# Pre-Lab Information

Purpose Use a virtual lab to explore the use of Punnett squares to predict genotypes and phenotypes of offspring.

**Time** Approximately 45 minutes

**Question** How are Punnett squares used to predict phenotypes?

**Summary** Some characteristics are passed to offspring directly through the inheritance of traits. Regions on a chromosome that code for a trait are called genes. There are different forms that genes can take, known as alleles. In organisms that reproduce sexually, one form of a trait, or one allele, is inherited from one parent and the other allele is inherited from the other parent. The physical expression of this combination of alleles is known as the phenotype.

In this virtual lab, you will be completing orders for certain types of sheep. You will need to understand which allele is dominant and which allele is recessive, and select correct combinations of parents in order to produce the desired offspring.

# Scenario

Jessie is a young scientist and entrepreneur. She owns a company called **For Sheep’s Sake** that accepts and places orders for sheep. She receives several orders for a variety of sheep and must use what she knows about alleles, Punnett squares, genotypes, and phenotypes to correctly fill the orders.

# Lab Procedure

1. **Watch the scenario.** 
   1. Press **Play** to begin. You will watch a scenario of Jessie and Ewe-Gene, her assistant, receiving orders. View the orders that Jessie receives for sheep.
   2. You can refer back to the **Orders Cheat Sheet** by selecting the icon in the lower-left corner at any time. Select the **Orders Cheat Sheet** again to close that view. The dominant allele for hair color is *W* for white. The recessive allele for hair color is *w* for black. The dominant allele for hair texture is *C* for curly. The recessive allele for hair texture is *c* for straight.
   3. Select **Next** to learn how to fill the first order.

**Step 2: Complete Order 1.**

* 1. To get started, you must first calibrate the Gene-O-Tubes. Move the slider under each genotype to select the matching phenotype. Then fill in Table A in the Student Guide. Select **Continue** to proceed to the order.
  2. Select two sheep for mating and drag them into the Offspring-O-Matic. You may use parent sheep from the same Gene-O-Tube to fill the order. The blinking arrows indicate where to drop each sheep. The arrows will only blink the first time you try to load sheep into the Offspring-O-Matic. You will have three attempts to pick the correct sheep to mate for each sheep in each order. Remember that each sheep donates one of its two alleles, creating four possible genotypes in the Punnett square of the Offspring-O-Matic.
  3. Click in each square of the Offspring-O-Matic to display the drop-down menu, which allows you to select the genotypes to complete the Punnett square. Record these in Punnett square A of the Student Guide. Select **Continue** to proceed. Note: In order to correctly fulfill your sheep order, two things must happen.
     + 1. You must select sheep that can produce a genotype that results in the correct phenotype.
       2. The Offspring-O-Matic must output this genotype. For example, you could select *Ww* x *Ww* with the understanding that a black sheep is possible. However, the probability of this occurring is ¼, so the Offspring-O-Matic may actually output a white sheep. It is important to note that your sheep selection was not wrong, but that the odds were not in your favor!
  4. If you get the correct sheep, you will be prompted to proceed to the following sheep by selecting **Continue**. If your sheep selection or the odds do not produce the correct output, you will be prompted to select **Try Again**.
  5. The **Orders Cheat Sheet** will pop up to help you remember what sheep are needed for this order. Review the information and select **Orders Cheat Sheet** to close this popup when you are ready to proceed to Sheep 2.
  6. Complete Order 1 for Sheep 2. Select two sheep for mating and drag them into the Offspring-O-Matic. If you get the correct sheep, you will be prompted to proceed to the following sheep by selecting **Continue**. If your sheep selection or the odds do not produce the correct output, you will be prompted to select **Try Again**.
  7. The **Orders Cheat Sheet** will pop up to help you remember what sheep are needed for this order. Review the information and select **Orders Cheat Sheet** to close this popup when you are ready to proceed to Sheep 3.
  8. Complete Order 1 for Sheep 3. Select two sheep for mating and drag them into the Offspring-O-Matic. If your sheep selection or the odds do not produce the correct output, you will be prompted to select **Try Again**.
  9. When you have successfully completed the order, you will see a prompt that tells you it is time to load the sheep onto the truck. Select **Ready**. You will see your sheep load onto the truck.

**Step 3: Complete Order 2.**

1. You do not need to calibrate the Gene-O-Tubes for Order 2.
2. Select two sheep for mating and drag them into the Offspring-O-Matic. You will have three attempts to pick the correct sheep to mate with each sheep in each order. Remember that each sheep donates one of its two alleles and there are four possible genotypes in the Punnett square of the Offspring-O-Matic.
3. If you get the correct sheep, you will be prompted to proceed to the following sheep by selecting **Continue**. If your sheep selection or the odds do not produce the correct output, you will be prompted to select **Try Again**.
4. The **Orders Cheat Sheet** will pop up to help you remember what sheep are needed for this order. Review the information and select **Orders Cheat Sheet** to close this popup when you are ready to proceed to Sheep 2.
5. Complete Order 2 for Sheep 2. Repeat steps 3b–d until you fulfill the order for Sheep 2.
6. Complete Order 2 for Sheep 3. Repeat steps 3b–c until you fulfill the order for Sheep 3.
7. When you have successfully completed the order, you will see a prompt that tells you it is time to load the sheep onto the truck. Select **Ready**. You will see your sheep load onto the truck.

**Step 4: Complete Order 3.**

1. The third order involves a new physical trait. You must calibrate the Gene-O-Tubes again for this third order. Move the slider under each genotype to select the matching phenotype. Then fill in Table A in the Student Guide. Select **Continue** to proceed to the order.
2. Select two sheep for mating and drag them into the Offspring-O-Matic. You will have three attempts to pick the correct sheep to mate with each sheep in each order. Remember that each sheep donates one of its two alleles and there are four possible genotypes in the Punnett square of the Offspring-O-Matic.
3. Select the genotypes to complete the Punnett square. Record these in Punnett square B of the Student Guide. Select **Continue** to proceed to the order.
4. If you get the correct sheep, you will be prompted to proceed to the following sheep by selecting **Continue**. If your sheep selection or the odds do not produce the correct output, you will be prompted to select **Try Again**.
5. The **Orders Cheat Sheet** will pop up to help you remember what sheep are needed for this order. Review the information and select **Orders Cheat Sheet** to close this popup when you are ready to proceed to Sheep 2.
6. Complete Order 3 for Sheep 2. Repeat steps 4b–d until you fulfill the order for Sheep 2.
7. Complete Order 3 for Sheep 3. Repeat steps 4b–c until the order is complete.
8. When you have successfully completed the order, you will see a prompt that tells you it is time to load the sheep onto the truck. Select **Ready**. You will see your sheep load onto the truck.

# Data

Record your data either in your lab notebook or in the table below.

**Table A**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Color** | | | **Texture** | | |
| **Genotype** |  |  |  |  |  |  |
| **Phenotype** |  |  |  |  |  |  |

**Punnett Square A**

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**Punnett Square B**

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