Chapter 3: The science of Heredity

Heredity: The passing on of physical characteristics from parents to offspring (throughDNA)

Trait: A physical characteristics (eye color, hair color)

Genetics: The scientific study of heredity

Fertilization: When an egg and sperm join together to form a new organism

Homozygous: When an organism has two of the SAME ALLELES for a given trait. Also known as a *purebred.* (written as TT or tt).

Heterozygous: When an organism as two different alleles for a given trait. Also known as a *hybrid.* (written as Tt).

Gene: Factor that controls a trait (made of DNA).

Alleles: Different forms of a gene.

Dominant Allele: An allele whose trait always shows up in the organism when the allele is present. Usually represented by a capital letter.

Recessive Allele: An allele whose trait is hidden or masked whenever a dominant allele is present. Usually represented by a lowercase letter.

Genotype: Genetic makeup or allele combinations.

Phenotype: Trait, or physical appearance in the organism.

Probability: A number that describes how likely it is that an event will occur. (example: 1/2, 2/4 or 50%)

Punnett Square: A chart that shows all the possible genotypes (combinations of alleles) that can result from a genetic cross.

Mendel's Laws:

Law of Dominance: In a pair of alleles, one allele can mask, or hide, the trait of the other allele.

Law of Segregation: The pairs of alleles from each parent separate, and only one allele passes from each parent to an offspring for each trait.

Law of Independent Assortment: Different pairs of alleles are passed to offspring independently of each other. The result is that new combinations of genes are present in the offspring.

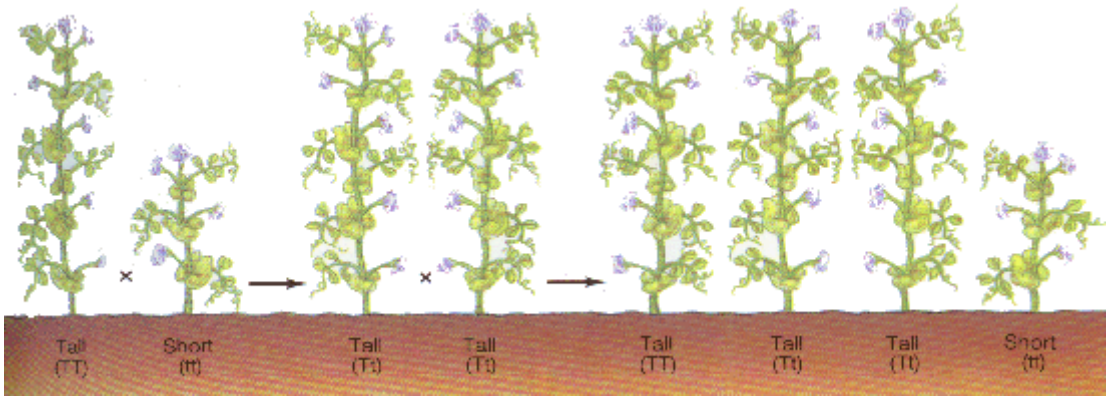
Exceptions to Mendel's Laws:

Codominance: When neither allele is dominant nor recessive they are said to be *codominant*, and result in both allele traits being expressed in the organism. (example: black feathered chicken and white feathered chicken have offspring with both white and black feathers)

Incomplete Dominance: When both alleles are expressed in the organism but the traits are blended together, the alleles are said to be *incomplete dominant*. (example: A homozygous white snapdragon plant and a homozygous red snapdragon plant produce offspring that are pink)

Mendel's Pea Plant Experiments

What happened when Mendel crossed a tall plant and a short plant in the P generation? (P generation is the parent generation)



Tall is the dominant allele = T

Short is the dominant allele = t

One of the parent plants is *Homozygous Dominant* (TT) and one is *Homozygous Recessive* (tt)

Punnett Square for F1 generation:

	T	T
t	Tt	Tt
t	Tt	Tt

Phenotypes:

4/4, 100% Tall Plants

Genotypes:

4/4, 100% Heterozygous (hybrids, Tt)

Punnett Square for F2 generation:

	T	t
T	TT	Tt
t	Tt	tt

Phenotypes:

3/4, 75% Tall Plants

1/4, 25% Short Plants

Genotypes:

1/4, 25% Homozygous Dominant (purebred, TT)
1/4, 25% Homozygous Recessive (purebred, tt)
2/4, 1/2, 50% Heterozygous (hybrid, Tt)

Multiple Alleles

A genotype is made up of TWO alleles to create a phenotype (trait) in an offspring. For many genes there may only be two alleles (forms of the gene).

Multiple Alleles is when there are THREE or MORE alleles for a given phenotype (trait).

Example: Human blood type

Possible alleles for blood type: I^A, I^B, i

I^A = is the allele for A type blood
I^B = is the allele for B type blood
i = is the allele for O type blood

I^A and I^B are *Codominant*! That means that a person who receives the allele for A blood and the allele for B blood will have AB blood because both phenotypes are expressed! (see definitions on first page)

Possible genotypes and phenotypes:

Blood Type	Genotype
A	I^AI^A or I^Ai
B	I^BI^B or I^Bi
AB	I^AI^B
O	ii

Sample Question on Blood Type:

What are the possible genotypes and phenotypes of the offspring between a heterozygous type A mother and a type AB father?

Mother's genotype: I^Ai

Father's genotype: I^AI^B

Punnett Square:

	I^A	i
I^A	I^AI^A	I^Ai
I^B	I^AI^B	I^Bi

Phenotypes:

1/2, 50% type A blood
1/4, 25% type AB blood
1/4, 25% type B blood

Genotypes:

1/4, 25% homozygous dominant A
1/4, 25% heterozygous A
1/4, 25% heterozygous codominant
1/4, 25% heterozygous B