2. In the presence of dominant allel the recessive allel can never express itself.

2. Dihbrid Cross - In dihybrid cross, Mandel deal with two constrasting characters.

(a) Shape of seed -
Dominant - Round Recessive - Wrinkled

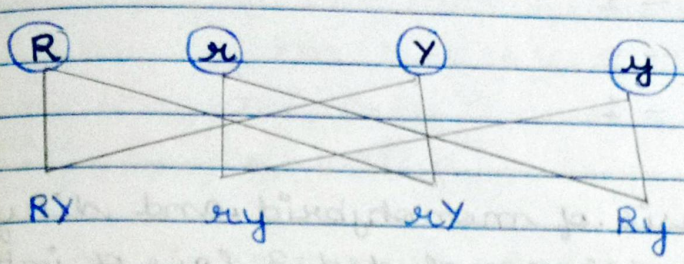
(b) colour of seeds -
Dominant - Yellow Recessive - Green

He took a plant having round and yellow seeds and crossed it with a another plant having wrinkled green seeds. In F_1 generation he found that all plants were Round yellow. On selfing F_1 generation he got F_2 generation. The Genotype and Phenotype of F_1 generation are as follows.

P_1 - Round Yellow × Wrinkled green
RRYY × rryy

gametes - (RY) (ry)

F_1 generation - RrYy
round yellow



F_2 generation

♀ \ ♂	RY	Ry	rY	ry
RY	RRYY Round, yellow	RRYy Round yellow	RrYY Round yellow	RrYy Round, yellow
Ry	RRYy Round yellow	RRyy Round green	RrYy Round yellow	Rryy Round green
rY	RrYY Round yellow	RrYy Round yellow	rrYY Wrinkled yellow	rrYy wrinkled yellow
ry	RrYy Round yellow	Rryy Round green	rrYy wrinked yellow	rryy wrinked green

Phenotype

Round yellow : Round green : Wrinkled green : Wrinkled yellow

9 : 3 : 1 : 3

genotype

RRYY — 1
RRYy — 2
RrYY — 2
RrYy — 4

RRyy – 1
Rryy – 2
rrYY – 1
rrYy – 2
rryy – 1

⊙ On the basis of monohybrid and dihybrid cross mendal concluded 3 law of inheritance.

1. Law of Dominance
2. Law of seperation (seggrugation) / Laws of Purity of gametes.
3. Laws of independent assortment

1) LAW OF DOMINANCE :—

This law states that when 2 alternative forms of a characters are present in an organism only one character or trait which express itself in F_1 generation. It inhibits the expressions of another character. It is known as dominant while other charater that remain inhibited is known as Recessive. Ex- Monohybrid cross (till F_1 generation)

2) LAW OF SEGGREGATION / LAW OF PURITY OF GAMETES :—

This laws states that the factor / allel of

a gene pair segregate or separate from each other at the time of gamete formation so that each gamete recieves only one of the two alleles. They do not show any mixing. Ex - Monohybrid cross [Till F_1 generation]

3) LAW OF INDEPENDENT ASSORTMENT (INHERIT)/ SEPARATION OF TRAITS :-

According to this law when two contrasting characters are taken simultaneously in a cross both the characters express themselves in F_1 generation they do not affect the inheritance of each other.
Ex - Dihybrid cross

Example of the Mandal's law

(i) Law of Dominance

In monohybrid cross

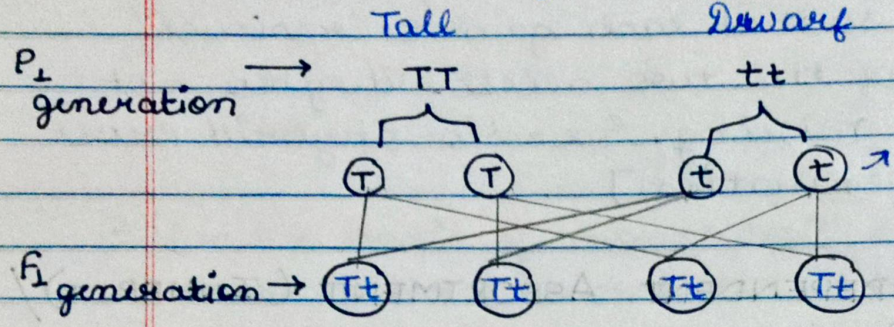
TT (Tall) × tt (Dwarf)

♀ →	t	t
T	Tt (Tall)	Tt (Tall)
T	Tt (Tall)	Tt (Tall)

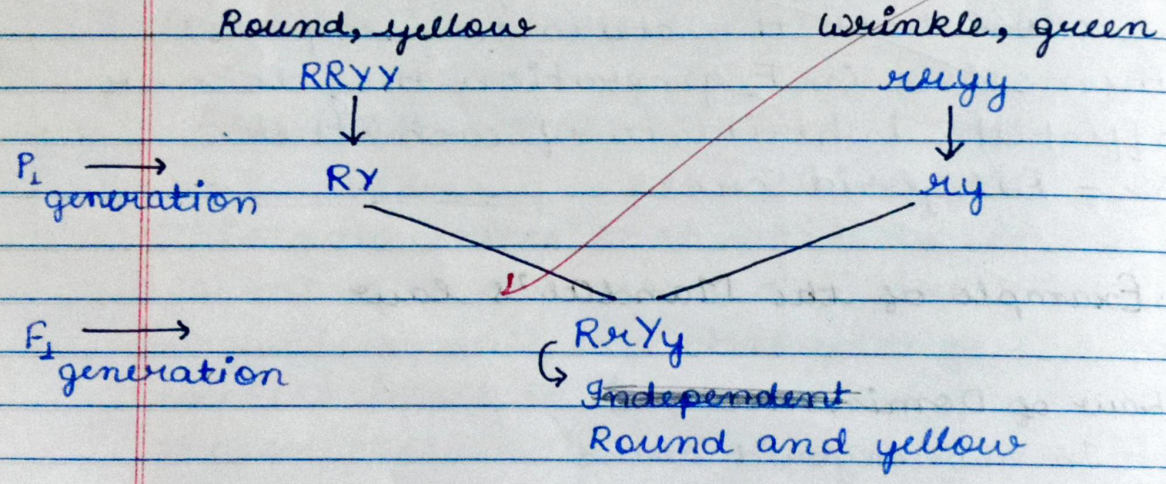
→ Thus, all are tall, and it proves the law of Dominance.

(ii) Law of Segregation

The monohybrid cross,



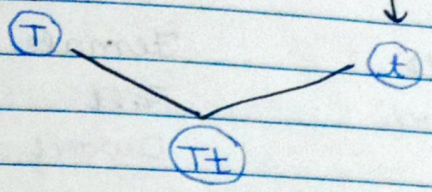
(iii) Law of Independent assortment



Back Cross ...

When a cross is made between parent and its progeny it is called a Back Cross. This cross of F_1 progeny with either of 2 ~~part~~ parents.

$P_1 \rightarrow$ Tall (TT) × Dwarf (tt) (Homozygous recessive)



Test cross

Tt × TT

♂ / ♀	T	T
T	TT (Tall)	TT (Tall)
t	Tt (Tall)	Tt (Tall)

Tt × tt

♂ / ♀	T	t
t	Tt (Tall)	tt (Dwarf)
t	Tt (Tall)	tt (Dwarf)

Phenotype : 100% tall

Tall : Dwarf
2 : 2

Genotype : TT : Tt
2 : 2
1 : 1

Tt : tt
2 : 2
1 : 1

Test Cross [Type of Back cross]

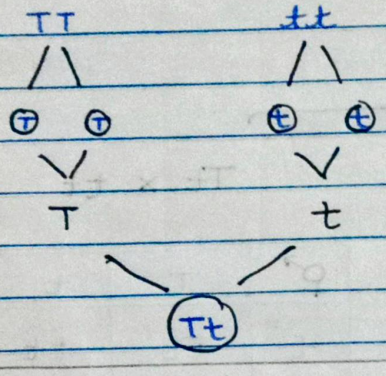
When a cross is made between F_1 generation and homozygous recessive parents. It is known as Test cross. It is used to determine the homozygous or heterozygous nature of F_1 progeny.

Reciprocal Cross

changes the parent (P_1 to P_2) (P_2 to P_1) parent.

Female × male

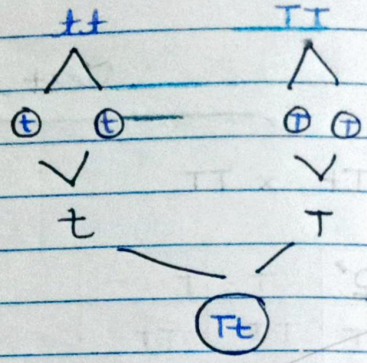
Tall × dwarf



Female × male

~~Tall~~

Dwarf × tall



- Multiple alleles are three or more alternative forms of a gene that can occupy the same locus but only two of the alleles can be present in a single organism. For example, the ABO system of blood groups is controlled by three alleles, I^A, I^B and i only, two of which are present in an individual.

- Back Cross is a cross which is made between a hybrid and one of its parents. In plant breeding, such crosses are performed to improve the variety of crop plants. For example, a crop plant is crossed with a wild variety (all crop plants are originated from wild varieties) in order to obtain its disease resistance.

- Reciprocal cross Involves the same trait but sexes are reversed to those in the original cross.

- Cross between an individual of unknown genotype and recessive parents is called test cross to know that unknown genotype.

- ~~Cross between an indi~~

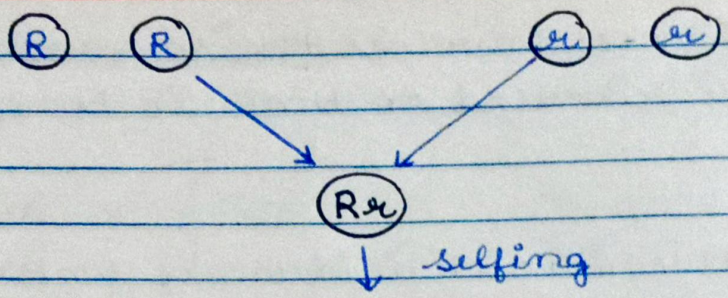
Exception of Law of Dominance ⟶

1) Incomplete Dominance

In Snapdragon or 4'O clock plant (mirabilis Jalapa) exception of law of dominance was found when a plant of snapdragon with red flowers with crossed with another plant of Snapdragon having white flowers. According to law of dominance, in F_1 generation red flowers should have obtained and but instead of red and white colour a new colour was obtained that is all plants of F_1 generation were having pink colour.

In F_2 generation, on selfing of F_1 generation the phenotypic ratio obtained was 1:2:1 instead of 3:1

Red	White
RR	rr
↓	↓



♀	R	r
R	RR (Red)	Rr (Pink)
r	Rr (Pink)	rr (white)

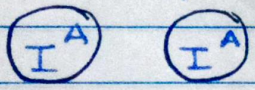
Rhenotype → Red : Pink : white
1 : 2 : 1

genotype → RR : Rr : rr
1 : 2 : 1

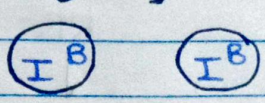
Co-dominance / Inheritance of blood group

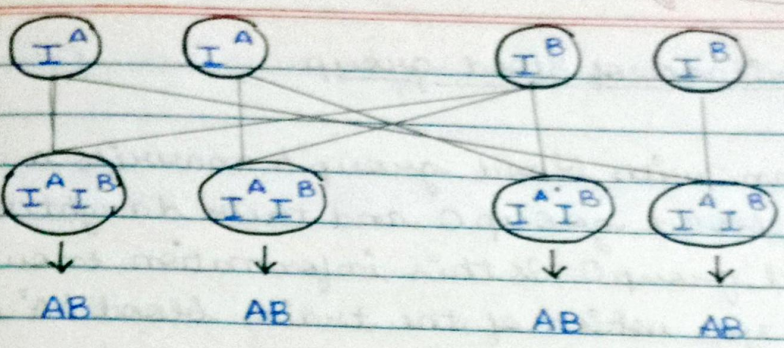
Blood group	genotype
A	I^AI^A, I^AI^O / I^A, i
B	I^BI^B, I^BI^O / I^B, i
AB	I^AI^B
O	$I^O.I^O$ / ii

Blood group A
I^AI^A



Blood group B
I^BI^B





When an individual having blood group A (I^AI^A) is crossed with another individual having blood group B (I^BI^B). In F_1 generation, according to law of dominance, A Blood group should have expressed, But instead of all progeny of F_1 generation were having AB blood group (I^AI^B).

This showed that Dominat character was not completely dominant and recessive character was not completely recessive and in F_1 generation both Dominant and recessive characters were espressed.

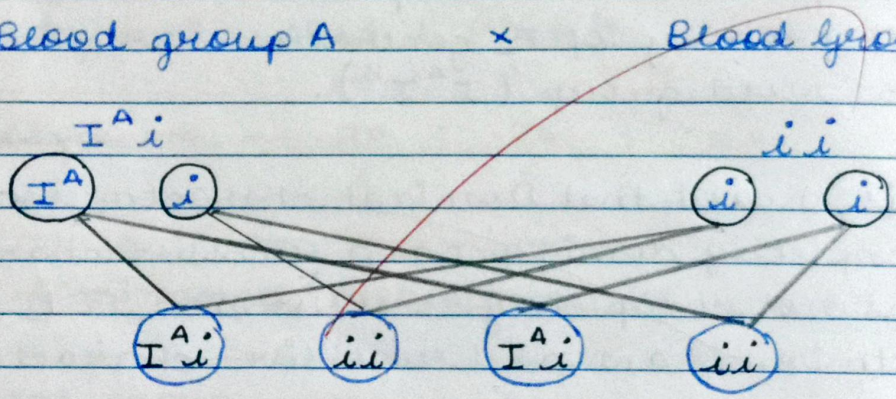
- Blood group AB is universal recipient.
- Blood group O is universal donar as there is no antigen.
- ABO blood group discovered by Landsteiner (1901)
- I : Isoagglutogen [an antigen that on the membrane of RBC's]

⊙ Inheritance of Blood group

→ A man with blood group A marries a women with blood group O and their daughter has blood group O. Is this information enough to tell you which of the traits blood 'A' or 'O' is dominant why or why not?

Man (A) — I^AI^A / I^Ai

Women (O) — ii



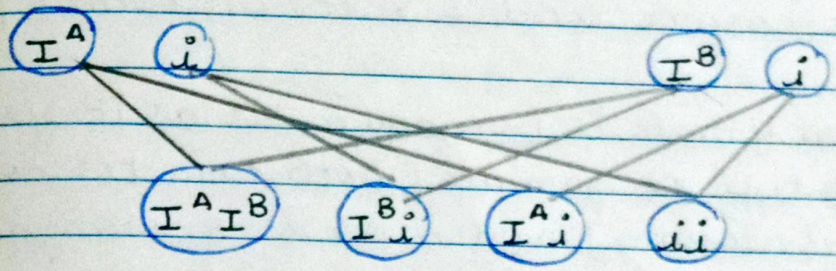
Yes, Blood group A is dominant over blood group O. If a man with blood group A (I^Ai) marries a women with blood group O (i,i) then the man will produce only produce 1 copy of A blood group and 1 copy of O blood group.

→ A man having blood group A marries a women with blood group B the probability of blood group of their four children is that they are having all types of blood groups.

Identify the grouptype of parent.

man (A) — $I^A i$
Women (B) — $I^B i$

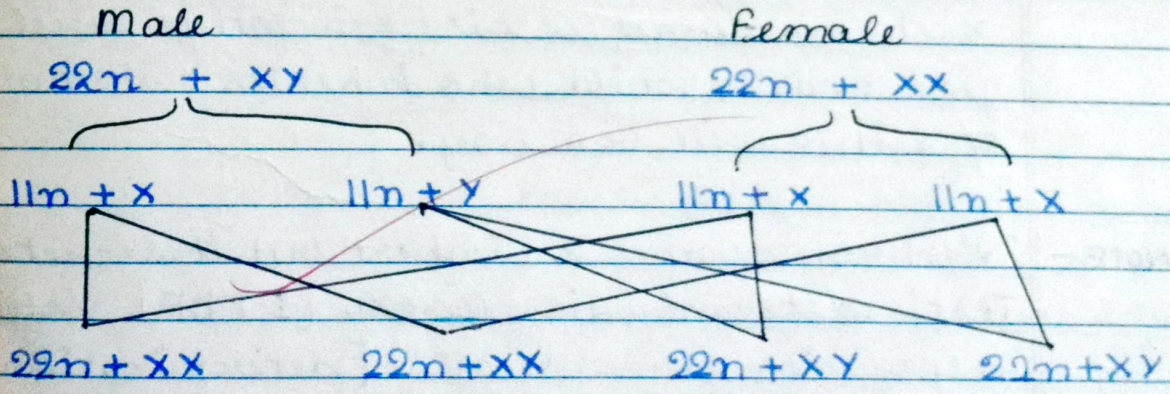
Blood group A × Blood group B
$I^A i$ $I^B i$



AB B A O

SEX DETERMINATION in Human Beings

male → XY
Female — XX



50% Female
50% male

Human beings have 23 pairs of chromosomes out of 22 pairs are somatic chromosomes and they are known as Autosomes whether 23rd pair is responsible for Sex determination and known as Sex chromosomes or Allosomes. The Sex chromosomes in femal are 2 'x' chromosomes [XX] and in male are 1 'x' chromosome and 1 'Y' chromosome [XY].

Human female is homogamatic as it forms same type of gamete [both gametes contains x chromosome] and male is known as heterogamatic as it produce 2 type of gametes 1 contains x chromosome and another 'Y' chromosome.

During sex determination half of the children will be males and half will be females because a children inherit 'x' chromosome from their mother, the child who inherit x chromosomes of his/her father will be a girl and the child who inherits Y chromosomes of father will be a boy.

NOTE - 'Y' chromosomes is inhert but it secretes Testis determination factor [TDF] which is responsible for maleness [determination of testis].

NOTE - Different organism use different strategies for sex determination which may be

chromosomal, environmental or temperature. Even some animals like snails can change sex. Eg - Turtle.

How do Traits get Expressed ?

As we know that the smallest functional unit of chromosomes is a gene which carry a genetic Information for the formation of a specific character. The expression of these characters is carried out with the help of formation of some specific proteins are responsible for expression of characters.

If a gene works efficiently the amount of synthesised protein will be more and the character will be expressed more efficiently and if gene works less efficiently. Then the amount of the protein form will be less and the character will be expressed less efficiently.

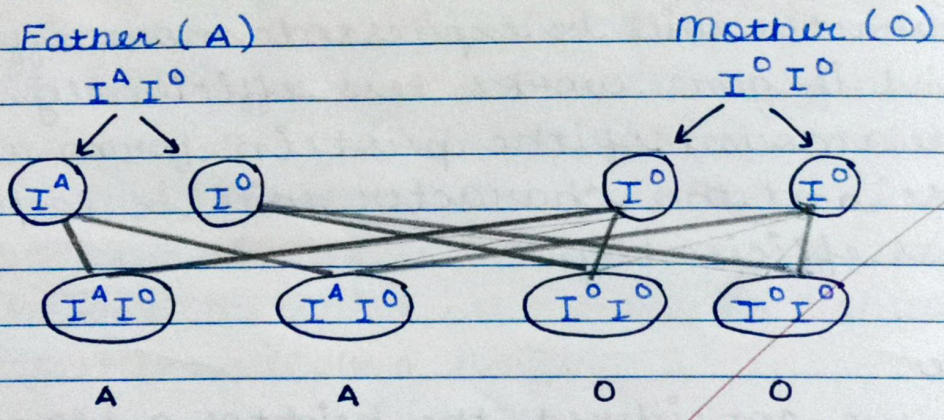
Example

If we considered, the height of a plant as a example we know that plant hormones are responsible for the growth of the plant. If a gene controlling height of a plant works effiently, then the plant hormone will be form in a high amount and the plant will be tall and if the gene works less amount and the plant will be Dwarf.

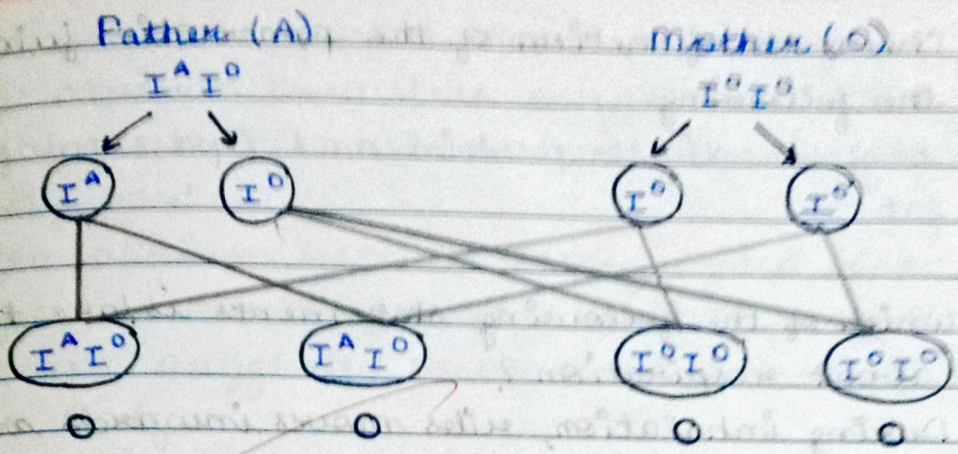
Q. A man with blood group 'A' married a women with blood group 'O' and their daughter has blood group 'O'. Is this information enough to tell you which of the traits blood group 'A' or 'O' is dominant? Why or why not?

The information is insufficient to tell whether the trait 'A' or 'O' is dominant. We can find out by assuming the following cases.

In case I, Let us assume that trait 'A' is dominant. Father may I^AI^A or I^AI^O and mother I^OI^O. In this case, 50% of the progenies will have blood group 'A' and 50% of the progenies will have blood group 'O' when father's blood group is I^AI^O and mother is I^OI^O.



In case II Let us assume that 'O' is dominant. In this case we see that the child may have blood group 'O'



since, in both the assumptions, the child can have blood group 'O', so we cannot infer which trait is dominant.

16/7/21