

11-2 Probability and Punnett Squares

Genetics and Probability

The likelihood that a particular event will occur is called **probability**.

The principles of probability can be used to predict the outcomes of genetic crosses.

Organisms that have two identical alleles for a particular trait are said to be **homozygous**.

Homozygous organisms are true-breeding for a particular trait. **TT (Tall) or tt (short)**

Organisms that have two different alleles for the same trait are **heterozygous**.

Heterozygous organisms are hybrid for a particular trait. **Tt (Tall)**

Phenotype is physical characteristics.

Phenotypes include = Tall, short, green, yellow.

Genotype is genetic makeup.

Genotypes = TT, Tt, tt

A capital letter represents the dominant allele for tall.

A lowercase letter represents the recessive allele for short.

In this example,

T = tall

t = short

Punnett Squares

The gene combinations that might result from a genetic cross can be determined by drawing a diagram known as a **Punnett square**.

Punnett squares can be used to predict and compare the genetic variations that will result from a cross.

What are the possible gamete genotypes that an organism can produce?

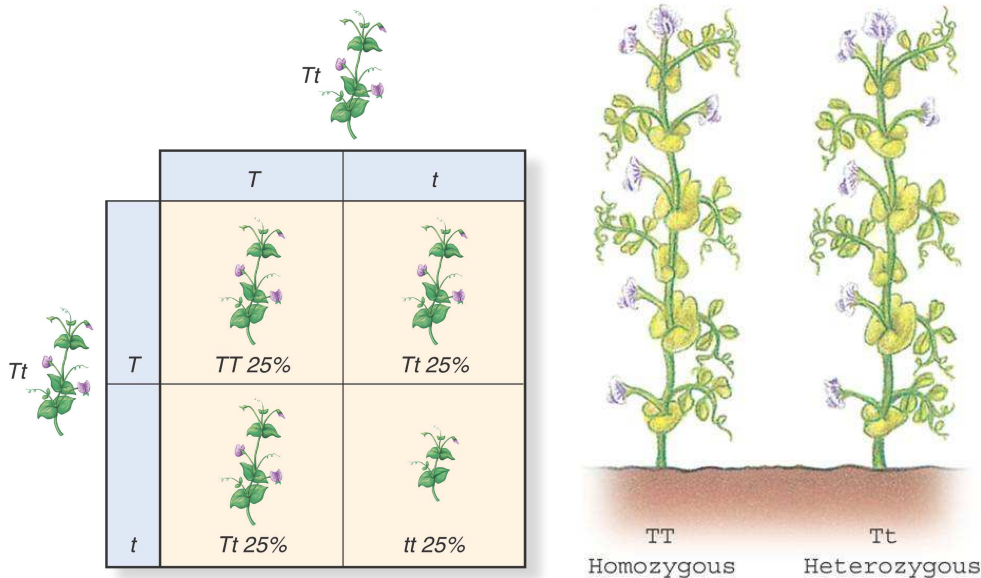
Pure bred Tall (TT) can only produce gametes carrying T

Pure bred Short (tt) can only produce gametes carrying t

Hybrid Tall (Tt) can produce gametes carrying either T or t

Gametes produced by each F1 parent are shown along the top and left side.

Possible gene combinations for the F2 offspring appear in the four boxes.



The plants have different genotypes (*TT* and *Tt*), but they have the same phenotype (tall).

Probability and Segregation

One fourth ($1/4$) of the F₂ plants have two alleles for tallness (TT).

$2/4$ or $1/2$ have one allele for tall (T), and one for short (t).

One fourth ($1/4$) of the F₂ have two alleles for short (tt).

Because the allele for tallness (T) is dominant over the allele for shortness (t), $3/4$ of the F₂ plants should be tall. The ratio of tall plants (TT or Tt) to short (tt) plants is 3:1.

The predicted ratio showed up in Mendel's experiments indicating that segregation did occur.

Probabilities Predict Averages

Probabilities predict the average outcome of a large number of events.

Probability cannot predict the precise outcome of an individual event.

In genetics, the larger the number of offspring, the closer the resulting numbers will get to expected values.