

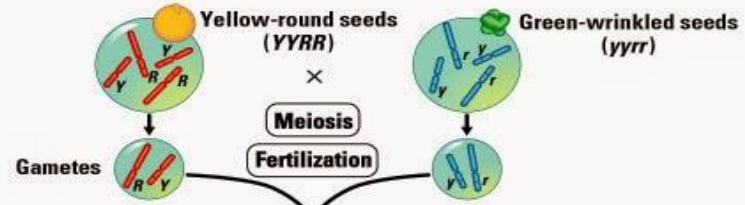


Bhagalpur National College, Bhagalpur

(A Constituent unit of Tilka Manjhi Bhagalpur University, Bhagalpur)

PPT Presentation for B.Sc. III- Principle of Inheritance

P Generation



F₁ Generation



Principle of Segregation: Follow the long chromosomes (carrying *R* and *r*) taking either the left or right branch.

Principle of Independent Assortment: Follow both the long and the short chromosomes.

The *R* and *r* alleles segregate in anaphase I of meiosis.

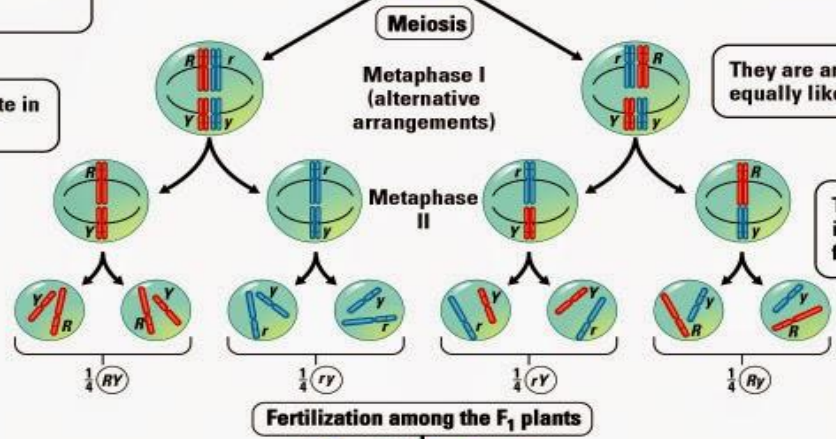
They are arranged in either of two equally likely ways at metaphase I.

Only one long chromosome ends up in each gamete.

They assort independently, giving four gamete types.

Fertilization recombines the *r* and *R* alleles at random.

Fertilization results in the 9:3:3:1 phenotypic ratio in the F₂ generation.



F₂ Generation



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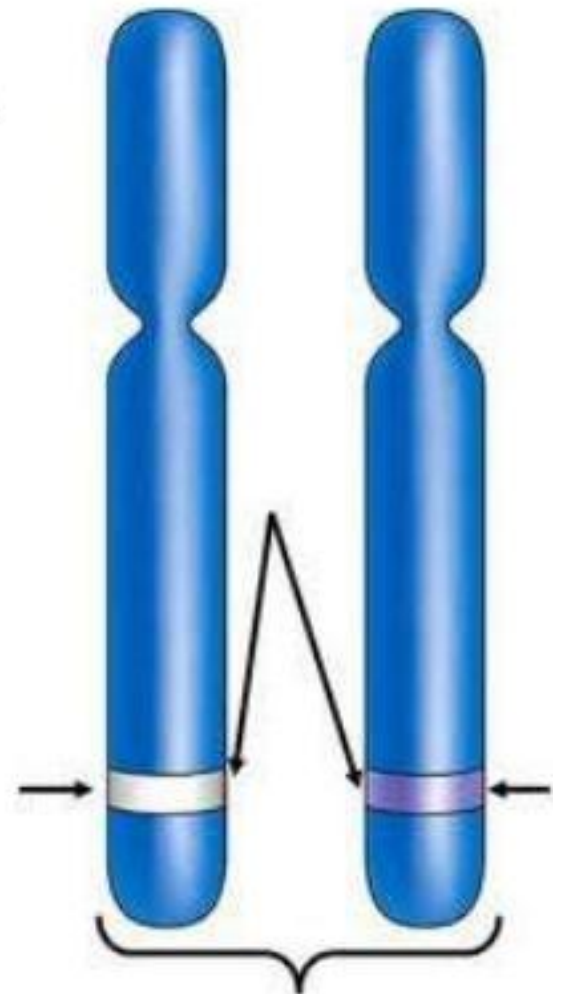
GENETICS

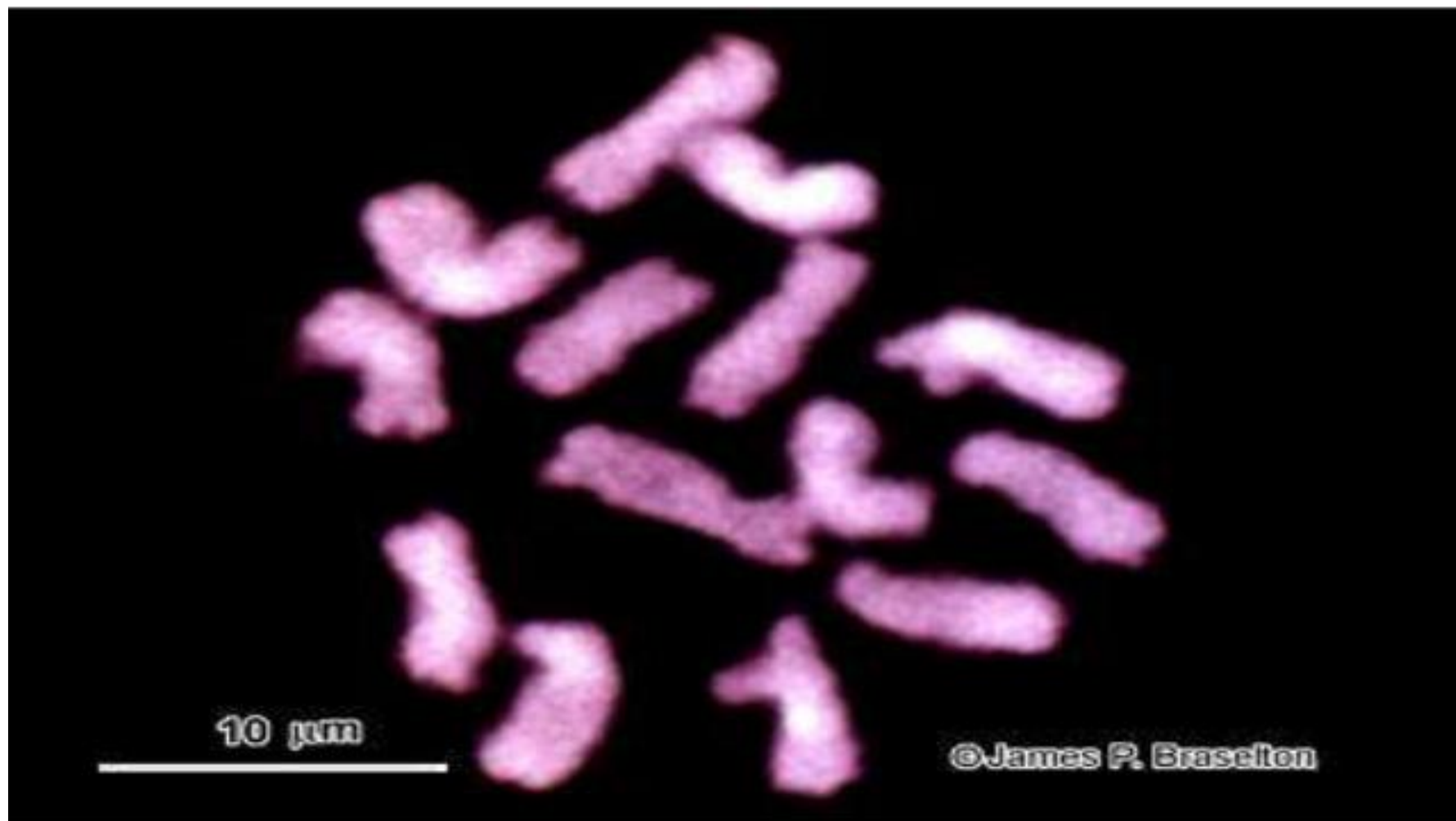
- Organisms reproduce- formation of offspring of the same kind.
- The resulting offspring most often do not totally resemble the parent.
- Branch of biology that deals with the inheritance and variation- **Genetics**.
- Inheritance- the process by which characters are passed on from parent to progeny.
- Variation-it is the degree by which progeny differ from their parents.



Terminologies in Genetics:

- ***Factor or Gene:*** Functional unit of heredity responsible for the expression of character in the progeny.
- ***Locus:*** The position of the gene on the chromosomes.
- ***Allele:*** The alternative form of a gene for a contrasting character present on identical locus of homologous chromosomes.





The 14 chromosomes in a root cell of a pea plant as seen with confocal scanning laser microscopy.

- **Phenotype:** The external appearance of an organism due to the influence of genes and environmental factors.
- **Genotype:** The genetic constitution of an individual responsible for the phenotype .
- **Phenotypic ratio:** The correct proportion of phenotype in population.
- **Genotypic ratio:** The correct proportion of genotype in population.
- **Homozygous:** The individual having identical genes in an allelic pair for a character. Ex: TT, tt.
- **Heterozygous:** The individual having un-identical genes in an allelic pair for a character. Ex: Tt.

- ***Dominant gene:*** The gene that expresses its character in heterozygous condition.
- ***Recessive:*** The gene that fails to express its character in heterozygous condition.
- ***Hybrid:*** The progeny obtained by crossing two parents that differ in characters.
- ***Back cross:*** The cross between F1 hybrid and one of its parents.
- ***Test cross:*** The cross between hybrid and its homozygous recessive parent. It is used to identify the genotype of the hybrid.















Gregor Johann Mendel: Father of Genetics

- Known as the **father of modern genetics**
- Gregor Mendel developed the principles of heredity while studying seven pairs of inherited characteristics in pea plants.
- Although the significance of his work was not recognized during his lifetime, it has become the basis for the present-day field of genetics.



- **Mendel selected pea plant bcoz,**
- Pure variety are available.
- Pea plants are easy to cultivate.
- Life cycle of plants are only few months. So that result can be got early.
- Contrasting trait are observed.
- Flowers are bisexual and normally self pollinated.
- Flowers can be cross pollinated only manually.
- Hybrids are fertile.

Seven pair of contrasting characters selected by Mendel for his experiment.

	Height	Seed Shape	Seed Color	Seed Coat Color	Pod Shape	Pod Color	Flower Position
Dominant	 Tall	 Round	 Yellow	 Green	 Inflated (full)	 Green	 Axial
Recessive Trait	 Short	 Wrinkled	 Green	 White	 Constricted (flat)	 Yellow	 Terminal

Mendelian laws of heredity.

- Law of paired factors: Factors are responsible for transmission of characters. These are present in pairs.
- Law of dominance: In hybrid dominant character suppresses the expression of recessive character.
- Mendel's 1st law or Law of segregation or Law of purity of gametes:
It states that, 'when a pair of factors for a character brought together in a hybrid, they segregate (separate) during the formation of gametes.'

Inheritance of one gene.

- *Inheritance of one gene* can be explained by monohybrid cross.
- The cross between two parents differing in one pair of contrasting character is called monohybrid cross.

Monohybrid cross.

Parental Generation



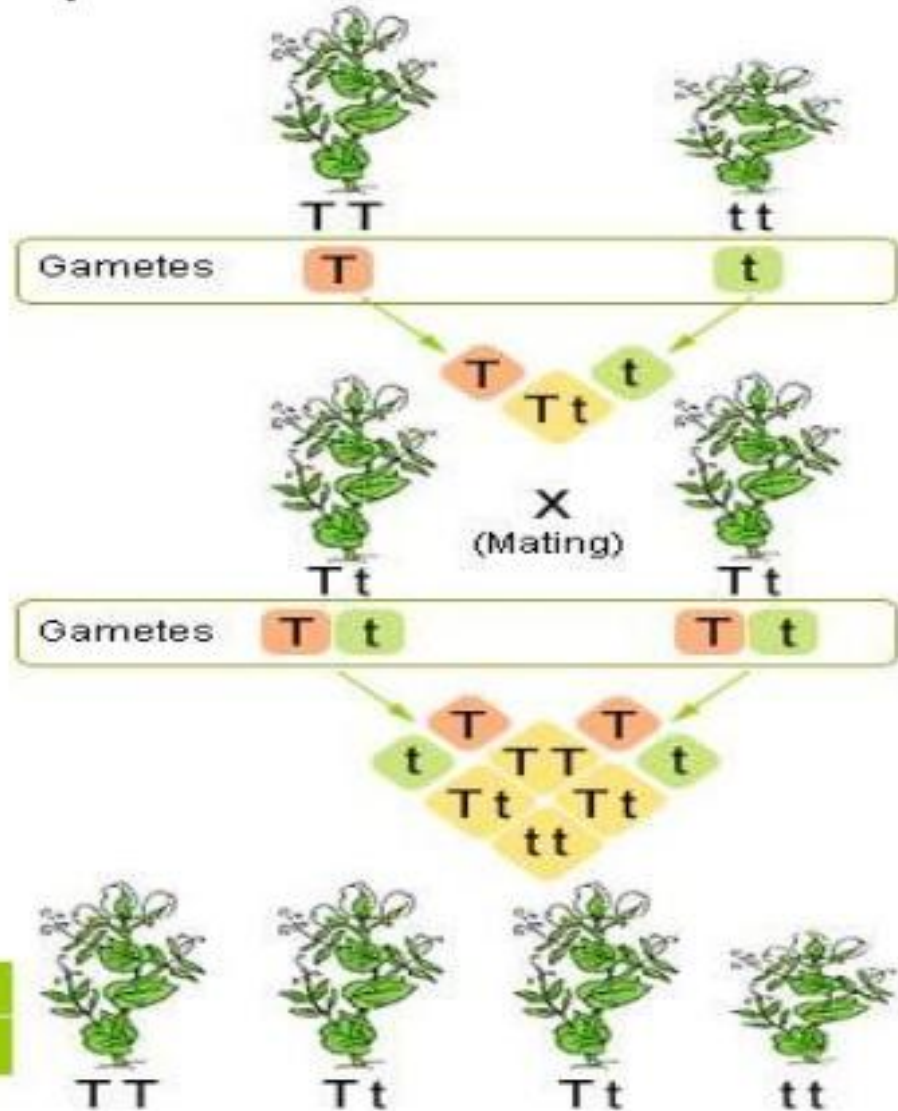
F1 Generation

Genotype	All are Tt
Phenotype	All are tall



F2 Generation

Genotype	TT : Tt : tt = 1 : 2 : 1
Phenotype	Tall : Dwarf = 3 : 1



Monohybrid cross : mendel's 1st law

P Phenotype Tall x Dwarf
 Genotype TT tt
Homozygous Dominant **Homozygous Recessive**

F1 Tt
 All Tall **Tall is dominant to Dwarf**
 Self pollinated **Heterozygous**

F2

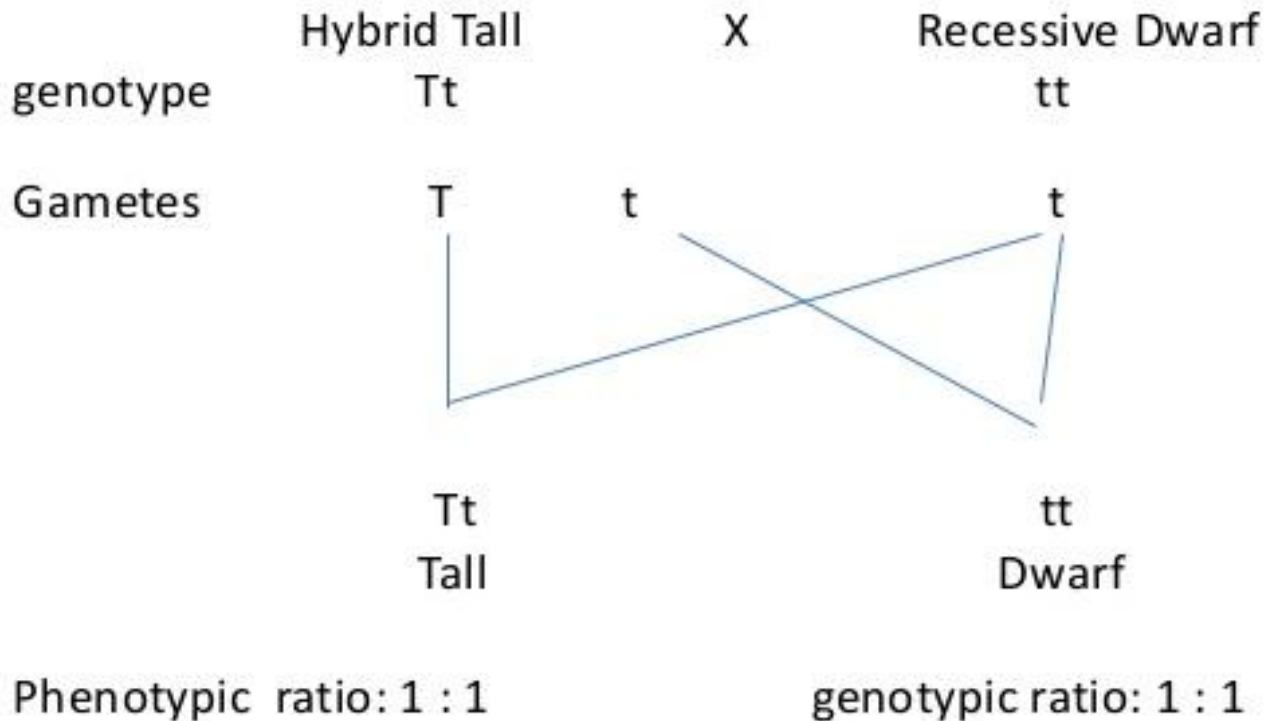
Gamets	T	t
T	TT tall	Tt tall
t	Tt Tall	tt dwarf

Phenotypic ratio 3:1

Genotypic ratio: 1:2:1

test cross

Test cross: The cross between hybrid and its homozygous recessive parent is called test cross. It is used to identify the genotype of the hybrid.



LAW OF SEGREGATION

- It states that, 'when a pair of factors for a character brought together in a hybrid, they segregate (separate) during the formation of gametes.
- Alleles do not blend & both characters recovered in F2 & one in F1
- Factors which is present in parent segregate & gametes receives only one of two factors
- Homozygous parent- one kind gamete
- Heterozygous parent- two kind gamete each one have one allele with equal proportion

P Phenotype Tall x Dwarf
 Genotype TT tt
Homozygous Dominant **Homozygous Recessive**

F1 Tt
 All Tall
Heterozygous **Tall is dominant to Dwarf**
 Self pollinated

F2

Gamets	T	t
T	TT tall	Tt tall
t	Tt Tall	tt dwarf

Phenotypic ratio 3:1

Genotypic ratio: 1:2:1

INHERITANCE OF TWO GENE:

Mendel's 2nd law or Law of independent assortment:

- It states that, 'factors for different pairs of contrasting characters in a hybrid assorted (distributed) independently during gamete formation.

Mendel's 2nd law can be explained by dihybrid cross.

- Dihybrid cross: The cross between two parents, which differs in two pairs of contrasting characters.

DIHYBRID CROSS:

Parents

Phenotype Round Yellow Wrinkled Green

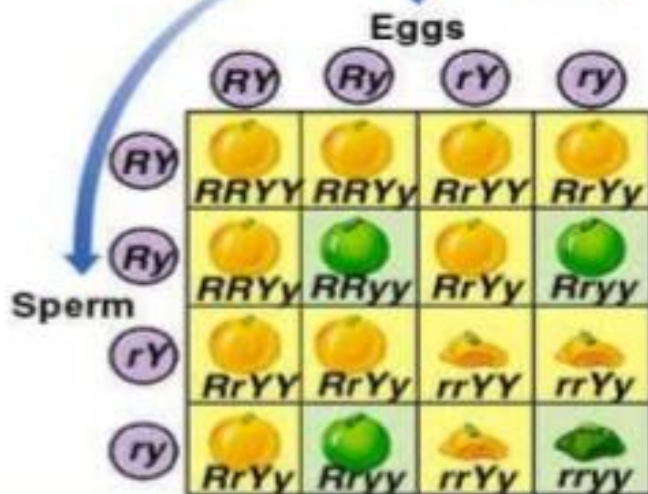
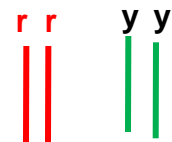
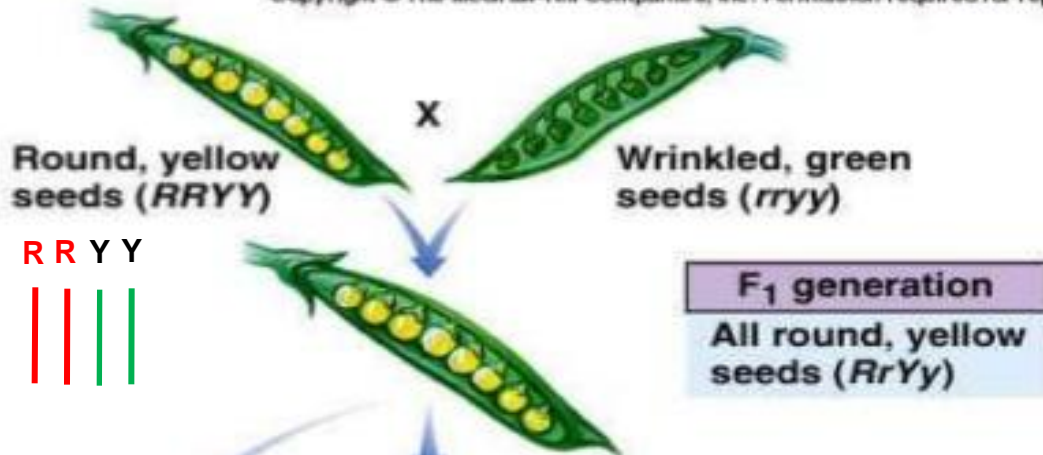
Genotype RRYY rryy

Gametes RY ry

F1 generation RrYy

Round Yellow

Dihybrid Cross



F₂ generation

9/16 are round, yellow
 3/16 are round, green
 3/16 are wrinkled, yellow
 1/16 are wrinkled, green

Phenotypic ratio : 9 : 3 : 3 : 1

DIHYBRID TEST CROSS.

- F1 hybrid is crossed with recessive green wrinkled pea plant.
- Recessive green wrinkled – rryy, Gamete ry
- F1 hybrid : round yellow- RrYy, Gametes:

Ry, Ry, rY, ry.

Gametes	RY	Ry	rY	ry
ry	RrYy	Rryy	rryY	rryy

Phenotypic ratio – 1 : 1 : 1 : 1

- Mendel work published On 1865 but remain unrecognized till 1900
- Reasons for that:
 1. Lack of communication
 2. Concept of genes / factors- clear
 3. Mathematical approach for biology was not acceted
 4. No proof for existence of factors

Exception of Mendel's law

- **Incomplete dominance: Ex mirabilis jalapa.**
(4 o clock plant)



P Generation



Gametes

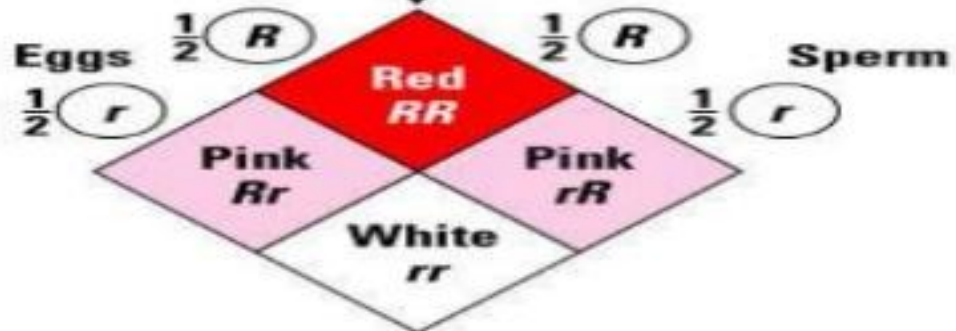


F₁ Generation

Gametes



F₂ Generation



Parent: Red X White
 Genotype. RR WW
 Gametes R W
 F1 generation Pink (Hybrid)
 RW

Self pollination
 F2 generation

Gametes	R	W
R	RR Red	RW Pink
W	RW Pink	WW white

The phenotypic ratio is
 1:2:1.

The genotypic ratio is 1:2:1

THANX

