

Gregor Mendel

Classical Genetics

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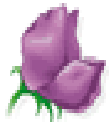



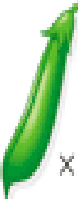









Gregor Mendel

- He is known as the “Father of Genetics”
- His understanding of heredity came from carefully observing the characteristics of pea plants over several generations



Pea Plant Characteristics & Traits

- Mendel Studied 7 different characteristics
 - A *character* is a heritable physical feature (e.g. flower color)
- There were 2 variations of each characteristic
 - A *trait* is a variation of a character (e.g. purple colored flowers, white colored flowers)

	Flower color	Flower position	Seed color	Seed shape	Pod shape	Pod color	Stem length
P	Purple 	Axial 	Yellow 	Round 	Inflated 	Green 	Tall 
	White 	Terminal 	Green 	Wrinkled 	Constricted 	Yellow 	Dwarf 

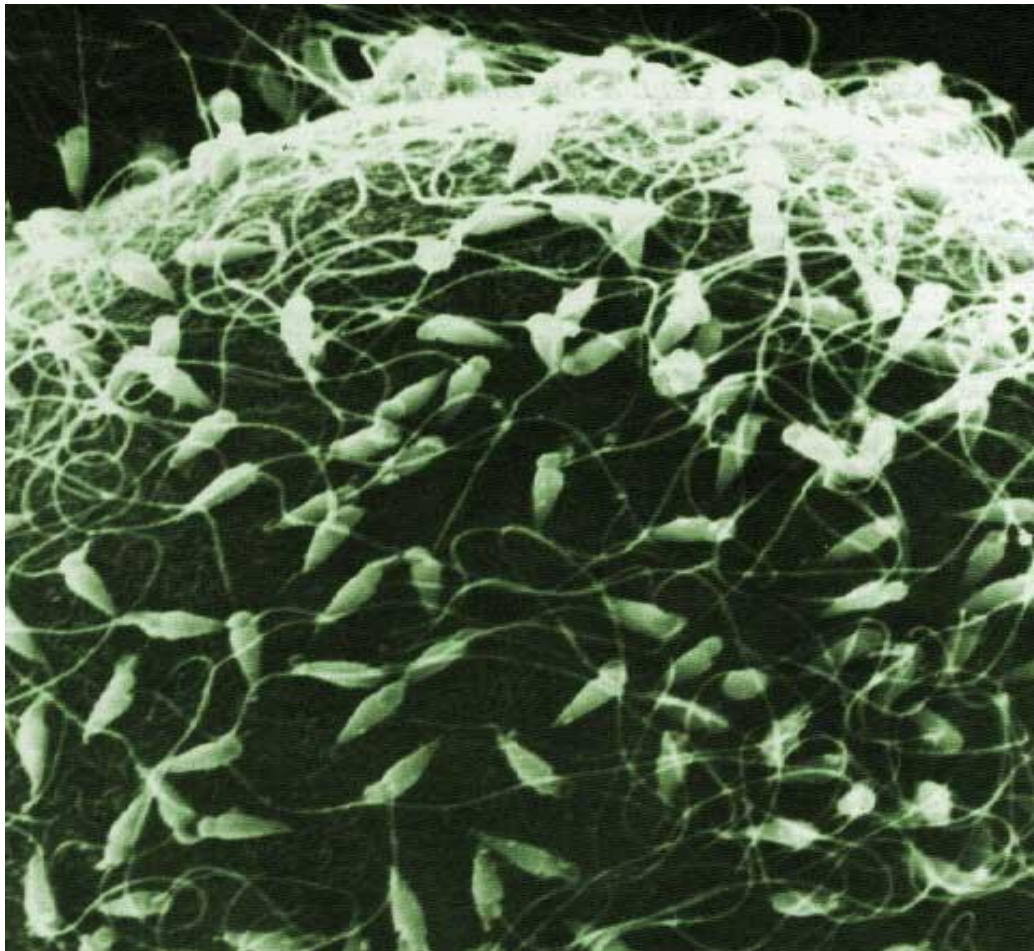
Character and Trait



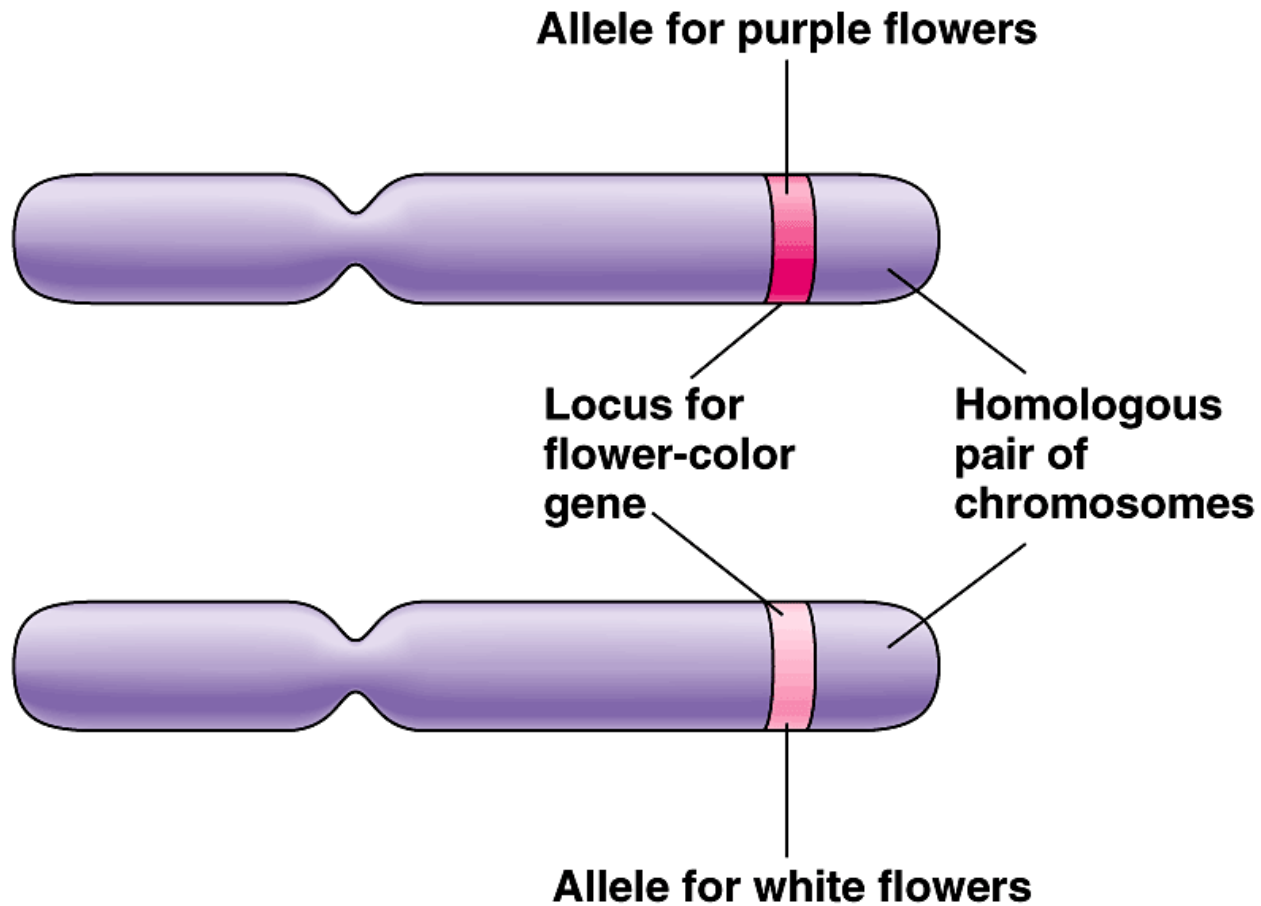
- *Gene*—DNA segments that are inherited from parents during reproduction
 - A gene is the “blueprint” for making a polypeptide, a.k.a. protein (e.g. purple flower color, white flower color)
- *Allele*—different versions of a gene. (The purple color allele and the white color allele are two versions of a single gene; they both make flower color)
 - Offspring inherit 2 alleles; one from each parent
- Alleles are represented by letters: P, p
 - Capital letters are used for *dominant* alleles
 - Lowercase letters are used for *recessive* alleles

Offspring Inherit 2 alleles

- One from **EACH** parent: Sperm AND Egg



Alleles for a gene

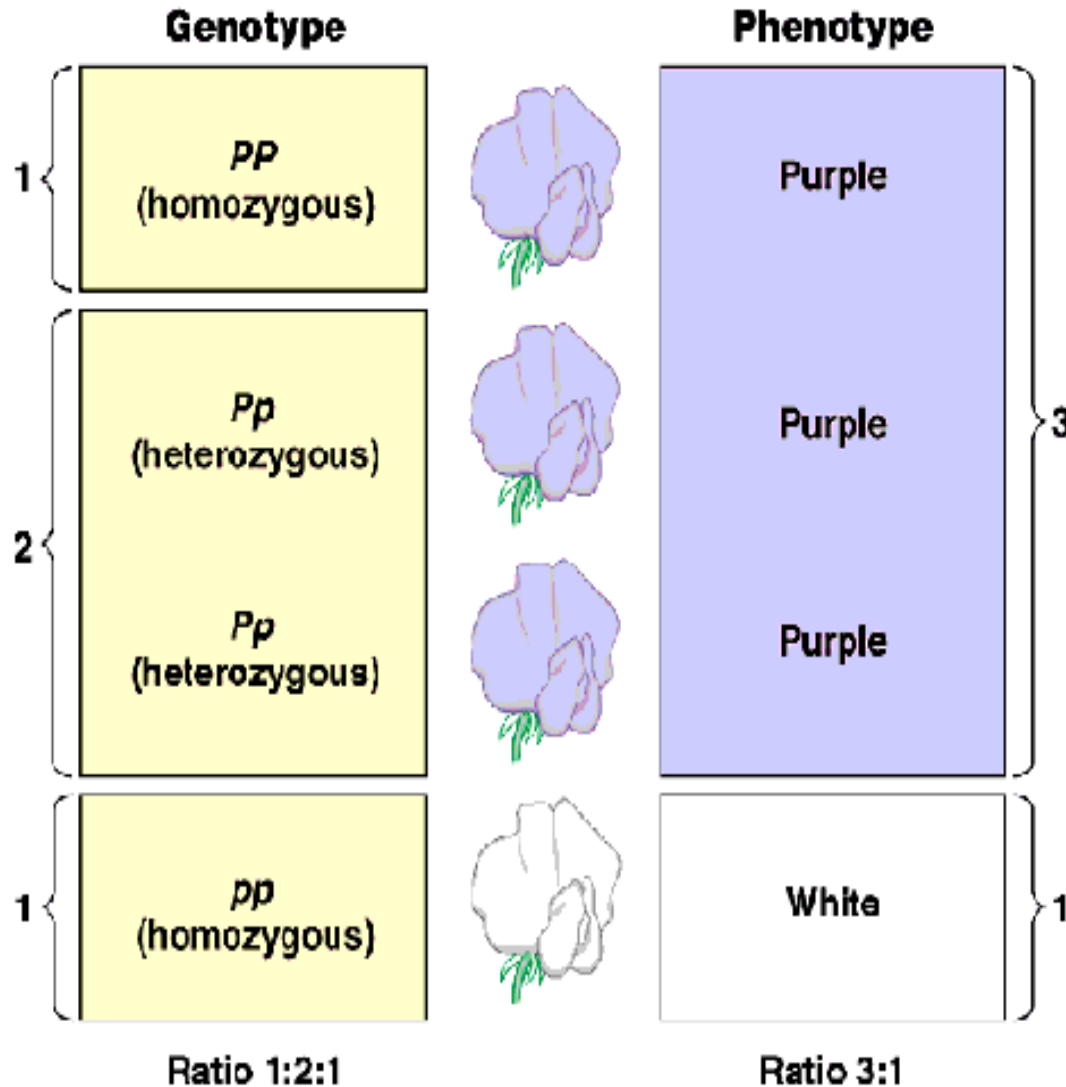


Genotype vs. Phenotype

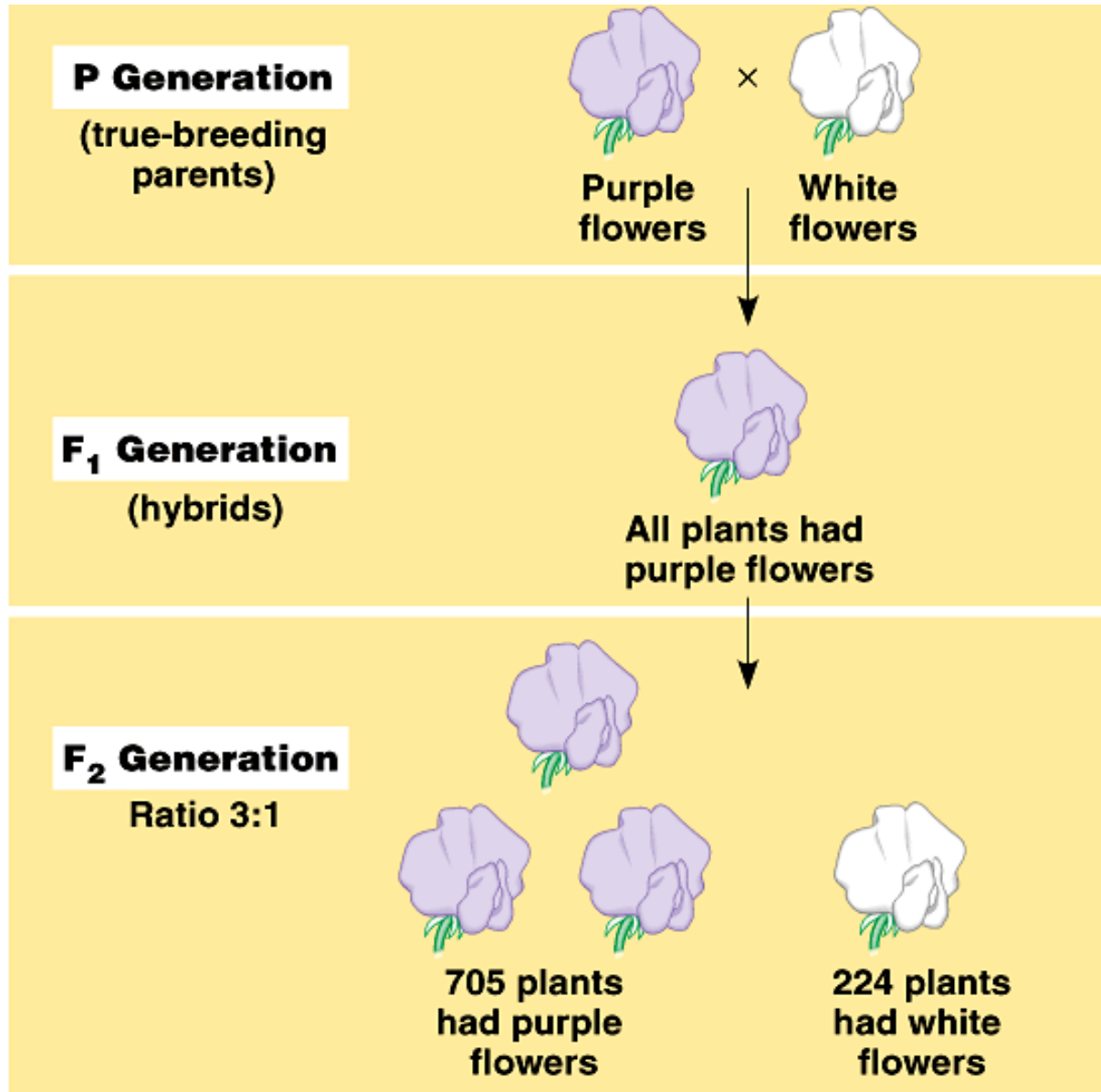
- *Genotype*— the pair of alleles (or genes) an organism inherits.
 - *True “pure” breed*: organism with only one type of allele for a trait
 - AKA *Homozygous Alleles*: PP, pp
 - *Hybrid*: organisms with two different types of alleles for a trait
 - AKA *Heterozygous Alleles*: Pp
- *Phenotype*—the physical trait that can be “seen” (purple or white flower color)

Phenotype vs. Genotype

Physical Trait vs. Gene allele type

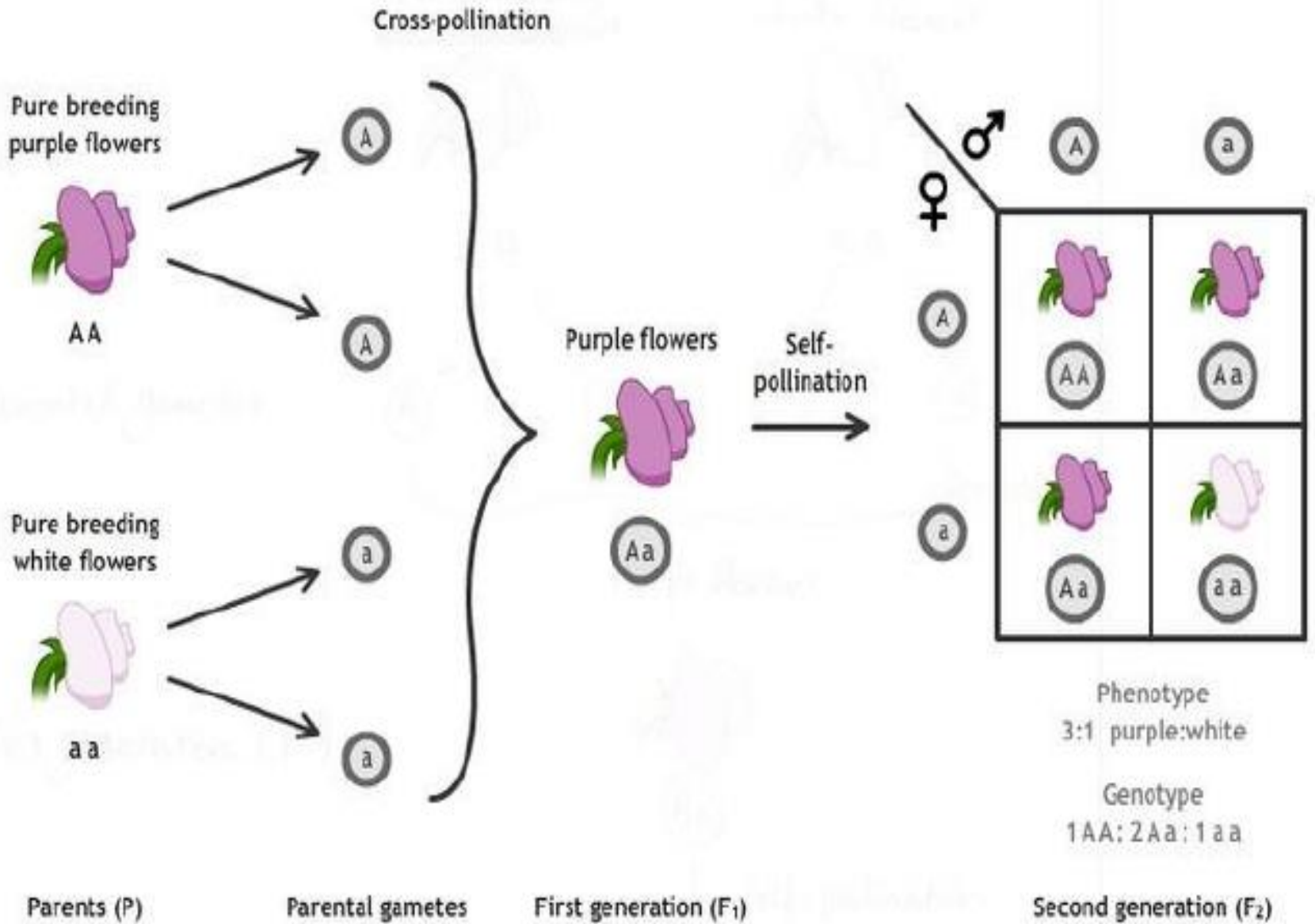


Mendel's Experiments: **Monohybrid** Cross



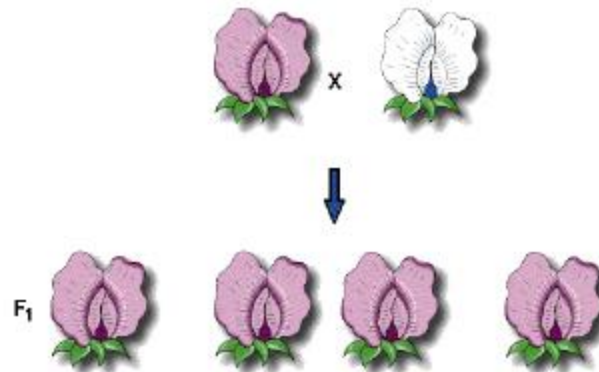
Law of Dominance

- When two pure-bred (homozygous) individuals with different versions of a trait are crossed, the offspring will all exhibit the dominant trait.
- Mendel called the version of the trait that appeared in the first generation “dominant,” and the version that disappeared “recessive.”



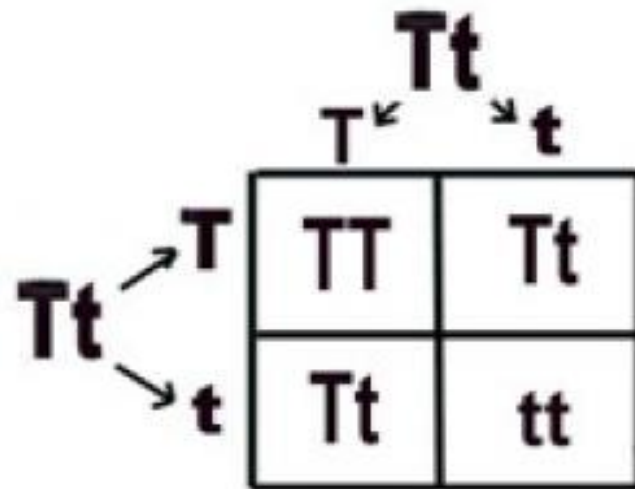
F₁ Results

- Organisms with heterozygous genotypes (Pp) have the appearance (phenotype) of the allele that is dominant.
- Example: purple flowers (P) are dominant to white (p); a plant with the genotype Pp will have purple flowers because purple is dominant to white



Law of Segregation

- When reproductive cells are made the pair of alleles for a characteristic will separate from each other into different reproductive cells
- Pairs of alleles separate when homologous chromosomes separate in anaphase I of meiosis



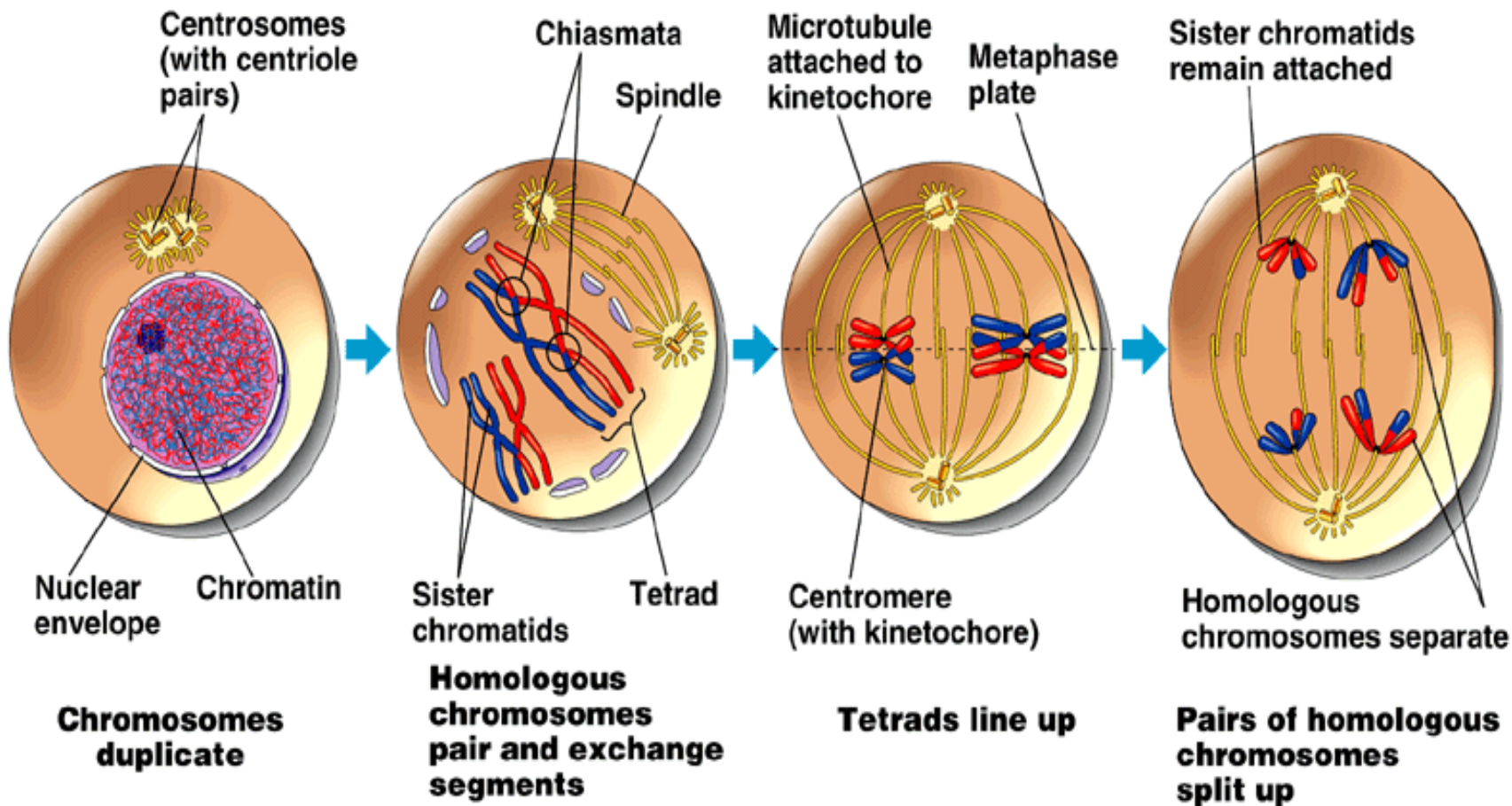
MEIOSIS I: Separates homologous chromosomes

INTERPHASE

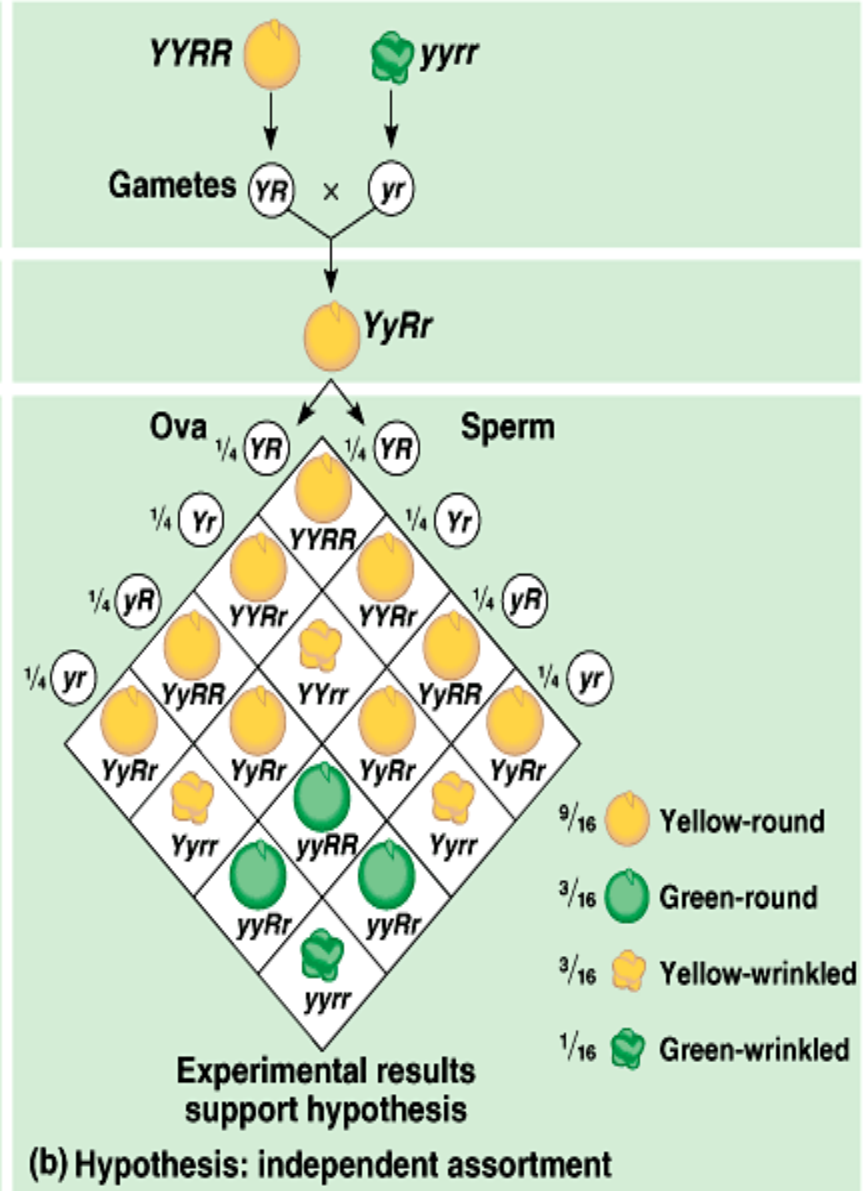
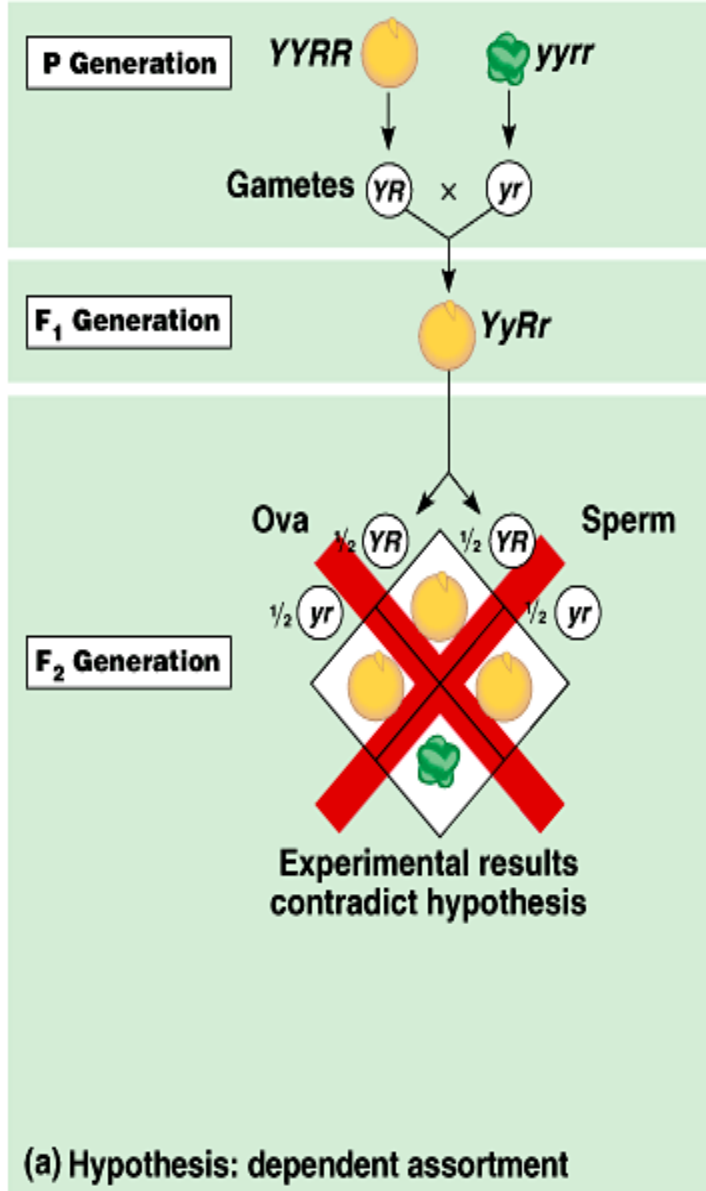
PROPHASE I

METAPHASE I

ANAPHASE I



Mendel's Experiments: **Di**hybrid Cross



Law of Independent Assortment

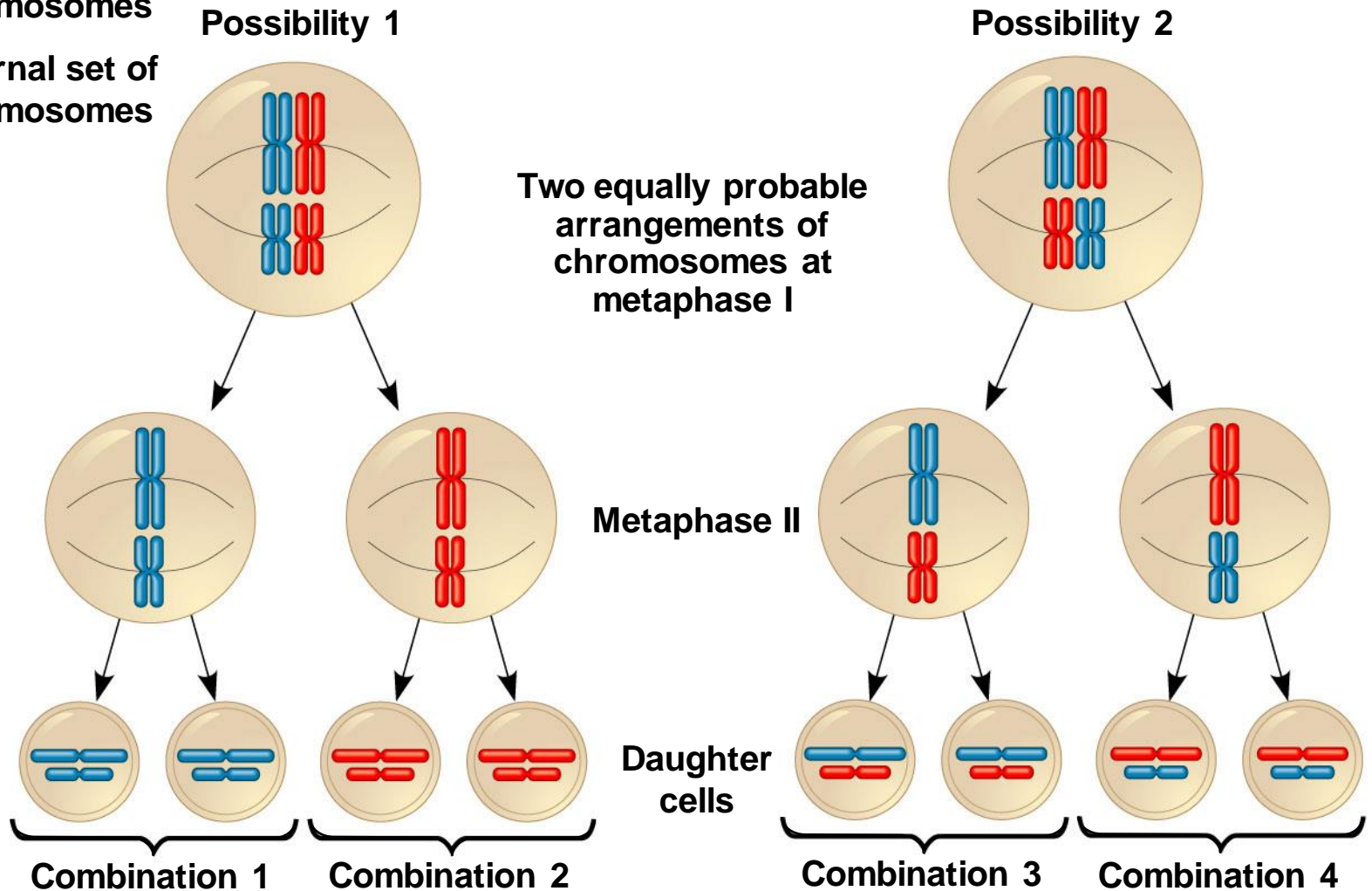
- Alleles for different traits are inherited independently of each other
 - This means that the alleles a pea plant inherits for flower color do not affect which alleles it inherits for flower position, seed shape, height, etc.
- Chromosomes line up independently of one another in the middle of the cell in metaphase I of meiosis

Independent Assortment

Key

 Maternal set of chromosomes

 Paternal set of chromosomes



Segregation vs. Independent Assortment

F₁ Generation

All F₁ plants produce yellow-round seeds (*YyRr*)

LAW OF SEGREGATION
The two alleles for each gene separate during gamete formation.

LAW OF INDEPENDENT ASSORTMENT
Alleles of genes on nonhomologous chromosomes assort independently during gamete formation.

