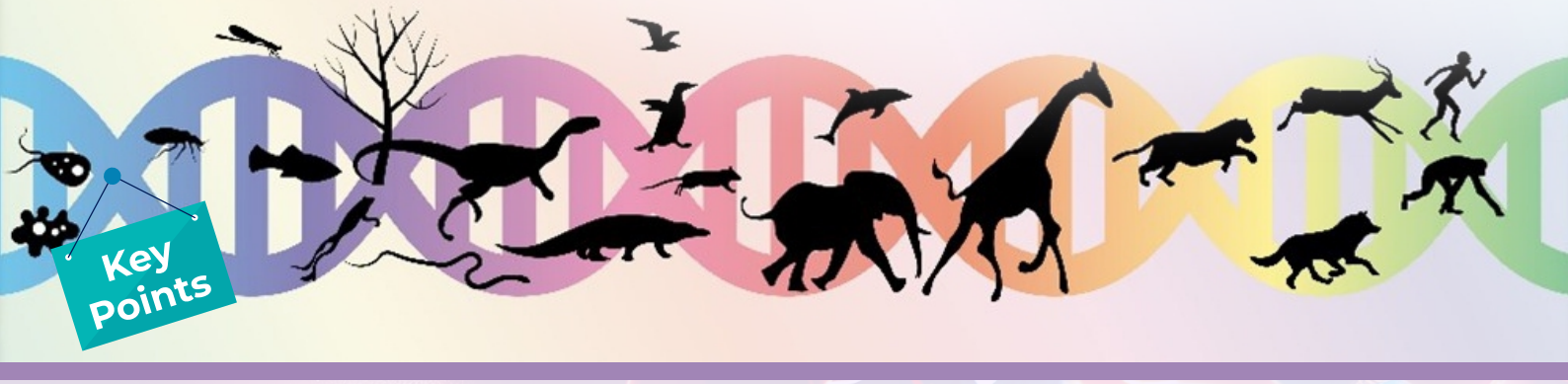
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Heredity



Key Points

- **Heredity is the passing of characters from parents to offspring's or from one generation to next.**

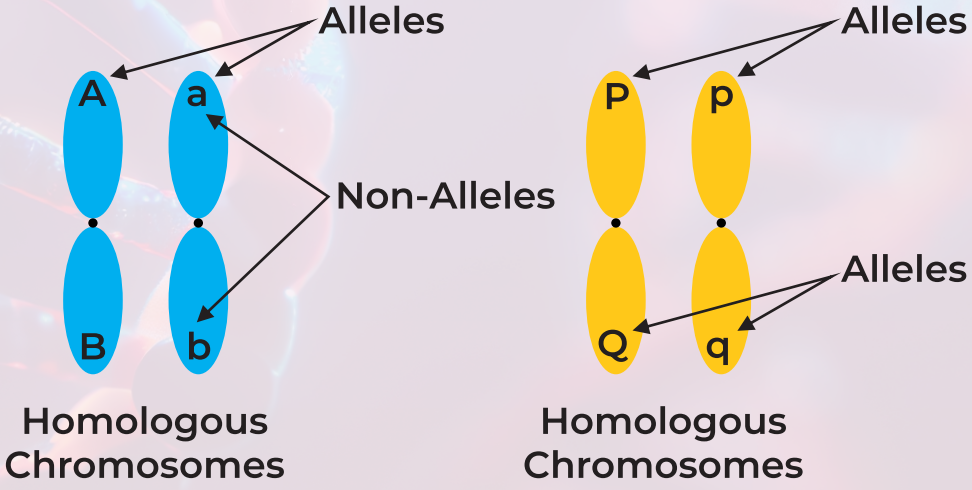
NOTE

- Genetics is a branch of biology which deals with the study of heredity and variation.
- Sexually reproducing organisms show greater variations which may lead to increased survival of individual. So greater diversity will be generated by sexual reproduction.
- The lowest part of the ear, called the earlobe, is closely attached to the side of the head in some of us, and not in others. Free and attached earlobes are two variants found in human populations.

Terminology used

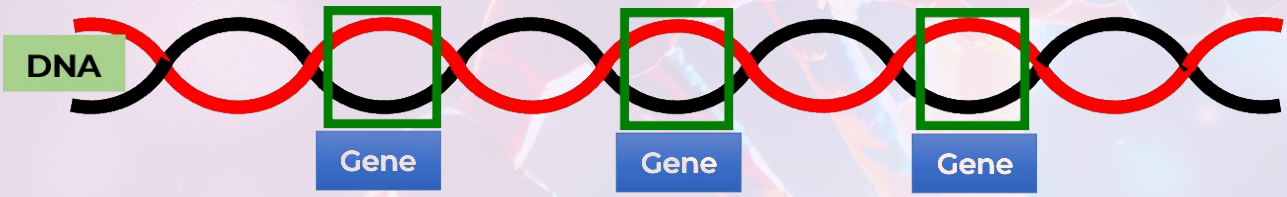
Alleles

- Alternative forms of a gene which are located on same position (loci) on the homologous chromosome are called alleles.



Gene

- Unit of heredity which transfers characters from parents to their offsprings during reproduction is called genes.
- Chromosome is a thread like structure in the nucleus of a cell. It is formed of DNA which carries the genes.



Gene

NOTE

- The differences in the traits or characters among the individuals of a species are called variations. e.g. Plant height - tall and dwarf.

Genotype

- The genetic constitution of an organism or the description of genes present in an organism e.g., TT, Tt, tt is called genotype.

Phenotype

- External and morphological appearance of an organism for a particular character is called phenotype. e.g., Tall, Dwarf.

Dominant

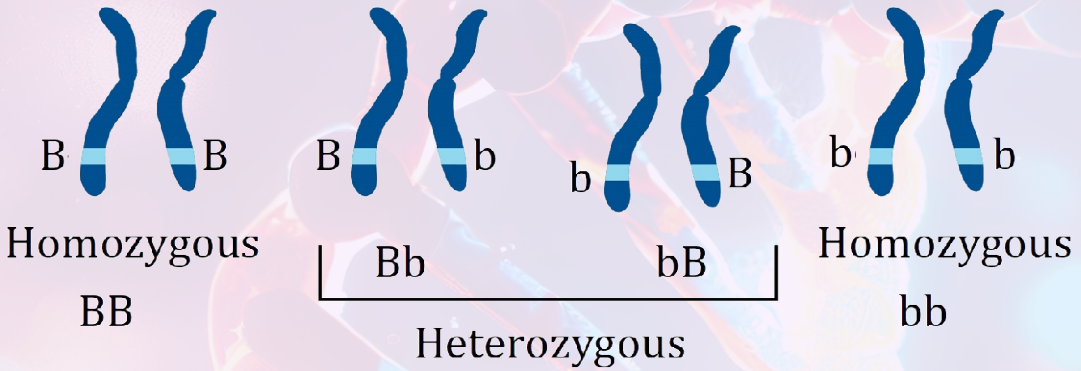
- Any character that appears in the F_1 generation offspring from a cross between parents possessing contrasting characters (such as tallness and dwarfness in pea plants) is called dominant character.

Recessive

- Recessive factor or allele is one which is unable to express its effect in the presence of its contrasting factor in heterozygous state.

Homozygous

- In homozygous condition, two factors of a character are same (TT).
- In hybrid/heterozygous condition, two factors of a character are different (Tt).



Mendel's Experiment

Gregor Johann Mendel (1822 - 1884)



Gregor Johann Mendel

- Mendel was an Austrian monk and scientist who first worked on heredity experiments and gave theory in 1866.
- Later in 1900 three different scientists Hugo de Vries, Tschermak and Carl Correns rediscovered Mendel's laws of inheritance.
- Mendel is called father of genetics.

Mendelian experiments

- In 1856-57, he started his historical experiments of heredity on pea (Pisum sativum) plant.



Pea Plant



Flower of Pea Plant

NOTE

- Mendel said that each character is controlled by a pair of factor which is now known as gene.

Advantage of Pisum sativum

- Pisum sativum is a unique plant selected by Mendel for his experiments which had following importance :

	Property	Advantages of properties
a.	Short life cycle	Results of experiments were obtained in less time.
b.	Could be grown throughout year	More experiments can be done in a year.
c.	Choice of cross or self fertilization	Mendel could conduct experiment as per his desire.
d.	7 pairs of allelic characters	Large number of choice for experiments.
e.	Large number of offspring	Good number of data for statistical analysis.

Pairs of allelic characters found in garden pea plant:

	Properties	Dominant	Recessive
1.	Height	Tall	Dwarf
2.	Colour of seed	Yellow	Green
3.	Colour of pod	Green	Yellow
4.	Colour of flower	Violet	White
5.	Shape of seed	Round	Wrinkled
6.	Shape of pod	Inflated	Constricted
7.	Position of flower	Axial	Terminal

Monohybrid cross

- It is a cross in which only one character is studied at a time.
- In his first monohybrid cross, Mendel crossed a pure breed tall plant (TT) and a pure breed dwarf plant (tt).
- He found that in F_1 generation only tall plant were born out of these seeds, no intermediate character or mixing or blending was observed by him. Mendel termed tallness as dominant and dwarfness as a recessive character.

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IN F_2 GENERATION :
Phenotypic ratio was → 3 : 1
Genotypic ratio for was → 1 : 2 : 1



Tall × Short
(TT) (tt)

All Tall offspring
(Tt)

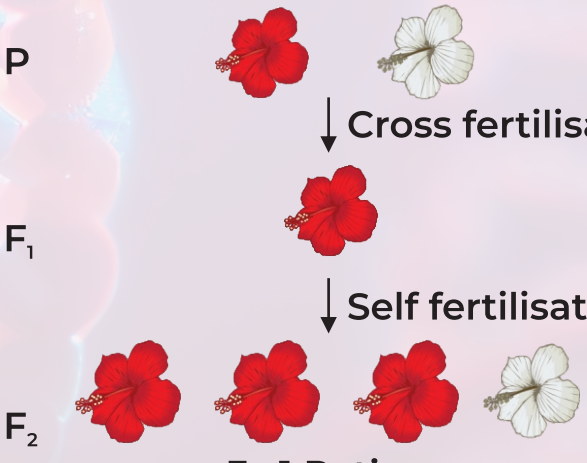


Tall × Tall
(Tt) (Tt)

Tall × Tall Tall × Short
(TT) (Tt) (Tt) (tt)

Mendel's postulates

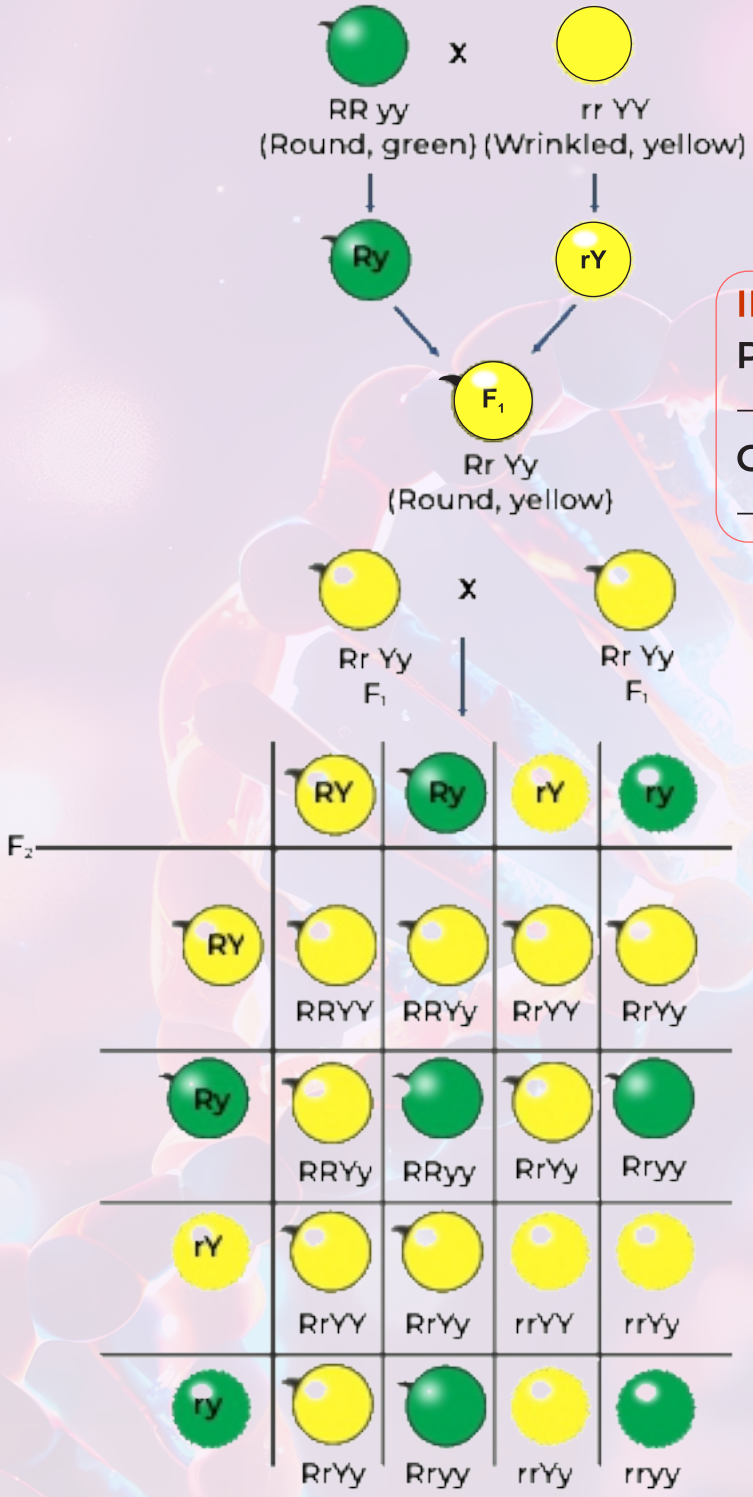
- In heterozygous conditions out of the two alleles only one allele is able to express its effect and it is called dominant allele and other which does not show its effect in heterozygous condition is called recessive allele.
- When F_1 plants are grown and allowed to self-pollinate he got many seeds and when they were grown he found that the ratio of tall plants and dwarf plants was 3 : 1 respectively.
- The dwarfness which was not visible in F_1 generation reappeared in F_2 generation.
- The dwarfness which was not visible in F_1 generation reappeared in F_2 generation.



3 : 1 Ratio

Monohybrid cross

Dihybrid cross



IN F_2 GENERATION :

Phenotypic ratio was

→ 9 : 3 : 3 : 1

Genotypic ratio for was

→ 1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1

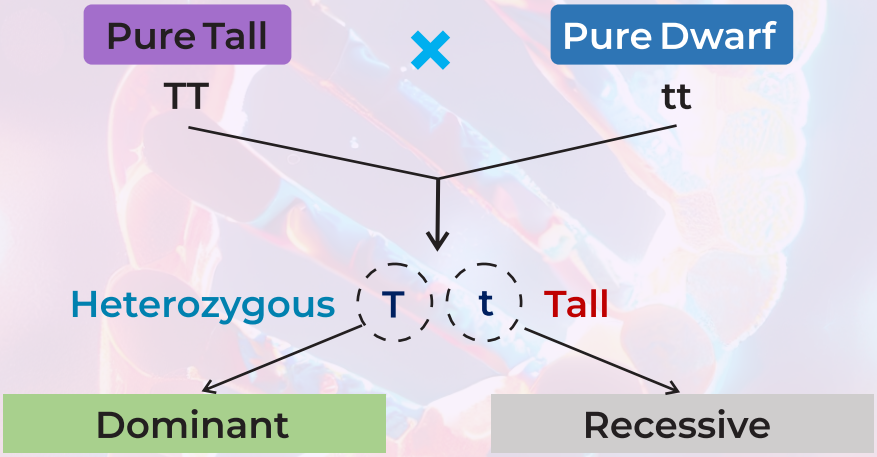
315 round, yellow	9
108 round, green	3
101 wrinkled, yellow	3
32 wrinkled, Green	1
556 seeds	16

Independent inheritance of two separate traits.
Shape and colour of seeds (Dihybrid cross)

Mendel's laws of inheritance

Law of dominance

- In crossing between organisms pure for contrasting characters of a pair, only one character of the pair appears in the F_1 generation.
- This character is termed dominant while the one which does not express itself in F_1 generation is termed recessive.



Law of segregation

- Different alleles or genes of a character remain together in an individual and segregate randomly at the time of gamete formation. This is also known as the Law of purity of gametes.

Law of independent assortment

- This law states that when individuals differ in two or more than two pairs of contrasting characters are crossed, the inheritance of any one pair is not affected by the presence of the other.
- E.g. The inheritance of seed shape character is not related to the seed colour character. Rather, the two characters inherit independently of each other.

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Sex determination

- It is the phenomena of determination of sex of an offspring.
- Factors responsible for sex determination

1. Environmental
2. Genetic

Sex determination in humans



Chromosomes

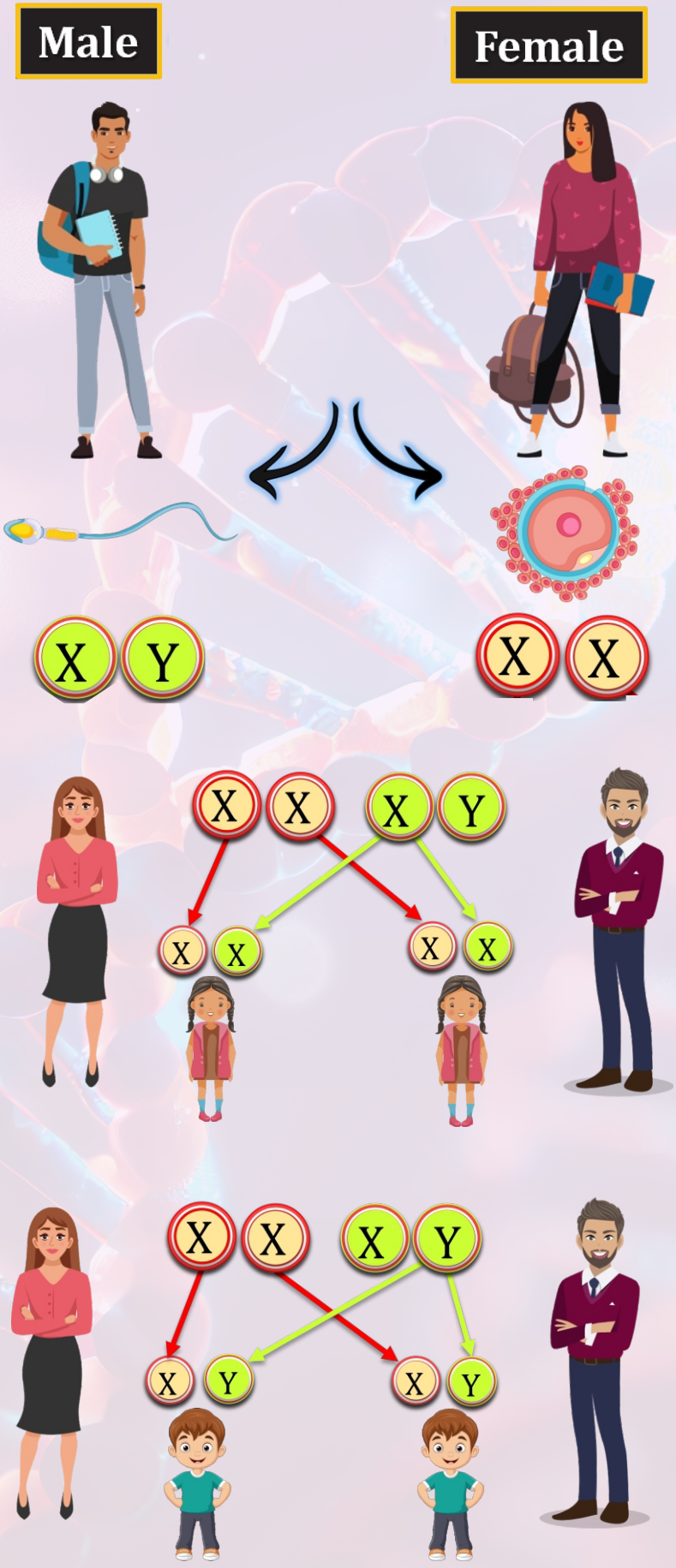
- In humans, the diploid number of chromosomes is 46, or 23 pairs present in the nuclei of their cells.

1. There are 22 pairs of homologous chromosomes (look alike) called autosomes.

2. The 23rd pair which differs in males and females are called sex chromosomes or allosomes.

- These two chromosomes determine the sex of an individual, and are indicated by the letters X and Y.
- The gametes (egg and sperm) have only one set of chromosomes.

Two important things to be noticed here are



- Birth of male and female child has equal %, because X and Y chromosomes are produced in equal number and it all depends on either sperm with X or Y chromosome fuses with egg containing X chromosome.
- Birth of male and female child depends on Y or X chromosomes of male, female always produce X chromosomes, so have no significant role in sex determination of offspring.