LAB -1- ***GENETICS***

MENDELIAN INHERITANCE

The laws of inheritance were derived by Gregor Mendel, conducting hybridization experiments in garden peas (*Pisum sativum*). Between 1856 and 1863, he cultivated and tested some 5,000 pea plants. From these experiments, he induced two generalizations which later became known as *Mendel's Principles of Heredity* or *Mendelian inheritance*.

Inheritance characteristics are determined by `factors' called (alleles)
these factors occur in pairs (gene on maternal and paternal homologous chromosomes)
Gametes when form ,these genes segregate so that only of the homologous pairs is contained in a particular gametes

** **Mendel reasons for choosing pea plant for genetic experiments :**

1- Short life cycle

2- Produce large numbers of offspring (progeny)

3- The possibility of genetic mutations when exposed to radiation or chemicals

4- The possibility of controlling mating in this plant

5- Ease of upbringing

6- Characterized by genetic contraindication

7- The possibility of Artificial hybridization Because it possesses hermaphrodite flowers

**** Mendel studied seven pairs of characters in pea, Shown in the following picture**

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

Gene is unit of hereditary on a chromosome

Gene has an alternate state called allele

Allele for particular gene occur in pairs (of the same gene (green, white for seed colors).

Dominant

a relationship between alleles of a gene, in which one allele masks the expression (phenotype) of another allele at the same locus.

Recessive

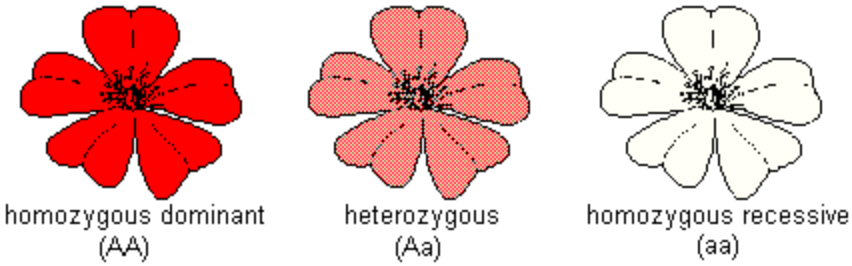
It is the character that able to be covered up by a dominant trait

Homozygous

Offspring inherit matching alleles, one from each parent (AA or aa).

Heterozygous

Offspring inherit non-matching alleles, one from each parent (Aa).



Genotype

The sum of all your genes, many of which will not ever be expressed.

Phenotype

The part of your genetic constitution that is expressed (the appearance of an organism)

Phenocopies

Is a variation in phenotype which is caused by environmental conditions, it is not a type of mutation, as it is non-hereditary.

Mendel's laws

Mendel's ***law of segregation*** **(The"First Law")** Mendel's law of segregation says that **the alleles that make up a gene separate from each other, or segregate, during the formation of gametes with phenotypic ratio 3:1.** That fact can be represented by simple equations, such as:

RR → R + R or Rr → R + r

When breeding red flower pea plant with white flower, All the members of the resulting progeny was red flower

	Red		White
P1	RR	X	rr
G1	R	↓	r
F1		Rr	

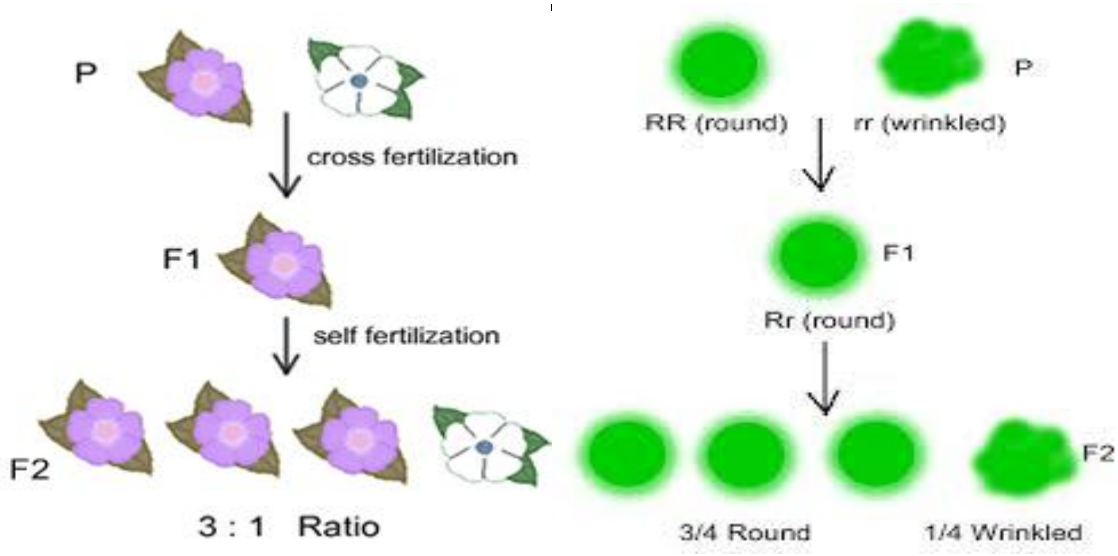
100% red flower

When leaving the members of the resulting progeny in first generation to self pollination (cross), half of the members of the resulting generation have red flower and the other have white flower as follow

	Red		Red
P2	Rr	X	Rr
G2	R r	↓	R r
F2		RR , Rr, Rr, rr	

Phenotype : (red) 3 : 1 (white)

Genotype: 1 : 2 : 1



Types of crosses

1) Test Cross

A test cross is a cross to a **homozygous recessive** genotype (aa). The goal in a test cross is to discover if the genotype is homozygous dominant (AA) or heterozygous (Aa).

e.g: Genotype could be AA or Aa so crossing with aa will give us different results.

AA x aa = All Aa (All one phenotype) i.e. the dominant trait is homozygous

Aa x aa = 1 Aa: 1 aa (half one phenotype, half other) i.e. the dominant trait is heterozegous

When cross of *Tall x short,* the F_1 are all *tall*. Let us see what happens when this F_1*tall* is test crossed with the homozygous recessive parent i.e. *short* with (tt) genotype.

	Tall		short
P1	TT	X	tt
G1	T	↓	t
F1		Tt	

100% Tall plants

When test crossed

P	Tt	X	tt
G	T t	↓	t
F		Tt , tt	

Phenotype : 1 (Tall) : 1 (short)

Genotype : 1 : 1

2) *Back Cross*

Backcrossing is a crossing of a **hybrid** with one of its **parents** or an individual genetically similar to its parent. Useful because you to know the genotype of the parent and can use that as a 'constant'.

e.g. In the fruit fly *Drosophila melanogaster* black body (b) is recessive to the normal gray body (B*). You are given a male with a *gray body with genotype (Bb) crossing with female (bb).* Determine the genotype when backcrossing happens.

	♂ gray		♀ black
P1	Bb	X	bb
G1	B b		b
F1	Bb , bb		

Phenotype : 1 (gray) : 1 (black)

Genotype : 1 : 1

When backcrossing happens

Either

P Bb X Bb

G B b ↓ B b

F BB, Bb, Bb , bb

Phenotype : 3 (gray) : 1 (black)

Genotype : 1 : 2 :1

Or

P Bb X bb

G B b ↓ b

F Bb , bb

Phenotype : 1 (gray) : 1 (black)

Genotype : 1 : 1

***Difference between test and back cross*

A test cross involves breeding to a homozygous recessive for the trait being isolated. A back cross is the breeding of an F1 back to a homozygous individual (either dominant or recessive)

3) Reciprocal Cross

1st: Male Phenotype **A** x Female Phenotype ***B***
2nd: Male Phenotype ***B*** x Female Phenotype **A**

Usual test for sex linkage as if it is sex linked these crosses will produce different results. If autosomal will produce same results for both crosses.