

Genetics, the Law of Segregation and Simple Dominance

(pages 262-274)

Genetics is the scientific study of heredity.

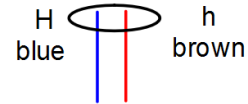
Diploid cells contain two versions of each trait. One version is inherited from the mother and one version is inherited from the father. Each version is called an allele.

Alleles are represented by letters in genetics.

A capital letter represents a dominant trait.

A lowercase letter represents a recessive (hidden) trait.

Alleles for eye color



Homologous chromosomes

genotype--genetic allele makeup (ex. HH, Hh, hh)

phenotype--observable physical characteristics (ex. blue eyes)

Possible allele combinations:

heterozygous or hybrid = different versions of an allele (example: Hh)

homozygous or true breeding or purebred--same versions of an allele (example: HH or hh)

In an inheritance pattern of simple dominance, the dominant allele is always the phenotype expressed in the heterozygous state.

Gregor Mendel

- father of modern genetics
- experimented with pea plants and proved how traits are passed to offspring from parents



First Experiment:

Mendel crossed truebreeding short pea plants with truebreeding tall pea plants. All the offspring were tall, establishing tall as the dominant allele.

Second Experiment:

Mendel crossed two mixed or heterozygous pea plants. Three offspring were tall, and one offspring was short, proving that the alleles for tall and short could separate and recombine in four different ways.

A Punnett square is used to predict the genotypic and phenotypic ratio of offspring from a genetic cross

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Mendel's First Experiments: Determined Allele Dominance

Experiment: Crossed two true breeding P (parent) generations
 Results: All offspring (F1 generation) expressed the dominant trait but are heterozygous (hybrids)

| | | |
|---|------------|------------|
| | A | A |
| a | Aa tall | Aa tall |
| a | Aa tall | Aa tall |

Genotypic ratio: 100% Tt
 Phenotypic ratio: 100% Tall

Mendel's Second Experiments: Beginnings of the Concept of Meiosis

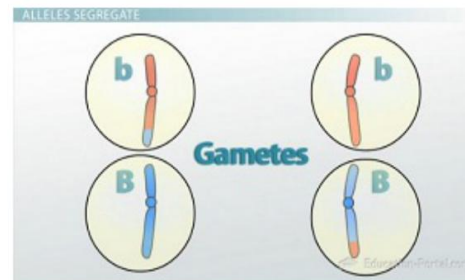
Experiment: Crossed two hybrid F1 plants
 Results: One F2 offspring expressed the recessive trait

| | | |
|---|------------|-------------|
| | T | t |
| T | TT tall | Tt tall |
| t | Tt tall | tt short |

Genotypic ratio: 25% TT
 50% Tt
 25% tt
OR 1:2:1

Phenotypic ratio: 75% Tall
 25% short
OR 3:1

Law of Segregation --the two alleles that govern a trait separate from each other and go into one of four different gametes during meiosis.



Practice

In humans, brown eyes are dominant over blue. A heterozygous brown eyed man marries a blue eyed woman. What is the probability that they will have a blue eyed child?

Pattern of Inheritance
 Simple Dominance

Genes
 Dominant-- B=brown
 Recessive-- b=blue

Genotype of Parents
 Male-- Bb=brown
 Female-- bb=blue

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

Offspring Ratios

Genotypes:
 50% Bb
 50% bb

Phenotypes:
 50% brown eyes
 50% blue eyes

Practice

In purple people eaters, one-horn is dominant and no horns is recessive. Draw a Punnett Square showing the cross of a purple people eater that is hybrid for horns with a purple people eater that does not have horns. Summarize the genotypes and phenotypes of the possible offspring.

Pattern of Inheritance
 Simple Dominance

Genes
 Dominant-- B=one horn
 Recessive-- b=no horns

Parent Genotypes
 Male-- Bb=hybrid for horns
 Female-- bb=no horns

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

Offspring Ratios

Genotypes:
 50% Bb
 50% bb

Phenotypes:
 50% one horn
 50% no horns