

HEREDITY

Traits are inherited from one generation to the next. Each person inherits half of their chromosomes from their mother and half of their chromosomes from their father.
Genes- sections of DNA on a chromosome- control traits. There are different forms of each gene called **alleles**. For example, a gene for flower color may code for white flowers (one version/ allele) or red flowers (another version/ allele).

Some important terms to use in genetics:

Homozygous- the two alleles for a trait are the same

Ex. If a plant inherits two copies of the red allele (RR)

If a plant inherits two copies of the white allele (rr)

Heterozygous- the two alleles for a trait are different

Ex. If a plant inherits one copy of the red allele and one copy of the white allele (Rr)

Genotype- the gene combination that an organism contains

Phenotype- the way an organism looks (its physical appearance)

In simple inheritance, if an organism is heterozygous for a trait, only one form of the trait will be observed. The observed trait is **dominant**. The trait that is masked by the dominant trait is **recessive**.

Punnett Squares are devices used to find out the possible offspring of a cross.

For example... In mice, black fur is dominant to white fur. If two heterozygous individuals (Bb) are crossed:

$\frac{3}{4}$ of the offspring are likely to be black. (BB or Bb)

$\frac{1}{4}$ of the offspring are likely to be white. (bb)

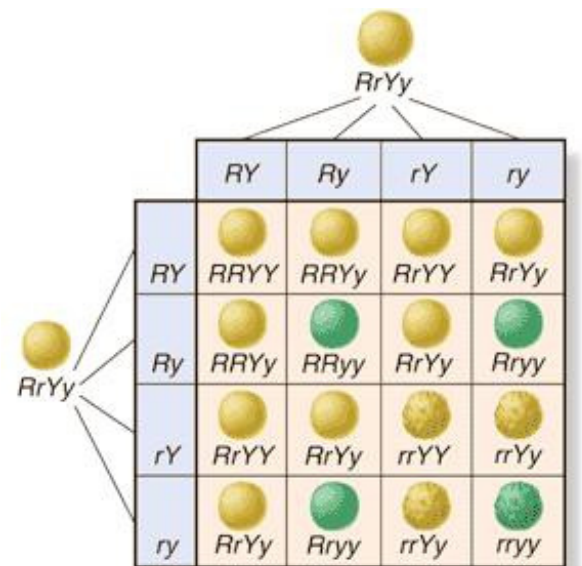
| | | | |
|---|----|---------|---|
| | | Bb x Bb | |
| | | B | b |
| B | BB | Bb | |
| b | Bb | bb | |

In a **dihybrid cross**, scientists examine the inheritance of two traits. While they may appear intimidating, dihybrid crosses follow the same rules as above.

In order to set up a dihybrid cross, you must first determine all possible gametes that each parent can contribute. In pea plants, round is dominant to wrinkled and yellow is dominant to green. Crossing two heterozygous individuals will yield a 9:3:3:1 phenotypic ratio.

RrYy x RrYy

9 yellow and round
 3 yellow and wrinkled
 3 green and round
 1 green and wrinkled



Consider the following example...

| Gene | Trait |
|------|-----------------------------|
| G | Green feathers (dominant) |
| g | Yellow feathers (recessive) |
| L | Long beak (dominant) |
| l | Short beak (recessive) |

Notice that the male is homozygous dominant for feathers (GG), therefore he can only donate dominant (G) alleles for feather color to his offspring.

This automatically means that all offspring will carry at least one dominant allele and will therefore have green feather – regardless of female genotype.

GGLl (male) × Ggll (female)

PRACTICE

1. There are different forms of each gene called _____.
2. Which of the following is heterozygous?
 - A. TT
 - B. tt
 - C. Tt
3. In fruitflies, long wings (L) are dominant to short wings (l). If the following individuals are crossed, what is the probability that their offspring will have long wings?

Ll X ll

- A. $\frac{1}{4}$
- B. $\frac{1}{2}$
- C. $\frac{3}{4}$
- D. 100%

| Allele | Trait | Type |
|--------|---------------|-----------|
| T | Bent tail | Dominant |
| t | Straight tail | Recessive |
| B | Brown eyes | Dominant |
| b | Green eyes | Recessive |

TtBb (male) X ttBB (female)

4. According to the table above, which of the following phenotypes would probably be seen in all of the offspring from the parents shown above?
 - A. Bent tail
 - B. Straight tail
 - C. Brown eyes
 - D. Green eyes

5. What is one possible combination that can be found in a gamete formed by an individual with the genotype AaBB?

- A. AB
- B. Ab
- C. Aa
- D. BB

6. How are genotype and phenotype different?