

What are phylogenies?? Phylogenies, or “tree diagrams,” are a principle way that scientists depict the evolutionary relationships between living organisms. You could diagram your family tree in a similar way! Your brother or sister is your relative because you share a common ancestor: your parents. Your first cousins are more distant relatives, because your last common ancestors with them, your grandparents, were born further back in time. If we look back thousands of generations, all humans share common ancestors, so we are all related. Biologists have discovered that all species are similarly related, and we depict these relationships with phylogenies. Living things in the world around us are placed at the leaves of the outermost branches. If you were to follow those branches towards the trunk, you would find that the branches of the tree begin connecting together. When two branches connect at a single point, that “node” can be thought of as the most recent common ancestor of the organisms at the branch tips. Oftentimes, this ancestor is an extinct organism that may have resembled the two living tips. As you follow branches deeper into the tree and further back in time, more and more branches unite until they all are connected at the trunk.

Why do branches split into two at nodes? The creation of the tree of life took a LONG time. A single branch on this tree represents a lineage of organisms that may have persisted for millions of years! We usually do not know exactly why a branch split into two, but sometimes groups of organisms become isolated from each other for enough time that genetic changes begin to happen in the groups, so that they can no longer reproduce together. Using fossil evidence, we can often approximate when such splits occurred.

How can you tell how closely related things are? The correct way to figure out how organisms are related to each other is to read DOWN the tree, NOT across the leaves. If you trace two leaves to the point where they meet, that node represents their most recent common ancestor. The fewer the nodes that occur between two leaves of interest, the more closely related the organisms are to each other. The deeper a common ancestor is in a tree (e.g. the more nodes between two leaves), the more distantly related the organisms are. We can place characteristics (or synapomorphies) that are shared by the leaves on the branch leading to them.

How are scientists discovering the Tree of Life? Many scientists around the world are working hard to learn how all living things- from bacteria to humans- fit in the great Tree of Life. Mostly, scientists are using modern DNA sequencing to study changes in the common genetic code of all living things. New advances in biotechnology and computer technology are making the process easier and easier!

Where can I find more information on the Tree of Life? www.tolweb.org/tree/ - the Tree of Life- especially check the “Treehouses” link www.eol.org - the Encyclopedia of Life interactive quiz at : http://www.ufes.br/dbio/cursos/gme/tree_exerc_advanced.pdf
<http://www.ucmp.berkeley.edu/exhibits/historyoflife.php>- “History of life through time” from University of California Museum of Paleontology (UCMP)
Richard Dawkins- The Ancestor’s Tale: A Pilgrimage to the Dawn of Evolution. 2004. Houghton Mifflin
Teachers, check out the publication: Phylogenetics and Tree-thinking by DA Baum and S Offner, 2008. The American Biology Teacher 70 (4) 222-229

In this simplified example, mushrooms are more closely related to humans than they are to plants because the most recent common ancestor of mushrooms and humans is more recent (shallower in the tree) than the most common recent ancestor of mushrooms and plants.

