WHALE DNA Discussion 2015

You will find that the numbers sort into two groups: Pairs with 2-4 differences, then pairs with 7-18 differences.

1. List the pairs of species with only 2-4 differences in their DNA (show number of differences for each pair)

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2 Porpoise - Sperm Whale	3	3
3	3	4
3	3	4

2. Notice in the 9 pairings listed above that there are 4 species that are found in all 3 possible combinations with each other. What are those **4 species**? (Give common names, as used on the strips):

3. What does this suggest about how close those 4 species are related to each other (or how relatively recent they branched from a common ancestry?

4, Then there are 3 species that are found in their own 3 possible combinations. What are those **3 species**?

5. What does this suggest about how close those 3 species are related to each other (or how relatively recent they branched from a common ancestry)?

6. Notice that there is a gap in the number of differences between pairs of DNA segments, showing none with 5-6 differences, and only one psit with 7 differences. **What two species** show 7 differences?

7. What does that suggest about **when** those two species (#6) branched from each other relative to when the other two groups (#2 and #4) branched from each other?

8. The remaining pairings all range between 8 and 18 differences in this segment of DNA. What are the **2 remaining species** that were not listed already?

9. From the above information, about **how long ago** did these last 2 species share a common ancestor compared to when the first group of 4 species, the second group of 3 species, and the third group of 2 species first appeared? This last sharing (#8) of a common ancestor was... A) more recent than those three groups; B) about the same time as those three groups; or C) earlier than those three groups. **How can you tell?**

10. As for our original question, to which species are cetaceans (whales) most closely related?

Comparing the specific numbers of differences between these last 4 species and those previous 7 species can be a little tricky, mainly because differences of 1-3 don't seem very significant, and the range is fairly wide (from 8 to 18, with no real gaps in the continuum). However, for our purposes, this isn't important.

11. Using the analysis you've made above, try drawing a "family tree" with all the species we've looked at here. Show short branches for closely related (recently branching) species, and longer branches for the more distantly related species. Label the common name for each species at the end of each branch   Most people find it easier to draw the tree as if it's lying on its side, with the "trunk" end to the left, and the shorter branches on the right. You might want to practice before drawing it in neatly in lower box.

Here's a sample tree, using groups of carnivores:

House cat
Leopard
Lion
Tiger

Dog
Wolf
Coyote

Seal
Bear
Skunk

Bat
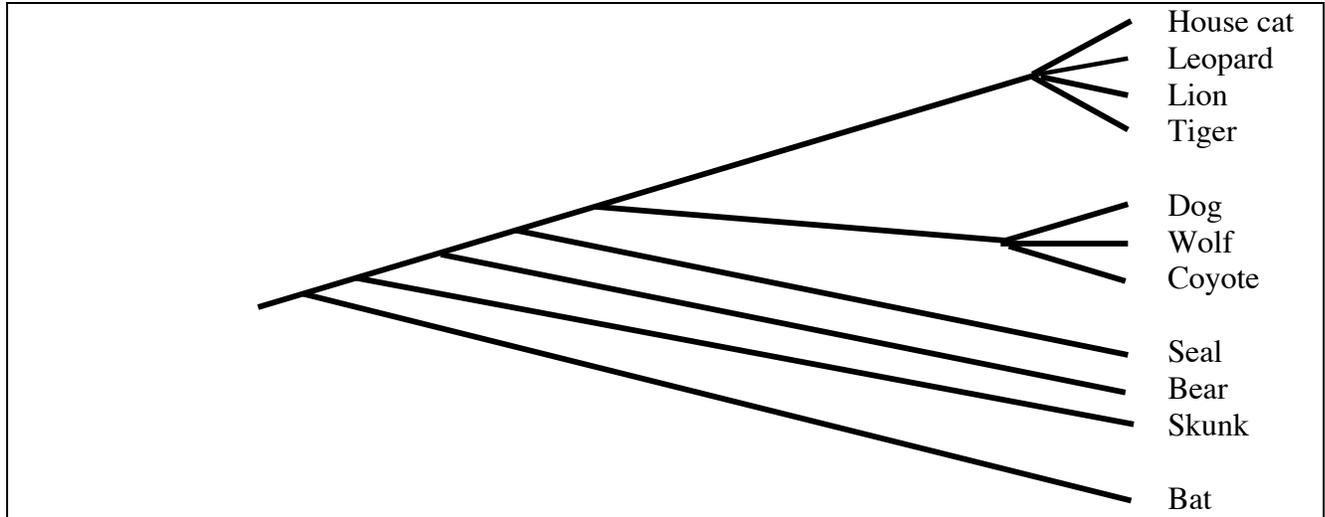
Family Tree for Cetaceans and Artiodactyls:
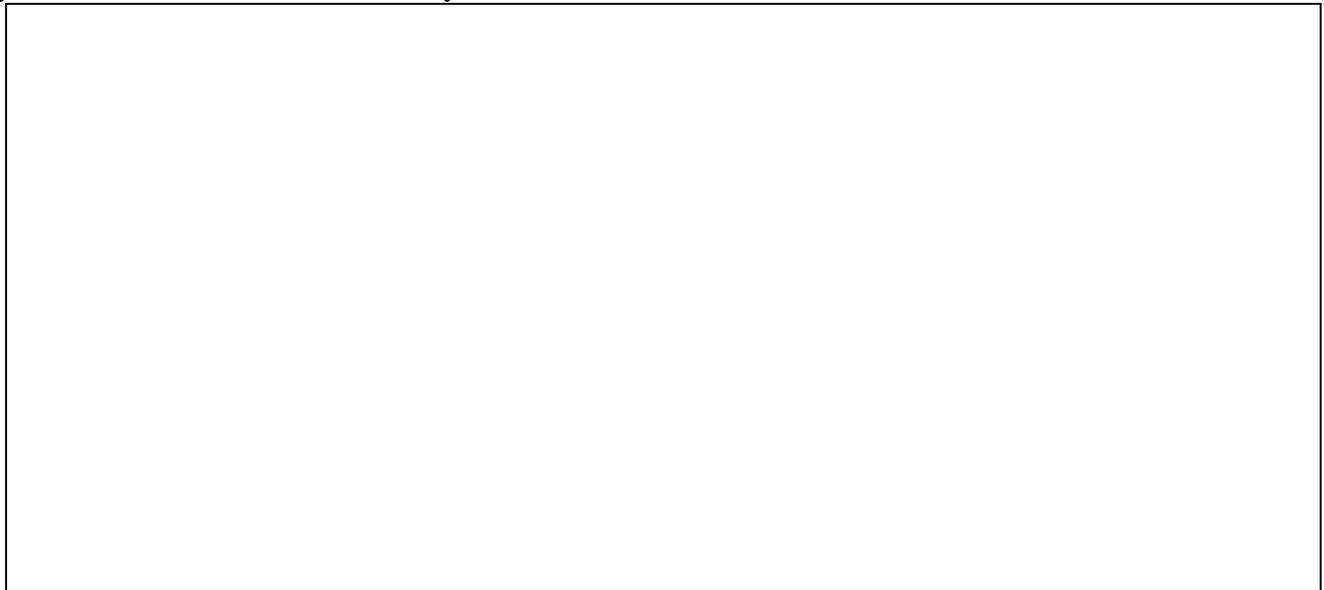
EXTENSION

Now that you've done a lot of the hard work, you'll be happy to hear that there are sophisticated computer programs, with online access by anyone, that can not only compare very large DNA segments (even entire genes) between many different species, but can also draw branching "family trees" based on those differences, showing which groups are most closely related (most recently branched from a common ancestor) and those that are more distantly related (longer branches from common ancestry at an earlier time). Different genes may give slightly different results, but overall, looking at many genes and many representatives of each group, a fair amount of consensus has emerged, generally consistent with the small sampling that you've looked at here. In fact. cetaceans and artiodactyls are now tentatively combined in the single order "Cetartiodactyla."

If you would like to use those online tools to compare and draw trees for any particular group of animals, ask your teacher about doing the Tutorial lesson: "**Investigating Evolutionary Questions: Using online Molecular Databases**,"