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Taxonomy Practice

What is a cladogram? It is a diagram that depicts evolutionary relationships among groups. It is based on **PHYLOGENY**, which is the study of evolutionary relationships. Sometimes a cladogram is called a phylogenetic tree (though technically, there are minor differences between the two).

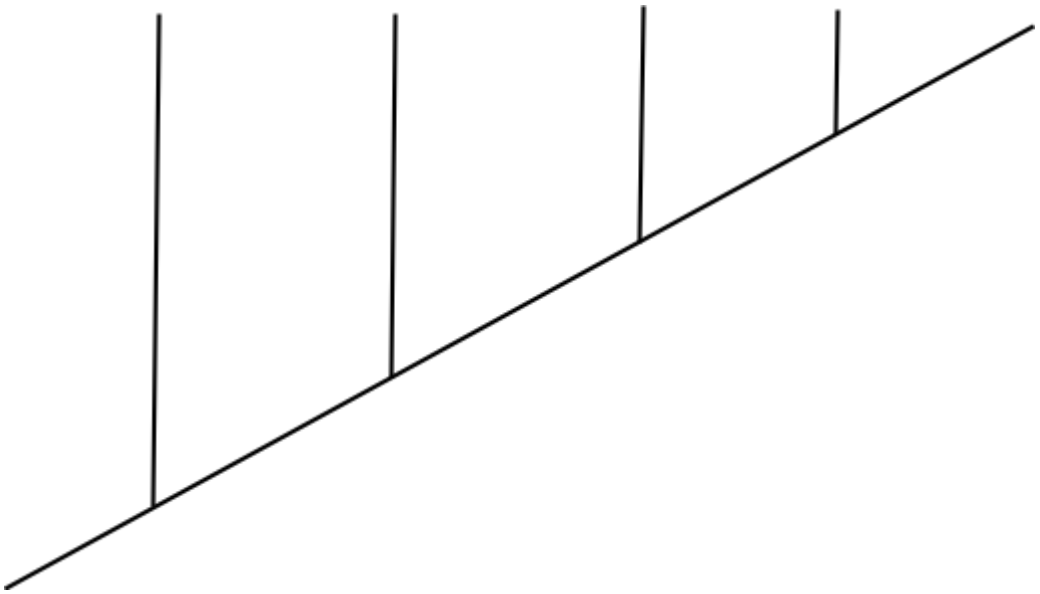
In the past, biologists would group organisms based solely on their physical appearance. Today, with the advances in genetics and biochemistry, biologists can look more closely at individuals to discover their pattern of evolution, and group them accordingly - this strategy is called **EVOLUTIONARY CLASSIFICATION**

CLADISTICS is a form of analysis that looks at features of organisms that are considered "innovations", or newer features that serve some kind of purpose. (Think about what the word "innovation" means in regular language.) These characteristics appear in later organisms but not earlier ones and are called **DERIVED CHARACTERS**.

Fill out the following table. Mark an "X" if an organism has the trait.

	Cells	Legs	Antenna	Wings	2 sets of wings
Spider					
Ant					
House fly					
Worm					
Dragonfly					

In the space below, create a cladogram based off your table. Double click on the cladogram to edit it.



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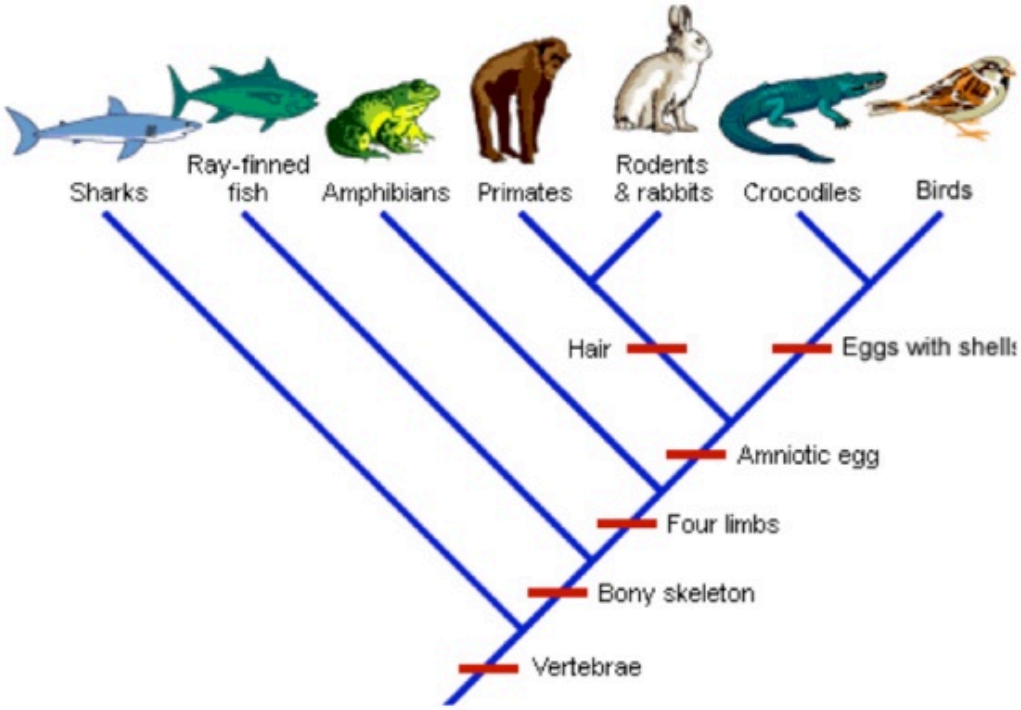
1. According to your cladogram, which two species are more closely related: worms and spiders or worms and ants? How do you know?

2. According to your cladogram, what species is the dragonfly most closely related to? How do you know?

Use the following cladogram to answer questions #3-7. Explain your answers.



3. What separates rabbits/primates from the crocodiles on this cladogram?

4. Which organism is most related to the rodents and rabbits on this cladogram?

5. What 5 traits do the bird and its closest relative share?
   a.
   b.
   c.
   d.
   e.

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6. Which organism will have DNA most similar to the bird? Why?

7. Which organism's DNA will differ the most from the bird? Why?

When making a cladogram we often use anatomical features, behavior, or molecular similarities. The most reliable data though is molecular. When comparing molecular data we can look at the number of mutations in a common strand of DNA, or compare strings of amino acids and note differences in the order of the amino acids.

Cytochrome c is a protein located in the mitochondria of cells involved with cellular respiration. Below is a table showing a portion of the amino acid sequences for cytochrome c in several organisms. The more amino acids, or nucleotides, that two organisms have in common, both type and order, the more closely related they are.

Organism	**Biochemical Data**
Amoeba	Amino Acid Sequence: ISO-SER-ASP-GLN-PHE-ILE-LEU-GLN-SER-ARG-LEU-LEU-HIS DNA Sequence: ATTAGCGACCAGTTTATCCTACAATCCCGTCTACTTCAT
Kangaroo	Amino Acid Sequence: LEU-ISO-PRO-PRO-PHE-ILE-LEU-LEU-SER-HIS-LEU-LEU-SER DNA Sequence: CTAATCCCCCCGTTTATCCTACTTTCCCATCTACTAAGT
Earthworm	Amino Acid Sequence: LEU-ISO-ASP-PRO-PHE-ILE-LEU-HIS-SER-ARG-LEU-LEU-ARG DNA Sequence: CTTATCGACCCGTTTATCCTACATTCCCGTCTACCTTCGT
Cat	Amino Acid Sequence: LEU-ISO-PRO-PRO-PHE-ILE-LEU-LEU-SER-HIS-LEU-LEU-SER DNA Sequence: TTAATCCCCCCGTTTATCCTACTTTCCCATCTACTAAGT
Shark	Amino Acid Sequence: LEU-ISO-PRO-PRO-PHE-ILE-LEU-LEU-SER-ARG-LEU-LEU-ARG DNA Sequence: CTTATCCCCCCGTTTATCCTACTTTCCCGTCTACTTCGT
Dolphin	Amino Acid Sequence: LEU-ISO-PRO-PRO-PHE-ILE-LEU-LEU-SER-HIS-VAL-VAL-SER DNA Sequence: CTAATCCCCCCGTTTATCCTACTTTCCCATGTAGTAAGT
Lizard	Amino Acid Sequence: LEU-ISO-PRO-PRO-PHE-ILE-LEU-LEU-SER-ARG-LEU-LEU-ARG DNA Sequence: CTAATCCCCCCGTTTATCCTACTTTCCCGTCTACTTCGT
Sponge	Amino Acid Sequence: ISO-ISO-ASP-GLN-PHE-ILE-LEU-HIS-SER-ARG-LEU-LEU-ARG DNA Sequence: ATTATCGACCAGTTTATCCTACATTCCCGTCTACTTCGT

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8. Using the cytochrome c data above, which organism is most closely related to the lizard? Why?

9. Using the cytochrome c data above, which organism is most closely related to the dolphin? Why?

Use the table below to answer questions #10-20.

Taxon	**Green Frog**	**Mountain Lion**	**Domestic Dog**	**Human**
Kingdom	Animalia	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Chordata	Chordata
Class	Amphibia	Mammalia	Mammalia	Mammalia
Order	Anura	Carnivora	Carnivora	Primates
Family	Ranidae	Felidae	Canidae	Hominidae
Genus	*Rana*	*Felis*	*Canis*	*Homo*
Species	*Rana clamitans*	*Felis concolor*	*Canis familiaris*	*Homo sapiens*

10. Which taxon includes the most specific characteristics?

11. Which taxon includes the broadest characteristics?

12. Which taxon includes more organisms: species, order, or family?

13. Which taxon includes only organisms that can successfully mate with each other?

14. If two organisms belong to the same family, what other taxonomic levels do the organisms have in common?

15. Which two organisms from the table above are most closely related? Why?

16. Which taxa do all four organisms in the table above have in common?

17. Which class does not include animals that have hair or fur?

18. What is the order, family, and genus of a human?

19. Linneaus created binomial nomenclature to give each species a unique two part name. Following formatting rules for binomial nomenclature, what is the scientific name of a mountain lion?

20. What species from the table above is most closely related to an organism with the scientific name *Canis aureus*? Explain.