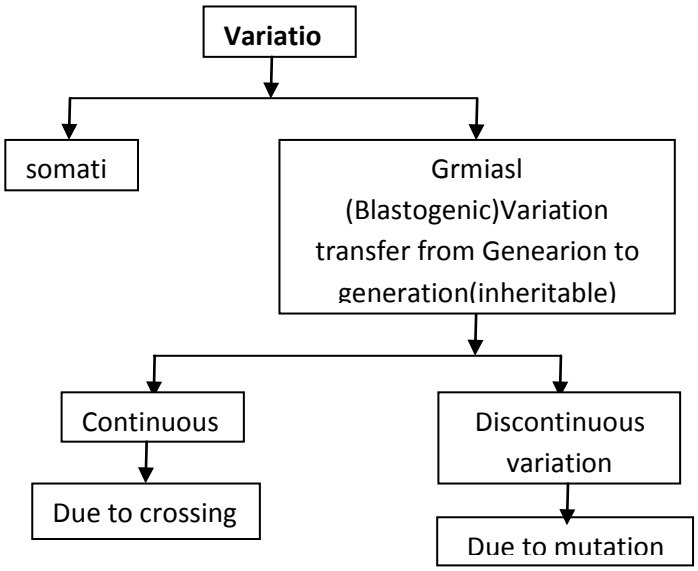
GENETICS

Genetic term was given by bateson.W bateson is father of mdern grnetics.
Gneetics =lCollective strudy of heerdity & variations.
Heredity =Thramission of genetic chareacter from parent to offspring.
Variation=Individual of same specles have some diffecrnce these are called variation



- History of reserches in genetics.
Muller-Propesed the term "Cytogenesis"(Cytology Genetics) Father of ActinobiologyActinobiology study the leffect of radiation on living organisms.
Morgan Father of Exprimental genetics He exprimenten of drosophila & proposed various concepts.
Gene theory –According to fene theoty ; genes are linearly located on chromosome. Linkage therm theory of ses linkage .crossing over term criss –cross inheritance Linkafge map on drosophila given by morgan.

- **A.Garrod=**Father of human genetics & Bichemical gnetics carrod discocverd first human Metabolic genetic disorder which is called alkaptonuria (black urine diseasse) in this desease enayme homogentisic acid to explain the like begets like (offsprings are similar to their parents) sevaeral theories were givan.

1. **Vapour fluid theory.**Greek philosopher pythagoras(500B.C) proposed this theory.
ccording to this theory at the time of coitus of malw and lfemale moist vapour seretes from the brain and due to this offsprings are similar as their parents.

2. **Semen theory -:** This theory has given by Empedocles.
According to his view the semen of male and female is mised during coitus characters of parents appear into the offsprings due to the mixture.According to aristotle a semen of male is considered as 'Highly' furified blood which has power of life and it is nourished by semen of female.

3. **preformation theory** According to thei theory germinal (reproductive)cell contaains a miniature figure of a man
Accroding to swammerdan priformation of a miniature of man is found inside the egg is called minkin those scientists who believed in eh hypothesis of swammerdam are known an ovists. On contraary accrding to Harsoeker preformed miniature of man is present in sperm.

A miniature of man is present in sperm he called **Homunculus**
Scientist who beloved in Hart soeker view are called spermist

4. **Encasenent theory :-**This theory was proposed by **charles Bonnet.**
   According to his view body of female is just like a Chinese box the all future progenies ae pascked in the body of female like chines box.

5. **Epigenesis theory :-** this theory was proposed by **K.Wolf**
   According to his view germinal cells possess an undifferentiated material this material develops step by step (Gradually) after the fertilization .such type development is known as Epigenesis

6. **pangenesis theory :-** The theory of pangenesis was described by **C.Darwin**
   This theory postulated that all part of a living body (Tissues) synthesize micro molecules theses micro molecules are known as **pangene or Gemmules.**
   The male and female pangenes fuse together during the fertilization these are further again distributed in the various organs of the body at the time of development.

7. **Germplasm theory:-** The view was proposed by **A Weisman (1886)**
   According to him living body of an individual possess two different types of fluid material-somtoplasm and Germplasm. Somatoplasm does not participate in the formation of germinal cells therefore variations are not transferred in to the progeny somatoplasm is mortal because eventually lit dies.

8. **MENDELISM** Experiments performed by Mendel on genetics and description of mechanisms of hereditary processes and formulation of principles are known as mendelism.mendel postulated various experimental laws in relation of genetics

   Gregor Johann Mendel(1822-1884) :-mendel was born on july 22,1822 at Heinzendorf in Austria at in 1856-57 he started his historical experiments of heredity on pea (pisum sativum) plant .His exprimental work continued on pea plant till 1865 (19^{th} century)
   The results of this experiments were published in the science journal "Nature for schender varein" in 1866
   This journal was in germen language title was "**Verschue uber plangent Hybridan"**
   This journal was published by **Natural History society of Bruno"**
   A paper of Mendel by the name of Experiment in plant Hybridization" published in this journal .
   Mendel was unable to get any popularity No one understood of him he died in 1884 without getting any credit of his work (due to kidney disease)(Bright disease) After 16 years of Mendel death in 1900 mendel postulates were rediscovered. Rediscovery by three scientists independently

1. **Carl Correns** –Germany(Experiment on Maize)

2. **Hugo de vries** (Holland) (Experiment on Evening primerose) He republished the Mendel results in 1901 in Flora magazine.

3. **Erich von tschermak seysenegg**-(Austria (Experiment on different flowering plants) the credit of rediscovery of mendelism goes to three scientists.correns gave two laws of mendelism
   Low of heredity/Inheritance/mendelism
   I^{st} Law –Law of segregation.
   2^{nd} Law-Law of independent assortment.
   Mendel experiments remain Hidden for 34 years.

Mnedel results remain hidden due to :
1. At that time darwin's book origin of species published scientists were busy in discussion with this book
2. Mendel's idseas were ahead of that time.

3. Mendel used higher statistical calculation in his experiments so the results were complicated to understand.
4. Mendel also performed his experiment on Heiracium plant on suggestion of karl lNageli but Mendel did not get succeed because in Heioacium parthenogenesis is present.

Reassons for lmendel's success:

1. Mendel studied the inheretace of noe or two characters at a time unlike his predecessors who had considered many characters at a time (Kolreuter-Tobacco plant John Goss &Kinght pea plant)

2. Selection of material-
Selection of garden pea plant is suitable for studies which have the following advantages:

(i) pea plant is annual plant with short life cycle of 2-3 month so large no of offspring can be analysed within a short period of time.

(ii) It ha many contrasting traits.

(iii) Natural self pollination is present in pea plant .

(iv) Cross pollination can be performed in it artificially so hybridization can be made possible.

(v) pea plant easy to cultivate.

(vi) pea seeds are large in addition to pea Mendel worked on rajama.

3. Mendel quantitatively analyze the inheritance of qualitative characters.

4. He maintained the statistical records of all the experiment .

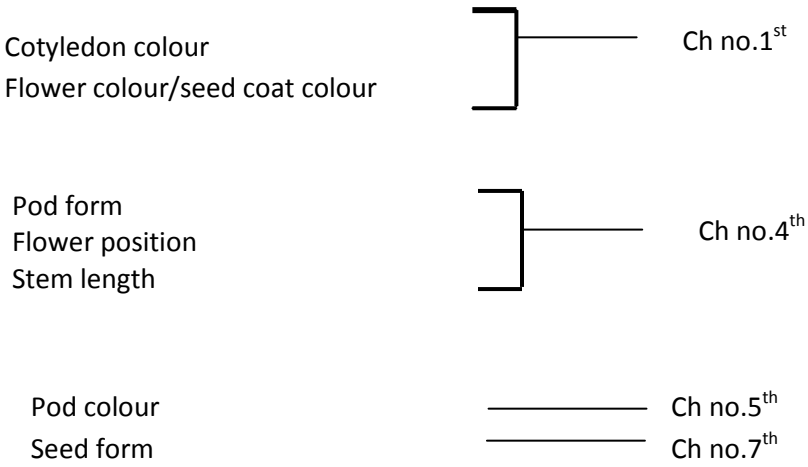
Mendel's work: Mendel studied 7 characters or 7pairs of contrasting traits.

Actual data obtained by Mendel in F_2 progenies in garden pea				
SNo	**Character**	**Dominant**	**Recessive**	**Ratio**
1	Length of plant	787(tall)	277(dwarf)	2.84:1
2	Flower position	651(axial)	207(terminal)	3.14:1
3	Shape of pod	882(inflated)	299(constricted)	2.91:1
4	Colour of pod	428(green)	152(Yellow)	2.82:1
5	Shape of seed	5,474(round)	1.850(wrinkled)	2.96:1
6	Colour of colytedon	6,022(yellow)	2,001(green)	3.01:1
7	Colour of flower	705(violet)	224(white)	3.15:1
Average of all traits studied				2.98:(=3:1)

- In pea plant sead coat colour and Flower colour are regulated by same gene.
  Gene which controls more than on character is called ad **pleiotropic gene**
- Mendel obtained wrinkled seeds due to absence of **starch Branching eazyme(SBE)**
  In wrinkled seed free sugar is more in place of starch.

Special point:

S Blixt concluded that the genes studied by Mendel are located on four different pairs of chromosomes.



Two of the genes are on chromosome 1st and three are on chromosome 4 genes are located for apart on the chromosome except genes controlling plant height and pod shape so0 mendel did not detect linkage.

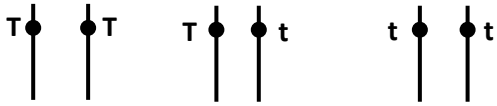
Technique of Mendel

He developed a technique **Emasculation and bagging** for hybridization in plant.
Flowers of pea plant are bisexual in this method one considered as male and another as female.
The plant used as female stamens of this plant are removed at juvenile stage this is called Emasculation Emasculation is done to prevent self pollination.
Emasculated flowers covered by bage this is called begging.
Begging is only used to prevent undesirable cross pollination.
Mature pollen grains are collected from male plants and spread over emasculated flower.
Seeds are formed in the female flower after pollination
The plant that are obtained from theses seeds are called first fillal generation or f_1 generation accrding to Mendel.
Mendel was great plant breader(True breader)

Some defined terms:

1. **Factor:-**unit of heredity which is responsible for inheritance and appearance of characters. Theses factors were referred as genes by **Johannsen** (1909) Mendel used term "**element"** for factor morgan first used symbol to represent the **factor** .Dominant factor are represented by capital letter while recessive factor by small letter.

2. **Allele :-** Alternative forms of a gene which are located on same position (loci) on the homologous chromosome is called Allele. term allele was coined by **bateson.**



3. **Homozygous :-** A zygote is formed by fusion of two gametes having indeticle factors is called homozygote and organism developed form this zygote is called homozygous. Ex.TT,RR,tt

4. **Heterozygous :-** A zygote is formed by fusion of two different types of gamete carrying different factors is called heterozygote (Tt Rr) and individual from such zygote is called heterozygous. The term homozygous and heterozygous are coined **Batecon**

5 **.Hemizygous:-** If individual contains only ont gene of a pair the n individual said to be Hemizygous male individual is always Hemizygous for sex linked gene

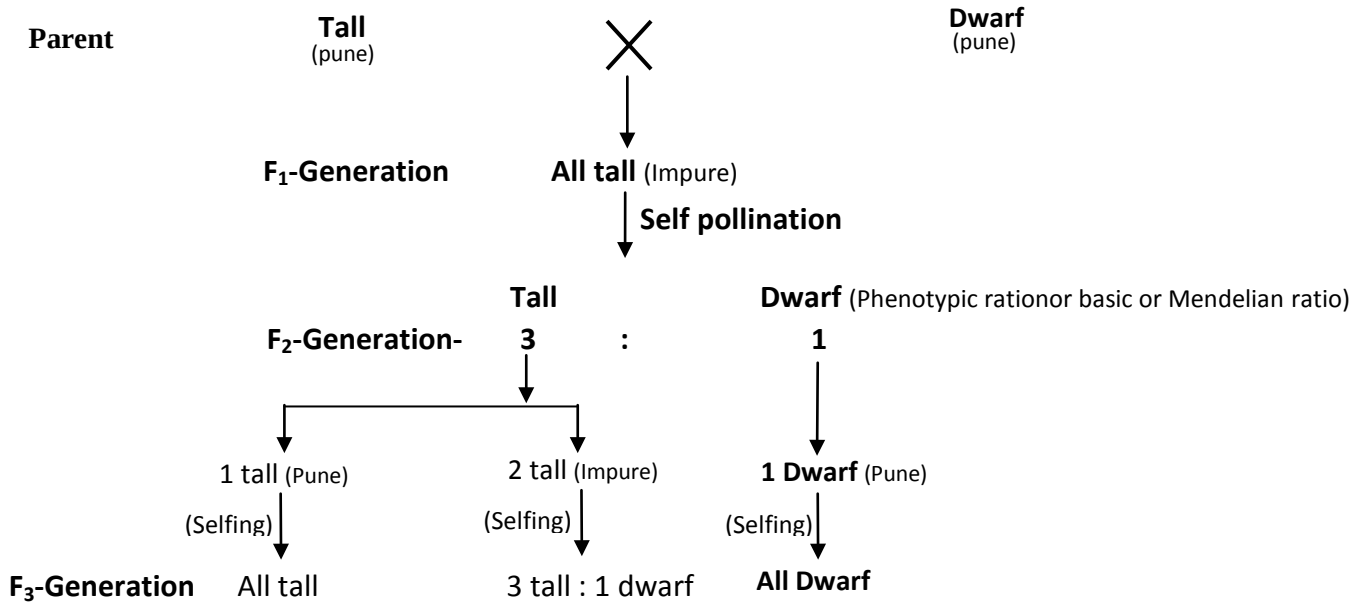
6. **Phenotype:-** It is the external and morphological appearance of an organism for a particular character.

7. **Genotype :-**The genetic constitution or genetic make up of an organism for particular character.Genotype &phenotype terms were coined by **Johannes,**

8:- It different genotypes are placed in different environmental condition then they produce same phenotype .The these genotypes are said to be phenocopy of each other.

MONOHYBRID CROSS

When we consider the inheritance of one character at a time in a cross this is called monohybrid cross. First of all, Mendel selected tall and dwarf plants.



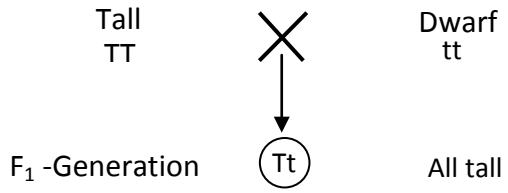
Conclusion (results) of monohybrid cross

I[st] conclusion:

According to Mendel each genetic character is character if c0ontrolled by a pair of unit factor .It is known as know as conclusion of paired factor or unit factor.

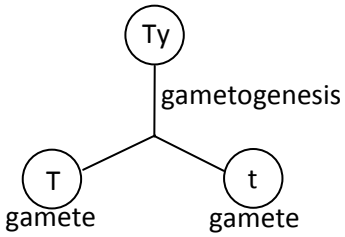
II[nd] conclusion:

This conclusion is based on F_1 generation .When two different unit factor are present in single individual ,only on unit factor is able to express itself and knows as dominant unit factor Another unit factor fail to express is the recessive factor in the presence of dominant unit factor recessive unit factor can not express and it is known as conclusion of dominance.



III[nd] conclusion:

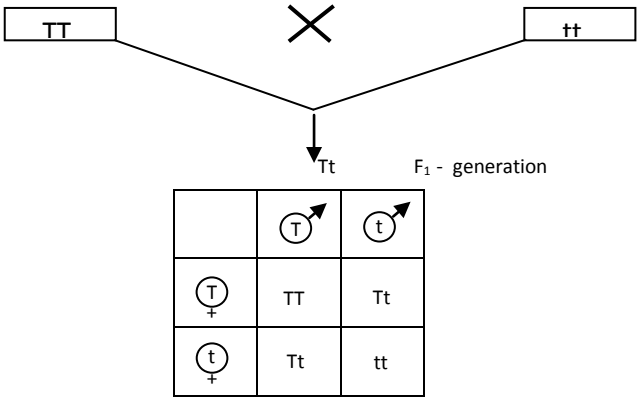
During gamete formation ; the unit factors of pair segregate randomly and transfer inside different gamete. Each gamete receives only one factor of a pair so gametes are pure for a particular trait it is known as conclusion of purity of gametes or segregation.



Checker Board method:

First time it was used by **Reginald C punnett** (1875-1967)

The representation of generations to analyze in the form of symbols of squares male gamets lie horizontally and female gemetes lie vertically



T T=tall (dominant homozygous)
T t=Tall(dominant heterozygous)
Tt= Dwarf(recessive homozygous)
The ratio of characters (traits)appear/visible morphologically is phenotypic ration it is 3:1 Genbetic constitution is called Genotype (using symbols for genes) it lis 1:2:1

Fork line method

To find out the composition of factors inside the gamete we use fork line method

AaBb=4type of gamete

A
- B - AB = 1 =25%
- B - Ab = 1 =25%
- B - aB = 1 =25%

Type of gamete /phenotypic category=2^n

N= NO of hybrid character or heterozygous pair

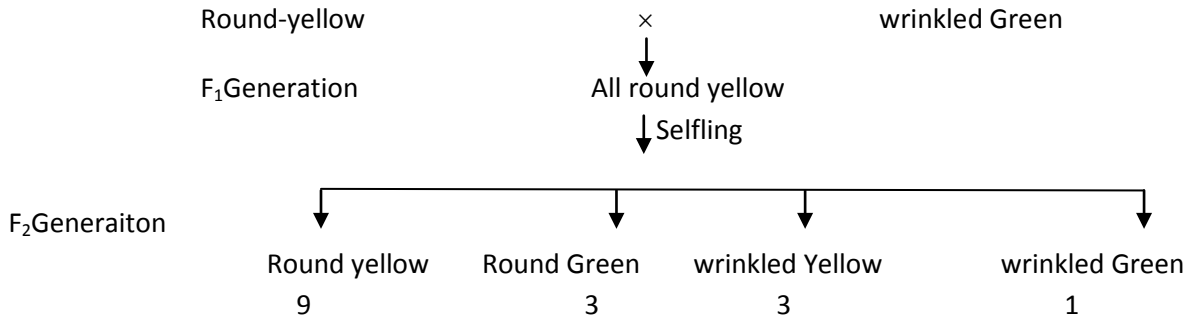
Ype of genotype=3^n

Eg in dihybrid cross =3^2 9 genotype

No of zygote produced by selfing of a genotype=4^N

Dihybrid cross

A cross in which study of inheritances of two pairs of contrasting traits.
Mendel wanted to observe the effect of one pair of heterozygous on other pair
Mendel selected traits for dihybrid cross for his experiment as follows:-
(1)colour of cotyledons $\rightarrow$ Yellow (Y) green (y)
(2)seed form $\rightarrow$ Round (R) and wrinkled (r)
Yellow and round characters are dominant and green and wrinkled are recessive characters.
Mendel crossed,yellow and round seeded plants with green and wrinkled seeded plants.
All the plant in F_1-generation had yellow and round seeds. When F_1plant were self pollinated to produce fou4 kinds of plants in F_2 generation such as yellow round yellow wrinkled green round and green wrinkled there were in the ratio of 9:3:3:1 this ratio is known as dihybrid ratio.



Expression of yellow round (9)and green wrinkled (1) traits shows as their parental combination Green round and yellow wrinkled wrinkled type of plant are produced by the results of new combination

Conclusion:

The F_2 generation plant produce tow new phenotypes so inheritance3 of seed coat colour is independent from the in heritance of shape of seed Otherwise it can not possible to obtain yellow wrinkled and green round type of seeds.

This observation leads to the Mendel conclusion the different type of characters present in plant assorted independently during inheritance This is Known as **Conclusion of independent assortment** it is based on F_2 generation of dihybrid cross The nonhomologous chromosome show random distribution during anaphase I of meiosis

Explaination-

A pure yellow and round seede plant crossed with green and wrinkled seeded plant which are having genotype YYRR and yyrr to produced F_1 generation having Yy Rr genotype

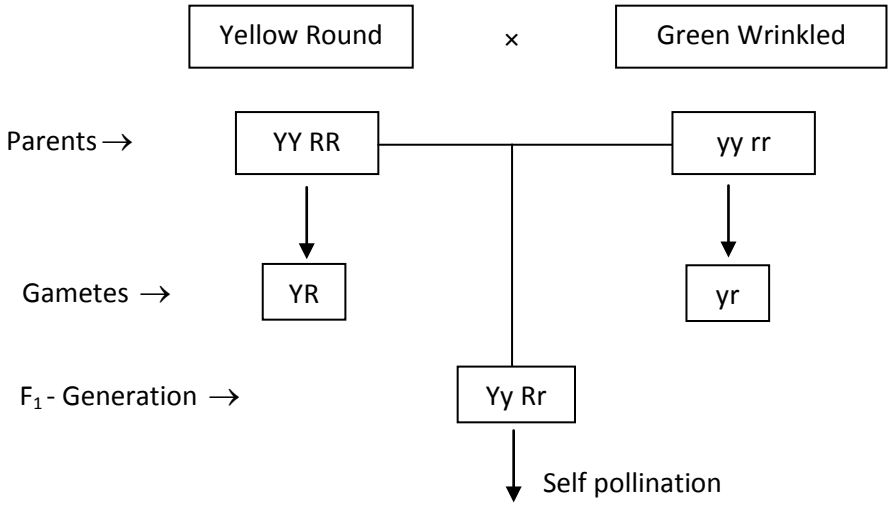
Both the characters recombine independently from each other during gamete formation in F_1generation Factor (R) of pair factor (Rr) is having equal chance to (Y) factor or (y) factor of gametes during recombination to form two type of gametes (YR) and (yr)

Similarly(r) factor also having equal chance with(Y) factor (y) factor of gametes to form a two type gemetes –(Yr)and (yr).

Thus total four types of gametes –(YR),(yR),(Yr) and (yr) are formed.

Therefore during the gametes formation in F_1 generation independent recombination is possible

Demonstration by checker board method:-



F_2 - Generation →

	YR	**Yr**	**yR**	**yr**
YR	YYRR	YYRr	YyRR	YyRr
Yr	YYRr	YYrr	YyRr	Yyrr
yR	YyRR	YyRr	yyRR	yyRr
yr	YyRr	Yyrr	yyRr	yyrr

Phenotype :- Yellow Round = 9/16
Yellow wrinkled = 3/16
Green Round = 3/16
Thus phenotypic Ratio = 9 : 3 : 3 : 1

Genotype:-

Homozygous yellow &Homozygous Round	-	YYRR	=	1
Homozygous yellow &Heterozygous Round	-	YYRr	=	2
Heterozygous yellow &Homozygous Round	-	YyRR	=	2
Heterozygous yellow & Heterozygous Round	-	YyRr	=	4
Homozygous yellow& Homozygous wrinkled	–	YYrr	=	1
Heterozygous yellow&Homozygous wrinkled	-	Yyrr	=	2
Homozygous Green&Homozygous Round	-	yyRR	=	1
HOmozygousGreen&Heterozygous Round	-	yyRr	=	2
Homozygous Green &Homozygous wrinkled	-	yyrr	=	1

Thus genotpic Ratio =1:2:2:4:1:2:1:2:1

(i) Back cross:-
A back cross is a cross in which F_1individuual are crossed with any of their parents.
When F_1individual is crossed with dominant parent then it is termed out cross the generation obtained from this cross All possess dominant character so the any analysis can not possible in F_1generation.

(ii) Test cross :-When F_1 progeny is crossed with recessive parent the it is called test cross.
The total generation obtained from this cross 50 having dominant character and 50 having recessive character (monohybrid test cross) test cross heps to find out the genotype of dominant individual.

(a) Monohybrid test cross :- The progeny obtained from the monohybrid test cross are in equal proportion it can be represent in symbolic forms as follows.

F_1 progeny(hybrid) Tt × Recessive parent tt

↓

t

T	Tt
t	tt

Monohybrid test cross ratio = 1 : 1