6.3 Mendel and Heredity

KEY CONCEPT - Mendel's research showed that traits are inherited as discrete units.

EQ – What did Mendel's research show about the inheritance of traits?

SB2. Students will analyze how biological traits are passed on to successive generations.

GREGOR MENDEL
(1822-1884)

6.3 Mendel and Heredity

Gregor Mendel laid the groundwork for genetics.

- **Traits** are distinguishing characteristics that are inherited.
- **Genetics** is the study of biological inheritance patterns and variation.
- **Gregor Mendel** showed that traits are inherited as discrete units ("**Father of Genetics**").
  - Many in Mendel's day thought traits were blended.

6.3 Mendel and Heredity

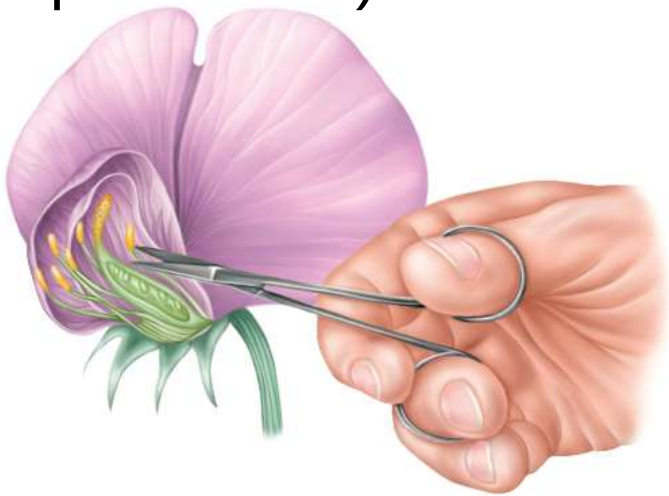
Mendel's data revealed patterns of inheritance.

- Mendel made **three key decisions** in his experiments.
  1. use of purebred plants
  2. control over breeding
  3. observation of seven "either-or" traits

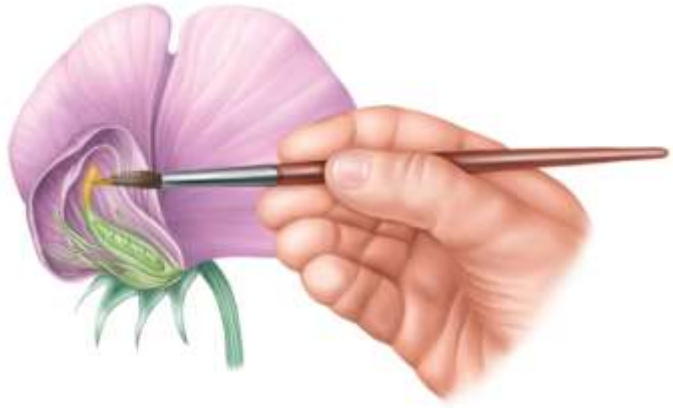
6.3 Mendel and Heredity

Cross: the mating of 2 organisms

- Mendel used pollen to fertilize selected pea plants.
  - **P (parental) generation** crossed to produce F_1 generation
    - Mendel **used purebred plants** for the P generation (purebred white pea flowers crossed with purebred purple flowers)



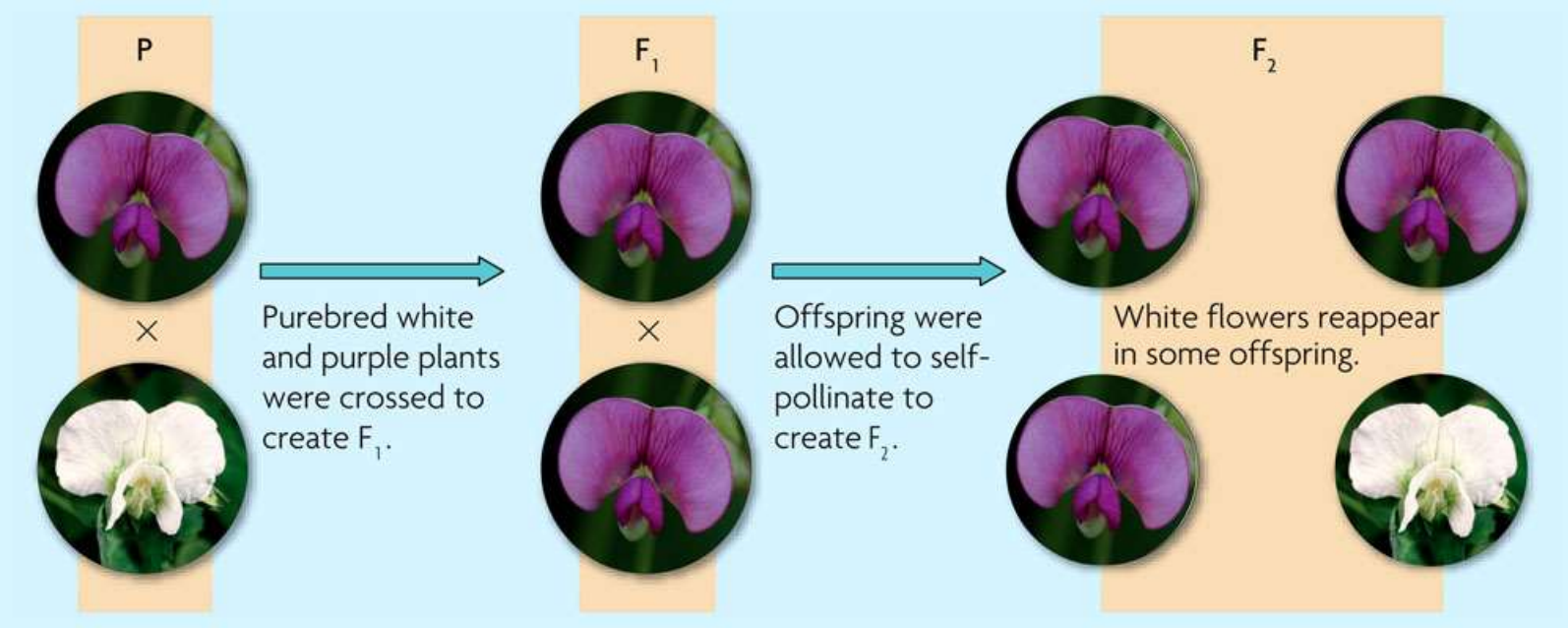
Mendel controlled the fertilization of his pea plants by removing the male parts, or stamens.



He then fertilized the female part, or pistil, with pollen from a different pea plant.

6.3 Mendel and Heredity

- Mendel allowed the resulting plants to ***self-pollinate***.
  - Among the **F_1 generation (1st Filial– the first generation resulting from the parental (P) generation)**, all plants had purple flowers
    - **F_1 plants are all heterozygous**
  - Among the **F_2 generation (2nd Filial– result of the self-pollination of the F_1 plants)**, ¾ of the plants had purple flowers and ¼ had white



6.3 Mendel and Heredity

- Mendel observed patterns in the first and second generations of his crosses.

Pea Plant Characteristics

	FIGURE 6.10 MENDEL'S MONOHYBRID CROSS RESULTS			
	F_2 TRAITS	DOMINANT	RECESSIVE	RATIO
1	Pea shape	5474 round	1850 wrinkled	2.96:1
2	Pea color	6022 yellow	2001 green	3.01:1
3	Flower color	705 purple	224 white	3.15:1
4	Pod shape	882 smooth	299 constricted	2.95:1
5	Pod color	428 green	152 yellow	2.82:1
6	Flower position	651 axial	207 terminal	3.14:1
7	Plant height	787 tall	277 short	2.84:1

- **RESULTS**: For all 7 traits, Mendel found that approximately ¾ of the F_2 offspring had one trait and ¼ of the offspring had the other trait.

6.3 Mendel and Heredity

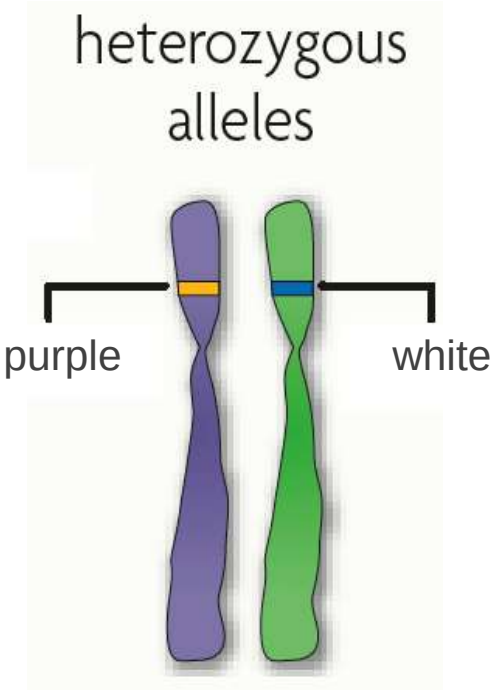
- **Mendel drew 3 important conclusions.**

– 1. Traits are inherited as discrete units (called **genes**).

Law of segregation:

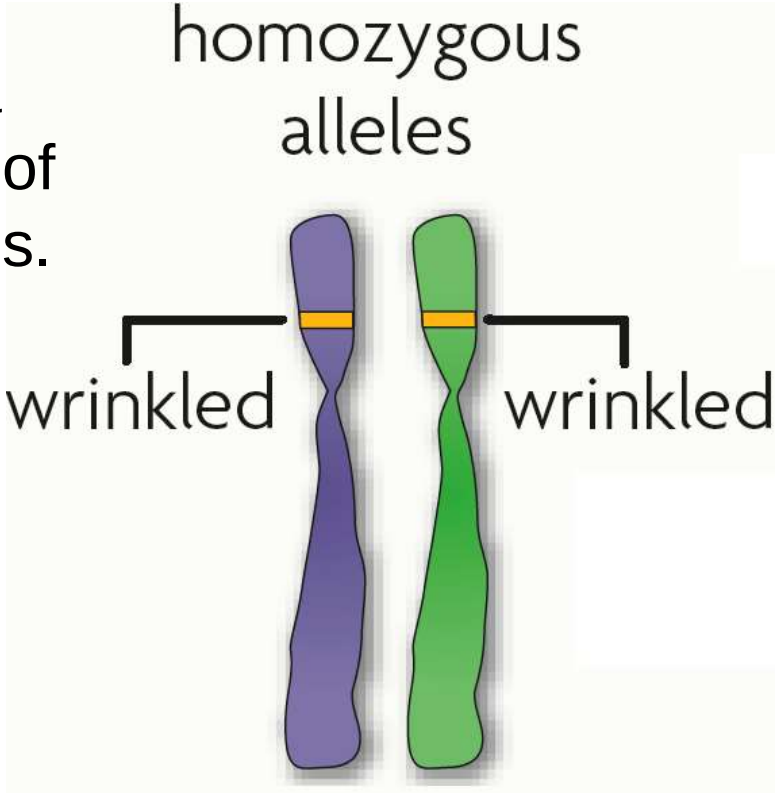
– 2. Organisms inherit two copies of each gene, one from each parent.

– 3. The two copies segregate during gamete formation (only donate 1 copy of each gene in the gametes).



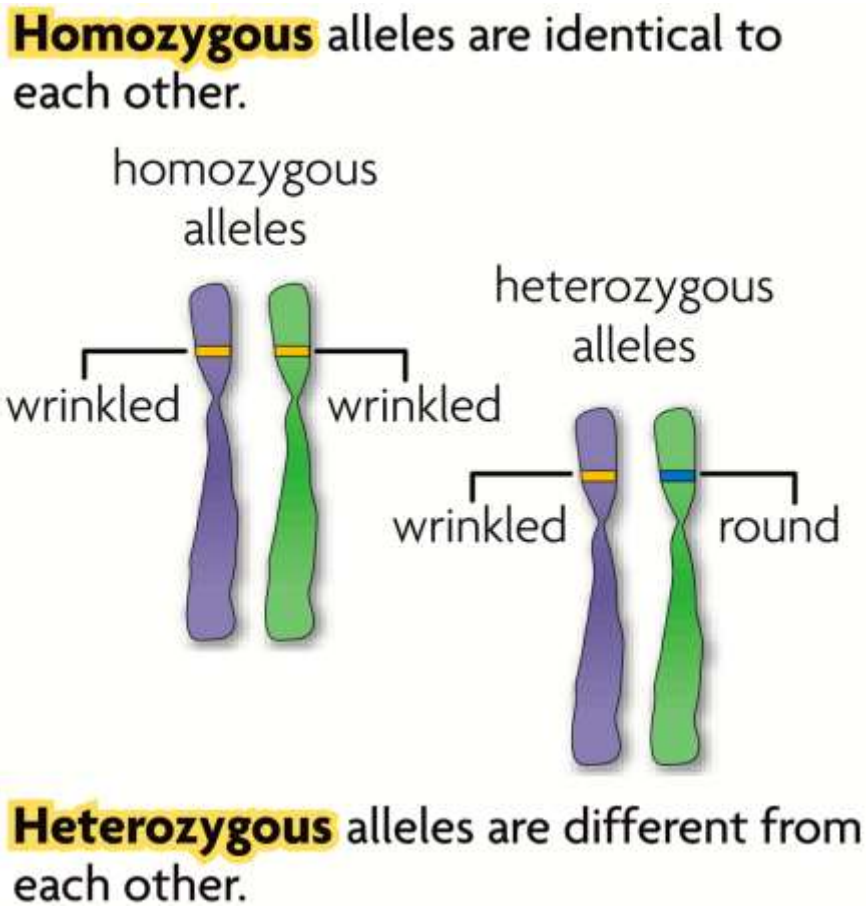
6.3 Mendel and Heredity

- **The same gene can have many versions.**
  - A **gene** is a piece of DNA that directs a cell to make a certain protein.
  - Each gene has a **locus**, a specific position on a pair of homologous chromosomes.



6.3 Mendel and Heredity

- An **allele** is any alternative form of a gene occurring at a specific locus on a chromosome.
  - Each parent donates one allele for every gene.
  - **Homozygous** describes two alleles that are the **same** at a specific locus.
  - **Heterozygous** describes two alleles that are **different** at a specific locus.



6.3 Mendel and Heredity

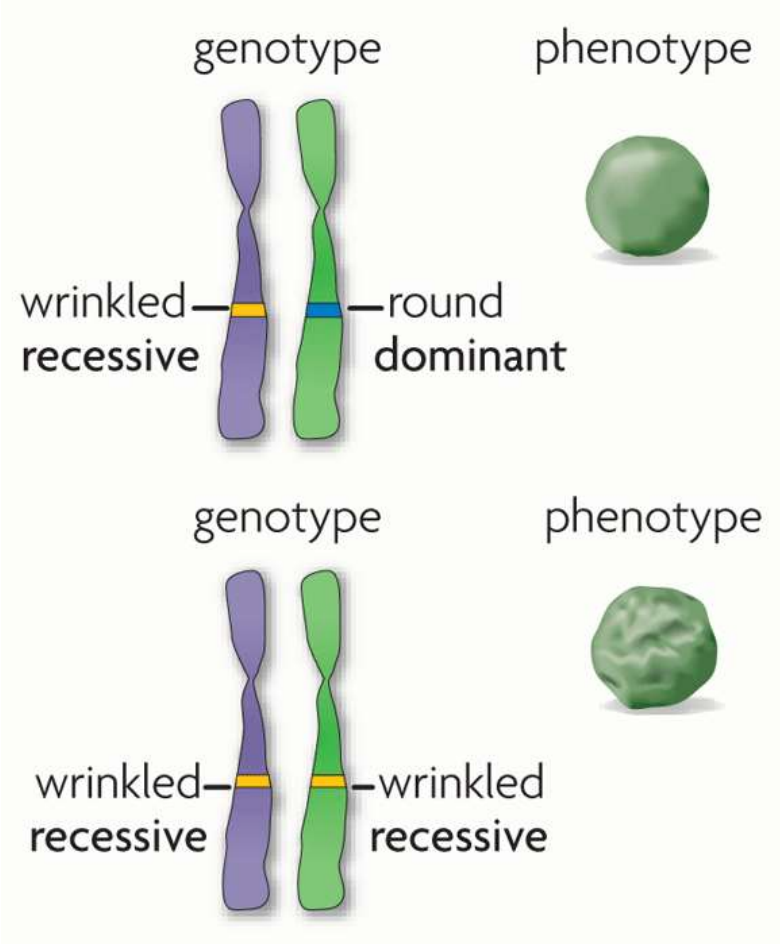
Genes influence the development of traits.

- All of an organism's genetic material is called the genome.

- A **genotype** refers to the makeup of a specific set of genes.
- A **phenotype** is the physical expression of a trait.

6.3 Mendel and Heredity

- Alleles can be represented using letters.
  - A **dominant allele** is expressed as a phenotype when at least one allele is dominant.
  - A **recessive allele** is expressed as a phenotype only when two copies are present.
  - Dominant alleles are represented by *uppercase* letters; recessive alleles by *lowercase* letters.



6.3 Mendel and Heredity

- Both homozygous dominant and heterozygous genotypes yield a dominant phenotype.
- Most traits occur in a range and do not follow simple dominant-recessive patterns.