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## **Phylogenetic Tree:**

A phylogenetic tree is a diagram that represents evolutionary relationships among organisms that are believed to have some common ancestry. Phylogenetic trees are hypotheses, not definitive facts. The pattern of branching in a phylogenetic tree reflects how species or other groups evolved from a series of common ancestors. A phylogenetic tree or evolutionary tree is a branching diagram or tree showing the inferred evolutionary relationships among various biological species or other entities their phylogeny based upon similarities and differences in their physical or genetic characteristics. The taxa joined together in the tree are implied to have descended from a common ancestor. Phylogenetic trees are central to the field of phylogenetic. The term “dendrogram” is the broad term for trees. Charles Darwin (1859) for the first time represented phylogenetic tree and published in his book “The Origin of Species” which evolutionary biologists use as tree diagrams to understand the evolution.

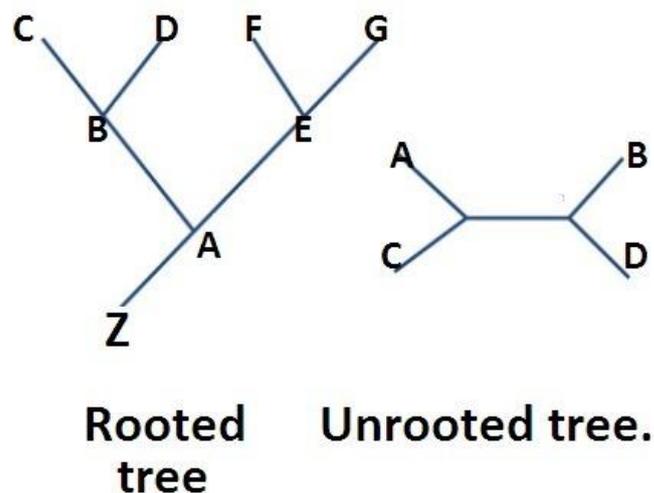
## **Categories of Trees:**

### **1. Rooted Phylogenetic tree**

A rooted phylogenetic tree serves as a useful diagram which shows the evolutionary history. It has a basal node which is called the root, representing the common ancestor of all the groups of the tree. The root of a tree is considered as the oldest point in the tree which represents the last common ancestor of all groups included in the tree. Hence, a rooted tree shows the direction of evolutionary time. Since the rooted tree depicts the direction of evolutionary time, it is easy to find the older or newer groups it has. A rooted tree can be used to study the entire groups of organisms. For eg. A rooted tree is used to make inferences about the most common ancestor of the leaves or branches of the tree.

## 2. Un- Rooted Phylogenetic Tree:

An un rooted phylogenetic tree is a phylogenetic diagram which lacks a common ancestor or a basal node. This type of a tree does not indicate the origin of evolution of the groups of interest. It depicts only the relationship between organisms irrespective of the direction of the evolutionary time line. For eg. An un rooted tree is used to make an illustration about the leaves or branches, but not make assumption regarding a common ancestor.



## What is the difference between Rooted and Unrooted Phylogenetic Tree?

Rooted vs Unrooted Phylogenetic Tree	
A rooted phylogenetic tree is a diagram which shows the last common ancestor of the groups.	An unrooted phylogenetic tree shows the relationships between organisms without showing the common ancestor.
Node	
It has a node (root).	It does not have a node.
Direction of Evolution	
It has a direction to indicate the evolutionary time.	It does not specify an evolutionary relationship.

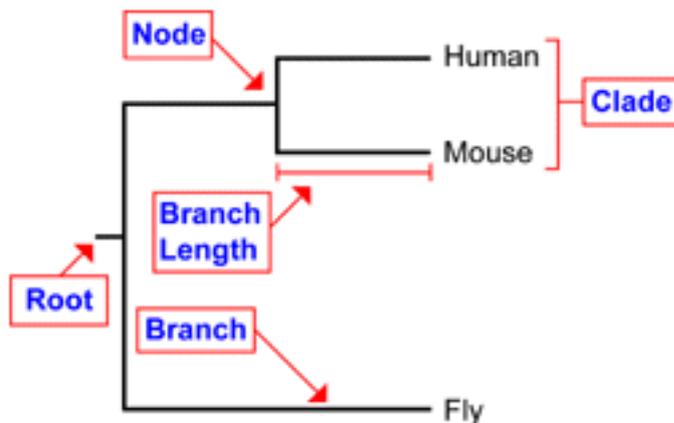
### Attitude towards Others

The tree allows to determining the ancestor – descendant relationship between groups.

The tree does not allow to talk about ancestor – descendant relationship.

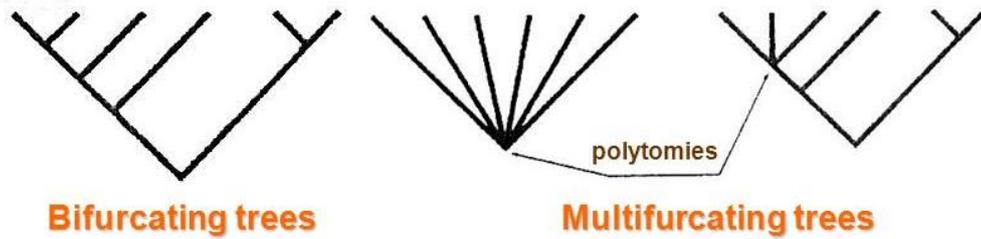
### 3. Bifurcating Tree:

A tree that bifurcates has a maximum of 2 descendants arising from each of the interior nodes. When all the internal nodes in a cladogram are connected to three different nodes, the cladogram is said a bifurcating tree.



### 4. Multi-Furcating Tree:

A tree that multi-furcates has multiple descendants arising from each of the interior nodes. When one or more internal nodes in a cladogram are connected to more than three different nodes, the cladogram is a multifurcating tree.



## 5. Polytoomy

Polytomy explains unresolved relationship of taxa. - Polytomies can represent two different situations: i) simultaneous divergence – all the descendants evolved at the same time (a “hard” polytomy) ii) uncertainty of phylogenetic relationships or lack of resolution due to insufficient data (a “soft” polytomy).

Links:

<https://slideplayer.com/slide/11460053/>

<https://www.ncbi.nlm.nih.gov/Class/NAWBIS/Modules/Phylogenetics/phylo7.html>

<https://www.differencebetween.com/difference-between-rooted-and-vs-unrooted-phylogenetic-tree/>