

## Fruit Fly Exercise 5

### Goal

In this exercise, you will use StarGenetics, a software tool that simulates mating experiments, to analyze the nature and mode of inheritance of specific genetic traits.

### Learning Objectives

After completing this exercise, you will be able to:

1. Identify the phenotype of a fruit fly within StarGenetics.
2. Determine whether a phenotype is dominant or recessive relative to another phenotype through the analysis of results from genetic crosses.
3. Infer and assign genotypes of individual organisms using proper nomenclature of alleles.
4. Generate a genetic map that specifies the map distances between alleles.

### Getting started with StarGenetics

- To get to StarGenetics, please navigate to: <http://star.mit.edu/genetics/>.
- Click on the **Start** button to launch the application.
- Click **Trust** when a prompt appears asking if you trust the certificate.
- Click on **File → New** on the main menu.
- Click on the **Fruit Fly Exercise 5** file.

You are studying three distinct traits in fruit flies: body color, wing size, and antennae length. You come across six different fruit flies and decide to determine the nature and mode of inheritance of these traits. These flies (called Fly #1 – Fly #6 in the **Strains** box in StarGenetics) are true breeding (homozygous for all alleles). You may assume that each trait is controlled by a single gene.

**1** You first perform three mating experiments: Fly #1 x Fly #2, Fly #3 x Fly #4, and Fly #5 x Fly #6. What are the phenotypes and genotypes that you obtain from each mating experiment? Score 100 progeny for each experiment and indicate the number of F1 flies that correspond to each phenotype. Use the letter B for body color, W for wing size, and A for antennae length. For each gene, use the upper case letter to represent the allele associated with the dominant phenotype and the lowercase letter to represent the allele associated with the recessive phenotype.

- To set up a cross, drag the specific parent flies to the **Mating site** and click on the **Mate** button.
- Mating results can be seen on the **Summary** tab and each resulting individual offspring can be viewed by clicking on the **Individual** tab.
- To keep track of your experiments, you can click on the **New experiment** button in the main menu and your current experiment will automatically be saved in the **Saved experiments** window.

Mating experiment	Flies	F1 progeny	
		Phenotypes	Genotypes
I	Fly #1 x Fly #2		
II	Fly #3 x Fly #4		
III	Fly #5 x Fly #6		

**2** Based on your answer to question 1, for each trait, what is the dominant phenotype and what is the recessive phenotype?

Trait	Dominant Phenotype	Recessive Phenotype
Body color (brown/gray)		
Wing size (winged/wingless)		
Antennae length (small/long)		

**3** Based on these experiments, indicate the genotypes of the following flies. Use the letters B/b, W/w, and A/a to write the genotypes as you did in Question 1.

Flies	Genotypes
#1	
#2	
#3	
#4	
#5	
#6	

**4** Next, cross F1 individual flies from each mating experiment and analyze 1000 resulting progeny.  
*Note: Meiotic recombination only occurs in female Drosophila melanogaster and does not occur in males. In this exercise however, StarGenetics is modeling meiotic recombination in male and female flies to focus on the genetics concepts instead of species-specific biology.*

a) What are phenotypic and genotypic ratios you obtain?

- To add additional progeny to an experiment, click the **Add more matings** button.

Source of F1 progeny	Phenotypic ratio	Genotypic ratio
Mating Experiment I (See Question 1) F1 x F1		
Mating Experiment II (See Question 1) F1 x F1		

Mating Experiment III (See Question 1) F1 x F1		

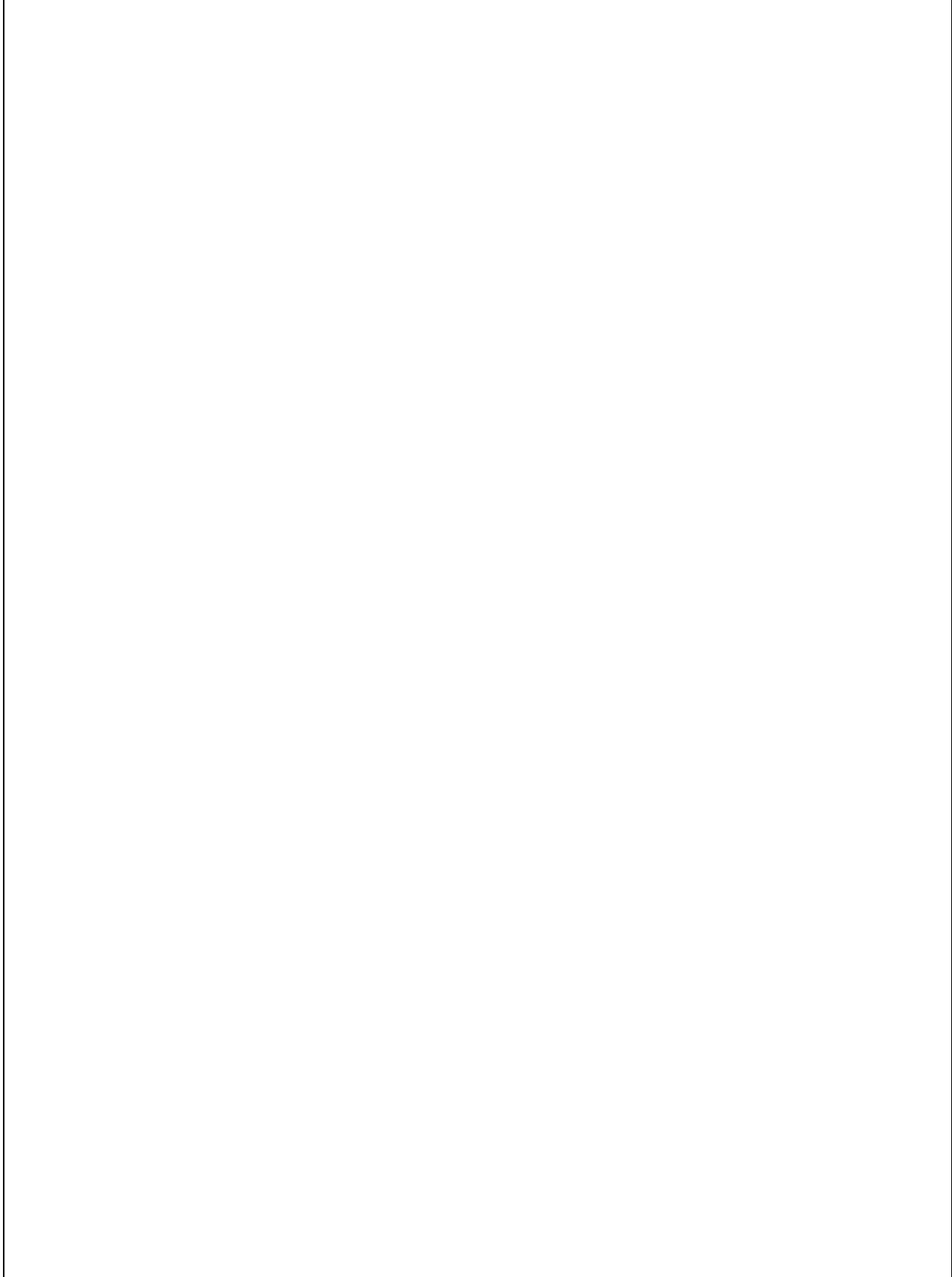
b) Based on your results in the table above, indicate which genes are linked and which ones are unlinked.

**Answer**

**5** You now want to determine the distance between any of the genes that you believe are linked. For these experiments, you are provided with three true breeding double mutant fly strains (called Fly #7 - #9 in the **Strains** box in StarGenetics). For any genes that you believe are linked, mate F1 progeny from Mating Experiments I-III (Question 1) with the appropriate double mutant fly strain provided to you to determine the distance between the linked genes.

What are the phenotypes and genotypes for the parental and recombinant classes you obtain from these mating experiments? Score 1000 progeny and indicate the number of flies that correspond to each phenotype.

**Answer:**



**6** Based on your results, create a chromosomal map containing these three genes. Indicate the map distances in centimorgans (cM).

**Answer:**