Prelab Information

**Purpose** Explore the relationship between genotype and phenotype.

**Time** Approximately 45 minutes

**Question** What is the effect of the genes of the parental mice on the fur color of the offspring mice? **Hypothesis** If either parent mouse passes a dominant allele, the offspring will have black fur. **Variables** *Independent Variable:*genotype of parents

*Dependent Variable:*traits of offspring

*Note:*The variables will switch their roles (independent vs. dependent) in steps 4 and 5.

Lab Procedure

**In each of steps 1 through 3 on the next page, you will cross a different female and male pair of mice and examine the inheritance of fur color. Repeat the substeps below each time.**

**a)** In the Punnett square, fill in the shaded boxes with the alleles of each parent. Use *B* for the dominant allele (black fur) and *b* for the recessive allele (white fur).

**b)** Fill in the unshaded boxes of the Punnett square with all possible offspring genotypes.

**c)** Based on the genotypes, fill in the table to the right with the predicted percentage (0%, 25%, 50%,

75%, or 100%) of offspring for each phenotype, black or white fur.

**d)** Confirm your prediction by simulating ten offspring. You can simulate breeding using technology or by using cards, as described below:

 Work with a partner. One represents the female mouse and the other the male mouse.

 Prepare two cards (or slips of paper) that match the alleles for your mice. For example, for step

1, both would have two B cards.

 Each partner shuffles the cards and picks one at random. The selected cards represent the alleles passed on to the offspring mouse. Together, the two alleles determine the genotype of the offspring.

 Repeat this process ten times, once for each of ten offspring. Keep track of whether the mouse had black fur or white fur.

**e)** In the data table, record the number (out of 10) and percentage (out of 100%) of each phenotype in

the rows “Simulated Number” and “Simulated Percentages.”

**f)** In the box labeled “Comparison Statement,” write a comparison of the predictions of the Punnett square with the offspring you saw.

1. Predict and Confirm the Offspring of Two Mice Homozygous for Black Fur

**Genotypes (Punnett Square) Phenotypes**

**Male**

|  |  |  |
| --- | --- | --- |
|  | **Black Fur** | **White Fur** |
| **Predicted****Percentage** |  |  |
| **Simulated****Number** |  |  |
| **Simulated****Percentage** |  |  |

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |

**Comparison Statement:**

**Female**

1. Cross a Mouse Homozygous for White Fur with a Mouse Homozygous for Black Fur

**Genotypes (Punnett Square) Phenotypes**

**Male**

|  |  |  |
| --- | --- | --- |
|  | **Black Fur** | **White Fur** |
| **Predicted****Percentage** |  |  |
| **Simulated****Number** |  |  |
| **Simulated****Percentage** |  |  |

|  |  |  |
| --- | --- | --- |
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|  |  |  |

**Comparison Statement:**

**Female**

1. Determine and Verify the Inheritance Pattern of a Hybrid Cross

Mate two black mice from the F1 generation. Both mice are hybrids.

**Genotypes (Punnett Square) Phenotypes**

**Male**

|  |  |  |
| --- | --- | --- |
|  | **Black Fur** | **White Fur** |
| **Predicted****Percentage** |  |  |
| **Simulated****Number** |  |  |
| **Simulated****Percentage** |  |  |

|  |  |  |
| --- | --- | --- |
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**Comparison Statement:**

**Female**

1. Test Cross a Female with White Fur and a Male with Black Fur

This time, you’re going to work backward! Instead of doing the Punnett square first and then breeding the mice, you will breed the mice and then figure out what genotype the parents have.

Look at the picture below. In the data table, record the number of offspring with each fur color. Then convert these numbers to percentages.

**Phenotypes**



|  |  |  |
| --- | --- | --- |
|  | **Black****Fur** | **White****Fur** |
| **Given****Number** |  |  |
| **Given****Percentage** |  |  |

1. Determine the Genotypes of the Parents in the Test Cross

Remember, the female on the left should have white fur, and the male should have black fur. Their offspring should have a 50:50 ratio between black and white fur. **Hint:** Start by figuring out the female’s genotype. Then, adjust the male’s genotype until you get a 50:50 ratio in fur color among the offspring.

To help you solve that problem, try out different cases with the Punnett square below. Be sure to use a pencil so you can erase and try other combinations!

**Genotypes (Punnett Square)**

**Male**

Genotype of the female: \_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  |  |  |
|  |  |  |

Genotype of the male: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Female**