Lec1

The science of heredity or genetics is the study of two contradictory aspects of nature : **heredity** and **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 attempts to explain the mechanism and the basis for both similarities and differences between related individuals. It also tries to explain the phenomenon of evolution and cytodifferentiation

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

Genetics – the branch of biology dealing with the principles of variation and inheritance in animals and plants

The heredity and variations play an important role in the formation of new species (speciation).

The biological science which deals with the mechanism of heredity and causes of variations in living beings (viruses, bacteria, plants and animals) is known as 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.

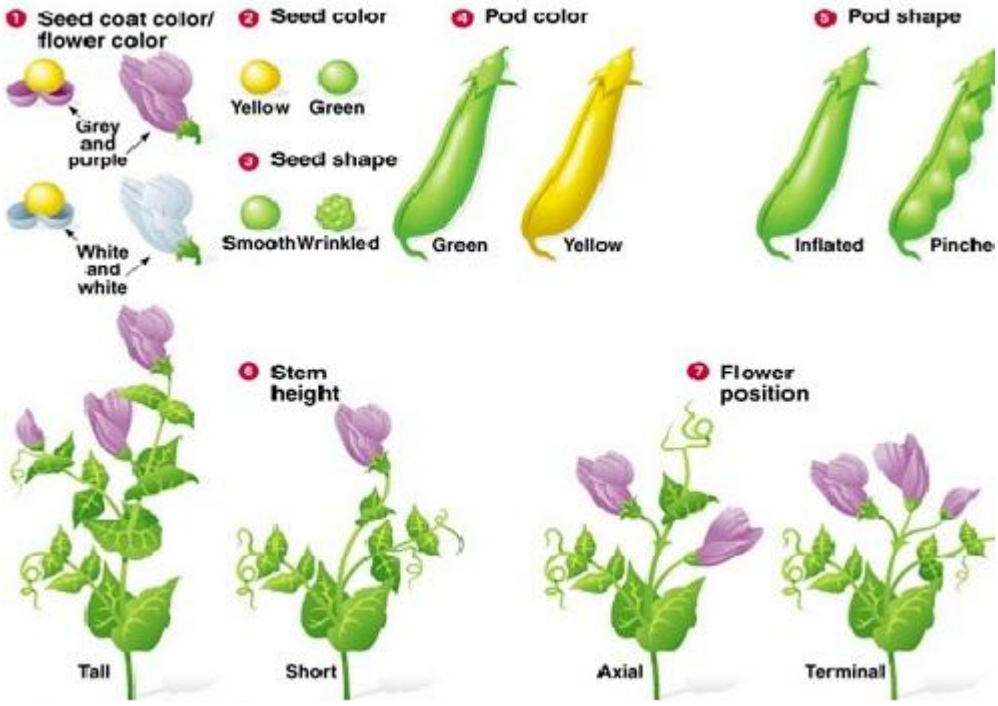
Mendel and His Work

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.

Why was Mendel's use of the Garden Pea ideal?

1- **Variation.** The organisms which are to be chosen for the genetically experiments should have a number of detectable differences and at a time only single detectable character should be considered.
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**. The experimental species should be of a type that can be raised and maintained conveniently and inexpensively in the laboratory



Mendel's Experiments:

Mendel found edible pea (Pisum sativum) a best material for his hybridization experiments. The pea plant has various contrasting characters among its different varieties such as

- 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.

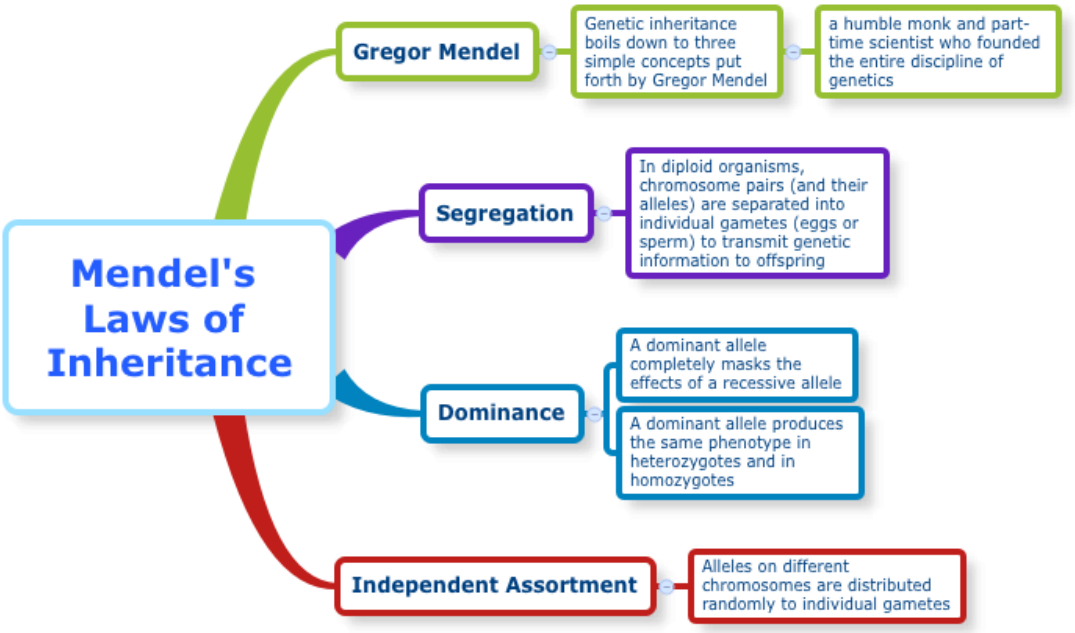
Mendel's law of segregation the two alleles for each trait separate (segregate) during gamete formation and then unite at random one from each parent, at fertilization

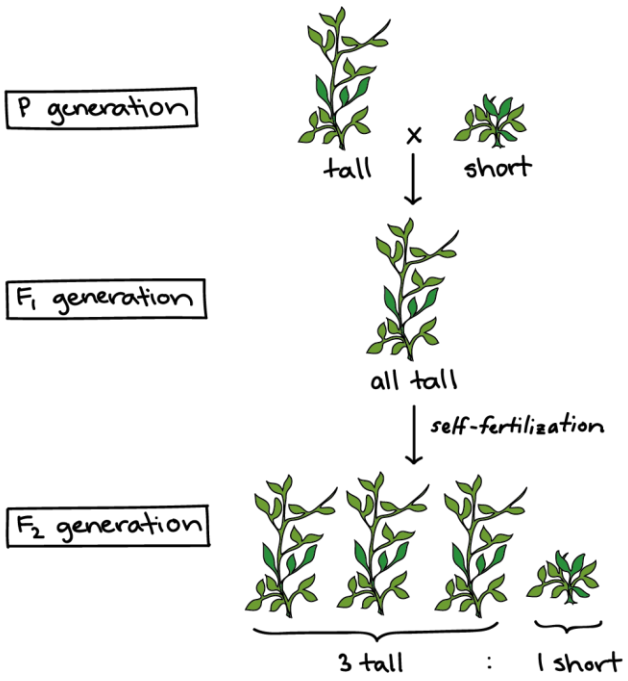
Mendel's Laws

Law of Dominance: if the two alleles at a locus differ, then one, the **dominant allele**, determines the organism's appearance; the other, the **recessive allele**, has no noticeable effect on the organism's appearance

Law of Segregation: the two alleles for a heritable character separate (segregate) during gamete formation and end up in different gametes

Law of Independent Assortment: each pair of alleles segregates independently of other pairs of alleles during gamete formation





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.

Mendel's Conclusions:

- Evidence indicated factors could be hidden or unexpressed, these are the **recessive traits**.

- The term **phenotype** refers to the outward appearance of a trait, while the term **genotype** is used for the genetic makeup of an organism.
- 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
- Male and female contributed equally to the offspring's' genetic makeup: therefore the number of traits was probably two (the simplest solution.(
- Upper case letters are traditionally used to denote **dominant traits**, lower case letters for **recessives**.
- Mendel reasoned that factors must segregate from each other during gamete formation (remember, meiosis was not yet known)

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