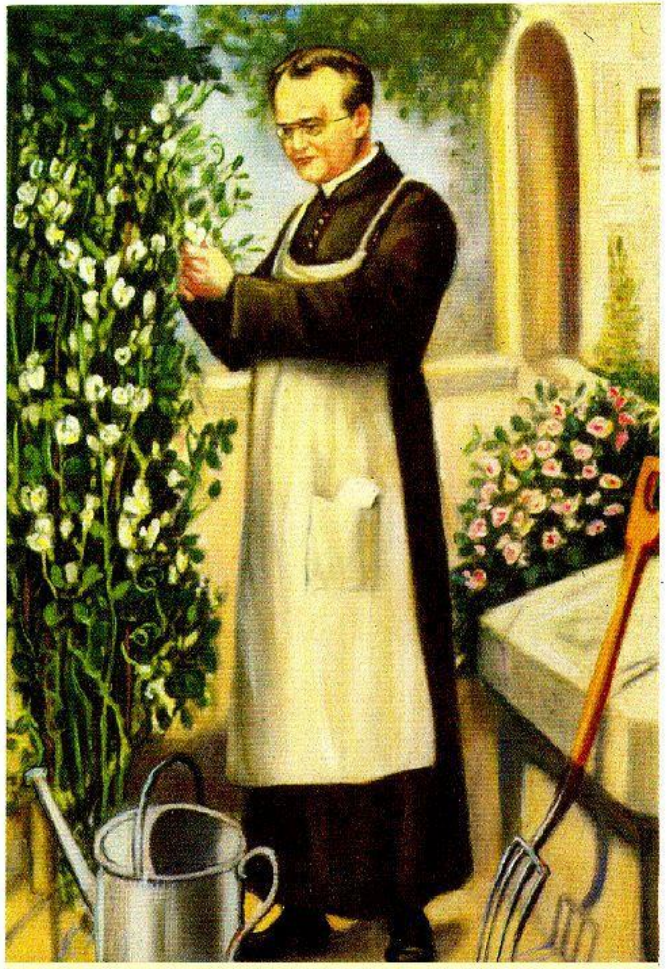
COMPLIMENTARY COURSE : SEMESTER IV

GENETICS

JASMINE MARIYA A J
ASSISTANT PROFESSOR ON CONTRACT
LITTLE FLOWER COLLEGE GURUVAYUR

- Study of hereditary and variation
- Deals with the transmission ,expression, modification and evolution of genes
- Father of Genetics – Gregor Johann Mendel



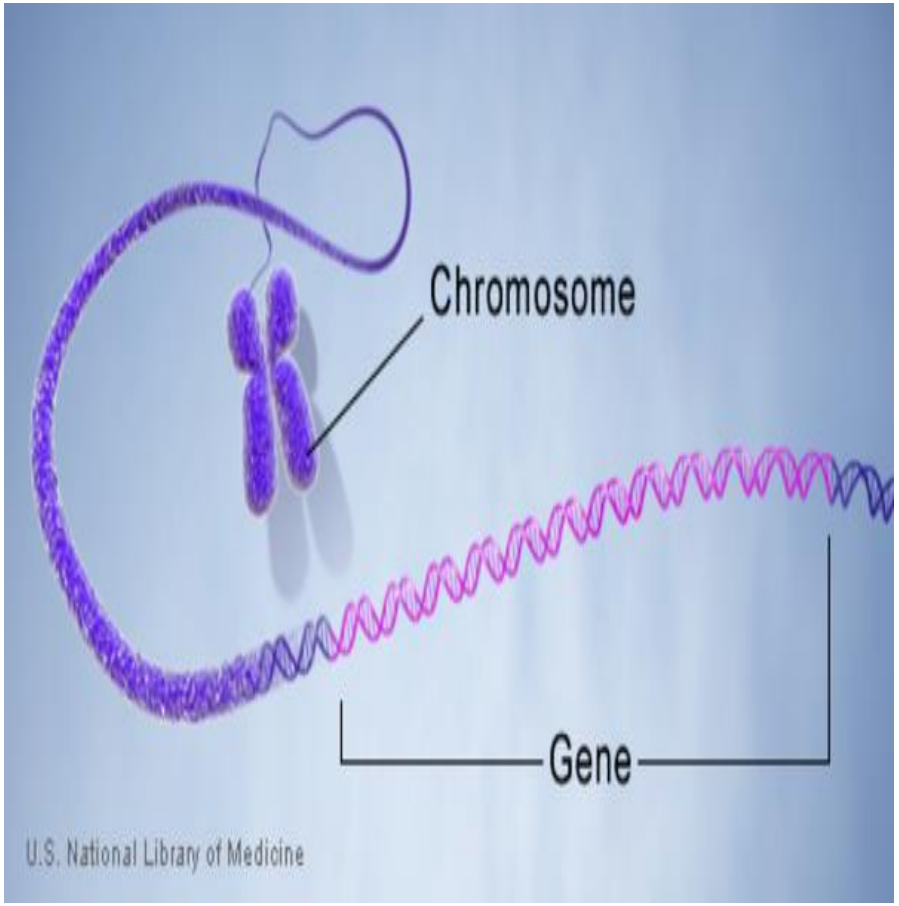
GREGOR MENDEL

Three Major Areas of Genetics

Classical Genetics (Transmission)	Molecular Genetics	Evolutionary Genetics
Mendel's Principles	Genom	Quantitative Genetics
Meiosis + mitosis	DNA structure	Population Genetics
Sex determination	Chemistry of DNA	Evolution
Sex linkage	Transcription	Speciation
Chromosomal mapping	Translation	
Cytogenetics	Control of gene expression	
	DNA cloning	

Common terminologies

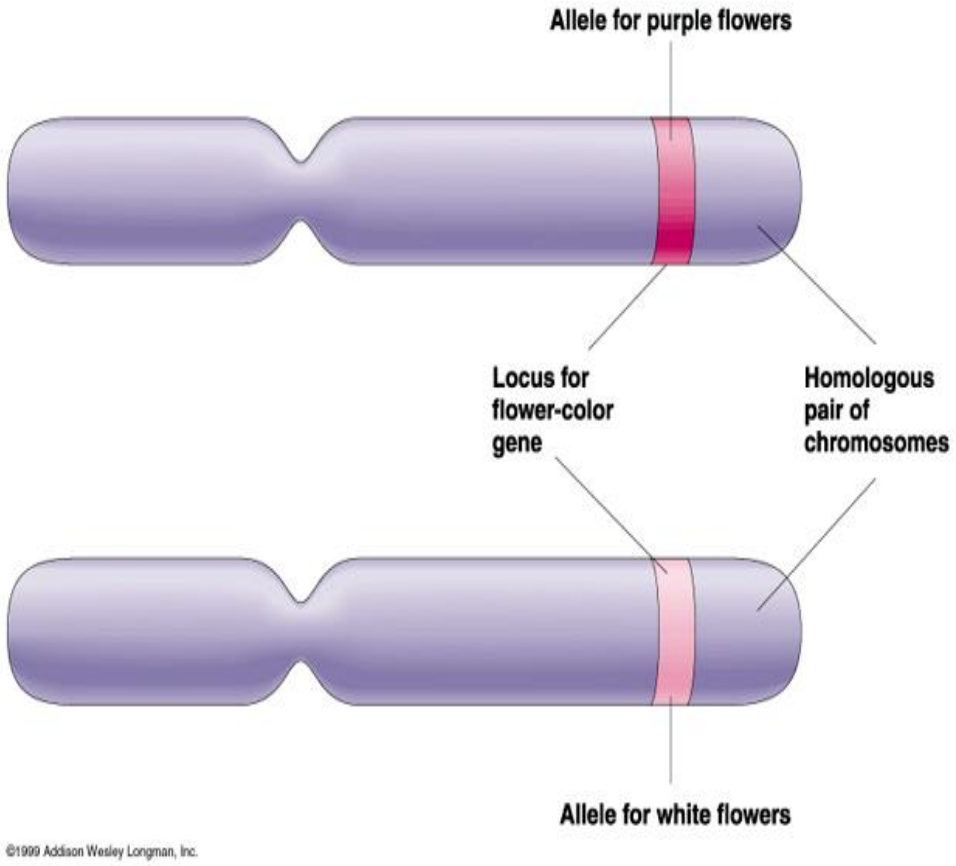
- Gene
- It is the segment of DNA which controls the heredity of a particular trait ,produces variation, controls metabolism and directs development
- Genes occupy in a specific position called gene locus



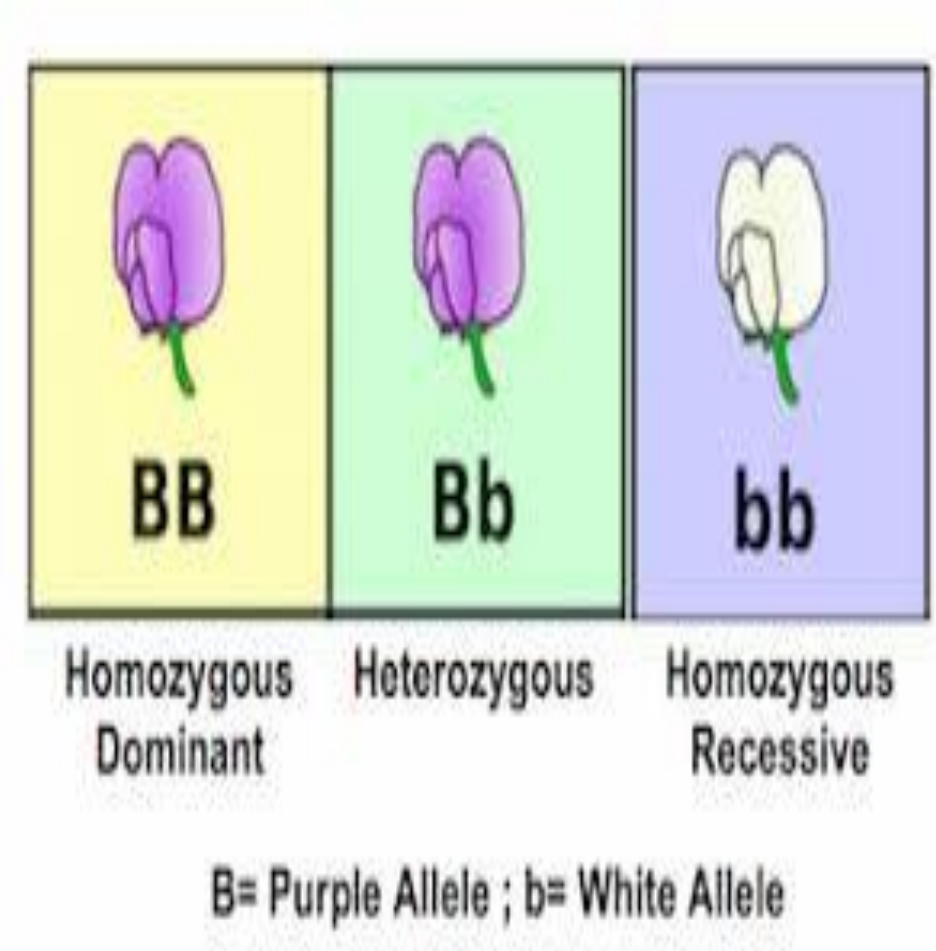
1. structural genes –which codes for a protein
2. r RNA genes –undergoes transcription to produce Rrna
3. t RNA genes – produce t RNA
4. Regulatory genes –which are not transcribed and translated and functions as recognition signals for enzymes such as polymerases

Allele

Alternative forms of a gene which occupy identical loci on homologous chromosomes and control contrasting forms of the same trait

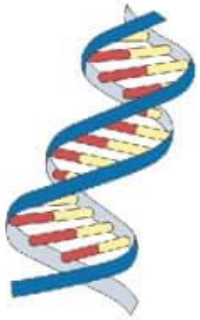


Usually a gene exist in two allelic forms dominant and recessive



Genotype and phenotypoe

Genotype VS Phenotype



Genotypes are the genetic make-up of an individual.

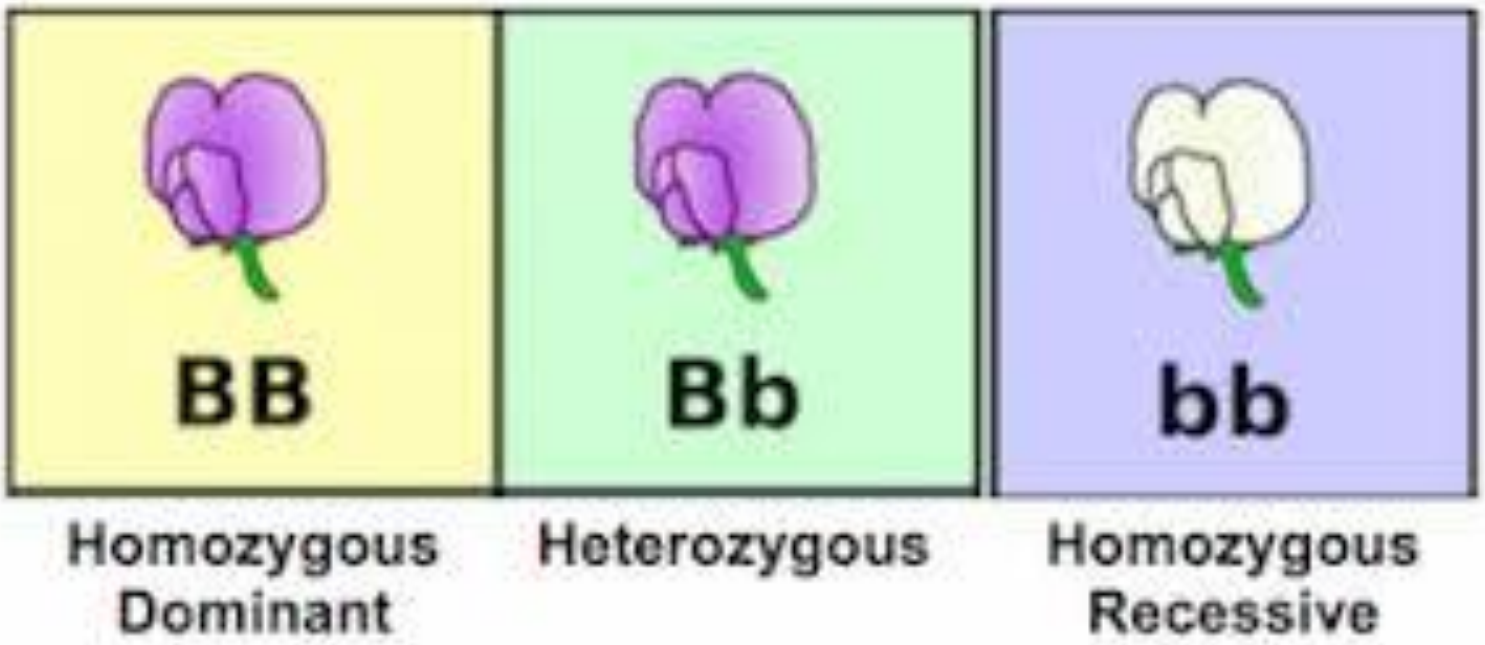
Phenotypes are the set of observable characteristics of an individual resulting from the interaction of its genotype with the environment.

Genocopy and phenocopy

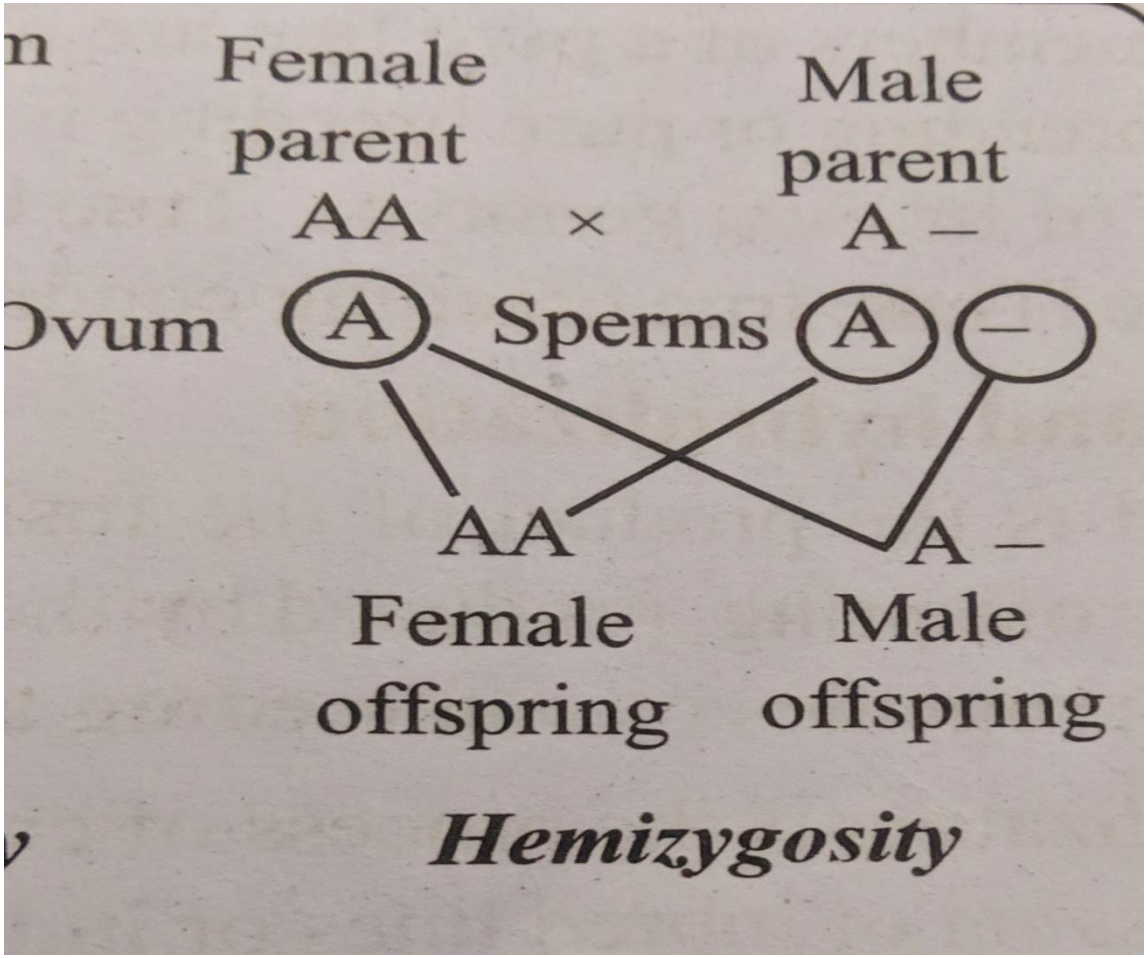
- Genocopy – different genes same phenotype

  hereditary
- Phenocopy -non hereditary phenotypic modification due to environmental modification

Homozygosity and Heterozygosity



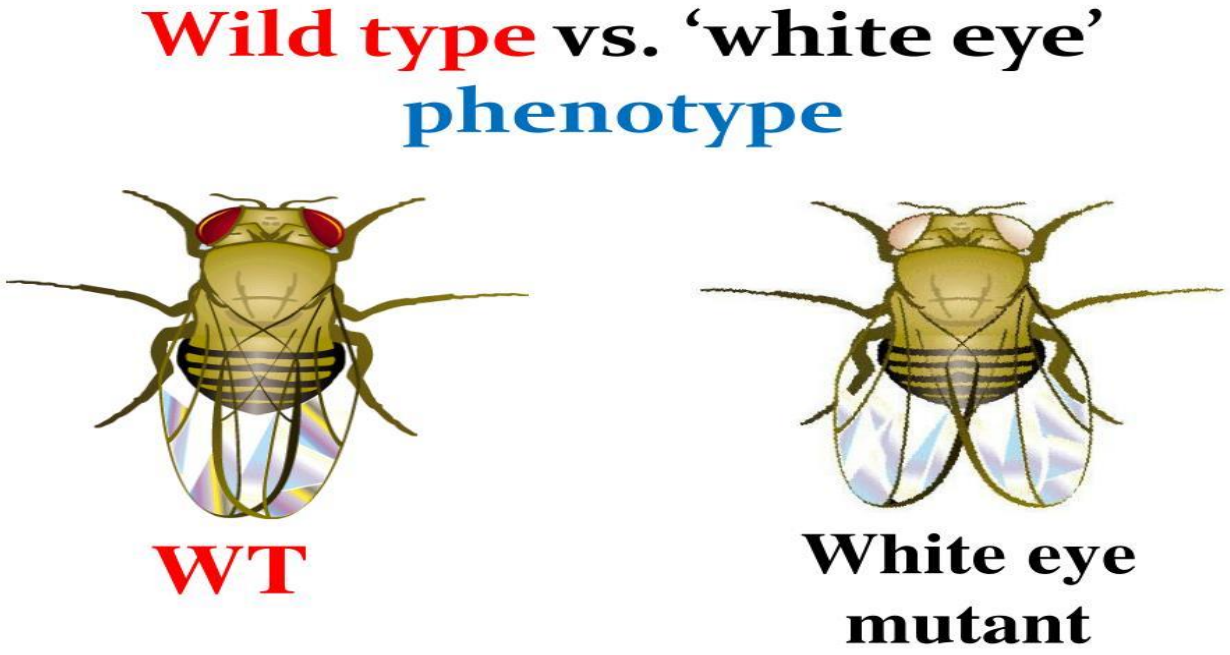
Hemizygocity



- Dominance – ability of an allele to express itself in homozygous and heterozygous conditions
- Recessiveness – failure of a particular allele to get expressed in heterozygous condition
- Carrier – A heterozygous individual with a deleterious recessive allele ,whose phenotypic expression is masked by the normal dominant allele

Wild type and mutant type

- Wild type – original type of genotype or phenotype
- Mutant – Genetically altered form



Pure line ,True breeding

- True breeding – condition in which a parent on selfing produces a progeny with its own genotype
- Pure line – continues series of generations of true breeding individuals .

  All members of pure line will be homozygous and with same genotype.

Experiment

P Generation

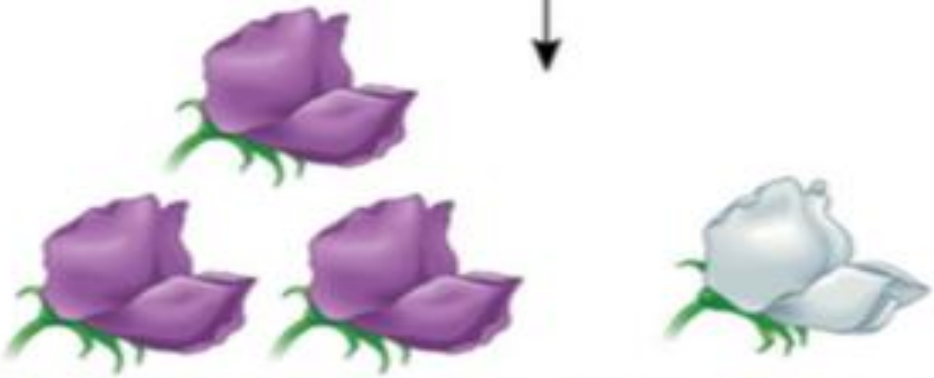
(true-breeding parents)

Purple flowers × **White flowers**

F_1 Generation

All plants had purple flowers

F_2 Generation

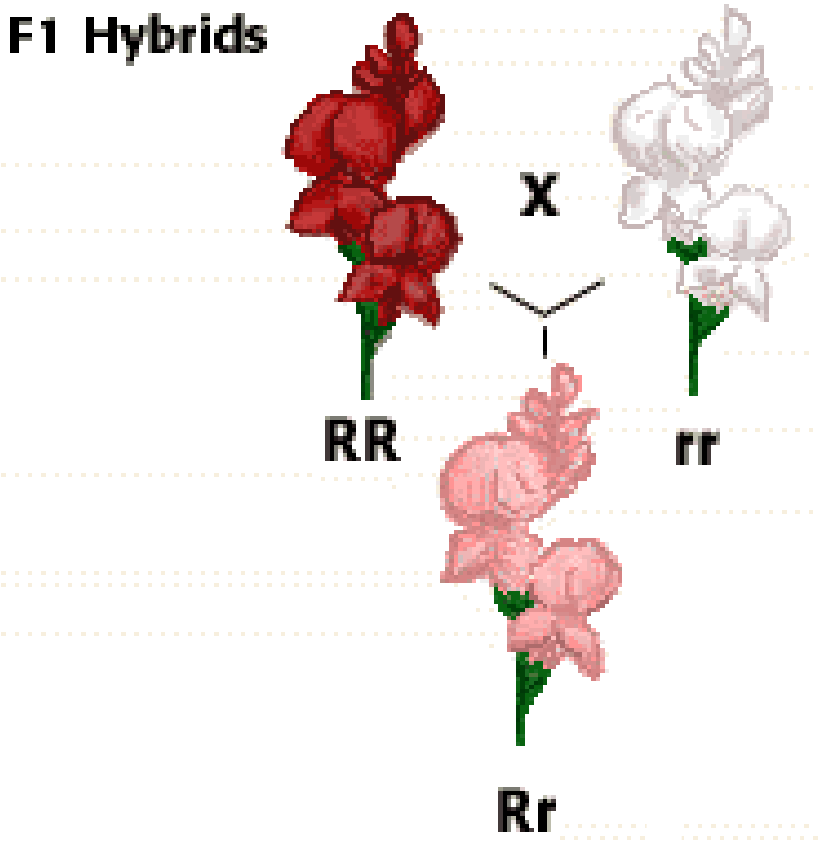


705 purple-flowered plants **224 white-flowered plants**

3:1 ratio

Hybrid

Product of fusion between two genetically different cells or offspring produced by the hybridisation between two genetically dissimilar parents



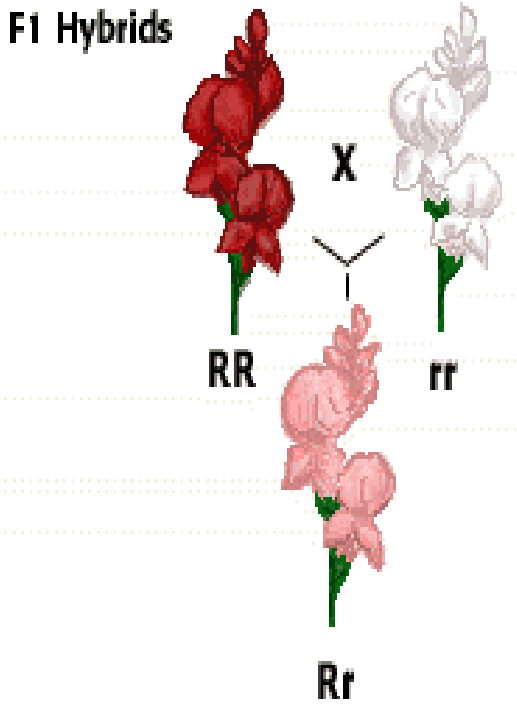
Hybridisation

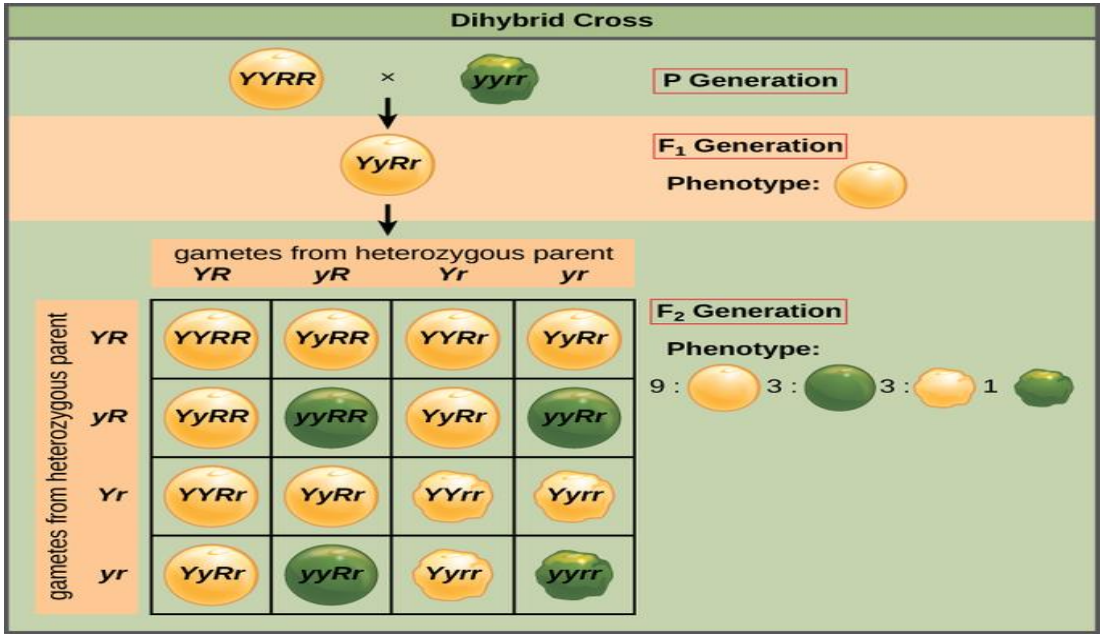
- Process of crossing between genetically different forms

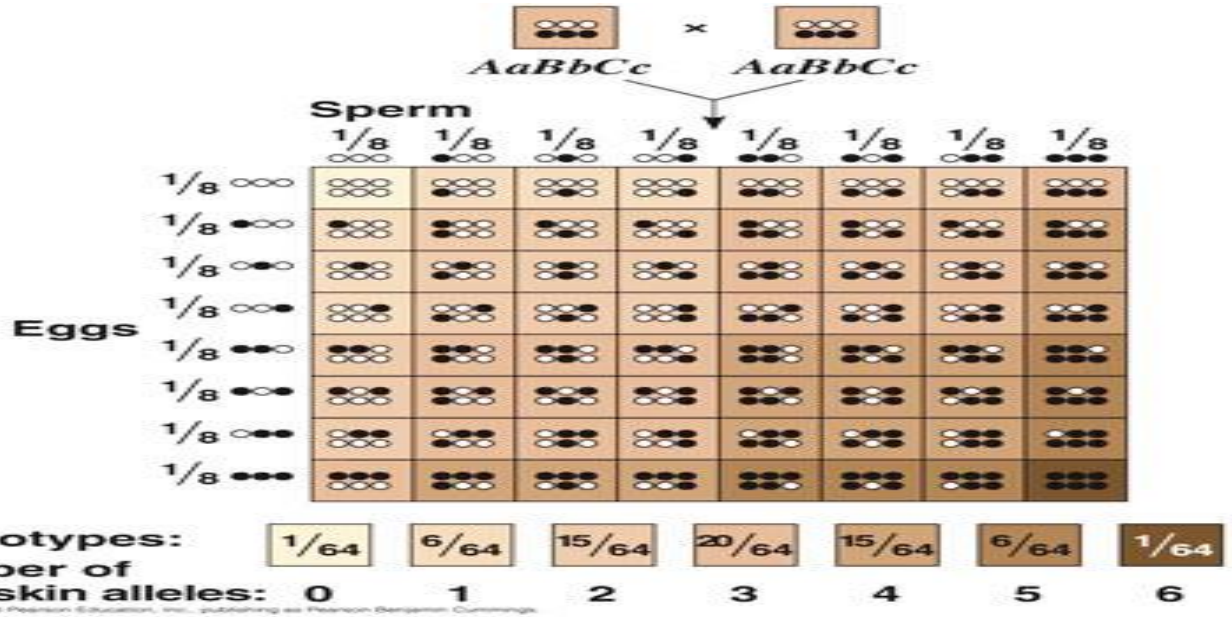
eg. 1.crossing of individual belonging to genetically dissimilar population

2.Mating between unlike genotypes

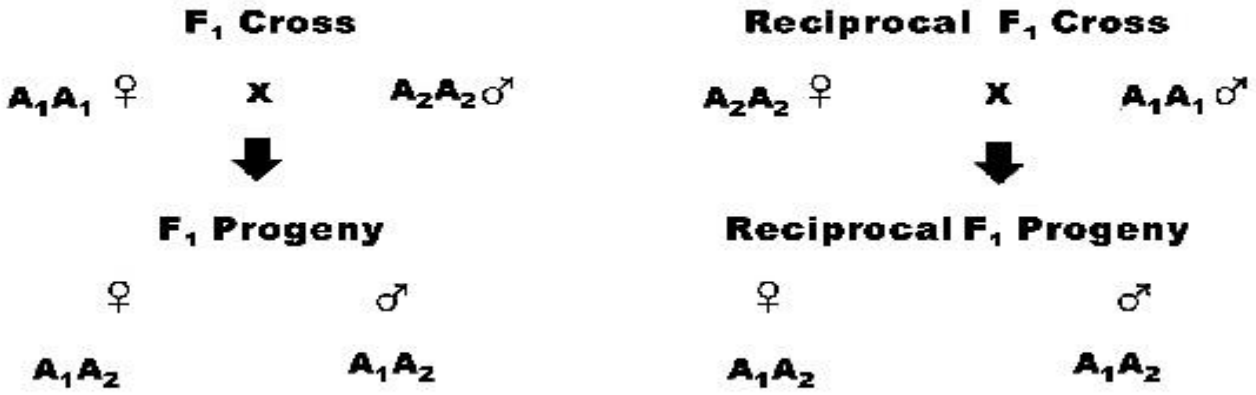
3.Pairing between complimentary RNA and DNA


F1 Hybrids
X
RR
rr
Rr


Dihybrid Cross
YYRR
×
yyrr
P Generation
F1 Generation
YyRr
Phenotype:
gametes from heterozygous parent
YR yR Yr yr
gametes from heterozygous parent
YR yR Yr yr
YYRR YyRR YYRr YyRr
YyRR yyRR YyRr yyRr
YYRr YyRr YYrr Yyrr
YyRr yyRr Yyrr yyrr
F2 Generation
Phenotype:
9 : 3 : 3 : 1

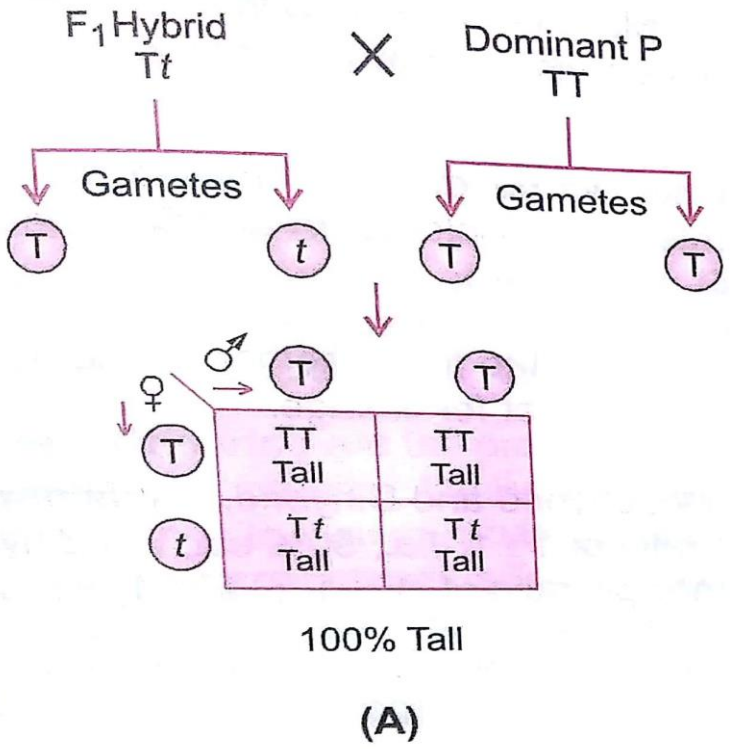

AaBbCc
×
AaBbCc
Sperm
1/8
Eggs
Phenotypes:
Number of dark-skin alleles:
1/64 6/64 15/64 20/64 15/64 6/64 1/64
0 1 2 3 4 5 6

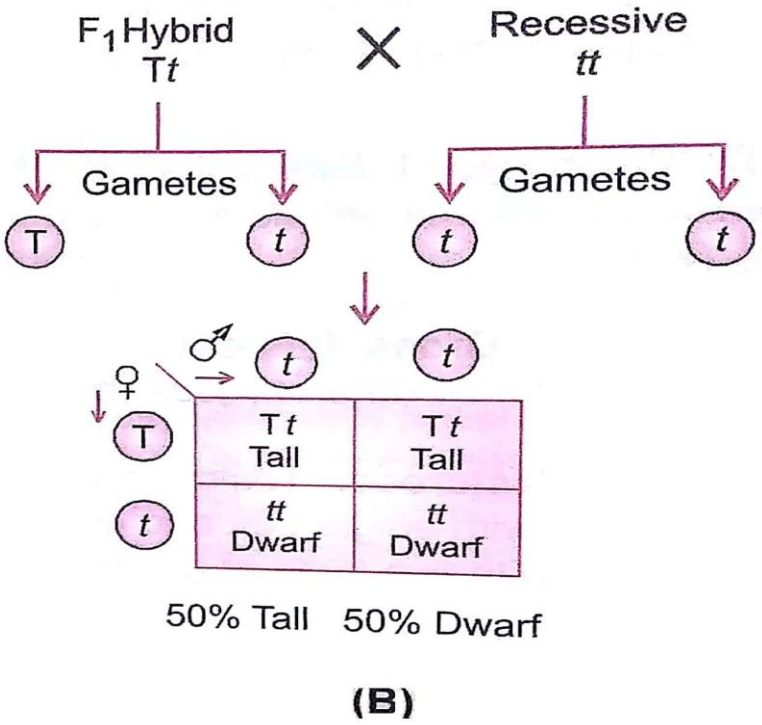
RACIPROCAL CROSS



Sexes of parents of one cross are reversed in the other

Back cross



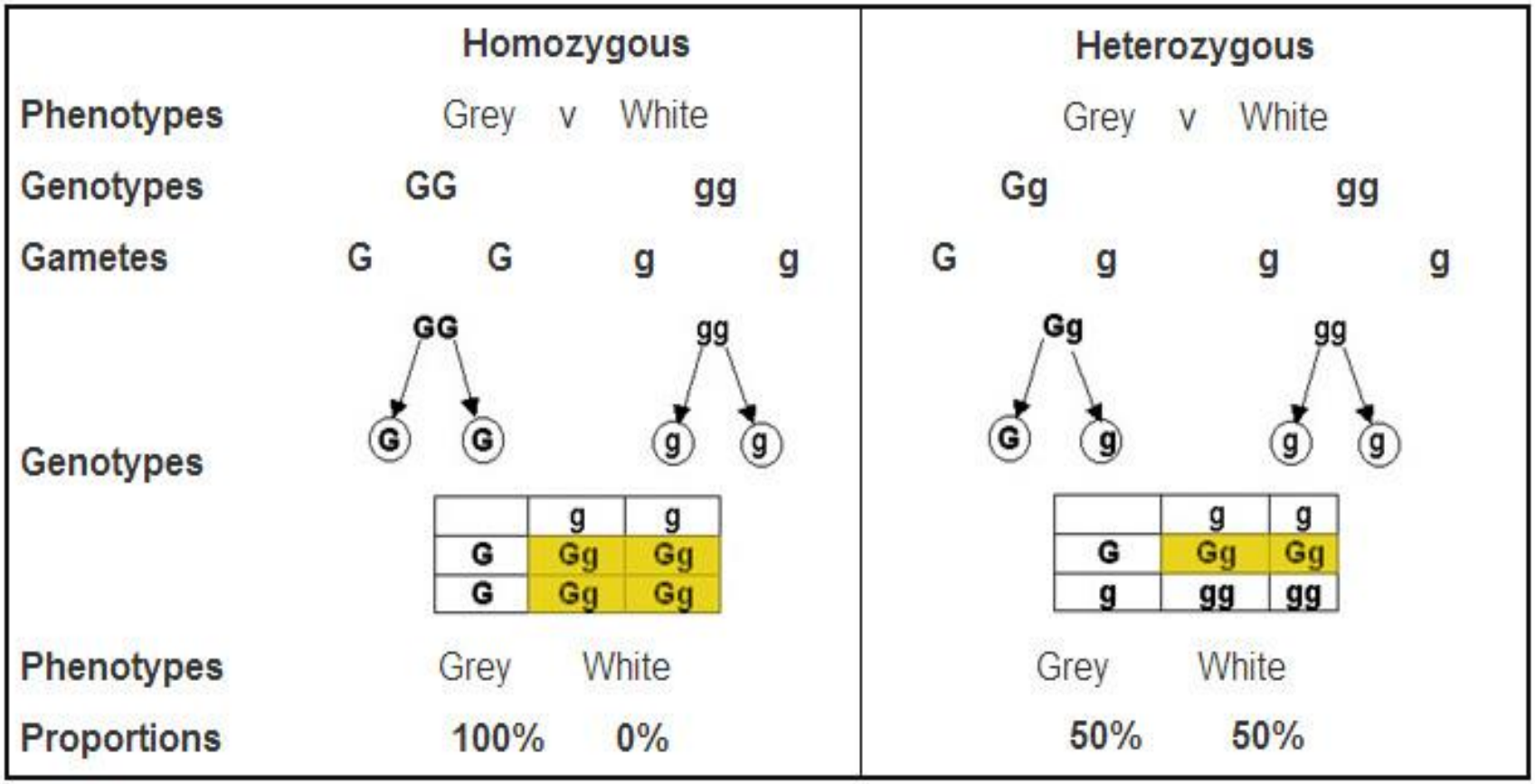


Crossing the F1 progeny with one of the homozygous parents

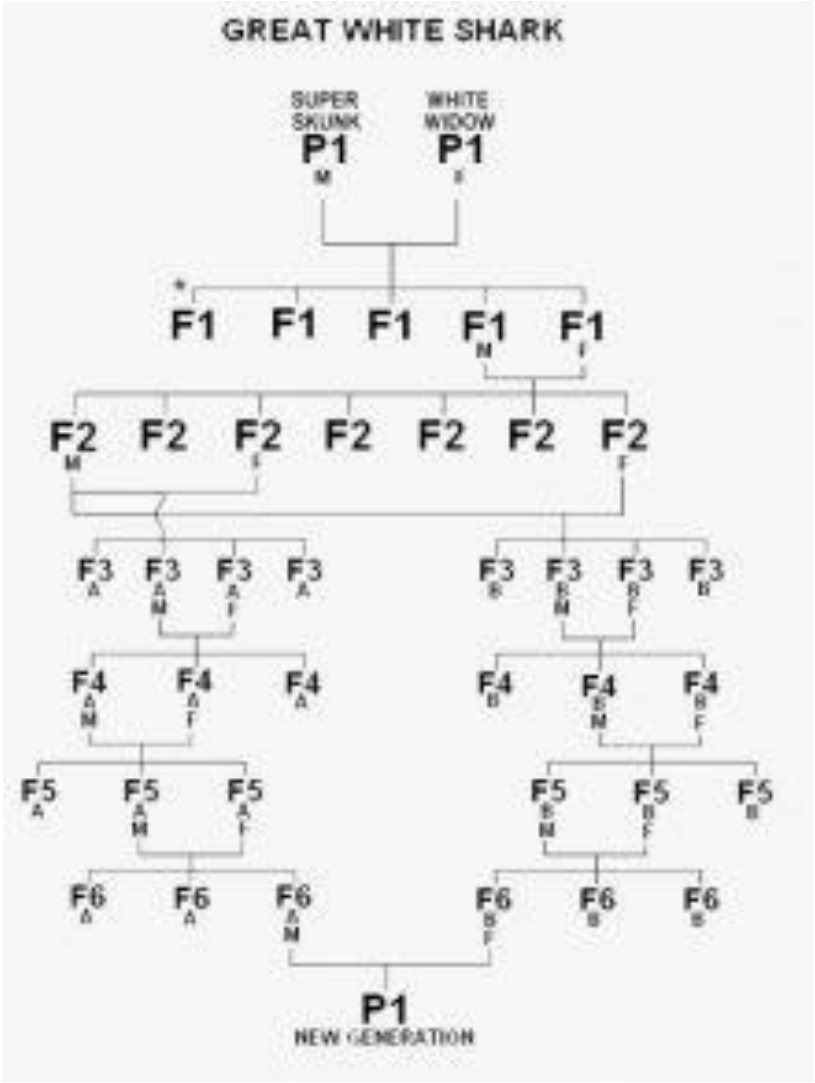
Test cross

- Crossing of an individual of unknown genotype but showing dominant phenotype with homozygous recessive parent
- This will reveal the genotype of the tested parent

Test Cross


Homozygous
Phenotypes
Grey v White
Genotypes
GG
gg
Gametes
G G g g
Genotypes
GG
gg
G G g g
g g
G Gg Gg
G Gg Gg
Phenotypes
Grey White
Proportions
100% 0%
Heterozygous
Grey v White
Gg
gg
G g g g
Gg
gg
G g g g
g g
G Gg Gg
g gg gg
Grey White
50% 50%

F1 ,F2, F3 generations



Punnett square