Mendelian inheritance

Gregor Mendel (1822 - 1884)

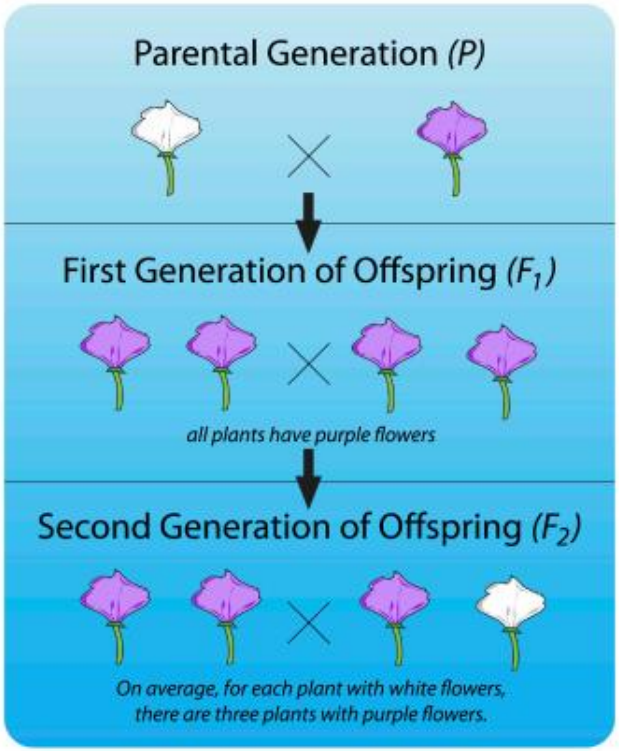
Seed		Flower	Pod		Stem	
Form	Cotyledon	Color	Form	Color	Place	Size
						
Grey & Round	Yellow	White	Full	Green	Axial pods	Tall
						
White & Wrinkled	Green	Violet	Constricted	Yellow	Terminal pods	Short

Mendel's first set of experiments

1. Mendel allowed each variety of pea plants to self-pollinate for several generations. He wanted to ensure that the offspring of each variety would display the same characteristics (a pea plant with purple flowers will only produce plants with purple flowers). These pea plants formed the **P (parent) generation**.

2. Mendel cross-pollinated two P generation plants with different characteristics (a pea plant with purple flowers and a pea plant with white flowers). The offspring formed the **F1 generation**.

3. The plants of the F1 generation were allowed to self-pollinate. The offspring formed the **F2 generation**.



Results

All the F1 generation plants were alike.

When plants in the F1 generation are self-pollinated, the plants in the F2 generation are no longer the same (exhibit two different characteristics).

Furthermore, the F2 generation plants displayed the two different characteristics in a consistent ratio **(3:1).**

Example: on average, there were three purple-flowered plants to one white-flowered plant.

The law of segregation
When reproductive cells form, the pair of alleles separates, or segregates. Each reproductive cell, or gamete, receives one allele. During fertilization, two gametes combine, giving the offspring two alleles. The inherited alleles can be the same or different.

Beyond the Mendelian rules

Multiple alleles

Trait that is determined by more than two alleles.

But even if more than two alleles exist in a population, any given individual can have no more than two of them: one from the mother and one from the father.

In Labrador retriever, coat color is determined by one gene with *four different alleles*. Five different colors result from the combinations of these alleles.

Codominance

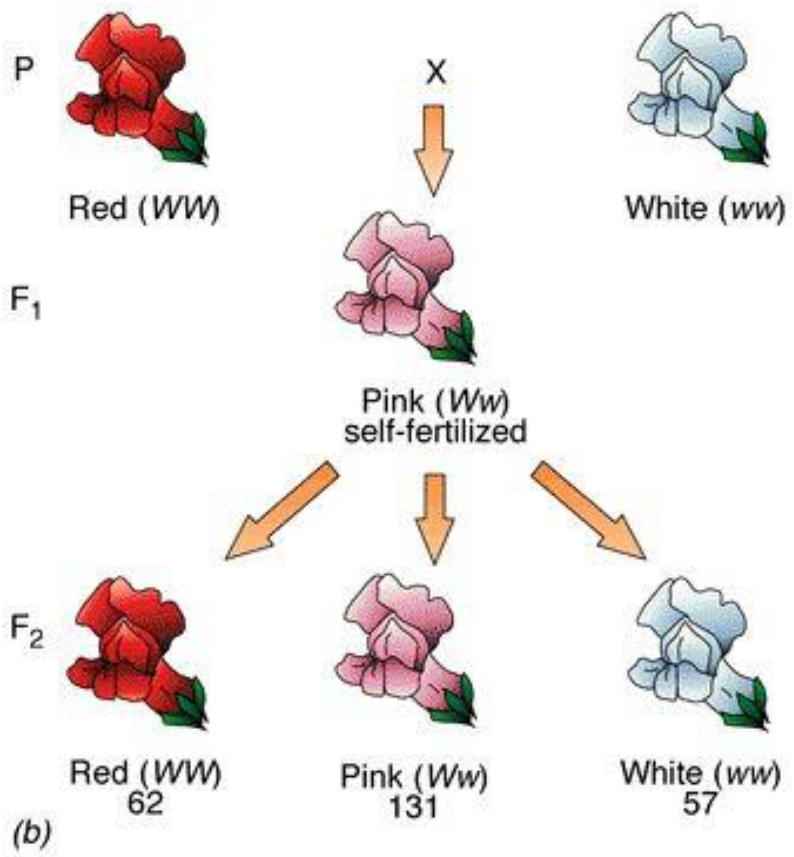
Condition in which both alleles for a gene are expressed when present.

For example, red cows crossed with white will generate roan cows. Roan refers to cows that have red coats with white blotches.

Incomplete dominance

An intermediate phenotype is shown where neither allele is dominant.

For example in snapdragons, flower color can be *red, pink, or white*. The heterozygous condition results in pink flowers (or an intermediate trait). If a white snapdragon crossed with a red snapdragon, the offspring will all be pink. Two pinks crossed together produce 1/4 white, 2/4 pink, and 1/4 red.



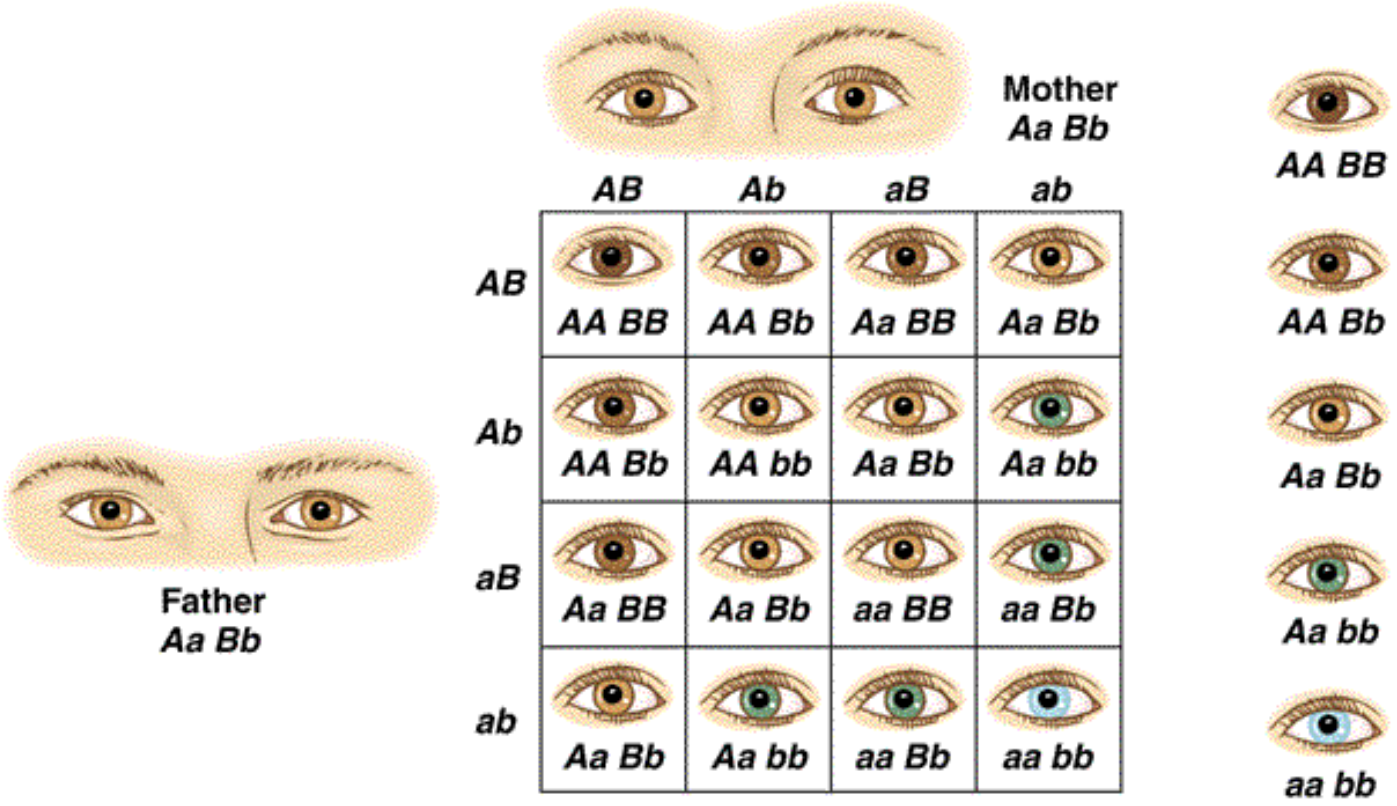
Polygenic traits

Trait influenced by several genes.

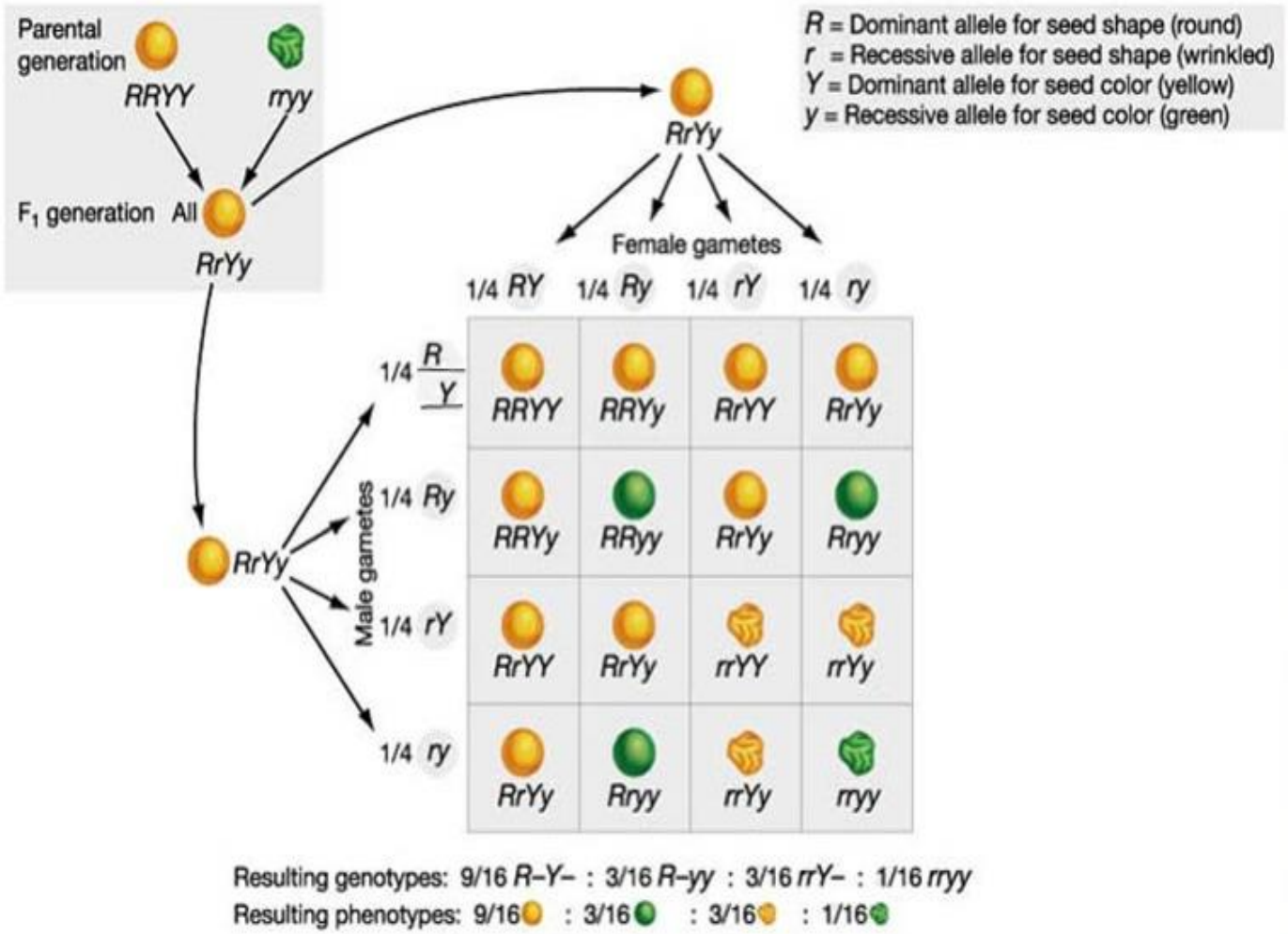
Genes may be on same chromosome or on different one .

An example can be human eye color, weight or skin tone.

Tobin/Dusheck, Asking About Life, 2/e
Figure 16.4



Mendel's second set of experiments



Results

All the plants in the **F1 generation** were the same.

When plants in the F1 generation were self-pollinated, the **F2 generation** plants showed all possible combinations of the two characteristics.

The F2 generation plants displayed all possible combinations in a consistent ratio **(9:3:3:1).**

The Law of Independent Assortment
The genes controlling different characteristics are inherited separately and therefore are not related.