11-2 Probability and Punnett Squares

How do geneticists use the principles of probability?

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.

How do geneticists use Punnett squares?

Punnett Squares

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

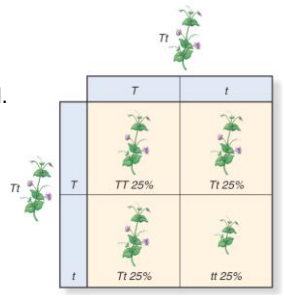
Punnett squares can be used to predict and compare the genetic variations that will result from a cross.

A capital letter represents the dominant allele for tall.

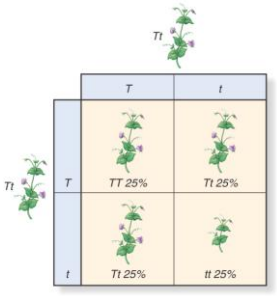
A lowercase letter represents the recessive allele for short.

In this example,

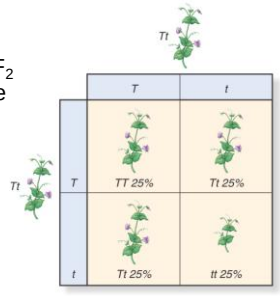
T = tall
t = short



Gametes produced by each F_1 parent are shown along the top and left side.



Possible gene combinations for the F_2 offspring appear in the four boxes.



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

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

Homozygous organisms are true-breeding for a particular trait.

Heterozygous organisms are hybrid for a particular trait.

All of the tall plants have the same **phenotype**, or physical characteristics.

The tall plants do not have the same **genotype**, or genetic makeup.

One third of the tall plants are *TT*, while two thirds of the tall plants are *Tt.*

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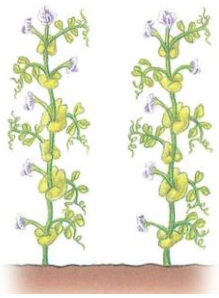
The plants have different genotypes (*TT* and *Tt*), but they have the same phenotype (tall).



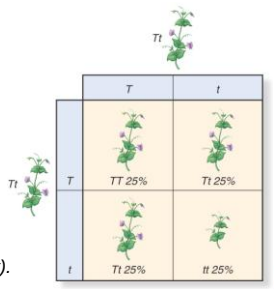
TT **Homozygous** ***Tt*** **Heterozygous**

Probability and Segregation

One fourth (1/4) of the F_2 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 F_2 have two alleles for short *(tt).*



Because the allele for tallness (*T*) is dominant over the allele for shortness (t), 3/4 of the F_2 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.

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1 Probability can be used to predict

A a. average outcome of many events.

b. precise outcome of any event.

c. how many offspring a cross will produce.

d. which organisms will mate with each other.

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2 Compared to 4 flips of a coin, 400 flips of the coin is

A a. more likely to produce about 50% heads and 50% tails.

b. less likely to produce about 50% heads and 50% tails.

c. guaranteed to produce exactly 50% heads and 50% tails.

d. equally likely to produce about 50% heads and 50% tails.

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3 Organisms that have two different alleles for a particular trait are said to be

a. hybrid.

A b. heterozygous.

c. homozygous.

d. recessive.

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4 Two F_1 plants that are homozygous for shortness are crossed. What percentage of the offspring will be tall?

a. 100%

b. 50%

A c. 0%

d. 25%

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5 The Punnett square allows you to predict

a. only the phenotypes of the offspring from a cross.

b. only the genotypes of the offspring from a cross.

A c. both the genotypes and the phenotypes from a cross.

d. neither the genotypes nor the phenotypes from a cross.