

## Labtivity: Using Homologous Structures to Classify

**Background:** One way to discover how groups of organisms are related to each other is to compare the anatomical structures of many different organisms. Corresponding organs and other body parts that are alike in basic structure and origin are said to be Homologous Structures (for example the front legs of a horse, wings of a bird, flippers of a whale, and the arm of a person are all homologous to each other.) When different organisms share a large number of homologous structures, it is considered strong evidence that they are related to each other. When organisms are related to each other, it means they must have had a common ancestor at some time in the past. If there are specific modifications of those features shared by different groups of organisms, we say that those features are "shared derived characters".

When we do studies in comparative anatomy, and find different numbers of shared derived characters exist between different groups, we can draw a diagram of branching lines which connect those groups, showing their different degrees of relationship. These diagrams look like a tree and are called "Phylogenetic Trees." The organisms are at the tip of the stems. The shared derived features of the homologous structures are shown between the stems along the main branch. The more derived structures two organisms share, the closer is their evolutionary relationship – that is, the more recently their common ancestor lived. On the phylogenetic tree, close relationships are shown by a recent fork from the supporting branch. The closer the fork in the branch between two organisms, the closer is their relationship.

**Step 1: Total the shared characteristics of the animals on your data table.**

Traits	Kangaroo	Lamprey	Rhesus Monkey	Bullfrog	Human	Snapping Turtle	Tuna
Dorsal nerve cord	X	X	X	X	X	X	X
Notochord							
Paired appendages	X		X	X	X	X	X
Paired legs	X		X	X	X	X	
Amnion (amniotic sac)	X		X		X	X	
Mammary glands	X		X		X		
Placenta			X		X		
Canine teeth short foramen magnum fwd					X		
<b>Totals of X's</b>							

**Explanations of characteristics:**

1. Dorsal nerve cord (running along the back or "dorsal" body surface)
2. Notochord (a flexible but supporting cartilage-like rod running along the back or "dorsal" surface)

3. Paired appendages (legs, arms, wings, fins, flippers, antennae)
4. Paired legs
5. Amnion (a membrane that holds in the amniotic fluid surrounding the embryo; may or may not be inside an egg shell)
6. Mammary glands (milk-secreting glands that nourish the young)
7. Placenta (structure attached to inside of uterus of mother, and joined to the embryo by the umbilical cord; provides nourishment and oxygen to the embryo)
8. Canine teeth short (same length as other teeth)
9. Foramen magnum forward (spinal cord opening, located forward, under skull)

**Step 2: Make a Phylogenetic Tree** on the back of your worksheet to illustrate the ancestry of these animals. The diagram should reflect shared characteristics as time proceeds. Notice how the different animals are all at the same time level (across the top) since they all live today.

**Step 3: Answer the following:**

Summary: List three pieces of information that can be obtained from a phylogenetic tree.

Application: Three previously unknown vertebrates have been discovered in a rain forest in South America. One animal is very similar to an iguana lizard. The second animal resembles a large rat. The third is similar to a goldfish. Place these animals on you Phylogenetic Tree and explain why you placed them where you did.