
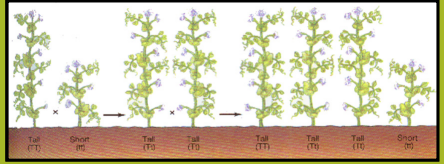


MENDELIAN GENETICS




Chapter 6.3 – 6.5



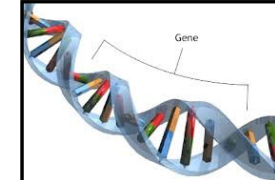
Mendel and Heredity

Gregor Mendel (1822-1884)

I'm known as the "Father of Genetics"




- **Genetics** = the study of inheritance patterns and variation in organisms
- **Genes** = segments of DNA that direct a cell to make a certain protein (proteins make up your traits!)



Mendel and Heredity

- **Traits** = characteristics that are inherited


Examples of Traits



Mendel and Heredity

Mendel's Peas

Mendel used pea plants to study patterns of inheritance.



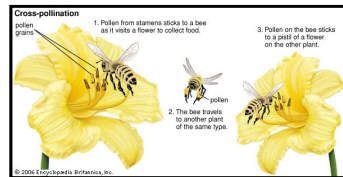
Why do you think he used plants instead of animals in his research?

Mendel and Heredity

Mendel's Peas

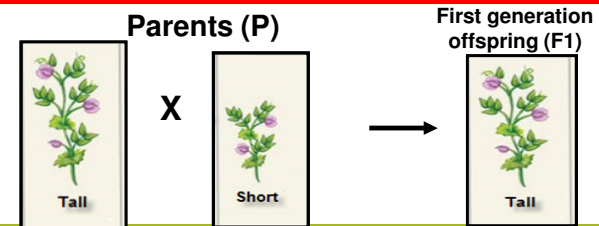
- Mendel studied 7 different traits in pea plants by **cross-pollinating** plants that had variations of each trait:

Height	Seed Shape	Seed Color	Seed Coat Color	Pod Shape	Pod Color	Flower Position
Tall	Round	Yellow	Green	Inflated (full)	Green	Axial
Short	Wrinkled	Green	White	Constricted (flat)	Yellow	Terminal



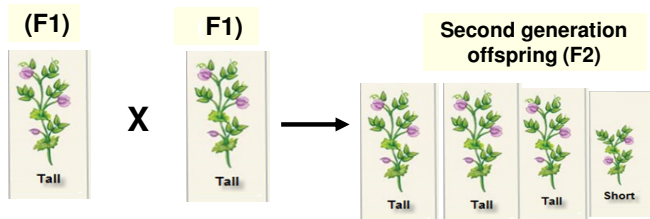
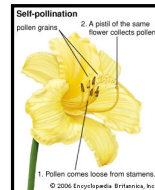
Mendel's 1st Experiment

- Only used "either-or" traits (ex: either tall or short...not medium)
- First experiments were **monohybrid crosses** (cross one trait at a time)
- Only used **true-breeding** (purebred) plants so he could control the outcome



Mendel's 2nd Experiment

- Allowed F1 offspring to self-pollinate to produce F2 offspring.



Mendel's Results

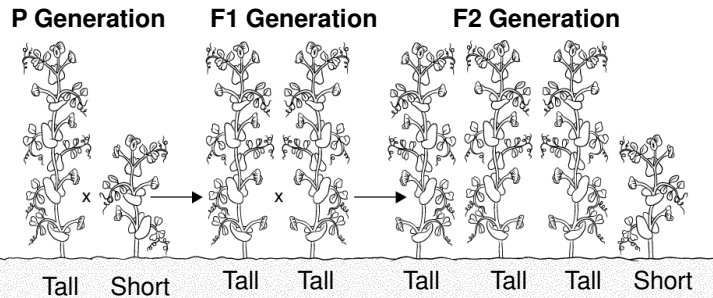
- One particular variation of each trait showed up in offspring more often.

FIGURE 6.10 MENDEL'S MONOHYBRID CROSS RESULTS

F ₂ TRAITS	DOMINANT	RECESSIVE	RATIO
Pea shape	5474 round	1850 wrinkled	2.96:1
Pea color	6022 yellow	2001 green	3.01:1
Flower color	705 purple	224 white	3.15:1
Pod shape	882 smooth	299 constricted	2.95:1
Pod color	428 green	152 yellow	2.82:1
Flower position	651 axial	207 terminal	3.14:1
Plant height	787 tall	277 short	2.84:1

Mendel's Experiments:

Mendel observed the same results every time he crossed two different forms of a trait.



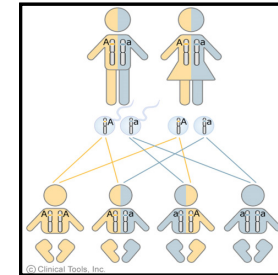
Mendel's Conclusions

1. Biological inheritance is determined by factors (or GENES) that are passed from one generation to the next.

- Traits are inherited from parents to offspring in patterns

2. Law of Segregation =

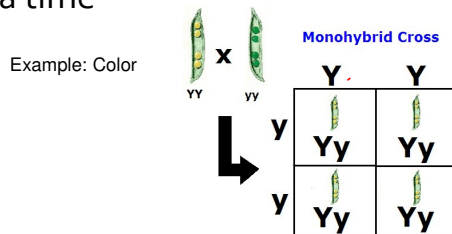
- organisms inherit two copies of each gene, one from each parent
- organisms donate only one copy of each gene to their offspring



Mendel's Conclusions

The Law of Segregation arose from doing monohybrid crosses

- Monohybrid = only testing only ONE trait at a time

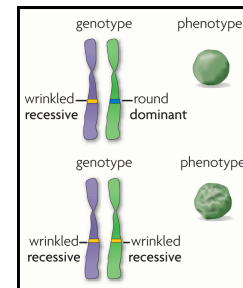


Mendel's Conclusions

• "Principle of Dominance" - some alleles are dominant and some are recessive

- Alleles = different versions of a gene

- Dominant alleles are expressed over recessive alleles
- (Recessive characteristics of a trait are "hidden" if a dominant allele is present)
- Dominant alleles use capitalized letters, recessive alleles use lower-cased letters



T = tall t = short
 Y = yellow y = green
 R = tongue roller r = non-tongue roller

**** This does NOT mean that dominant is better or stronger or occurs more often in a population!**

Traits, Genes, and Alleles

- We use capital letters to signify dominant alleles and lower case letters to signify recessive alleles.

Alleles are identical to each other

Alleles are different from each other

Homozygous

Dominant : AA ,GG,RR

Recessive : aa, gg, rr

Heterozygous

Aa , Gg , Rr

Traits, Genes, and Alleles

Genotype

- The genetic makeup of a particular trait
- (the alleles an organism has for a trait)

Examples:

RR
Bb
aa

Phenotype

- The physical appearance of a trait
- *what the alleles stand for

Examples:

round seeds
brown eyes
albino skin

Genome = all of an organism's genetic material

Traits and Probability

- Probability = the likelihood that an event will occur
- Probability is used to predict outcomes of genetic crosses

Ex: flipping a coin → What is the probability that it will land on heads?

Parent 1 alleles
A a

A	AA	Aa
a	Aa	aa

Parent 2 alleles

possible genotypes of offspring

The Punnett square yields the ratio of possible genotypes and phenotypes

Punnett Squares allow us to calculate the probability that certain traits will be passed on to offspring.

Monohybrid Crosses – involves 1 trait

1. In pea plants tall plants (T) are dominant to short plants (t). Cross a homozygous tall pea plant with a homozygous short pea plant.

Parents: _____ × _____

Genotype Ratio= #TT : #Tt : #tt

_____ : _____ : _____

Genotype Percentages : _____ : _____ : _____

Phenotype Ratio = #Dominant:#Recessive

_____ : _____

Phenotype Percentages: _____ : _____

Monohybrid Crosses

2. In pea plants round seeds (R) are dominant to wrinkled seeds (r). Cross one heterozygous pea plant with another heterozygous pea plant.

Parents: _____ x _____

Genotype Ratio= #RR : #Rr : #rr
 _____ : _____ : _____

Genotype Percentages : _____ : _____ : _____

Phenotype Ratio = #Dominant:#Recessive
 _____ : _____

Phenotype Percentages: _____ : _____

Monohybrid Crosses

A= tall a= short

3. Cross a heterozygous genotype with a homozygous recessive genotype

Parents: _____ x _____

Genotype Ratio= #AA : #Aa : #aa
 _____ : _____ : _____

Genotype Percentages : _____ : _____ : _____


Phenotype Ratio = #Dominant:#Recessive
 _____ : _____

Phenotype Percentages: _____ : _____


Mendel's Conclusions

3. Law of Independent Assortment

- the inheritance of one gene does not influence the inheritance of another gene



In other words...just because peas are green does not mean they will also be wrinkled (they could be round)



[Video L of IA](#)

AABB

self-pollinated

x

aabb

parental generation (P)

↓

AaBb

F₁ generation

		pollen			
		AB	Ab	aB	ab
eggs	AB	AABB	AABb	AaBB	AaBb
	Ab	AABb	AAbb	AaBb	Aabb
	aB	AaBB	AaBb	aaBB	aaBb
	ab	AaBb	Aabb	aaBb	aabb

© 2006 Encyclopedia Britannica, Inc.

Dihybrid Crosses

round yellow peas x **wrinkled** green peas

- Involves 2 different traits
- Mendel tested many combinations of traits:

R R Y Y **r r y y**

Dihybrid Crosses

What if we crossed the F1...
heterozygous x heterozygous

RrYy RrYy

Dihybrid Crosses

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

Genotype	Genotypic Ratio	Phenotype	Phenotypic ratio
RRYY			
RrYy			
RrYY			
RRYy			
RRyy			
Rryy			
rrYY			
rrYy			
rryy			

TERMS to know:

Gene: segment of DNA that codes for a trait	Allele: different forms of the same gene
Dominant allele: expressed when at least one copy is present; represented by a CAPITAL letter Example: _____ or _____	Recessive allele: expressed only when 2 copies are present; represented by a lowercase letter Example: _____
Heterozygous: 2 alleles are different Example: _____	Homozygous: 2 alleles are the same Examples: _____ or _____
Genotype: genetic makeup Example: _____	Phenotype: physical traits Example: _____
Probability: the likelihood that an event will occur	Genome: all of an organisms genetic material

Review

- Gregor Mendel used peas to study how traits are inherited
- He developed 2 major conclusions:
 1. Law of Segregation
 2. Law of Independent Assortment
- Today, we simply use Punnett squares to predict the outcome (genotypes and phenotypes) of offspring
- Mendel's principles apply to ALL sexual organisms, not just plants!

[Review Video Great](#)