



**HEREDITY &
EVOLUTION**
One Shot Revision

Types of Reproduction

ASEXUAL

- Produces clones (genetically identical)
- Single parent
- Little variation in population
- only through mutations
- Fast and energy efficient
- Eg. budding, binary fission

SEXUAL

- Meiosis produces gametes (sex cells)
- 2 parents: male/female
- Lots of variation/diversity
- Slower and energy consumptive
- Eg. humans, trees



VARIATION



When we observe a corn field we see that there is little variation among the individual plants.

In animals including human beings, which reproduce sexually, we see distinct variations among individuals.



Variations more in sexual and less in asexual.

Types of variation

Somatogenic Variations:

1. These are variations that affect the somatic or body cells of the organisms.

They are also called the modifications or acquired characters since they are acquired by the individual during its lifetime.

Factors causing it are:

Environment: The environmental factors are the medium, light, temperature, nutrition, wind, water supply, etc. Such environmental factors bring about changes in the phenotype of the individual.

Germinal or Blastogenic Variations:

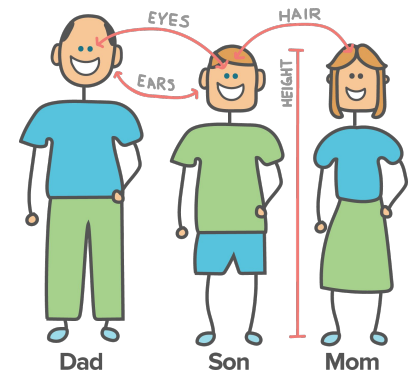
1. They are produced in germ cells of an organism & are inheritable.

- All the variations in the species do not have equal chances of survival in the environment.
- The survival of the variations depends upon the nature of variation.
- Variations enable stability to the population of various species by preventing them from getting wiped out during adverse conditions. Thus, variations help a species in survival.

Heredity :

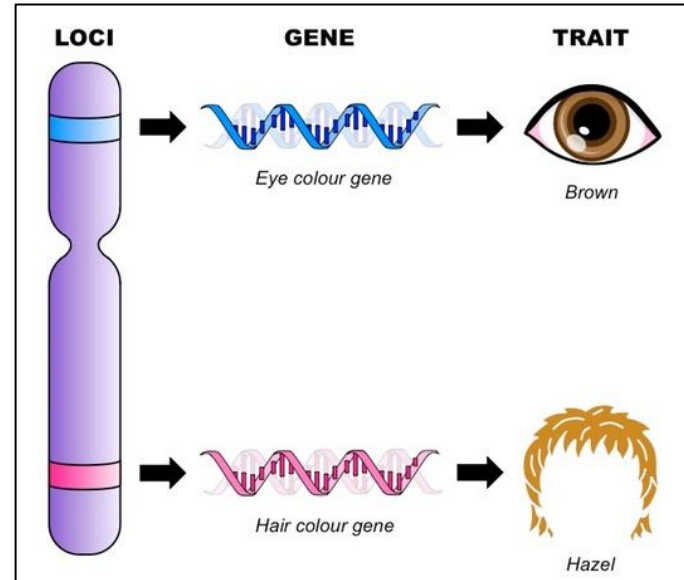
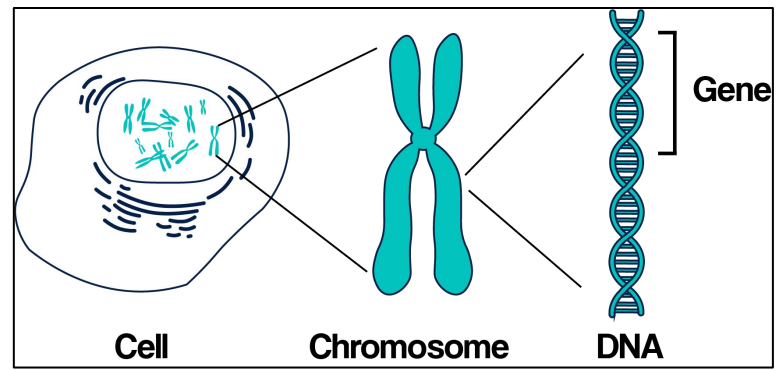
refers to the transmission of the characters from the parents to offsprings.

Inheritance - depicts the pathway of the genetic traits and its expression from one to another generation.

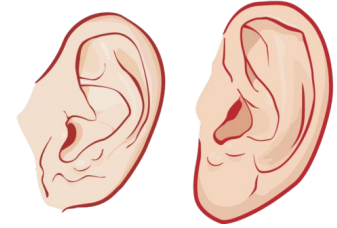


Traits are characteristic features of an organism, present in a physical form that is visible or in a physiological aspect of the organism.















ACQUIRED TRAITS	INHERITED TRAITS
<p>The traits that are acquired by an organism over the period of its lifetime are termed as acquired characters.</p> <p>No change in gene or DNA.</p> <p>Cannot pass from one generation to another.</p> <p>Eg: Dancing, Swimming, etc.</p>	<p>Transferred from parents to offspring.</p> <p>Occur due to change in genes.</p> <p>Pass from one generation to another.</p> <p>Eg: Height, Skin, Colour, etc.</p>



EGFR makes a protein known as the epidermal growth factor receptor, which positions the cell membrane to bind to other proteins outside the cell to help it receive signals to trigger cell growth, division, and survival.



Allele	Gene
<ul style="list-style-type: none">• Alleles are different variants of a gene.• Encode for a single protein.• Examples: Black, brown, blue or green eyes colour.	<ul style="list-style-type: none">• A gene is a short sequence of DNA encoding for a certain trait• Produce opposite phenotypes (heterozygous/Homozygous)• Examples: skin, hair or eye colour.

Seed shape	Seed colour	Pod shape	Pod colour	Flower colour	Flower location	Plant size
Round 	Yellow 	Inflated 	Green 	Purple 	Axial 	Tall 
Wrinkled 	Green 	Constricted 	Yellow 	White 	Terminal 	Dwarf 

Dominant traits

The traits that express themselves in an organism in every possible combination and can be seen are called Dominant traits

Recessive traits

A trait which is not expressed in the presence of a dominant allele is known as recessive.

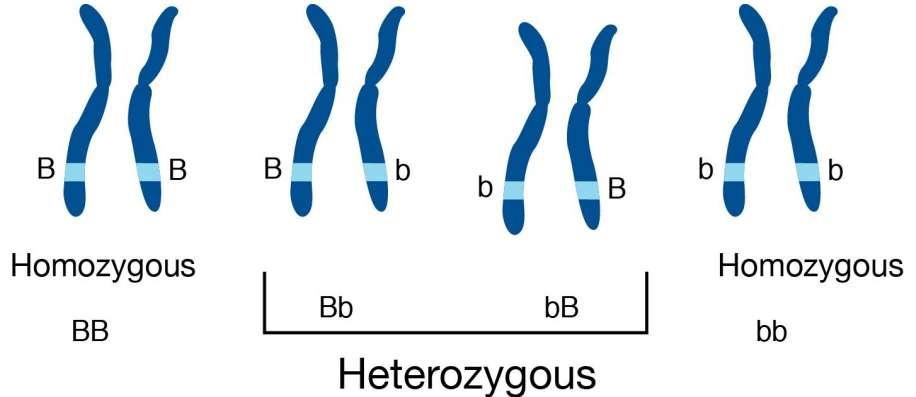
Some Terms to Understand

Homozygous:

When both the alleles of a gene are the same in the genotype, for example, TT, tt.

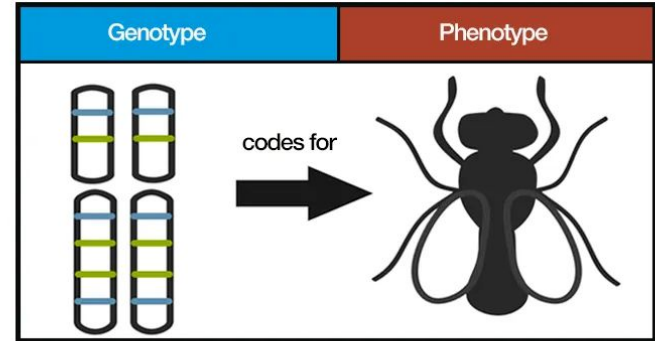
Heterozygous:

When both the alleles of a gene are different in the genotype, for example, Tt.

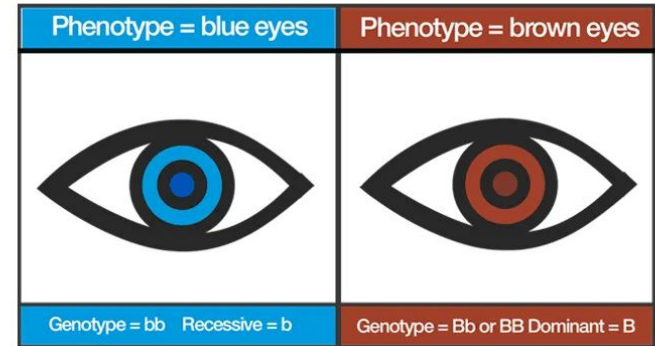


Some Terms to Understand

Genotype is the genetic makeup of the organism



Phenotype is the physical appearance of the organism



Gregor Johann Mendel (Father of Genetics)

Mendel was educated in a monastery and went on to study science and mathematics at the University of Vienna



Mendel blended his knowledge of science and maths to formulate laws of Inheritance

Reason for the selection of pea plants for the genetic experiments :

- **Easy to grow** in the garden.
- The flowers of pea plants are hermaphrodite, i.e **flowers have bisexual characteristics.**
- **Easy to obtain pure breed** plant through self-fertilization
- The **generation time of pea plants is less.**
- They have **excellent disease resistance** and have an optimal rate of survival.

Monohybrid Cross

Crosses that study the inheritance pattern of a single gene controlling one character are called monohybrid crosses.

Dihybrid Cross

A cross in which inheritance of two pairs of contrasting characters is simultaneously studied.

- In his early experiment, Mendel crossed a short plant (tt) and a tall plant (TT). These plants were called **parents**. Cross Pollination.
- Mendel observed that the offspring of this cross (**called the F1 generation**).
- Next, Mendel let the F1 generation self-pollinate. That means the tall plant offspring were crossed with each other and the generation produced was known as F2 generation.
- In monohybrid crosses, he studied one trait but in dihybrid he studied two traits simultaneously.

Mendelian Laws of Inheritance

MONOHYBRID INHERITANCE

VERSUS

DIHYBRID INHERITANCE

MONOHYBRID INHERITANCE

Inheritance of a single allele pair

Defined in Mendel's first law

Phenotypic ratio of the F₂ generation is 3:1

Genotypic ratio of F₂ generation is 1:2:1

Used to study the pattern of inheritance during the first and second generation offspring

DIHYBRID INHERITANCE

Inheritance patterns of two pairs of characters during a dihybrid cross

Defined in Mendel's second law

Phenotypic ratio of the F₂ generation is 9:3:3:1

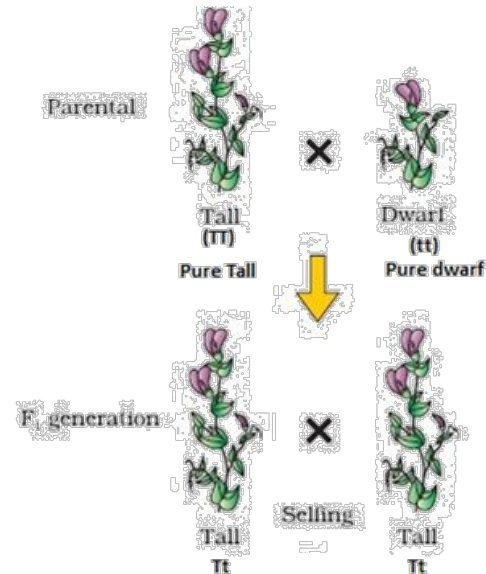
Genotypic ratio of F₂ generation is 1:2:1:2:4:2:1:2:1

Used to study the inheritance pattern of dominant and recessive characters for two different traits

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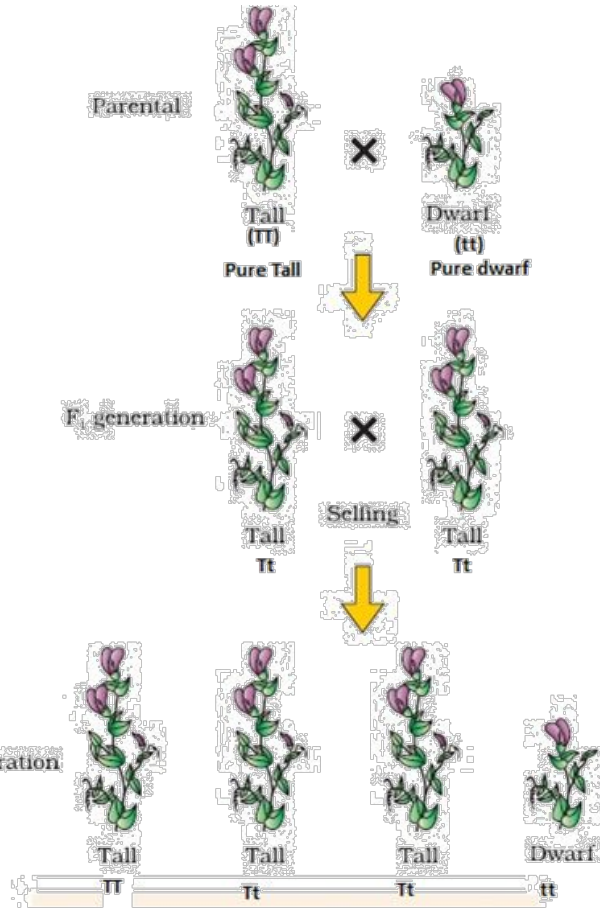
First Law :

Law of Dominance says that a gene has two contrasting alleles and one always expresses itself in the organism irrespective of the other allele. This allele is called dominant allele.



Second Law :

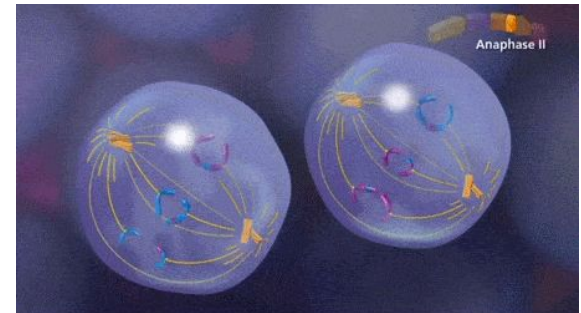
Law of Segregation says that traits get segregated completely during the formation of gametes without any mixing of alleles. It means When an organism makes gametes, each gamete receives just one gene copy, which is selected randomly.

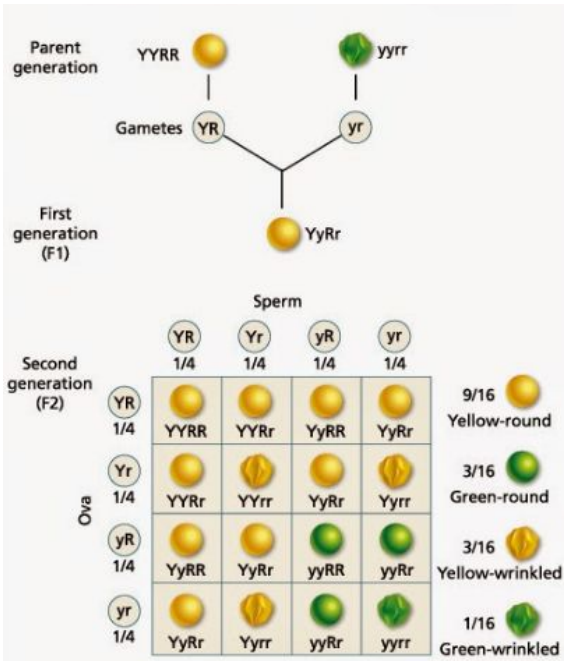


Third Law :

Law of Independent Assortment says that the traits can segregate independently of different characters during gamete formation.

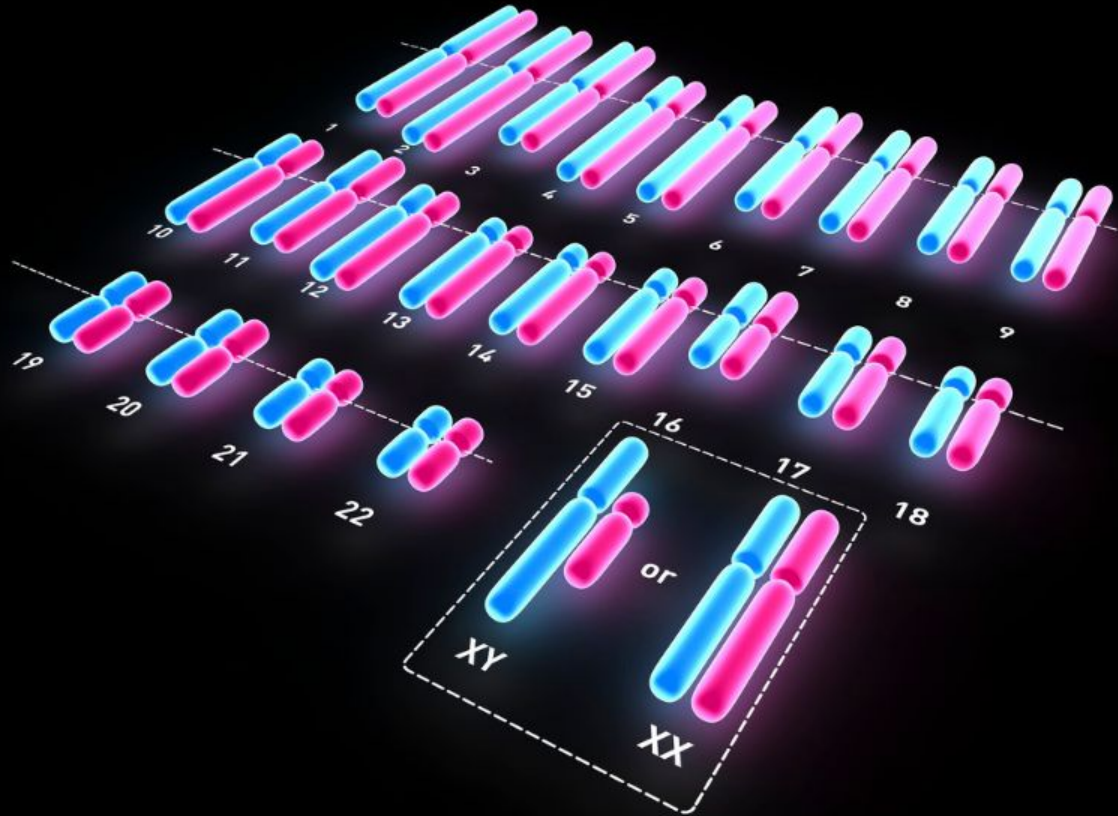
- In other words, during gamete formation, one pair of trait segregates from another pair of traits independently. This gives each pair of characters a fair chance of expression.
- We can say that the allele of a gamete which is received for one gene does not influence the allele received for another gene.

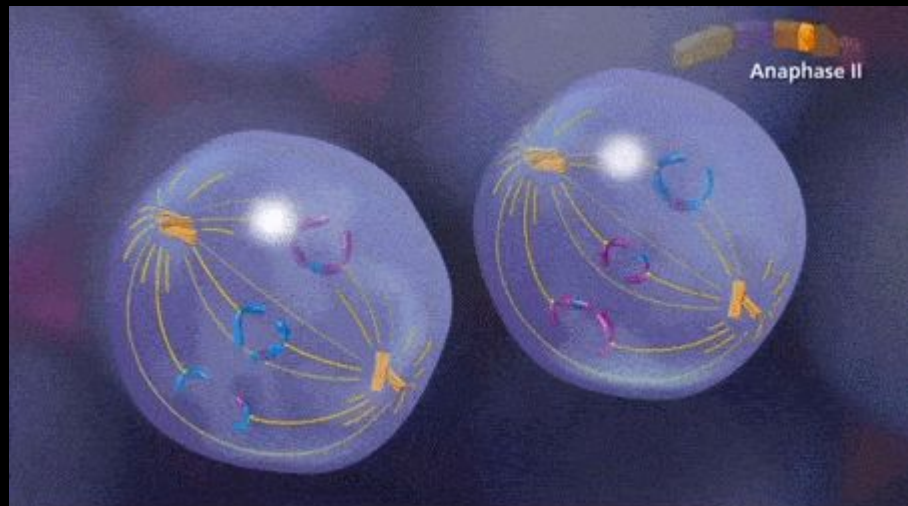




How Do Traits Get Expressed?

- Cellular DNA is the information source for making proteins in the cell.
- A part of DNA that provides information for one particular protein is called a gene for that protein for example; the height of a plant depends upon the growth hormone which is in turn controlled by the gene.
- If the gene is efficient and more growth hormone is secreted the plant will grow tall. If the gene for that particular protein gets altered and less of it is secreted when the plant will remain short.





- Sex chromosomes in Humans : A male has one X chromosome and one Y chromosomes, whereas female has two X chromosomes.
- Sex of a child depends on the two conditions which takes place during fertilisation. The two conditions are:
 - If a sperm carrying X chromosomes fertilises an ovum which carries X chromosome, then the child born will be **girl. - (XX)**
 - If a sperm carrying Y chromosomes fertilises an ovum which carries X chromosome, then the child born be a **boy. (XY)**

		Mother's Alleles	
		X	X
Father's Alleles	X	XX	XX
	Y	XY	XY

50% Female
50% Male

A cross between a tall pea-plant (TT) and a short pea-plant (tt) resulted in progenies that were all tall plants because

A. Tallness is the recessive trait

B. Tallness is the dominant trait

C. Shortness is the dominant trait.

D. Height of pea-plant is not governed by gene T or t

A zygote which has an X-chromosome inherited from the father will develop into a

A. Girl

B. Boy

C. Twins

D. Can't say

