# Applying Mendel's Principles

# Probability and Heredity

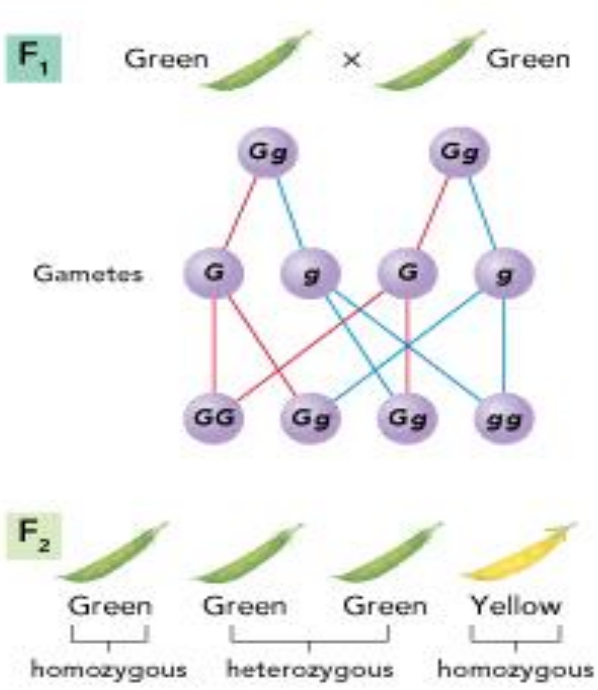
**Probability:** the likelihood that a particular event will occur. If you flip a coin, what is the probability of either outcome (heads or tails)

- ½ or 50%

- What is the probability for 3 coin tosses landing on heads?
  - ½ x ½ x ½ = 1/8

- Each flip is an *independent* event with ½ probability of landing heads up.

# Using Segregation to Predict Outcomes




Probability of a gamete receiving a *G*?

50%, or 1/2

Probability of gamete receiving a *g*?

50%, or 1/2

Probability of green offspring is

3/4 (Dominant allele)

Probability of yellow offspring is

1/4 (recessive allele)

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Single-gene crosses are monohybrid crosses

The prefix *mono-* means 1.

# Using Segregation to Predict Outcomes

**Homozygous:** organisms that have 2 identical alleles for a particular gene

- GG – dominant true-breeding
- gg – recessive true-breeding
- Prefix *homo-* means same

**Heterozygous:** organisms that have 2 different alleles for the same gene

- Gg – dominant and recessive allele
- Prefix *hetero-* means different

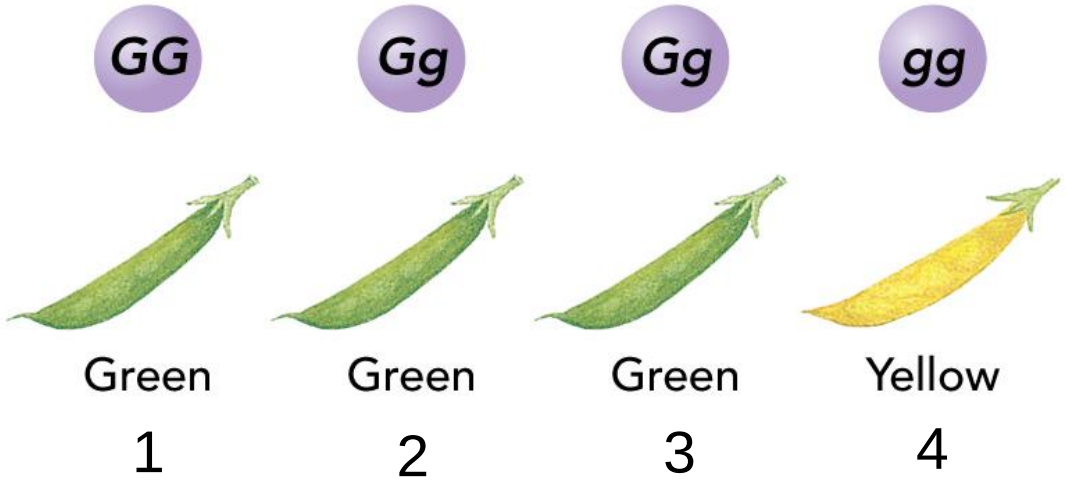
# Heterozygous and Homozygous

**Homozygous:** has two identical alleles for a gene

**Heterozygous:** has two different alleles for a gene

Which are:

homozygous? 1, 4 heterozygous? 2, 3

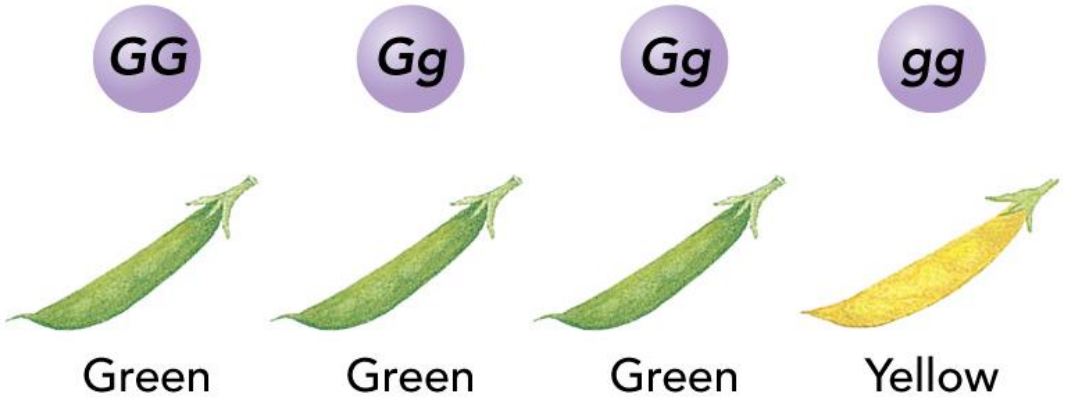


# Genotype and Phenotype

**Genotype:** genetic makeup

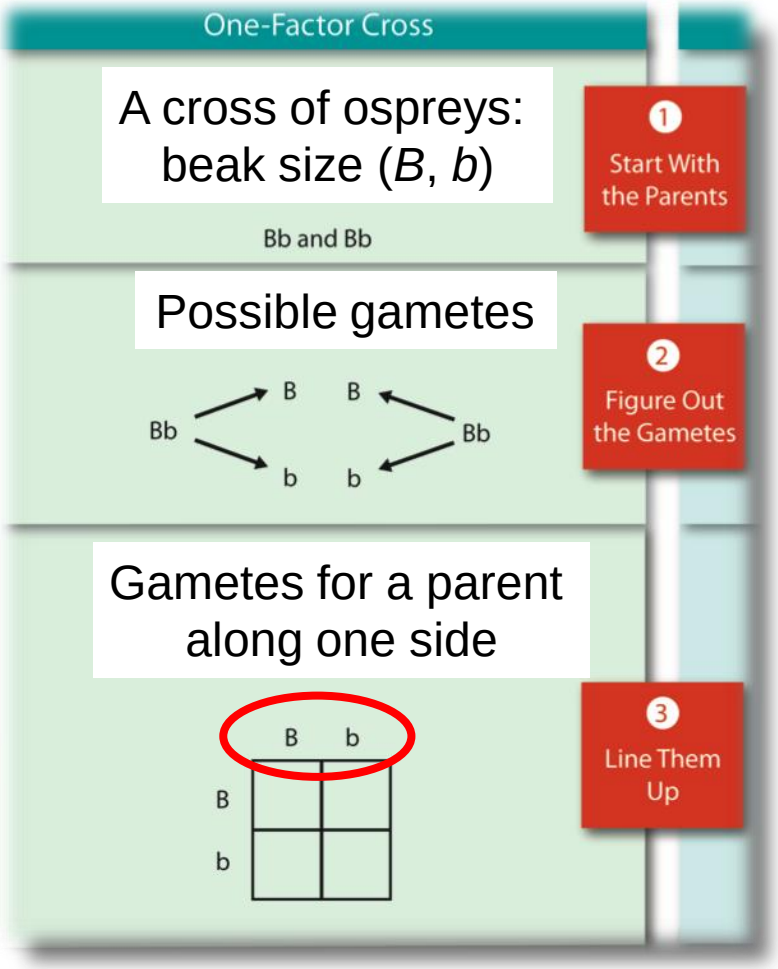
**Phenotype:** physical traits

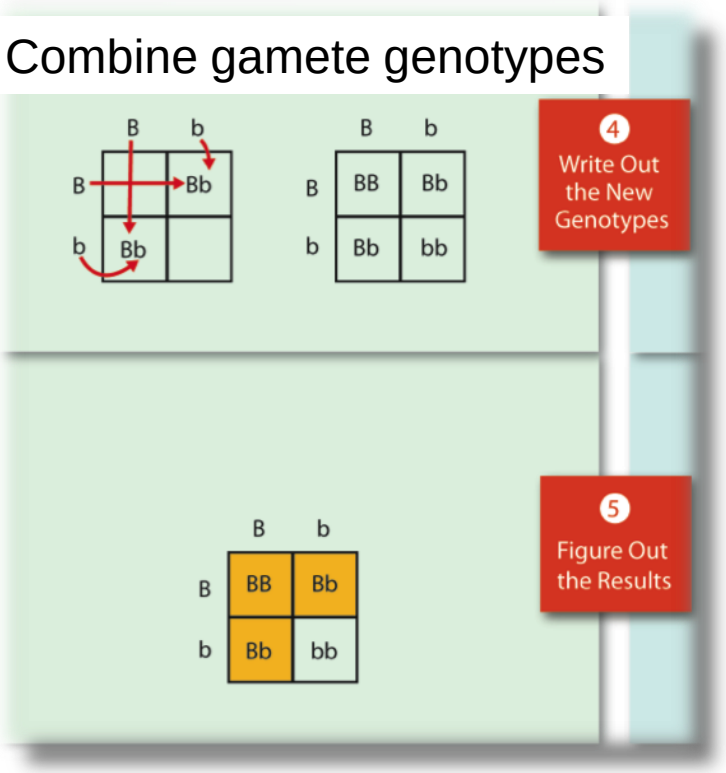
Two organisms may share the same phenotype but have different genotypes .



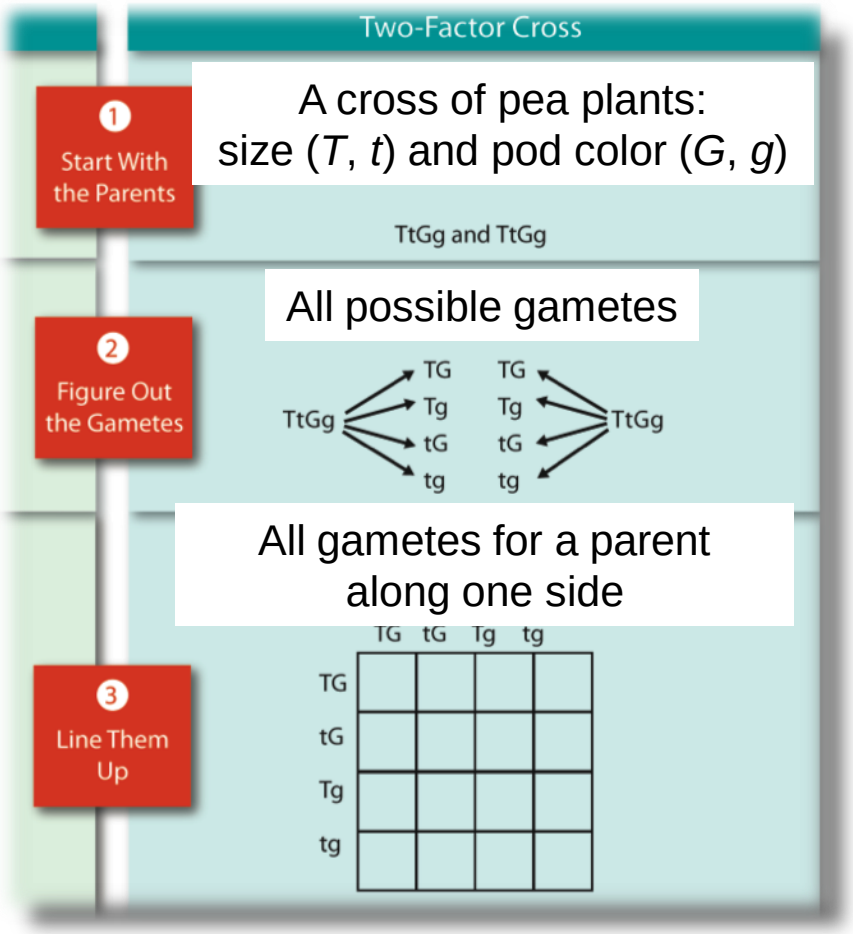
# Making a Punnett Square

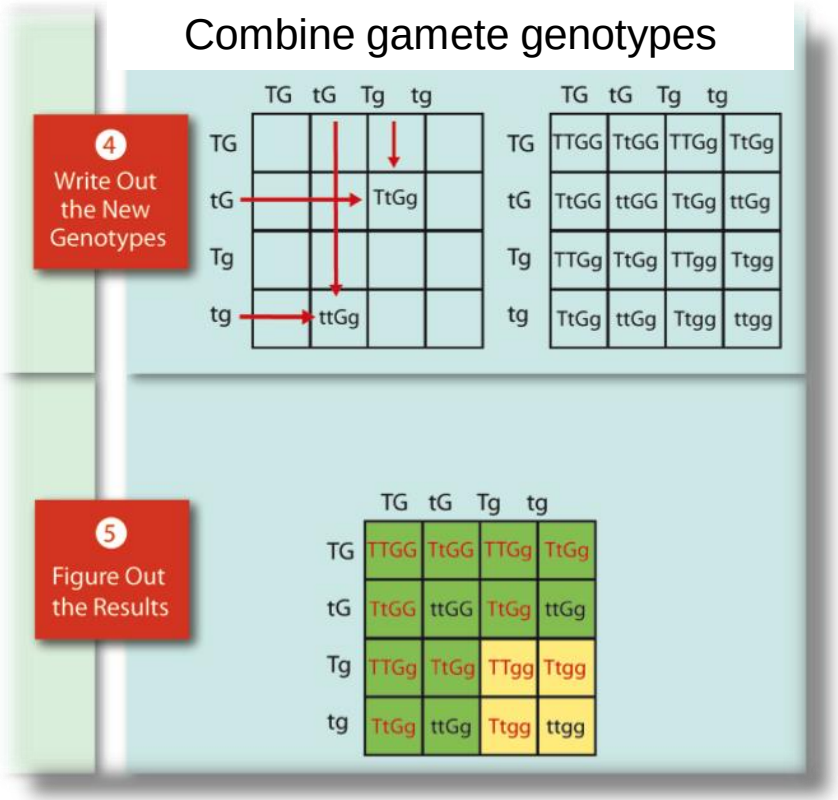
**Punnett square:** uses mathematical probability to help predict the genotype and phenotype combinations in genetic crosses



# Making a Punnett Square: Two Factors



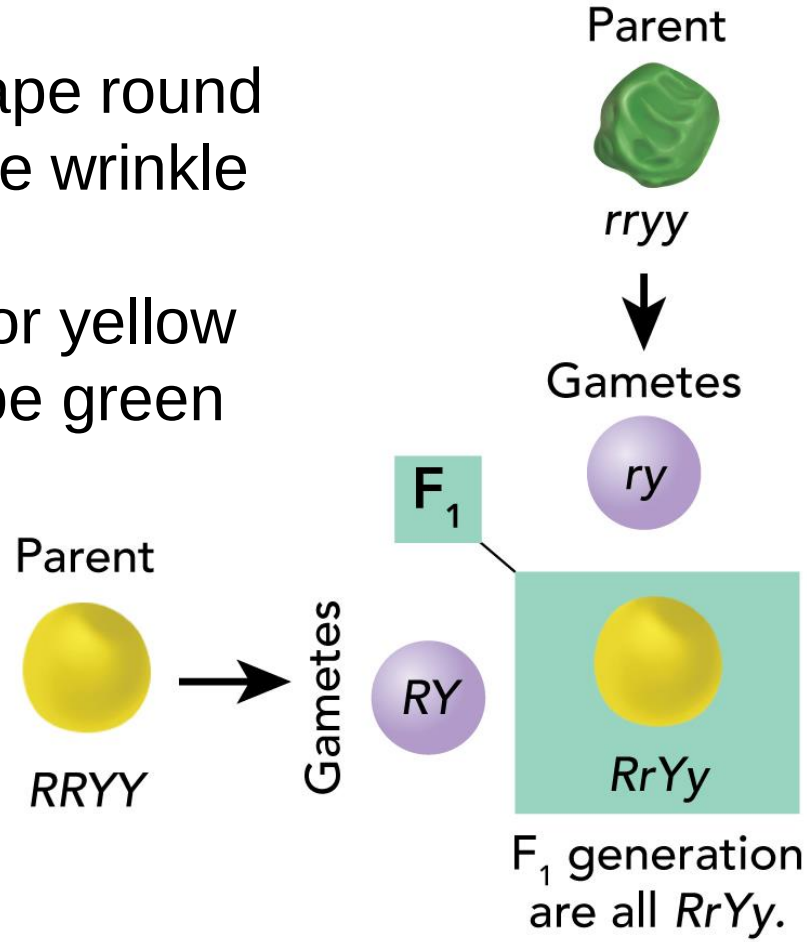
# The Two-Factor Cross: $F_1$

Two-factor, or dihybrid, cross

R = **Dominant** – seed shape round
r = recessive – seed shape wrinkle

Y = **Dominant** – seed color yellow
y = recessive – seed shape green

The prefix *di-* means 2

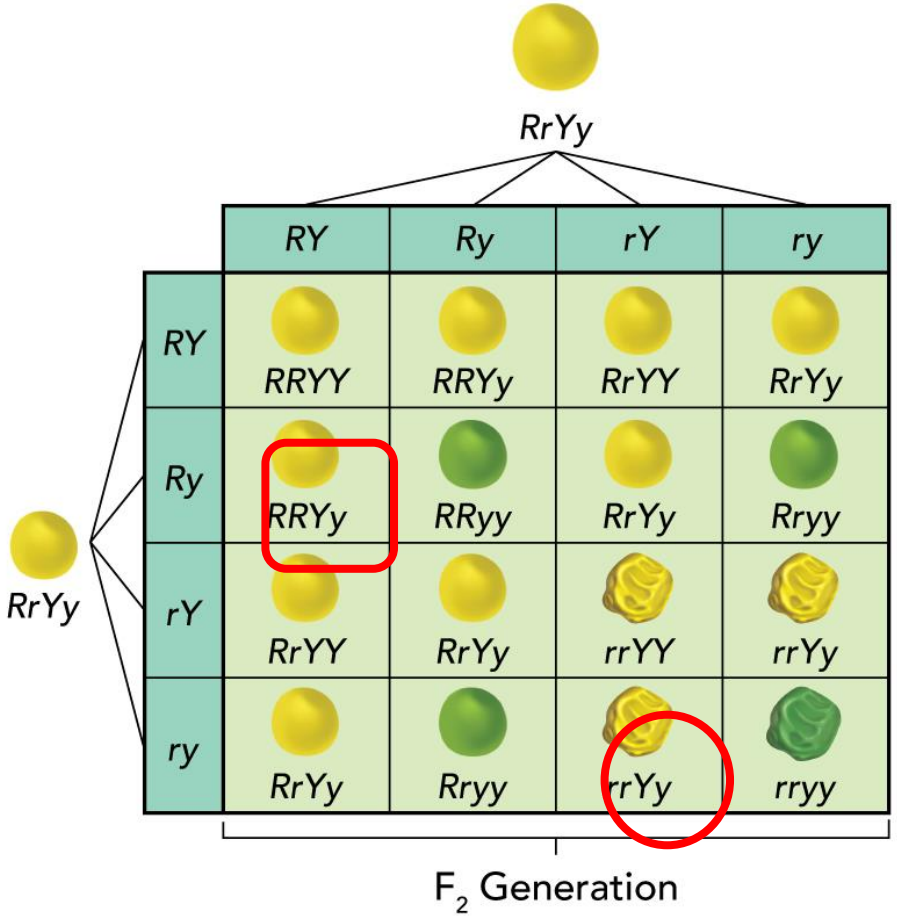


# The Two-Factor Cross: $F_2$

**Independent assortment:** Genes for different traits can segregate independently during gamete formation.

9:3:3:1 ratio of phenotypes

This helps account for the many genetic variations observed in organisms even when they have the same parents.



# Summary of Mendel's Principles, Part I

Mendel's principles of heredity, observed through patterns of inheritance, form the basis of modern genetics.

Inheritance is determined by units called genes, which are passed from parents to offspring.

Where more than one form of a gene for a single trait exists, some alleles may be dominant and others recessive.

Each adult has two copies of each gene—one from each parent. These genes segregate from each other when gametes are formed.

# Summary Mendel's Principles, Part II

Alleles for different genes usually segregate independently of each other.

Scientists have done Mendel's work on organisms other than plants. Fruit flies produce many offspring. Biologists have determined that Mendel's principles applied to fruit flies and other organisms as well.

Mendel's work can be used to study the inheritance of human traits and genetic disorders such as cystic fibrosis.