



RAMA
UNIVERSITY

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FACULTY OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF BIOTECHNOLOGY

Mendel's Laws

- A scientific law is an evidence-based **description** of a natural phenomenon in a given set of circumstances.
- Mendel's three Laws of Heredity describe what Mendel observed in patterns of inherited traits.

- Monohybrid Cross
- Dihybrid Cross



Hybrid

The offspring of parents that have different forms of a trait, such as tall and short

Monohybrid cross (*mono* = one)

The two parent plants differed by a single trait – height

P₁ – parent generation

F₁ – first generation

F₂ – second generation

The First Generation

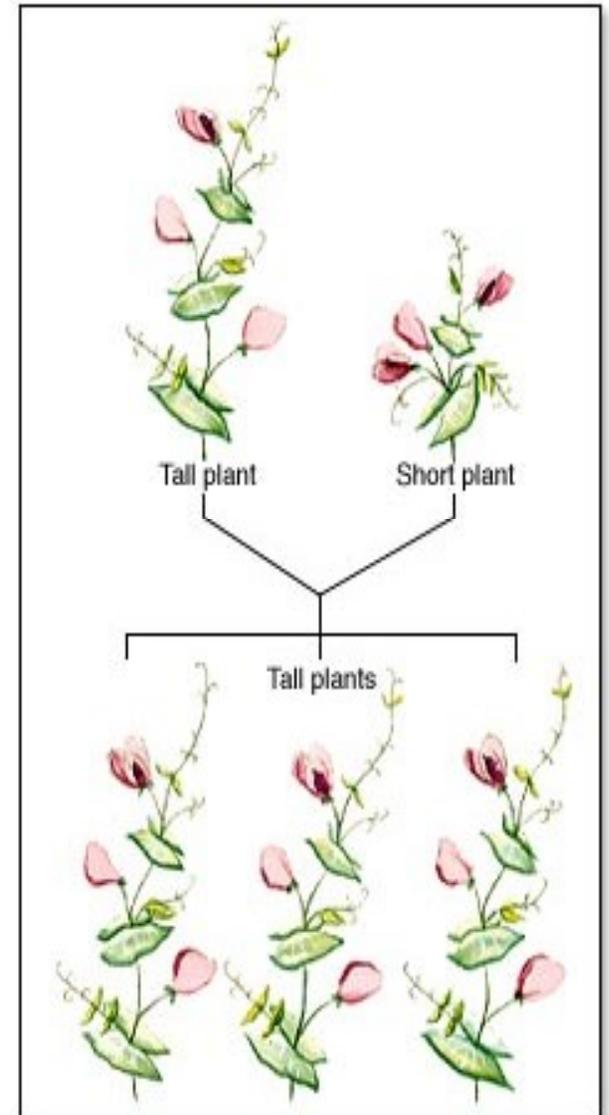
- Crossed 2 true breeding plants
1 tall and 1 short
- All offspring of the 2 parent plants were tall

The Second Generation

- Self-pollinated the plants from the first generation
- $\frac{3}{4}$ the offspring were as tall as the tall plants in the parent and first generation
- $\frac{1}{4}$ the offspring were as short as the short plant in the parent generation
- 3:1 ratio tall to short

The rule of unit factors

- Each organism has 2 factors that control each of its traits
- These factors are genes
 - Genes exist in alternative forms called alleles
Ex. Plant height – one allele is for tall and another is for short
One comes from the mother and one from the father



The rule of dominance

- Each trait has an allele that will be observed more than the other

- Dominant (gene)

The observed trait
Tall plant

- Recessive (gene)

The trait that disappeared
Short plant
Only shows when both alleles are recessive



- Recording the results for crosses
 - Dominate allele is always written first
 - Uppercase letter is used for dominate
T – tall
 - Lowercase letter is used for recessive
t – short

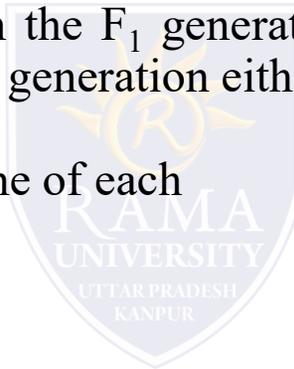
Dominate and Recessive

Pea Traits Mendel Studied

	Seed form	Seed color	Pod form	Pod color	Flower position	Seed coat color	Stem length
Dominant	 Round (<i>R</i>)	 Yellow (<i>Y</i>)	 Inflated (<i>V</i>)	 Green (<i>G</i>)	 Axial (<i>F</i>) along stem	 Gray or gray-brown (<i>A</i>)	 Tall (<i>L</i>)
Recessive	 Wrinkled (<i>r</i>)	 Green (<i>y</i>)	 Restricted (<i>v</i>)	 Yellow (<i>g</i>)	 Terminal (<i>f</i>) on top	 White (<i>a</i>)	 Short (<i>l</i>)

Law of segregation

- During fertilization, male and female gametes randomly pair to produce 3 combinations of alleles.
- Concluded that each plant in the F_1 generation carried one dominant allele and one recessive allele and the F_2 generation either received
- 2 dominant; 2 recessive; or one of each



Phenotypes and Genotypes

- Two organisms can look alike but have different underlying gene combinations

- Phenotype

 - ✓ The way an organism looks or behaves

 - ✓ What you see

- Genotype

 - ✓ The gene combination an organism contains

 - ✓ The genetic makeup



- Homozygous

 - ✓ The two alleles for the trait are the **same**

 - ✓ TT or tt

- Heterozygous

 - ✓ The two alleles for the trait are **different**

 - ✓ Tt

Dihybrid Crosses

The First Generation

Two true breeding plants (P_1)

$RRYY$ = round yellow seed (homozygous dominant)

$rryy$ = wrinkled green seed (homozygous recessive)

When they were crossed all the plants had round yellow seeds (F_1)

The Second Generation (F_2)

Self-pollinated plants from the first generation

Resulted in 9 round yellow, 3 round green, 3 wrinkled yellow, 1 wrinkled green A ratio of 9:3:3:1

Dihybrid Cross = round yellow X wrinkled green

	RY	RY	RY	RY
ry	RrYy	RrYy	RrYy	RrYy
ry	RrYy	RrYy	RrYy	RyYy
ry	RrYy	RrYy	RrYy	RrYy
ry	RrYy	RrYy	RrYy	RrYy

Heterozygous Cross = round yellow X round yellow

	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy