Mendelian principles of heredity

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FATHER OF GENETICS

GREGOR JOHANN MENDEL
(1822-1884)

- ✓ Austrian monk
- ✓ Born in 1822 near Brunn in Austria, in a poor family.
- ✓ Studied the inheritance of traits in the garden pea
- ✓ Published his theory in 1866 "*Experiments on Plant Hybrids*"
- ✓ In 1900, the work of Mendel was independently rediscovered by
  - **Hugo de Vries** (Holland)
  - **Carl Correns** (Germeny)
  - **Erich Tschermak** (Austria).





White flower



Purple flower



Purple flower

The friar who grew peas

Why pea?

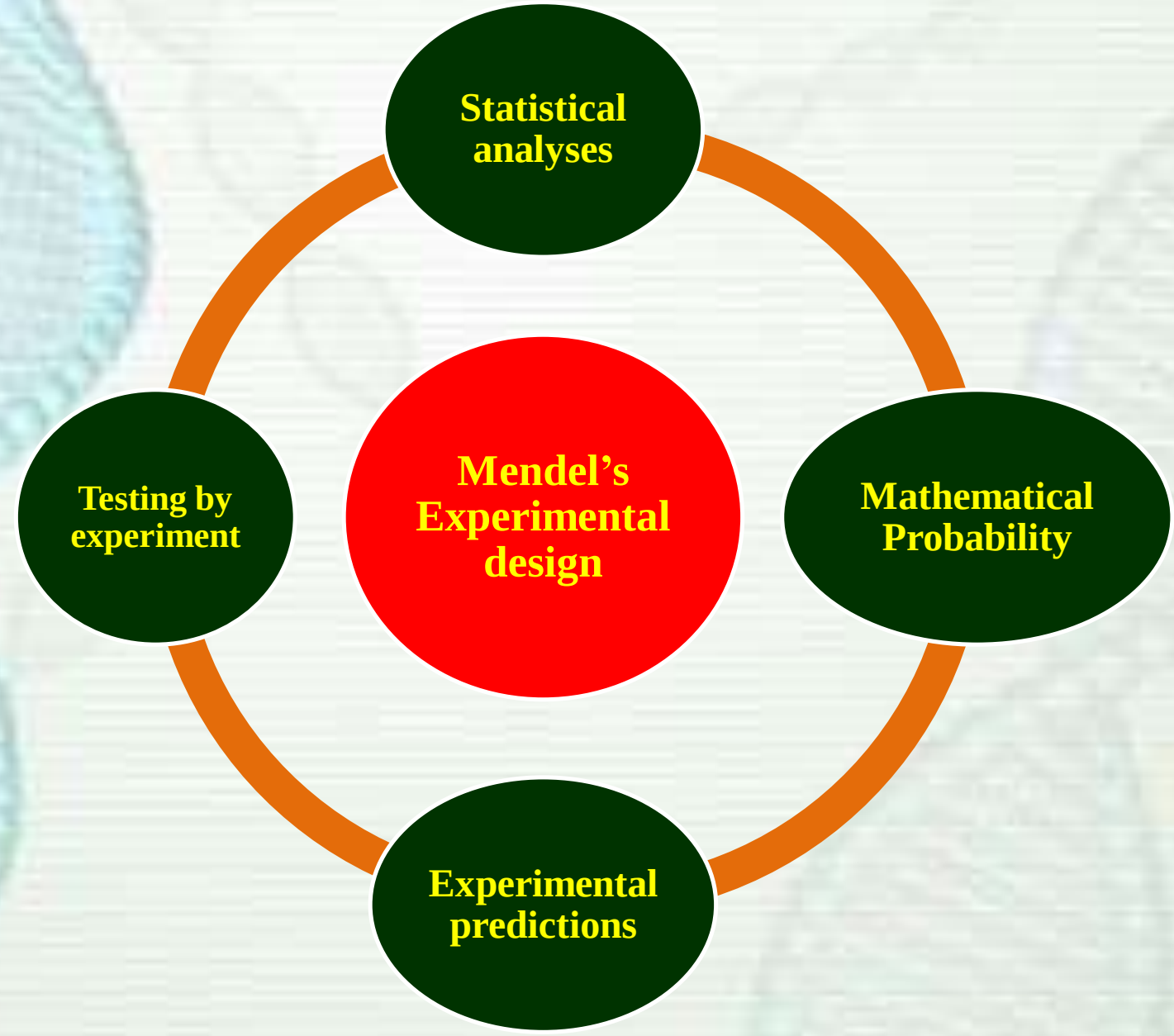
Pea are easy to grow



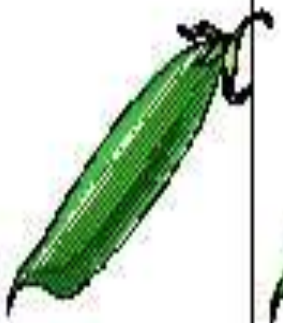
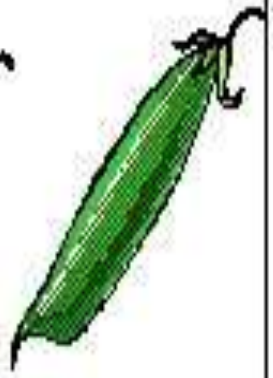
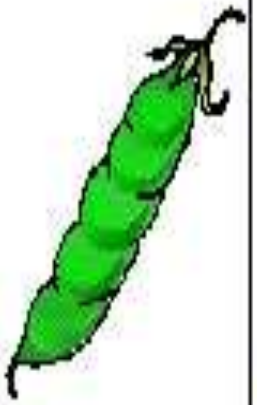
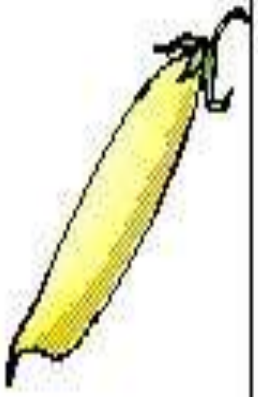
They reproduce quickly

Emasculation and pollination quite easy

They are capable of self fertilization


Statistical analyses
Mathematical Probability
Experimental predictions
Testing by experiment
Mendel's Experimental design

Pea Plant Traits

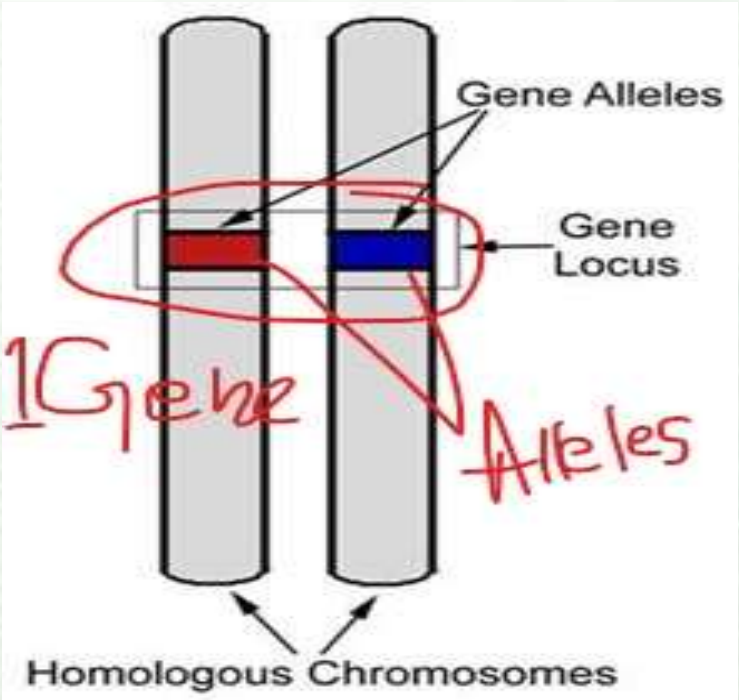
Seed Shape	Seed Color	Pod Shape	Pod Color	Flower Color	Flower Location	Plant Size
Round 	Yellow 	Inflated 	Green 	Purple 	Axial 	Tall 
Wrinkled 	Green 	Constricted 	Yellow 	White 	Terminal 	Short (Dwarf) 

Mendel's Laws of Inheritance

1. Law of dominance
2. Law of segregation
3. Law of independent assortment

Important Term

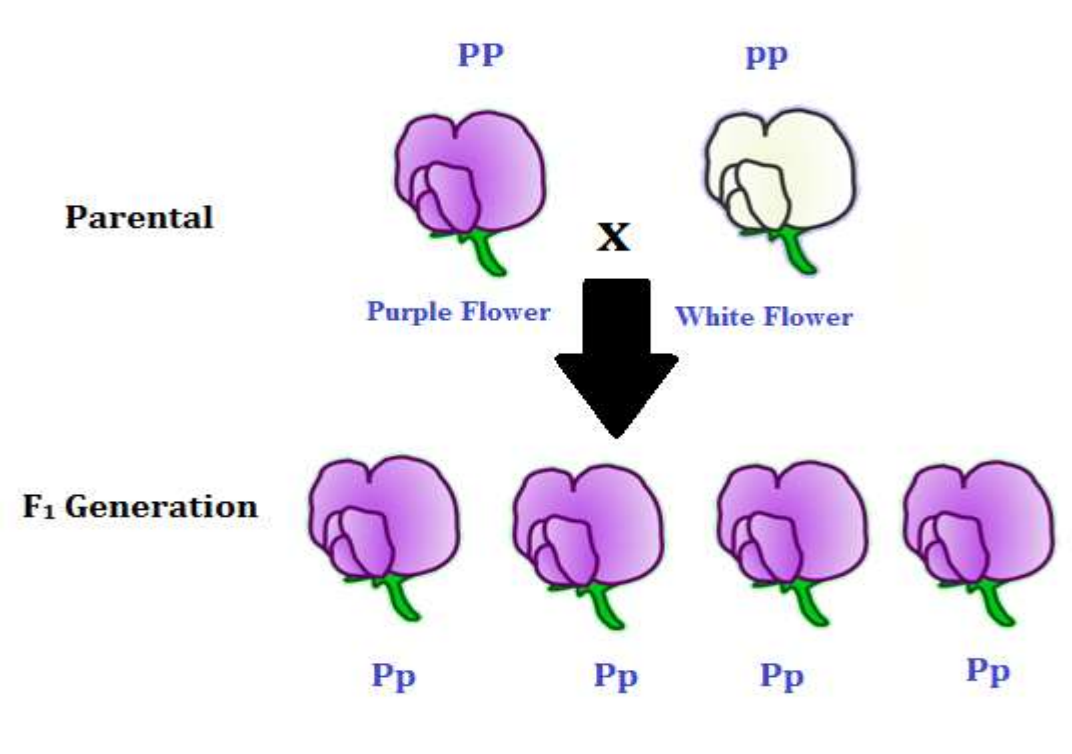
- **Gene:** Units of inheritance usually occurring at specific locations, or loci, on a chromosome. Physically, a gene is a sequence of DNA bases that specify the order of amino acids in an protein. Genes are responsible for the hereditary traits in plants and animals.
- **Allele:** An alternative form of a gene that occurs at the same locus on homologous chromosomes



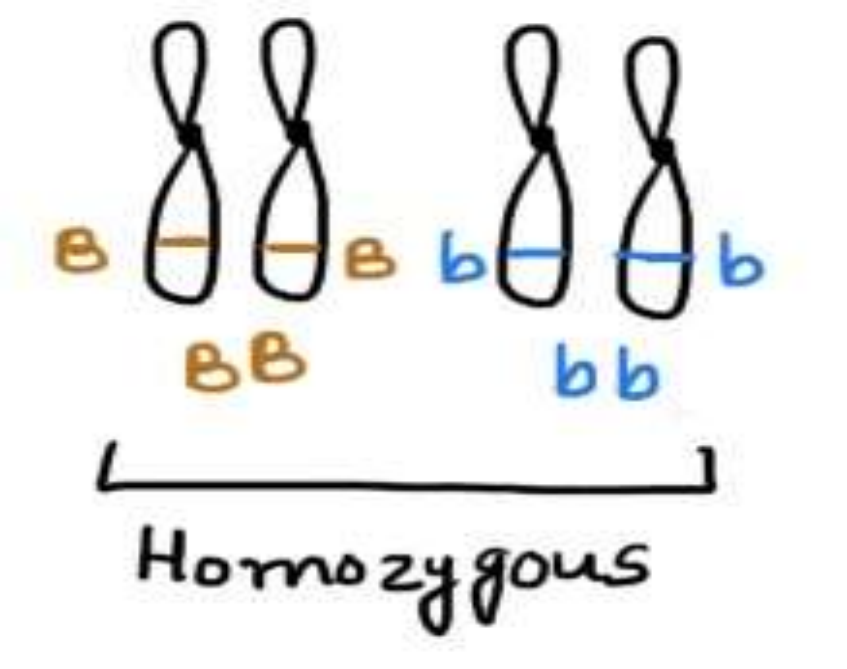
➢ **Dominant allele: A**n allele that masks the presence of a recessive allele in the phenotype. Dominant alleles for a trait are usually expressed if an individual is homozygous dominant or heterozygous.

➢**Recessive alleles:** An allele that is masked in the phenotype by the presence of a dominant allele. Recessive alleles are expressed in the phenotype when the genotype is homozygous recessive

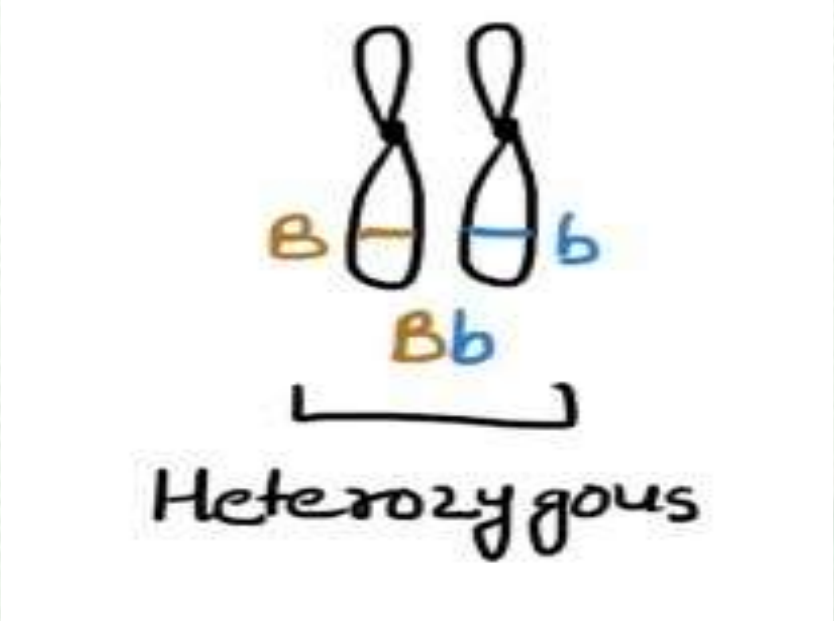
➢The uppercase letters are used to denote dominant alleles, whereas the lowercase letters are used to denote recessive alleles.



➢ **Homozygous:** Having the same allele at the same locus on pair of homologous chromosomes. Homozygous also refers to a genotype consisting of two identical alleles of a gene for a particular trait. Individuals who are homozygous for a trait are referred to as homozygotes.



➢ **Heterozygous : A** genotype consisting of two different alleles of a gene for a particular trait (Bb). Individuals who are heterozygous for a trait are referred to as heterozygotes.



Genotype refers to an individual's the "genetic potential": what kind of genes s/he carries.

Phenotype (from the Greek "pheno" meaning "to show") refers to the traits an individual actually shows.

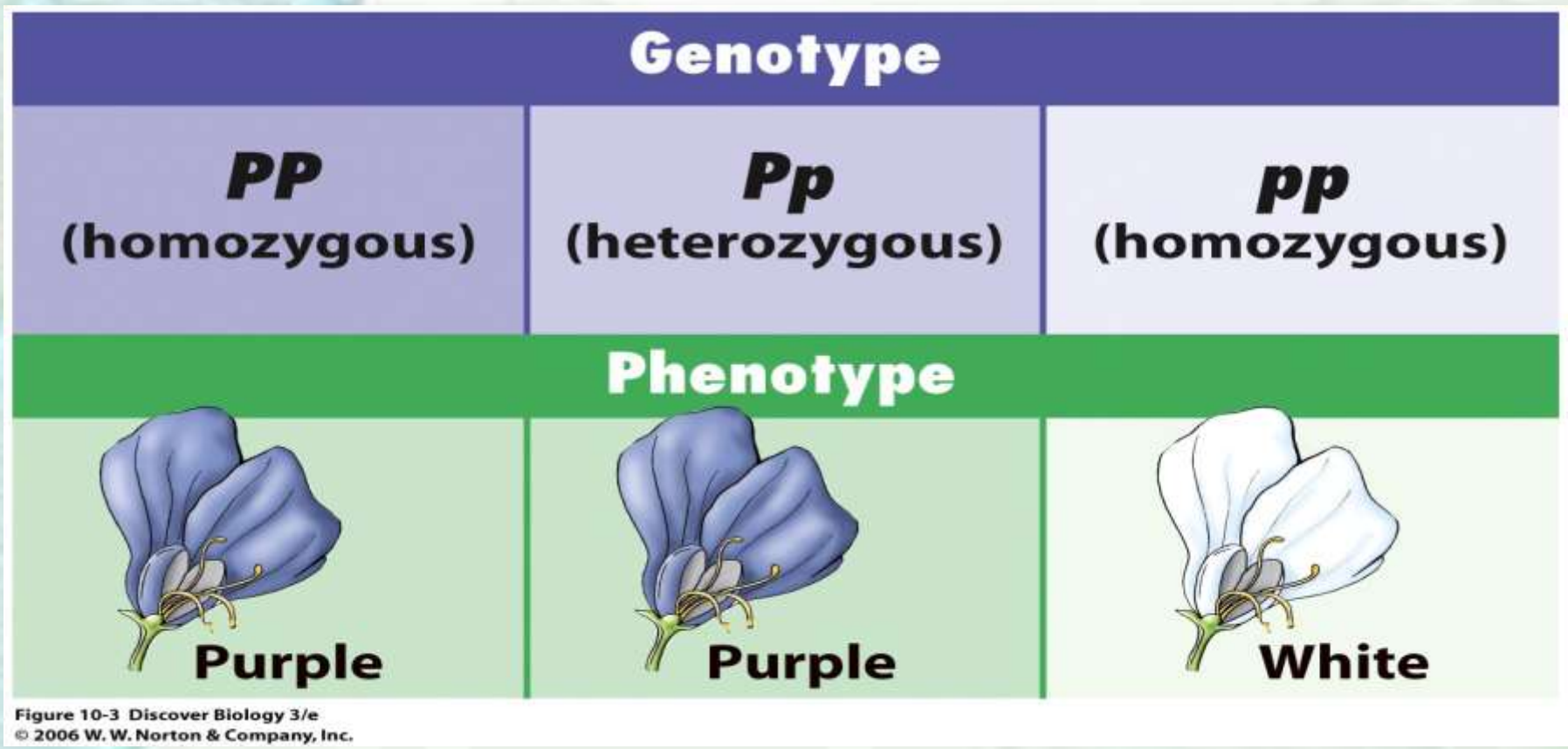


Figure 10-3 Discover Biology 3/e
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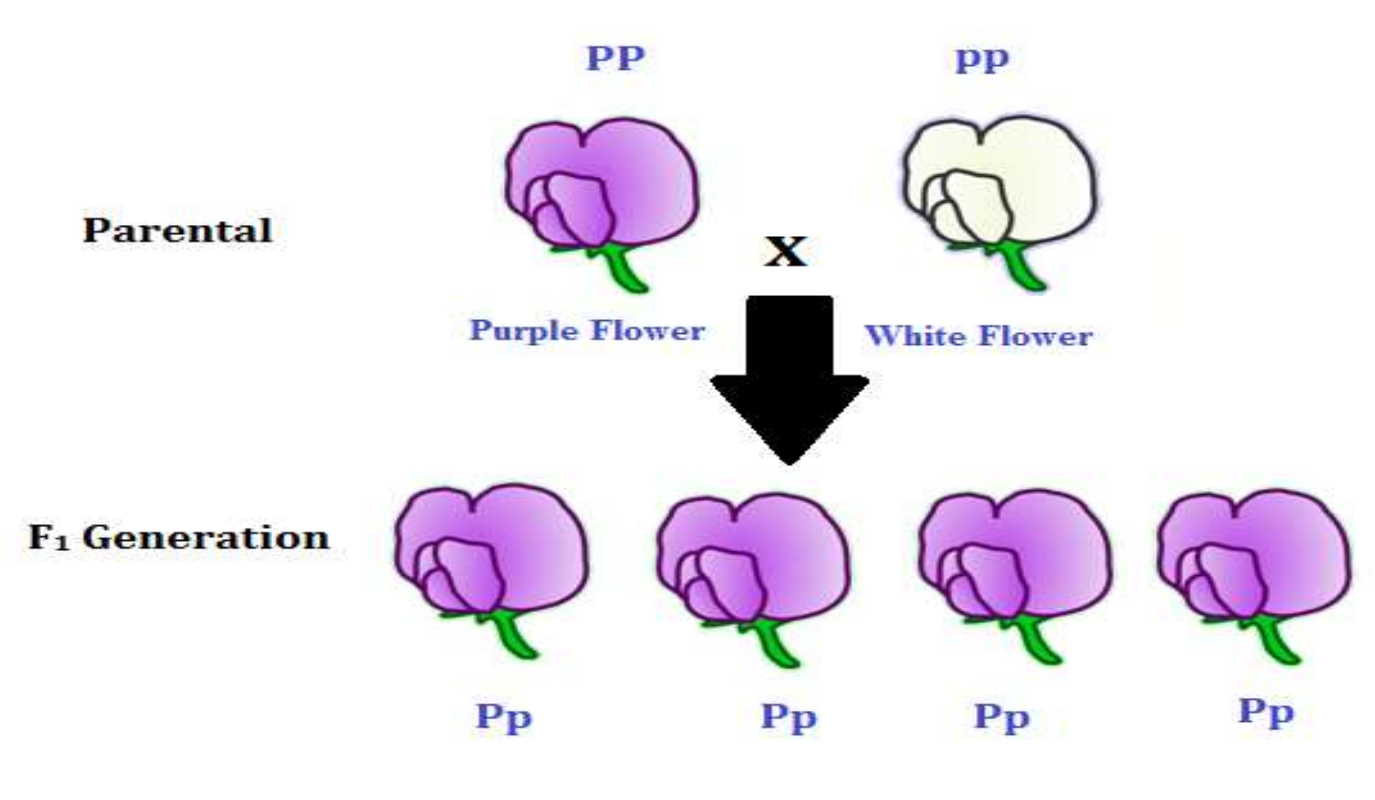
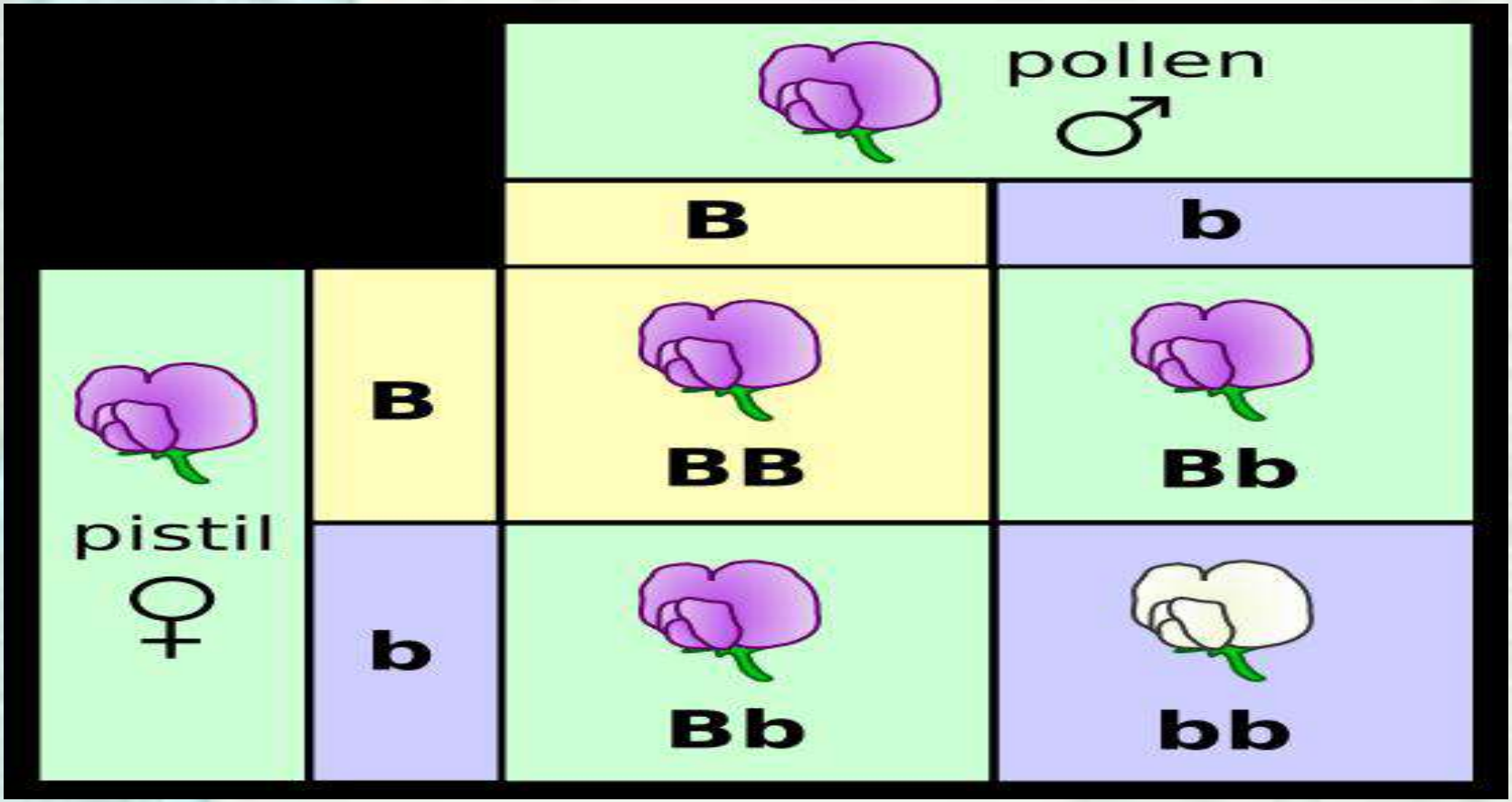
- **Hybrid** offspring that are the result of mating between two genetically different kinds of parents
- F_1 generation the first offspring (or filial) generation. The next and subsequent generations are referred to as F_2, F_3 etc.
- **Monohybrid** cross is a cross between parents differing in only one trait or in which only one trait is being considered.
- **Dihybrid** cross is a cross between parents in which two pairs of contrasting characters are studied simultaneously for the inheritance pattern.

Law of Dominance

In a cross of parents that are pure for contrasting traits, only one form of the trait will appear in the next generation. All offspring will be hybrid for a trait and will have only the dominant trait express the phenotype. The phenotype trait that is NOT expressed in the hybrid is called recessive.



Law of Dominance

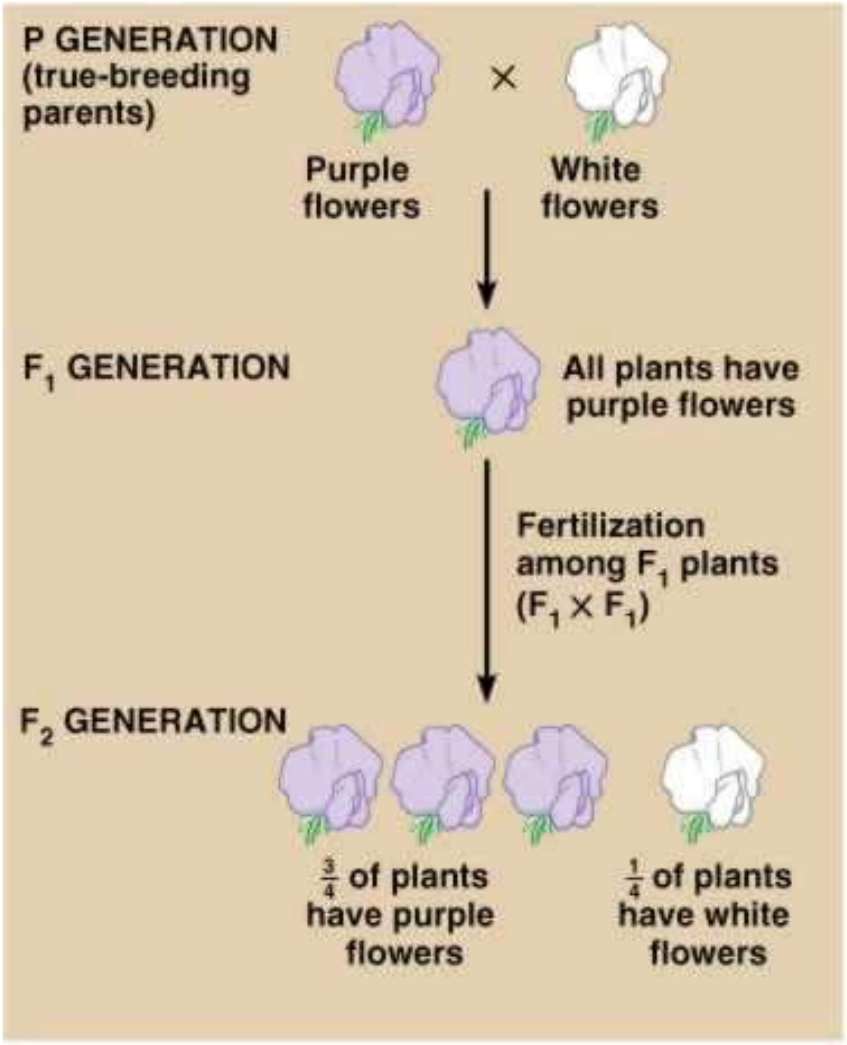


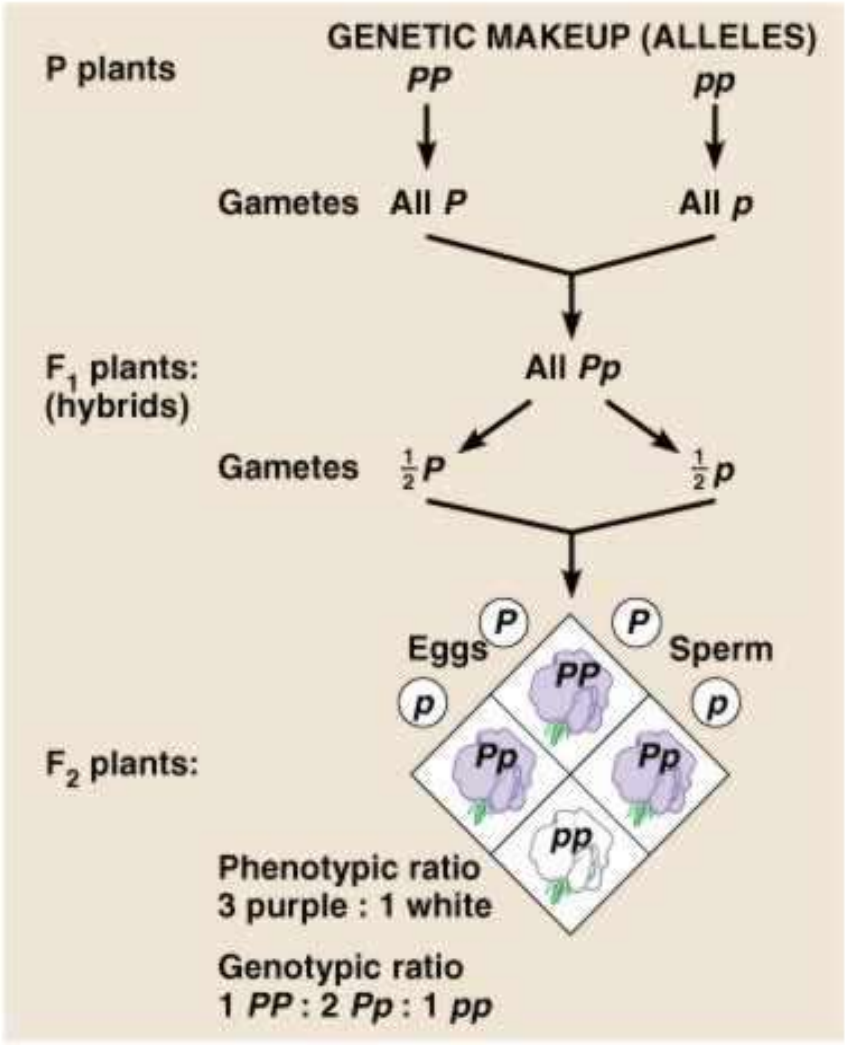
Genotypic ratio 1:2:1
Phynotypic ratio 3:1

The Law of Segregation

- Mendel's law of segregation states that the two alleles of a gene that are found on a chromosome pair separate, with the offspring receiving one from the mother and one from the father. According to Mendel's law, the two alleles act in a segregated fashion and do not mix or change each other.
- Mendel's second law, the law of segregation, states that these two alleles will be separated from each other during meiosis. Specifically, in the second of the two cell divisions of meiosis the two copies of each chromosome will be separated from each other, causing the two distinct alleles located on those chromosomes to segregate from one another.
- This law is also referred to as **law of purity of gametes.**

The Law of Segregation

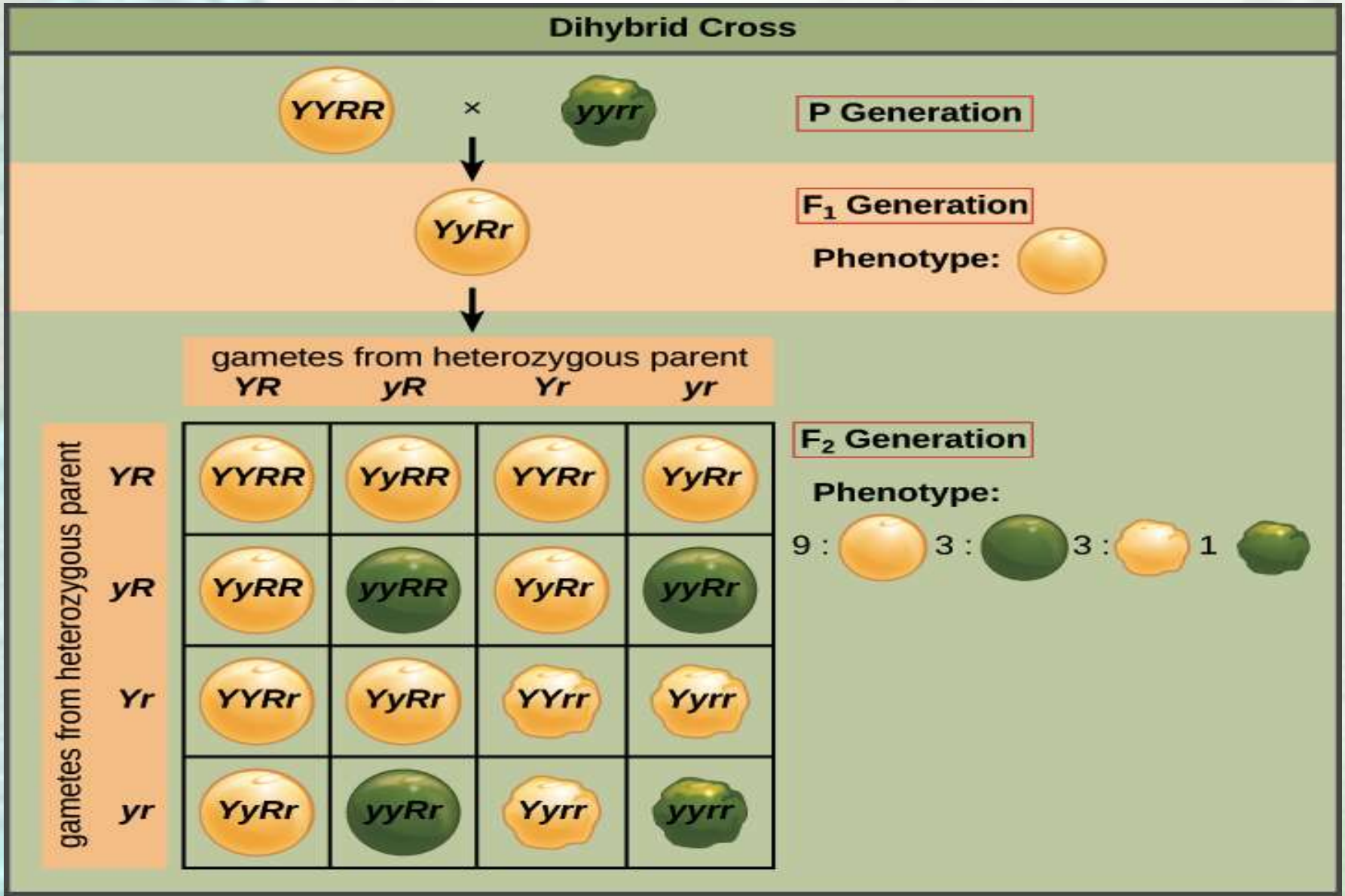




The Law of Independent Assortment

- It states that inheritance of one character is always independent of the inheritance of other characters within the same individual.
- Law of independent assortment is based on **dihybrid cross**.
- The alleles of two more genes get sorted into gametes independent of each other. The allele received for one gene does not influence the allele received for another gene.
- Genes linked on a chromosome can rearrange themselves through the process of crossing-over. Therefore, each gene is inherited independently.

The Law of Independent Assortment



Thank You