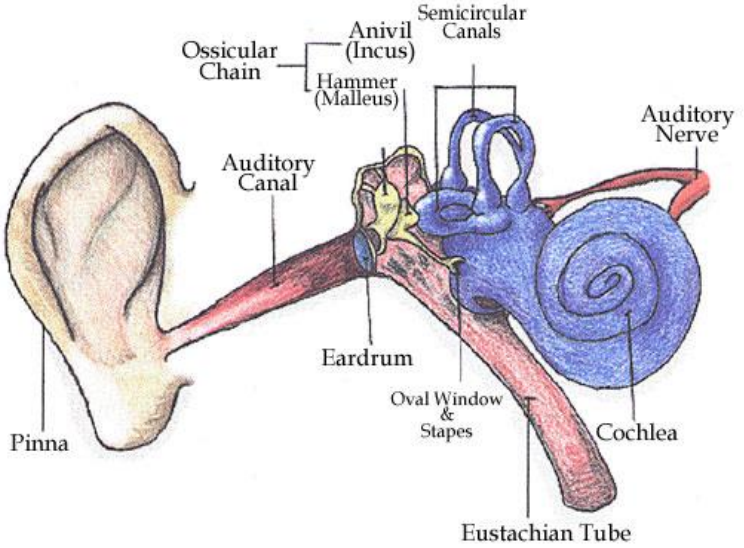
Mammalia- Placentals, Marsupials & Monotremes

1. All mammals have hair in some form, even dolphins!

2. The production of milk by modified sweat glands called mammary glands

3. The three middle ear bones (malleus, incus, and stapes)

4. Endothermic



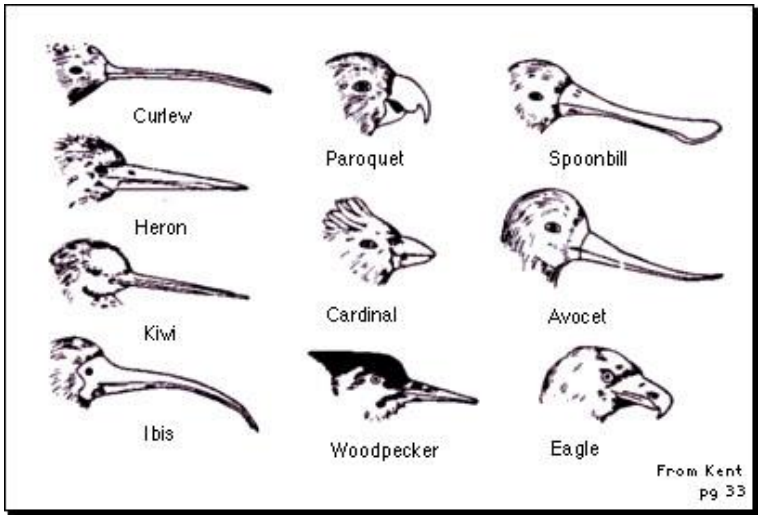
Aves - Birds

1. All Birds have Feathers

2. All birds have a Beak

3. Birds have hollow bones

4. Endothermic



Vertebrate Classification

We Need a System for Naming Species

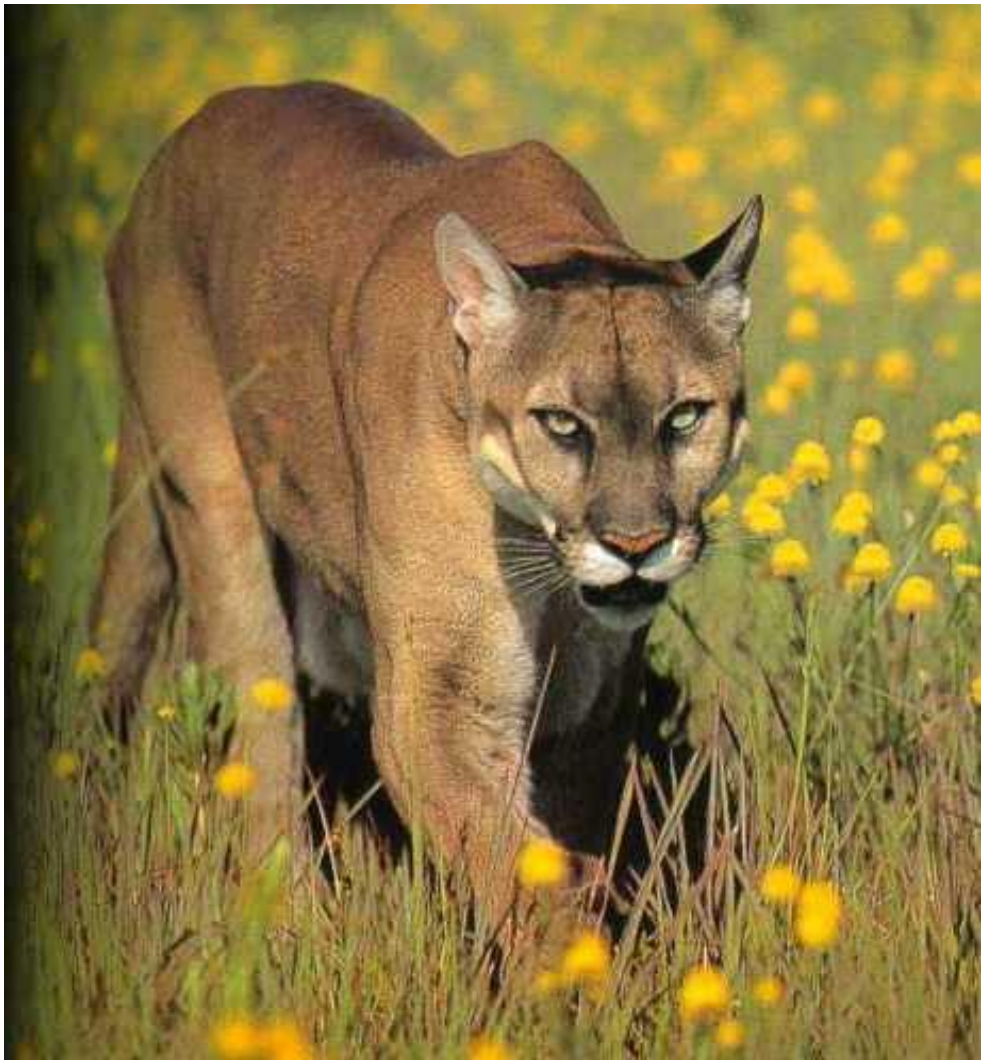
- Each species must have a universally accepted, unique name
- Common names can create confusion

Little Brown Bat

Myotis lucifugus

Kentucky Warbler

Oporornis formosus



Cougar, **Puma** or **Mountain Lion**

or

Puma concolor

Traditional Classification

Produces the orderly lists based on anatomical traits that are typically found in a textbook.

- **Kingdom** - Most general. Vertebrates belong to Animalia.
- **Phylum** - Vertebrates are in the phylum, Chordata.
- **Subphylum -** Chordata is divided into sub-phylums, including Vertebrata.
- **Class** – Agnatha, Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Mammalia, Aves
- **Order**
- **Family**
- ***Genus* –** when typed it should always be capitalized and italicized and is usually a noun.
- ***species*** - always paired with a genus to produce a binary species name. For example, *Turdus migratorius*

Taxonomy is the science of the classification of organisms

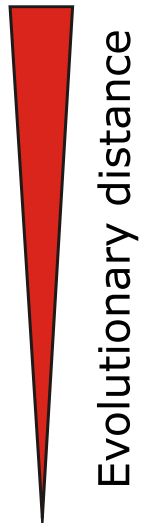
Taxonomy deals with the naming and ordering of taxa.

The Linnaean hierarchy:

1. Kingdom
2. Phylum
3. Class
4. Order
5. Family
6. Genus
7. Species

Classification of Humans

Kingdom: Animalia
Phylum: Chordata
subphylum: Vertebrata
Class: Mammalia
Order: Primates
Family: Hominidae
Genus: Homo
species: sapiens

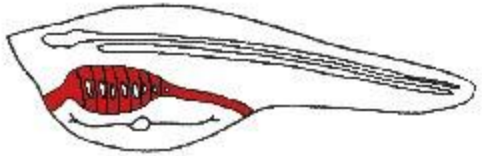


Remembering the Hierarchy

King	Kingdom
Phillip	Phylum
Came	Class
Over	Order
For	Family
Grandma's	Genus
Soup	species

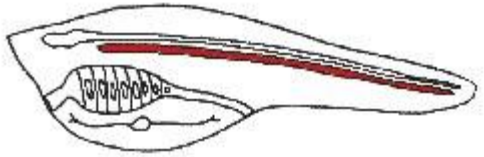
Characteristics of Phylum Chordata

1. Pharyngeal gills



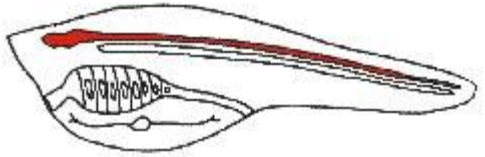
pharyngeal gill slits

2. Notochord



notochord

3. Dorsal nerve chord



dorsal nerve cord

4. Post anal tail

Tunicate larvae and mouse embryos both have a notochord. What does this suggest about their relationship?

A. They share common ancestry
B. There is no relationship, it is just a coincidence
C. All animals have a notochord
D. None of the above

Remember the 6 Kingdoms?

Animalia

Plantae

Fungi

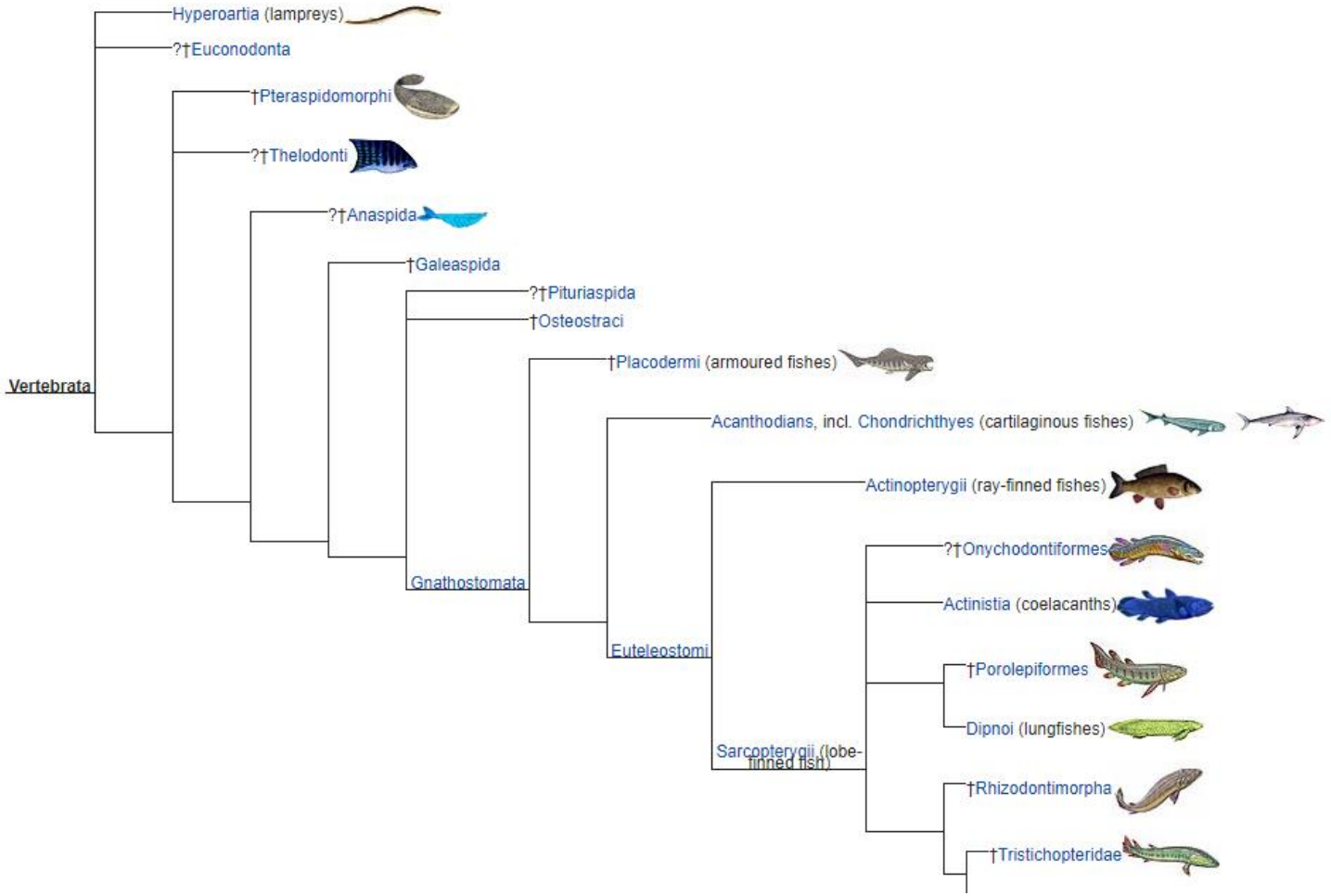
Protista

Eubacteria

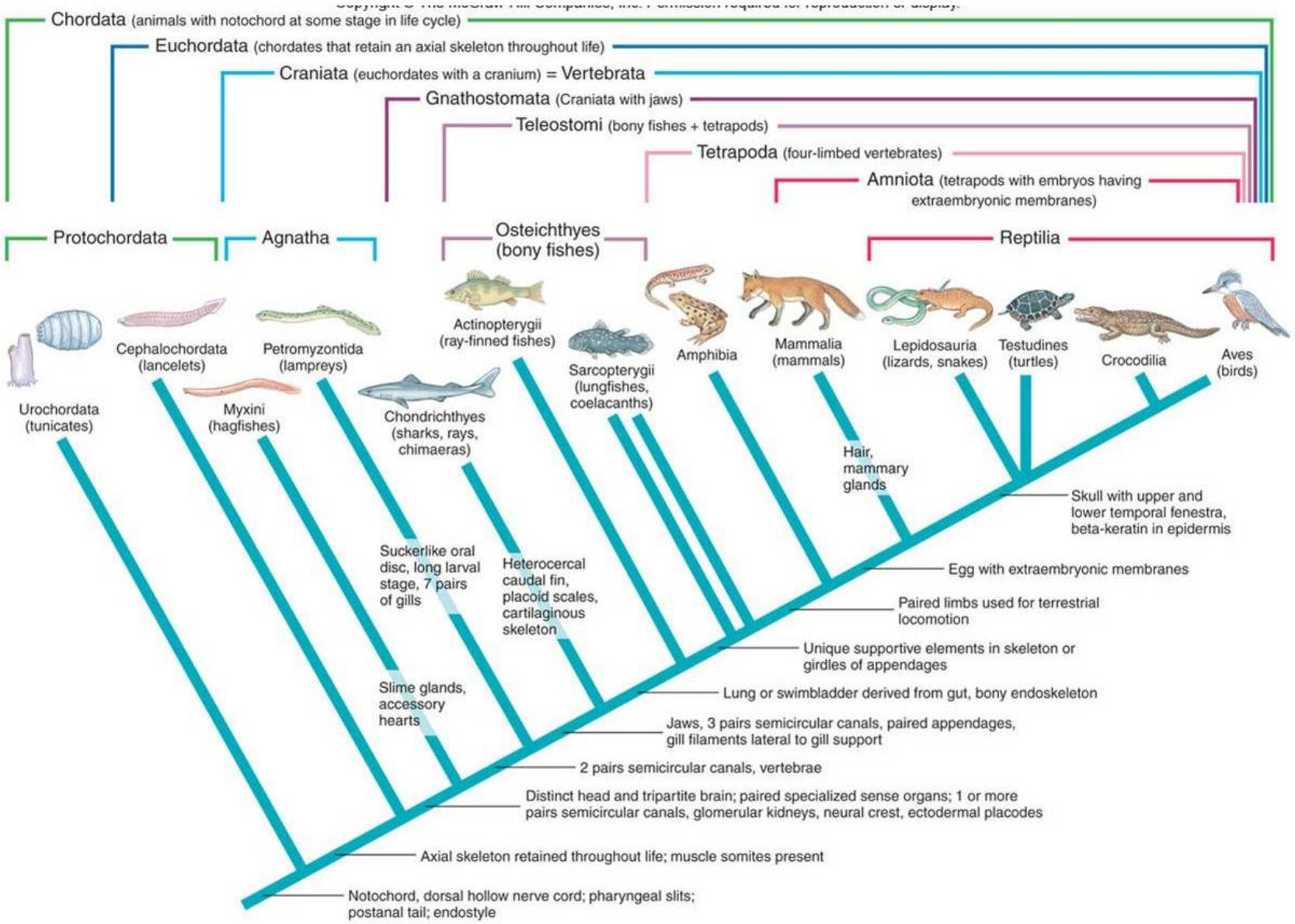
Archaebacteria

Evolutionary Systematics

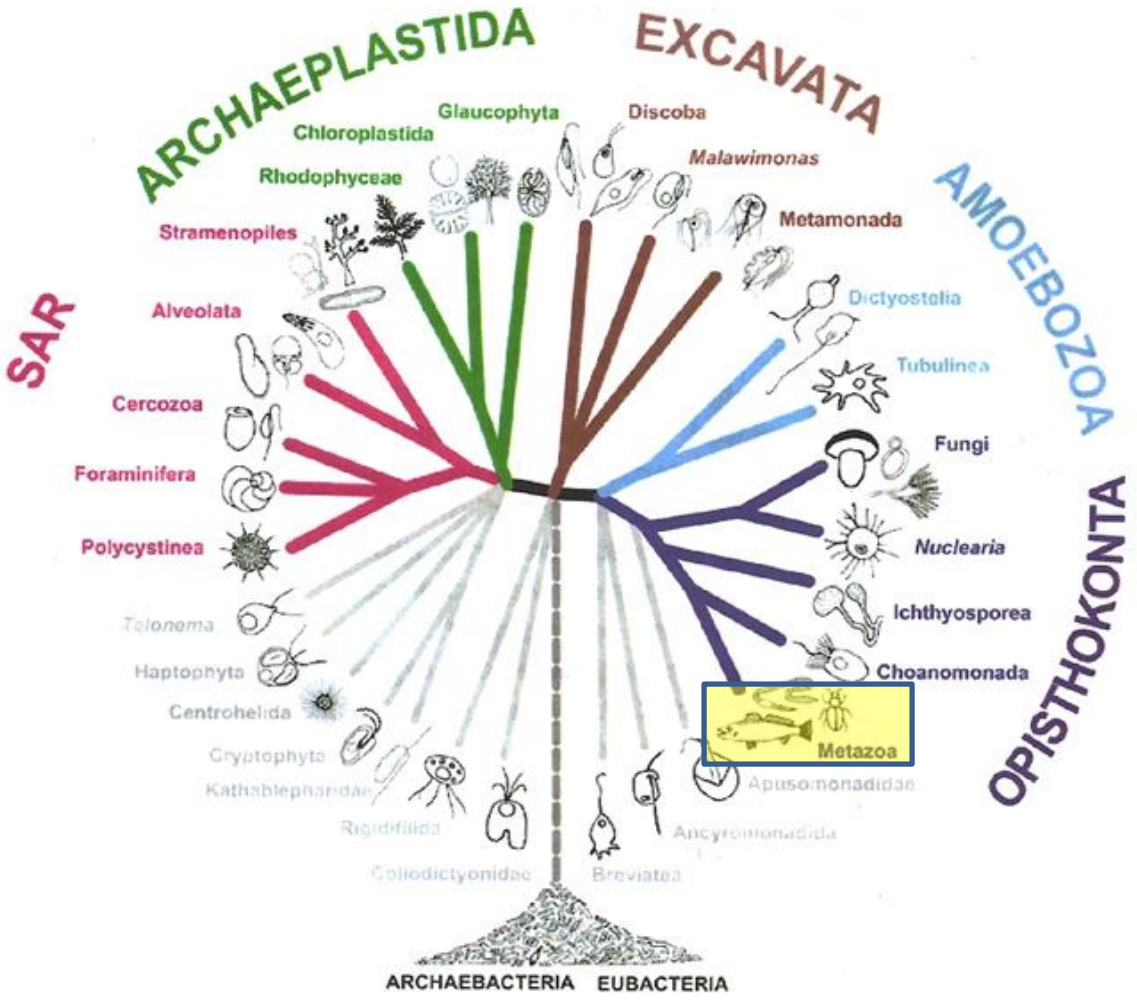
Relies on anatomy, physiology and evolutionary history, which is determined through similarities in the anatomy and genetics of organisms.



A cladogram (from Greek *clados* "branch" and *gramma* "character") is a diagram to show relations among organisms.



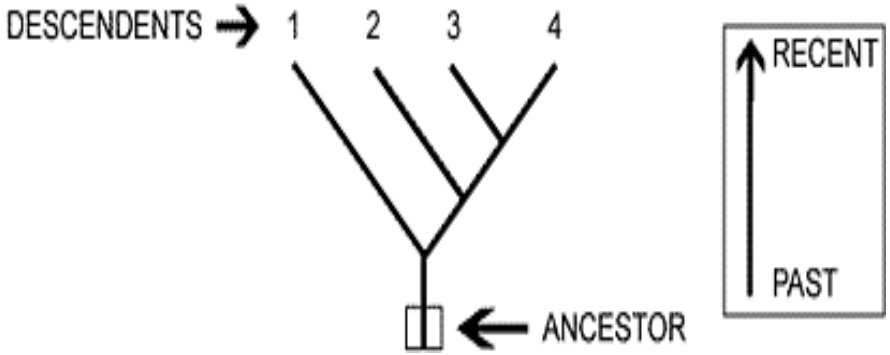
One hypothesis for classifying eukaryotes has 26 groups (like kingdoms) lumped into 5 super-groups.



Like all previous classification systems, this one is likely to change as we learn more.

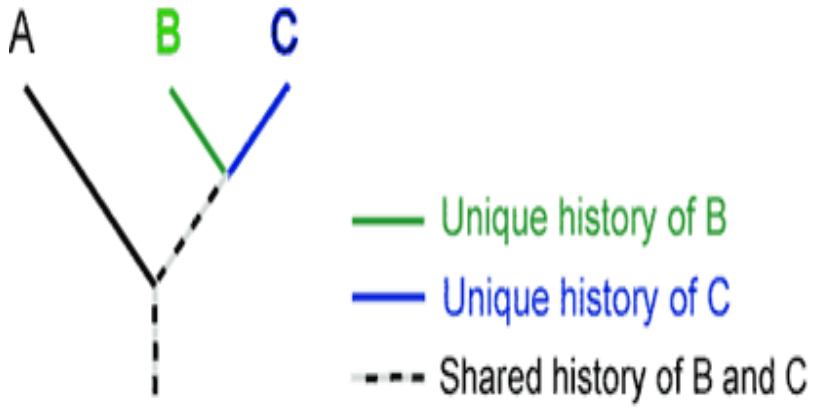
How to read a Cladogram

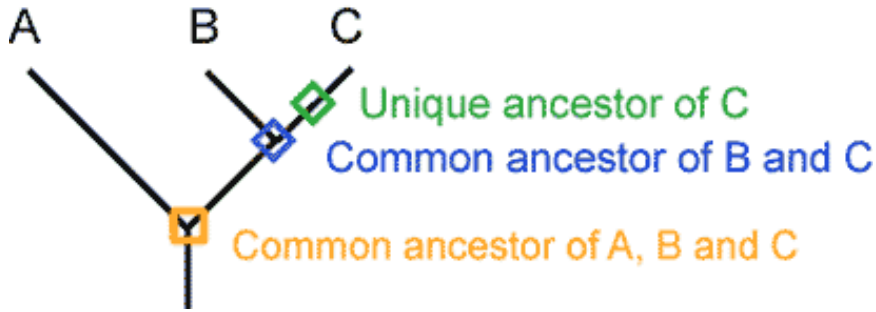
- This diagram shows a relationship between 4 relatives. These relatives share a common ancestor at the root of the tree.
- This diagram is also a timeline. The older organism is at the bottom of the tree.
- Branches on the tree represent SPECIATION, the formation of a new species.
- The four descendants at the top of the tree are DIFFERENT species. This is called SPECIATION.



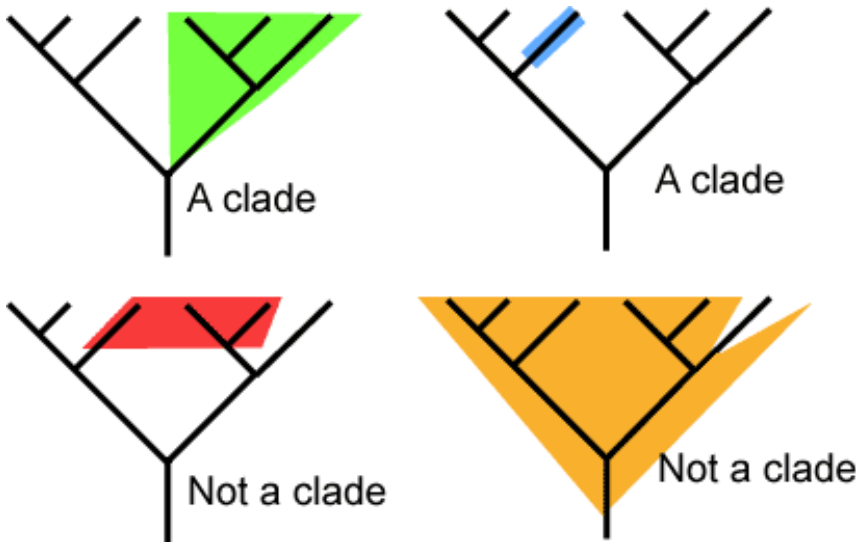
How to read a Cladogram

- Species B and C each have characteristics that are unique only to them.
- But they also share some part of their history with species A. This shared history is the common ancestor.

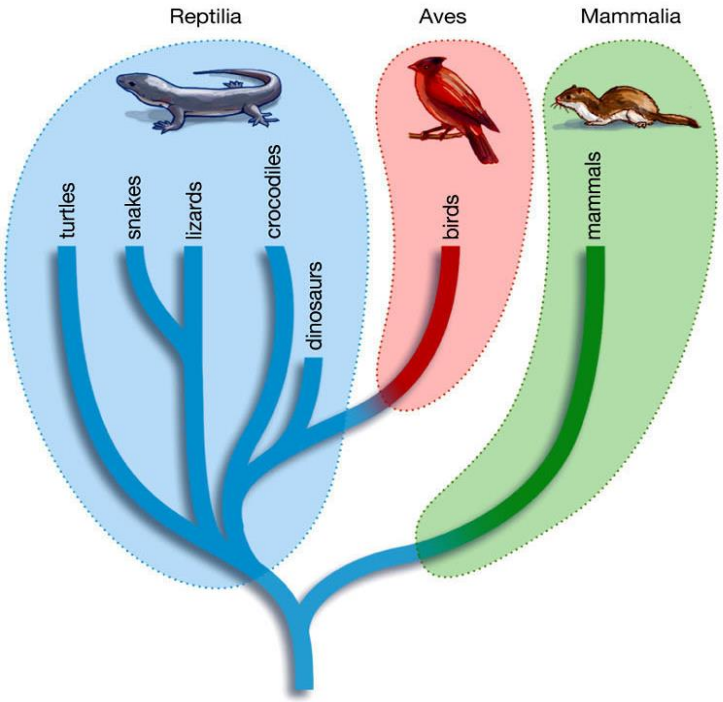




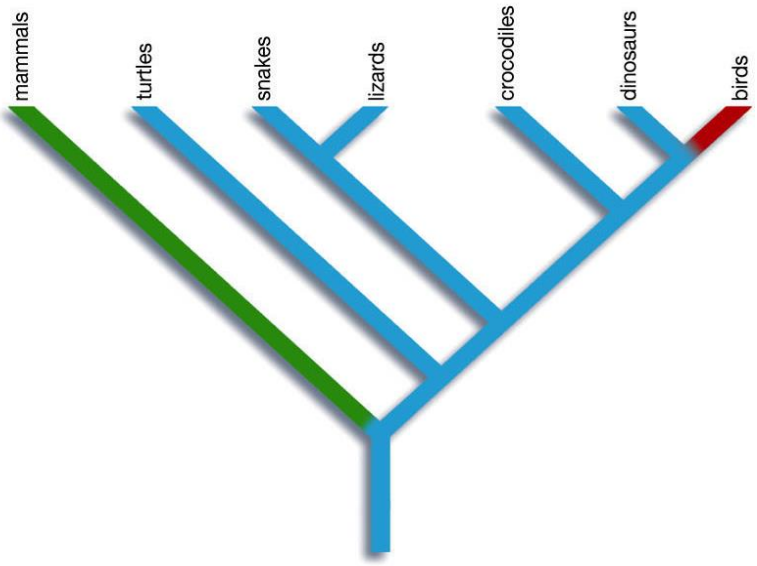
A Clade is a group of organisms that come from a common ancestor.



Traditional view of relationships among tetrapods (4 limbs)



Cladistics view of relationships among tetrapods (4 limbs)



Which pair is more closely related? A lizard/crocodile or bird/crocodile?

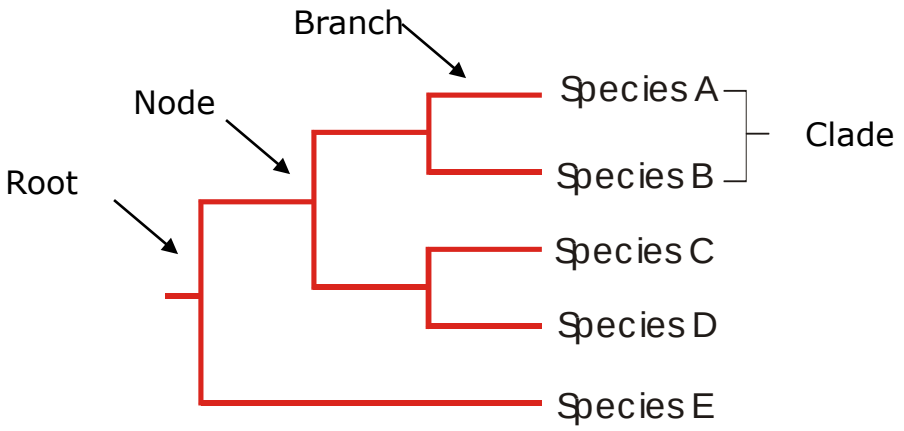
Important Definitions

Node: a branch point in a tree (a presumed ancestor)

Branch: defines the relationship between the taxa in terms of descent and ancestry

Root: the common ancestor of all taxa

Clade: a group of two or more taxa or DNA sequences that includes both their common ancestor and all their descendants



Additional Reading

Chapters 28- 30 pp. 816 – 899

Chapter 17, pp. 482 - 505