

01 : GENETIC BASIS OF INHERITANCE

HSC WT : 8 Mk

- Heredity : The transmission of characters from one generation to the next generation or from parents to their offspring is called heredity.
- Variations : The differences which occur between parents & the offsprings are called variations.
- Genetics : A branch of biology which deals with the study of heredity & variation.
The term 'Genetics' was coined by 'William Bateson' in 1906.
- Mendelism : Mendel's laws of inheritance & epoch making work is known as Mendelism.
- clones : Organisms produced by asexual reproduction or plants produced by vegetative reproduction, which are identical to their parents are called clones.
- offsprings : Organisms that are produced by sexual reproduction are called offsprings. They are not identical to their parents.
- Factors : According to Mendel, the characters are transmitted from one generation to the other through particles called factors.

- selection of material for experimentation :-

Mendel selected garden pea (*Pisum sativum*) for his experiments.

- Three steps of Mendel's experiment ;

1) selection of parents & obtaining pure lines.

2) Artificial cross of the selected parents to produce F_1 generation.

3) selfing of F_1 hybrids to raise F_2 generation

- Eemasculat'ion :

The removal of stamens from a flower before the formation of pollen grains i.e. anthesis.

- F_1 generation : The offspring obtained in the first generation of a cross between two homozygous individuals having contrasting characters is called F_1 / first filial generation.

- F_2 generation : The offspring obtained in the second generation by self fertilization of any two individuals of F_1 generation is called F_2 generation.

- Monohybrid cross : A cross that involves any one pair of contrasting character is called a monohybrid cross.

- Monohybrid ratio : A phenotypic ratio of 3:1 obtained in the F_2 generation of a monohybrid cross is called monohybrid ratio.

- Dihybrid cross : A cross that involves two pairs of contrasting characters is called a dihybrid cross.
- Dihybrid ratio : A phenotypic ratio $9:3:3:1$ obtained in the F_2 generation of a dihybrid cross is called dihybrid ratio.
- Alleles (Allelomorphs) :
Two or more forms of gene are called alleles.
out of the two forms of gene one is dominant & the other is recessive.
- Dominant : It is an allele that express its trait even in the presence of an alternative allele.
- Recessive : It is an allele which is not expressed in the presence of an alternative allele.
- phenotype : The external appearance of an organism produced for any trait is called phenotype.
- Genotype : Genotype refers to the genetic constitution of an organism.
- Traits : An inherited character & its detectable variant.
eg. Tall & Dwarf.
- Homozygous : An organism having similar alleles for any one gene is called Homozygous. i.e. TT , tt .

- Heterozygous : An organism having dissimilar alleles for any one gene is called heterozygous. i.e. Tt
- It is heterozygous individual produced from any cross involving pure parents having one or more contrasting traits
- Mende's law of Inheritance :
 - 1) law of dominance :-

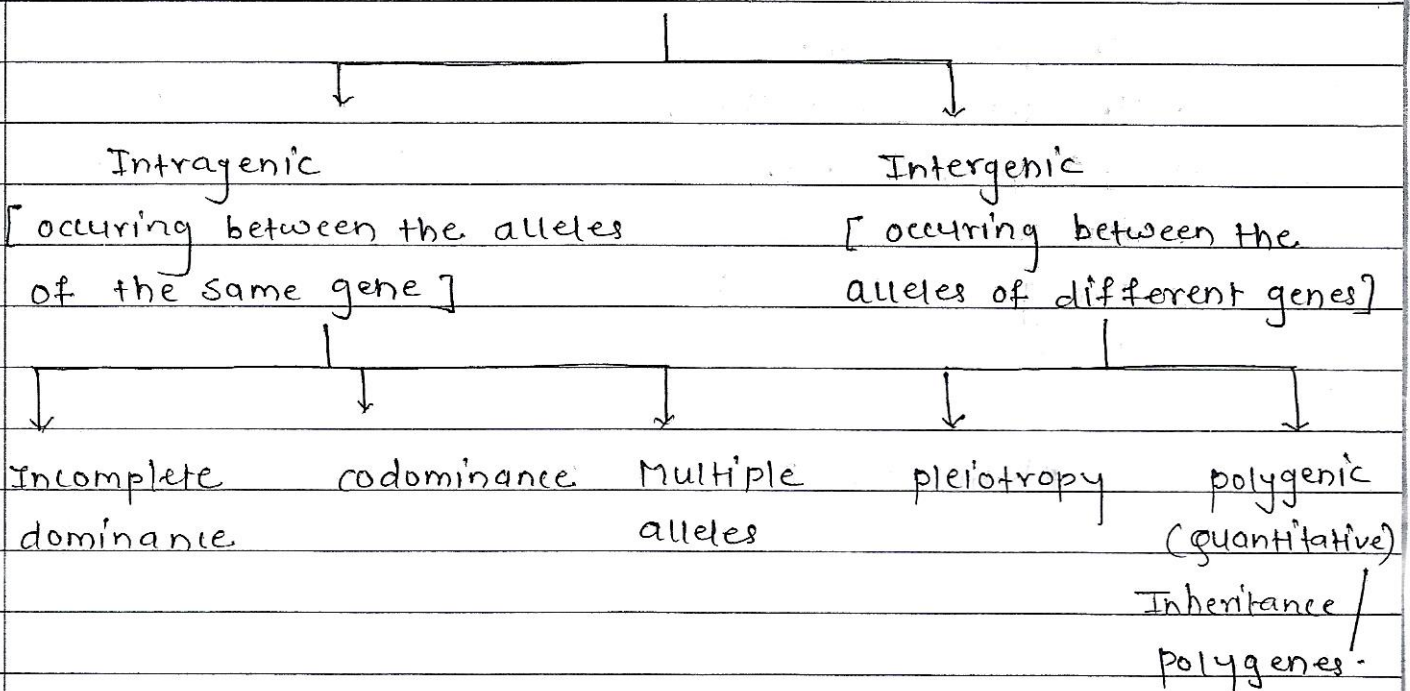
The law of dominance states that out of the contrasting characters of a pair in a cross the character which expresses itself in F_1 generation is called a dominant character & the character which is suppressed is called a recessive character.
 - 2) law of segregation : / law of purity of gametes.

The law of segregation states that when a pair of contrasting characters occur together in a hybrid, they remain together without mixing with each other & segregate during the formation of gametes.
 - 3) Law of Independent assortment :-

The law of independent assortment states that when two parents differing from each other in two or more than two pairs of contrasting characters are crossed then the inheritance of one pair of characters is independent of the other pair of characters.

- Homologous chromosomes :- structurally similar chromosomes present in a diploid cell are called homologous chromosomes.
- Test cross : A cross between the F_1 offspring & its homozygous recessive parent is called test cross.
- Back cross : A cross between an F_1 offspring with any of its parents (Dominant / Recessive) is called a back cross.

Gene interactions.



- Incomplete dominance :-

When both the genes of an allelomorphic pair express themselves partially the dominance is called incomplete.

In case of Incomplete dominance, there is an intermediate expression in F_1 hybrids. i.e. hybrid individuals are more or less intermediate between the parents.

- Codominance :

When both the genes of an allelomorphic pair express themselves equally in F_1 hybrids, the dominance is called codominance.

- Multiple alleles :-

→ When more than two alleles of a gene occupy the same locus on a chromosome, then such alleles are called multiple alleles. eg: Wing series in *Drosophila* & ABO blood groups in human beings.

→ Blood group inheritance is due to multiple alleles.

→ The gene I controls the ABO blood groups.

→ The gene I has three alleles I^A , I^B & I^i

→ I^A & I^B are codominant & are completely dominant over i .

→ The genotypes & phenotypes of blood groups are as follows :

phenotype (Blood group)

Genotype.

A

$I^A I^A$ or $I^A i$

B

$I^B I^B$ or $I^B i$

AB

$I^A I^B$

O

ii

- pleiotropy :

When a single gene controls two or more than two traits, it is called a pleiotropic gene & the phenomenon is known as pleiotropism / pleiotropy.

eg. sickle cell anaemia.

- Lethal gene :

A gene which causes death of the bearer is called lethal gene.

- polygenic inheritance / polygenes / multiple factors :-

When characters are determined by two or more pairs of genes having additive / cumulative effect, they are called polygenes / multiple factors.

eg : 1) inheritance of wheat kernel colour
2) human skin colour.

- Davenport & Davenport studied the inheritance of skin colour in Negroes & albinos.

- A person having one white parent and one negro parent is called mulatto.

- A dark skinned person of Africa is known as negro.

- A white skinned person is called Albino / Caucasian.