

ALLELE APPEAL!

Exploring Genetics and Plant Breeding Lesson Plan

Objectives:

1. Students will be able to cross parent plants to generate offspring using Punnett squares.
2. Students will be able to define genotype and phenotype in simple terms.

Preparation Time: 5–10 minutes

Teaching Time: 45–50 minutes

Clean-up Time: 5–10 minutes

Materials:

- Pencils
- Punnett square templates, several copies per student

Methods:

- I. Genetics is the study of the way physical traits and characteristics are passed down from one generation to the next.
- II. Genes are made of alleles. Alleles basically serve as a code for a gene, just like our telephone numbers serve as a code to reach someone. If you use the right “code” you’ll call the right person.
- III. Some genetic traits are dominant while others are recessive. Genetic dominance means a specific trait has alleles that express dominance over other alleles. A dominant trait is typically expressed more often than another trait—it “dominates” over others. For example, brown eyes are dominant and blue and green eyes are recessive because the brown eye trait is found most often.
- IV. These tiny alleles determine our physical traits including the color of your eyes, whether your hair is straight or curly, etc. Explain that the students inherited genes from their parents which is why someone might say, “You have your mother’s smile.”
- V. When we observe a trait with our eyes such as the color of one’s hair or the height of one’s body, we are observing their phenotype, or their physical appearance. When scientists look at people’s alleles using very powerful and very special equipment, they observe genotypes, or the code for someone’s physical appearance.
- VI. Scientists typically use letters when they observe genotypic codes. A capital letter represents a dominant allele, and a lowercase letter represents a recessive allele.
 - a. When two capital letters are together (AA), the trait is dominant.
 - b. When a capital letter and lowercase letter are together (Aa), the trait is also dominant because the dominant allele (A) will maintain dominance over the recessive allele (a).
 - c. When two lowercase letters are together (aa), the trait is recessive.

- d. Try a few scenarios using different letters having the students determine if the trait is dominant or recessive and which components are the phenotypes and the genotypes.
- If A = tall plant and a = short plant, what is AA? Tall plant
What is the phenotype? Tall. What is the genotype (code)? AA
 - If P = tall plant and p = short plant, what is pp? Short plant
What is the phenotype? Short. What is the genotype? pp
 - If Q = tall plant and q = short plant, what is Qq? Tall plant
What is the phenotype? Tall. What is the genotype? Qq
 - If B = purple flower and b = white flower, what is Bb? Purple flower
What is the phenotype? Purple. What is the genotype? Bb
- VII. If the students understand phenotypes, genotypes, dominant alleles/traits, and recessive alleles/traits, begin to teach the students how to make a single, or monohybrid, cross using the Punnett square template provided.
- Choose a plant in which to cross (soybeans, corn, tomatoes, peas, etc.).
 - Decide on a trait that is appropriate for the selected plant species that the class will cross (i.e. flower color, plant height, hairiness of leaves, seed size, seed shape, leaf shape, etc.).
 - Have the students decide which trait (i.e. purple vs. white, tall vs. short, hairy vs. hairless, etc.) is likely the dominant trait in nature for the selected species.
 - Choose a letter to represent the trait and be sure to assign the capital letter to the dominant trait (i.e. purple flowers are dominant, so purple = A; white flowers are recessive, so white = a).
 - Have the students decide on the genotypes for the two parent plants (i.e. mother plant = Aa; father plant = aa).
 - Have the students fill in the mother plant and father plant genotypes on the Punnett square template like this example:

		Mother plant	
		A	a
Father plant	a		
	a		

- g. Next have the students fill in the squares by placing the corresponding letters in the appropriate square as follows:

		Mother plant	
		A	a
Father plant	a	Aa	aa
	a	Aa	aa

- h. Now encourage the students to determine the phenotypes of the offspring. In the above example, two offspring would have purple flowers, and two offspring would have white flowers, meaning there is a 50/50 chance of having purple or white flowers.
- VIII. Try several different traits with the students to further explore genetic crosses.

Evaluation Questions:

1. What is a dominant/recessive allele?
2. What is a phenotype?
3. What is a genotype?

PLANT GENETICS

Name: _____

MOTHER PLANT

FATHER PLANT

PLANT GENETICS

Name: _____

MOTHER PLANT

A a

FATHER PLANT

A

AA

Aa

a

Aa

aa

If A = tall; a = short
75% tall
25% short

PLANT GENETICS

Name: _____

MOTHER PLANT

A

A

a

Aa

Aa

a

Aa

Aa

FATHER PLANT

If A = tall; a = short
100% tall

PLANT GENETICS

Name: _____

MOTHER PLANT

A

a

FATHER PLANT

A

AA

Aa

A

AA

Aa

If A = tall; a = short
100% tall