HEREDITY

- ⇨ The transfer of traits from one generation to the next is termed heredity.
- ⇨ Genes are the functional units of heredity that transfer characteristics from parents to offspring.
- ⇨ Genes are short stretches of DNA that code for a specific protein or RNA.
- ⇨ Genetics is the branch of biology that deals with the study of genes, heredity and variations.
- ⇨ Sexual reproduction, in particular, creates new combinations of genes, leading to greater variation among offspring.

⇨ Gregor Johann Mendel's work

- ⇨ Mendel was an Austrian monk and scientist who first worked on heredity experiments and gave theory in 1866 but people of that time couldn't understand him and rejected his theory.
- ⇨ Later in 1900 three different scientists from 3 different places also found the same result. They were Hugo deVries, Tschermak and Correns.
- ⇨ They rediscovered the theory of heredity proposed by Mendel. So Mendel is called "Father of genetics".
- ⇨ He made three basic laws of inheritance –
  1. The Law of Dominance
  2. The Law of Segregation
  3. The Law of Independent Assortment.
- ⇨ Some important terms
  1. **Chromosomes** are long thread-like structures present in the nucleus of a cell which contain hereditary information of the cell in the form of genes.
  2. **DNA** is a chemical in the chromosome which carries the traits in a coded form.

3. **Gene** is the part of a chromosome which controls a specific biological function.
4. **Contrasting characters:** A pair of visible charactes such as tall and dwarf, white and violet flowers, round and wrinkled seeds, green and yellow seeds etc.
5. **Trait:** An inherited character/feature, which is normally inherited and has its detectable variant too. Here tall and dwarf are traits of a character, that is height.
6. **Allele:** One of the different forms of a particular gene, occupying the same position on a chromosome.
7. **Dominant trait/allele:** The character which expresses itself in a (Ft) generation is dominant trait. Example: Tallness is a dominant character in pea plant.
8. **Recessive trait/allele:** The character which does not express itself but is present in a generation is recessive trait. Ex. dwarfism in the pea plant.
9. **Homozygous:** A condition in which both the genes of same type are present for example; an organism has both the genes for tallness it is expressed as TT and genes for dwarfness are written as tt.
10. **Heterozygous:** A condition in which both the genes are of different types for example; an organism has genes Tt it means it has a gene for tallness and the other for dwarfness only tall character is expressed.
11. **Genotype:** It is genetic makeup of an individual for example; A pure tall plant is expressed as TT and hybrid tall as Tt.
12. **Phenotype:** It is external appearance of the organism for example; a plant having Tt composition will appear tall although it has gene for dwarfness.
13. Homologous pair of characters are those in which one member is contributed by the father and the other member by the mother and both have genes for the same character at the same position.

⇨ Experiment Conducted by Mendel.

⇨ G. Mendel worked out the main rules foe inheritance. He worked on number of contrasting characters, which are tabulated below…….

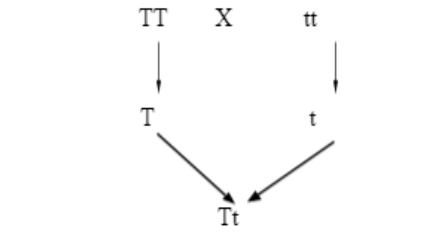
PEA PLANTS IN MENDEL EXPERIMENT

Seed shape	Seed colour	Pod shape	Pod colour	Flower colour	Flower location	Plant size
Round 	Yellow 	Inflated 	Green 	Purple 	Axial 	Tall 
Wrinkled 	Green 	Constricted 	Yellow 	White 	Terminal 	Dwarf 

- Mendel started his experiment on the pea plants. He conducted first monohybrid and then dihybrid crosses.

1. Monohybrid

- When only one character is considered while crossing two organisms, then such a cross is known as a monohybrid cross.
- The ratio of characters arising out of this cross at F2 generation is called the monohybrid ratio.
- E.g., If a tall plant (TT) is crossed with a dwarf plant (tt), we get 3 tall:1 short plant at the end of the F2 generation.
- So, 3:1 is a monohybrid ratio.
- Here, the height of the plant is considered at a time.



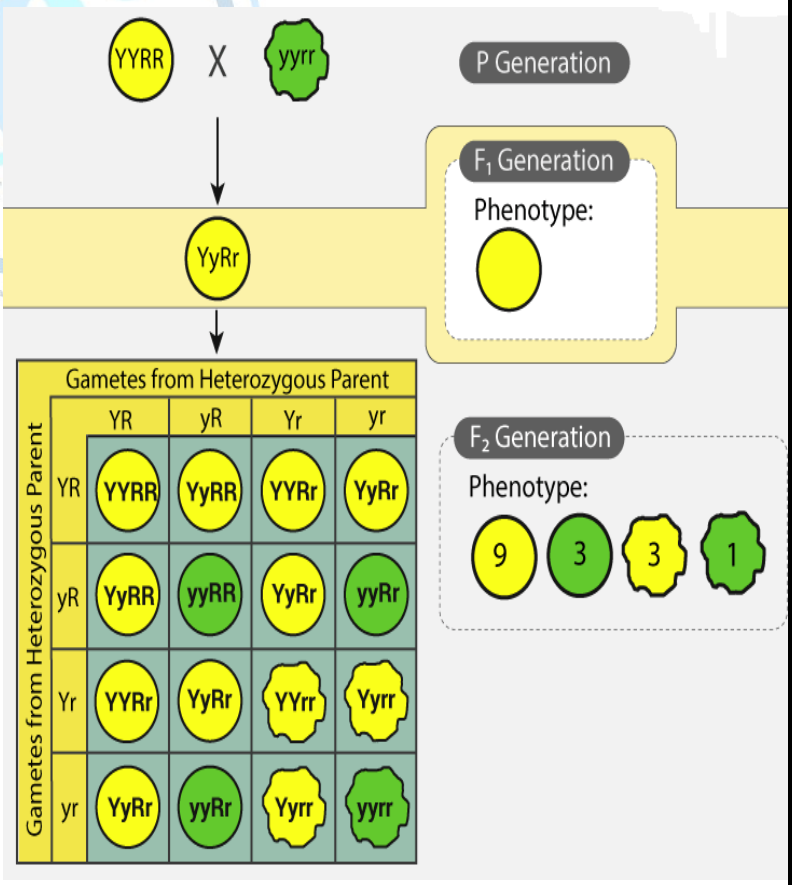
	T	t
T	TT	Tt
t	Tt	tt

Phenotypic ratio: Tall: Short= 3:1

Genotypic Ratio: TT:Tt:tt= 1:2:1

2. Dihybrid cross

- When two characters are considered while crossing two organisms, then such a cross is known as a dihybrid cross.
- The ratio of characters arising out of this cross at F2 generation is called the dihybrid ratio.
- E.g., If a plant with round and green pea is crossed with a plant with wrinkled and yellow pea.
- The first-generation plants would all have round and green peas.
- On crossing the same for an F2 generation, we would observe four combinations of characters in the ratio of 9:3:3:1.



⇨ Thus, 9:3:3:1 is the dihybrid ratio.

⇨Inheritance

⇨ In Biology, inheritance pertains to the transfer of traits from one generation to another.

⇨ **Laws of Inheritance**

1. **Law of dominance :** In crossing between organisms purely for contrasting characters of a pair, only one character of the pair appears in the F1 generation. This character is termed as dominant while the one which does not express itself in F1 generation is termed as recessive.
2. **Law of segregation :** Different alleles or genes of a character remain together in an individual and segregate randomly at the time of gamete formation. This is also known as the Law of purity of gametes.
3. **Law of independent assortment :** This law states that when individuals differing in two or more than two pairs of contrasting characters are crossed, the inheritance of any one pair is not affected by the presence of the other. e.g., The inheritance of seed shape character is not related to the seed color character. Rather, the two characters inherit independently of each other.

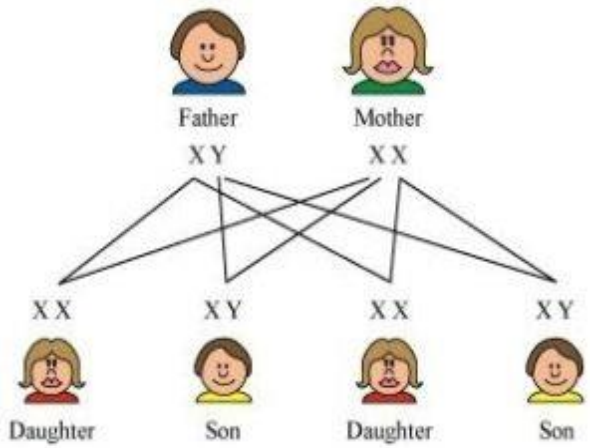
⇨Sex Determination

⇨ In sexually reproducing species, determining the sex of offspring can vary between species.

⇨ In humans, sex is determined genetically by specific sex chromosomes.

⇨ When offspring are conceived, the mother always contributes an X chromosome, while the father can contribute either an X or a Y chromosome.

⇨ If the child inherits an X chromosome from the father, the child will be female; if the child inherits a Y chromosome, the child will be male.



⇨ In other species, environmental factors such as temperature can determine the sex of offspring, as in certain reptiles.

⇨ Additionally, some species, like snails, can change their sex based on environmental conditions, demonstrating that sex determination mechanisms vary widely in nature.