**LAB 5**

**GENE MAPPING**

In this study you will learn about a modification of Mendelian inheritance which is also an important source of genetic variation.

You are about to perform what looks like a classic dihybrid testcross ("***A***" is the gene for eye color and "***B***" is the gene for wing color.)

***A*** allele for red eyes

***a*** allele for white eyes

*B* allele for clear wings

*b* allele for spotted wings

(***AaBb***) X (***aabb***) Note the genotypes and phenotypes.

**Question #1:** Predict the expected phenotypic ratio of this P X P cross.

**Observed results:**

500 red eyes clear wings

500 white eyes spotted wings

**Question #2:** How do the expected results compare with the observed results?

**Question #3:** Considering Mendel's second law (regarding dihybrid crosses), suggest an explanation for the discrepancy between the observed results and those predicted.

Genes are located at specific positions on a chromosome. The distance between genes is measured in terms of "mapping units". In this exercise the gene for wing phenotype “***B***” will be moved from its original position of zero to different positions on the chromosome. You will observe the effect of this gene movement.

First, gene **"B"** (wing color) is moved from position zero to position 10 on the same chromosome. Gene **"A"** (eye color) stays at position 0.

**Observed Results: (position 10)**

450 red eyes clear wings

50 red eyes spotted wings

50 white eyes clear wings

450 white eyes spotted wings

**Question #4:** How do these results differ from those predicted by Mendel's second law?

**Question #5:** From those in the first cross?

**Question #6:** Can you suggest a hypothesis to explain these new results?

Gene **"B"** (wing color) is now moved to position 20 on the same chromosome. Gene **"A"** (eye color) stays at position 0.

**Observed Results: (position 20)**

400 red eyes clear wings

100 red eyes spotted wings

100 white eyes clear wings

400 white eyes spotted wings

**Question #7:** How do the proportions of the phenotypic classes in this cross differ from the proportions you obtained in the earlier crosses?

The wing color gene **"B"** is now moved farther away (positions 30, 40, 50, and 60).

**Observed Results: (position 30)**

340 red eyes clear wings

158 red eyes spotted wings

162 white eyes clear wings

340 white eyes spotted wings

**Observed Results: (position 40)**

292 red eyes clear wings

220 red eyes spotted wings

195 white eyes clear wings

293 white eyes spotted wings

**Observed Results: (position 50)**

250 red eyes clear wings

250 red eyes spotted wings

250 white eyes clear wings

250 white eyes spotted wings

**Observed Results: (position 60)**

250 red eyes clear wings

250 red eyes spotted wings

250 white eyes clear wings

250 white eyes spotted wings

**Question #8:** Prepare a line graph plotting the % of recombinant offspring (Y-axis) vs. difference in position between the two genes (X-axis). (Hint: your graph should be **one line** with labeled points at map positions 0, 10, 20, 30, 40, 50, & 60).

**Question #9:** A genetic definition of "1 map unit" is the distance between 2 genes that gives 1% recombinants out of the total number of progeny. Using this definition, how many map units separate the **"A"** and **"B"** genes when the eye color gene **"A"** is at position 0 and the wing color gene **"B"** is at position 40? (Show how you determined the results.)

**Question #10:** How does the distance between two genes on the same chromosome affect the proportion of recombinants? Why?

**Question #11:** Maximum crossover frequency can be defined as the point at which no more recombination can be detected no matter how far apart the genes are located. Do your results (**please specify**) indicate that you are approaching the maximum crossover frequency?

**Question #12:** Show (using a Punnett Square) the expected phenotypic ratios if the two genes were located on different chromosomes.

**Question #13:** Which of your simulated cross or crosses (**please specify**) do the data from the Punnett Square most closely fit? Why?

**Question #14:** A wild-type fly (heterozygous for gray body color and normal wings - b+ vg+/b vg) was mated to a black fly with vestigial wings (b vg/b vg). The F1 had the following phenotypic distribution: wild type, 285; black body - vestigial wings, 285; black body - normal wings, 210; gray body - vestigial wings, 220. What is the recombination frequency (RF) between these genes for body color and wing type? **(show work)**

**Question #15:** A cross produced 1800 offspring with normal pigment and 900 with albinism.

Conclusion? (Please show **ALL WORK** to receive full credit!).

**NOTE: Please show all work to support your answers.**