**KEY CONCEPT**
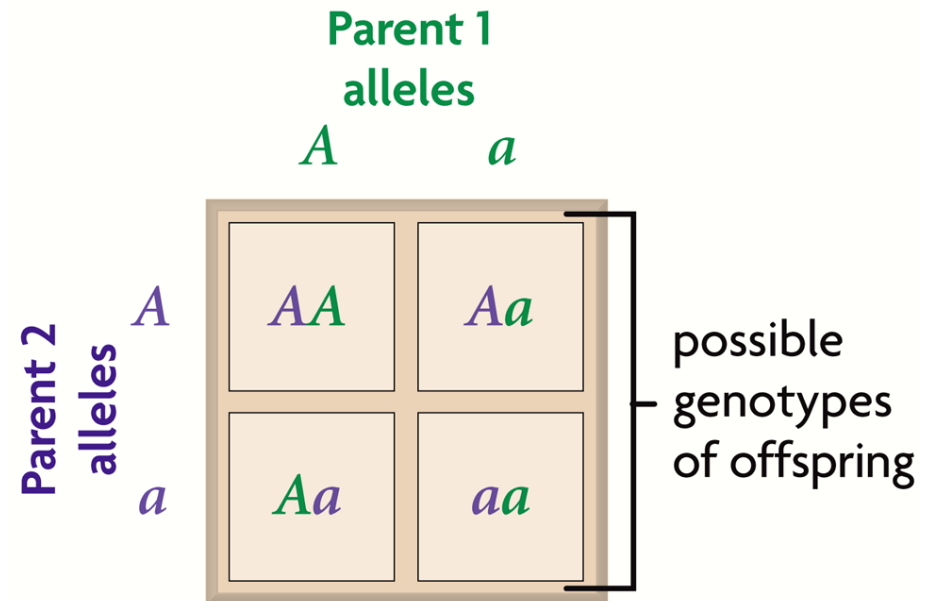
**The inheritance of traits follows the rules of probability.**

**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.
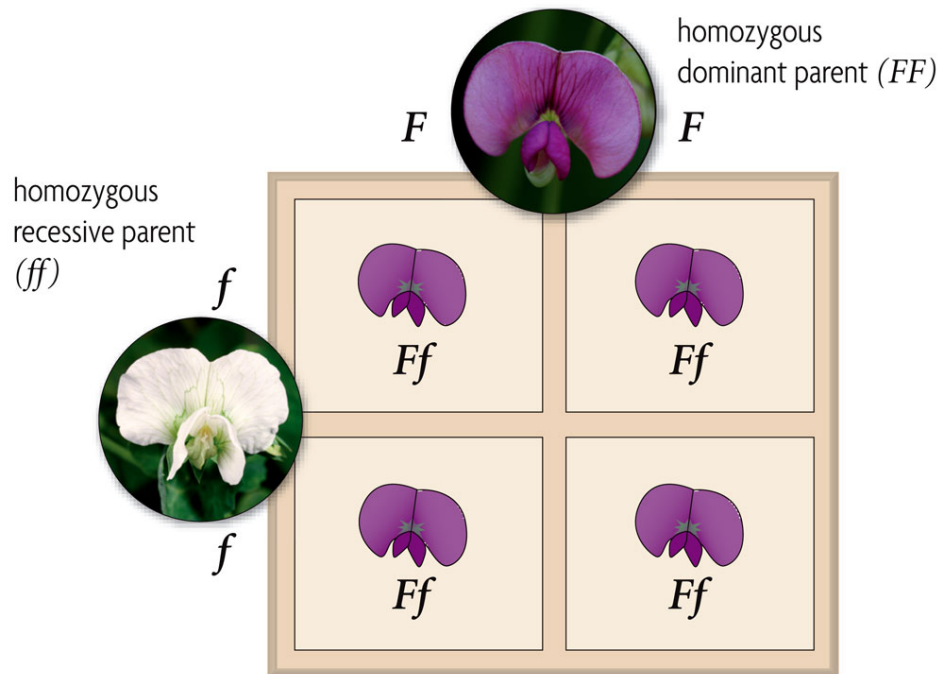- The Punnett square yields the ratio of possible genotypes and phenotypes.

The **Punnett square** is a grid system for predicting possible genotypes of offspring.
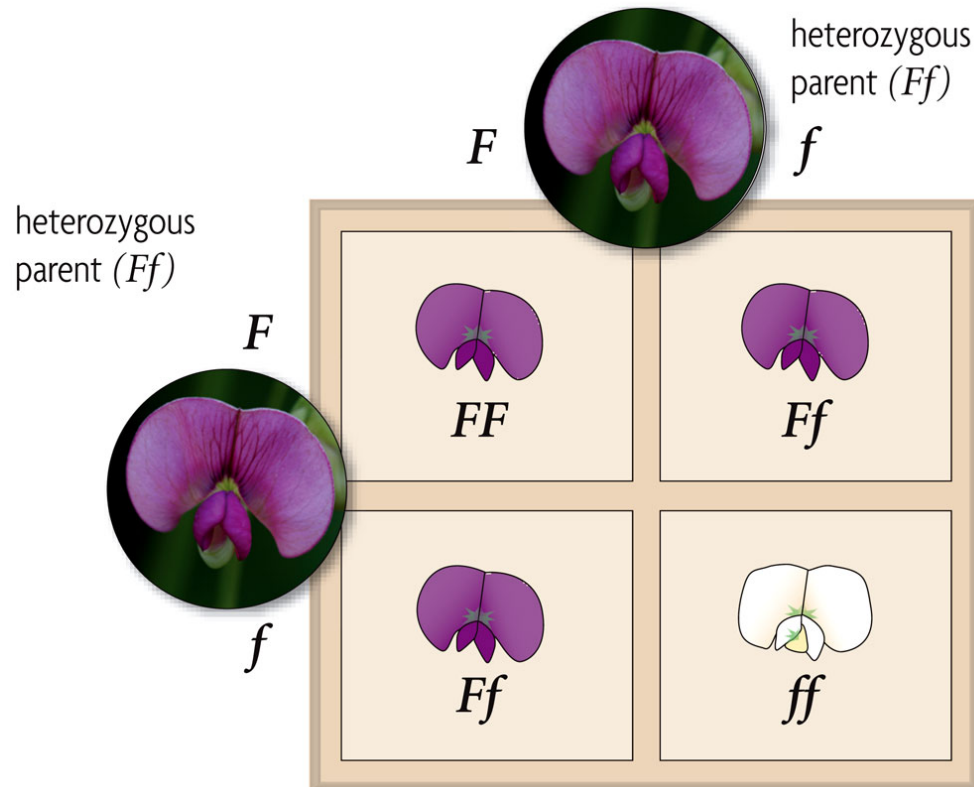
- **A monohybrid cross involves one trait.**

  - **Monohybrid crosses** examine the inheritance of only one specific trait.

    – homozygous dominant-homozygous recessive: all heterozygous, all dominant
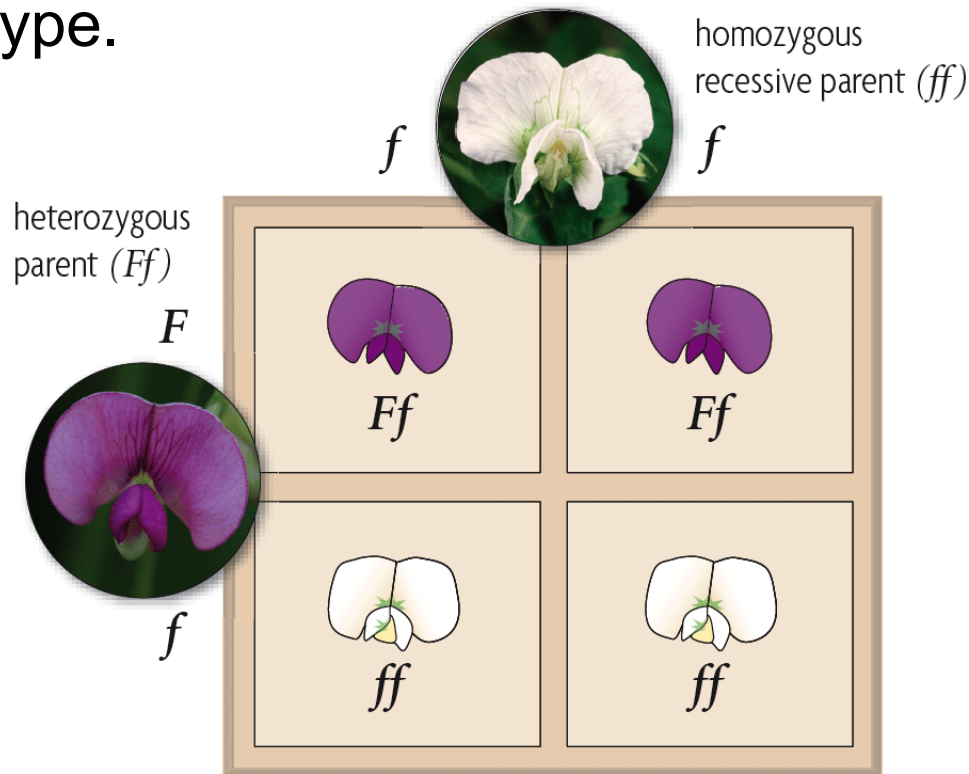
# 6.5 Traits and Probability

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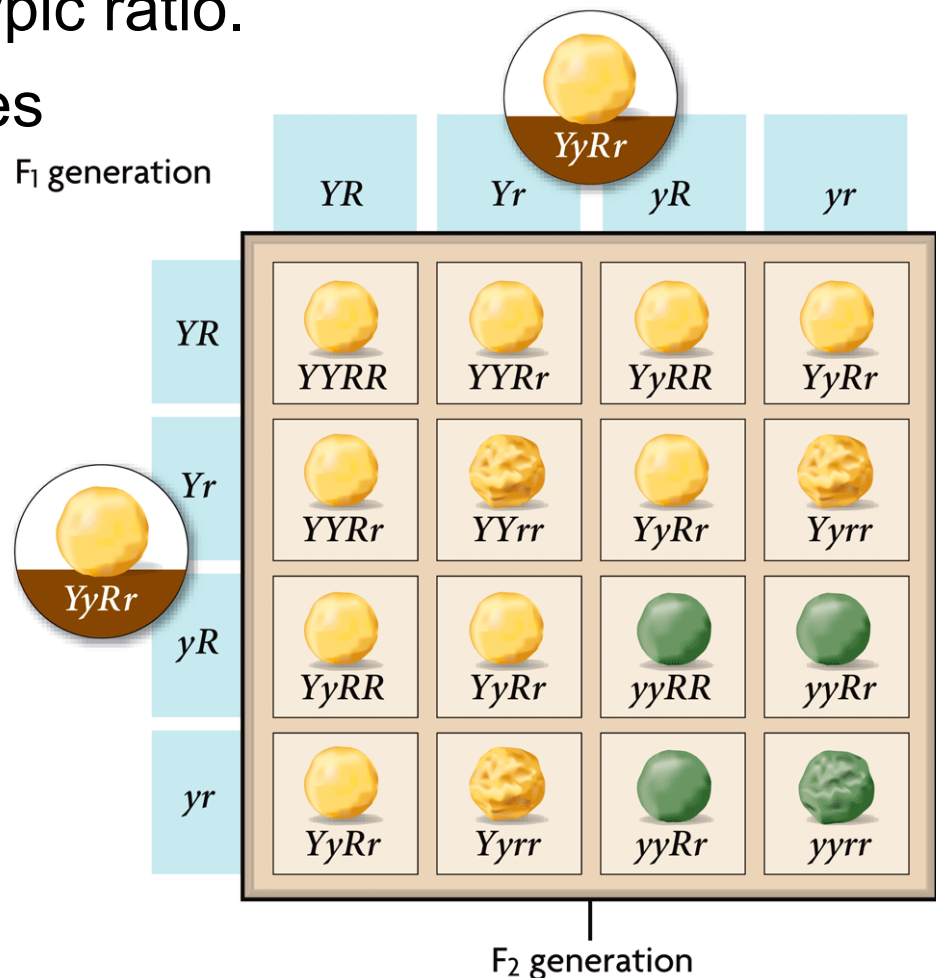
- heterozygous-homozygous recessive—1:1 heterozygous:homozygous recessive; 1:1 dominant:recessive

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

## 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

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

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

Two sides of coin 1

$\frac{1}{2}H$

$\frac{1}{2}T$

| | $\frac{1}{2}H$ | $\frac{1}{2}T$ |
|---|---|---|
| $\frac{1}{2}H$ | $\frac{1}{4}\ HH$ | $\frac{1}{4}\ HT$ |
| $\frac{1}{2}T$ | $\frac{1}{4}\ HT$ | $\frac{1}{4}\ TT$ |