KEY CONCEPT

The inheritance of traits follows the rules of probability.
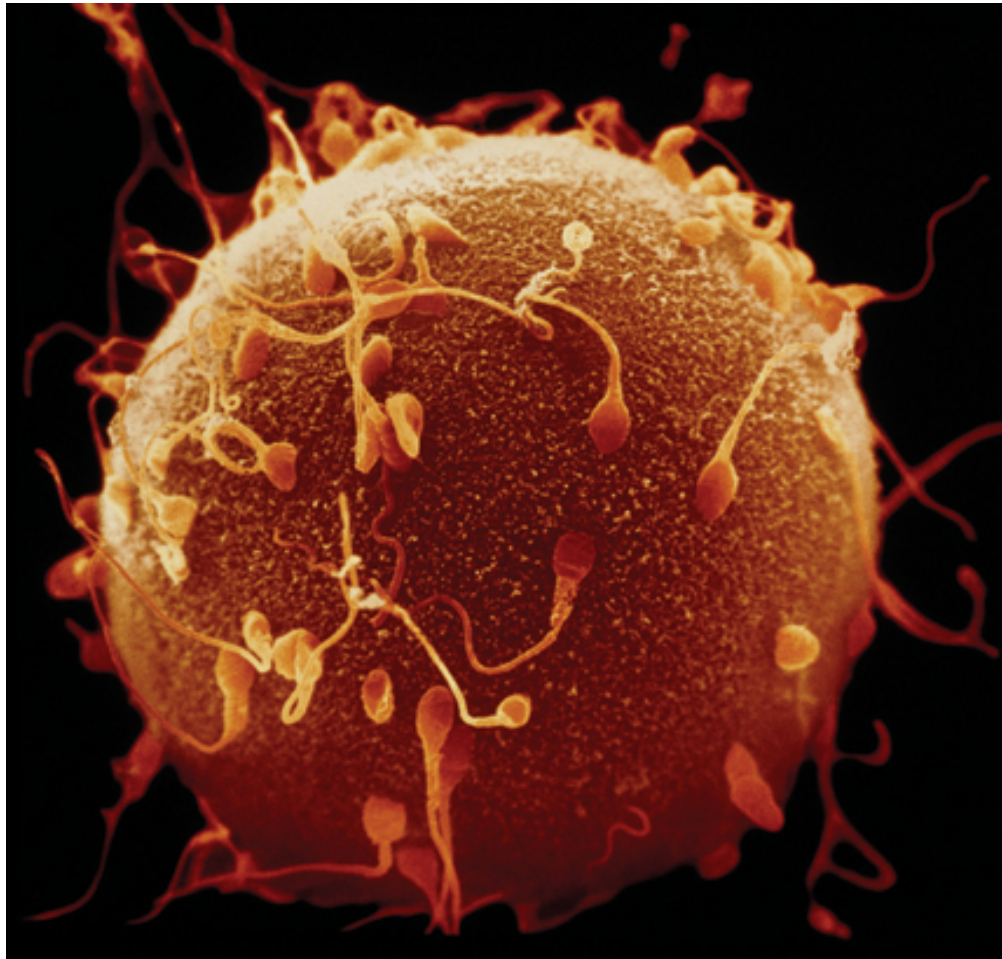
Punnett squares illustrate genetic crosses.

- The Punnett square is a grid system for predicting all possible genotypes resulting from a cross.
  - The axes represent the possible gametes of each parent.
  - The boxes show the possible genotypes of the offspring.
- The Punnett square yields the ratio of possible genotypes and phenotypes.
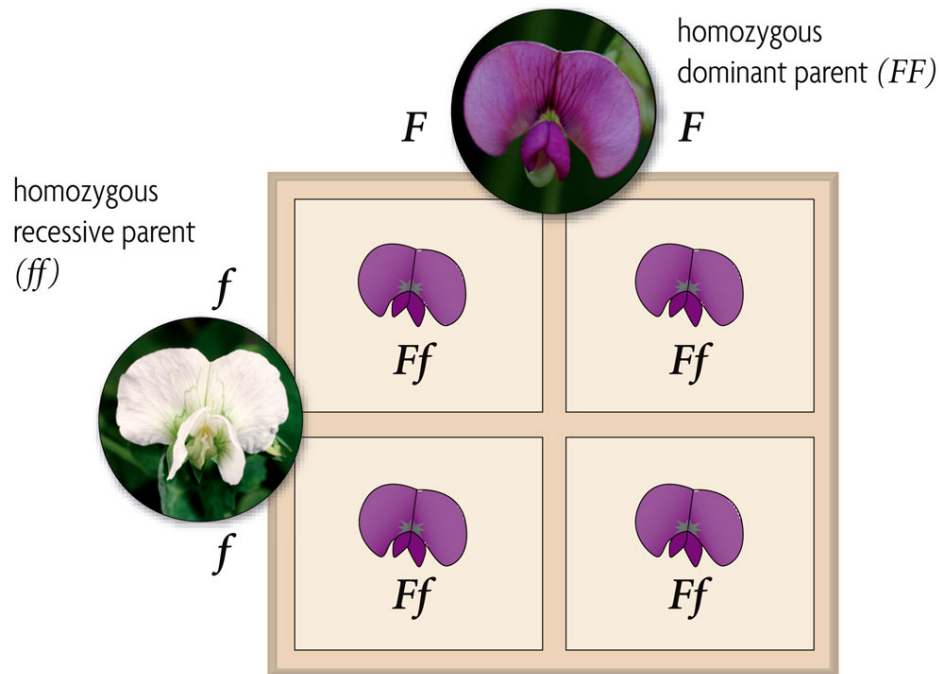
The **Punnett square** is a grid system for predicting possible genotypes of offspring.

|	Parent 1 alleles	
	A	a
A	AA	Aa
a	Aa	aa

Parent 2 alleles

possible genotypes of offspring
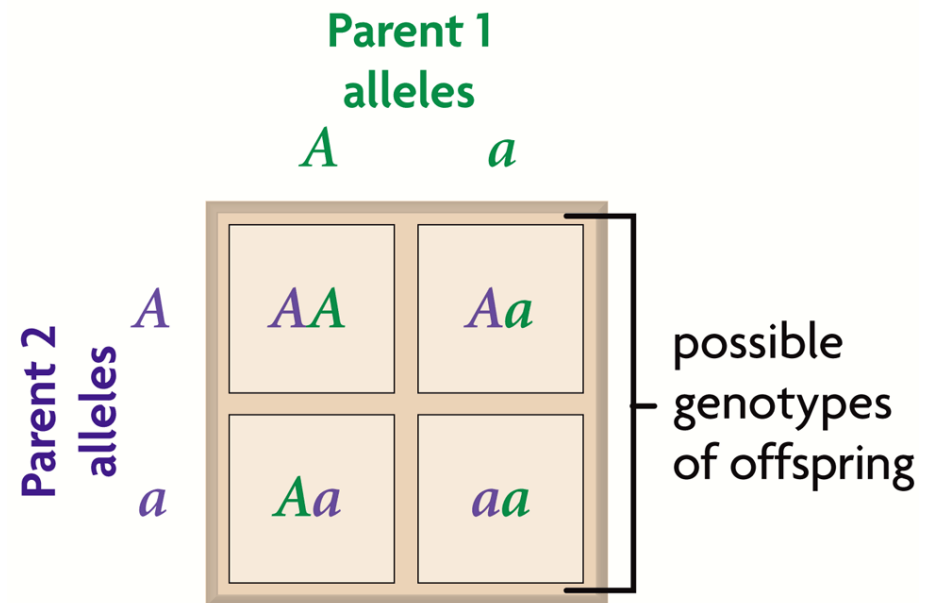
A monohybrid cross involves one trait.

- Monohybrid crosses examine the inheritance of only one specific trait.
 - homozygous dominant-homozygous recessive: all heterozygous, all dominant

– heterozygous-heterozygous—1:2:1 homozygous dominant: heterozygous:homozygous recessive; 3:1 dominant:recessive
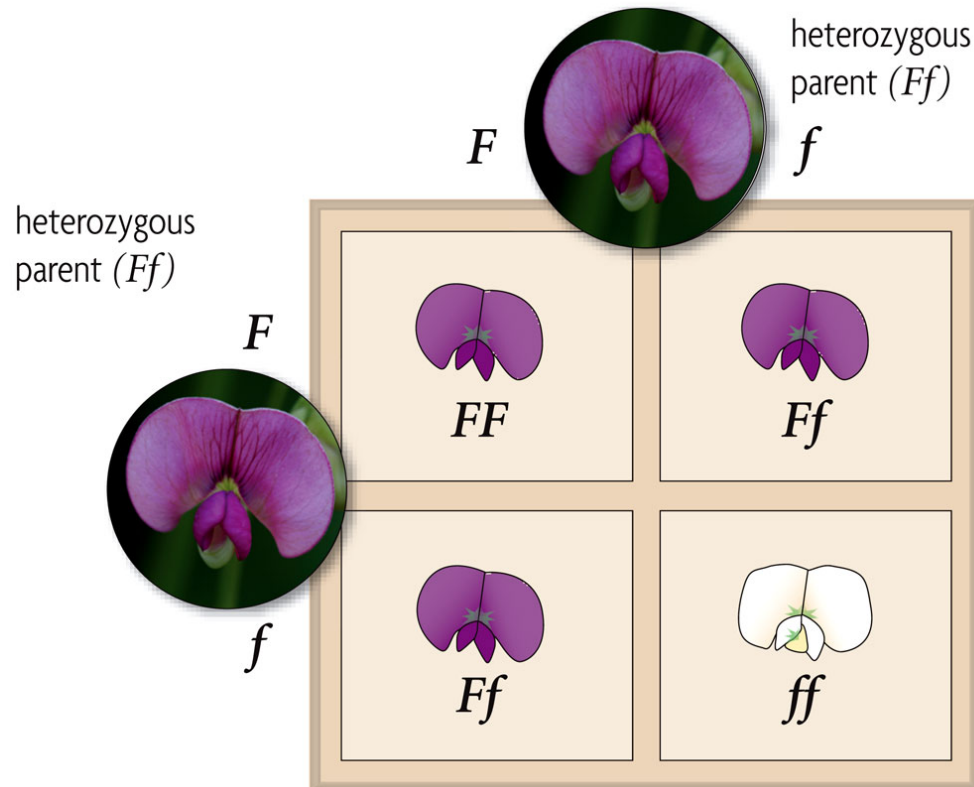
- heterozygous-homozygous recessive—1:1 heterozygous:homozygous recessive; 1:1 dominant:recessive

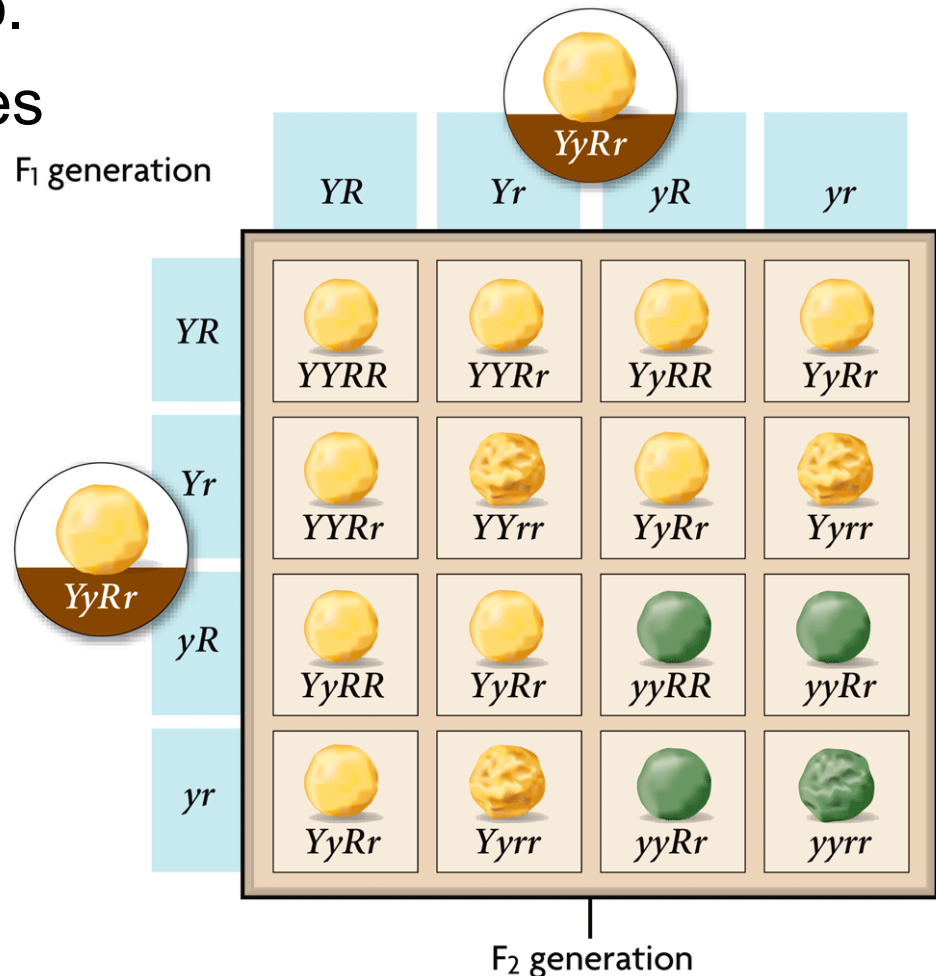- A testcross is a cross between an organism with an unknown genotype and an organism with the recessive phenotype.

homozygous recessive parent (*ff*)

heterozygous parent (*Ff*)

F

f

f   *f*

Ff   *Ff*

ff   *ff*
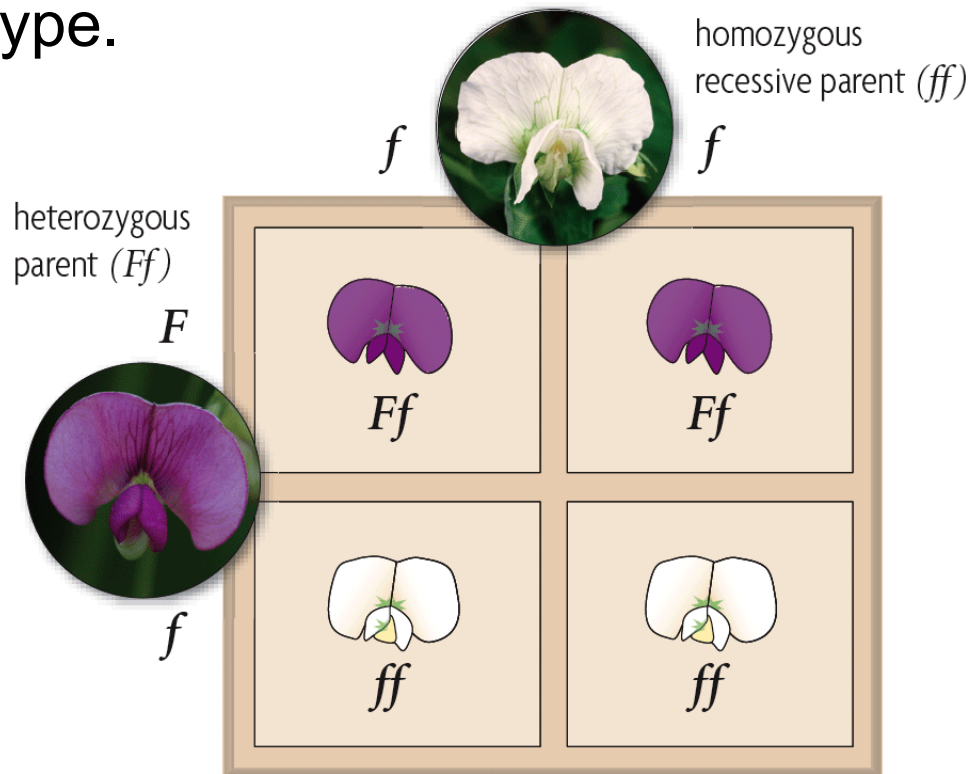
▶ **A dihybrid cross involves two traits.**

- Mendel's dihybrid crosses with heterozygous plants yielded a 9:3:3:1 phenotypic ratio.

- Mendel's dihybrid crosses led to his second law, the law of independent assortment.

- The law of independent assortment states that allele pairs separate independently of each other during meiosis.

F₁ generation

YyRr

	YR	Yr	yR	yr
YR	YYRR	YYRr	YyRR	YyRr
Yr	YYRr	YYrr	YyRr	Yyrr
yR	YyRR	YyRr	yyRR	yyRr
yr	YyRr	Yyrr	yyRr	yyrr

YyRr

F₂ generation

Heredity patterns can be calculated with probability.

- Probability is the likelihood that something will happen.

- Probability predicts an average number of occurrences, not an exact number of occurrences.

- Probability = $\dfrac{\text{number of ways a specific event can occur}}{\text{number of total possible outcomes}}$

- Probability applies to random events such as meiosis and fertilization.

The coins are equally likely to land heads up or tails up.

Two sides of coin 2

$\frac{1}{2}H$ $\frac{1}{2}T$

$\frac{1}{2}H$

Two sides of coin 1

$\frac{1}{2}T$

$\frac{1}{4}$ HH $\frac{1}{4}$ HT

$\frac{1}{4}$ HT $\frac{1}{4}$ TT