Mendel's Laws of Inheritance:-

- Gregor Mendel, conducted hybridisation experiments on garden peas for seven years (1856-1863) and proposed the laws of inheritance in living organisms.
- During Mendel's investigations into inheritance pattern it was for the first time that statistical analysis and mathematical logic were applied to problems in biology.
- AIR Mendel's experiment had a large sampling size, which gave greater credibility to the data that he collected
- Mendel investigated characters in the garden pea plant that were manifested as two opposing traits eg. tall or dwarf plants, yellow or green seeds.
- Mendel conducted such artificial pollination or cross pollination experiments using several true-breeding pea lines.
- Mendel selected 14 true-breeding pea plant va-

rities, as pairs which were similar except for one character with contrasting traits.

- contrasting traits studied by Mendel in pea

Characters	Dominant trait	Recessive trait
Flower position	Axial	terminal
Flower color	Violet	white
Pod shape	Full (Inflated)	constricted
Pod color	Green	Yellow
Seed shape	Round	wrinkled
seed color	Yellow	Green
stem height	Tall	Dwarf

INHERITANCE OF ONE GENE :-

explain in detail.

- Based on his observation on monohybrid crosses Mendel proposed two general rules to consolidate his understanding of inheritance in monohybrid crosses. Today these rules are called the Principles or Laws of inheritance :

(i) First Law or Law of dominance

(ii) Second Law or Law of Segregation

(i) Law of Dominance :-

(a) characters are controlled by discrete units called factors.

(b) factors occur in pairs

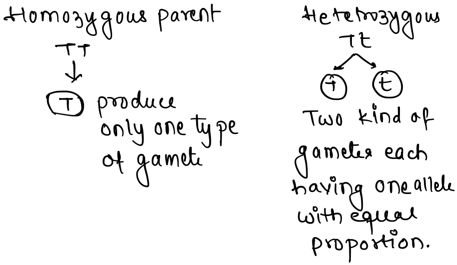
(c) In a dissimilar pair of factors one member of the pair dominates (dominant) the other (recessive)

The law of dominance is used to explain the expression of only one of the parental characters in a monohybrid cross in the F_1 and the expression of both in the F_2. It also explains the proportion of 3:1 obtained at the F_2.

(ii) Law of segregation :-

- This law is based on the fact that the alleles do not show any blending and that both the characters are recovered as such in the F_2-generation though one of these is not seen at the F_1 stage.

- Though the parents contain two alleles during gamete formation, the factors or alleles of a pair segregate from each other such that a gamete receives only one of the two factors.


Homozygous parent
TT
T
produce only one type of gamete
Heterozygous
Tt
T
t
Two kind of gametes each having one allele with equal proportion.

Dihybrid cross
↓
In detail

(iii) Law of independent assortment :- It is based on obeservation of dihybrid cross. The law states that 'when two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters'.

Exception to Mendelian Genetics

(Interallelic or Intragenic interaction)

(1) Incomplete Dominance :-

- Incomplete dominance is the phenomenon where none of the two alleles of a gene is dominant over each other so that when both of them are present together, a new phenotype is formed which is some what intermediate between the independent expression of the two alleles.

- It was discovered by Carl correns in 1903.
- In this case f_1- has a phenotype that doesnot resemble either of the two parents and was in between the two.

Example :- Flower color in Dog flower (snapdragon or Antirrhinum sp.) and Flower color in Mirabilis jalapa (four o'clock)

explain cross

Explanation of the concept of dominance :-

- Every gene contains the information to express a partiular trait.
- In a diploid organism, there are two copies of each gene, i.e., as a pair of alleles. Now, these two alleles need not always be identical, as in heterozygote. one of them may be different due to some changes that it has undergone which modifies the information that particular allele contains.
- Let's take an example of a gene that contains the information for producing an enzyme.

Now there are two copies of this gene, the two allelic forms

Normal allele → It produces the normal enzyme that is needed for the transformation of a substrate 'S'

Modified allele :- Theoretically it could be responsible for production of -

(i) the normal / less efficient enzyme

(ii) a non-functional enzyme

(iii) no enzyme at all.

In first case → modified allele is equivalent to the unmodified allele i.e. it will produce the same phenotype / trait i.e. result in the transformation of substrate 'S'. Such equivalent allele pairs are very common.

In (ii) & (iii) case, the phenotype may be effected. The phenotype / trait only be dependent on the functioning of unmodified allele. The unmodified (functioning allele), which represents the original phenotype is the dominant allele and the modified allele is generally recessive allele. Hence in the example above the recessive trait is seen due to non-functional enzyme or because no enzyme is produced.

(2) Codominance :-

- when both the allele of a gene express themselves simultaneously in a heterozygote, this condition is called codominance.
- In case of co-dominance the F_1- generation resembles both parents.

Example :- • Sickel cell Haemoglobin $Hb^A Hb^s$

↓

" Having both type of Haemoglobin "

• Coat colour in cattle

• AB- Blood group.

ABO Blood group :-

ABO Blood groups are controlled by the gene I. the plasma membrane of red blood cells has sugar polymers that protude from its surface and the kind of sugar is controlled by the gene.

Gene I has three allele
- → I^A } → Produce slightly different sugar
- → I^B } → Produce slightly different sugar
- → i → do not produce any sugar

I^A & I^B is dominant over i.

Genotype possible		Blood group	
$I^A I^A$, $I^A i$	→	A	
$I^B I^B$, $I^B i$	→	B	
$I^A I^B$	→	AB	→ RBC have both A & B type of sugar
ii	→	O	
6 Genotype		4 phenotype	