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Biology

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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.

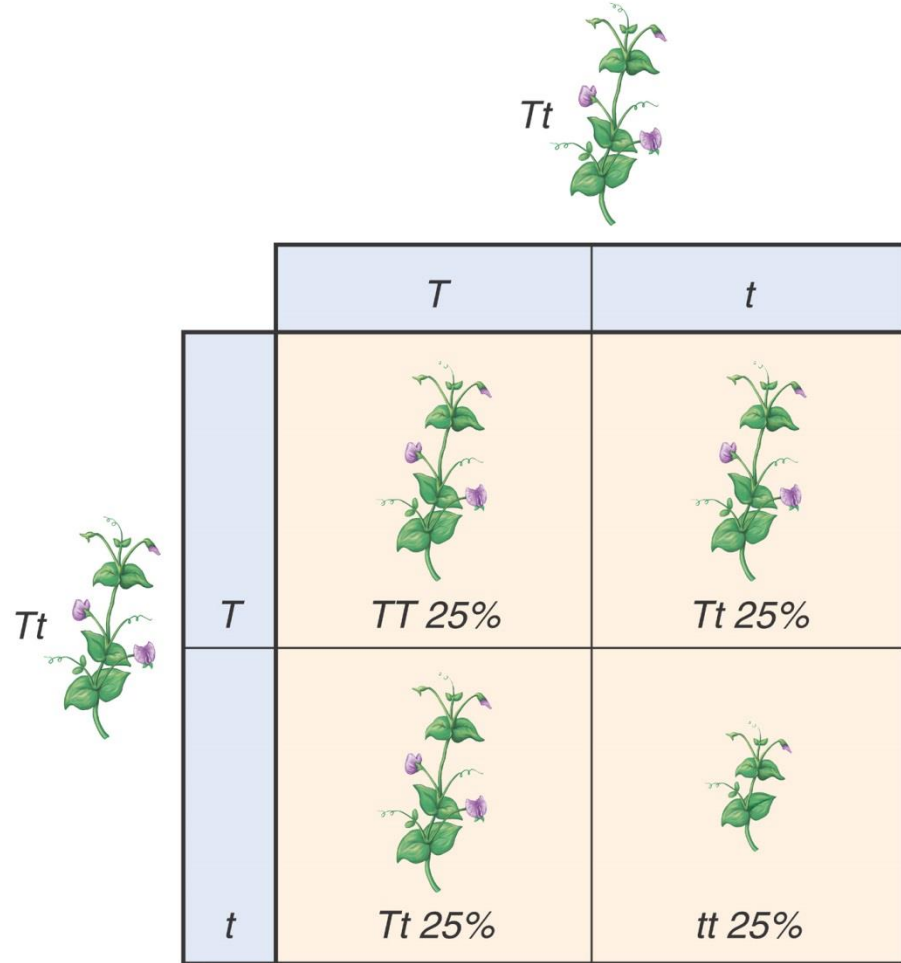A capital letter represents the dominant allele for tall.

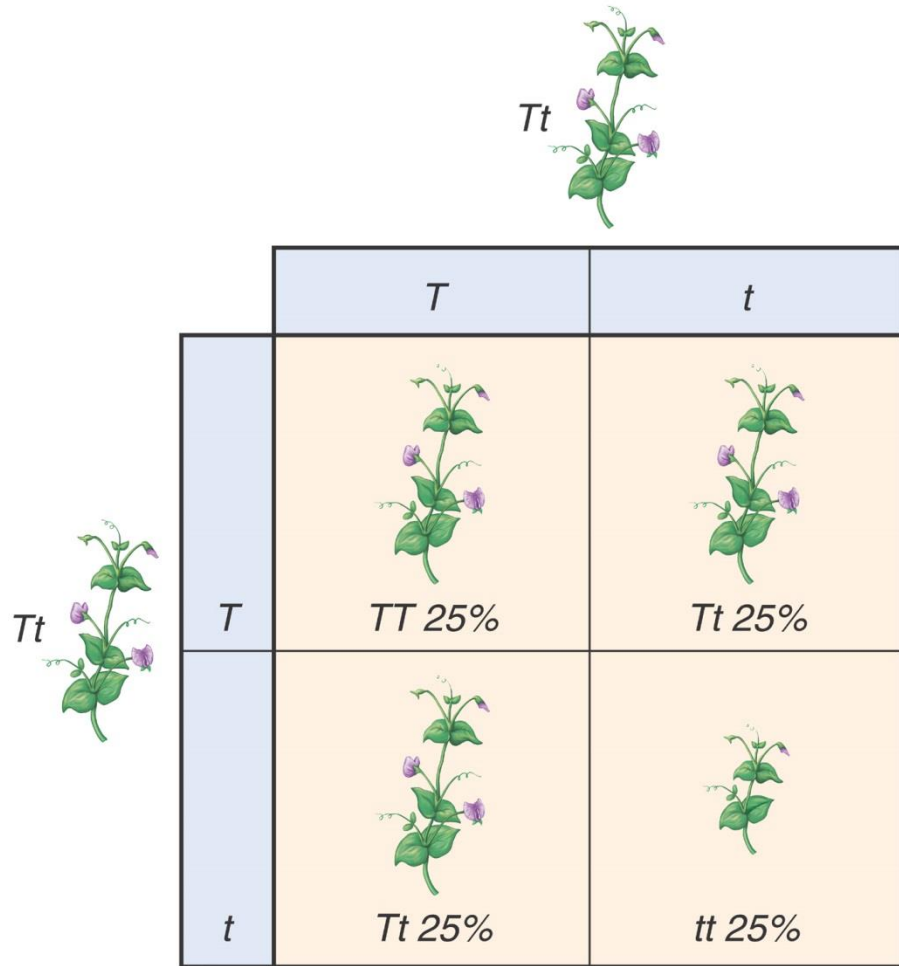A lowercase letter represents the recessive allele for short.

In this example,

T = tall
t = short

Tt

Tt

	T	t
T	TT 25%	Tt 25%
t	Tt 25%	tt 25%

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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.** (TT, tt)

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

Homozygous organisms are <u>true-breeding</u> for a particular trait.

Heterozygous organisms are <u>hybrid</u> for a particular trait.

All of the tall plants have the same **phenotype**, or physical characteristics. (what it LOOKS like)

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

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

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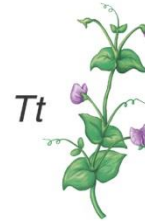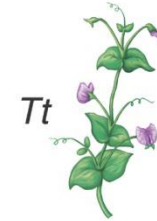
***TT*
Homozygous**

***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.

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Probabilities Predict Averages

Probabilities predict the <u>average outcome</u> of a <u>large number</u> of events.

Probability <u>cannot predict the precise outcome</u> of an individual event. (only the chance of an 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.

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.

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

a. hybrid.

b. heterozygous.

c. homozygous.

d. recessive.

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%

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.

END OF SECTION