**Virtual FlyLab**

**Exercise 8:  Three-Point Crosses, Gene Order (Optional)**

1. Three sex-linked mutations, white eyes, yellow body, and miniature wings were used in the earliest mapping experiments by Sturtevant and Morgan. Mate a male fly that carries all three mutations with a wild type female and then do a test cross on the F1 female.

a. Identify the paired recombinant events based on relative frequencies of progeny. (If you work directly from the results page, you must first combine males and females for each phenotype -- alternatively, you can go to the Chi-square page where males and females are already added together.)

b. Determine the fraction of progeny that fall into each recombinant class by dividing by the total number of flies counted.

c. Verify the identity of the parental pair (which you already know from the original cross).

d. Identify the double recombinant pair.

e. Identify the middle genetic locus.

f. Identify the two single crossover pairs

g. Determine the corrected map distances between each of the possible pairings of these three loci, adding in double crossover frequencies where appropriate.

h. Reexamine your data, looking only at those classes of progeny in which the two outside loci have recombined. This is equivalent to examining a two point cross. How much does the apparent distance between these two loci differ from the corrected distance, which is based on a three point cross.

1. Set up another experiment in which you can mate a female that is heterozygous at all three of the loci in question 1 with a wild type male. Repeat all of the exercises in question 1, looking only at male progeny of the new cross. How closely do the results of the two experiments correlate?
2. The loci for sable body, bar eyes, and cross-veinless wings are also sex linked. Determine whether each of these mutations is dominant or recessive, and then perform appropriate three point crosses to determine their map positions relative to loci whose locations you already know from problem 1 or earlier parts of this problem. (Remember that wild-type is recessive to a dominant mutation. Also, be aware that you can only use one mutation at a time from each category in the Virtual FlyLaband plan your crosses accordingly.).
3. Sepia eyes and ebony body are linked.

a. Determine the nature of each of the mutations.

b. Do two point crosses for each combination and construct a rough map of the linkage group.   
c. Calculate the interference to crossing over that was observed in your two point cross.

d. Aristapedia antennae is very closely linked to one of these two markers. Determine the nature of the AR mutation and see if you can place it on your map relative to the other two mutations. (Remember that the test parent must be all recessive, and that the fly that you select for recombinant studies must be heterozygous for all of the markers you are examining.)

1. All of the makers in this exercise are recessive and carried on chromosome II. Perform the following steps to obtain a partial map of chromosome II and to examine the underestimation of map distance that occurs in direct measurements between distant markers. Note that VFL can only work with one eye color mutation at a time. Also, vestigial wings and apterous wings cannot be used in the same cross. In addition, these two mutations are epistatic to wing shape mutations.

a. Measure the distance from purple eyes to apterous wings in a two point cross.

b. Use a three point cross to identify the middle locus and measure apparent map distance among black body, apterous wings and purple eyes.

c. Use a three point cross to identify the middle locus and measure apparent map distances among dumpy wings, black body, and purple eyes.

d. Use a three point cross to identify the middle locus and measure apparent map distances among apterous wings, black body, and brown eyes. (If you wish to shorten this exercise, you may skip to part g at this time. However, doing so will reduce the accuracy of your final result by reducing the number of intermediate measurements available.)

e. Use a three point cross to identify the middle locus and measure apparent map distances among brown eyes, curved wings, and black body.

f. Use a three point cross to identify the middle locus and measure apparent map distance among curved wings, purple eyes, and black body.

g. Construct a map of chromosome II, using the intermediate distances obtained in all of the exercises above. Use the map to determine the distance between brown eyes and dumpy wings as accurately as you can.

h. Measure the distance from brown eyes to dumpy wings in a two point cross. How do you reconcile the difference between this measurement and the map distance obtained in part g?

http://mandevillehigh.stpsb.org/teachersites/laura\_decker/introl\_flylab\_exercises.htm