UNIT 3 : GENETICS

Def^{n}. Genetics is the science of genes, genetic variation and heredity in living organisms.

Heredity (Inheritance) :- The transformation of traits (or character) from parents to their offsprings through gamete (sex cell) is called heredity (or inheritance).

Terminology in genetics:

1. Traits : distinguishing characterstics that are inherited. Ex. Tallness, shortness, Colour (white, black, red, etc), etc.
2. Alleles : Different versions of the same gene. In other word, Alternate form of a gene is called alleles.
   Ex. Tt T - one allele & t - another allele. Also Gg = G - One allele, & g - another allele. Because sexually reproducing organisms recieve half of the Chr. from one parent and half from the other.
3. Gene :- a section of DNA that determines a specific feature.

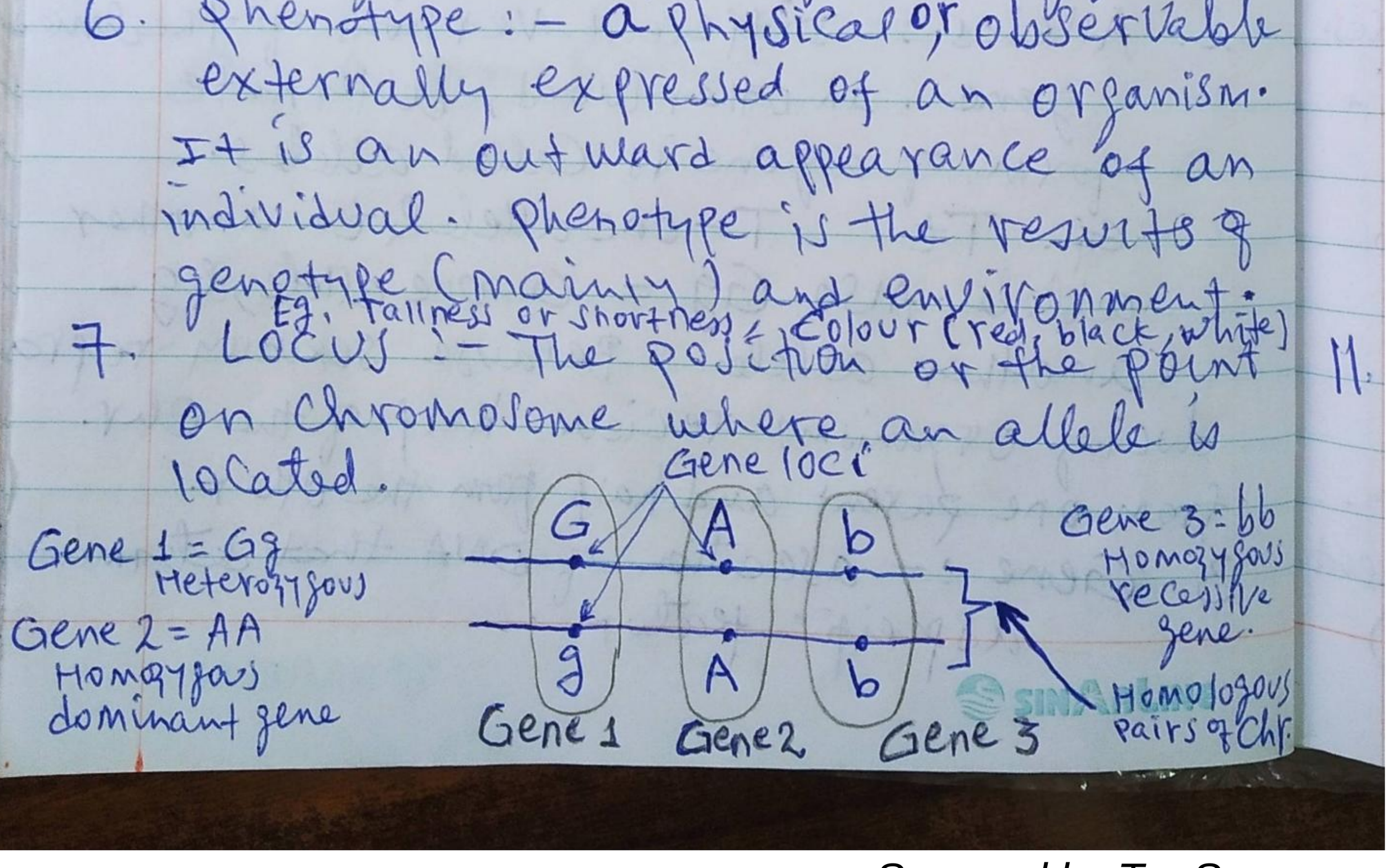
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4. Homologous pairs / Homologous Chromos :- a pair of chromosomes having the same gene sequence, each drived from One parent. Half Chr. inherited from Mother (Maternal) and half Chr. inherited from father (paternal) and Chr. Come in pairs called homologous pairs of chromosomes.

5. Genotype :- A genetic Material, which describes the pair of alleles for a particular gene possessed by an organism. Eg. Gg, GG, gg.

6. phenotype :- a physical or observable externally expressed of an organism. It is an outward appearance of an individual. phenotype is the results of genotype (mainly) and environment. Eg. Tallness or shortness / Colour (red, black, white)

7. LOCUS :- The position or the point on Chromosome where an allele is located.



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8 Heterozygous trait :- different allele for that gene on homologous pair, in which the dominant allele express itself. Ef. Tt, Gg.

9. Homozygous trait :- the same allele for that gene on homologous pair, in which both of them are Capital or both of them are small letters.
Ef. TT, GG, tt, gg.
TT = Homozygous dominant gene.
tt = Homozygous recessive gene.

10 Dominant trait :- The allele that express itself in heterozygous trait by masking (hidding) the effects of the other gene (the recessive allele.).
Ef. Gg = G- is dominant allele
g- is recessive allele.

11. Recessive traits :- The allele that do not expres itself in heterozygous trait. Because it is masked (hidden) allele. It expres itself in small Amounts in F2.
Ef. gg - recessive allele.
Tt = t- is recessive allele.
written in small letter.

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~~12. Punnet square :- a table that shows the possible combinations of gametes of two parents. It represents the possible genotype of the offsprings to produced, and the ratio in which they will occurs.~~

12. Punnet square : a table that shows:
- Possible combinations of gametes
- Possible genotype of the offsprings
- The ratio of the offsprings they will occur

Gregor Mendle (1822-84)
- G. Mendel was the father of genetics.
- He was an Austrian MONK, live in the Monastry.
- He made an experiments on garden pea plant (or Pitsum Sativum).
- He considered the father of genetics because his experiment laid down foundation ~~from~~ of rules of heredity.
- He was the first person that experimentally prove that characters (or traits)

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are determined by factors (gene).
- He prove the hereditary transformation of traits from parents to their offsprings through gametes
- He deduce the rules of inheritance from his results.
- He noticed the pea plants exhibited "Contrasting Characterstics"
- The Seven (7) contrasting traits or Characterstics that Mendle used in his experiments are :-

	Variant		
N°-	Traits	Dominant	Recessive
1	Stem height	Tall	Short
2	flower colour	purple	White
3.	flower position	Axial	Terminal
4	Pod colour	Green	Yellow
5.	Pod Shape	Smooth	Constricted
6.	Seed colour	Yellow	Green
7.	Seed shape	Round	Wrinkled

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Mendel Explained these results in the following ways :-

1 - The Only physical link between the generation is the gametes (or sex cells). these must pass the genes from one generation to the next.

2 - The heritable factors (alleles) separate when the gametes are formed. Each gamete Contains only one allele controlling the trait. This is Called Mendel Law of segregation. He also stated that the gametes fuse randomly at fertilization

3 If the two alleles in an individual are different / heterozygous, one is dominant and one is recessive. Dominant traits Mask the appearance of recessive traits.

4. Every trait (like flower colour, or seed shape or pod colour) is controlled by two heritable factors. These are Called genes. The heritable factors (genes) Maybe take different forms (alleles).

In addition to the law of segregation, Mendel also formulate the Law of Independent assortment. States that the Inheritance of one trait is

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independent of the inheritance of another trait. That is, the allele of one pair segregate independently of the alleles of another pair controlling a different features.

- A genome is all of an organism's gene. but genotype is typically refers to the genetic make up of a specific set of genes.

The alleles that do not segregates at gamete formation is called genetic linkage. (or linkage of genes). This genetic phenomenon not discovered by Mendel.

Test cross (or Back cross)

Test cross or back cross :- is to find out if an organism is ahomozygous or aheterozygous for a dominant trait is called test cross

Eg. If T- the dominant for, tall trait, and t- represents the recessive, short trait. The tall trait represented by two genotypes, TT (homozygote dominant) and Tt (heterozygote gene). To identify the two genotype, breeding If we breed with a plant whose

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genotype is definity known, we can make prediction of the outcome. This can be homozygous recessive allele.

There are two possible out comes.

possible out comes from atest cross:

Tall trait TT or Tt

Short trait (Homozygous recessive allele = tt

1 TT x tt

All offspring have genotype of Tt, & all are tall traits (One phenotype)

Tt x tt

Tt : tt

1 : 1

Two types of genotypes & phenotypes.

2

Therefore, in a test cross or back cross One genotype is known (homozygous recessive alleles), we can know the genotype of a parent. If it is only one phenotype it must be TT (homozygous dominant gene), If the out come is two phenotypes, it must be heterozygous (Tt) parental genotype.

3

- Test cross is to show the unknown genotype of the parent.

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Genotypes of Individuals in a pedigree

A - The allele for normal pigmentation
a - " " " albinism
Normal Pigmentation is AA or Aa
Individual with albinism is aa.

i How two carriers can produce an albino child
NORmal but carrier (Aa) parental genotype

Aa x Aa

	A	a
A	AA	Aa
a	Aa	aa

1AA : 2Aa : 1aa genotypic ratio

possible F1 phenotypes:
3 NORmal : 1 albino

2 Heterozygous allele (carrier) but phenotypically normal Parent (Aa) and albino (aa) parent:

Aa x aa

	a	a
A	Aa	Aa
a	aa	aa

Aa : aa
1 : 1
genotypic ratio

Possible F1 phenotypes 1 Normal : 1 albino

3 An albino parent (aa) with homozygous normal (AA) individual would never have an albino child.

AA x aa

All offsprings (children) phenotypes are normal.

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