Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Predicting Genes of Offspring

**Purpose**

The purpose of this exercise is to compare expected and observed results and predict genes in sheep offspring.[[1]](#endnote-1)

**Background**

The Punnett square can be used to predict expected results from a genetic cross. In mice black coat (B) is dominant over white coat color (b). If two heterozygous parents are crossed, we would expect 3 black to every 1 white offspring. The Punnett square shows the expected results of the Bb x Bb cross.

You know observed results do not always agree with expected results. Four offspring of the Bb x Bb parents may really all be white. That is, the *observed results* may all be white. These results are not what would be expected. Of what good are *expected results*? The expected results help us determine what the observed results will *likely* be.

**Procedure**

 **Materials**

1. 2 pennies

2. Masking tape

**Sequence of Steps**

|  |  |  |
| --- | --- | --- |
|  | B | b |
| B | BBBlack | BbBlack |
| b | BbBlack | bbWhite |

**Part A: Calculating Expected Results Figure 1. Punnett Square**

Assume that a female mouse has several litters of young in one year. She is heterozygous (Bb) for coat color and mates with a male that is also heterozygous (Bb) for coat color. You can predict what kind of offspring she will have by constructing a Punnett square as shown in Figure 1. Results from mating two mice can be shown by tossing and reading coins.

1. Place 2 coins in your cupped hands and shake the coins. Drop the coins on a desktop.
2. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Examine the coins and determine whether you have 2 heads, 2 tails, or a head and a tail.
3. Make a mark (/) in Table 1 under the correct combination of genes.
4. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Repeat shaking and reading the coins for a total of 40 times. These 40 shakes will represent the combination of genes you might have observed in the offspring of several litters.
5. Count the marks for each gene combination and write the total observed in Table 1.
6. Calculate the expected number for each gene combination by using the Punnett square in Figure 1.
	1. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()First divide the number of BB squares in Figure 1 by 4; multiply that number (a percentage) by 40. Record this number as the expected number for the gene combination of BB genes in Table 1.
	2. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Repeat these calculations for Bb and bb squares. Record your values for each gene combination in Table 1.
	3. Record the colors (phenotypes) in the last row of Table 1.

![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()

Table 1. Results of Coin Tosses (Coat Color in Mice Bb x Bb)

|  |  |  |  |
| --- | --- | --- | --- |
| Coin Combinations | Head-Head | Head-Tail | Tail-Tail |
| Gene Combinations | BB | Bb | bb |
| Observed results (/) |  |  |  |
| Total observed in 40 tosses |  |  |  |
| Total expected in 40 tosses |  |  |  |
| Coat color in mice (phenotype) |  |  |  |

**Part B: Predicting Mouse Offspring Figure 2. Predicting Bb x bb**

|  |  |  |
| --- | --- | --- |
|  | B | b |
| b |  |  |
| b |  |  |

Suppose you mate a female mouse that is heterozygous (Bb) with a male that is pure recessive (bb). Predict what kind of offspring she will have by completing a Punnett square in Figure 2.

1. Place tape on both sides of the two coins and mark both sides of one coin with a “b”. Mark one side of the other coin with a “b” and the other side with a “B”.
2. Place the two coins in your cupped hands and shake the coins. Drop the coins on a desktop.
3. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Examine the coins and determine whether the offspring are heterozygous (Bb) or pure recessive (bb).
4. Make a mark (/) in Table 2 under the correct combination of genes.
5. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Repeat shaking and reading the coins a total of 40 times. The 40 shakes will show the combination of genes you observed in the offspring of several litters.
6. Count the marks for each gene combination and write the total observed in Table 2.
7. Use the method of calculating expected numbers for each gene combination as in Part A, step 6, by using the Punnett square in Figure 2.
8. ![C:\Users\Angela\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\DRP2N1IJ\MCj04242300000[1].wmf]()Determine the coat color of the offspring by using the Punnett square in Figure 2. Record the color in the proper part of Table 2.

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|  |  |  |
| --- | --- | --- |
| Coin Combinations | B-b | b-b |
| Gene Combinations | Bb | bb |
| Observed results (/) |  |  |
| Total observed in 40 tosses |  |  |
| Total expected in 40 tosses |  |  |
| Coat color in mice (phenotype) |  |  |

 Table 2. Results of Coin Tosses (Coat Color in Mice Bb x bb)

**Questions**

1. How often do you expect a tossed coin to land on heads? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. How often do you expect a tossed coin to land on tails? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. When 2 coins are tossed, how often do you expect to get the following combinations?

 a. heads/heads \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b. heads/tails \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c. tails/tails \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

4. What gene combinations and features (coat color) do the following coin tosses produce?

|  |  |  |
| --- | --- | --- |
|  | Gene Combinations | Features |
| Heads/heads |  |  |
| Heads/tails |  |  |
| Tails/tails |  |  |

5. What gene combinations and features (coat color) do the following marked coin tosses produce:

|  |  |  |
| --- | --- | --- |
|  | Gene Combinations | Features |
| B/b |  |  |
| b/b |  |  |

6. How close were your observed results to what you expected to get?

7. When will the observed results be close to the expected?

8. What is the expected result of a cross BB x bb? Draw a Punnett square below to show your solution.

9. Suppose you mated 2 other mice and expected 1 black mouse for each white mouse. How many of the following mice would you expect to observe out of 100 offspring?

 a. black mice \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ b. white mice \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

10. A scientist made a cross between 2 black mice. The cross was repeated between the same 2 mice several times. The data chart showed the color of all 42 offspring to be black. Use the Punnett squares below to show what you think the gene combinations were of both parents.

|  |  |  |
| --- | --- | --- |
|  |  B |  \_\_\_\_\_\_\_\_ |
| B | BB | B\_\_\_ |
| \_\_\_\_ | B\_\_\_ | \_\_\_ \_\_\_ |

|  |  |  |
| --- | --- | --- |
|  |  B |  \_\_\_\_\_\_\_\_ |
| B | BB | B\_\_\_ |
| \_\_\_\_ | B\_\_\_ | B \_\_\_ |

1. Goehring, JessaLee (2008).How can the genes of offspring be predicted?. *Lodi High School Agriculture Department*. [↑](#endnote-ref-1)