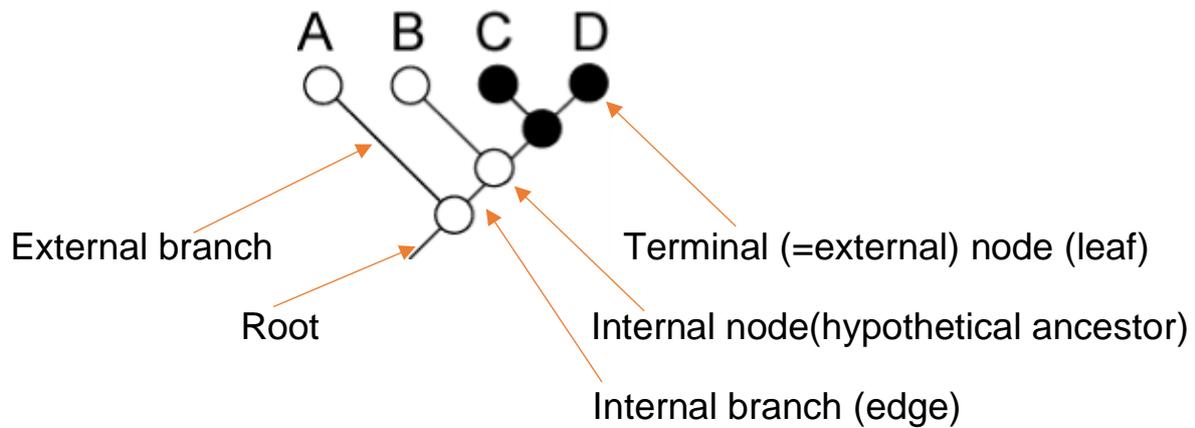
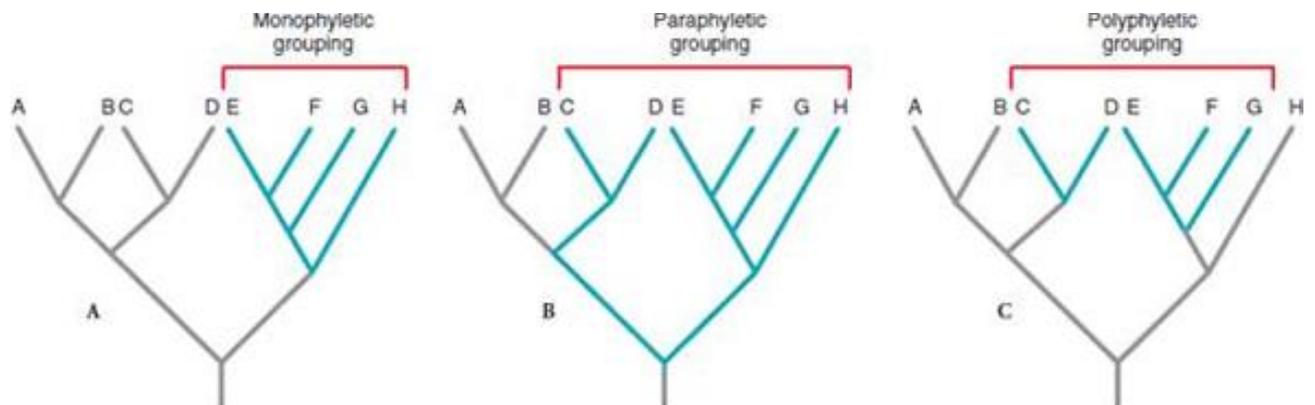


Lecture by: Dr. Priyanka Srivastava



Topic: Monophyly, Paraphyly, Polyphyly:

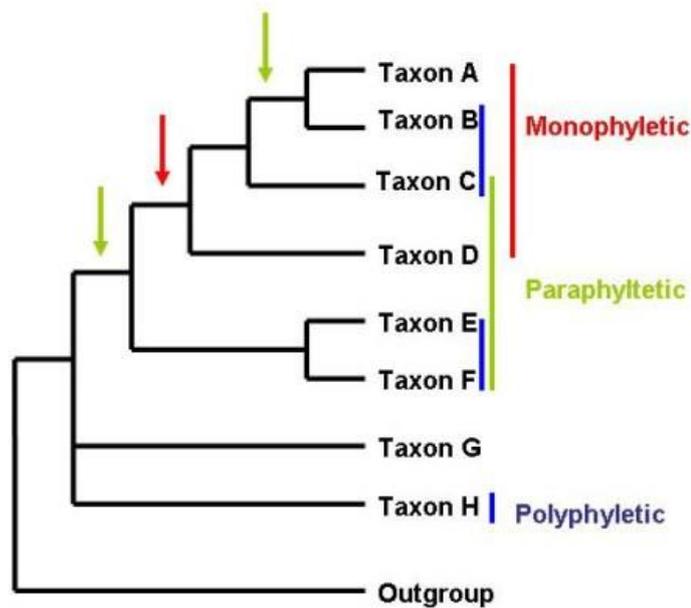
Part I:



1. Monophyly/ Monophyletic Group:

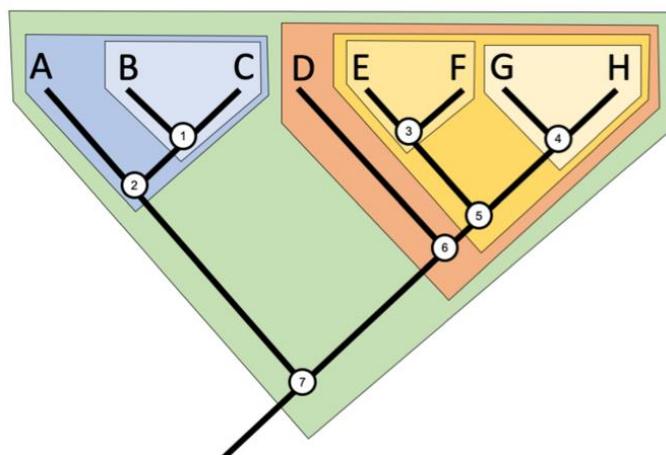
A **monophyletic** group consists of the common ancestor and all of its descendants. These groups and lineage are basics to understand the taxonomy and evolution of organism. A monophyletic group of species shares a **single common ancestor and also includes all of the descendants** of that common ancestor. This phenomenon is known as monophyly and based on synapomorphies. On a phylogenetic tree, a monophyletic group

includes a node and all of the descendants of that node, represented by both nodes and terminal taxa. Thus, a monophyletic group is also a **clade**.

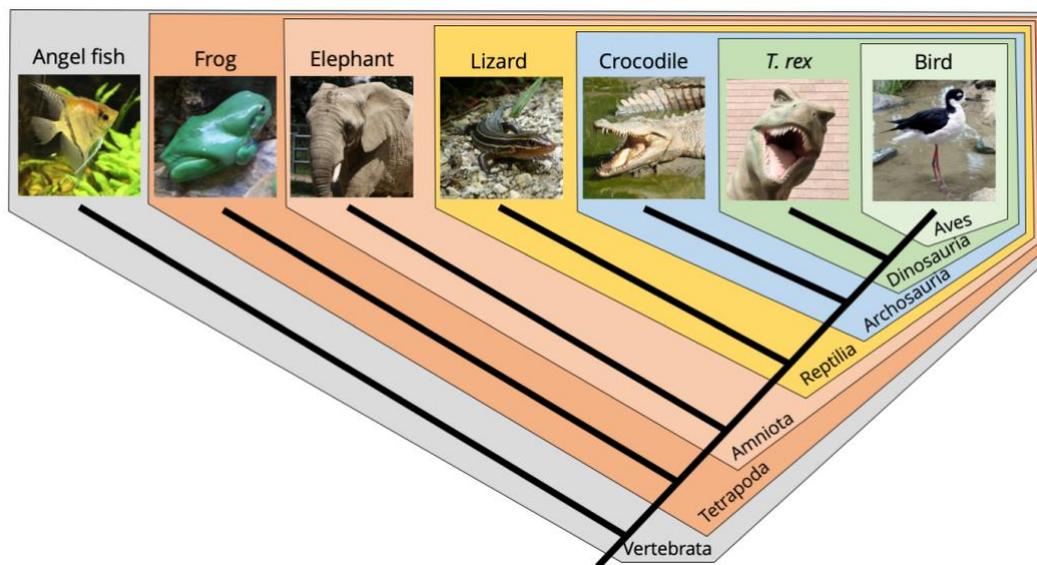


In above diagram the clade comprising taxa A, B, C and D is monophyletic (in diagram red line and arrow shows the monophyletic group).

It is not like that only that only A-D is monophyletic any new relatives that fit anywhere in the tree above that point then they would also by definition be part on that monophyletic clade. For eg. A-B or A-F would still be monophyletic.



Phylogenetic tree illustrating the concept of monophyletic group or clades. Clades are nested within one another 1-7 (whole covered in green) (Image by Jonathan R. Hendricks)

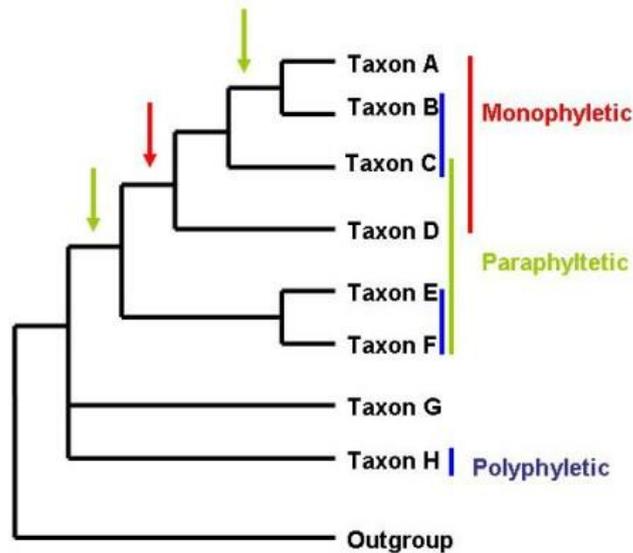


Monophyletic group (clade) of Class Mammalia with group of animals sharing characteristics of having hair and mammary glands (Jonathan R. Hendricks)

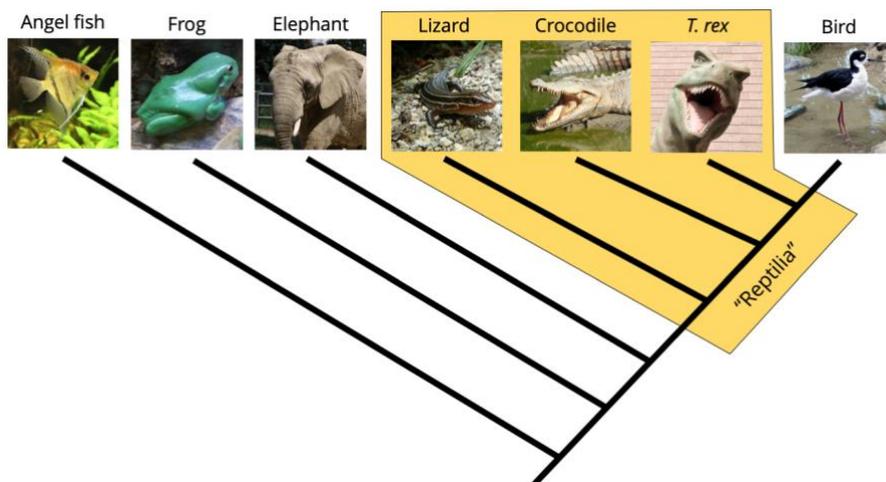
In above diagram the phylogenetic tree shows the relationships of seven types vertebrates, showing a monophyletic group (clade). Each sub-clade shown here is having common ancestry and also that birds are descendants of a particular clade of dinosaurs.

2. Paraphylly/ Paraphyletic Group:

A paraphyletic group do not include all of the descendants of a common ancestor while only some of them are considered. it is similar to a monophyletic group, but some descendants are excluded. Such groups are characterized by the possession of plesiomorphies. (A group is paraphyletic if its group membership character appears uniquely derived but reversed). This means that while the group has a common ancestor, we are artificially ignoring a subset of its descendants.

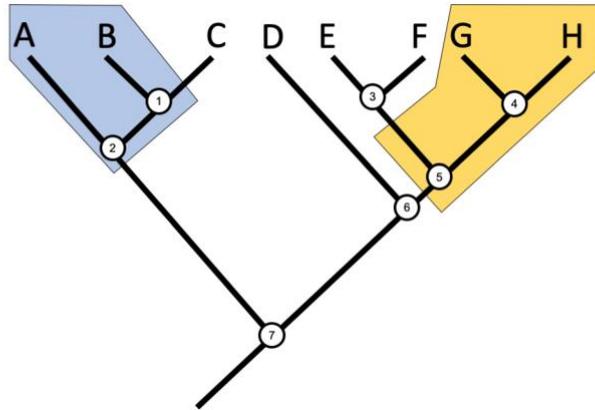


Here the **green arrows** indicate first the monophyletic group which we are considering (A-F) and then the second monophyletic group (A & B) that we are not considering, thus leaving us with the paraphyletic clade of C-F.



Paraphyletic group shown in yellow highlighted box only considering Lizard, Crocodile and *T. rex* of "Reptilia" (excluding Birds from the Clade)

Birds are dinosaurs, that is, they are the direct descendants of an ancestor that spawned the dinosaurs, yet palaeontologists typically refer to dinosaurs while explicitly not referring to birds. Thus one should formally call them non-avian dinosaurs (basically all dinosaurs except birds) and this does happen quite regularly



Examples of two paraphyletic groups, one represented by the blue polygon, the other by the yellow polygon. (Image by Jonathan R. Hendricks)