Genetics

Lecture 1

WHAT IS THE **GENETICS**

- The word **genetics** was derived from the Greek root gen which means to become or to grow into and it was coined by **Bateson in 1906** for the study of physiology of heredity and variations.
- **is the study of inherited traits and their variation.**
- The process of transmission of characters from one generation to next, either by gametes–sperms and ova– in sexual reproduction or by the asexual reproductive bodies in asexual reproduction, is called **inheritance or heredity.**

- **Heredity** is the cause of similarities between individuals. This is the reason that brothers and sisters with the same parents resemble each other and with their parents.
- **Variation** is the causes of differences who do resemble each other are still unique individuals. Thus, we have no trouble in recognizing the differences between sisters, for example, and even ‘identical’ twins are recognized as distinctive individuals by their parents and close friends.

- The science of genetics is the study of **heredity which is the cause of similarities**; and
- **variation which is the cause of differences between individuals**

Mendel and His Work

- Johann Mendel was the pioneer of classical geneticists. He was born in July 22, 1822 in He Zinzendorf in Austrian Silesia, where his father, Anton Mendel was the owner of a small farm.
- In 1862, Mendel became a founding member of the Burnn Natural Science Society.
- On February 8, 1865, he delivered his first lecture on pea experiments to Brunn Natural Science Society. In 1866 his paper "Experiments on plant hybridization" published in volume 4 of the proceedings of the Natural Science Society.
- In the same year, he began experiments with other plant species. In this paper, Mendel proposed some basic genetic principles. But unfortunately his remarkable piece of work remained unattended and unappreciated up to 1900.

Mendel's Experiments:

- stem may be tall or dwarf,
- cotyledons may be green or yellow;
- seeds may be round or wrinkled,
- seed coat may be coloured or colourless;
- the unripe pods may be green or yellow
- the ripe pods may be inflated or constricted between the seeds
- flowers may have axial or terminal positions
- The colors of flowers may be red or white.

- Besides these contrasting characters, the pea plant is a very satisfactory material for the hybridization experiments due to its
  flower structure.

Example for 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

Why was Mendel's use of the Garden Pea ideal

1- Variation.

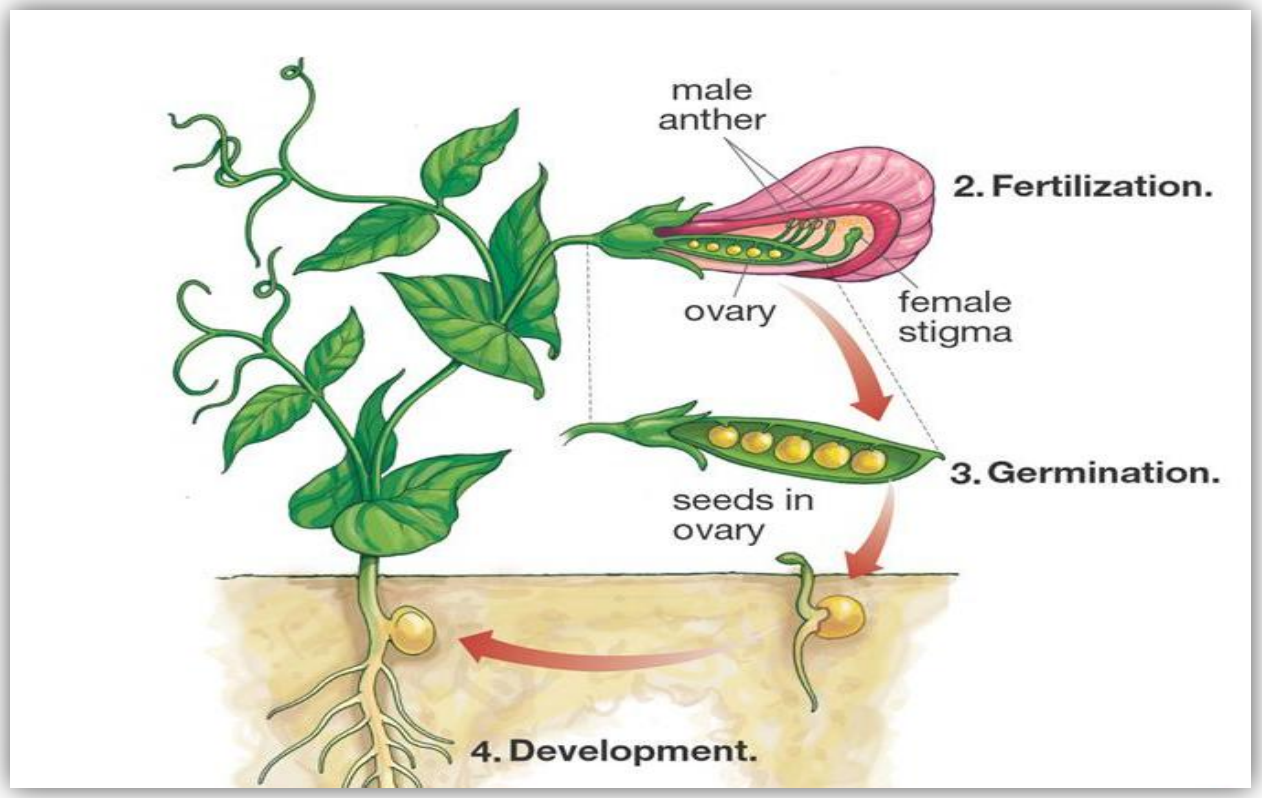
2- Reproduction. The chosen organisms should be sexually reproducing

3- Controlled mating.

4- Short life cycle.

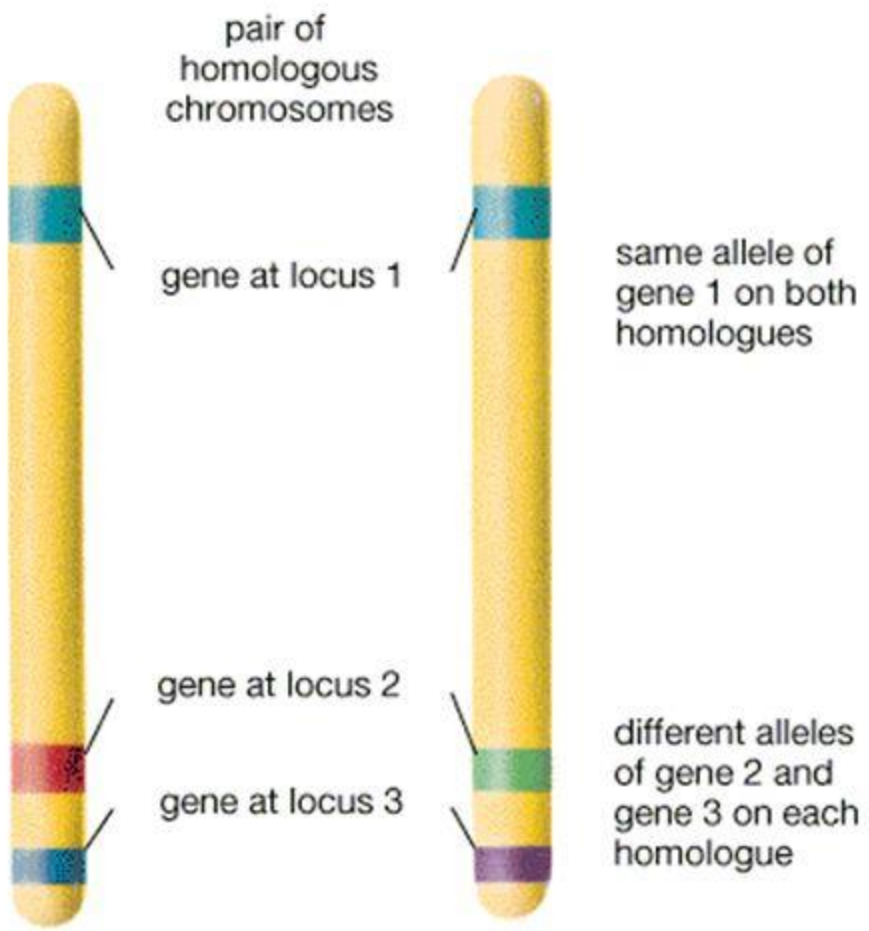
5- Large number of offspring.

6- Convenience in handling


male
anther
2. Fertilization.
ovary
female
stigma
3. Germination.
seeds in
ovary
4. Development.

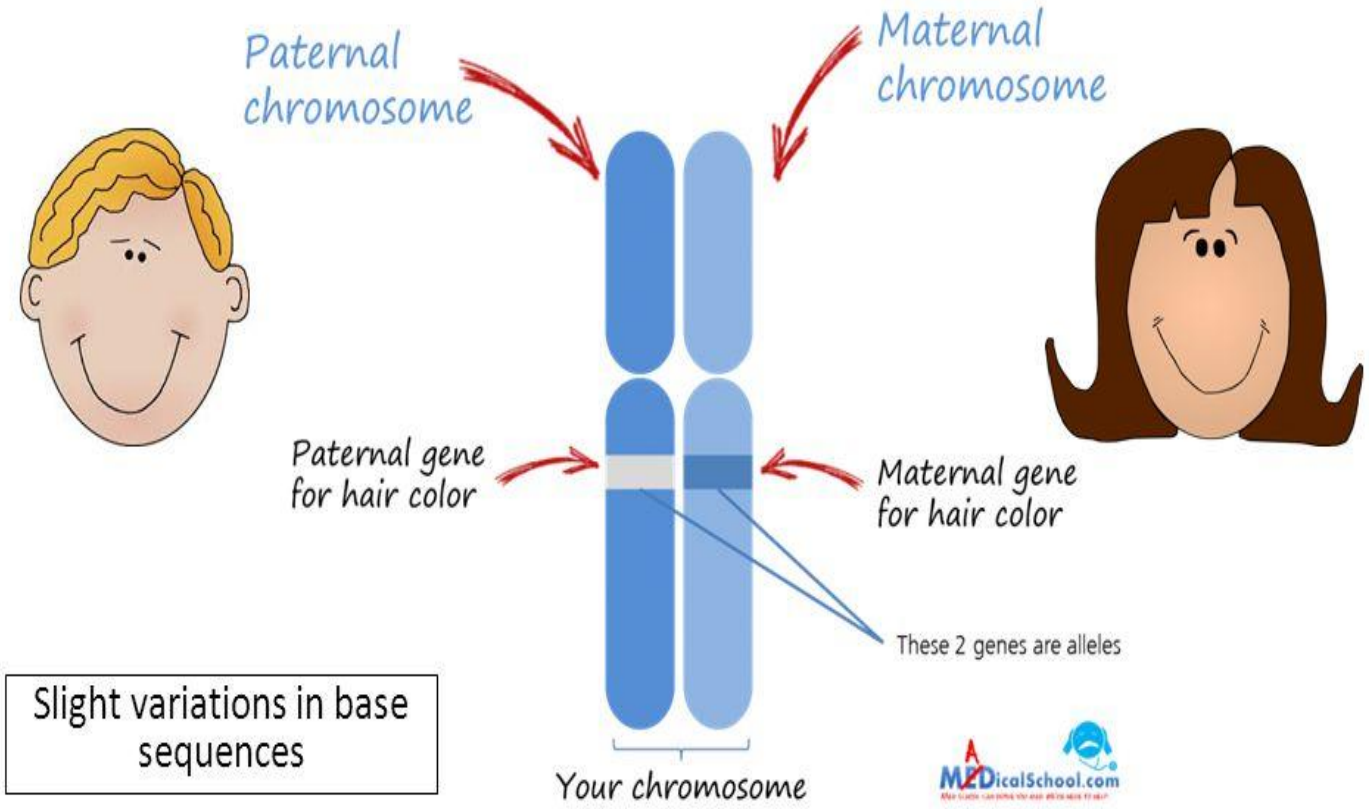
Homologous Chromosomes, Genes, and Alleles

- Chromosome pair:
  - "homologous chromosomes"
- pair has genes at the same loci
  - "alleles"
  - may be the same or different



Alleles

Various forms of genes



Slight variations in base sequences

Dominant allele shown (in this case brown hair)

- **The Principle of Dominance:**

  In a heterozygote, one allele may conceal the presence of another.

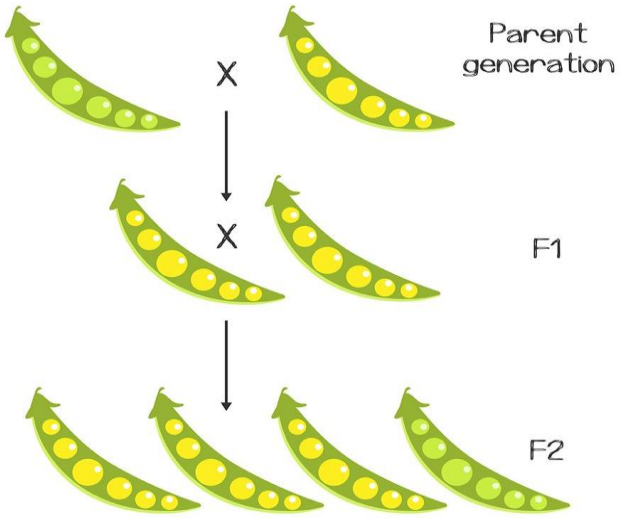
- **The Principle of Segregation:**

  In a heterozygote, two different alleles segregate from each other during the formation of gametes.

The Principle of Dominance

- **Dominant** forms of a trait will always be expressed when it is inherited.
  - Found in hybrids (**heterozygous** individuals)
  - Found in pure dominant (**homozygous dominant**)

- – GG = Yellow
  – Gg = Still Yellow
  – gg = green (recessive)



Crossing the F1's

- His second experiment:
  - He took 2 of the plants produced during his first test (F1 Generation), and breed them together to make another generation of offspring (F2 Generation).
  - When two of these F1 hybrids (dominant looking heterozygous plants) are crossed, the result is an F2 generation showing 3 dominant for every 1 recessive…a **"Mendelian Ratio"**

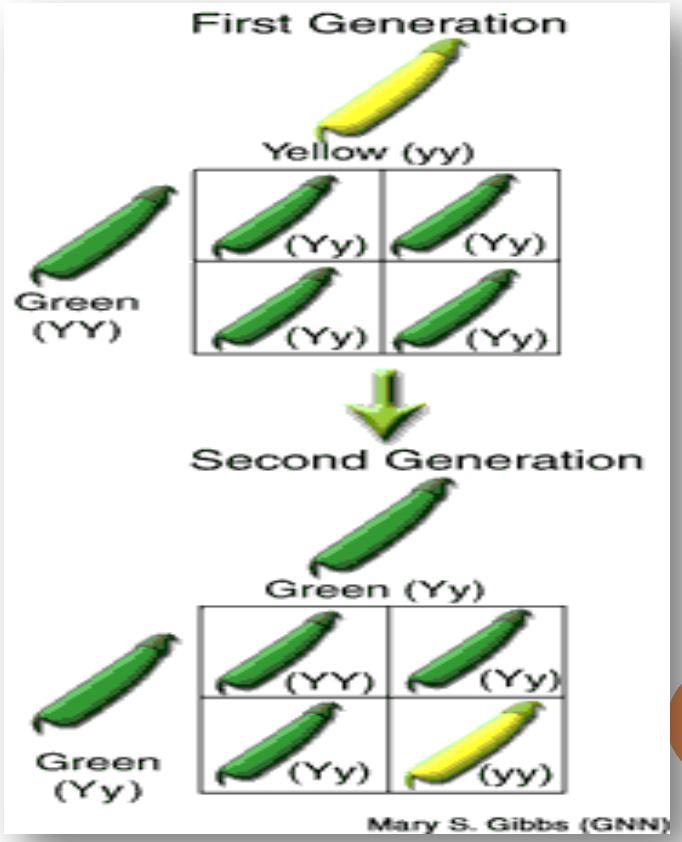
- (expressing 75% dominant, 25% recessive)

Mendelian Ratio:

- 3:1 **phenotype ratio -** dominant to recessive
  – **Phenotype** (what you can **Ph**ysically see)

  Genotype – the **GE**netic makeup of the alleles.

- 1 homozygous dominant :
  2 heterozygous :
  1 homozygous recessive
  1:2:1 Genotype Ratio



Summary of Mendel's Results

1 -The F1 offspring showed only one of the two parental traits, and always the same trait.

2-Results were always the same regardless of which parent donated the pollen (was male).

3-The trait not shown in the F1 reappeared in the F2 in about 25% of the offspring.

4-Traits remained unchanged when passed to offspring: they did not blend in any offspring but behaved as separate units

5- Reciprocal crosses showed each parent made an equal contribution to the offspring.

Terminology

- Evidence indicated factors could be hidden or unexpressed, these are the **recessive traits**.
- **phenotype** refers to the outward appearance of a trait
- **genotype** is used for the genetic makeup of an organism.
- **Gene** is the biological unit of heredity. hold the information to build and maintain their cells and pass genetic traits to off springs
- **allele** one member of a pair or series of different forms of a gene
- **Homozygous-an** organism in which 2 copies of genes are identical i.e. have same alleles
- **Heterozygous**-an organism which has different alleles of the gene
- A YY or yy genotype is called **homozygous**, because the two copies of the gene that determine the particular trait in contrast, a genotype with two different alleles for a trait is **heterozygous**; in other words, its hybrid for that trait