

Monohybrid Cross: Inheritance of One Gene

Uncovering the mathematical
logic of heredity.





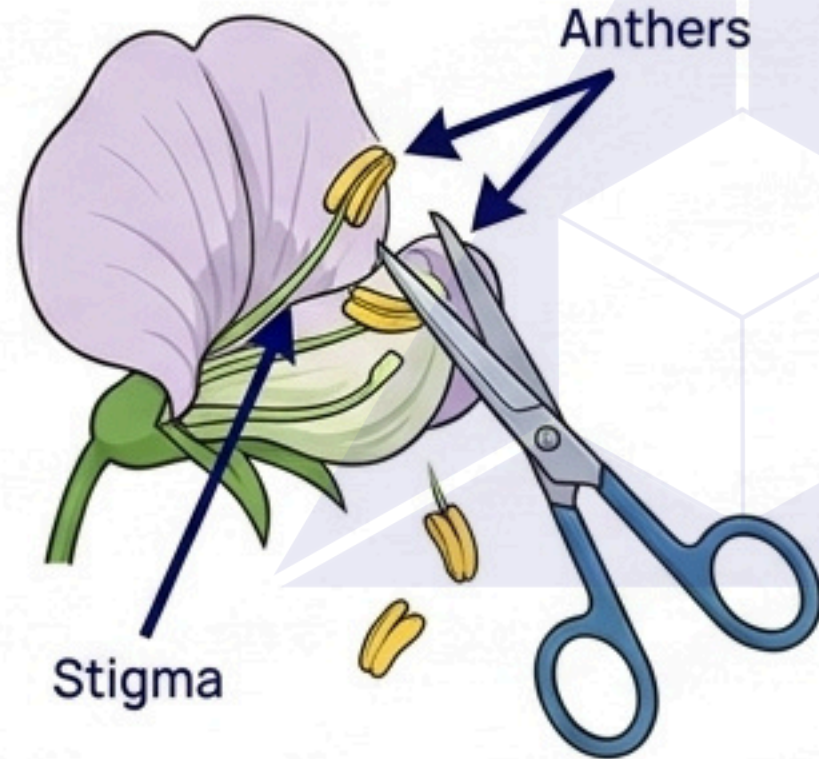
Parent 1: True-breeding Tall



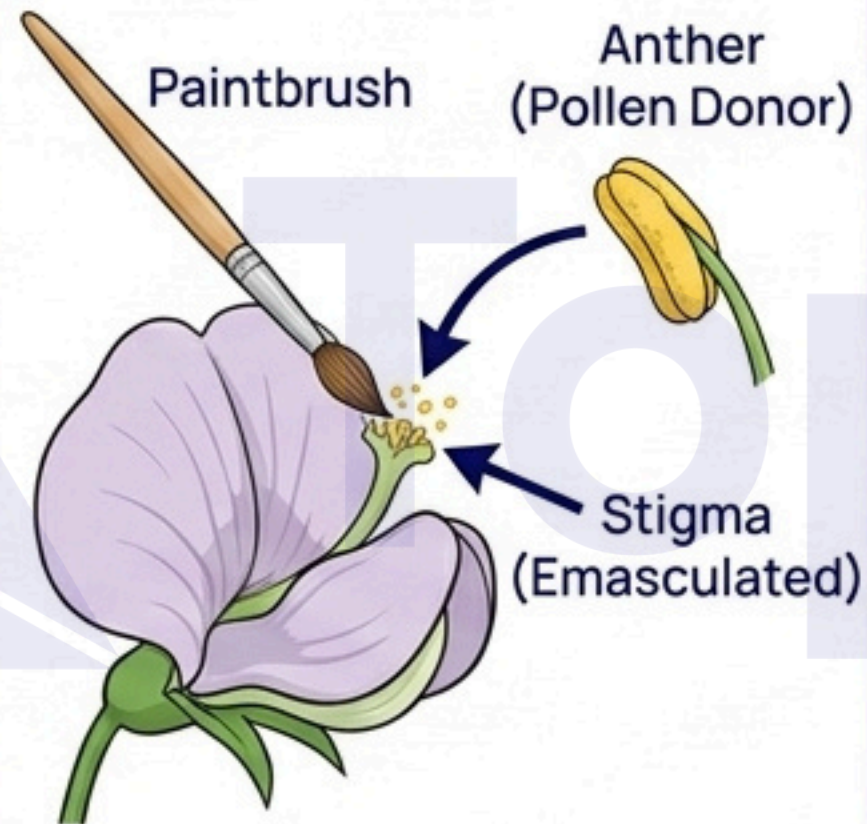
Parent 2: True-breeding Dwarf

Definition: A 'true-breeding' line undergoes continuous self-pollination, showing stable trait inheritance and expression for several generations.

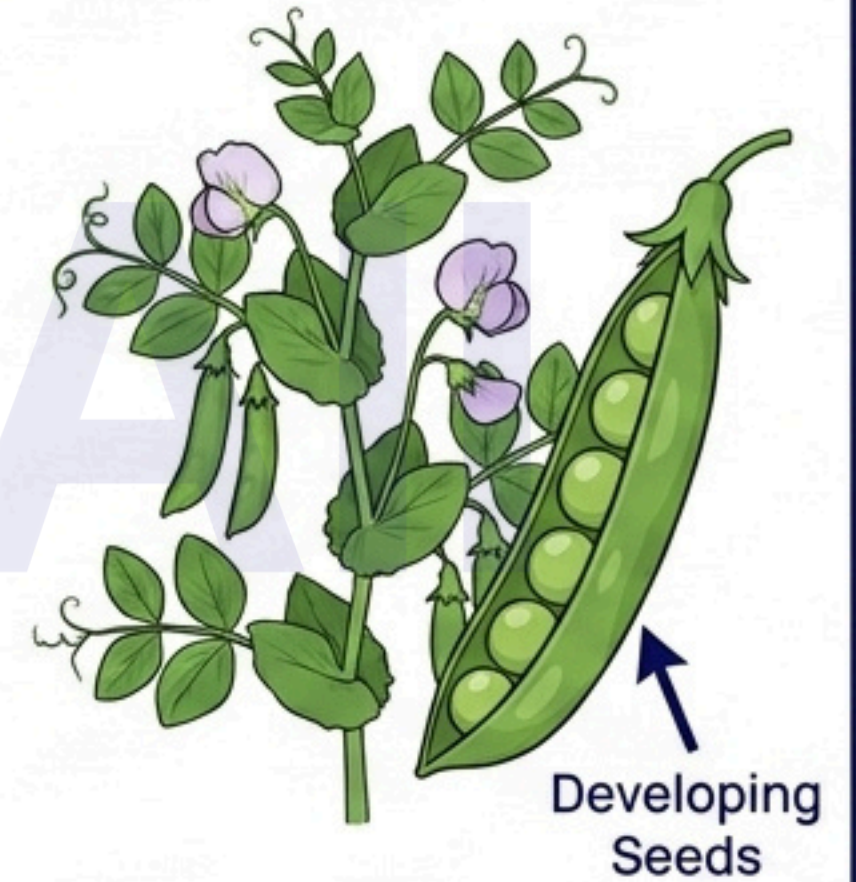
1. Emasculation



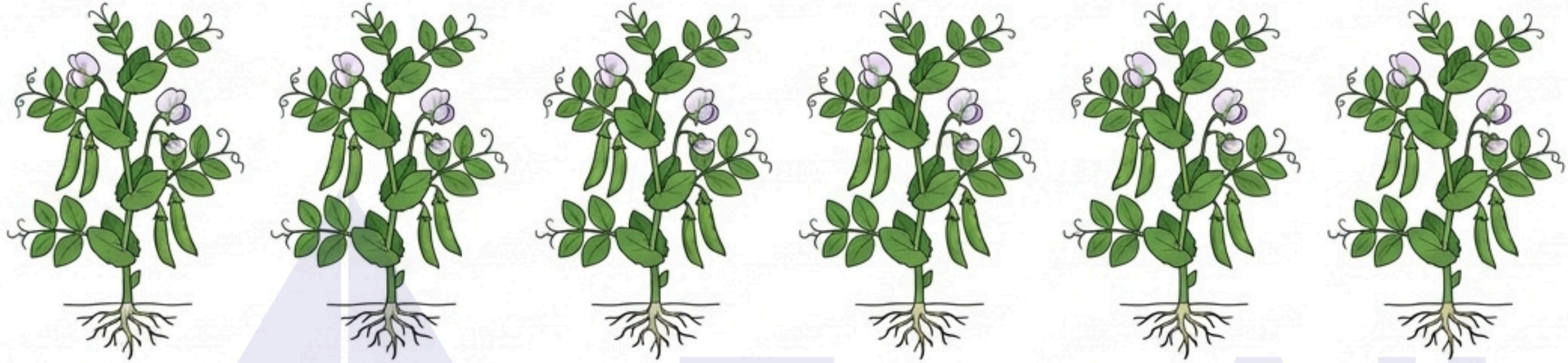
2. Pollination



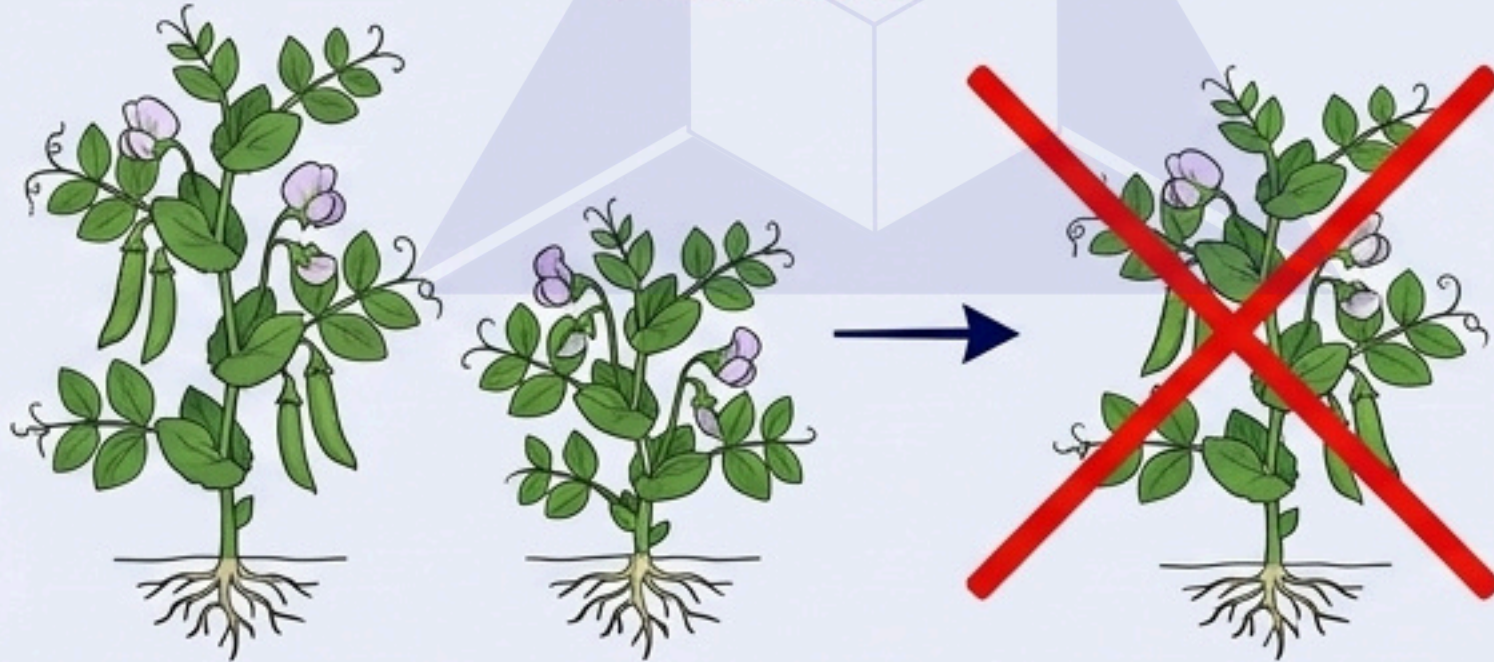
3. Harvest



Filial 1 (F1) Generation

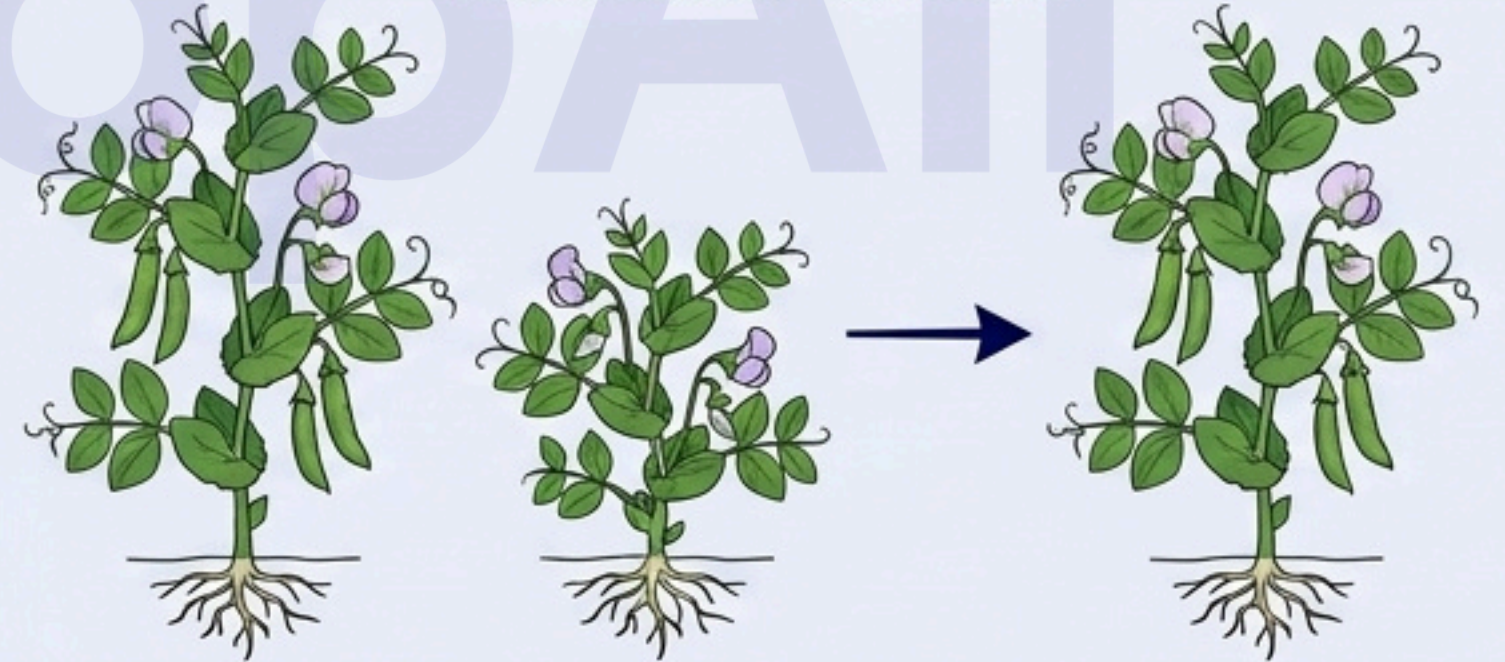


Mistake

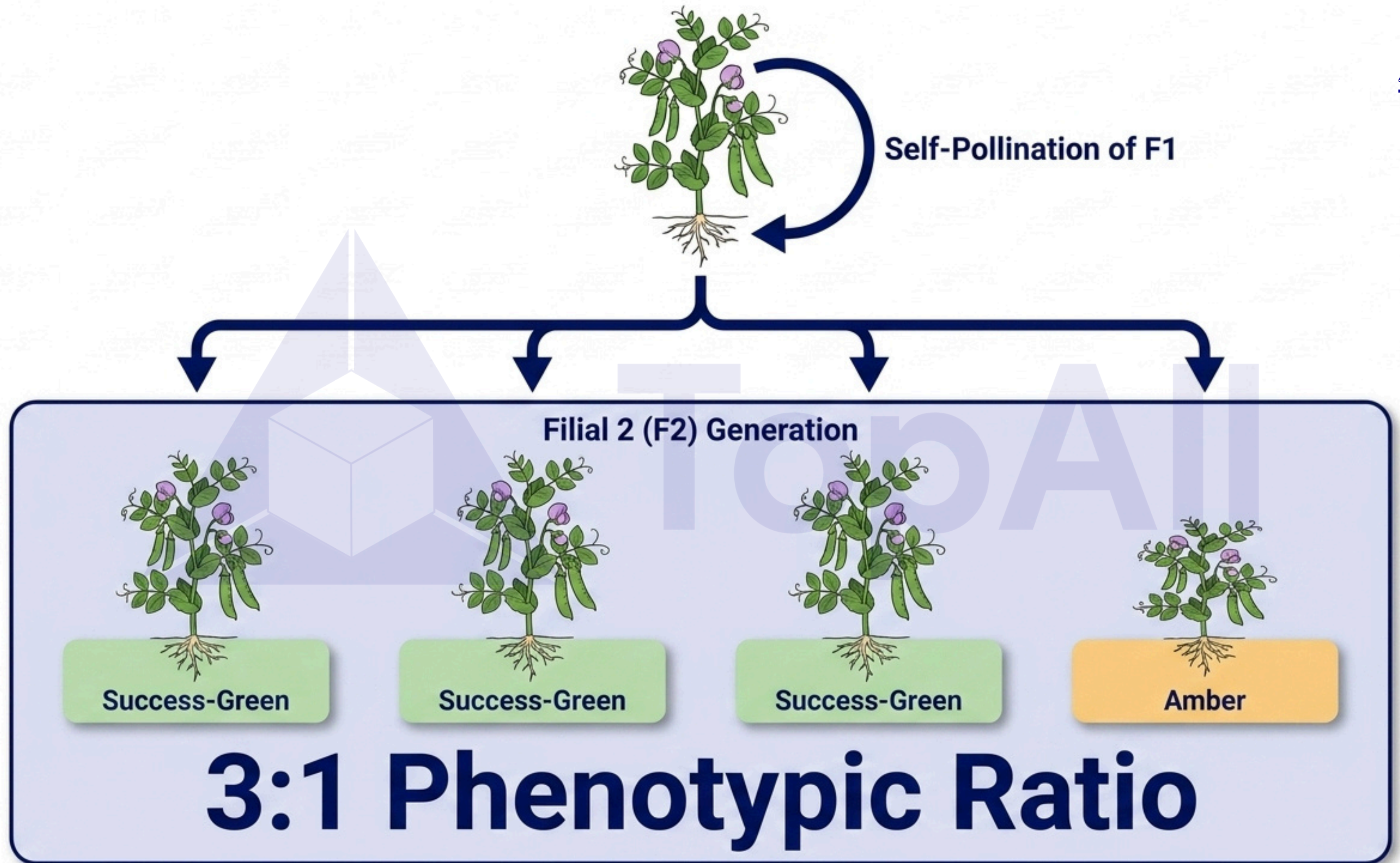


Myth: Traits blend to form an intermediate.

Success-Green



Reality: All F1 progeny perfectly resemble one parent. The dwarf trait completely vanishes.



Factors (Genes)

Alleles

Mendel proposed that invisible "factors" are stably passed down unchanged from parent to offspring. Today, we call these units of inheritance **genes**.

Slightly different forms of the same gene coding for a pair of contrasting traits.

T

Dominant
Tall trait

t

Recessive
Dwarf trait

TT

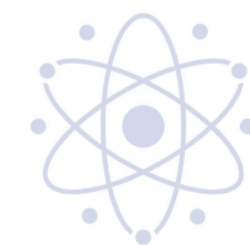
Tt

tt



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$$E=mc^2$$



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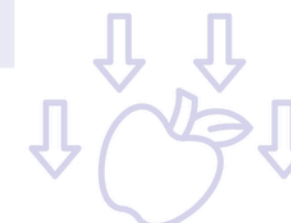
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Genotype (The Genetic Code)

Phenotype (The Physical Expression)

Homozygous

TT

tt

Heterozygous

Tt



The dominant 'T' masks the recessive 't', explaining why the F1 generation was entirely tall.

		Pollen	
		T	t
Eggs	T	TT	Tt
	t	Tt	tt

Developed by geneticist Reginald C. Punnett: a graphical representation to calculate the probability of all possible offspring genotypes.

Lab Note

$$\left(\frac{1}{2}T + \frac{1}{2}t\right)^2 = \frac{1}{2}T \times \frac{1}{2}T + 2\left(\frac{1}{2}T \times \frac{1}{2}t\right) + \frac{1}{2}t \times \frac{1}{2}t$$

$$= \frac{1}{4}TT + \frac{1}{2}Tt + \frac{1}{4}tt$$

1

Genotypic Ratio
= 1 : 2 : 1

2

Phenotypic Ratio
= 3 : 1 (Presents as Tall)

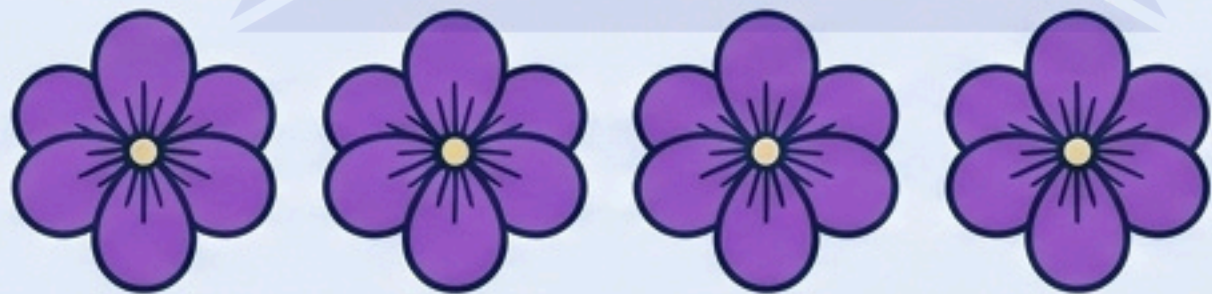
TEST CROSS: DETERMINING UNKNOWN GENOTYPE



Is this dominant phenotype
Homozygous (VV) or
Heterozygous (Vv)?



Cross with Recessive Parent (vv)



Result: All offspring are Violet.
Conclusion: Unknown Parent was **VV**.



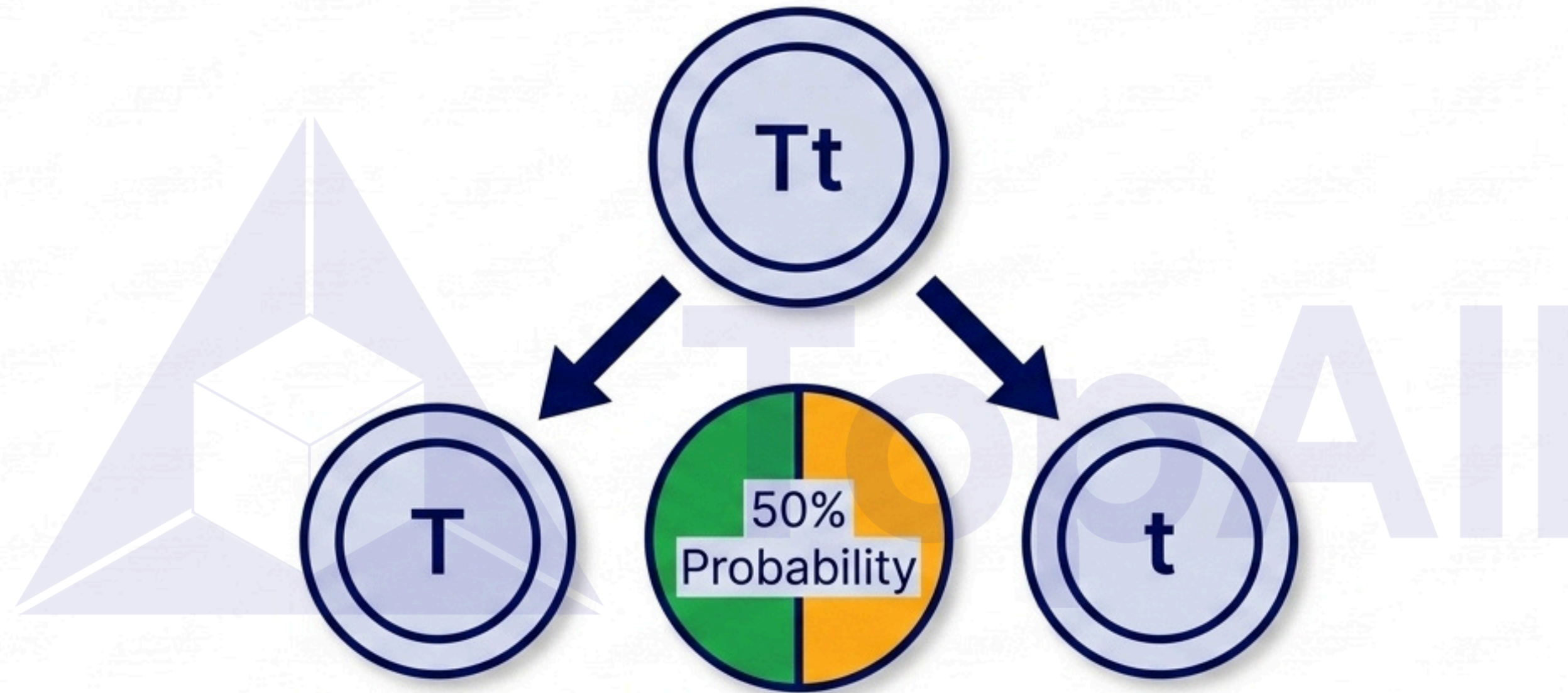
Result: Half offspring Violet, half White.
Conclusion: Unknown Parent was **Vv**.

First Law: Law of Dominance

1. Characters are controlled by discrete units called factors.
2. Factors occur in pairs.
3. In a dissimilar pair, one member dominates (dominant) the other (recessive).

Tt

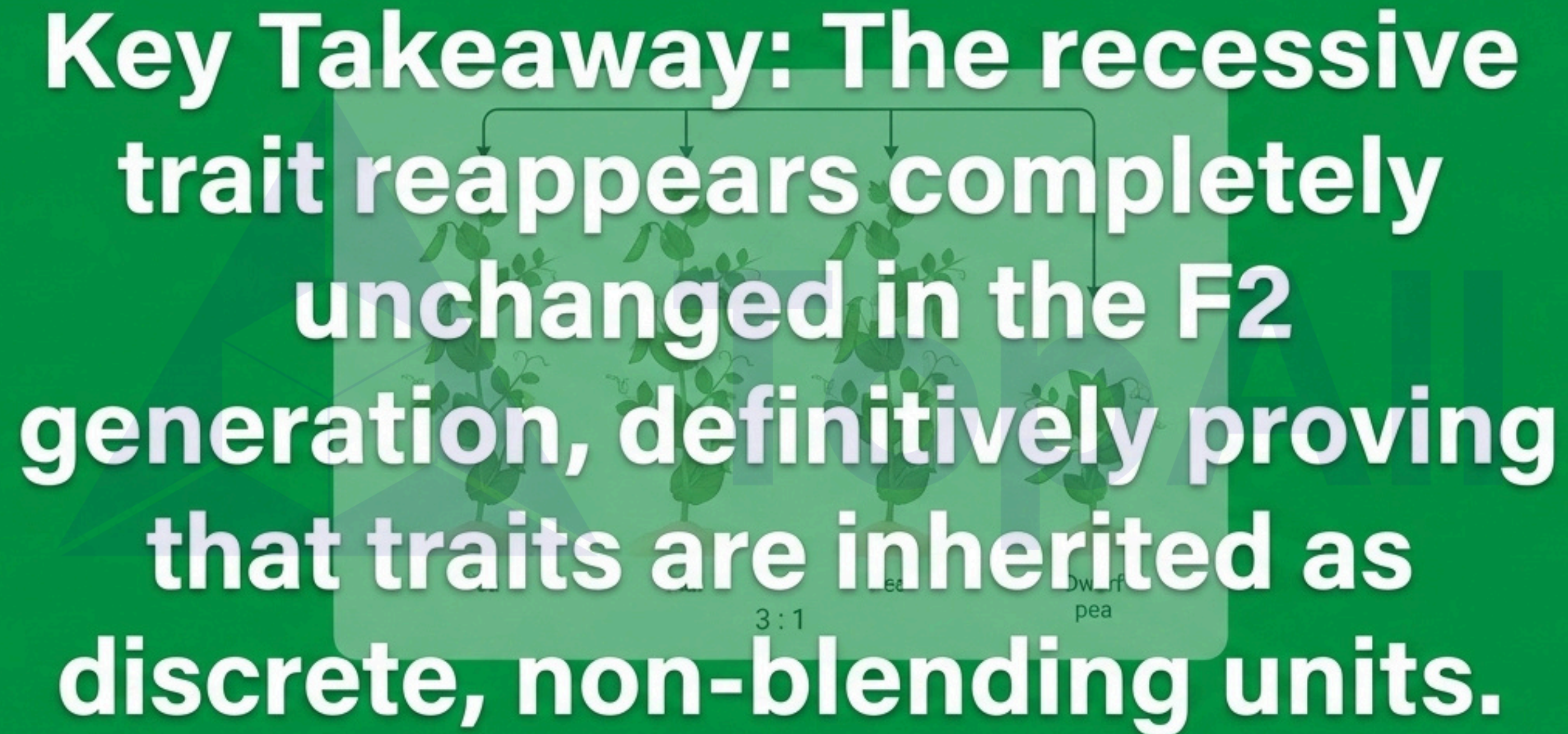
Second Law: Law of Segregation



Alleles do not show any blending. During meiosis, the allele pair segregates randomly, ensuring each gamete receives only one allele.

Generation	Parents Used	Phenotypes Observed	Genotypes Present	Recessive Trait Status
F1 Generation	True Tall × True Dwarf	100% Tall	Tt (100%)	Hidden (Masked)
F2 Generation	F1 Tall × F1 Tall (Self)	75% Tall, 25% Dwarf	TT, Tt, tt (1:2:1)	Expressed Intact

Key Takeaway: The recessive trait reappears completely unchanged in the F2 generation, definitively proving that traits are inherited as discrete, non-blending units.



The background of the text box features a faint image of pea plants. Overlaid on this image is a diagram illustrating a 3:1 phenotypic ratio. A horizontal line at the top has three arrows pointing down to three tall pea plants, and one arrow pointing down to one short pea plant. Below the short plant, the text '3:1' is visible. To the right, the words 'Dwarf' and 'pea' are partially visible.



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