A3.2 Classification & Cladistics (HL)

Traditional Hierarchy Ranking

(Past) Physical features (Morphology) → (Now) DNA!

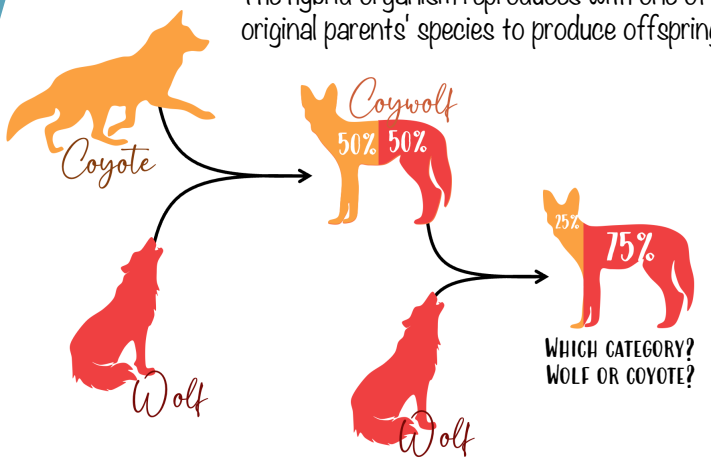
Difficulties with the traditional hierarchy ranking

- Highly subjective & Arbitrary
- Does NOT SHOW evolutionary relationships
- Moving organisms within the hierarchy
- Introgression

A process by which hybrids form over many generations but, instead of having an equal share of the original two species genetic information, there is an unequal contribution from each species.

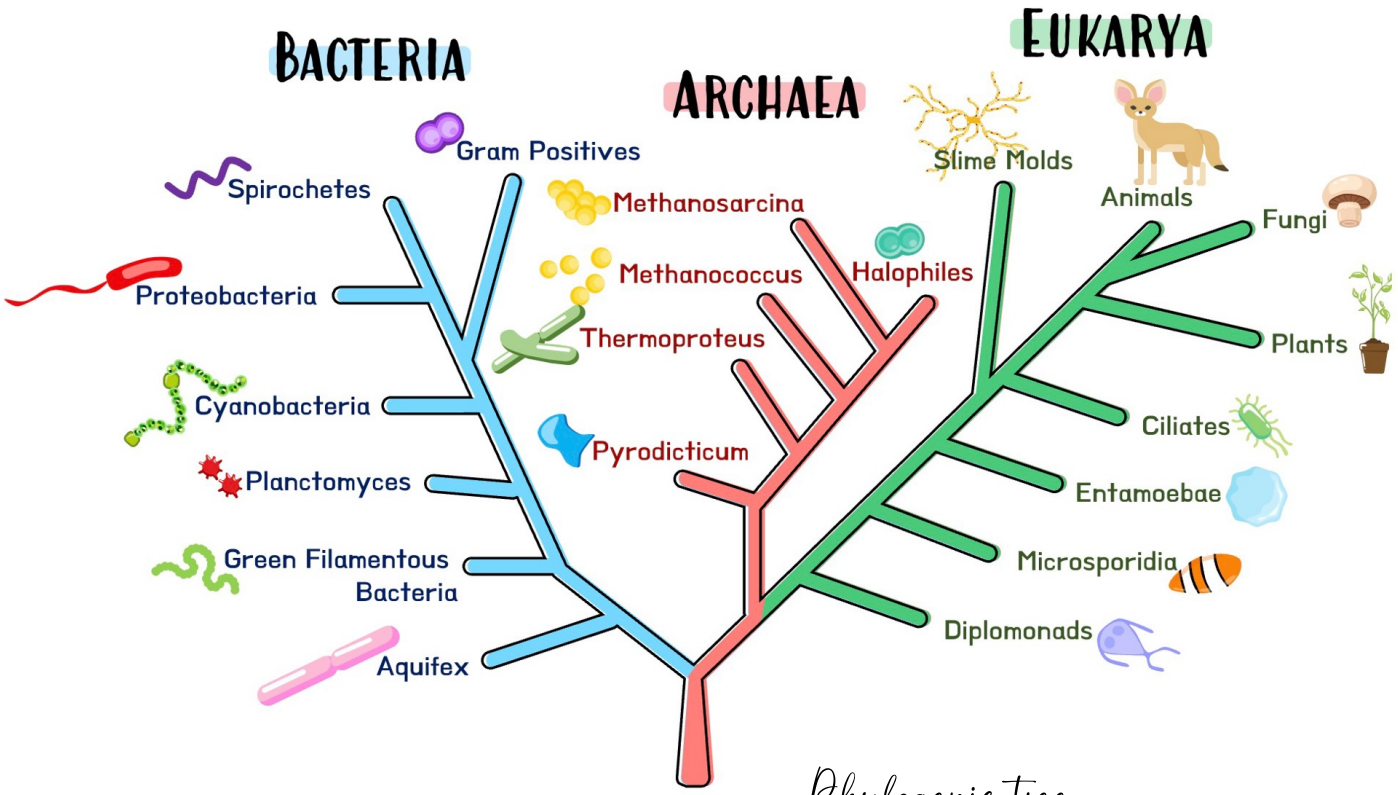
Backcrossing

The hybrid organism reproduces with one of the original parents' species to produce offspring.



NEW! Hierarchy Ranking

Classification using evolutionary relationships:



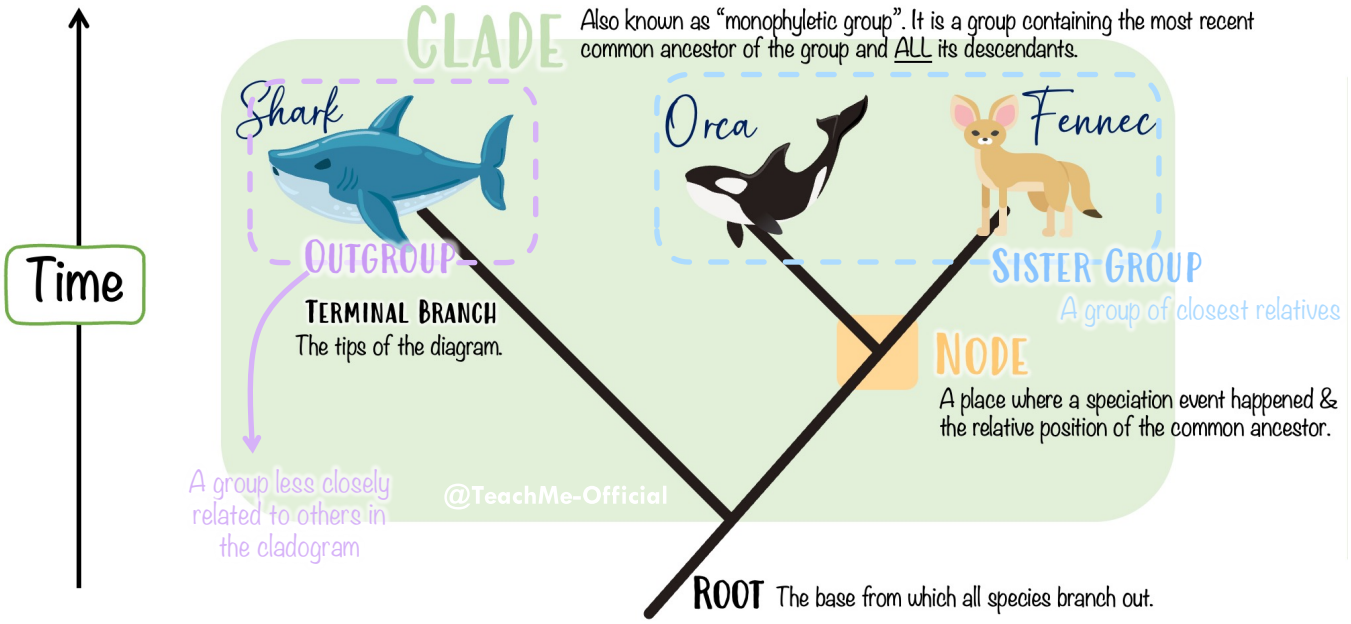
Phylogenic tree

Organised acording to **PROTEIN** (amino acid sequences) or **DNA** similarities.

CLADISTICS

A natural system of classification, for grouping taxa, based on characteristics that have evolved most recently.

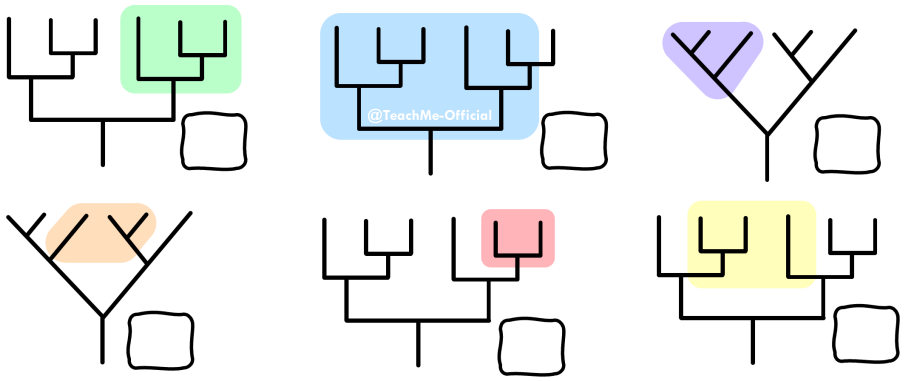
CLADOGRAM – A diagram that represents the findings of cladistics in a visual way.



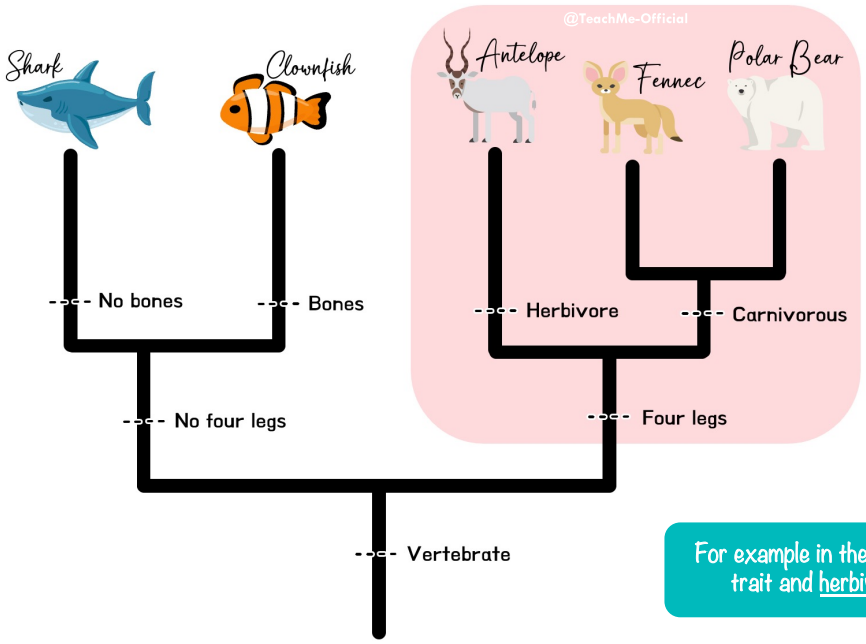
Try for yourself!

DECIDE IF EACH IS:

A CLADE! OR NOT A CLADE!



HINT: see how many times you need to "cut" to free the highlighted region!

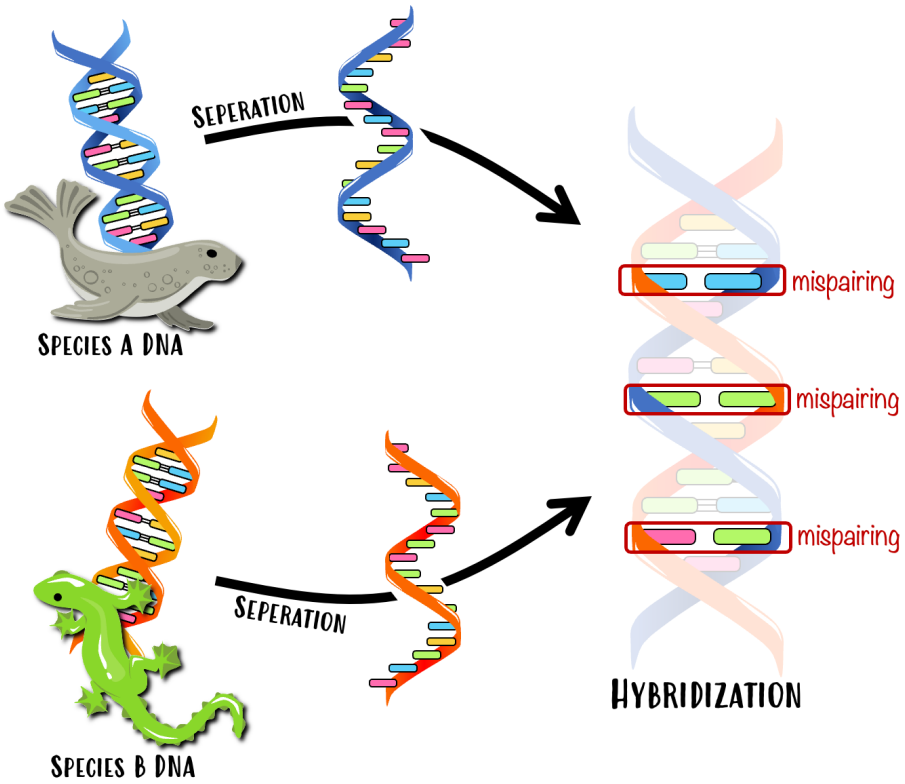


DERIVED TRAITS (APOMORPHIC TRAITS) :
Characteristics that have evolved more recently and help set apart a group of organisms from their ancestors.

PRIMITIVE TRAITS (PLESIOMORPHIC TRAITS) :
Characteristics that have evolved early in history of the organisms being studied.

For example in the pink shaded area, four legs is a primitive trait and herbivore & carnivorous are derived traits

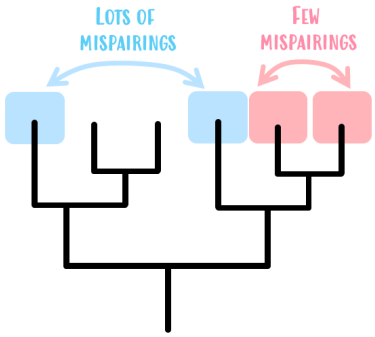
ANSWERS: 1. a clade, 2. not a clade, 3. a clade, 4. not a clade, 5. a clade, 6. not a clade.



How do we count the differences?

DNA HYBRIDIZATION

Differences in DNA & polypeptide sequences accumulate gradually over time, as mutations occur from generation to generation in a species. Consequently, changes can be used as a kind of clock to estimate how far back in time two related species split from a common ancestor.



WORDS THAT SOUND TOO SIMILAR?

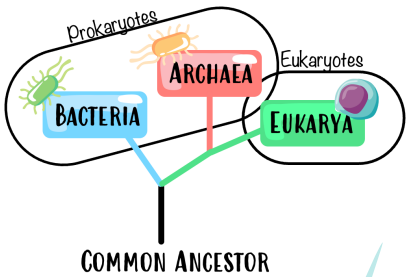
Definitions!

PHYLOGENY - Study of the evolutionary past of a species. Very BROAD term.

PHYLOGENETICS - A more specific term that applies to the techniques and methods used to analyze and infer evolutionary relationships. Involving the construction of phylogenetic trees.

CLADISTICS: A natural system of classification, for grouping taxa, based on characteristics that have evolved most recently.

CLADOGRAM: A way to represent the findings of cladistics in a visual way.



THE 3 DOMAINS

Archaea

Single celled organisms
Often found in extreme conditions
Those that prefer extreme conditions are Extremophiles

HALOPHILES:
Salt-loving. Live in very salty environments such as the dead sea, where the sun has evaporated much of the water. Also found in salt mines.

THERMOPHILES:
Heat-loving. Inhabit hot sulphur springs and hydrothermal vents and survive at temperatures more than 70 degrees Celsius, and up to 100.

METHANOPHILES:
Methane-loving. They are found in the gut of ruminants, as well as in waste landfills, paddy fields and marshlands. They produce methane as a waste product of respiration.

Bacteria

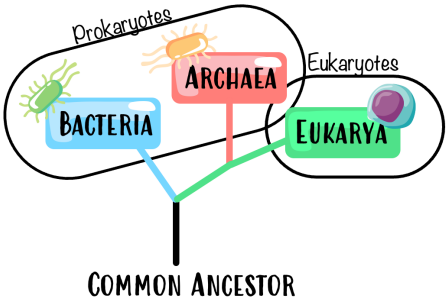
Sometimes called "eubacteria". Bacteria has a wide range of functions, including helping your intestines digest, being a part of your yogurt. BUT in our eyes they are notoriously known for making us sick.

Eukarya

Eukarya this domain includes essentially all other life. Small macroscopic organisms such as yeast (fungi) and trees and Wales.

Eukaryotic cells are unique because of membrane bound organelles.

A3.2



Why are ARCHEA separate from the other prokaryotes, BACTERIA?

(we used to only have 2 domains: prokaryotes and eukaryotes)

1. **Physical features differ**
   - Cell membrane
   - Cell wall
2. **Difference in transcription and translation**
   - Found to be more like eukaryotes
3. **Difference in ribosomes**
   (subunit called 16S rRNA)
4. **Differences in reactions**
   - Many reaction that are unique to archaea

Remember the example of the figworts; this species classified in the past using physical features but was reclassifed thanks to DNA!

notes