

## Practice with Monohybrid Punnett Squares

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80/30

Read the following passage and answer the questions.

Often times, people will refer to a trait or characteristic such as eye color or hair color as being genetic, but what does the word genetic really mean?

**Genetics** is termed as the study of heredity and how traits in offspring are based upon those of the parents.

**Heredity** is the process in which traits (characteristics that can be passed only from a living thing to its young) are passed from parents to offspring. A **Punnett square** is a grid system that can be set up and used to predict the possible outcomes that may result from the mating process between two individuals, when their genotypes are known. Each cell within the square is representative of one possible genotypic outcome for any offspring. The term **genotype** refers to the genetic make-up of an organism. Genotype is represented by using letters of the alphabet to stand for each allele that has been passed from the parents. A capital letter represents the dominant allele and a lower case letter represents the recessive allele. **Alleles** are all the forms of a gene for any given trait. There are usually two allele possibilities for every trait. For example: B and b are both alleles for the trait of hair color. Since genotype is the genetic make-up, **phenotype** is the physical result of a gene combination. **Dominance** is when one allele can mask the presence of another (B is the dominant gene for brown hair). **Recessive** refers to a characteristic that is masked by the presence of a dominant allele (b is a recessive gene for blonde hair). The only way to have a recessive trait expressed is to have both alleles be recessive (bb, resulting in the blond hair color). Homozygous is defined by the occurrence where the paired alleles for a specific trait, in this case hair color, are identical (BB or bb). If both parents are homozygous, they can each only pass on one allele type to their offspring. This means that all the offspring will have one B and one b allele and will be Bb genotype. This Bb genotype is termed as **heterozygous**. A heterozygous genotype is when the genes that an offspring receives are different, Bb. In this instance, dominance will also be expressed because the offspring will have the dominant trait of brown hair.

1. Genetics is the study of heredity.
2. Traits are characteristic that can be passed only from a living thing to its young.
3. The process in which traits are passed from parents to offspring is heredity.
4. Each cell of a Punnett square represents one possible genotype outcome for any offspring of two specific parents.
5. Genotype refers to the genetic make-up of an organism.

6. Phenotype is the physical trait that is expressed in an individual.
7. Genotype are the different forms of a gene for any given trait.
8. For each trait, there are \_\_\_\_\_ allele possibilities.
9. When the expression of one allele is masked by the presence of another, it is said to be \_\_\_\_\_.
10. When an allele masks the presence of another allele, it is said to be Dominant.
11. When both alleles of a parent or offspring are identical, one is said to be homozygous.
12. A heterozygous genotype is when the alleles present are opposite, such as Bb.
13. It is proper to put the Dominant allele before a recessive allele when determining the genotype of the offspring in a Punnett square.
14. For an offspring to \_\_\_\_\_ a recessive trait, both parents must have at least one recessive allele in their genotype.

For the following pairs of traits, conduct a monohybrid cross to determine the genotype and phenotype of the offspring.

1. Dominant trait: B (brown hair)  
 Recessive trait: b (blonde hair)  
 Possible Genotypes: ~~3:1~~ 1:2:1  
 Possible Phenotypes: ~~1:2:1~~ 3:1

|   | B  | b  |
|---|----|----|
| B | BB | Bb |
| b | Bb | bb |

2. Dominant trait: C (circular flower)  
 Recessive trait: c (square flower)  
 Possible Genotypes: ~~1:1~~ 0:2:2  
 Possible Phenotypes: ~~0:2:1~~ 2:2

|   | C  | c  |
|---|----|----|
| c | Cc | cc |
| c | Cc | cc |

3. Dominant trait: R (round seed)  
Recessive trait: r (wrinkled seed)

Possible Genotypes: 4:0 0:4:0

Possible Phenotypes: 0:4:0 4:0

|   |    |    |
|---|----|----|
|   | R  | R  |
| r | Rr | Rr |
| r | Rr | Rr |

4. Dominant trait: W (white fur)  
Recessive trait: w (black fur)

Possible Genotypes: 3:1 1:2:1

Possible Phenotypes: 1:2:1 3:1

|   |    |    |
|---|----|----|
|   | W  | w  |
| W | WW | Ww |
| w | Ww | ww |

5. Dominant trait: T (tall height)  
Recessive trait: t (short height)

Possible Genotypes: 0:0:4

Possible Phenotypes: 0:4

|   |    |    |
|---|----|----|
|   | t  | t  |
| t | tt | tt |
| t | tt | tt |

1. Dominant trait: H (high metabolism)  
Recessive trait: h (normal metabolism)

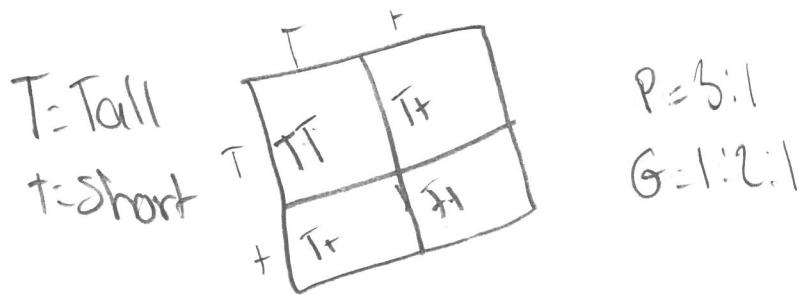
Possible Genotypes: 4:0 2:2:0

Possible Phenotypes: 2:2:0 4:0

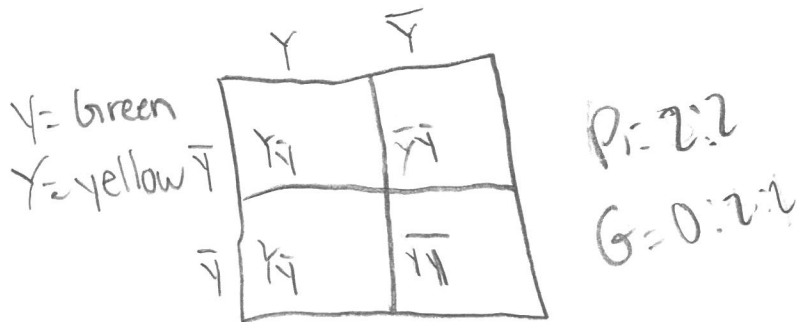
|   |    |    |
|---|----|----|
|   | D  | d  |
| D | DD | Dd |
| D | DD | Dd |

For each problem, draw a Punnett square and write the genotypes and phenotypes of the offspring.

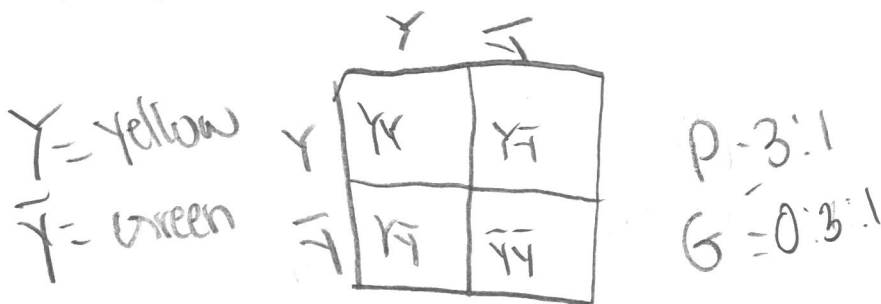
1. Predict the genotypic and phenotypic outcome (offspring) of a cross between two heterozygous tall pea plants.



2. In pea plants, yellow peas are dominant over green peas. Predict the genotypic and phenotypic outcome of a cross between a plant heterozygous for yellow peas and a plant homozygous for green peas.



3. Predict the phenotypic and genotypic outcome (offspring) of a cross between two plants heterozygous for yellow peas.



4. In pea plants, round peas are dominant over wrinkled peas. Predict the phenotypic and genotypic outcome (offspring) of a cross between a plant homozygous for round peas and a plant homozygous for wrinkled peas.

$R$  = round  
 $r$  = wrinkled

|     |      |      |
|-----|------|------|
|     | $R$  | $r$  |
| $R$ | $RR$ | $Rr$ |
| $r$ | $Rr$ | $rr$ |

$P = 4:0$   
 $G = 1:3:0$

5. Predict the phenotypic and genotypic outcome (offspring) of a cross between two plants heterozygous for round peas.

$R$  = round  
 $r$  = wrinkled

|     |      |      |
|-----|------|------|
|     | $R$  | $r$  |
| $R$ | $RR$ | $Rr$ |
| $r$ | $Rr$ | $rr$ |

$P = 3:1$   
 $G = 1:2:1$

6. One cat carries heterozygous, long-haired traits ( $Ss$ ), and its mate carries homozygous short-haired traits ( $ss$ ). Use a Punnett square to determine the probability of their offspring having long hair and the probability of their offspring having short hair.

$S$  = long hair  
 $s$  = short hair

|     |      |      |
|-----|------|------|
|     | $S$  | $s$  |
| $S$ | $SS$ | $Ss$ |
| $s$ | $Ss$ | $ss$ |

$P = 2:2$  50%  
 $G = 0:2:2$  50%

7. One flower is heterozygous red and it is crossed with a homozygous white plant. Use a Punnett square to determine the probability of their offspring having a red color and the probability of their offspring having a white color.

$R$  = red  
 $r$  = white

|      |      |
|------|------|
| $R$  | $r$  |
| $Rr$ | $rr$ |
| $r$  | $Rr$ |
|      | $rr$ |

$P = 2:2$   
 $G = 0.2:2$   
 50%  
 50%

8. A woman who is a carrier (heterozygous) for Cystic Fibrosis marries a man who has Cystic Fibrosis, a recessive disease. What are the genotypes? What is the probability that their children will have the disease? What is the probability that their children will not have the disease? Show a Punnett square!

$F$  = Not  
 $f$  = Cystic fibrosis

|      |      |
|------|------|
| $F$  | $f$  |
| $Ff$ | $ff$ |
| $f$  | $Ff$ |
|      | $ff$ |

$P = 2:2$   
 $G = 0.2:2$   
 50%  
 50%

9. A woman who is a carrier (heterozygous) for Huntington's Disease, which is a dominant disease, marries a man who is also a carrier for the disease. What are the genotypes? What is the probability that their children will have the disease? What is the probability that their children will not have the disease? Show a Punnett square!

$H$  = Huntington  
 $h$  = not

|     |      |
|-----|------|
| $H$ | $h$  |
| $H$ | $Hh$ |
| $h$ | $Hh$ |
|     | $hh$ |

$P = 3:1$   
 $G = 1:2:1$   
 25%  
 75%