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## Let's Build a Cladogram!

**Introduction:** <u>Cladistics</u> is one of the newest trends in the modern classification of organisms. This method shows the relationship between different organisms based on the presence or absence of certain characteristics called "derived characters." <u>Derived characters</u> are the unique characteristics of a particular group of organisms. These characteristics are "evolutionary innovations" that arose in one group of organisms, but are not found in the older members of the lineage. Based on these derived characters, cladistics is used to determine the sequence in which different groups of organisms evolved. The organisms and their derived characters are then illustrated on a diagram called a cladogram. A <u>cladogram</u> shows the evolutionary relationships among groups of organisms. Organisms that are grouped more closely on a cladogram share a more recent common ancestor than those farther apart.

Purpose: 1) To make careful observations to determine the derived characters of a group of organisms.

2) To arrange the derived characters into a cladogram showing the relationships between the organisms.

**Materials:** Pictures of lamprey, trout, caecilian, tortoise, cat, gorilla, and human

## **Procedure:**

- 1. Make careful observations of the animals in the pictures you have been given. As you study each picture, determine if the animal has any of the characteristics that you see in the data table below.
- 2. If the characteristic is present in the animal, place a " + " in the correct column, indicating that the animal has that particular characteristic.
- 3. If the characteristic is absent in the animal, place a " " in the correct column, indicating that the animal does not have that particular characteristic.

## **Table of Derived Characters:**

	Characteristic					
Organism	Jaws	Limbs	Hair	Lungs	Opposable thumb	Upright, erect posture
Lamprey						
Trout						
Caecilian						
Tortoise						
Cat						
Gorilla						
Human						
Total						

4. Fill in the line of the data table marked "total." Count how many organisms possess each characteristic. For example: How many organisms have jaws? List this number for the total. Determine the total for each characteristic.

by t dist pur	ok carefully at your data table. Find the organism that has none of the derived characters shared the other organisms in the data table. A cladogram deliberately includes an organism that is only tantly related to the other organisms. This organism is referred to as the "out-group." The pose of the out-group is to serve as a basis of comparison with the other organisms. The other tanisms are called the "in-group" and possess one or more of the shared derived characters.
The	e "out-group" in your data table is the:
	w draw the cladogram in the space below. (You might want to glance at the small picture at the of page 1.)  Start by drawing a diagonal line upon which all the derived characters will be placed.  Draw the first branch at the bottom of your diagonal line and place the name of the out-group at this first branch.  Which derived character is the most common? Look at your data table and determine the characteristic that occurs most often.  The most common derived character is:  The most common derived character is placed at the bottom of the diagonal line on the cladogram. Add this characteristic to your cladogram.  Now determine the second most common derived trait. Place it above the most common trait on your cladogram. Continue until all traits have been placed on the cladogram in order from most common to least common.
f) g) h)	Now add the names of the organisms to the cladogram. Which organism in the data table has only one shared derived character?  Draw a branch point for this organism at the bottom of the cladogram, just above the out-group organism.  Which organism in the data table has two shared derived characters?  Draw a branch point for this organism on the cladogram.  Continue until the names of all organisms have been added to the cladogram. Be sure to place
	by distiputions or general to the top a) b) c) d) e)

characters.

What is cladistics?
Vhat are "derived characters"?
Vhat is a cladogram?
Vhat does a cladogram show?
n the introduction, the term "evolutionary innovation" was used. What does this mean?
Iow is the out-group determined in a cladogram?
Vhy is the out-group needed on a cladogram?
Vhat is the in-group in a cladogram?
Which derived character is placed immediately after the out-group on a cladogram?
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10.	What must be true of organisms that have the most shared derived characters?
11.	What trait on your cladogram separates the least closely related organism from the other organisms?
12.	What is a "branch point" on a cladogram?
13.	According to your cladogram, the cat most recently shared a common ancestor with what organism?
14.	What are the derived characters of a tortoise?
15.	A derived character found in birds is feathers. Where would this be placed in the cladogram that you drew? Explain your answer.
16.	Which organism on your cladogram was the first to evolve?
17.	Which organism on your cladogram is the most recently evolved?
18.	Which derived character is unique to gorillas and humans?
19.	Which two organisms on the cladogram are the most closely related? Why are they the most closely related?