

Age: 4th -7th grade

Objectives: After this lecture and activity sheet, students will know who Gregor Mendel was, what he discovered about genetics, what traits are, the difference between genotype and phenotype, what dominant traits are, what recessive traits are, what hybrid means, what alleles are, what a Punnett's Square is, and how to find phenotype and genotype using it.

Lecture:

Gregor Mendel, was a monk in Austria in the mid-1800s who raised peas in the monastery gardens. While breeding his peas, he made some big discoveries. They were discoveries about genetics.

The peas had several **traits** he could see. Some plants were tall and some were short. Some had wrinkled pods and some had smooth pods. Some pods were green and some were yellow. The flowers were white or purple. Mendel looked at each trait and learned how they were passed down to the offspring plants. Since plants breed using pollen, Mendel controlled which plants pollinated other plants. This was how he discovered many important genetic rules.

How an individual looks and what their genetic code is sometimes do not match up. This is the difference between **genotype** and **phenotype**. The genotype is the actual genetic make up of an individual. The phenotype is what that individual *looks* like.

Traits that show up more often are called **dominant traits**. Traits that show up less often are called **recessive traits**. If an individual with dominant traits breeds with an individual with recessive traits, this can result in a **hybrid offspring**. Hybrid individuals can look like they have dominant traits (phenotype), but actually be hybrid (genotype).

Hybrid plants are different from dominant plants even if they looked the same. Each gene has two chances at a trait – two copies — two **alleles**. So a hybrid plant could be carrying the allele for a recessive trait even if you can't see it. So, for example, a hybrid plant might be tall like its dominant parent, but it still could have an allele for shortness that you don't see. This is the difference between genotype and phenotype. The genotype is the actual genetic make up of an individual. The phenotype is what that individual looks like.

This can be illustrated with a simple chart. It's called a **Punnett's Square**. We'll use the example of tall pea plants versus short pea plants. When two tall dominant plants breed, all the offspring are tall dominant. When two hybrid plants breed, one in four of the offspring are short. This is a 3:1 ratio. Look at the Punnett's Square to see what kind of offspring you would get from a dominant and hybrid parent mix and two recessive parents. See if you can figure out what the genotype and phenotype would be,

Punnett's Squares

These show the 2 alleles of each parent plant crossed with each other and the resulting 4 possible offspring with T = tall, t = short.

TT = dominant tall, tt = recessive short, Tt = mixed hybrid

TT = dominant tall (genotype tall, phenotype tall)

Tt = mixed hybrid (genotype hybrid, phenotype tall)

tt = recessive short (genotype short, phenotype short)

Using the Punnett's Squares below, name the offspring of all possible parent combinations.

	T	T
T		
T		

Both parents are dominant tall, name the 4 possible offspring.

1. _____ 2. _____
3. _____ 4. _____

	T	t
T		
t		

Both parents are mixed hybrids, name the 4 possible offspring and the expected ratio.

1. _____ 2. _____
3. _____ 4. _____

	T	T
T		
t		

One parents is dominant tall, one is mixed hybrid, name the 4 possible offspring.

1. _____ 2. _____
3. _____ 4. _____

	t	t
t		
t		

Both parents are recessive short, name the 4 possible offspring.

1. _____ 2. _____
3. _____ 4. _____

Punnett's Squares

These show the 2 alleles of each parent plant crossed with each other and the resulting 4 possible offspring with T = tall, t = short.

TT = dominant tall, tt = recessive short, Tt = mixed hybrid

KEY

TT = dominant tall (genotype tall, phenotype tall)

Tt = mixed hybrid (genotype hybrid, phenotype tall)

tt = recessive short (genotype short, phenotype short)

	T	T
T	TT	TT
T	TT	TT

Both parents are dominant tall so all offspring are tall.

	T	t
T	TT	Tt
t	Tt	tt

Both parents are mixed hybrids so offspring are a 3:1 ratio.

	T	T
T	TT	TT
t	Tt	Tt

One parent is dominant tall and one is mixed hybrid so all offspring are tall.

	t	t
t	tt	tt
t	tt	tt

Both parents are recessive short so all offspring are short.