Prelab Information

**Purpose** Explore the law of independent assortment by examining a dihybrid cross in mice.

**Time** Approximately 45 minutes

**Question** What is the effect of the inheritance of one trait on the inheritance of a second trait?

**Hypothesis** If a mouse inherits a particular form of one trait, then the inheritance of the other trait will not be affected because alleles assort independently.

**Summary** You will study two traits of mice: fur color and eye color. Throughout the lab:

• *B* represents the dominant allele for fur color (black fur).

*• b* represents the recessive allele for fur color (white fur).

*• E* represents the dominant allele for eye color (black eyes).

*• e* represents the recessive allele for eye color (red eyes).

**Variables** *Independent variable:* inheritance of the first trait

*Dependent variable:* inheritance of a second trait

Lab Procedure

1. Predict the Offspring for a Cross of True-Breeding Lineages (BBEE × bbee)

**a)** The Punnett square at the top of the data sheet is for a test cross of two true-breed mice:

 A male mouse that is BBEE, homozygous dominant for both fur color and eye color genes

 A female mouse that is bbee, homozygous recessive for both fur color and eye color genes

**b)** What will their offspring be? Fill in the white boxes of the Punnett square with all possible offspring genotypes.

**c)** For each offspring genotype in the Punnett square you just completed, determine the phenotype. In other words, for each, what will be the fur color and eye color? You may want to mark your data table.

**d)** Use that information to fill in the predicted fraction of each phenotype in the second data table.

**e)** Finally, convert the predicted ratios to predicted percentages. Divide each number by 16, then multiply by 100.

1. Simulate the Cross in Step 1

**a)** Breed ten offspring mice. You can simulate breeding using either technology or cards and craft sticks, as described in the blue box at the end.

Here is a fun way to simulate breeding using cards and craft sticks:

 Work with a partner. One partner will represent the male mouse; the other the female.

 On two cards, write down letters to represent the alleles for your mouse’s fur. So, the first partner will have two “B” cards, and the second will have two “b” cards.

 On the ends of two craft sticks, write down letters that represent the alleles of your mouse’s eyes. So, the first partner will have two “E” sticks, and the second will have two “e” sticks.

 Each person must pick one card and one stick at random to represent the alleles passed from the parent. You may wish to shuffle the cards and mix up the sticks, hiding the letters from view. The selected cards and sticks represent the alleles passed by each parent to the offspring. Together, the alleles determine the offspring’s genotype.

 Determine the phenotype for that offspring. Repeat a total of ten times, once for each of the ten offspring. Keep track of your results in your lab notebook.

**b)** In the data table, record the tally for each phenotype in the row marked “Simulated Number.”

**c)** In the row marked “Simulated Percentages,” convert the simulated numbers (out of 10) to simulated percentages (out of 100%).

**d)** Compare the predicted values to the simulated values. How does the data confirm that black fur and black eyes are indeed dominant alleles?

1. Predict the Offspring of a Dihybrid Cross (BbEe × BbEe)

Repeat step 1 using two mice from the F1 generation that are heterozygous for both fur color and eye color (BbEe).

1. Simulate the Cross in Step 3

Repeat step 2, except for two mice that are heterozygous for fur color and eye color (BbEe). If you simulate breeding using cards and sticks, both partners need to make cards and sticks that represent the alleles for a heterozygous mouse (BbEe). Don’t forget to simulate ten offspring.

1. (Optional) Combine Data from Step 5 with Classmates

Data

**Cross of True-Breeding Lineages (BBEE × bbee)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **BE** | **BE** | **BE** | **BE** |
| **be** |  |  |  |  |
| **be** |  |  |  |  |
| **be** |  |  |  |  |
| **be** |  |  |  |  |

**Punnett Square**

**Data**

**Dihybrid Cross (BbEe × BbEe)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Black Fur and****Black Eyes** | **Black Fur and****Red Eyes** | **White Fur and****Black Eyes** | **White Fur and****Red Eyes** |
| **Predicted Fraction** | /16 | /16 | /16 | /16 |
| **Predicted Percentage** |  |  |  |  |
| **Simulated Fraction** | /10 | /10 | /10 | /10 |
| **Simulated Percentage** |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **BE** | **Be** | **bE** | **be** |
| **BE** |  |  |  |  |
| **Be** |  |  |  |  |
| **bE** |  |  |  |  |
| **be** |  |  |  |  |

**Punnett Square**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Black Fur and****Black Eyes** | **Black Fur and****Red Eyes** | **White Fur and****Black Eyes** | **White Fur and****Red Eyes** |
| **Predicted Fraction** | /16 | /16 | /16 | /16 |
| **Predicted Percentage** |  |  |  |  |
| **Simulated Fraction** | /10 | /10 | /10 | /10 |
| **Simulated Percentage** |  |  |  |  |

**Data**