

Punnett Squares

by Sophia



WHAT'S COVERED

In this lesson, you will learn to determine explanations or possibilities in given hereditary examples. Specifically, this lesson will cover:

1. Punnett Squares

Punnett squares are tools that are used to determine the **probability** or the chance that a trait will show up in an offspring. **Genetic traits** are characteristics of an organism that are determined by their genes and are inherited.

➞ **EXAMPLE** An example of a trait could be eye color, height, hair color, or certain genetic disorders.



TERMS TO KNOW

Punnett Square

A tool used to determine the probability of offspring inheriting a trait based on the genotypes of both parents.

Probability

A measure of the chance of an outcome.

Genetic Trait

A characteristic of an organism such as eye color, skin color, hair color, gender, body type, etc.

1a. Sex Chromosome Example

A Punnett square helps determine the odds of an offspring's **genotype** given the parent's genotype. Ultimately, genotype will determine the **phenotype**.

To see how Punnett squares are used, look at this square crossing male and female sex chromosomes:

		Mother's Alleles	
		X	X
Father's Alleles	X	XX	XX
	Y	XY	XY

50% Female
50% Male

The Punnett square crosses the sex alleles of a male and a female. A female will have two X chromosome, and a male will have an X and a Y chromosome. The mother's alleles are listed on top, and the fathers are listed on the side.



THINK ABOUT IT

Using the square above, what are the odds an offspring will be female?

We can see that there is a 50% chance that any offspring would have two XX chromosomes, making the child female.



TERMS TO KNOW

Genotype

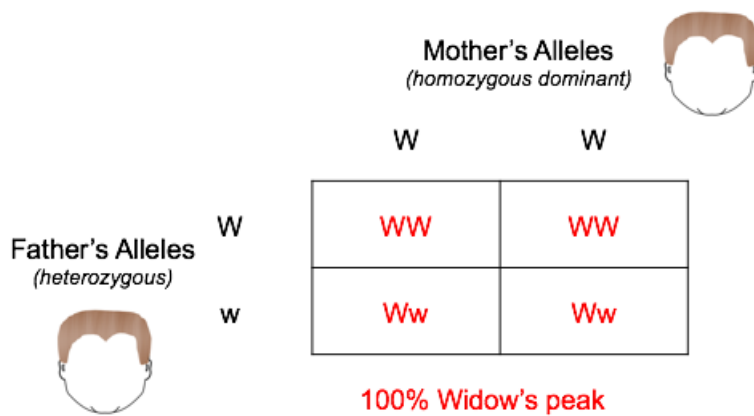
The genes inherited by an organism which represent a trait.

Phenotype

The physical manifestation of the expression of an organism's genes.

1b. Hairline Example

Below is a Punnett square related to a hairline showing whether a person is going to have a straight hairline or a widow's peak. A widow's peak is a dominant trait; if a person has at least one dominant allele (W), they will have the widow's peak.



The mom in this example is homozygous dominant for widow's peak. This means that she has the same alleles (W and W), and both are dominant. Her phenotype would be the dominant trait, which in this case means she has a widow's peak.

The father is heterozygous for the trait, meaning that he has one dominant allele (W) and one recessive allele (w). Since he has at least one dominant allele, it masks that recessive allele. The dad will also have a widow's peak as his phenotype.



THINK ABOUT IT

How many of the offspring from this example are going to have a widow's peak?

We can see that because each box has at least one big W, or dominant allele, 100% of their offspring will have a widow's peak.

2. Independent Assortment

Recall how gametes are made: In meiosis I, both sister chromatids of one homolog go to daughter cell A, and both sister chromatids of the other homolog go to daughter cell B. For each of the 23 homologous pairs of chromosomes, it's random which homolog goes where. That means that genes on separate chromosomes may or may not be inherited together.

➞ **EXAMPLE** If you inherited an allele for green eyes and an allele for sickle cell anemia from your father, and the allele for brown eyes and the allele for normal hemoglobin from your mother, each of your children might have green eyes and sickle cell anemia, or brown eyes and sickle cell anemia, or green eyes and normal hemoglobin, or brown eyes and normal hemoglobin.

The law of **independent assortment** is a law that states that the vast majority of traits are inherited independently of one another. This means that the inheritance of one trait is not influenced by the inheritance of another trait.

➞ **EXAMPLE** The inheritance of a Y chromosome does not influence, or is not dependent on, the inheritance of a widow's peak, for example. So traits are inherited independently of one another.



TERM TO KNOW

Independent Assortment

A law that states genes on different chromosomes are inherited independently of one another; the inheritance of one trait does not influence the inheritance of another trait.



SUMMARY

Punnett squares are used to determine the probability of inheriting a trait based on the parent's genotype. The dominant trait will always determine the phenotype of the offspring. The law of **independent assortment** says that traits on separate chromosomes are inherited independently of one another.

Keep up the learning and have a great day!

Source: THIS WORK IS ADAPTED FROM SOPHIA AUTHOR AMANDA SODERLIND



TERMS TO KNOW

Genetic Trait

A characteristic of an organism such as eye color, skin color, hair color, gender, body type, etc.

Genotype

The genes inherited by an organism which represent a trait.

Independent Assortment

A law that states genes on different chromosomes are inherited independently of one another. The inheritance of one trait does not influence the inheritance of another trait.

Phenotype

The physical manifestation of the expression of an organism's genes.

Probability

A measure of the chance of an outcome.

Punnett Square

A tool used to determine the probability of offspring inheriting a trait based on the genotypes of both parents.