

Fruit Fly Exercise 6

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. Determine whether mutations are in the same or different genes.
2. Design genetic crosses and analyze experimental results to construct a linear biochemical pathway that illustrates the relationship between genes.
3. Design an experimental strategy to isolate organisms with a specific genotype.
4. Describe how a mutation in an enzyme can alter the products of a biochemical pathway.

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 6** file.

You are studying the synthesis of a pigment that determines eye color in a species of the common housefly. Synthesis of this pigment involves a multi-step pathway where each step is catalyzed by a specific enzyme and each enzyme is encoded by one gene.

Wild-type flies have red eyes. A fly that is missing the function of any of the enzymes in this pathway has a different eye color. You wish to identify the genes encoding the enzymes involved in the eye pigment pathway by performing a hunt for mutants. You are able to collect eight mutants, called Mutants 1-8 in the **Strains** box in StarGenetics. To answer the questions below, you may assume that the phenotype of each of the mutant strains is caused by a mutation in a single gene, the enzymes controlling eye color act in a linear pathway, and that the genes in the pathway act independently. In addition to Mutants 1-8, you are also provided with a stock of true-breeding wild-type male and female flies, called WT male and WT female in the **Strains** box in StarGenetics.

1 Based on the information provided, arrange the mutants into different complementation groups.

Answer

2 a) Construct a linear biochemical regulatory pathway that accurately describes the eye color pigmentation pathway and that includes all of the genes that you identified in Question 1. Mate the mutant flies to determine the order of the enzymes and the respective eye-color intermediates of this multi-step pathway.

Note: your pathway should include genes, not mutations.

- 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 add additional progeny, click on the **Add more matings** button.
- 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.

Answer

b) Describe the crosses you performed, their outcomes, and the conclusion that you drew from each of the crosses to determine the order of the genes within the eye pigmentation pathway.

Answer: