

6. UNRAVELLING GENETIC MYSTERIES

CONTENT

- * Genetics -Heredity and Variations.
- * Experiments and inferences of Gregor Johann Mendel.
- * Genes and Alleles.
- * DNA, Nucleotides, RNA.
- * Gene action (protein synthesis).
- * Chromosomes, Sex determination.
- * Variations – Fertilization, Crossing over & Mutation.

1. What is genetics (Hereditary science) ?

Genetics is the branch of science that deals with heredity and variations.

- **Heredity** is the transmission of characters from parents to their offsprings.
- **Variations** are the features seen in offsprings that are different from their parents.



2. Who is known as 'the Father of Genetics' ? Why is he known as so ?

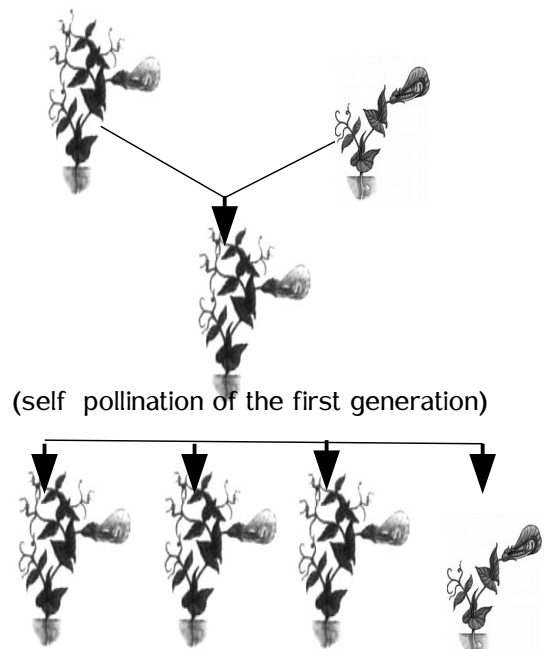
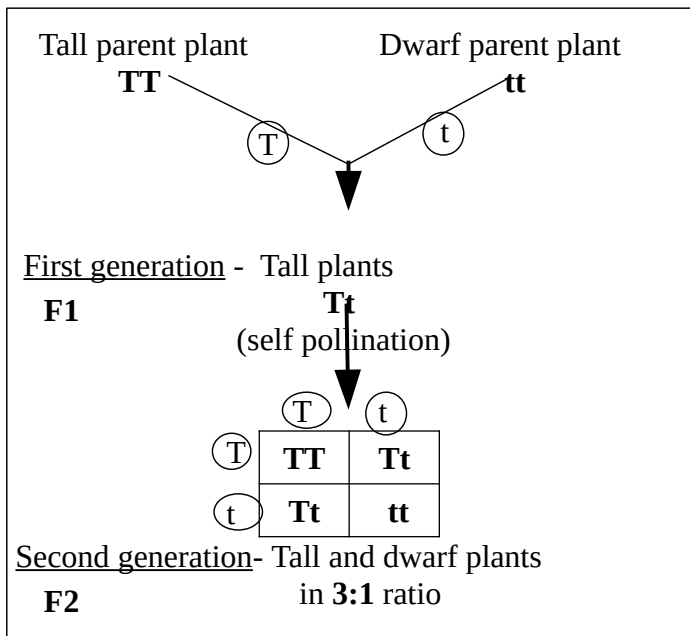
Gregor Johann Mendel.

The inferences from his hybridization experiments in pea plants led the foundation of genetics.

3. What were the traits which Gregor Mendel considered for his hybridization experiments in garden pea plants ?

- Height of the plant
- Position of the flowers
- Shape of the seeds
- Colour of seeds
- Colour of flowers
- Shape of the pods
- Colour of the fruits

4. Illustration of Mendel's experiment on garden pea considering one pair of contrasting traits of a character height. (tallness-dwarfness)



5. What, according to Mendel, the terms dominant character and recessive character are referred to ?

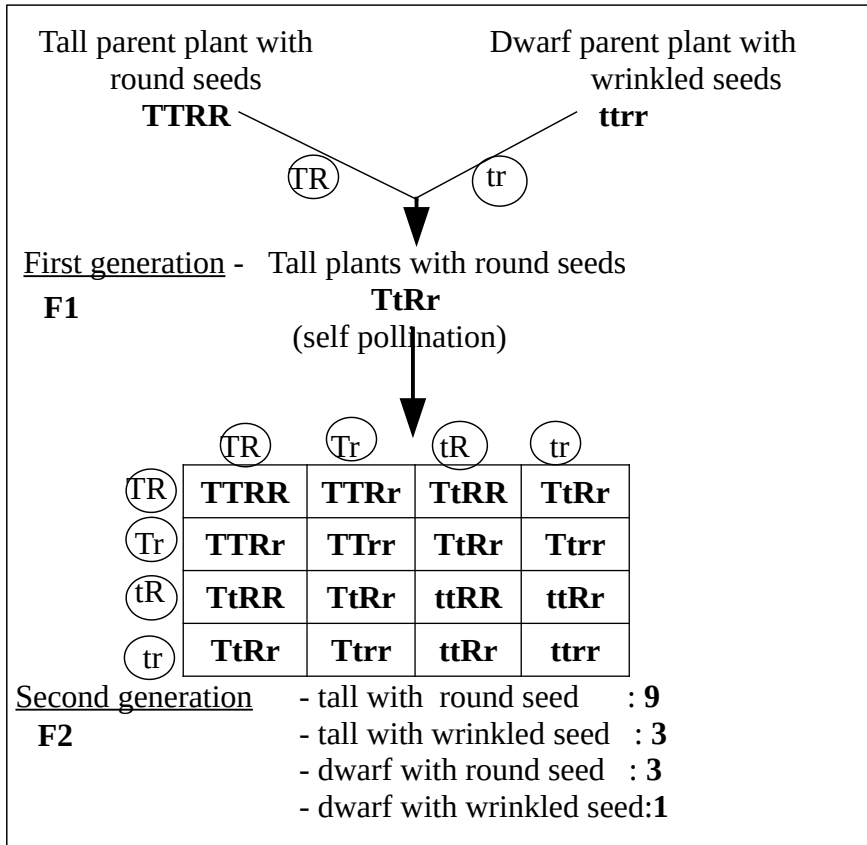
The expressed character, out of the two factors of a particular trait, is known as **dominant** character and the other factor which remains hidden, is known as **recessive** character.

For example, if 'Tt' are the two factors of the trait 'height', the 'T' is dominant and 't' is recessive.

6. When Gregor Mendel conducted experiments considering one pair of contrasting characters, the plants obtained in the second generation were always in ----- ratio.

3:1

7. The main inferences of Gregor Mendel that paved the way for the emergence of Genetics ?
- A trait is controlled by the combination of two factors.
 - One character is expressed (dominant character) and the other remains hidden (recessive character) in the first generation.
 - The trait which remains hidden in the first generation appears in the second generation.
 - The ratio of the dominant and recessive traits in the second generation is 3:1 .
8. Illustration of Mendel's experiment considering a pair of contrasting traits of **two** characters. (tallness-dwarfness and round seed- wrinkled seed)



Plants in F2 generation
in
9:3:3:1 ratio

9. The hereditary factors, first described by Gregor Mendel, are now known as ----- ?
Genes.
10. Define the term 'genes'.
Genes are parts of DNA that control metabolic activities and responsible for specific characteristic feature.
11. Define the term 'allele' ?
Alleles are the different forms of a gene that controls a trait.
Eg:- Suppose 'Tt' is the factors responsible for the trait, 'height', the allele 'T' determines tallness and the allele 't' determines dwarfness.
12. Offsprings of the same parents may show differences among themselves. Why ?
Fertilization causes change in the allele combination in the chromosomes and it causes variations in the the offsprings.
13. How many chromosomes are seen in each cell of human being ?
46 chromosomes (23 pairs)
Out of which, 44 (22 pairs) are somatic chromosomes and 2 (one pair) are sex chromosomes.
44+XX is female and 44+XY is male
14. The two types of sex chromosomes ?
X and Y chromosomes. [XY in males and XX in females]
15. Y chromosome of male gamete : Male child ;
X chromosome of male gamete : ----- ?
Female child
16. Who proposed the double helical model of DNA ?
James Watson and Francis Crick (in1953)

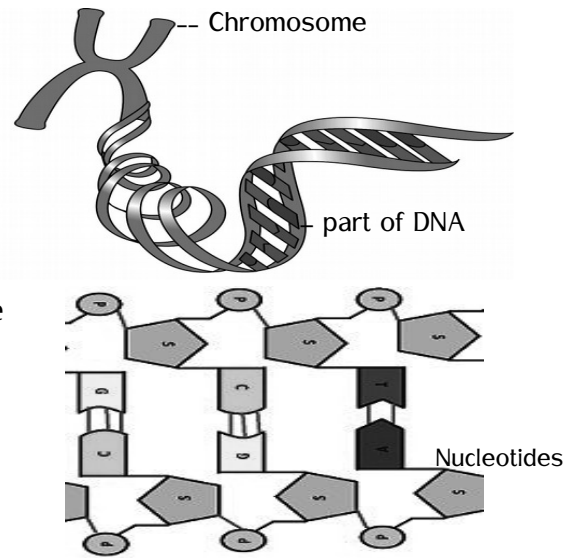


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17. Explain the Watson-Crick model of DNA.

Chromosome contains DNA and it is made up of several nucleotides. DNA is a double helical structured molecule. The two long strands of DNA contain deoxyribose sugar and phosphate groups, and its steps are made of pairs of nitrogen bases. The nitrogen base, adenine pairs with thymine and the nitrogen base, cytosine pairs with guanine.

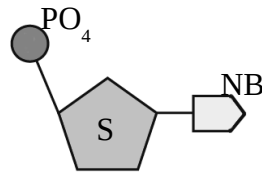
In other words, DNA molecule is made up of four kinds of nucleotides, namely adenine nucleotide, thymine nucleotide, cytosine nucleotide and guanine nucleotide.



18. Define a **nucleotide**.

Nucleotides are the basic units of nucleic acids, (DNA, RNA).

A nucleotide is made up of a nitrogen base, a sugar molecule and a phosphate group.



19. Molecules seen in the nucleic acids that contain nitrogen and are alkaline in nature ?

Nitrogen bases.

20. Adenine : Thymine;

Guanine : ----- ?

Cytosine.

21. Comparison between the two nucleic acids, DNA and RNA.

	DNA	RNA
Number of strand	2	1
Type of sugar	deoxyribose	ribose
Nitrogen bases	Adenine, thymine , cytosine, guanine	Adenine, uracil , cytosine, guanine

22. How do genes act ?

Genes, which are the specific parts of DNA, act through synthesizing proteins.

Different types of RNA involve in this process. Proteins are formed in the ribosomes.

23. Name different types of RNA.

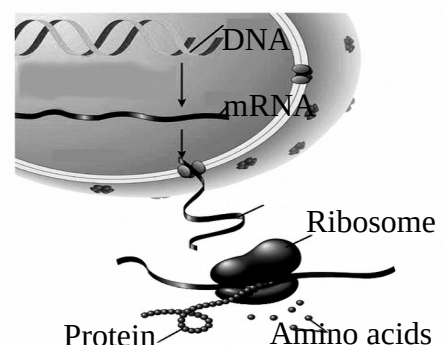
mRNA (messenger RNA), **tRNA** (transfer RNA), **rRNA** (ribosomal RNA).

24. DNA unwinds and ----- is synthesized which carries the information from DNA to the ribosomes.

mRNA.

25. The stages of protein synthesis of DNA (The action of genes) ?

- mRNA, which carries information, forms from DNA.
- mRNA reaches outside the nucleus.
- mRNA reaches ribosome.
- Based on the information, amino acids are transferred to ribosomes by the tRNA.
- Ribosomes bind amino acids to form protein molecule.



26. The cell organelles where protein synthesis occur ?

Ribosomes.

27. What are the reasons for variations in organisms ?

Fertilization, Crossing over and mutation.

28. How fertilization causes variations in offsprings ?

During fertilization, combination of alleles changes, which causes variations.

29. Define the term '**crossing over**'. How does crossing over cause variations ?

The process of pairing of chromosome and exchanging their parts, during the initial phase of meiosis, is called crossing over. As a result of this, part of one DNA becomes the part of another DNA, causing a difference in the normal distribution of genes. This may leads to the expression of new characters (variations) in the offsprings.



30. Define **mutation**.

Mutation is a sudden inheritable change in the genetic constitution of an organism. It may occur due to the defects in the duplication of DNA, certain chemicals, radiations etc.

Mutations lead to variations in characters. Certain mutations are harmful while certain others are helpful for survival of the organism.

31. The protein which gives colour to our skin ?

Melanin.

32. What may be the reason in the colour difference of skin in people living in various parts of the world ?

Melanin, a pigment protein, imparts colour to the skin . The difference in gene function is the reason for colour differences of skin. The differences in skin colour is mere an adaptation to live under sun.