Massachusetts Institute of Technology HHMI

Name_____

StarGenetics

Fruit Fly Exercise 8

Objective:

Your objective for this virtual laboratory project is to use genetic crosses to discover the mode of inheritance via which a mutant phenotype is transmitted from parent to offspring for each mutant fly.

Exercise:

In today's virtual laboratory exercise, you will use the StarGenetics software tool to carry out simulated genetic crosses that model the four modes of inheritance listed below:

a. Autosomal recessive
b. Autosomal dominant
c. X-linked recessive
d. X-linked dominant

You are studying the mode of inheritance of eye color in flies. You have isolated four true-breeding mutant strains with ***green eyes***. In contrast, wild-type flies have ***red eyes***. In your **Strains** box in StarGenetics you will find 1) **homozygous mutant** male and female flies for each mutant strain and 2) **homozygous wild-type** male and female flies. In each of the four mutant strains, the **mode of inheritance** underlying the green-eye phenotype is **DIFFERENT**. You will use StarGenetics to determine amongst the four modes of inheritance listed above for green eyes in **EACH** mutant strain by performing the same series of tasks. Below is a summary of the tasks you will perform for each mutant strain. The following page contains detail instructions of how to perform each cross in StarGenetics.

1 First, perform reciprocal cross A by crossing a wild-type female with a mutant male to generate F1 progeny. Observe the phenotypes of the F1 progeny flies resulting from this reciprocal cross.

2 Next, cross an F1 female with an F1 male, both obtained from reciprocal cross A, to generate F2 progeny. Observe the phenotypes of the F2 progeny flies from this reciprocal cross.

3 Next, perform reciprocal cross B by crossing a mutant female with a wild-type male to generate F1 progeny. Observe the phenotypes of the F1 progeny flies resulting from this reciprocal cross.

4 Next, cross an F1 female with an F1 male, both obtained from reciprocal cross B, to generate F2 progeny. Observe the phenotypes of the F2 progeny flies from this reciprocal cross.

5 Use your observations to determine the mode of inheritance for green eyes in each case. Use the Punnett squares provided at the end of the exercise to work through your predictions while you decipher the mode of inheritance for each mutant strain. In addition, you are required to complete the Punnett squares for the F1 X F1 cross for each reciprocal mating.

Getting started:

- 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** in the drop-down menu in the upper left hand corner.
- Click on the **Fruit Fly Exercise 8** file.

I. Determining the mode of inheritance of green eyes in Mutant1

Reciprocal Cross 1A: Wild-type Female x Mutant1 Male

- Set up a cross by dragging the indicated flies within the **Strains** box, one at a time, to the **Mating Site** and clicking on the **Mate** button.
- Each resulting offspring can be viewed within the **Individual** tab or a summary of the results is available on the **Summary** tab.

a) What eye color phenotype(s) do you observe among the F1 progeny? Do you see a difference in eye color between the F1 females and the F1 males? If so, describe this difference.

Answer

b) What eye color phenotype(s) do you observe among the F2 progeny from this cross? Do you see a difference in eye color between the F2 females and the F2 males? Indicate the percent of red-eyed and green-eyed flies in the F2 females and males. What is the ratio of red-eye to green-eyed flies in the F2 females and males?

- To start a new experiment, click on the **Save experiment** button.
- Set up a new cross by dragging the individual F1 flies within the **Individual** tab to the **Mating Site** and clicking on the **Mate** button.

Answer

c) Based on your results so far, what mode of inheritance do you predict that the Mutant1 strain models?

Answer

Reciprocal Cross 1B: Mutant1 Female x Wild-type Male

a) What eye color phenotype(s) do you observe among the F1 progeny? Do you see a difference in eye color between the F1 females and the F1 males? If so, describe this difference.

Answer

b) What eye color phenotype(s) do you observe among the F2 progeny from this cross? Do you see a difference in eye color between the F2 females and the F2 males Indicate the percent of red-eyed and green-eyed flies in the F2 females and males. What is the ratio of red-eye to green-eyed flies in the F2 females and males?

Answer

Based on your observations from both reciprocal crosses, what is the mode of inheritance for the mutant green-eye phenotype in Mutant1? Diagram the F1 x F1 cross for each reciprocal cross involving Mutant1. Use the Punnett squares below to write out the expected genotypes of the F2 progeny for each F1 X F1 reciprocal cross.

Answer

F1 x F1 for Reciprocal Cross 1A:

F1 x F1 for Reciprocal Cross 1B:

II. Determining the mode of inheritance of green eyes in Mutant2

Reciprocal Cross 2A: Wild-type Female x Mutant2 Male

a) What eye color phenotype(s) do you observe among the F1 progeny? Do you see a difference in eye color between the F1 females and the F1 males? If so, describe this difference.

Answer

b) What eye color phenotype(s) do you observe among the F2 progeny from this cross? Do you see a difference in eye color between the F2 females and the F2 males? Indicate the percent of red-eyed and green-eyed flies in the F2 females and males. What is the ratio of red-eye to green-eyed flies in the F2 females and males?

Answer

c) Based on your results so far, what mode of inheritance do you predict that the Mutant2 strain models?

Answer

Reciprocal Cross 2B: Mutant2 Female x Wild-type Male

a) What eye color phenotype(s) do you observe among the F1 progeny? Do you see a difference in eye color between the F1 females and the F1 males? If so, describe this difference.

Answer

b) What eye color phenotype(s) do you observe among the F2 progeny from this cross? Do you see a difference in eye color between the F2 females and the F2 males? Indicate the percent of red-eyed and green-eyed flies in the F2 females and males. What is the ratio of red-eye to green-eyed flies in the F2 females and males?

Answer

Based on your observations from both reciprocal crosses, what is the mode of inheritance for the mutant green-eye phenotype in Mutant2? Diagram the F1 x F1 for each reciprocal cross involving Mutant2. Use the Punnett squares below to write out the expected genotypes of the F2 progeny for each F1 X F1 reciprocal cross.

Answer

F1 x F1 for Reciprocal Cross 2A:

F1 x F1 for Reciprocal Cross 2B:

III. Determining the mode of inheritance of green eyes in Mutant3

Reciprocal Cross 3A: Wild-type Female x Mutant3 Male

a) What eye color phenotype(s) do you observe among the F1 progeny? Do you see a difference in eye color between the F1 females and the F1 males? If so, describe this difference.

Answer

b) What eye color phenotype(s) do you observe among the F2 progeny from this cross? Do you see a difference in eye color between the F2 females and the F2 males? Indicate the percent of red-eyed and green-eyed flies in the F2 females and males. What is the ratio of red-eye to green-eyed flies in the F2 females and males?

Answer

c) Based on your results so far, what mode of inheritance do you predict that the Mutant3 strain models?

Answer

Reciprocal Cross 3B: Mutant3 Female x Wild-type Male

a) What eye color phenotype(s) do you observe among the F1 progeny? Do you see a difference in eye color between the F1 females and the F1 males? If so, describe this difference.

Answer

b) What eye color phenotype(s) do you observe among the F2 progeny from this cross? Do you see a difference in eye color between the F2 females and the F2 males? Indicate the percent of red-eyed and green-eyed flies in the F2 females and males. What is the ratio of red-eye to green-eyed flies in the F2 females and males?

Answer

Based on your observations from both reciprocal crosses, what is the mode of inheritance for the mutant green-eye phenotype in Mutant3? Diagram the F1 x F1 for each reciprocal cross involving Mutant3. Use the Punnett squares below to write out the expected genotypes of the F2 progeny for each F1 X F1 reciprocal cross.

Answer

F1 x F1 for Reciprocal Cross 3A:

F1 x F1 for Reciprocal Cross 3B:

IV. Determining the mode of inheritance of green eyes in Mutant4

Reciprocal Cross 4A: Wild-type Female x Mutant4 Male

a) What eye color phenotype(s) do you observe among the F1 progeny? Do you see a difference in eye color between the F1 females and the F1 males? If so, describe this difference.

Answer

b) What eye color phenotype(s) do you observe among the F2 progeny from this cross? Do you see a difference in eye color between the F2 females and the F2 males? Indicate the percent of red-eyed and green-eyed flies in the F2 females and males. What is the ratio of red-eye to green-eyed flies in the F2 females and males?

Answer

c) Based on your results so far, what mode of inheritance do you predict that the Mutant4 strain models?

Answer

Reciprocal Cross 4B: Mutant4 Female x Wild-type Male

a) What eye color phenotype(s) do you observe among the F1 progeny? Do you see a difference in eye color between the F1 females and the F1 males? If so, describe this difference.

Answer

b) What eye color phenotype(s) do you observe among the F2 progeny from this cross? Do you see a difference in eye color between the F2 females and the F2 males? Indicate the percent of red-eyed and green-eyed flies in the F2 females and males. What is the ratio of red-eye to green-eyed flies in the F2 females and males?

Answer

Based on your observations from both reciprocal crosses, what is the mode of inheritance for the mutant green-eye phenotype in Mutant4? Diagram the F1 x F1 for each reciprocal cross involving Mutant4. Use the Punnett squares below to write out the expected genotypes of the F2 progeny for each F1 X F1 reciprocal cross.

Answer

F1 x F1 for Reciprocal Cross 4A:

F1 x F1 for Reciprocal Cross 4B: