



StarGenetics

## Fruit Fly Exercise 2 - Level 2

### Description of StarGenetics

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.

### Starting StarGenetics

- To get to StarGenetics, please navigate to: <http://web.mit.edu/star/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 2 - Level 2** file.

You have been working with *Drosophila melanogaster* flies. By now, you are familiar with wild type flies and know that they have red eyes. In one of your fly vials, you discover a male fly with orange colored eyes. You are intrigued since you have never seen a fly with such an unusual eye color. You call this mutant “**Orangeye**”. You decide to do some genetic analysis of this unusual mutant. To do this, you set up a cross between the **Orangeye** mutant and a wild type female.

- Drag the **Orangeye** mutant and the wild type female to the **Mating site**.
- Click on the **Mate** button.

#### 1 Describe the progeny that results from this cross.

- Each resulting offspring can be viewed by clicking on the **Individual** tab or a summary of the results is available in the **Summary** tab.

**Answer**

Number of flies that look like the wild type parent:

Number of flies that look like the Orangeye parent:

Total number of progeny:

#### 2 Based on these results, does the mutant allele that confers Orangeye appear to be dominant or recessive relative to wild type? How can you tell?

- You can use the **Punnett Square** tool to help decipher genotypes for a given trait.
- In the **Punnett Square** tool, click on the different genotypic options to see the resulting genotypic ratios.

**Answer**



StarGenetics

**3** You intended to separate the F1 males from the F1 females (from the cross in question 1, above) as soon as they emerged. Unfortunately, school closes due to a snowstorm and by the time you get back to your flies, you find that the F1 flies have emerged and mated! You decide to make the best of it and analyze the F2 progeny obtained from this cross. While you wait for the F2 larvae to mature into flies, you decide to predict what F2 progeny will result from this cross. **Show your predictions below (before using StarGenetics to perform the cross) and indicate the genotypic and phenotypic ratios that you expect.** Your predictions should be based on your answer to question 2.

**Answer**

**4** Now go ahead and actually mate an F1 female to an F1 male.

- To start a new mating click on the **Save experiment** button.
- Perform mating as previously described.

**a) What results do you observe?** Indicate the phenotypic ratios from this cross. **Do the results match your predictions?**

**Answer**



StarGenetics

**b) What hypothesis could explain the phenotypic ratios you observe for the F2 generation?**  
Explain your reasoning and show your work.

**Answer**

**5** You share your unusual results from question 4 with a friend who is also studying genetics in a *Drosophila* lab. She tells you that she has a fly strain with another mutant eye color, white. Your friend gives you a female fly, **Whiteye**, from her true-breeding white-eyed fly stock. She also tells you that the mutant allele that confers white eyes in this strain is recessive to wild type.

**a)** Set up a cross between **Orangeye** and **Whiteye**. *Based on the results you obtain, please indicate whether the mutations in Whiteye and Orangeye are in the same gene or in different genes.* Explain your answers and show your work.

**Answer**



StarGenetics

**b) Is the mutation that confers white eyes in the Whiteeye mutant found on the X-chromosome or on an autosomal chromosome?** Set up a series of cross(es) that will allow you to answer this question. Explain the rationale behind these crosses and show their results.

**Answer**



StarGenetics

**6** Your friend gives another homozygous true breeding female fly from a different white-eye fly strain that you name **Whiteye 3**. She tells you that based on the results you have obtained on question 4 she believes that the **Whiteye 3** mutation is located in the same chromosome as the **Orangeye** mutation.

**a) Is the mutation in Whiteye 3 located in the same gene or in a different gene from the Orangeye mutation? If the Whiteye 3 mutation is located in a different gene from Orangeye, then determine if it is linked or unlinked to the Orangeye gene.** Set up a series of cross(es) that will allow you to answer this question. Explain the rationale behind these crosses and show their results.

**Answer**



StarGenetics

**b) Integrate what you know about Whiteeye 1, 2, 3 and Orangeye to make a genetic map of the chromosome in which mutation Orangeye is found. Please indicate any distances between genes when relevant. If any of the gene(s) is found in a different chromosome indicate this as well.**

**Answer**