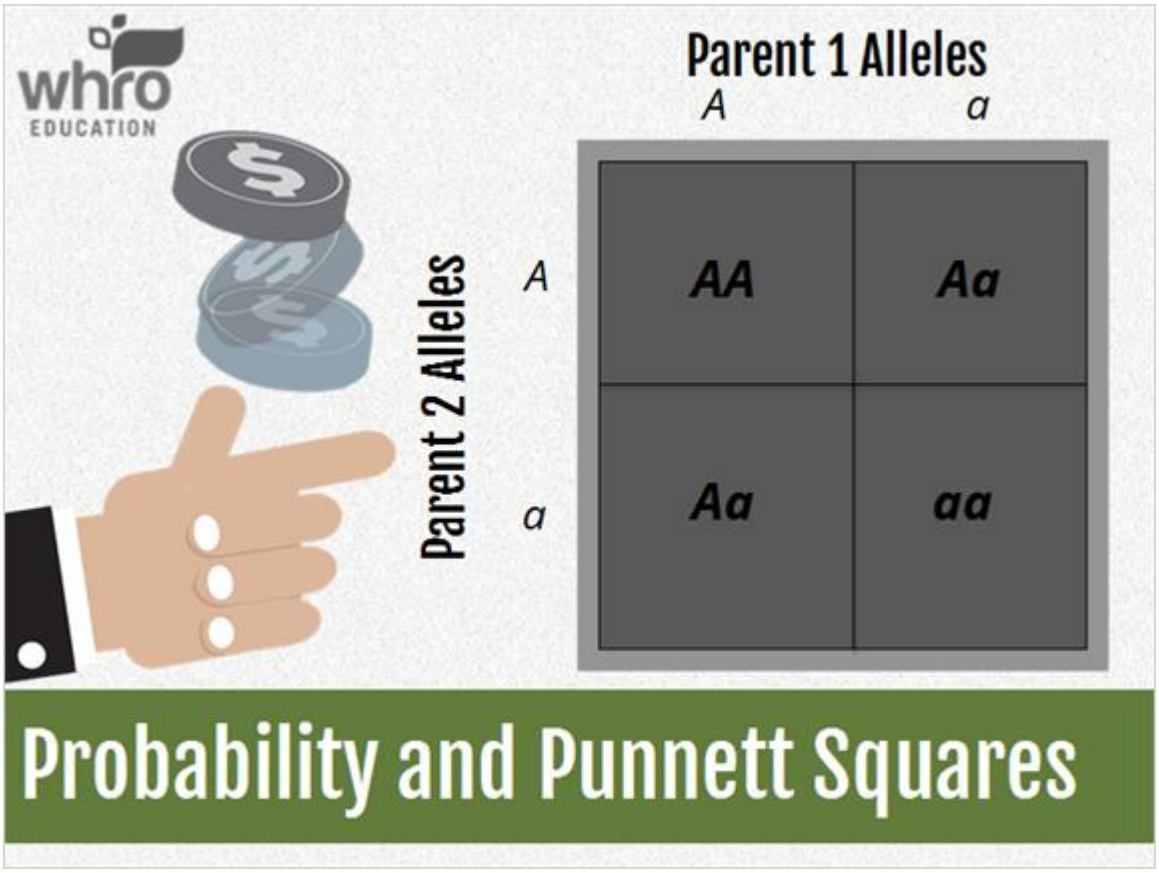
Module 5: Mendelian Genetics and Genetic Disorders
Topic 1 Content: Probability and Punnett Squares Notes



Probability and Punnett Squares

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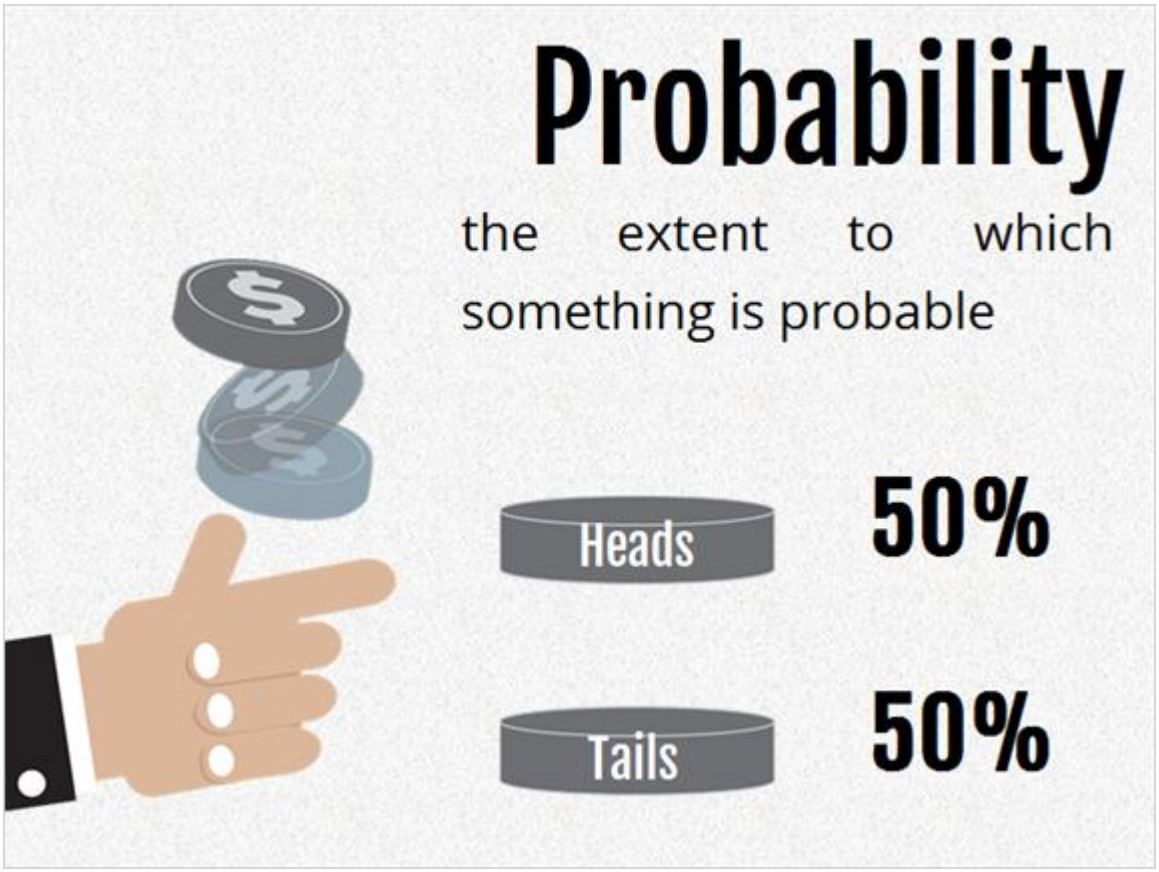

When you flip a coin, you know that there is a fifty percent chance that the coin will land on heads, and a fifty percent chance that the coin will land on tails. Even if you flip the coin twenty times, and the coin lands on tails twenty times, there still existed a fifty percent chance that the coin could have landed on heads each time you flip it. The probability that the coin will land on heads is the same for the last coin toss as it was for the first coin toss. Probability is the extent to which something is probable. The inheritance of traits can be predicted using probability.

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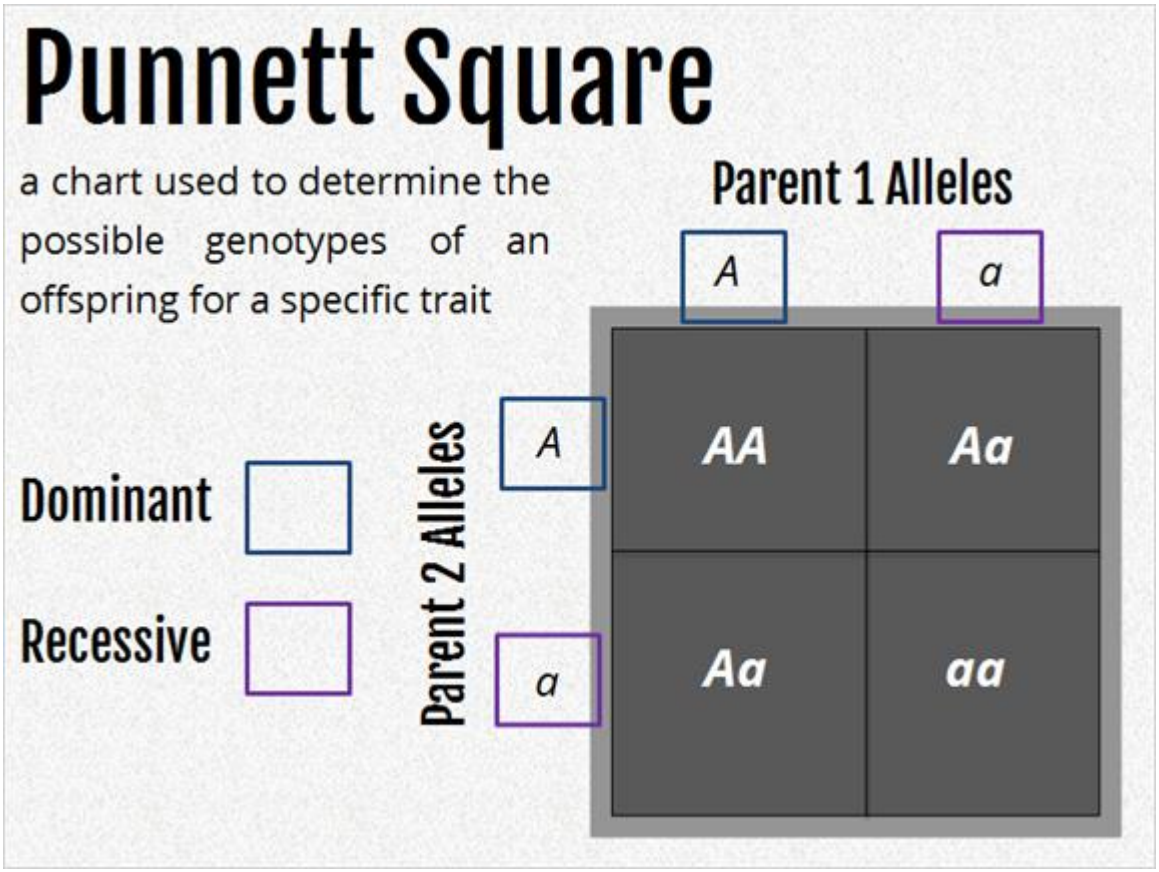
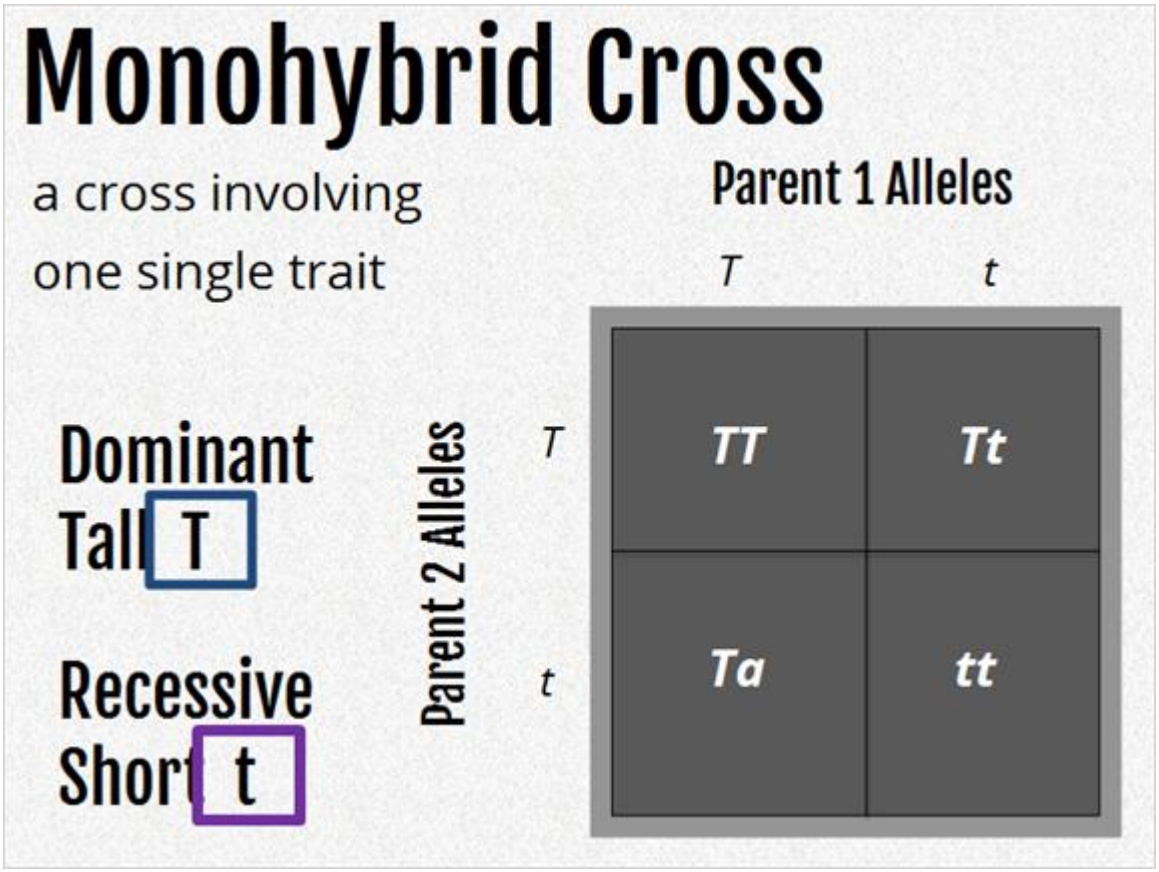
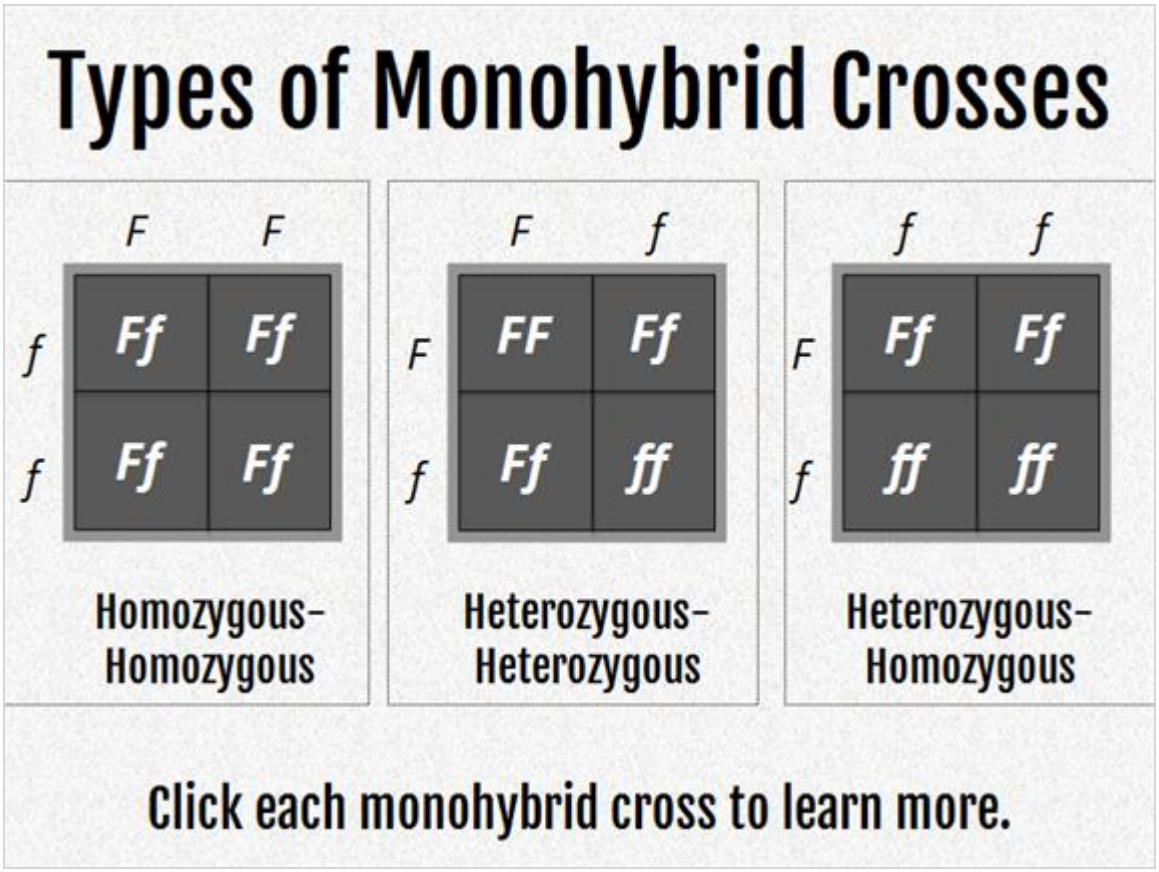


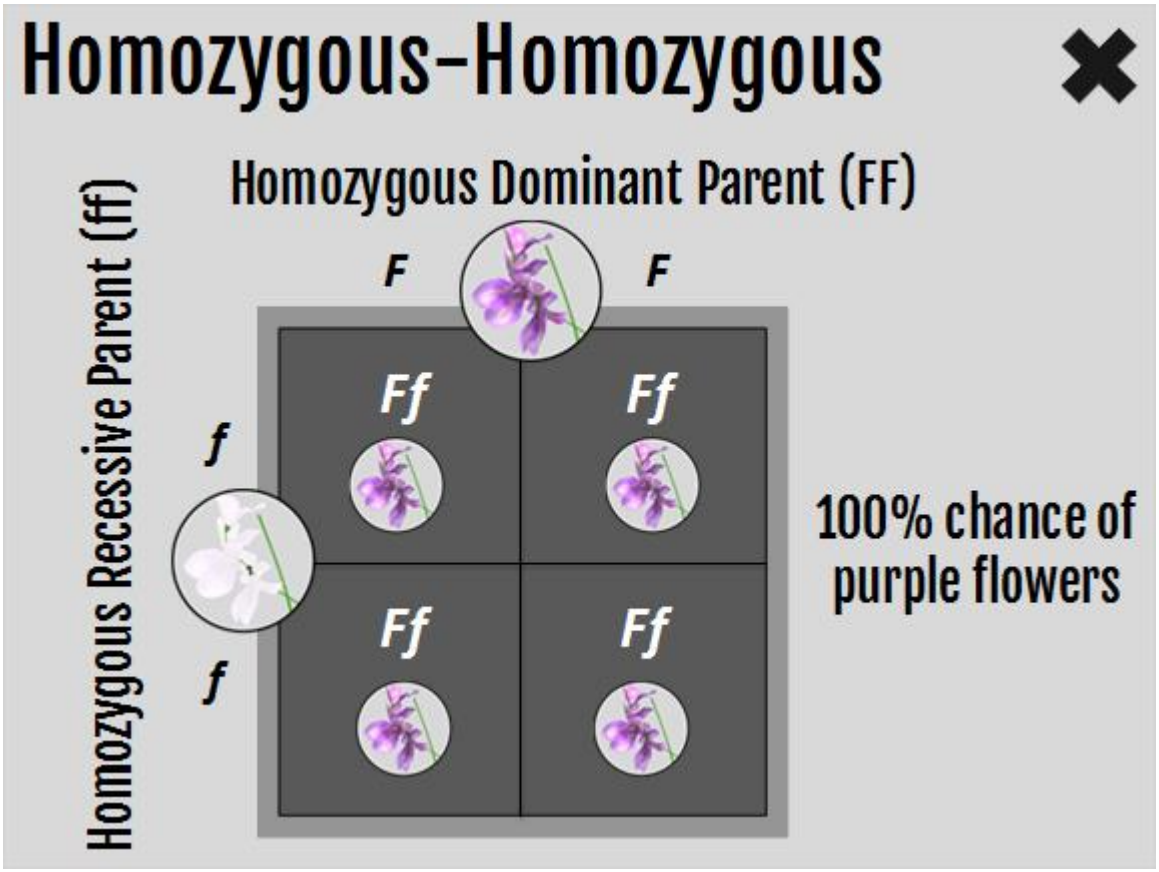
Inheritance of traits in possible offspring can be predicted using a Punnett square. A Punnett square is a chart that is used to determine the possible genotypes of an offspring for a specific trait. When completing a Punnett square, the dominant trait is represented by a capital letter, and the recessive trait is represented by the same letter in lower case.



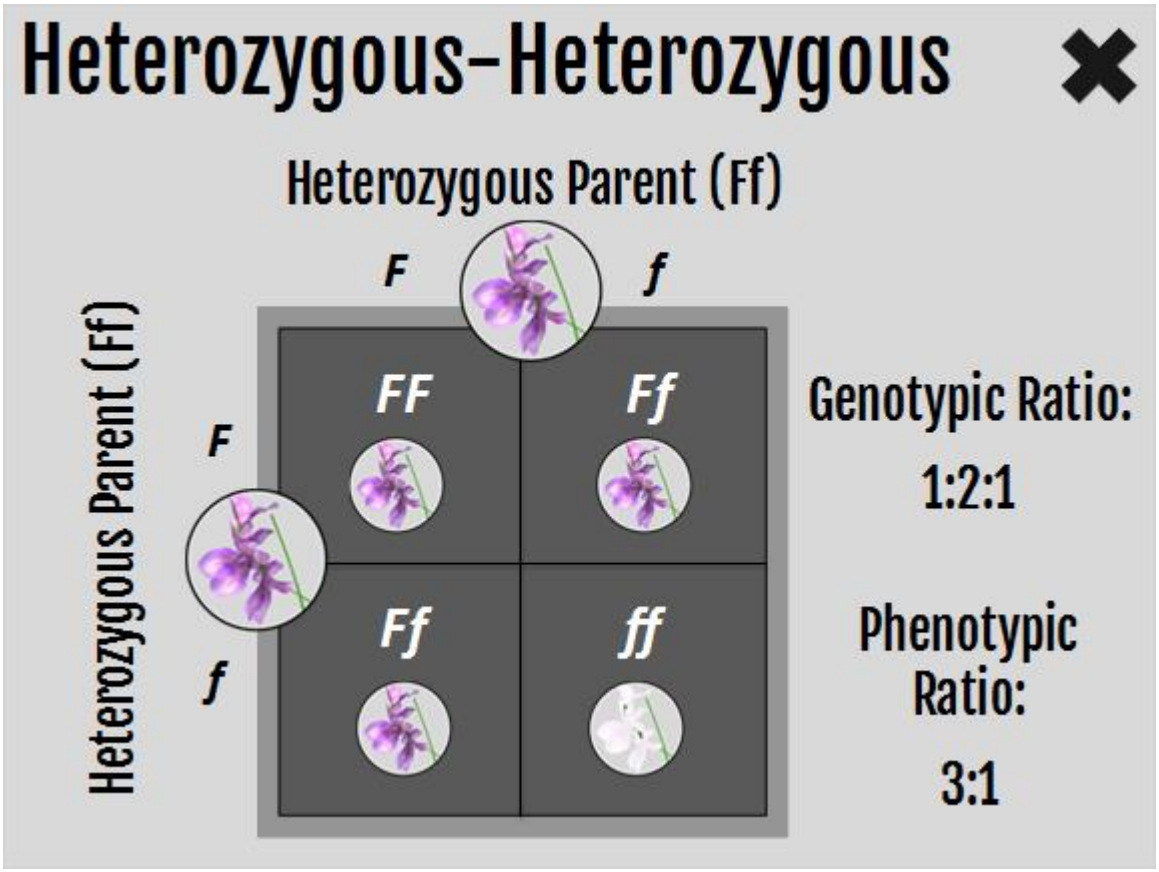
For example, if the dominant allele for the height trait is tall, then that allele would be represented by a capital letter "*T*." The recessive form of the allele, short, would be represented by a lower-case letter "*t*." The example Punnett square allows you to see the probability of all of the possible genotypes for the offspring in the monohybrid cross. A monohybrid cross involves only a single trait.



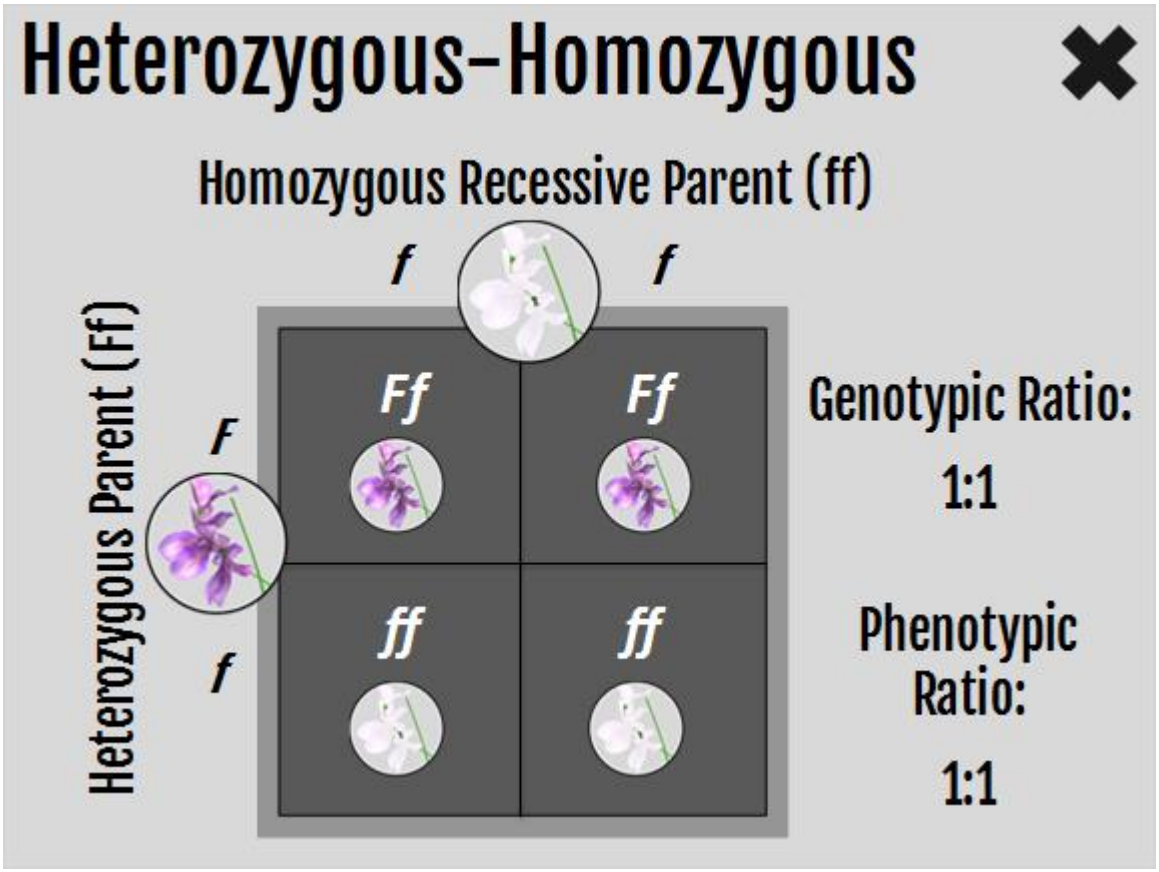
Using the example of pea plants, three different monohybrid crosses can exist with varying genotypes from the parents. Monohybrid crosses are homozygous-homozygous, heterozygous-heterozygous, or heterozygous-homozygous. Click each monohybrid cross to learn more about each.



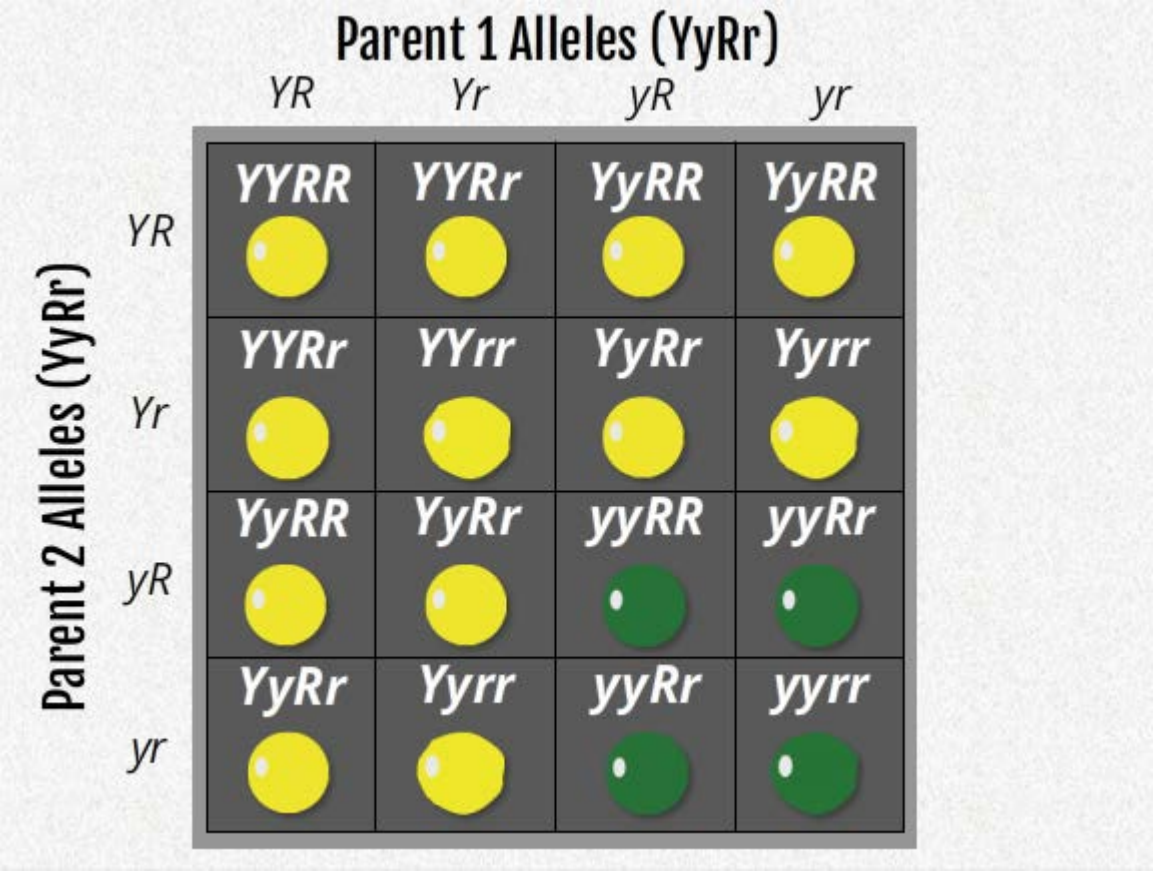
In this example, a pea plant that is homozygous dominant for purple flowers is crossed with a pea plant that is homozygous recessive for white flowers. In order to complete the Punnett square, write each parents genotype on an axis with one letter above each square. In this example, the homozygous dominant parent's genotype is written on the X-axis and the homozygous recessive parent's genotype is written on the Y-axis. Next, fill in the Punnett square by completing the cross. As you can see from the example, the dominant allele, represented by the capital letter *F*, is located in each square. This means that the offspring will have a 100% chance of having purple flowers.



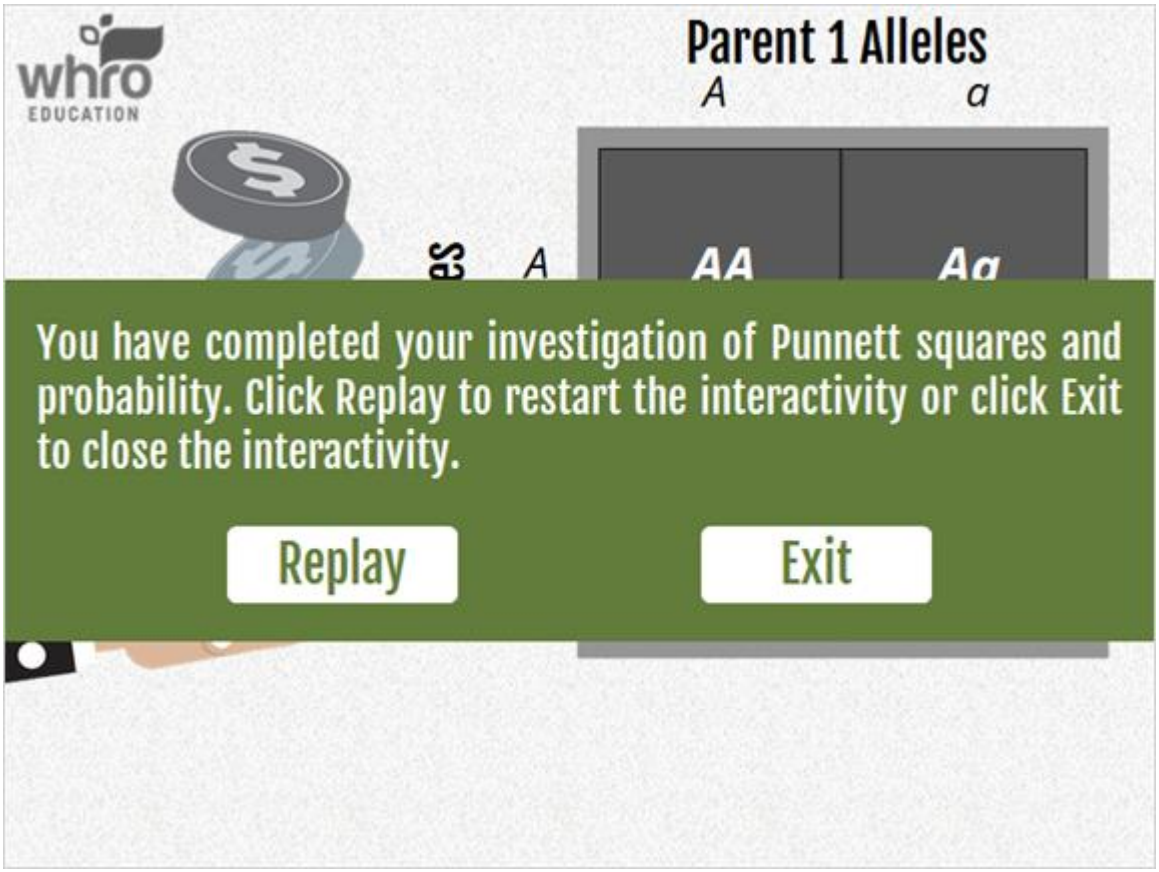
What would happen if you crossed two purple flowered pea plants that were heterozygous? In this situation, half of the offspring would receive a dominant allele and half of the offspring would receive a recessive allele from each parent. To complete the Punnett square, write each parent's genotype on an axis and complete the cross. After you complete the cross, you will see that one-fourth of the offspring's genotypes are homozygous dominant, half of the offspring's genotypes are heterozygous, and one-fourth of the offspring's genotypes are homozygous recessive. This produces a genotypic ratio of 1:2:1 of homozygous dominant, heterozygous, homozygous recessive. The phenotypic ratio is 3:1 in favor of purple flowers.



This example crosses a pea plant that is heterozygous for purple flowers with a pea plant that is homozygous for white flowers. To complete the Punnett square, write each parent's genotype on an axis and complete the cross. In this cross, half of the offspring's genotype is heterozygous and half is homozygous recessive. The genotypic ratio is 1:1. The phenotypic ratio is 1:1. The offspring has a fifty-percent chance of having white or purple flowers.



In his studies, Gregor Mendel also conducted dihybrid crosses. A dihybrid cross is a cross that involves the inheritance of two different traits. Mendel's dihybrid crosses can be expressed in a Punnett square. The Punnett square is larger because more alleles are involved. In this example, two plants with yellow, round peas that are heterozygous for both traits are crossed. The four allele combinations are shown here. After completing the Punnett square, a total of nine different genotypes produce four different phenotypes. The phenotypes are yellow round, yellow wrinkled, green round, and green wrinkled. The results of a dihybrid cross involving two contrasting traits results in a phenotypic ratio of 9:3:3:1.


Parent 1 Alleles
A
a
AA
Aa
You have completed your investigation of Punnett squares and probability. Click Replay to restart the interactivity or click Exit to close the interactivity.
Replay
Exit