BLOSSOMS Video Teacher's Guide

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Learning objectives: Students will learn how we can search through the whole genome of a dog to find which region(s) of that genome are associated with some specific trait/disease. Students will see footage of this experiment actually occurring in lab so they can visualize what this would look like. Students will learn how to analyze the data generated by these experiments to find the region of the genome for one specific trait.

Prerequisite knowledge: It would be helpful if the students had already learned that DNA is the genetic material, that DNA is made up of As, Ts, Gs, and Cs, and that differences in DNA between people can explain why some people get genetic disorders that others do not get.

Necessary Supplies: Only paper and writing utensils (and preferably a board at the front of the room) are necessary, and the ability to print out or display the provided handouts.

Part 1. Dog breeds.

a. Show pictures of dogs, prompt students to discuss what they were bred for (exercise #1)

Part 2. Making dog breeds

a. Discuss purpose of breeds shown in part 1
b. Give picture with many dogs, ask students which dogs they would use to create a large, brown dog breed (exercise #2)

Part 3. Diseases and dog breeds

a. In picture from part 2, tag some as having a disease (cancer)
b. Show that by choosing just a few dogs to create breed, disease can go from rare to common
c. Ask students what diseases they think dogs get.

Part 4. Why do we look for genes in dogs?

a. People and dogs get same diseases
b. We find genes by looking for differences in the DNA of sick and healthy individuals.
c. Because any two people are more different than any two dogs of the same breed, in people, it is harder to know which differences in the DNA of people are causing the disease and which are causing other differences.
d. Because dogs in a breed are so similar, it is easier to find the differences that cause disease.
e. Briefly mention of what the dog genome is: 39 chromosomes that hold all DNA needed

to make a dog. Remind students that DNA is made up of As, Ts, Gs, Cs. Explain idea of a SNP (single base difference in DNA between two dogs)

f. Ask students how many letters of DNA they think are present in one cell in a dog, and what percentage of those letters would be different between two dogs of the same breed.

Part 5. How do we look for genes in dogs?

a. Go over size of dog genome and how genetically identical members of a breed are.
b. Give concrete example of trait we are going to study as an example in this lesson: white coat color / deafness gene – explain trait very briefly.
c. Explain that we look at 170,000 SNPs in each dog spread across whole genome.
d. We find out what a dog looks like at each SNP: follow sample starting with taking blood sample from dog, isolating the DNA from the blood cells, then running DNA on Illumina scanning machines (show lab footage here), and getting data out.
e. Once we have the SNP data, what types of patterns are we looking for?
f. Give correlation worksheet and ask them to fill into the chart what DNA letters they would expect to find in which positions in which dogs, given the labels in the axes that describe how correlated each position is to the trait of interest (exercise #3).

Part 6. Students map locus for coat color

a. Go over answers to chart.
b. Show actual genome-wide graph of association data.
c. Explain graph in context of Megan's exercise.
d. Show that the genome-wide graph - tells us to look closer at chromosome 20
e. Give them data for the SNPs in the chromosome 20 region (using the group of 15 worksheets, one for each pair of students, with dog DNA sequence data), explain how to fill in chart on board. Ask each pair of students to fill in chart on board with the data from their two dogs (exercise #4).

   Note: It is important that all 15 worksheets are used, and all 15 rows in the table are filled, for this exercise to work.

Part 7. Finding the coat color gene

a. Show filled in chart
b. Explain how it tells us where to look for the coat color gene is
c. What is in the genome at that point? Discuss idea of genome browser
d. Go to computer, look up region and gene on UCSC website
e. Look at function of gene – both color and deafness!