Phylogenetics: Reading trees

Introduction to Evolution and Scientific Inquiry

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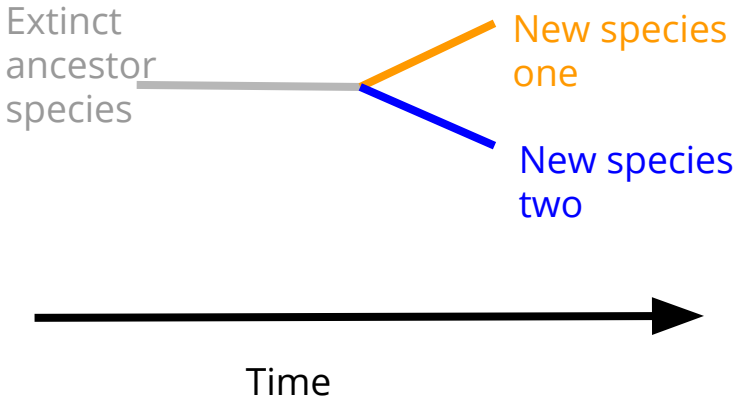
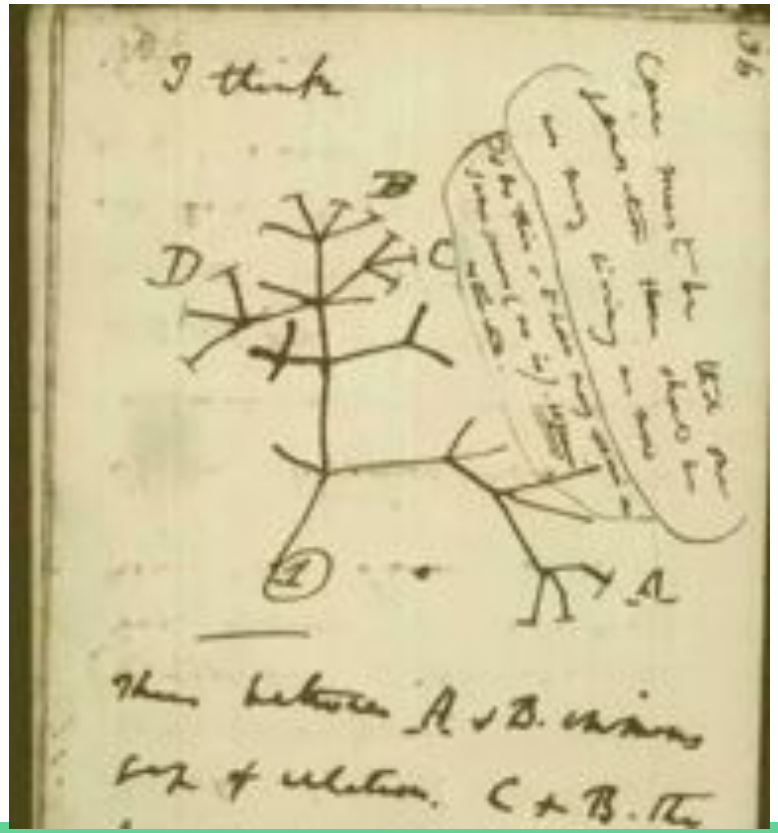
Cladogenesis: birth of new clades



The first ever phylogeny



Systematics, Cladistics, Phylogenetics

- Systematics: The study of diversity of life and identification of **taxa** (singular: taxon)

- Cladistics: The systematic classification of groups of organisms using *shared characteristics derived from a common ancestor*

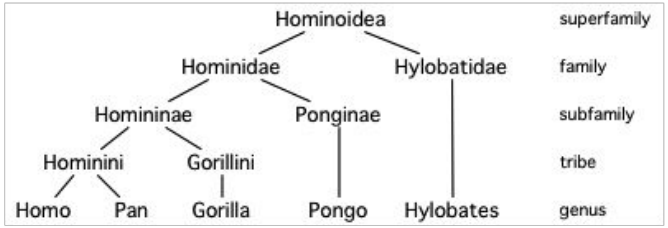
- Phylogenetics: The science of creating evolutionary trees that reveal how organisms are related to each other, based on common ancestry

The Linnaean Hierarchy

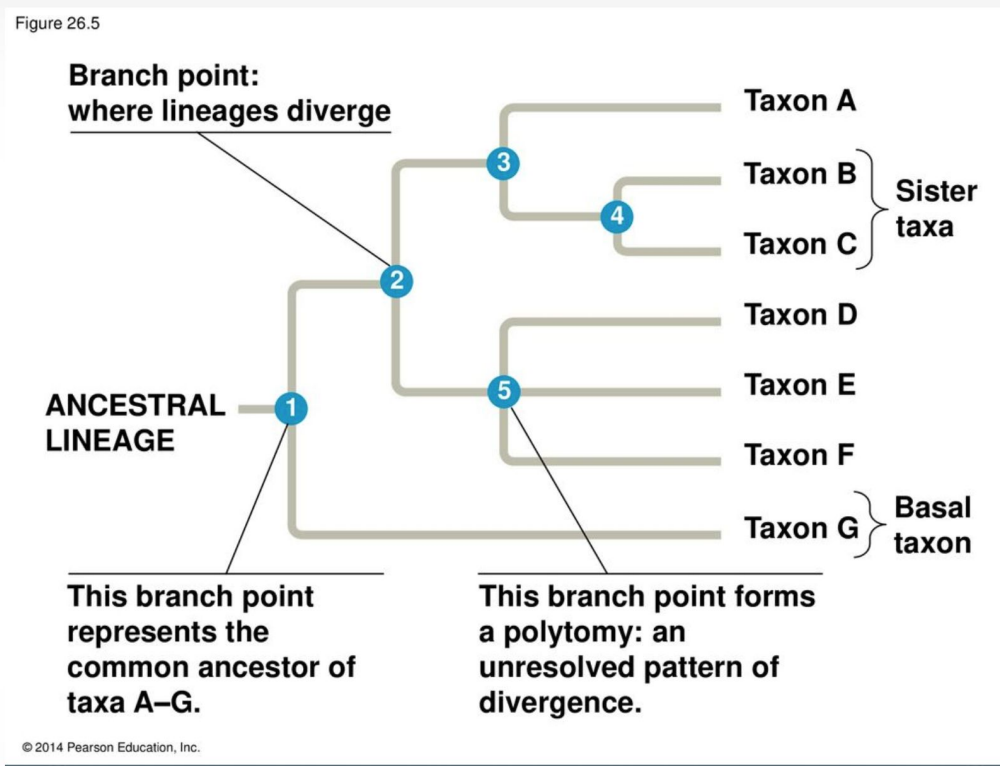
Kingdom
Phylum
Class
Order
Family
Genus
Species

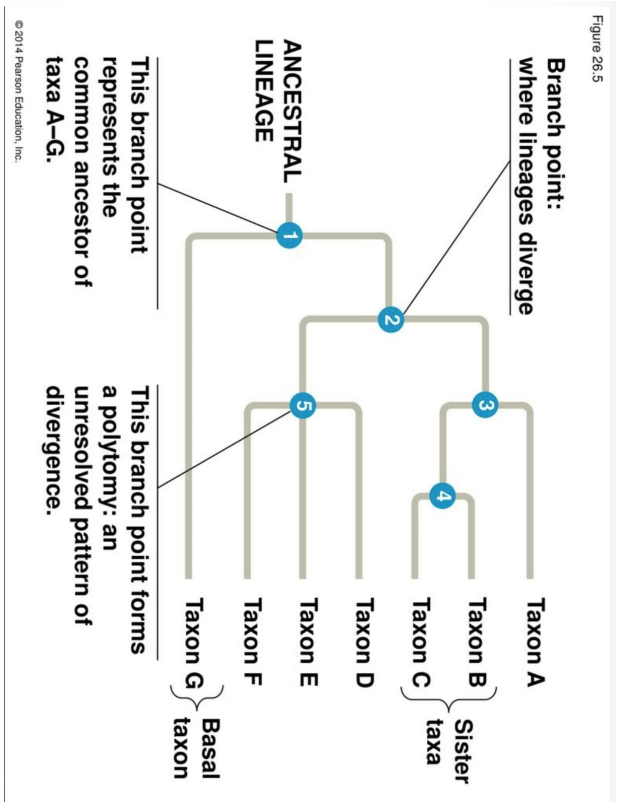
Is a “super family” or a “tribe” a real evolutionary entity?

Super family	Family	Sub family	Tribe	Genus	Species
Hominoidea	*Hylobatidae*			*Hylobates*	*Hylobates sp.*
	Hominidae	*Ponginae*		*Pongo*	*Pongo pygmaeus*
		Homininae	*Panini*	*Pan*	*Pan paniscus*
					Pan troglodytes
				Gorilla	*Gorilla gorilla*
			Hominini	*Homo*	*Homo sapiens*

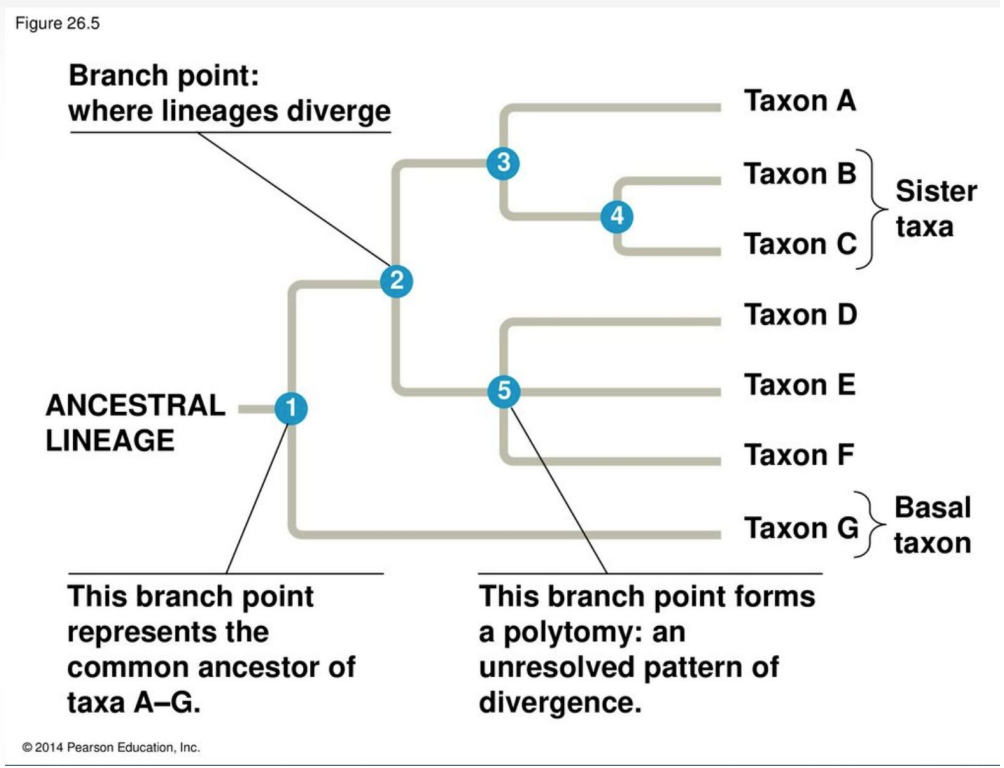


Anatomy of a phylogeny





Anatomy of a phylogeny

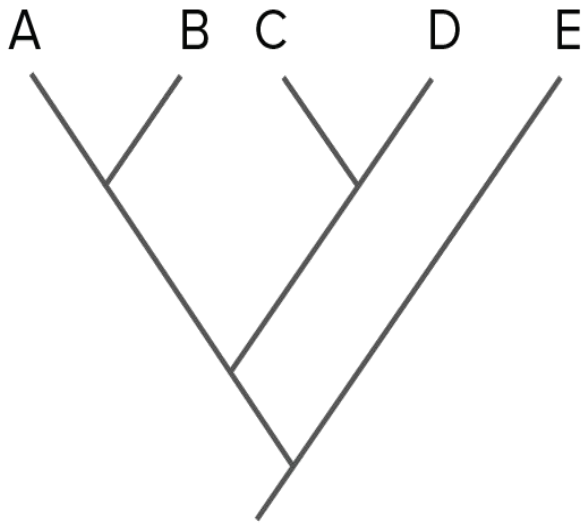


Sister taxa or clades share a common ancestor

A and B are sister taxa

(A,B) and (C,D) are sister clades

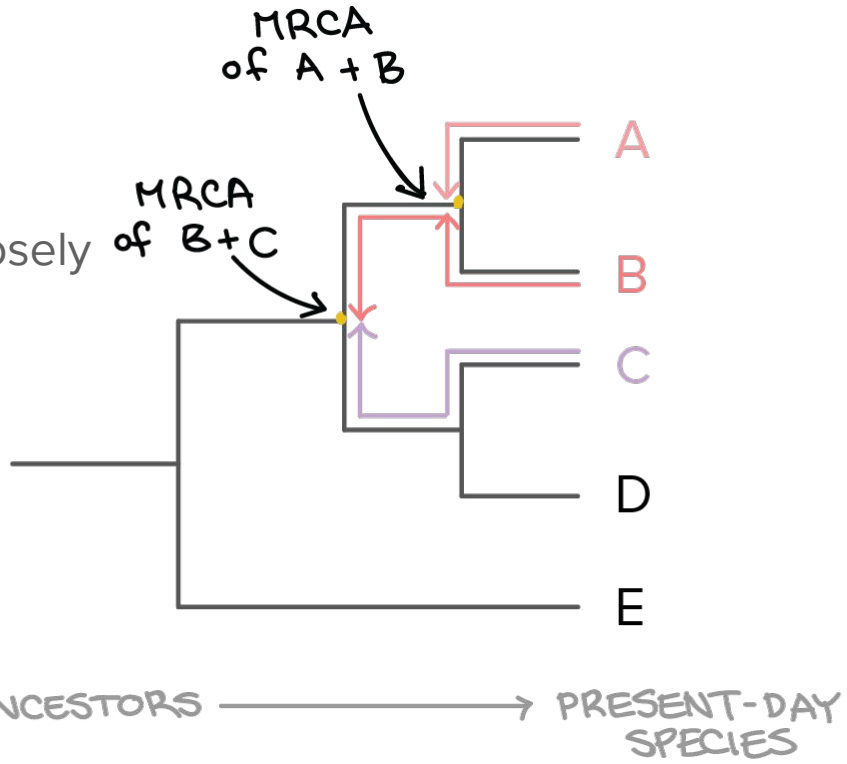
Who is E sister to?



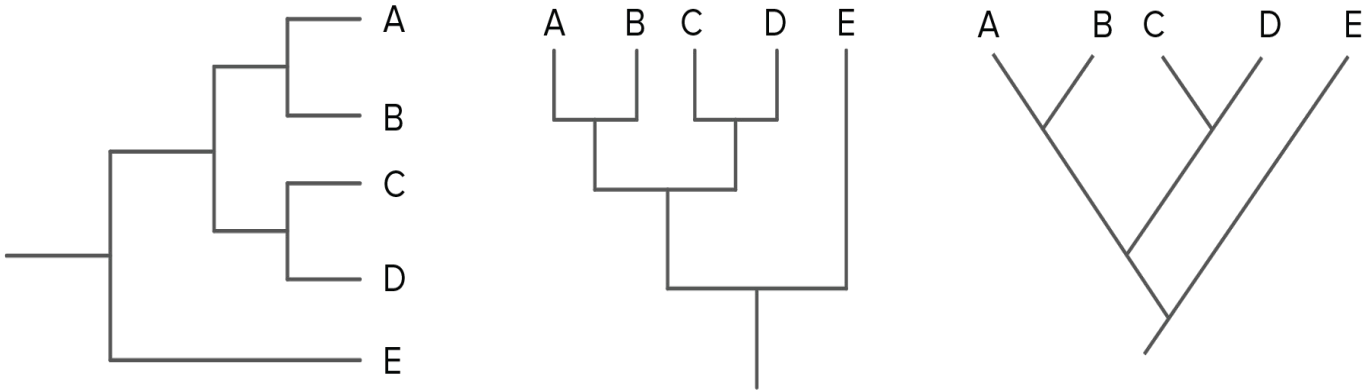
Read trees by tracing back through branches

MRCA = Most Recent Common Ancestor

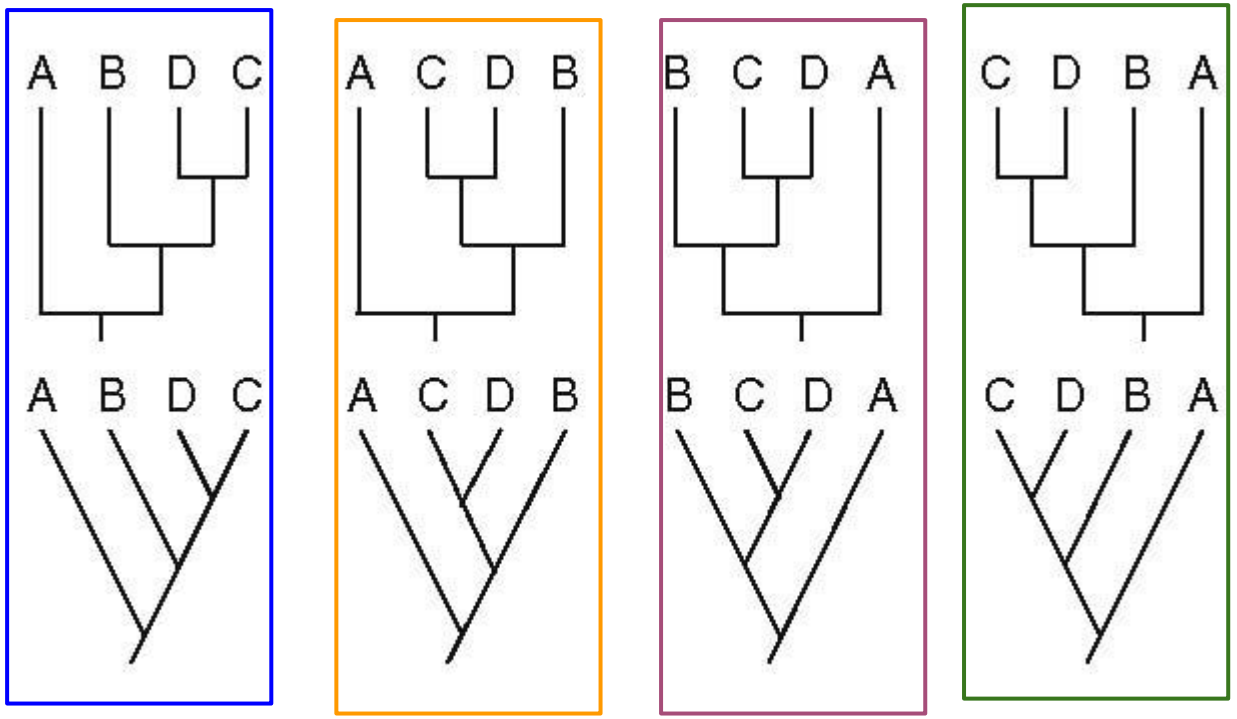
The more recently your MRCA, the more closely you are related.



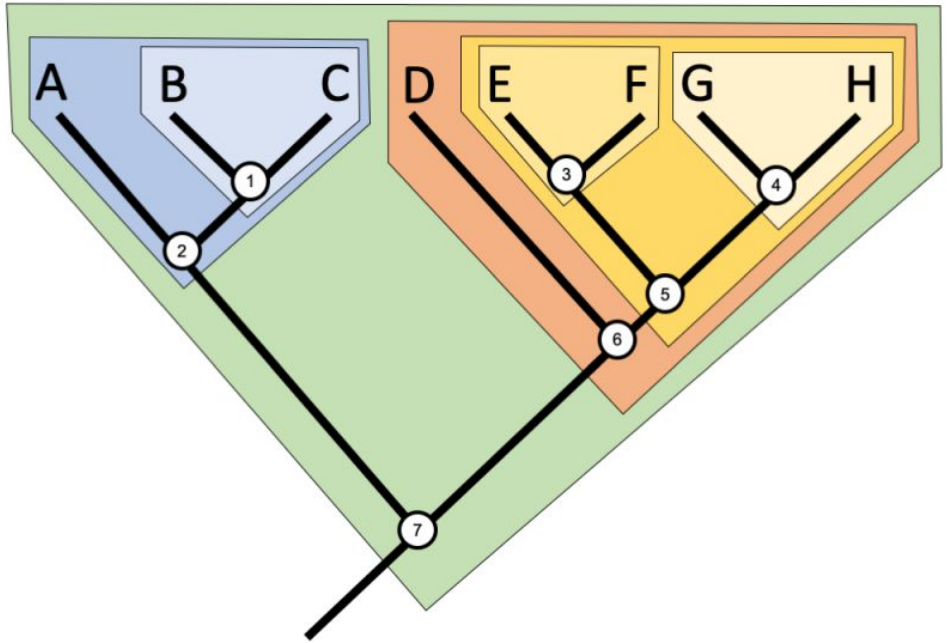
Angled or boxy shapes are still the same. It's all about *tracing through nodes!!*



Each box contains the same tree drawn two different ways



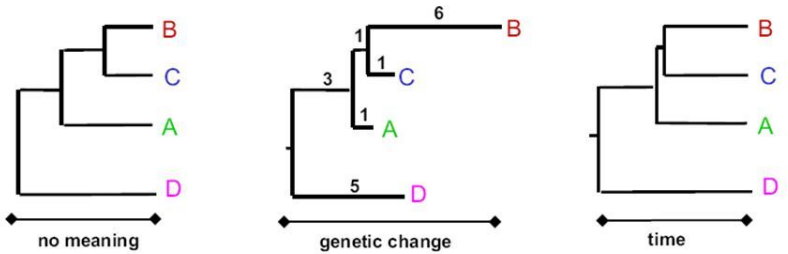
Trees are fundamentally a bunch of nested trees



The tree-thinking challenge!

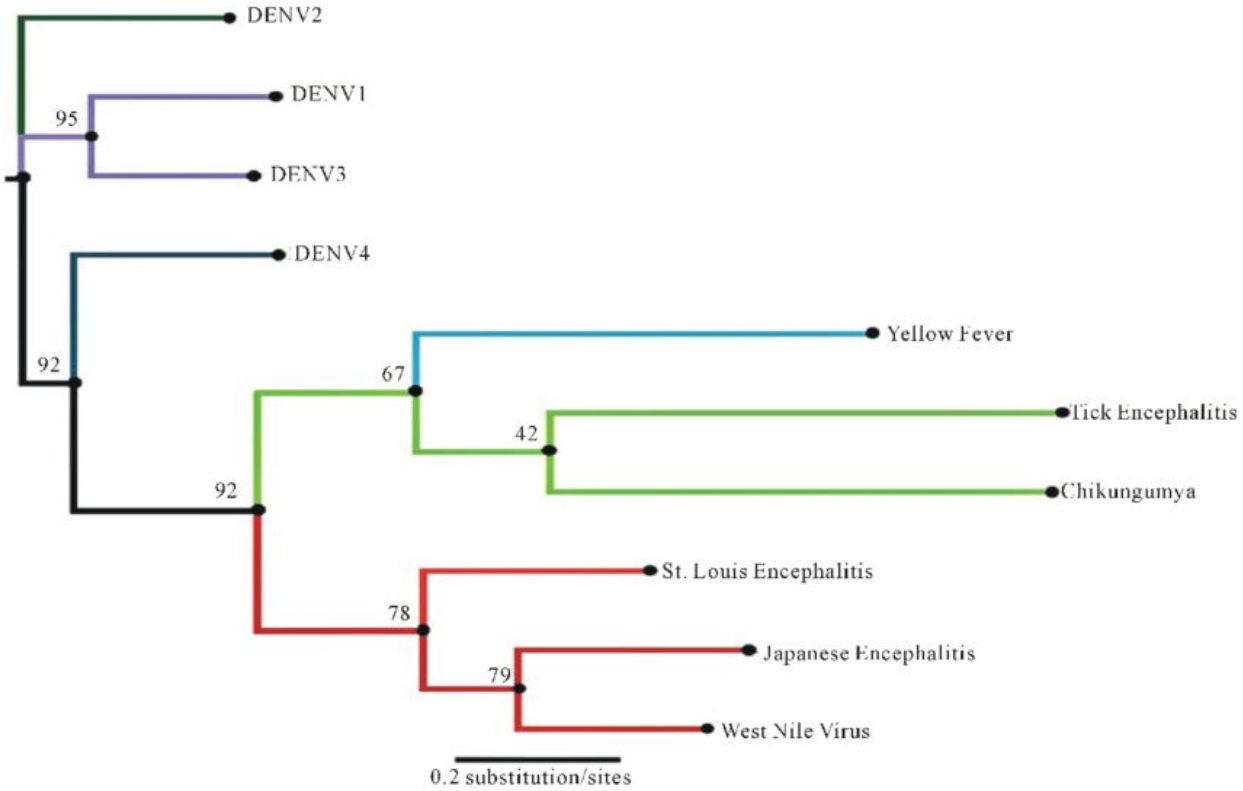
Components of a phylogeny

- **Topology**: the branching patterns
- **Branch lengths** can represent a variety of things (you'll be told!)
  - Nothing at all ("Cladogram")
  - Evolutionary distance (genetic change)
  - Time since divergence

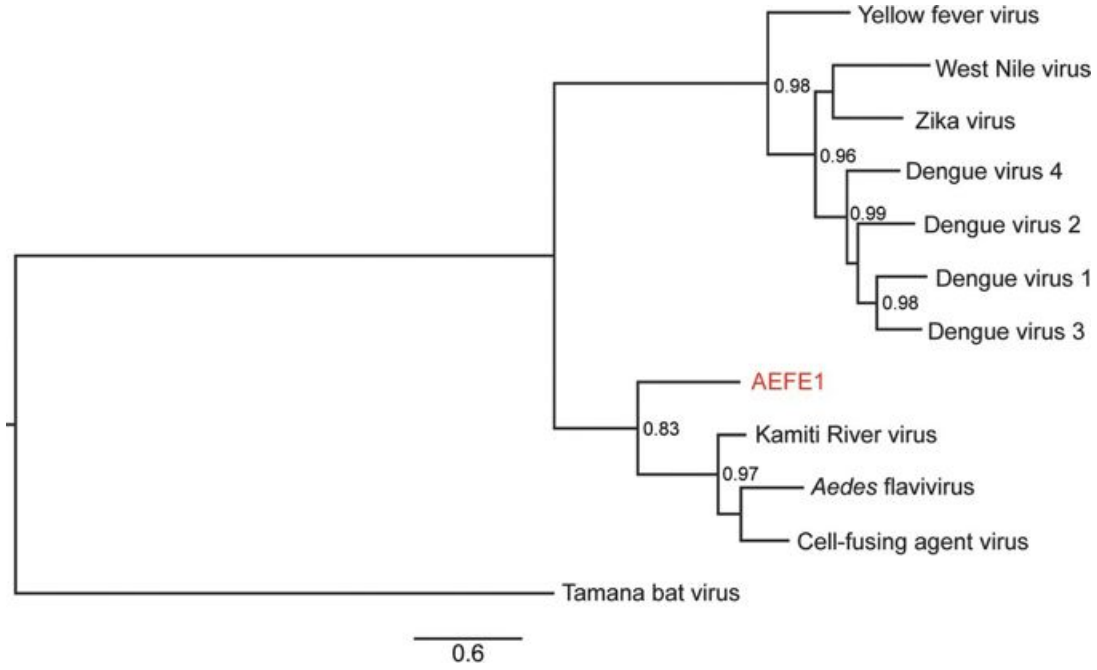


- **Confidence measures at nodes** (usually scaled 0-100)
  - Statistical quantity with complex interpretation. *ROUGHLY means:* How confident are we that this node is correct? Interpreted as, >70 pretty confident.

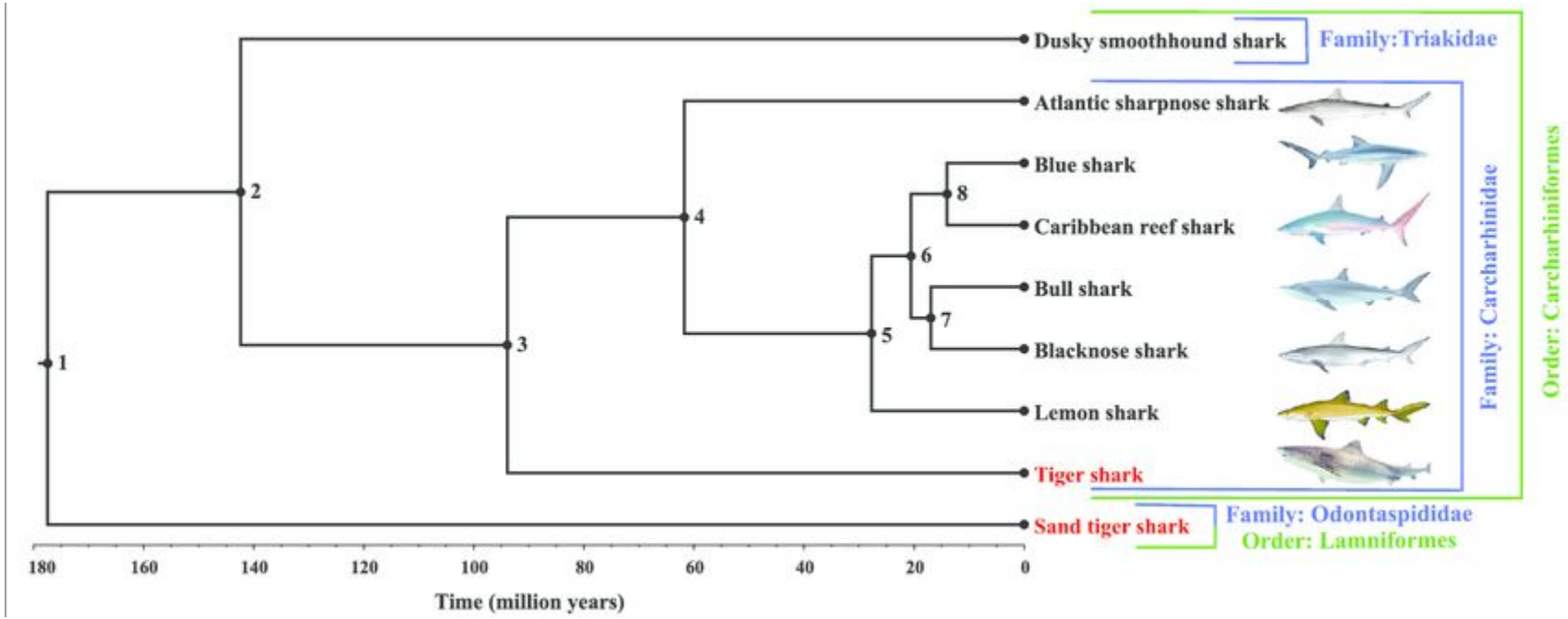
Branch lengths show evolutionary distance



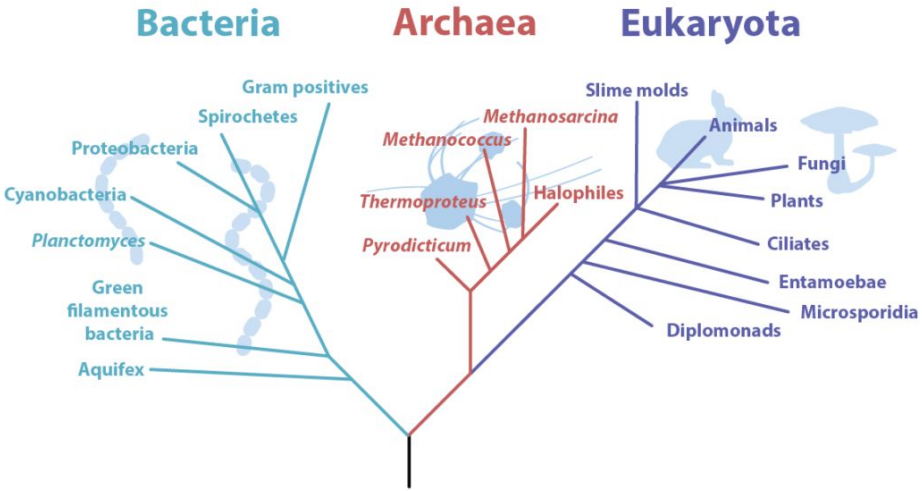
More flaviviruses

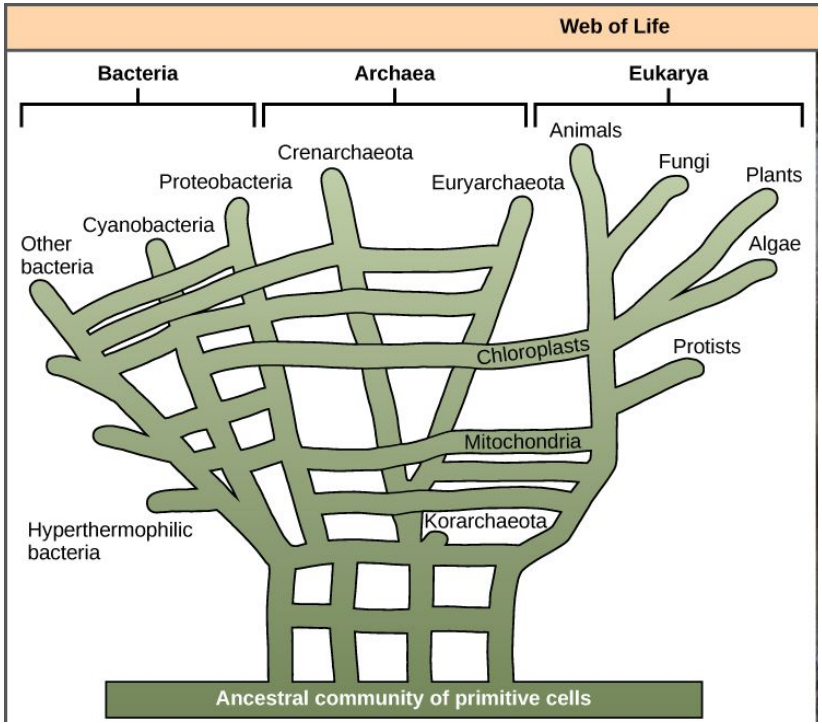


Time-scaled branch lengths, for example

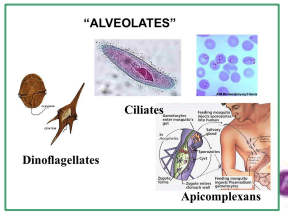


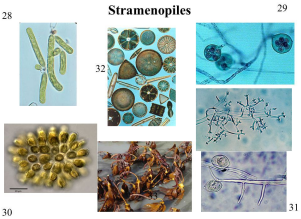
Our place in the tree of life

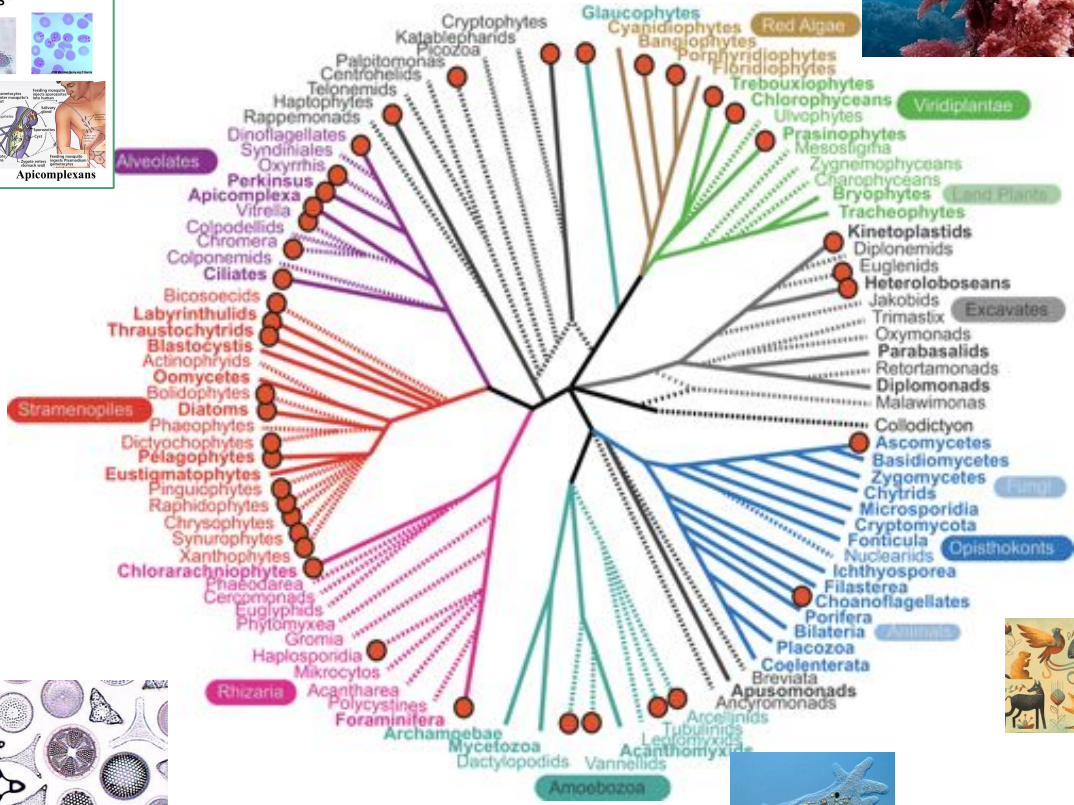




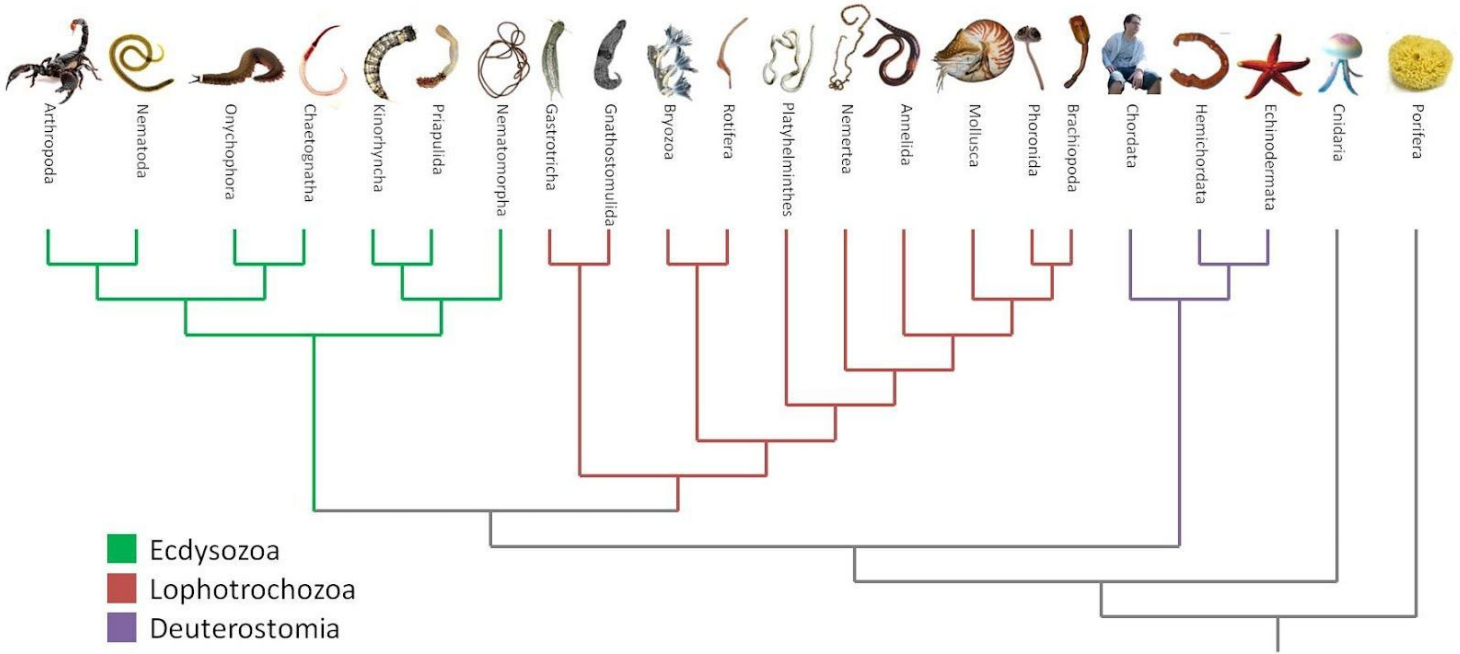
The eukaroytic tree of life





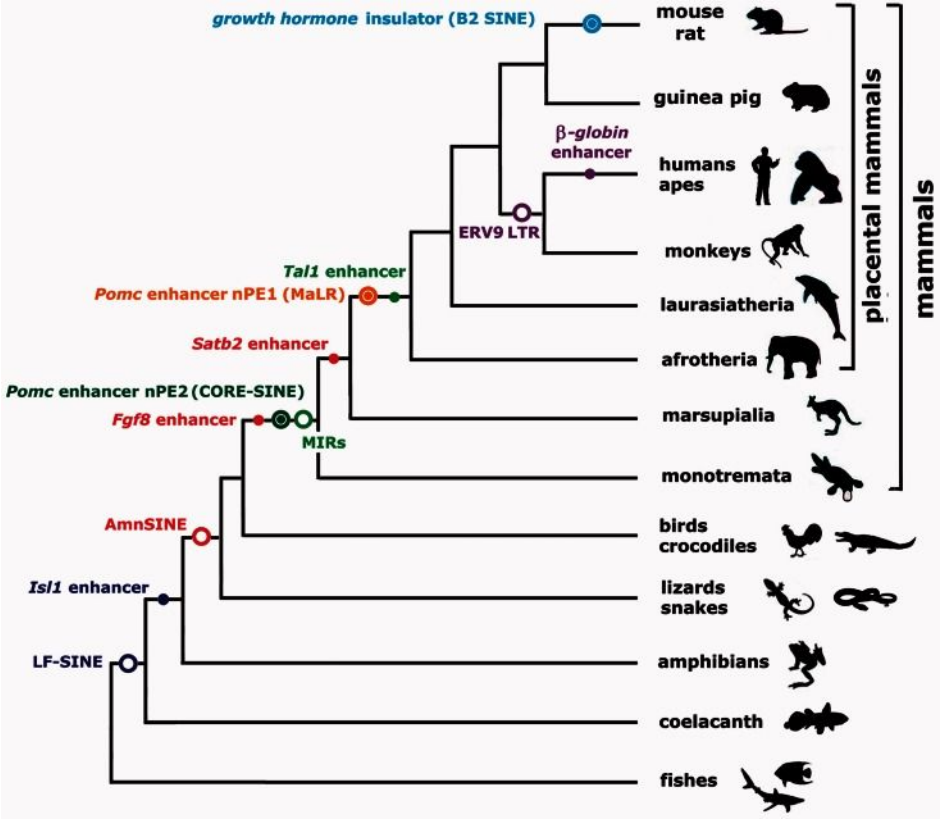


The Metazoan tree of life (animals!)

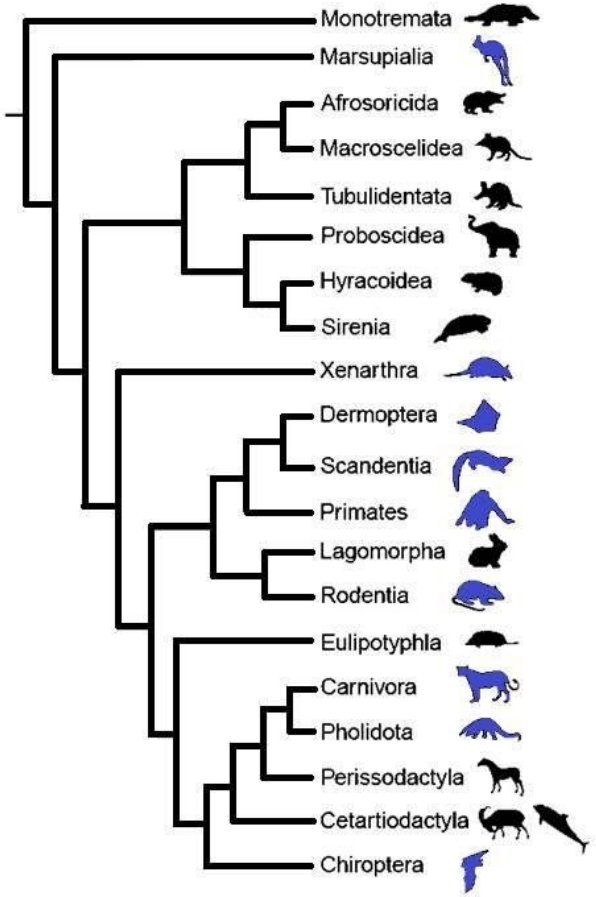


Vertebrate tree of life

(ignore marker dots at nodes)



Mammalian tree of life



The primate tree of life

(ignore branch colors)