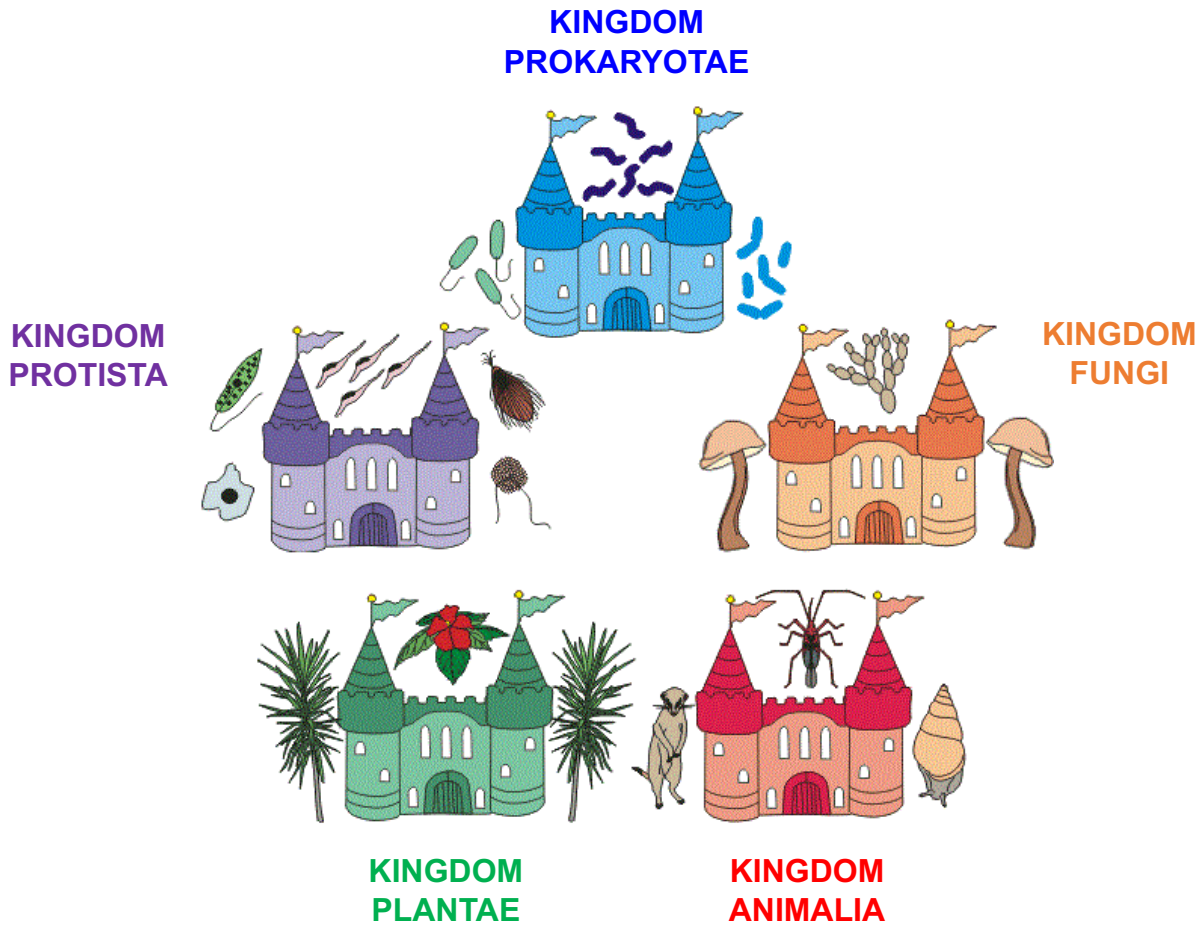
A. THE FIVE KINGDOMS (1969)



- Comparison of **rRNA base sequences** have shown that **prokaryotes diverged** into two groups **early** in the evolution of life
- So, it is **not appropriate** to put them all **together** in **one kingdom**

B. TYPES OF CLASSIFICATION

NATURAL

Place individuals into the same group if they've **evolved from the same recent common ancestor**.
Advantages of this:

- Easier **identification** of species
- Can help **identify common ancestors/evolutionary paths**
- It is a **universal system** (of naming organisms)
- Allows **research** of **larger taxa** groups

ARTIFICIAL

Place individuals into the same group if they **share a feature**.
Can be misleading.

- We could put **all animals with wings** into the **same group**.
- However, some could have **completely different wing structures** (analogous)
- They could also **differ** in **many other features**.

C. THE THREE DOMAINS (1999) – GENERAL OVERVIEW

- The **domains** are: **Eubacteria**, **Archaea** and **Eukaryota**
- **Individuals** within these domains are known as: **bacteria**, **archaeans** and **eukaryotes**

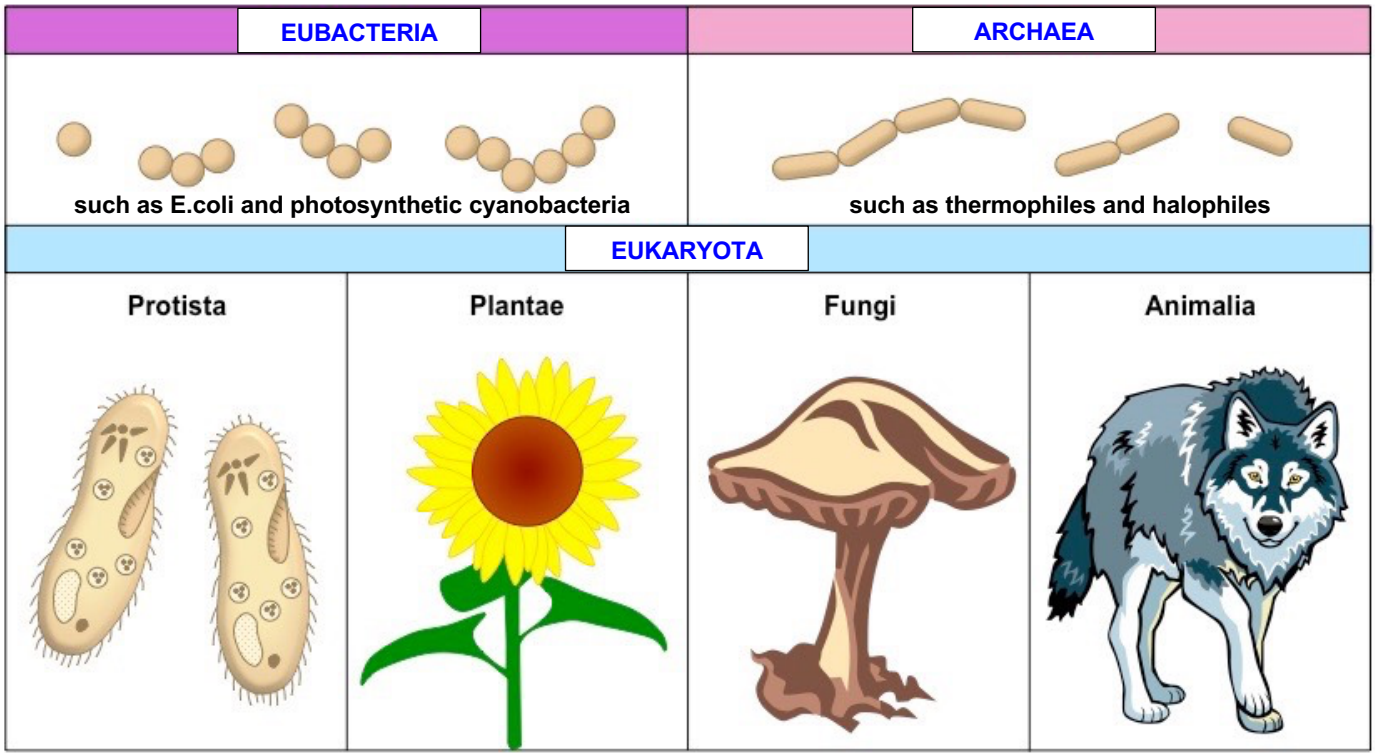
NO NUCLEUS AND NO MEMBRANE-BOUND ORGANELLES

Common and pathogenic bacteria e.g. *E.coli*

Extremophiles

"bacteria"

"archaeans"



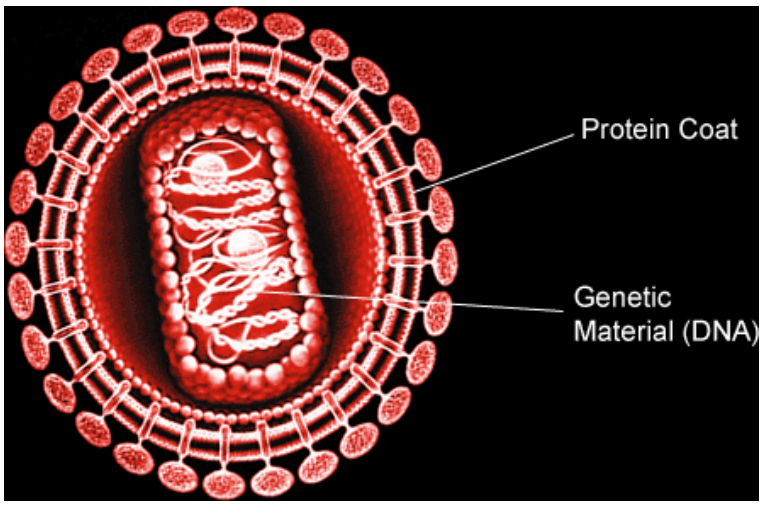
"eukaryotes"

HAS NUCLEUS AND HAS MEMBRANE-BOUND ORGANELLES

D. THE THREE DOMAINS (1999) – SPECIFIC DETAILS

Feature	DOMAIN		
	Eubacteria	**Archaea**	**Eukaryota**
Cell walls	Made of **peptidoglycan**	**Not** made of **peptidoglycan**	**Not** made of **peptidoglycan** (if present)
Cell membrane contains	Glycerol-**ester** lipids	Glycerol-**ether** lipids	Glycerol-**ester** lipids
Proteins associated with DNA	**Absent**	**Present**	**Histones**

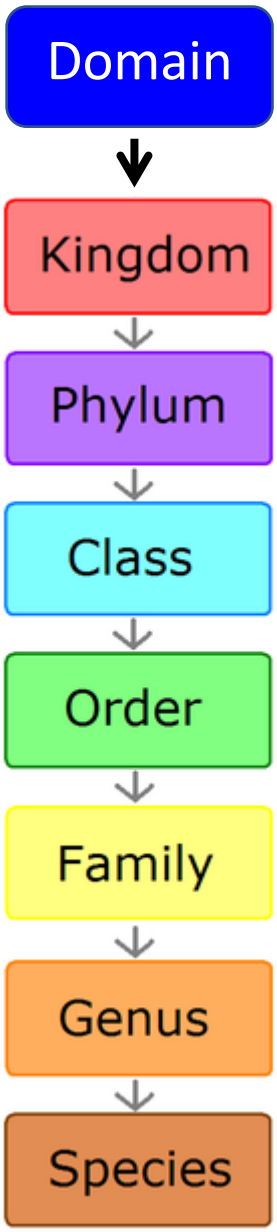
E. WHY NOT HAVE A SIXTH KINGDOM: "VIRUSES"?



- Viruses are **not cells** as they **lack organelles**.
- Virus are **not classed as living** as they **do not** carry out the seven **processes of life**.
- Viruses have **no metabolism** of their own – they hijack organelles in host cells and use these as "factories" for reproducing.

F. THE BINOMIAL CLASSIFICATON SYSTEM

- **Made up of EIGHT TAXONS = classification groups (DKPCOFGS)**



Less groups but **larger** in size

WIDEST range of **species**

Called the "PHYLOGENETIC HIERARCHY OF TAXA"

PHYLOGENTIC=

Grouped by evolutionary relationships

HIERARCHY=

Smaller groups within larger groups with no overlap

More groups but **smaller** in size

NARROWEST range of **species**

Dawson's

Kids

Prefer

Candy

Over

Fresh

Green

Salad

- Every organism has a **binomial** name that is decided by its ***Genus*** and ***species***.

Category	Human	Tiger	Mayfly nymph	Cabbage white butterfly
kingdom	Animalia	Animalia	Animalia	Animalia
phylum	Chordata	Chordata	Arthropoda	Arthropoda
class	Mammalia	Mammalia	Insecta	Insecta
order	Primata	Carnivora	Ephemeroptera	Lepidoptera
family	Hominidae	Felidae	Ephemeridae	Pieridae
genus	*Homo*	*Panthera*	*Ecdyonurus*	*Pieris*
species	*sapiens*	*tigris*	*venosus*	*brassicae*

- The **binomial name** of the tiger is *Panthera tigris.*
- The tiger's **genus** is *Panthera*.
- The tiger's **species** is *Panthera tigris*.
- The tiger's **domain** is Eukaryota
- The tiger's **kingdom** is Animalia
- The **binomial name** of each organism is an **internationally agreed system** in which the scientific name of an organism is made up of **two** parts showing the **Genus** and **species**.

Two organisms belong to the same species if they can breed together to produce fertile offspring

G. CLADOGRAMS

Vocabulary

A **clade** is a **group of organisms** that **evolved** from a **common ancestor**

A **cladogram** is a **tree diagram** that shows the **most probable sequence** of **divergence** in **clades**

A **node** is a **branching point** on a **cladogram**

What cladograms are based on

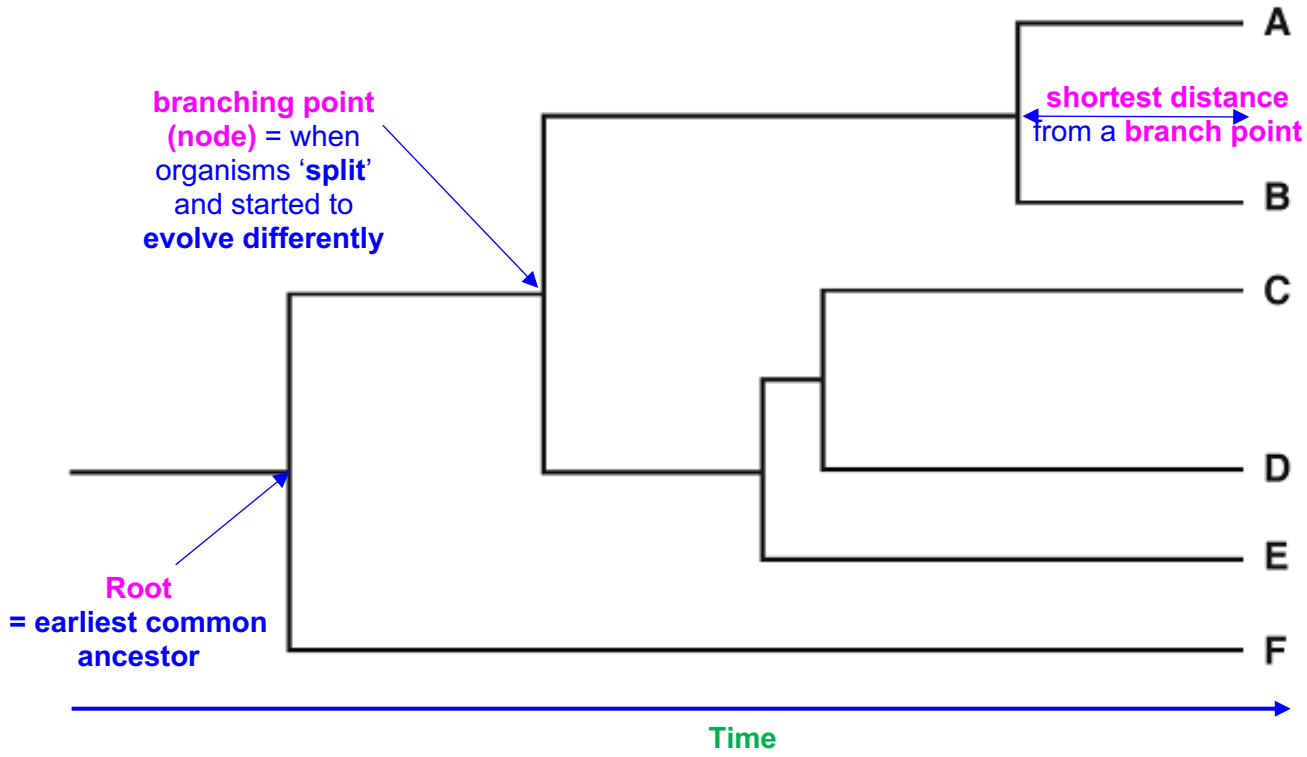
- Can compare the following in different organisms:
  - **DNA base sequence** of a **gene**

    OR:
  - **Amino acid sequence** of a **protein**

Comparing DNA bases sequences of a gene is more accurate as the genetic code is degenerate:

different codons can code for the same amino acid

What a cladogram looks like



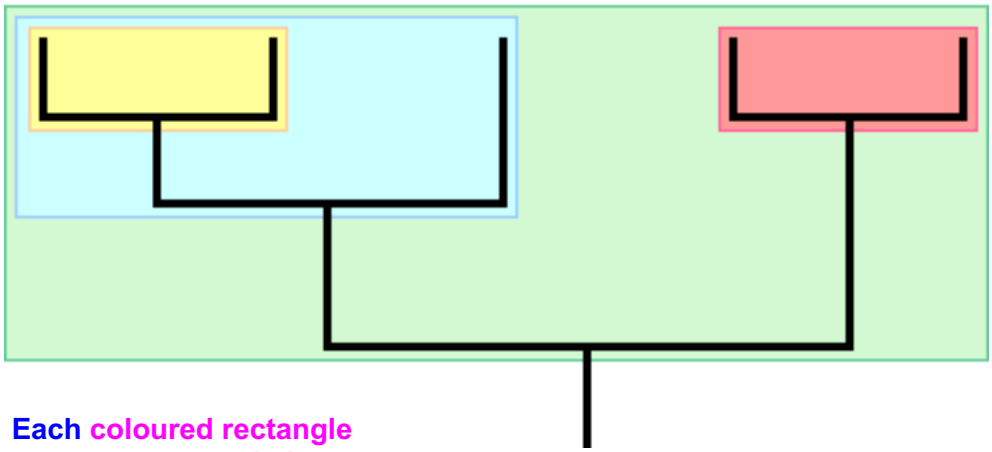
What this cladogram shows

- Organisms **A** and **B** are the **most closely related** in evolution
- (As) they **share** the **shortest distance** from a **branch point/node**
- (So) they **spilt** from **each other** more **recently**
- (So) they share a **more recent** **common ancestor**
- (So) they have the **most similar DNA base sequences**

('**F'** is **least closely related** to **all** other organisms for the **converse** reasons)

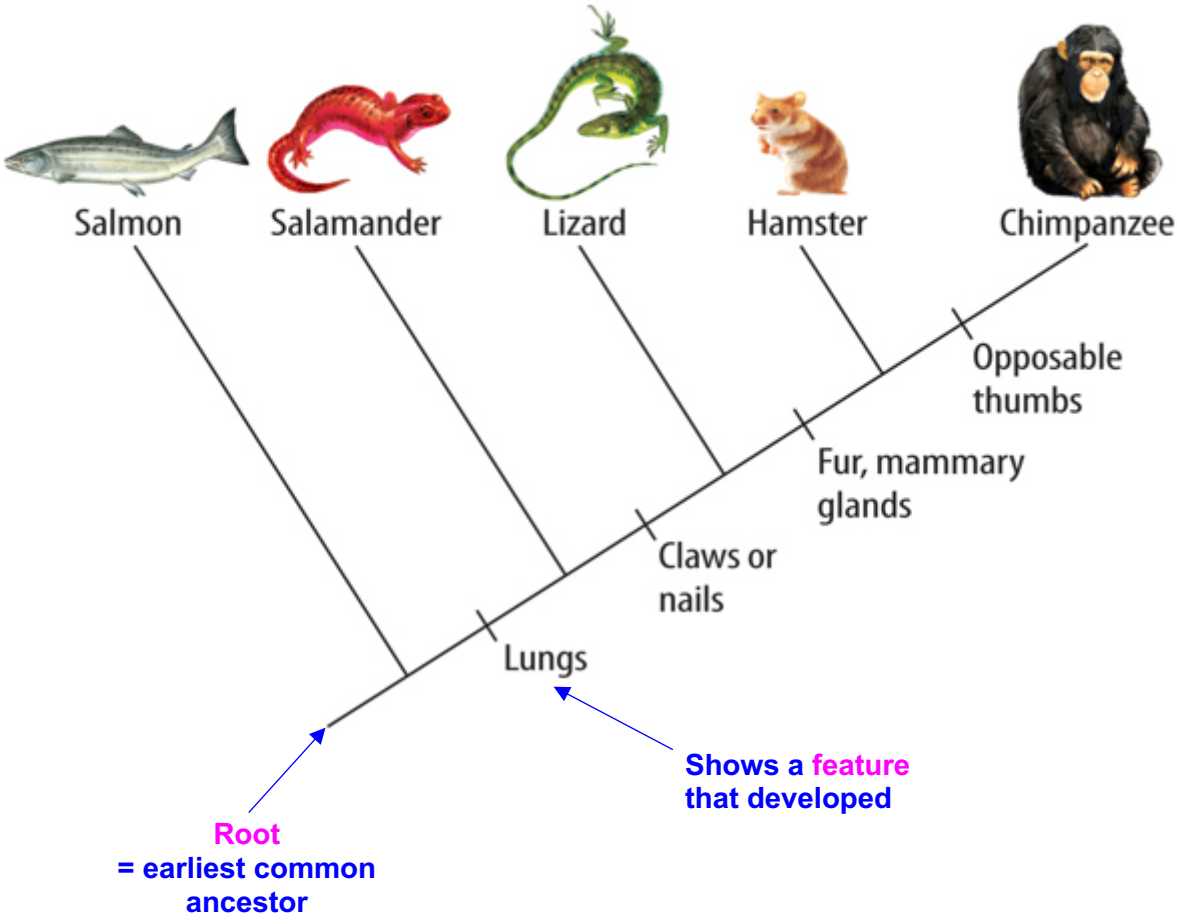
How And Why Cladograms Can Be Used To Investigate Evolutionary Relationships

- They show **evolutionary relationships** through a **common ancestor**
- They use **DNA base sequences**, **amino acid sequences** or shared **anatomical features**
- If the latter, then **homologous features** are used to place an organism in a **clade**.
- **Time of divergence** (splitting off) is related to the **number of differences** in **DNA base sequences** (there is a positive correlation)
- **More shared features / more similar DNA base sequences = share a more recent common ancestor**



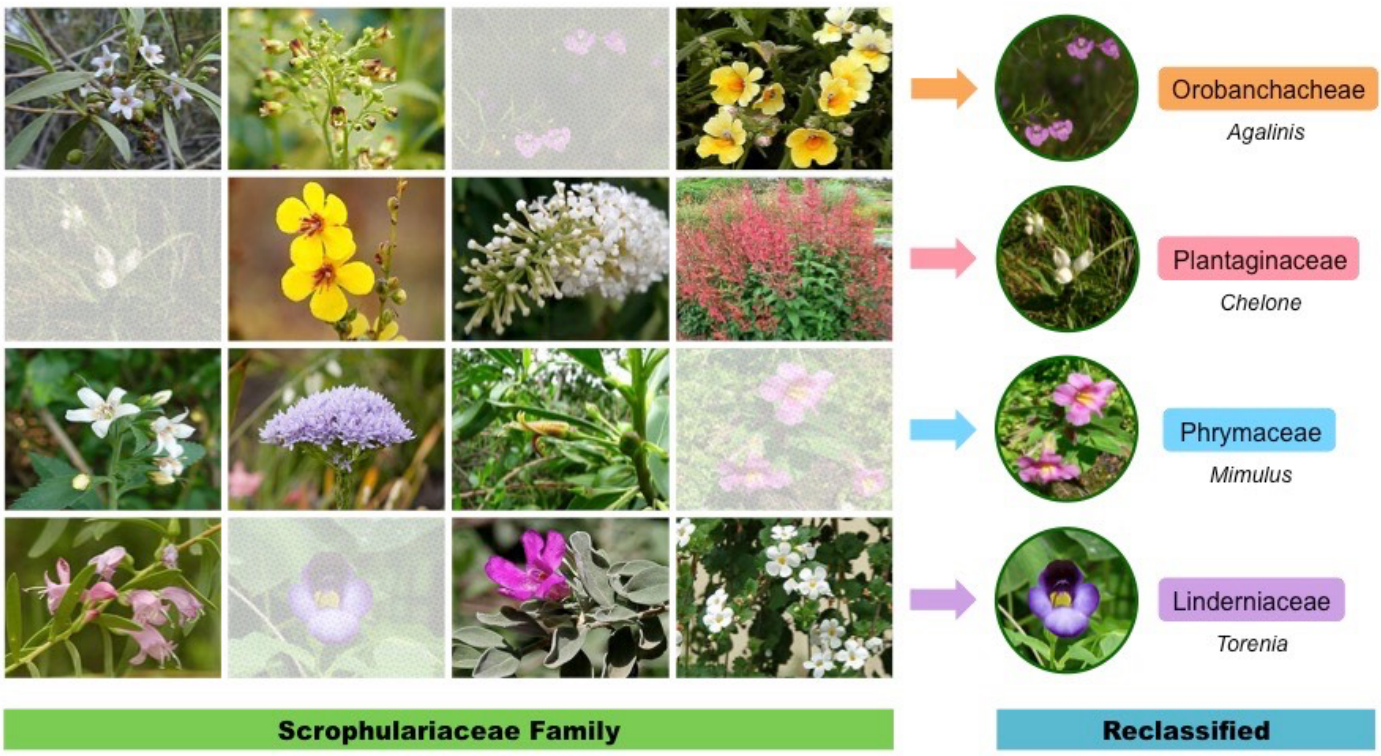
Each coloured rectangle represents a clade

Another way of drawing a cladogram



H. RECLASSIFICATION OF FIGWORTS

- Until recently, figworts were the **8th largest family** of **flowering plants** (angiosperms), containing **275 different genera**
- Their **previous** classification was based on the **appearance** of **features** such as **leaves**/**flowers**/**seeds**.
- This was problematic as **many** of the figworts were **too dissimilar overall** in structure to be in the **same group**
- **Modern** classification **compares DNA bases sequences** and has led to some figworts being **reclassified** into a **new family** as **similarities** in **flower shape** are thought to be a product of **convergent evolution**.
- This is when **two different species** show **similar adaptations** due to having the **same selective pressure**.
- The **fewer** the **differences** in **DNA base sequence**, the **closer** the **evolutionary relationship**.
- DNA **mutation** occurs at a **relatively constant rate** allowing **estimation** of **when** the species **diverged**.
- Scientists also examined the **chloroplast gene** in figworts and decided to **split** the figwort **family** into **five** different **clades**
- Now **less than half** of the species remain in the figwort family – which is now the 36th largest among flowering plants



You are **not** expected to know the **specific names** of these groups.

I. CLASSIFICATION OF A SPECIFIC ANIMAL AND A SPECIFIC PLANT

- You are expected to know the full classification of one animal and one plant.

Taxon	Dog	French Rose
Domain	**Eukaryota**	**Eukaryota**
Kingdom	Animalia	Plantae
Phylum	Chordata	Angiospermae
Class	Mammalia	Dicotyledonae
Order	Carnivora	Rosales
Family	Canidae	Rosaceae
Genus	**Canus**	**Rosa**
Species	***Canus familiaris***	***Rosa gallica***