BLOSSOMS Video Teacher's Guide:
Classifiying Animals by Appearance Versus DNA Sequence
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<u>Learning objectives:</u> Students will learn how to categorize organisms into phylogenetic trees, which are visual diagrams that represent how closely or distantly organisms are related. Students will learn to generate these trees in two ways, first using a comparison of the organisms' physical characteristics, and second using a comparison of the organisms' DNA sequence.

<u>Prerequisite knowledge:</u> Students should have already learned that DNA is the genetic material, that DNA is made up of As, Ts, Gs, and Cs, and that each species has a different and unique DNA sequence. It will be helpful if students have learned how to write DNA sequences previously, although this will be reviewed briefly in the lesson.

<u>Necessary Supplies:</u> Only paper and writing utensils are necessary, and the ability to print out or display the provided handouts.

<u>Length of Time Needed to Complete the Lesson:</u> The video footage for the lesson lasts for 34 minutes. This footage along with the activities in between each section can be completed in a total of 60-90 minutes, or 1 to 2 class periods, depending on the previous experience students have had with DNA sequences and with thinking about the relationships between organisms.

<u>Lesson Outline:</u> The activities that occur in between each lesson segment include deciding which organisms are most closely related to each other, making phylogenetic trees, counting differences in DNA sequence between organisms, and discussing answers to group discussion questions. More specifically, below are the activities the students will perform after each segment:

-- After Segment #1: Students pick which 2 of 10 mammals they think are most closely related.

-- After Segment #2: Students decide how to place 3 animals (rat, frog, and mouse) into a sample tree with three empty branches, based on appearance.

-- After Segment #3: Students decide how to place 10 mammals into a tree with 10 empty branches, based on appearance.

-- After Segment #4: Students decide how to place 3 animals into a sample tree with three empty branches, based on DNA sequence.

-- After Segment #5: Students count the pairwise DNA differences between sequences from 3 animals, so as to see how they could have done the activity after Segment #4 quantitatively.

-- After Segment #6: Students count the pairwise DNA differences between sequences from 10 mammals and fill in a chart with those numbers of differences

-- After Segment #7: Students decide how to place 10 mammals into a tree with 10 empty branches, using the chart of differences that they filled in after Segment #6.

-- After Segment #8: Students discuss whether all student groups in their class made the same trees based on physical characteristics, and the same trees based on DNA sequence.

-- After Segment #9: Students discuss which tree method is used currently by scientists.

-- After Segment #10: Students pick which organism from the tree they made after Segment #7 surprised them the most, in terms of its placement in the tree.

-- After Segment #11: Students go back to their DNA-based tree to see where the two organisms are found that they picked to be the most closely related after Segment #1.

The Challenge Lesson: The challenge lesson is described in the second half of the Video Teacher's Guide. The prerequisite for this lesson is completing the first lesson. The necessary supplies are computers, the internet, and the three handouts listed on the BLOSSOMS website under "Download Challenge Lesson." The students can do this part of the lesson either in school or as an assignment to do at home in about the length of one class period, approximately 45-60 minutes. All necessary instructions for the students doing the challenge lesson are provided within the handouts, and a step-by-step explanation of the lesson is provided to teachers at the end of the Video Teacher's Guide.