PRINCIPLES OF INHERITANCE AND VARIATION

Genetics Is the studv cif principles apid mechanism of hered4 and variation. Gregor Johann Mendel Is known as 'father of Genetimt

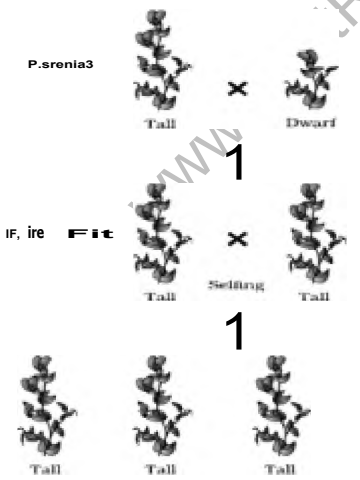
- Inheritance is the proce s.s by which charx_ter$ are pas.secl from one parent to progeny. It is. the basis of heredity..
- Variation is the degree 1:111 which progeny differ from their parents_ Variation nay be in terms of morphology, phy5ioloRy, vprtoloRy and behavioristic traits of individual belonging to same 5PeCie5-
- Variation occurs due to Resnuffliris of igeneichrornosornes, Crossing corer.. Mutation and effect of eniviionirnenit.

Menders Law of Inheritance

Mendel selected 7 contrasting characters of garden pee for his hybridization experiments.

alaratters	Dor'Inuit traits	Hecessime traitS
Plant height	Tall	dwarf
Flower/114d posilion	Paillary	Terminal
Prat/pod colour	Green	Yellow
Seed shape	Round	Wrinkled
Seed colour	Yellow	Green
Flower colour	Violet	White
Pod 5.heRe	Inflated	ConZiidled

Inheritance of one gene I Monohybrid cross)



.Ifr **Mendel called the 'factors' that passes through gametes from one generation. to next generation. Now a. day it is called as genes (unit of inheritance)_**

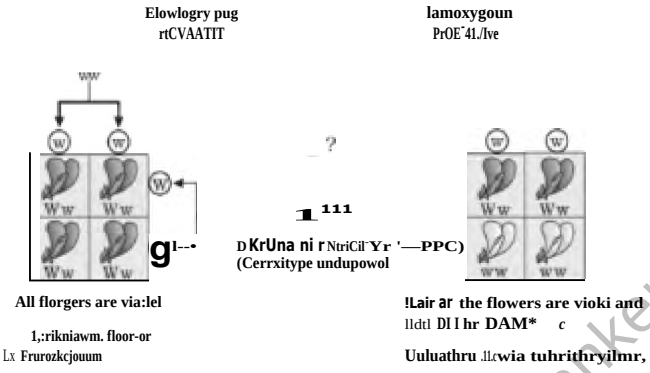
- **Genes that code for a pair of contrasting traits are known as Alain.**

°:* **Alphabetical 5yrnkPct are used to rePres-ent each gene, capital letter T11 for gene expressed in Fl generation and small letter** (tt) **For other gene_**

tt. **Mendel also proposed that in true kireecling tall and dwarf variety pair of .genes for height is homozygous (TT or ttl. TT, Ti or tt are called genotype and tall and dwarf are called phenartype.**

- **The hybrids which contain alleles which express contrasting traits are called heterozygous (Tt)_**
- **The monol-rybriel ratio of** F2 **hybrid R 3;1 phenotypic) and 11;1lgenotypic)..**

Test cross is the crass between an individual with dnminant trait and a recessive organism in order to knew whether the dominant trait is lhonbormous or heterozygous.



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Principle or Law of Inheritance

Based ork otiseryations of monohyhnid cross.. Mendel proposed two law of i n heritance-

Law of dominance sbtes that —

C.baracters are controlJed by discrete unit5 called factors_

Factors always occur in pair.

In a dissimilar pair cif factors Woe member of poi I dominate this othper.

Law of Segregation- alleles **du not blend and both the characters art retovered during gametes formation as in F, generation. During gamete formation trams segregate (separate)** from each **other arrd passes to** 'different gametes, Homozygous produce similar kinds of gametes but heterozygous produce to deferent **kinds of gametes with different**

Incompletedominance

- It is a post Mendelian dirscoyery. Incomplete dominance is the phenomenon of neither of the Nino **alleles being dominant SD that expression in the hybrid is a fine mixture or intermediate between the** expressions of two alleles.
- In **snapdragon (MfrabeIs johnpak, there are two types of pure breeding planim , red flowered and white** flowered. On crossing the how, F 1. plants possess pink flowers. On selling them, F2 generation has **ire& 2 pink: 1white. The pink flower is due to incomplete dorninarbm.**

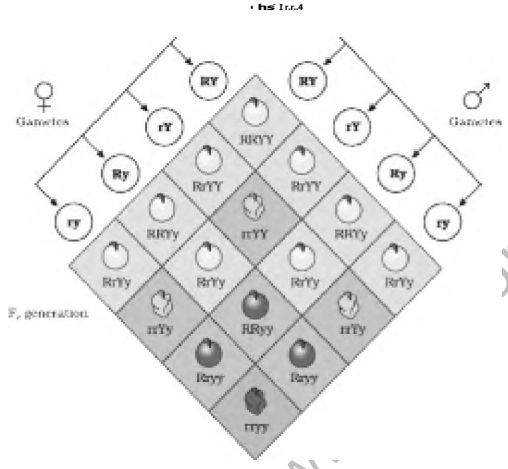
Co-diorninanEe

- It is the phenomenon of two lacking dominance -recessive relationship and both expressing. **thernselues in the organism.**
- **Hunan beings. ABC blood .grouping. are controlled by gene ?. The gene has three alleles 1.4. fa u Any person cont3 ins a ny two of three .genes. 0,•;. I's, are dominant over E**

Multiple Alleles

They are multiple forms of a mendelian factor or gene which occur an the same .gene locus distributed in different organisms In the gene pool with an organism carrying only two alleles and a gamete only one allele.

Inheritance of Two genes IlDihybrid Cross)



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Round }Bloke
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A cross made to study simultaneous inheritance of two pairs of mendelian factors of genes.

Law of indevennent Assortment – when two pairs of traits are combined lrti a hybrid, segregation of one pair of character is independent of other pair of characters_ In Dihybricl cross two new cornbinations, round and yellow and wrinkled and green are formed due to independent assortment of four traits, round, wrinkled, yellow and green_

Chromosomal Theory of Inheritance

- Chromosome as well as gene both occurs in pair. The hero alleles of a gene pair are located on homologous it fir« *horriolb.gous chrornimorms*_

a **Sutton and Boweri argued that the pairing and separation of a pair of chromosomes would lead to segregation of a pair of factors (gene) they carried**_

- Sutton united the knowledge of chromosomal ..eigregation **with rnenclelien principles-** and called it **the chromosornal** theory of inheritance.

Linkage and Recombination

4'When two genes in a Dihybrid cross were situated on same chromosome, the proportion of parental gene combination was much higher than the non-parental type. Morgan attributed this due to the physical association *or* the linkage *of th@.* two genes and coined the **linkage to** describe the physical association of genes **on same chromosome.**

4· The .generation of non-parental gene combination during Diliyhrid cross is called recombination_ When genes are located on same chromosome, they are tightly linked and show Dens low recombination.

Sex Determination

- Latter it was tiOsended that the ovum that receive the 5.perrn5 with x **kiddy** become female and those not becomes males, so this x body was called as sex chromosome and other chromosomes are called **autosornin.**
- In humans and other organisms **1Y types** of sex determination is **seen** but **in some insects** like **Drosophila,.** X0 type of sex cleterm ination is present.
- **In both types of sex determination, male produce two different types of gametes either with or without X** chromosome or some with X chromosome and some with w chromosomes, Such types of sex determination are called male heterogamety.

> In birds, two different types of gametes are produced by females in terms of sex chromosomes; this **type of sex determination is called female hetertgamety.**

Mutation is a phenomenon which results in alternation of **DNA sequence and consequerrtly results in the change** in the genotype and phenotype of an organism. The mutations that arise due to due to change in single base pair of DNA **a re called point Frit:Mind**_

Genetic Disorder

The analysis of traits In several of generation of a family Is called the pedigree analysis. The inheritance of a particular trait Is represented in family tree over several generations_ It is used *to* **trace-** the inheritance of **particular trait, abnormality and disease**_

Menciellanclisorder Includes-

a_ Hemophilia - sex linked recessive disease in whidh, in an infected individual a minor cuts leads to non .stop Weeding. hietercaygous female lca rrier) can transmit the disease to their son.

b. Sickle cell anemia- an autosome linked recessive trait in which mutant herno.globlin molecules

undergo polymerization under low oxygen tension causing change in shape of the REC from biconvex 4:11iSc teielorisated sickle like structure.

C. Pherrylikkonuirla• inborn error of metabolism inherited as autosornal recessive trait. The affected individual lacks an enzyme that converts the amino acids phenylalanine to tyrosine that results into mental retardation.

Chromosomal Clisorders-Failure of segregator' of chromatids during tell division results iri loss or gain of chromosome called aneuplaidy. The failure of cytokirbesis leads to two sets of chromosome called polyploldy,

a. Denim[P]s Syndrome. is due to presence of additional topyr of the chreimotorne number 21. The affected individual is short Mtlirecl with small rounded head, furrowed tongue and partially opened rrbOUthi. Mental Clew ell5prnent 'FS retarded.

h. Klinefleter's Syndrome- clue to presence of an additional copy of X-chrorrbosorne MY). Such persons have owerall masculine development. They are sterile.

C. Turner's Syndrome – canted due to the a bserket of one of the X chromosomes. Such females are Eterile *as* ovaries are rudimentary. They lack secondary sexual characters.