Types of classification

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Types of classification

1. Phenetic classification
2. Natural classification
3. Phylogenetic or Cladistic classification
4. Evolutionary classification
5. Omnispective classification

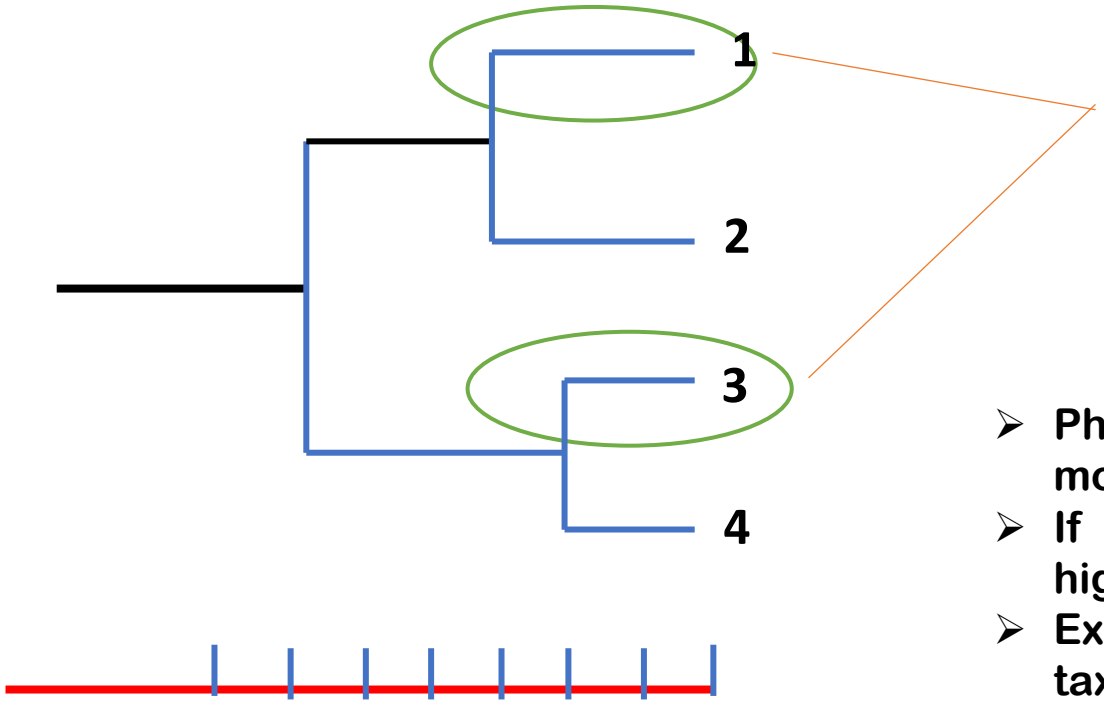
1. Phenetic classification

- Phenetic is also known as taximetrics
- The term Phenetics comes from Phenotype means external appearance characters.
- Classification based on morphology
- Others observable trait (Measurable)
- Evolutionary history or relationship is not consider in phenetics
- Only Morphological characters are used for the classification

1. Phenetic classification

Phenogram

- Phenogram is nothing but dendrogram it is based on phenetic data



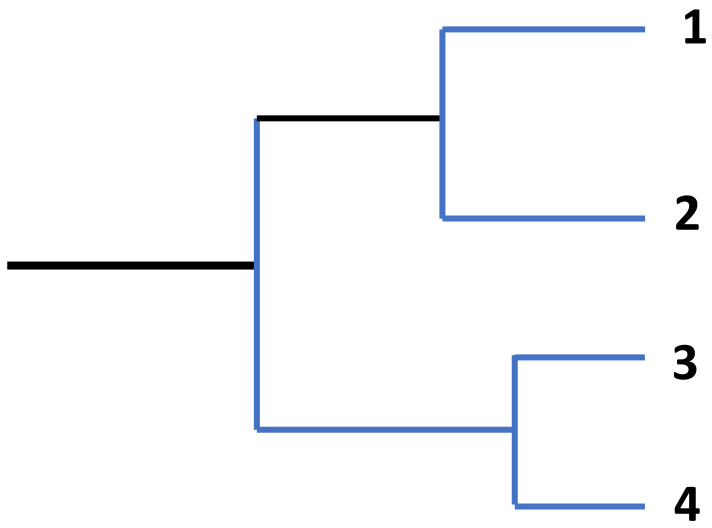
Phenon lines 90 degree dichotomous branching

- Phenon lines tell us % similarity by using the morphological characters between group.
- If phenon line is long then % of Similarity are high for longer period.
- Explain the difference between Numerical taxonomy and Phenetics.

1. Phenetic classification

Phenogram

- Closes between group that is always equal to common characters



- In phenogram, group 1 & 2 are morphologically very closer to each other because of both theses species share more common characters.
- Group 1 and group 4 shows more distance, shows less similarity that means it indicate less common characters in-between them.
- 1 & 2 – out of 10 – 7-8 common characters
- 1 & 5 – out of 10 – 1-2 Common characters

1. Phenetic classification

Phenogram

Determination of phenetics relationship

	Human	Chimpanzee	Gorilla	Lemur	Rat	Mouse	Goat	Bovine	Rabbit	Opossum	*Gallus*
Human	0	5.2500	4.3359	8.5891	10.670	9.7047	8.2219	8.1438	7.8281	15.6078	16.7109
Chimpanzee		0	1.1266	8.0297	10.645	9.6016	8.4375	9.3219	9.6000	14.2578	15.8734
Gorilla			0	7.8688	9.9625	8.6063	7.6734	8.5578	8.5547	13.9719	14.8781
Lemur				0	8.7219	9.5500	7.1328	9.3891	5.6891	12.9281	15.2000
Rat					0	6.0750	7.0484	9.3641	9.6578	13.5906	14.1219
Mouse						0	9.4953	9.2641	10.7984	12.3406	12.3688
Goat							0	5.2625	8.7219	11.9703	14.5359
Bovine								0	9.2906	12.5922	15.0234
Rabbit									0	14.8984	15.6953
Opossum										0	14.2750

- OUT- Operational Taxonomic Unit (Characters)
- Methods for understanding OUT-
- SMC- Simple Matching coefficient
- Counting of No. of Characters states
- Characters states- Hairs – Present (+), Absent (-)

- Common Characters states

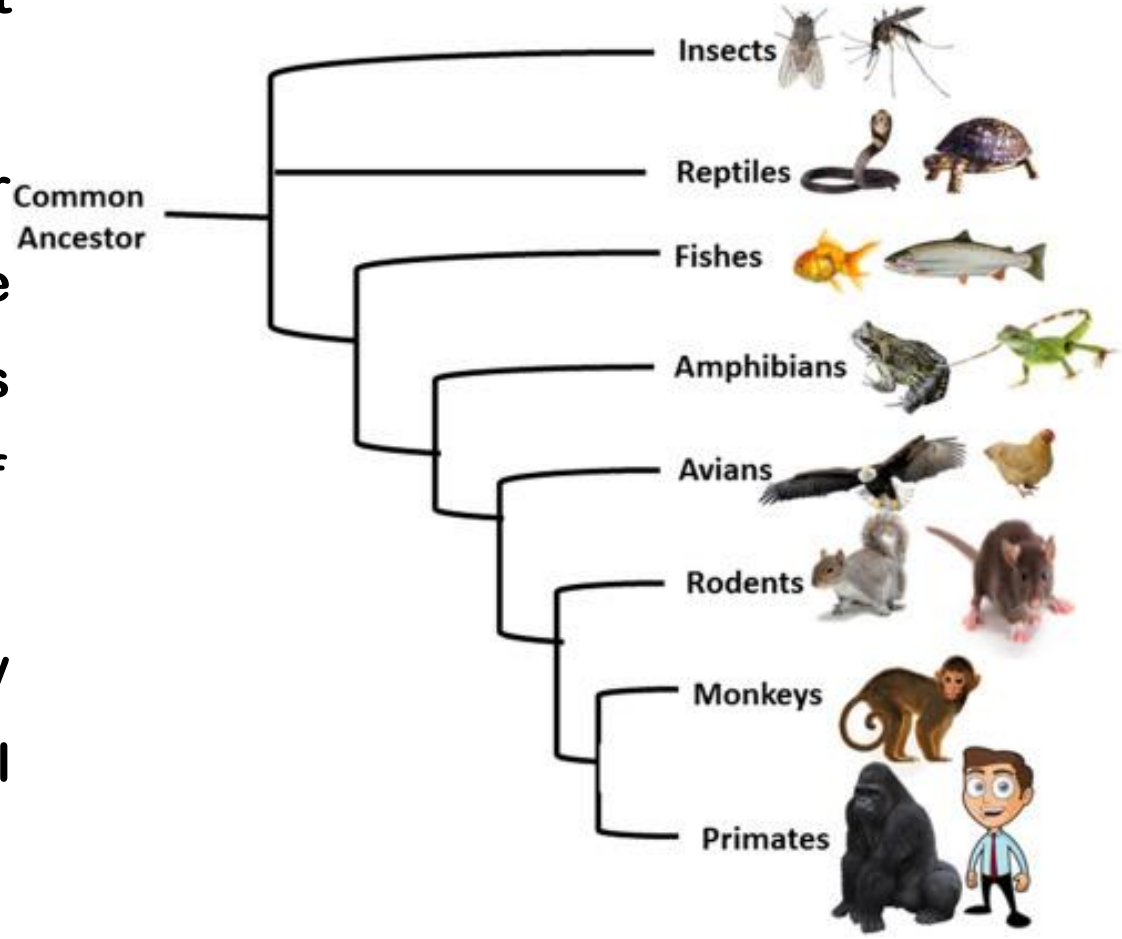
---------- = SMC

- Total No. of Characters

- Arrangement to form similarity matrix
- On the basis of matrix we can draw the phenogram

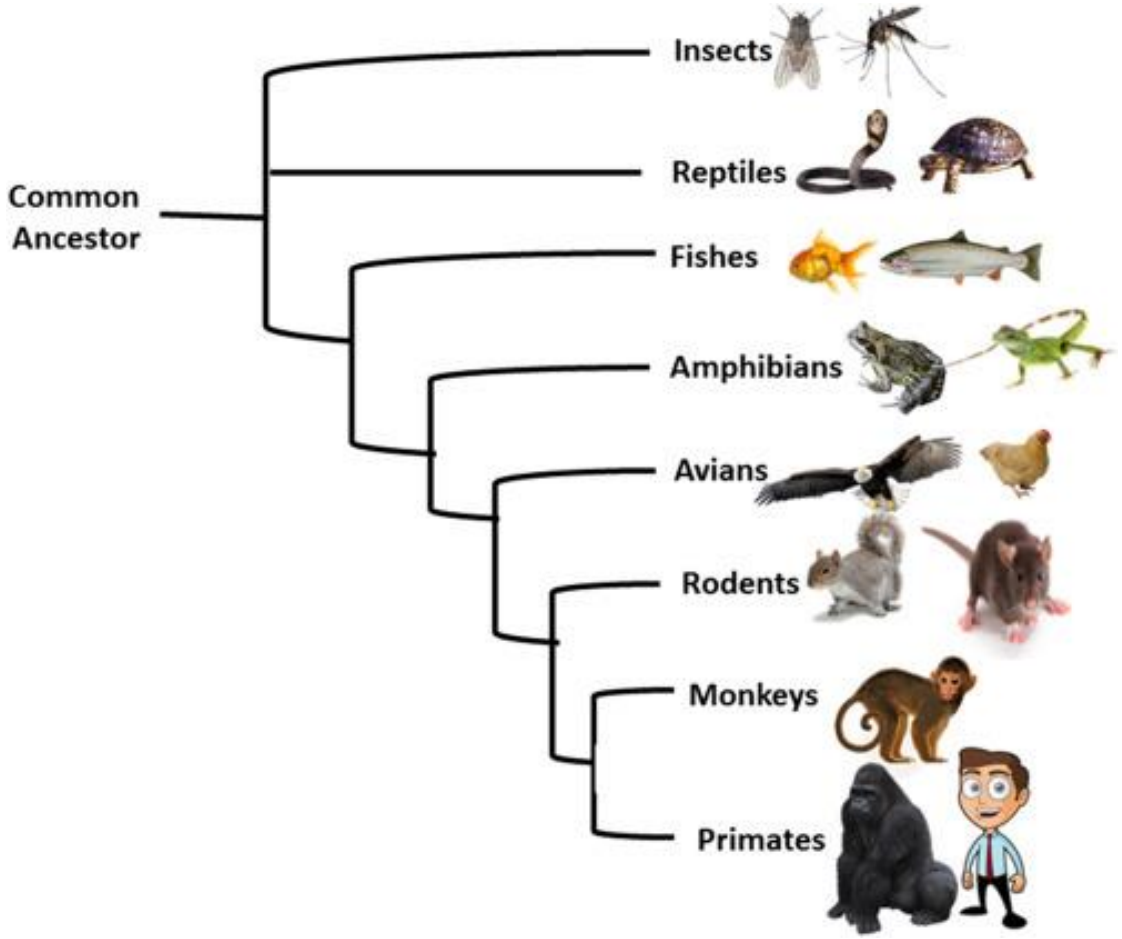
3. Phylogenetic systems of classification

- Phylogenetic systems of classification exhibit evolutionary relationships of entities.
- This system of classification came into being after the acceptance of natural selection and guideline of evolution put forward by Charles Darwin in his book ‘On the origin of Species’ by means of Natural Selection.
- Darwin proposed that the present-day plants/animals have origins from few ancestral ones after experiencing few periodical alterations.



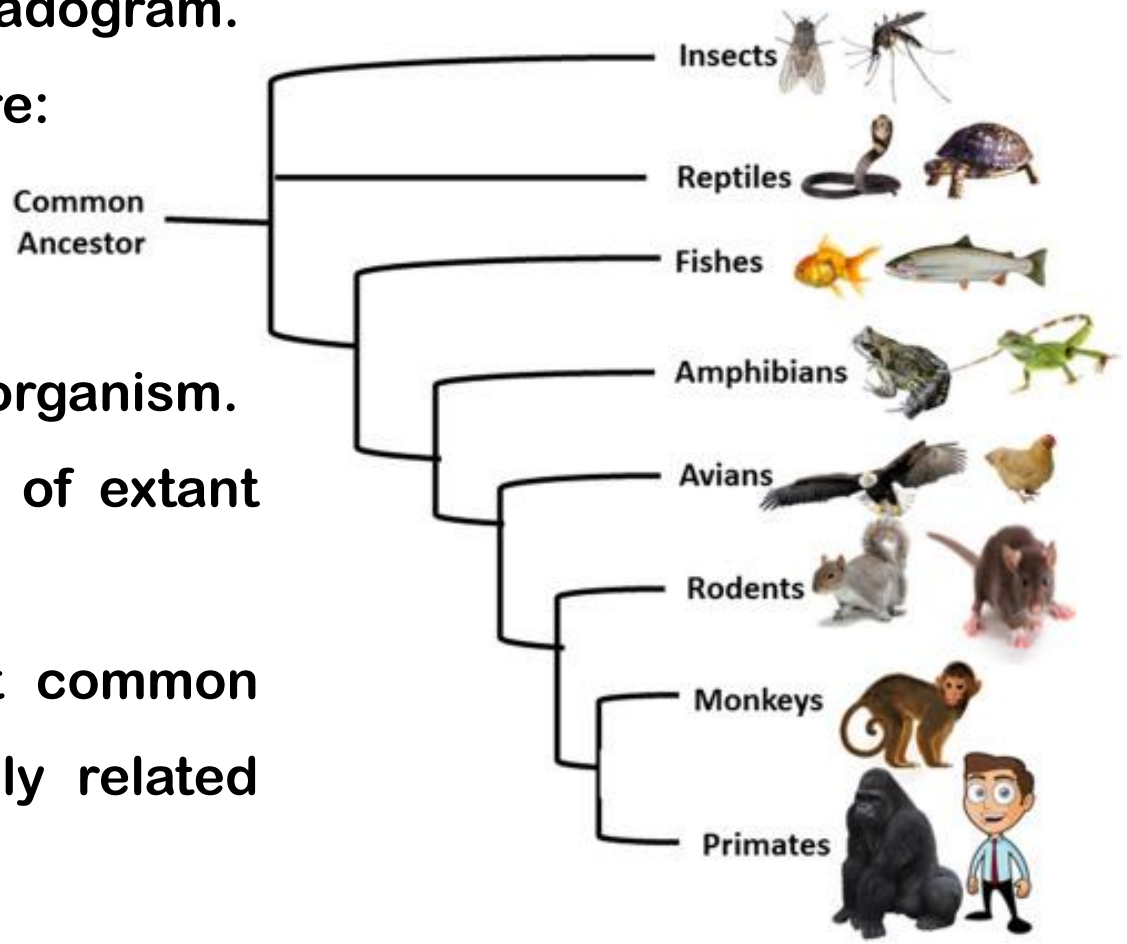
3. Phylogenetic systems of classification

- Hence, the phylogenetic classification is on the basis of the evolutionary descent of a group of entities.
- Relationships are exhibited via a cladogram and a phylogram.



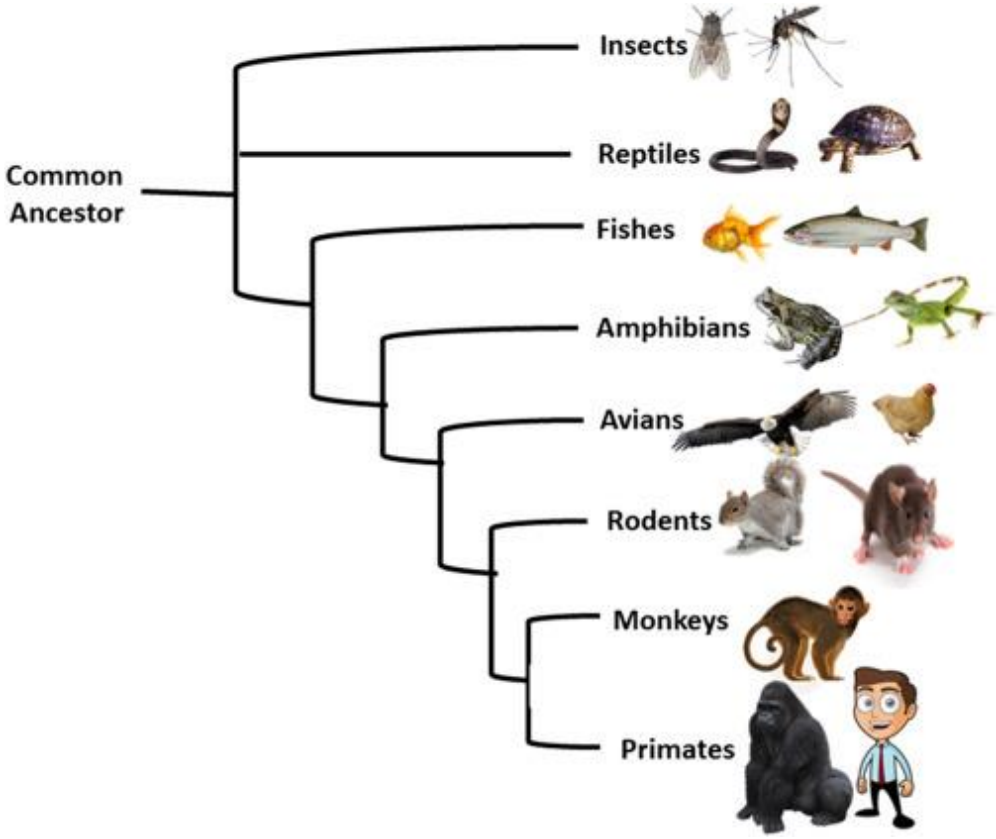
Purpose of the phylogenetic

- The phylogenetic tree is also known as the cladogram.
- The main purpose of the phylogenetic tree are:
  - It is used to study evolutionary histories.
  - It helps in the search for a new species.
  - It explains the evolutionary history of an organism.
  - It explains about the common ancestors of extant and extinct species.
  - It helps in identifying the most recent common ancestors and to recognize how closely related species are.



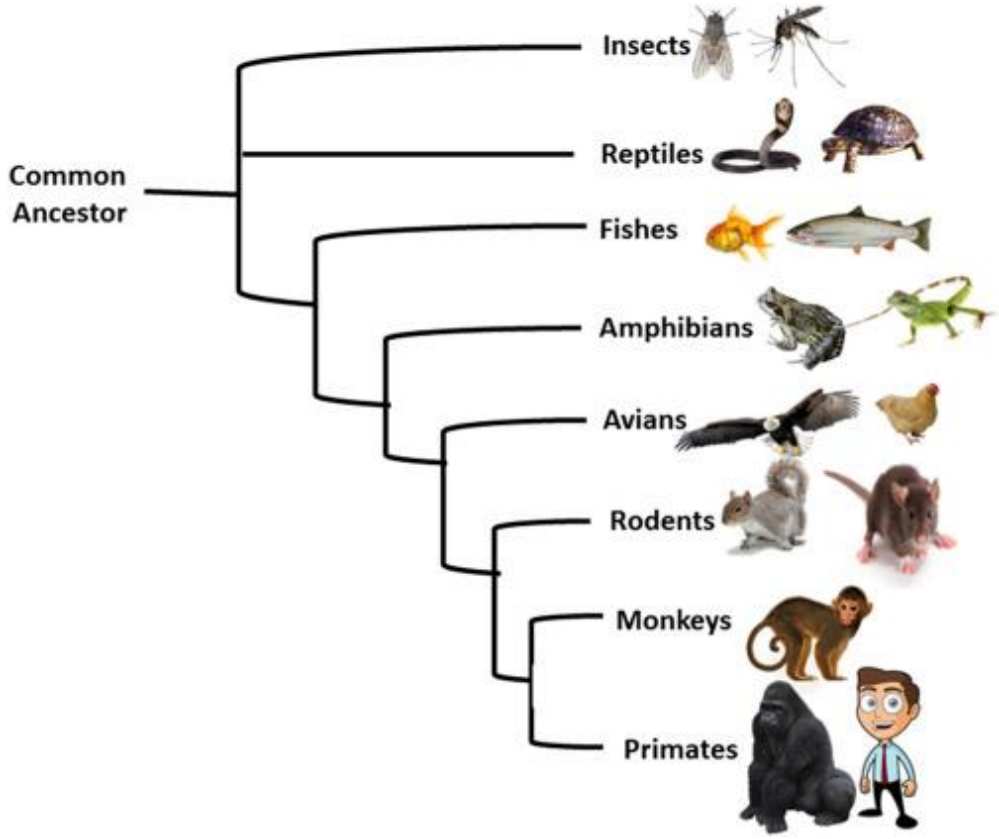
What is the Phylogenetic Tree?

- It is defined as a diagrammatic representation of evolutionary relationships among living organisms.
- This diagrammatic representation represents how different species evolved from a series of common ancestors.
- The phylogenetic tree can also be defined as the two-dimensional graph representing the evolutionary relationship between an organism from various other organisms.



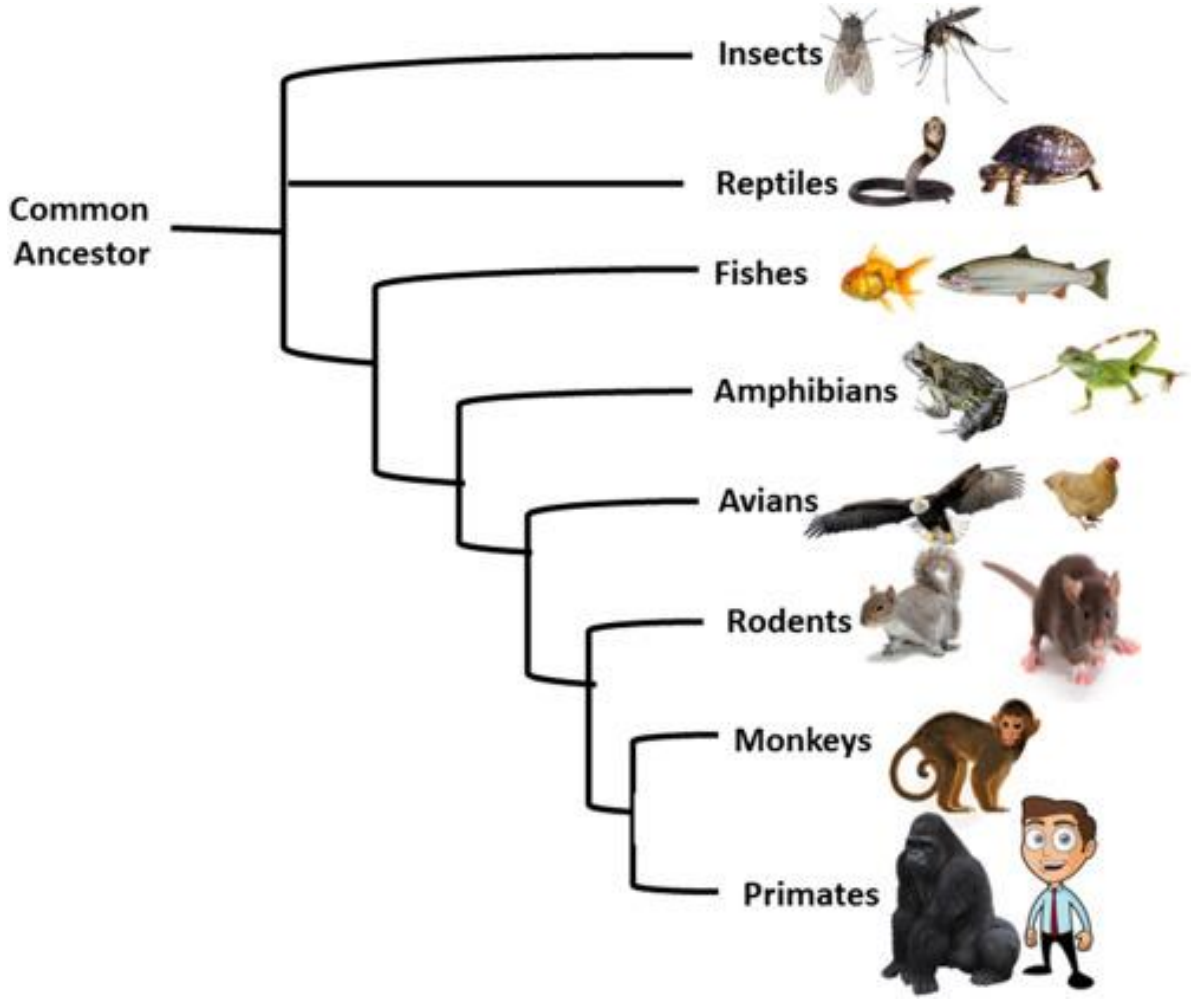
What is the Phylogenetic Tree?

- The phylogenetic tree is also called the “Tree of Life” or “Dendrogram”
- The term Phylogenetic or Phylogeny is derived from the ancient Greek word, which refers to race, origin or lineage.



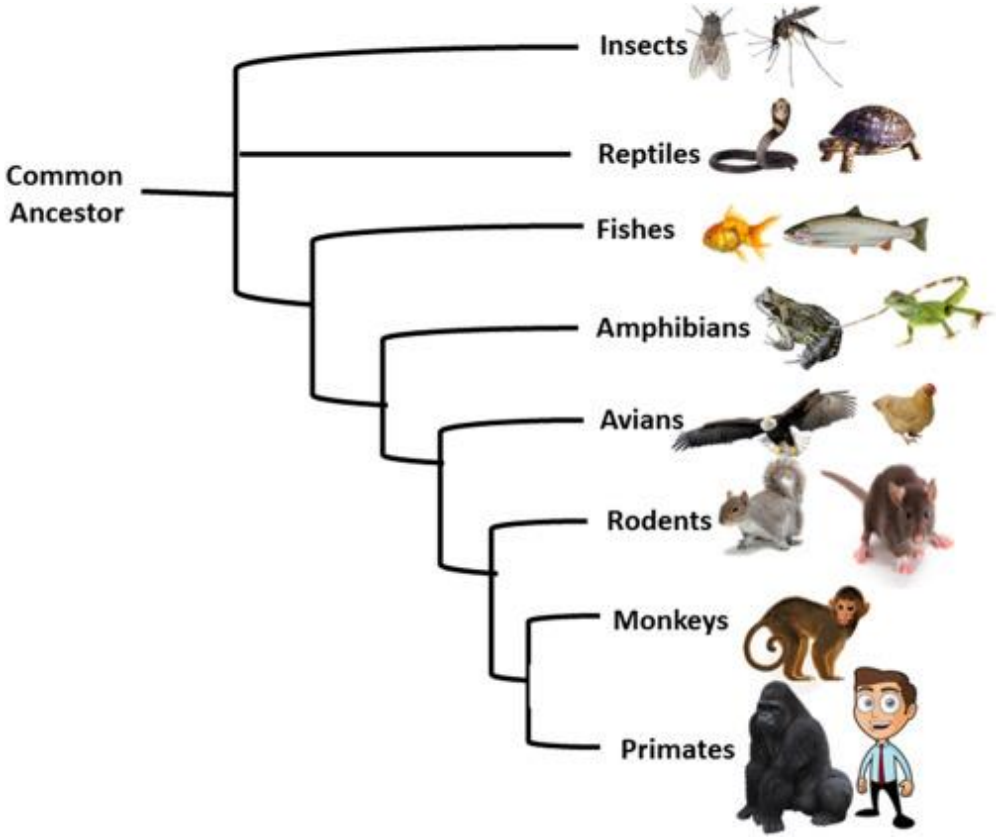
Construction of the Phylogenetic tree

- There are two different methods based on which the phylogenetic tree is constructed.
- 1. Character-based method
- 2. Distance-based method



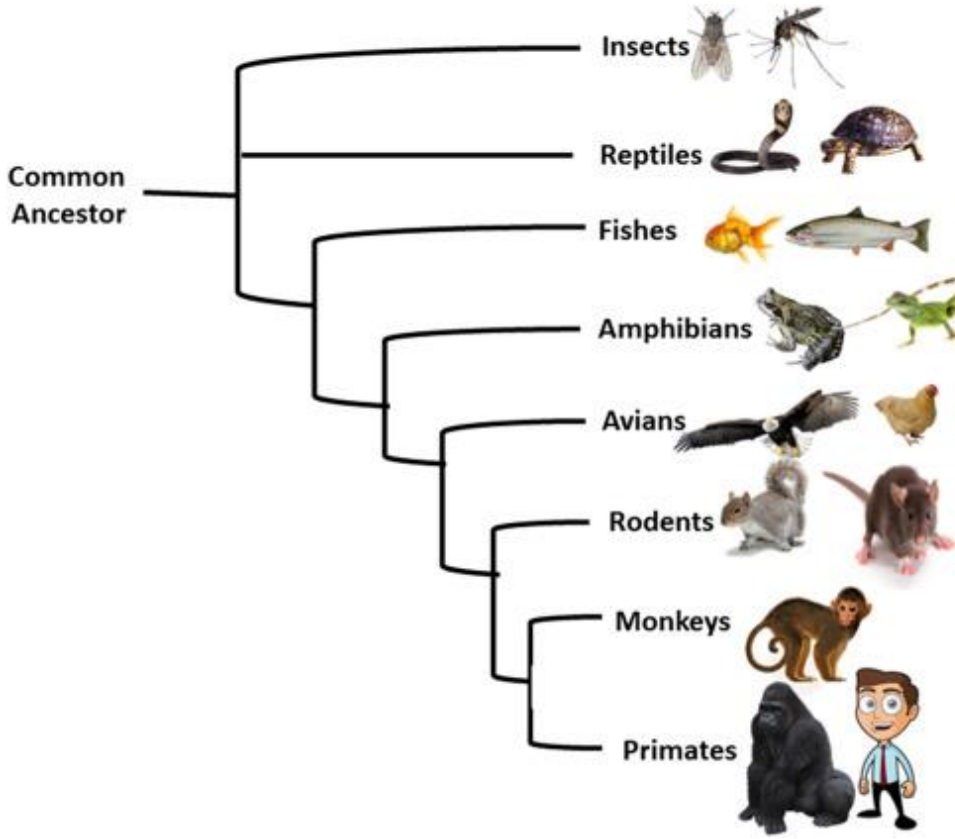
Construction of the Phylogenetic tree

- **1. Character-based method:**
- This method is based directly on the sequence characters, therefore it is also called the discrete method.
- The character-based method uses the aligned characters for constructing the phylogenetic tree.
- These aligned characters include either the DNA or protein sequences during the tree inference.
- The two most popular character-based methods are:
  i. Maximum parsimony.
  ii. Maximum likelihood.



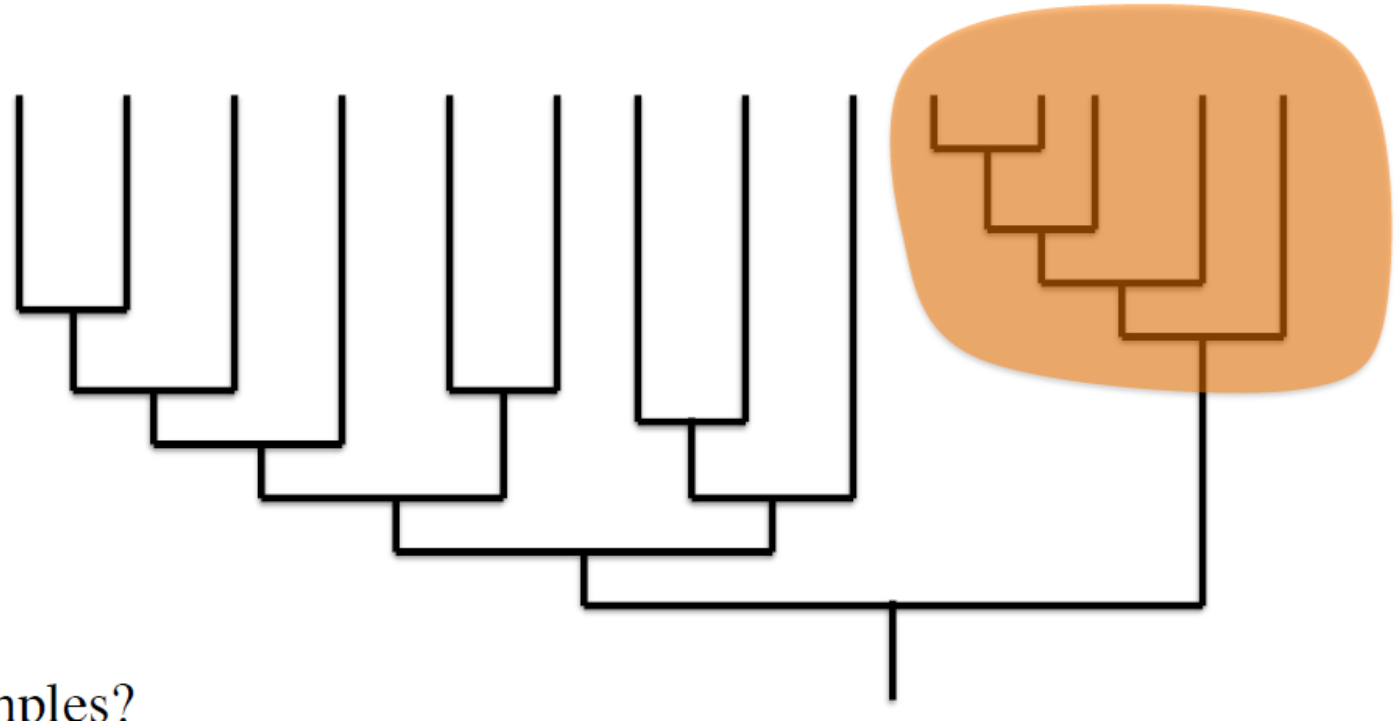
Construction of the Phylogenetic tree

- **2. Distance-based method:**
- **This method is based on the amount of the distance or the dissimilarity between the two aligned sequences.**
- **In this method of constructing the phylogenetic tree, the sequence data is transformed into pairwise distances and then the matrix is used for building a tree.**



Cladistics (Phylogenetic Systematics)

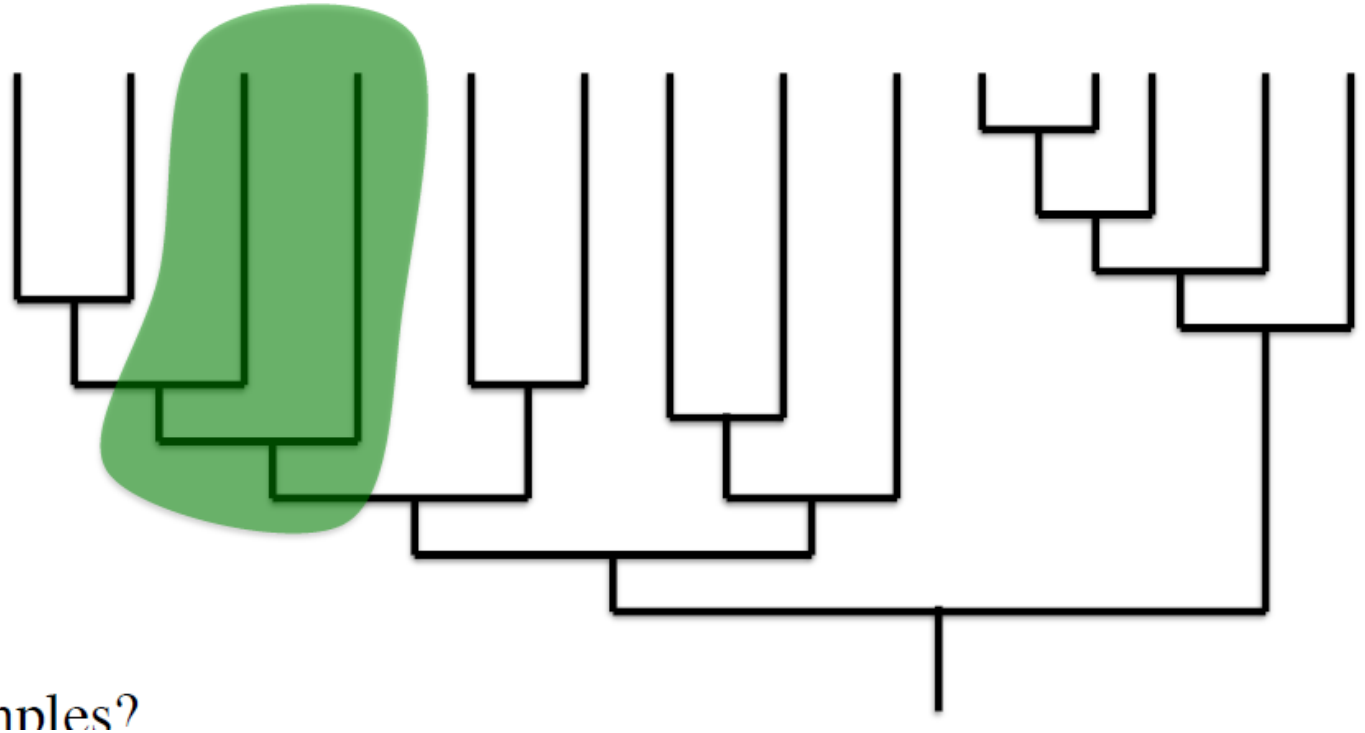
Monophyletic (aka clade): all taxa are descended from a common ancestor that is not the ancestor of any other group (every taxa descended from that ancestor is included)



examples?

Cladistics (Phylogenetic Systematics)

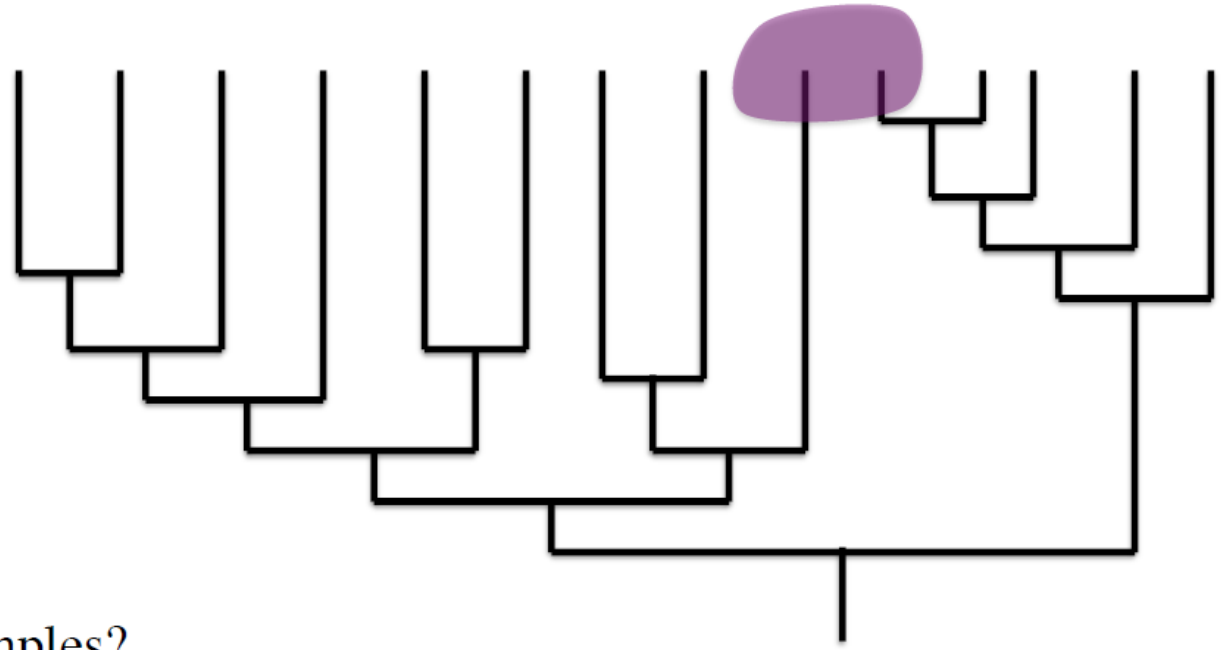
Paraphyletic: the group does not contain all species descended from the most recent common ancestor of its members



examples?

Cladistics (Phylogenetic Systematics)

Polyphyletic: taxa are descended from several ancestors that are also the ancestors of taxa classified into other groups



examples?

3. Phylogenetic or Cladistic classification

- Phylogeny plays a great role in classification. It is the appropriate theoretical background for taxonomy and is quite essential in explaining all the associations involved in classification. Some people believe phylogenetic and evolutionary classification are similar to each other since they both are based on the features derived from a common ancestor while some other consider as different approaches.
- Cladistic classification is exclusively based on phylogenetic branching. Cladistics phylogeny, in opposition to numerical phenetics, includes an attempt to map the sequence of phyletic branching through a determination of characters that are shared primitive (symplesiomorphic) and shared derived (synapomorphic) (Fig 3.1).

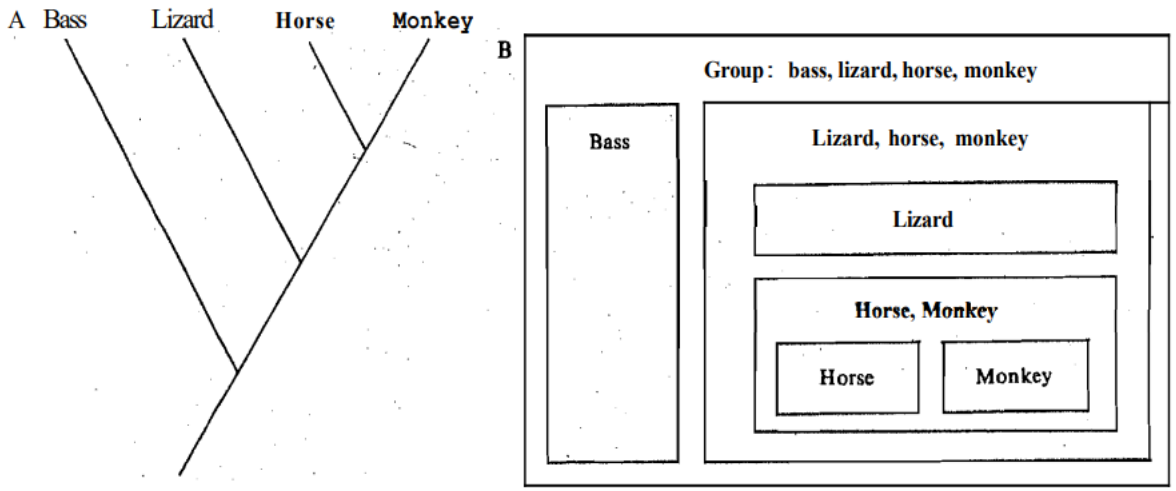


Fig. 3.1 : a) A simple **cladogram.** The bass is the outgroup, and monkey, horse **and lizard** are **closely related** groups. **Cladogram,** unlike traditional phylogenetic trees, carries no time to **scale** because it is **meant** to show only relative degree of relationship not actual historical events.
b) The "nested sets" of the cladistic hierarchy, constructed from the cladogram.

3. Phylogenetic or Cladistic classification

- But, to date there is no true phylogenetic classification for any group of animals except (tc some extent) that of horses.
- This is due to incomplete fossil record and also because the comparative data collected through other approaches fail to possibly give a clear picture by itself.
- Thus, cladistic taxonomic system attempts to communicate only genealogy.
- There is no attempt to express the degree of overall similarity of the organisms in such classification systems.

4. Evolutionary classification

- Black welder (1967) considers evolutionary classification and phylogenetic classification are synonymous and represent classification based on features derived from a common ancestor.
- Evolutionary classification combines aspects of both phenetic and cladistic systematics.
- However, Simpson (1961) and -Mayr & Ashlock (1991) consider both as different.

4. Evolutionary classification

- The whole concept of evolutionary classification is based on Darwinism.
- Darwin and his followers believe that the groups are created through evolution.
- They classify organisms rather than characters.
- It is based on the simple fact that easily delimit groups such as birds, bats, beetles etc. are exist in nature.
- The existence such groups demand the explanation from the taxonomists for the improvement of classification.
- It is the Darwin who first explained that closeness of descent is the only known cause of similarity of organisms.

4. Evolutionary classification

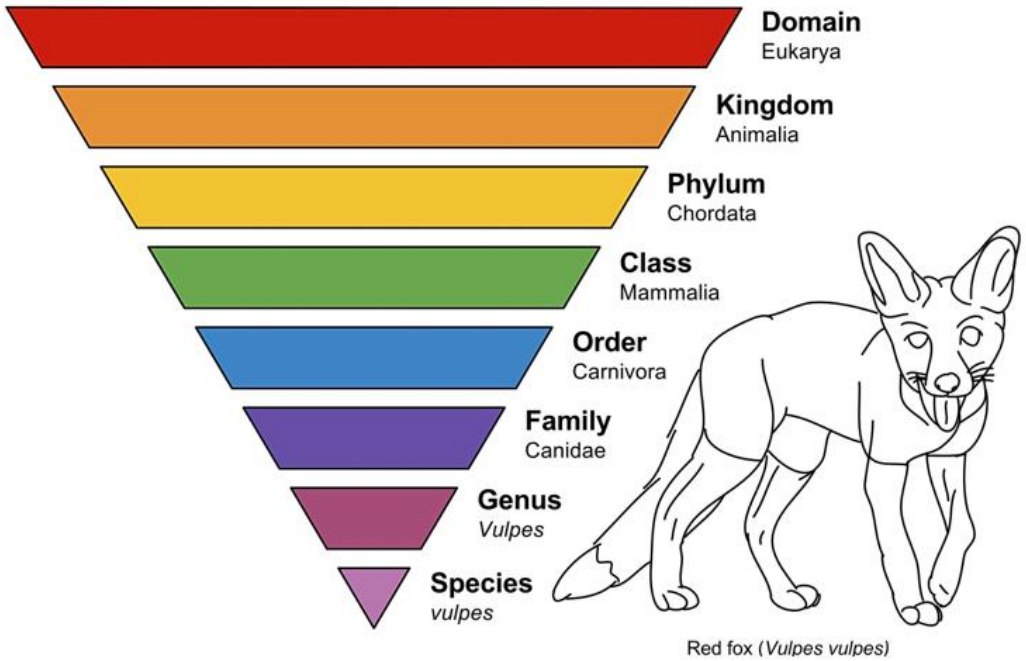
- **Now the taxonomists become the discoverer of groups made by evolution.**
- **Now a biologist understands that he is classifying populations, not individuals.**
- **The groups or populations are polyphetic (multi-charactered) and the result of divergent evolution (**In divergent evolution, **two or more distinct species share a common ancestor from which they diverged**. A common example is a modern elephant and woolly mammoth. They share a common ancestor and yet evolved into two different species.**).**
- **All living animal species are related to one another by the way of evolutionary descent and this type of relationship helps us to establish correct systematic groupings.**

5. Omnispective classification

- This is the extension of the concept of natural classification put forward by Black Welder (1967).
- Most taxonomists today practice this classification.
- In this approach, an experienced taxonomist takes into account all the available features but decide to use only some readily available ones for classification.
- It is a workable system of classification.
- The main feature of this classification system is that, it is based on comparative data drawn from individual organism and all the available data are used as far as necessary.

5. Omnispective classification

- This is highly extensive practice which is being used by animal taxonomist.
- These classificatory purposes and various distinctive feature which are very helpful.
- This classification "is all-seeing or all-considering system“ (Black welder, 1967).



Thank You