

Solving Dihybrid Punnett Squares with Coding Teacher Handout

Explain

Mendel had questions about how alleles separated during gamete formation, the product of meiosis.

- Does the segregation of one pair of alleles have any affect on the segregation of a different pair of alleles?

In other words, does the gene that determines whether a feather is red or blue have any effect on the gene for beak length?

1. What do you think? Why? _____
-
- _____
-
- _____

Mendel designed a second set of experiments to follow two different genes as they passed from parent to offspring.

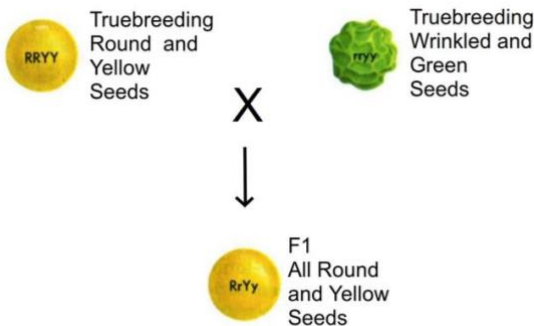
A Two-factor cross... or a Dihybrid Cross.

Mendel used pea plants in his experiments; one parent plant had peas that were round and yellow, and the other parent plant had peas that were wrinkled and green. The round and yellow traits are dominant.

In the Dihybrid Cross, Mendel crossed true-breeding parents:

True-Breeding Parent 1	True-Breeding Parent 2
Round, Yellow Peas	Wrinkled, Green Peas
RRYY	rryy

If the round and yellow traits are dominant, what is the genotype and phenotype of all the F1 offspring? Discuss with a partner.



All F1 offspring have the genotype of RrYy and the phenotype of round and yellow peas.

Next, Mendel allowed the hybrid F1 offspring, RrYy, to self-pollinate, which resulted in the production of 556 seeds!

- 315 round, yellow (dominant, dominant)
- 105 round, green (dominant, recessive)
- 104 wrinkled, yellow (recessive, dominant)
- 32 wrinkled, green (recessive, recessive)

2. What did this mean for alleles segregating during gamete formation? Discuss with a partner.

This meant that the alleles for seed colour had segregated independently of the alleles for seed shape.

The alleles for one gene had no effect on the alleles of another trait. This is known as independent assortment.

The Principle of Independent Assortment states:

When gametes are formed, the alleles of a gene for one trait segregate independently of the alleles of a gene for another trait.

Punnett Squares for Two-Factor or Dihybrid Cross

- When two traits are being considered, Punnett square will need 16 squares.
- Each parent will pass one allele of each gene pair to the offspring
 - o Example, a parent with AaBb could pass 4 allele combinations on to their offspring
 - AB, Ab, aB, ab

3. Given the following parental genotypes, what alleles could each parent pass to their offspring? Discuss with a partner.

Parent Genotype	4 allele combinations it can pass to their offspring
FfDd	FD, Fd, fD, fd
Ffdd	Fd, Fd, fd, fd
ffDd	fD, fd, fD, fd
FFDD	FD, FD, FD, FD

4. With a partner, use the Punnett Square to cross Mendel's True-Breeding Round and Yellow Plant x True-Breeding Wrinkled and Green Plant

- a. What is the genotype of each parent? **RRYY and rryy**
- b. On the Punnett Square, input the allele combinations that can be passed from each parent to the offspring.
- c. Complete the Punnett Square to illustrate the possible genotypes for the offspring.
- d. Complete the T-Chart, stating the possible offspring genotypes and the probability that each genotype will occur.

	RY	RY	RY	RY
ry	RrYy	RrYy	RrYy	RrYy
ry	RrYy	RrYy	RrYy	RrYy
ry	RrYy	RrYy	RrYy	RrYy
ry	RrYy	RrYy	RrYy	RrYy

Genotypes	Phenotypes
16/16 RrYy	16/16 are Round and Yellow

- e. Using full sentences, state the genotype for the offspring in this cross. Support your answer using correct terminology.

The genotype for the offspring in this cross is RrYy. The offspring is heterozygous for both traits, meaning that the offspring portay the dominant traits, round and yellow, but carry the recessive alleles for green and wrinkled, which could be passed on to their offspring.

5. If the offspring from the above cross are allowed to self-pollinate

- a. What is the phenotype of each parent? **Round and Yellow**
- b. What is the genotype of each parent? **RrYy and RrYy**
- c. Complete the Punnett Square to illustrate the possible genotypes for the offspring.
- d. Complete the T-Chart, stating the possible offspring genotypes and the probability that each genotype will occur.

	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

Genotypes	Phenotypes
1/16 RRYY	<u>Round, yellow</u> 9/16
2/16 RRYy	
1/16 RRyy	Round, green 3/16
2/16 RrYY	
4/16 RrYy	Wrinkled, Yellow 3/16
2/16 Rryy	
1/16 rrYY	Wrinkled, green 1/16
2/16 rrYy	
1/16 rryy	

- e. Using full sentences, state the probability that an offspring will be homozygous recessive for both traits, colour and texture. Support your answer using correct terminology.

The probability that a RrYy x RrYy cross will produce an offspring that is homozygous recessive for both the colour and texture trait is 1/16. It is probable that 1/16 of offspring will have the genotype rryy and portray a green colour and wrinkled texture.