Phylogeny and Classification

- Over 1.5 million species of animals classified to date
- Need a formal system for naming and classification (taxonomy)
- Methods of comparative biology = systematics
- Phylogeny = evolutionary history of group or taxon

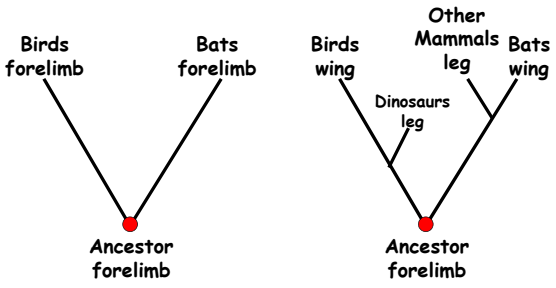
More recent common ancestor

More closely related

Phylogeny and Classification

- Remember: Major goal is to reconstruct phylogeny
- Tools: Study of characters (variable states)
- Homology = characters derived from common ancestor
- Homoplasy = similar features (same function) arises on different lineages, NO COMMON ANCESTRY.
  - Results from convergent evolution

Homologous structures



Structure is homologous ONLY as a forelimb

Phylogeny and Classification

Cladistics

- Organization into groups or clades based on shared **derived** character states

Derived = apomorphic

Ancestral = plesiomorphic

Synapomorphy = shared derived character state

Symplesiomorphy = shared ancestral character state

Outgroup comparison

- Study of character state in closely related animals outside group of interest

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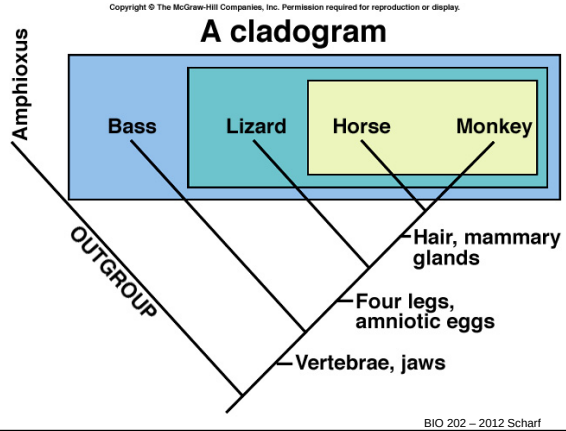

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Classification System

- Current scheme based on work of Linnaeus (1700's)
- Developed pre-evolution, but basic principles still used
- Hierarchical system of taxonomic ranks
- Seven ranks are mandatory
  - Kingdom, Phylum, Class, Order, Family, Genus, Species
  - Now also use many additional ranks (>30 ranks total)
    - e.g., superorder, subclass, subphylum

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Classification Examples

Human		Tiger shark	
Kingdom	Animalia	Kingdom	Animalia
Phylum	Chordata	Phylum	Chordata
Subphylum	Vertebrata	Subphylum	Vertebrata
Class	Mammalia	Class	Chondrichthyes
Order	Primates	Order	Carcharhiniformes
Family	Hominidae	Family	Carcharhinidae
Genus	Homo	Genus	Galeocerdo
Species	Homo sapiens	Species	Galeocerdo cuvier

Classification

Binomial nomenclature

- Latinized name composed of two words
  - First word is genus name (always capitalized)
    - Always a noun
  - Second word is species name (not capitalized)
    - Usually an adjective
    - Species name never used alone, must be combined with genus name
  - All ranks above species are single words and are always capitalized

Classification system

- Traditionally only two kingdoms (plant and animal)
- 1969 – Whittaker proposes 5 Kingdom system
  1. Monera = prokaryotes (no nuclei in cells)
  2. Protista = unicellular eukaryotes (contain nuclei)
  3. Fungi = absorb food
  4. Plants = photosynthesis
  5. Animals = ingest food
- 1990 – Woese et al. recognize 3 domains above Kingdom level
  1. Eucarya = all eukaryotes
  2. Bacteria = true bacteria
  3. Archaea = also prokaryotes but different from bacteria

Five kingdom classifi-cation system