Name: _____ _____ **Given 4/6 and due by 4/10**

CLADOGRAMS

Read the following passage explaining the usage of a cladograms. For further explanation please refer to the attached YouTube video and reach out to your teacher with any and all questions.

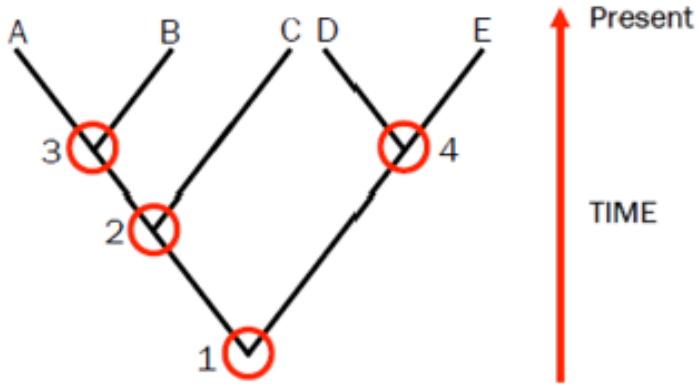
Video: bit.ly/STCladogram

INTRODUCTION

Scientists use diagrams to show evolutionary relationships. These diagrams are called cladograms or phylogenetic trees. Often times these two terms are used interchangeable but Cladograms typically show evolutionary relationships based on shared characteristics whereas phylogenetic trees represent the evolution of a set of organisms or groups of organisms, such as those that make up a taxon. Closely related organisms are placed closely together on the diagram. Organisms that evolve from a common ancestor are connected together with "branches."

The diagram below is a cladogram. The cladogram shows the evolutionary relationship between five different organisms, represented with letters A through E. These organisms are the descendants of a common ancestor.

The "root" of the tree represents a common ancestor for all organisms in the tree. On the diagram above, number "1" is the root. This point represents the common ancestor for all organisms in the tree. Two branches extend from the root. The split represents a speciation event. In other words, two species evolved from this common ancestor. One species becomes a common ancestor for organisms A, B and C. The other becomes a common ancestor for organisms D and E.



Numbers 2, 3 and 4 are called nodes. These nodes represent a common ancestor to *some* of the organisms in the tree. For example, node 2 is a common ancestor for A, B and C. These nodes also represent speciation. At node 2, speciation took place which gave rise to organism C and a common ancestor to A and B. At node 3, speciation took place to give rise to A and B. At node 4, speciation took place to give rise to D and E.

TIME

The length of the lines represents the length of time the species has existed. Longer lines suggest that an organism has existed for a longer period of time. Shorter lines suggest that an organism is a relatively new species. For example, the length of the line associated with organism C is longer than all other lines. This means that organism C has existed for a longer period of time than A, B D and E.

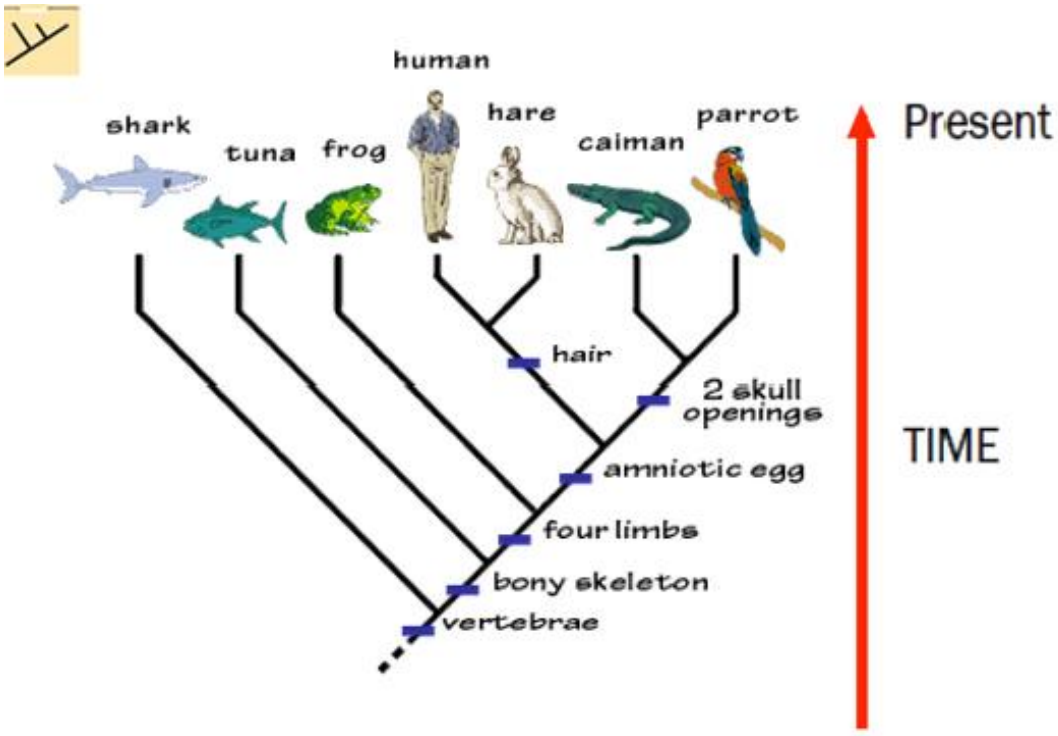
Cladogram show how evolution of organisms occurs over time. The root of the tree represents the past. The "top branches" of the tree represent the present. The nodes within the tree represent speciation events at different points in time. Nodes closer the bottom of the tree represent speciation events that took place a long time ago. Nodes close to the top represent recent speciation events.

SHARED CHARACTERISTICS

In cladograms, similar characteristic that come from a common ancestor are used to divide organisms into groups. A cladogram will begin by grouping organisms based on a characteristic displayed by all the members of the group. Then the increasing smaller groups of a cladogram will show the shared traits of the groups before them.

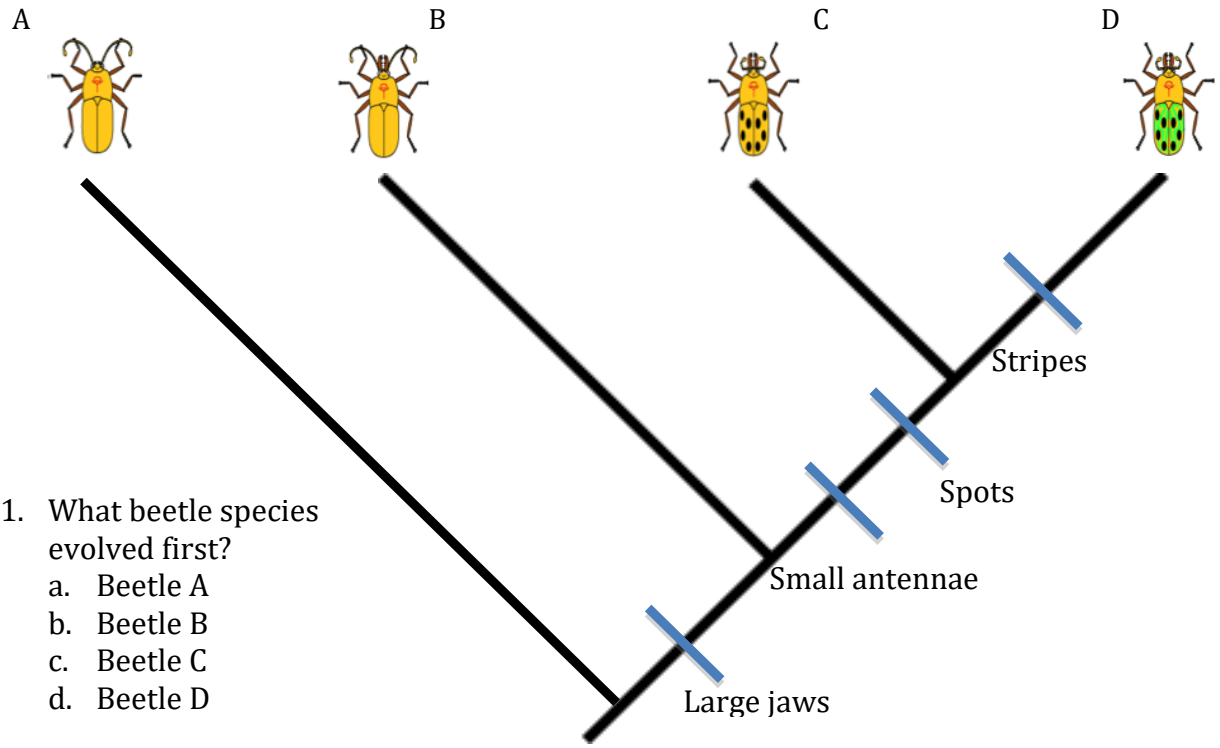
For instance, in this cladogram, every organism has vertebrae. If we move up in time the common ancestor of a shark branches off, but everything else has a bony skeleton. If we move up in time, the common ancestor of a from human, hare, caiman and parrot all have four limbs. Moving up we see that humans, hare, caiman and parrots all have amniotic eggs (eggs with a fluid filled membrane).

Here it starts to get a little confusing human and hares both have a common ancestor with hair and Ciaman and parrots both have a common ancestor with 2 skull openings. Although though both groups have a common ancestor with amniotic eggs, we know that humans and hairs are more closely related to each other because they both have hair. Even though hares and caiman are directly next to each other, hare share a more recent common ancestor with humans. The caiman and parrots are more closely related to each other because they have the most recent branch point



Practice Reading Cladograms:

Each beetle below is a different beetle species that has evolved. Use cladogram below to answer questions #1 – 6.



1. What beetle species evolved first?
   a. Beetle A
   b. Beetle B
   c. Beetle C
   d. Beetle D

2. What beetle species evolved most recently?
   a. Beetle A
   b. Beetle B
   c. Beetle C
   d. Beetle D

3. What traits does this species that evolved most recently have?
   a. Only spots
   b. Spots and stripes
   c. Small antennae, spots, and stripes
   d. Large jaws, small antennae, spots, and stripes

4. How is beetle "C" different from beetle "D"?
   a. Beetle C has large jaws and Beetle D doesn't
   b. Beetle C has spots and Beetle D doesn't
   c. Beetle D has a small antennae and Beetle C doesn't
   d. Beetle D has stripes and Beetle C doesn't

5. Could beetle "C" mate with beetle "D" and produce viable offspring?
   a. Yes, they can because they both have the same ancestor
   b. Yes, they can because they both have 3 out of the four similar characteristics
   c. No, they can't because they are different species
   d. No, they can't because Beetle C doesn't have stripes

6. Beetle D lives in a jungle and eats insects. A new predator bird species migrated into this area that primarily eats small insects, leaving a lot of larger insects for Beetle D to consume. Describe how "large jaws" evolved over time in these beetles. Explain using <u>natural selection</u>.

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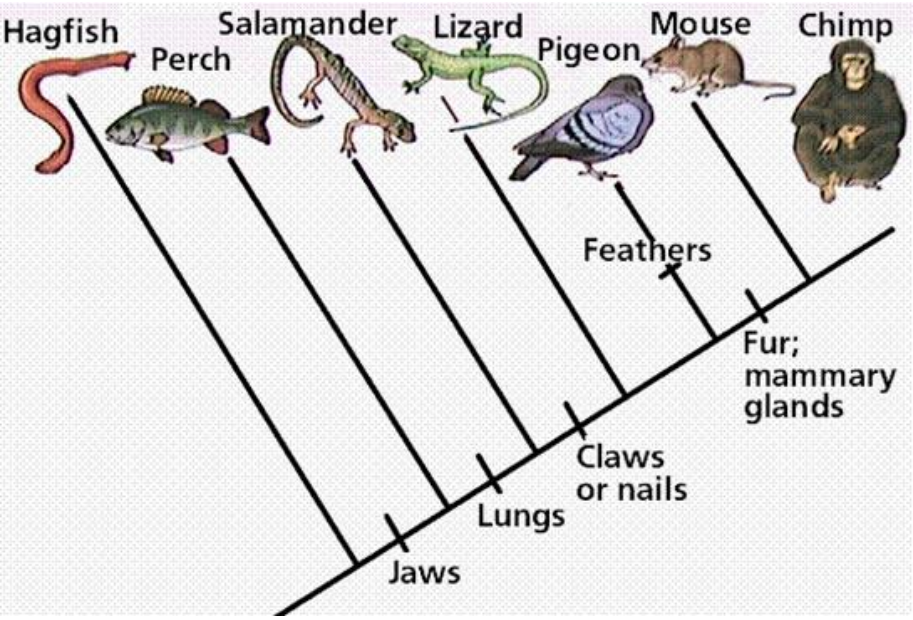
Use the cladogram to answer the follow questions # 7- 11



7. What characteristics do we know that the salamander has?
   a. Jaws, Claws/Nails, Feathers
   b. Jaws, Lungs, Claws/Nails
   c. Jaws, Claws/Nails, Fur
   d. Jaws, Lungs, Fur

8. According to the cladogram, how is the perch different from the salamander?
   a. The perch has lungs, the salamander doesn't
   b. The salamandar has lungs, the perch doesn't
   c. The perch has jaws, the salamandar doesn't
   d. The salamander has jaws, the perch doesn't

9. Which species evolved first?
   a. Perch
   b. Pigeon
   c. Hagfish
   d. Lizard

10. Which pair of organisms do you think share more DNA with each other out of the hagfish, pigeon and the salamander?
    a. Hagfish and pigeon
    b. Hagfish and salamander
    c. Pigeon and salamander

11. Explain why you choose that answer for question 10.

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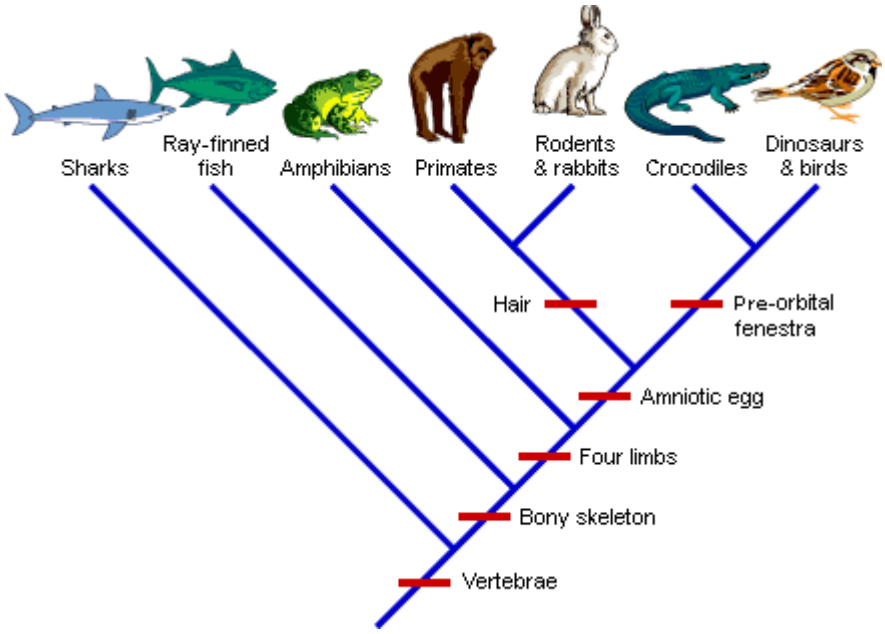
Use the cladogram below to answer the following questions #12- 17:



12. Which species evolved first: sharks or ray-finned fish?
    a. Sharks
    b. Ray-finned fish

13. What trait separates sharks and ray-finned fish from each other?
    a. Amniotic Egg
    b. Four Limbs
    c. Bony Skeleton
    d. Vertebrae

14. What are the only types of animals that have the pre-orbital fenestra?

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15. What trait do all of these animal species have in common with one another?

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16. Which are more closely related: "primates and rodents", or "primates and amphibians"? How do you know?

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17. What additional evidence could you use to confirm that these two are, in fact, most closely related?

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