

## CHAPTER -09 HEREDITY AND EVOLUTION

### IMPORTANT TERMS :-

1. **Heredity** :- It refers to the transmission of characters or traits from the parents to their offspring.
2. **Genetic** :- it is the branch of biology which deals with heredity and variation.
3. **Genes** :- A functional segment of DNA is called gene.
4. **Gametes** :- Reproductive cells are called gametes.
5. **Alleles** :- One of the different forms of a particular gene
6. **Recessive allele** :- It is the allele whose phenotypic expression is masked (suppressed) by dominant allele of that gene
7. **Dominant Gene** :- An allele whose phenotype will be expressed in the presence of other allele of that gene.
8. **Genotype** :- Genetic composition of an individual.
9. **Phenotype** :- Expression of genotype which is an observable and measurable characteristic.
10. **Hybrid** :- An individual having two different alleles for the same trait.

11. Homozygous :- When both alleles of a particular genes are the same  
ex: TT, tt
12. Heterozygous :- When both alleles of a particular gene are different.  
ex: Tt
13. Punnett Square :- Probability diagram illustrating the possible offspring of mating
14. Variations :- The difference in the characters (traits) among the individuals of a species are called variations.  
Variations are produced due to inaccuracies in copying of DNA and get accumulated generation after generation that leads to evolution.
15. Progeny :- A descendant or offspring as a daughter organism.
16. Trait :- A trait or character is a feature of an organism.  
  
\* Trait or characteristics, which are passed on from parents to their offsprings generation are controlled by genes.
17. Contrasting Characters :- The characters which always appear in two opposing conditions are called contrasting characters.
18. Monohybrid Cross :- A breeding experiment dealing with two characters at the same time.
19. Dihybrid Cross :- A breeding experiment dealing with two characters at the same time.
20. Dominance :- The phenomenon of appearance of only one of two contrasting traits in  $F_1$  generation.

21. Sex Determination :- The mechanism by which the sex of an individual is determined as it begins life.

## MENDEL'S CONTRIBUTION TOWARDS THE INHERITANCE OF TRAITS :-

Gregor Johann Mendel (1822 - 1884) Father of Genetics

\* He selected garden pea plant for his experiments because -

- i. These grow quickly and are easier to study
- ii. Pea plants can cross or self-pollinated and have a flower structure that limits accidental contact.
- iii. Garden pea has clear cut contrasting traits which are easy to observe like round / wrinkled seeds, tall/ short plant, white/violet flowers and so on.
- iv. They produce large no. of seeds, so large no. of plants can be studied.
- v. In these bisexual plants, artificial cross fertilization could easily be achieved.

## SEVEN CONTRASTING CHARACTER NOTED BY MENDEL IN GARDEN PEA PLANT :-

S.No	Character	Contrasting traits	
		Dominant	Recessive
1.	Plant size or height	Tall	Dwarf
2.	Position of flower on the stem	Axial	Terminal
3.	Colour of unripe pod	Green	yellow
4.	Shape of pod	Inflated	Constricted
5.	Shape of seed	Round	Wrinkled
6.	Colour of the seed	Yellow	Green
7.	Colour of flower	Violet	White

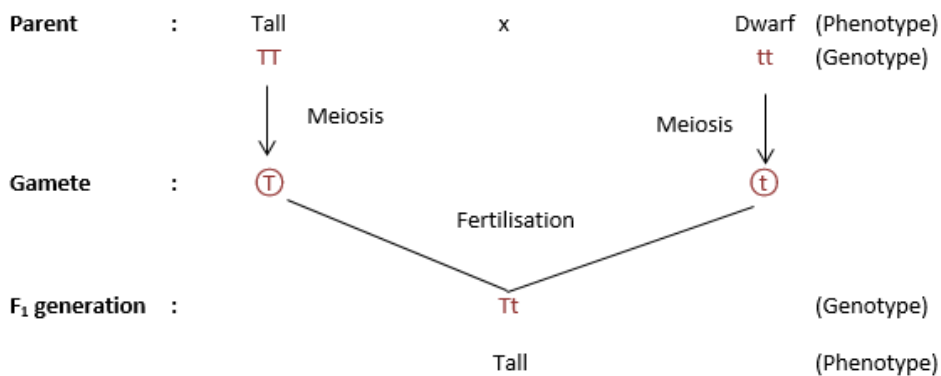
6.	Colour of the seed	Yellow	Green
7.	Colour of flower	Violet	White

## Inheritance of Traits for one contrasting character -> ( MONOHYBRID CROSS )

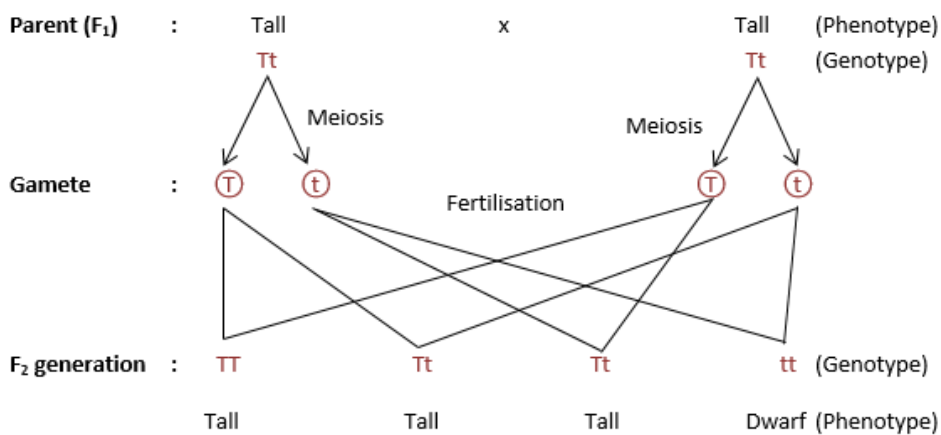
Let: T = Dominant allele that controls tall phenotype

t = Recessive allele that controls dwarf phenotype

### Cross between two pure-breeding parent generations:



### Selfing of two F<sub>1</sub> generations:



### Dominant and Recessive

(T = Tall & t = short)

Cross: Tt x Tt

	T	t
T	TT	Tt
t	Tt	tt

Genotypic ratio: 1 : 2 : 1 (TT=25% Tt=50% tt=25%)

Phenotypic ratio: 3 : 1 (Tall=75% Short=25%)

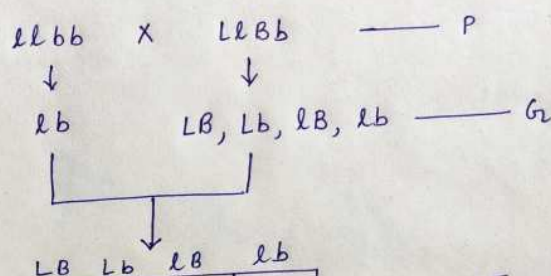
**LAW OF DOMINANCE :-** When parent plants are pure for contrasting traits, only one form of the trait will appear in the next generation i.e. known as dominant trait.

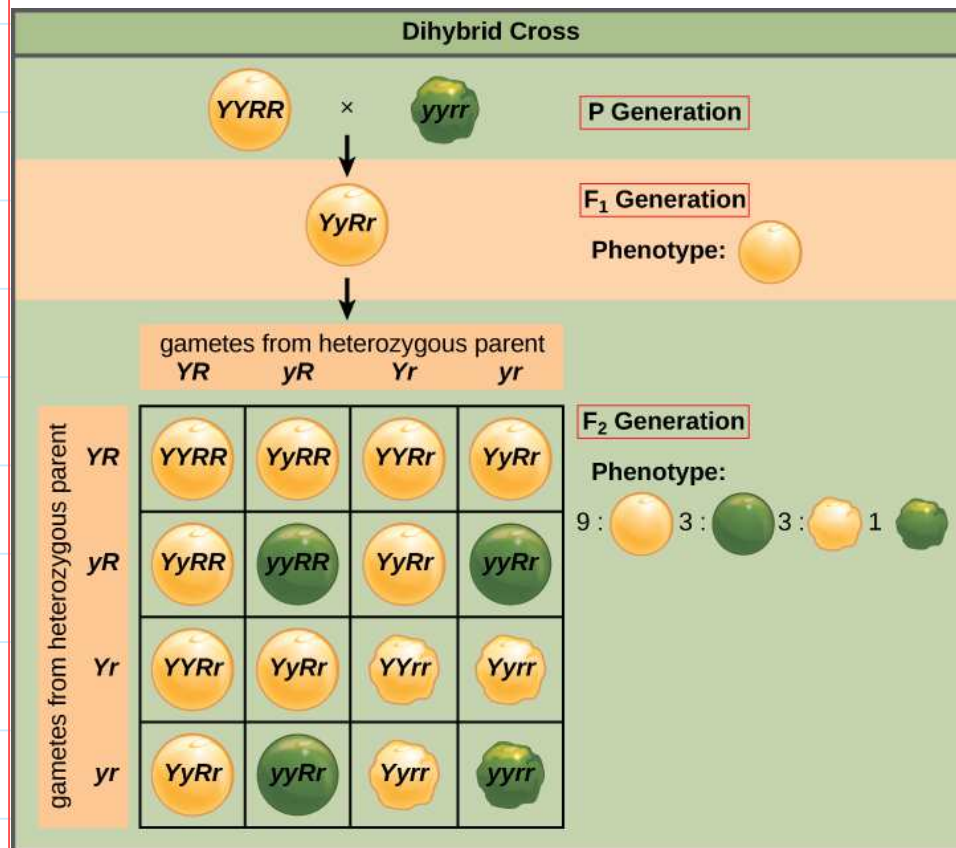
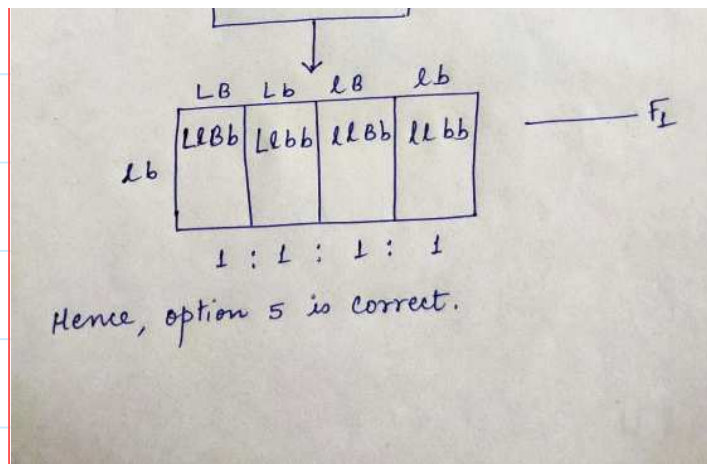
**LAW OF SEGREGATION :-** In  $F_1$  hybrid, the dominant and recessive trait though remain together for long time but do not mix with each other and separates or segregate at the time of gamete formation.

### INHERITANCE OF TRAITS FOR TWO VISIBLE CONTRASTING CHARACTER -> (DIHYBRID CROSS)

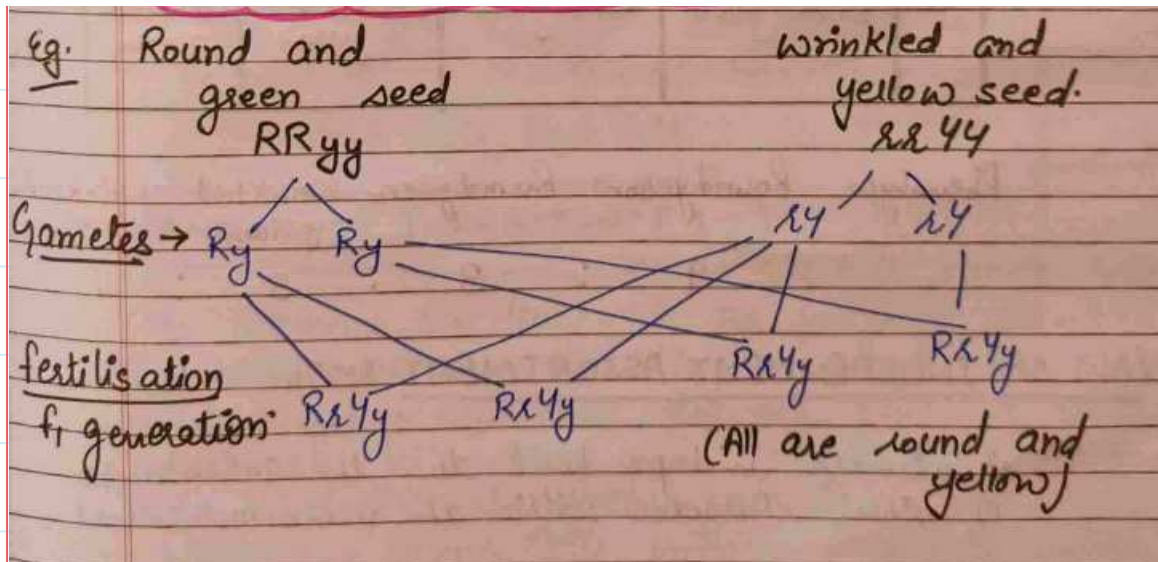
In a dihybrid cross, if an individual is heterozygous for both characters and is crossed with double recessive, a phenotypic ratio of 1:1:1:1 will be obtained.

Let us see how :









Self pollination of  $F_1$  hybrid:-

Gametes  $RrYy$        $RrYy$

$Ry$        $Ry$        $rY$        $rY$        $Ry$        $Ry$        $rY$        $rY$

$F_2$  generation  $\rightarrow$

$\frac{R}{r} \frac{Y}{y}$	$Ry$	$Ry$	$rY$	$rY$
$Ry$	$RRYY$ 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	$rrYy$ wrinkled yellow	$rryy$ wrinkled green

Phenotype Round yellow Round green wrinkled yellow wrinkled green

9 : 3 : 3 : 1

**LAW OF INDEPENDENT ASSORTMENT :-** The inheritance of one character is always independent to the inheritance of other character within the same

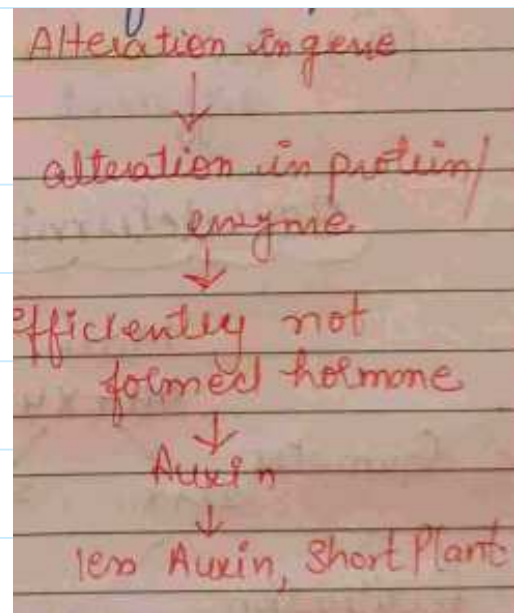
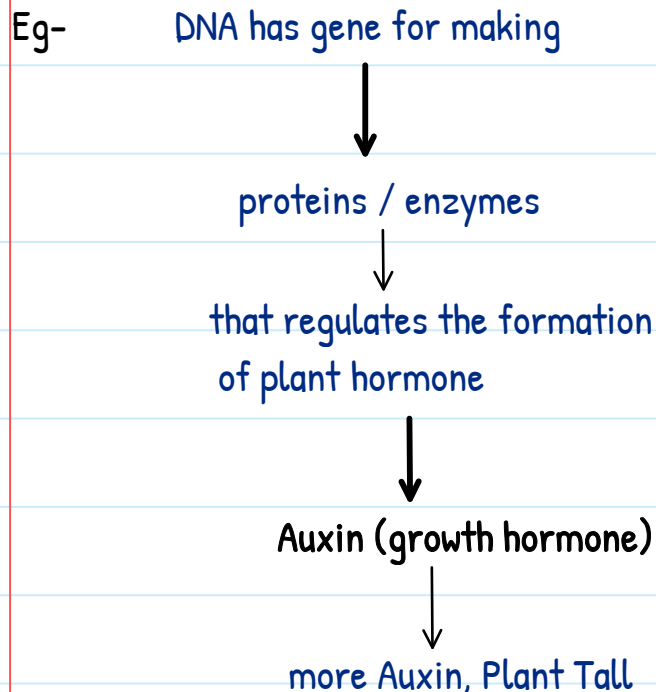
individual.

As in above cross, round, yellow, green, wrinkled, all four phenotypes inherited independently with respect to each other.

### HOW DO THESE TRAITS GET EXPRESSED ?

\*As we all know that cellulase DNA is the information source for making proteins in the cell.

\*A section of DNA that provides information for one protein is called the gene for that protein.



### MECHANISM OF INHERITANCE :-

- If both parents help to determine the trait in the progeny, then both parents must be contributing a copy of the same gene.
- So each germ cell have only one gene set.
- Each cell will have two copies of chromosomes one inherited from each parent.
- When two germ cells combine they will restore normal number of chromosomes ensuring the stability of DNA of species.



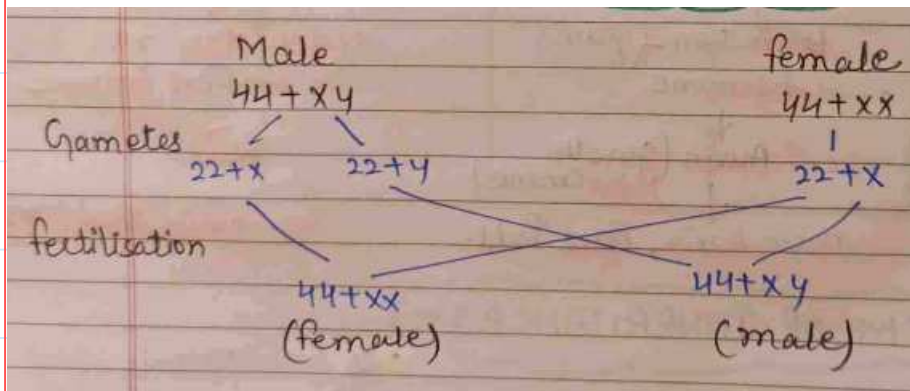
## SEX DETERMINATION :-

In most of the species, sex is determined genetically. But in some species, environmental factors are important in determining the sex of the developing individual

Eg:-

- (i.) In reptiles, the temperature at which the fertilised eggs are kept, determines the sex of the offspring.
- (ii.) In turtles, at high temperature more females are formed, while in lizards, it gives rise to more males.
- (iii.) In snails, individual can change sex in different conditions.

## SEX DETERMINATION IN HUMAN BEINGS :- (Sex determined genetically)



THE END

NOTES BY MRIDUL BHAIYA