

1. **Gene**: Gene is the functional unit of heredity. However, in chemical terms, a gene is a linear array of nucleotides or a segment of DNA which can code for an RNA that in turn may code for a protein.

▷ Exception: A. RNA virus: Where RNA ~~is~~ is the genetic material itself.

B. Non-coding RNAs: which do not code for any protein product.

2. **Chromosome**: In eukaryotes, the chromosome is a linear DNA molecule complexed with histone and non-histone protein. The 'Nucleo-Protein Complex' is highly folded, coiled and recoiled to form a solenoid structure. A chromosome is visible only in dividing cells.

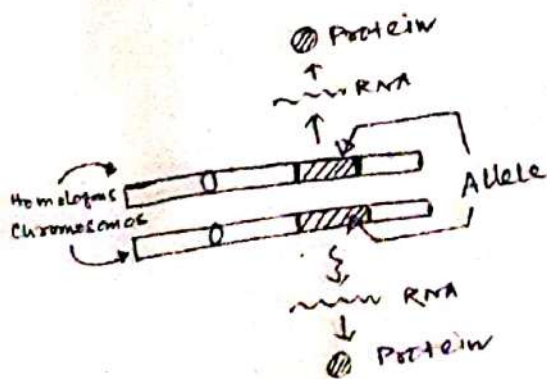
In prokaryotes, the chromosome is a ~~very~~ circular double helical DNA molecule.

In virus, it may be in the form of either DNA or RNA.

3. **Locus**: Each gene occupies a specific position in a chromosome. This position is called a 'locus'.

4. **Allele**: Alternative forms/^{copies} of a gene located on the same locus of two homologous chromosomes. One copy is inherited from ♂ parent and another one is inherited from ♀ parent.

- Features:
1. Affect same trait.
 2. Located on the same locus.
 3. No Recombination can occur between alleles.
 4. No Complementation can occur between alleles.

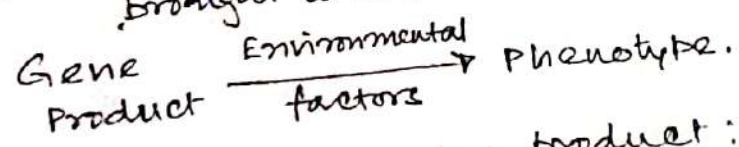


STUDY MATERIAL - LECTURE #1
6.04.15

- Abhishek Mishra
5. **Homo allele**: When both forms of a gene have identical nucleotide sequence / code for the product with identical function.
 6. **Hetero allele**: When two forms of a gene have different nucleotide sequence and code for products with varied function.
 7. **Homozygous**: An organism with two identical alleles for a particular character is said to be "Pure" or 'homozygous' for that character.
 8. **Heterozygous**: An organism with two non-identical / contrasting alleles for a particular character is said to be 'heterozygous' for that character.

'Zygos' means = A pair

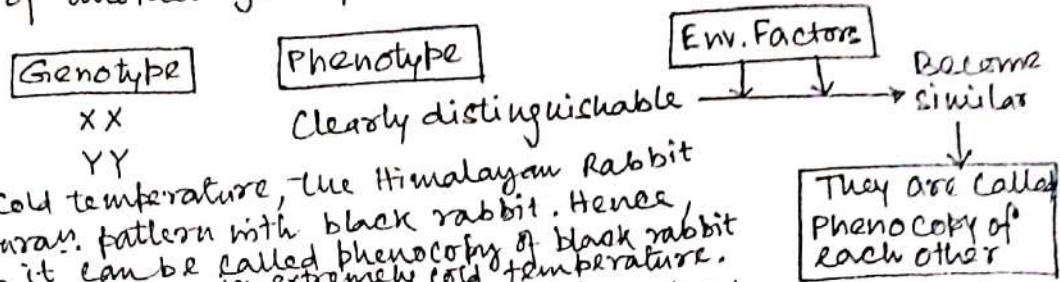
9. **Pure line**: Generations of homozygous individuals which produce offsprings of only one type.
10. **Genotype**: The written expression of all the genes possessed by an individual.
11. **Phenotype**: The ultimate visible result of gene products brought to expression in a given environment.



Effect of Environment on gene product:

- (a) Rabbits of the Himalayan breed develop black pigment at the tips of the nose, tail, feet and ears. However, if Rabbits of same genotype are raised at very high temp. then all white rabbit is produced.
 Explanation: - The gene responsible for black colouration actually codes for ~~enzyme~~ an enzyme which is temperature sensitive. This enzyme is inactivated at high temperature, resulting in a loss of black pigment.
- (b) The flowers of Hydrangea becomes blue if grown in acidic soil and becomes pink if grown in alkaline soil.
 Explanation: - This occurs due to the interaction of gene products with the H^+ ion concn. of their environment.

Phenocopy: Phenocopy is the term given to the individual whose phenotype becomes identical/similar to the individual of another genotype, in a particular environmental condition.

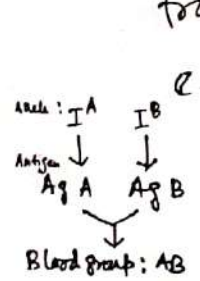


e.g.: In extremely cold temperature, the Himalayan Rabbit shows similar colour pattern with black rabbit. Hence, it can be called phenocopy of black rabbit in extremely cold temperature.

12. **Dominant & Recessive**: The allele which can phenotypically express itself in homozygous as well as heterozygous state, is called a dominant allele.

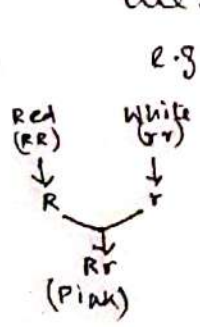
Whereas, the allele which can phenotypically express itself only in homozygous state, is called a recessive allele.

13. **Co-Dominance**: Certain alleles lack dominant and recessive relationships. When in heterozygous condition, each allele is capable of some degree of expression and hence the heterozygous genotype gives rise to a phenotype distinctly different from either of the homozygous genotypes.



e.g.: **ABO Blood group**: The alleles governing the ABO blood group: IA and IB are co-dominant alleles and in heterozygous condition, gives rise to a mixed phenotype called AB.

14. **Incomplete Dominance**: Incomplete dominance is a form of intermediate inheritance in which one allele of a specific trait is not completely dominant over the other allele. As a result a third phenotype is produced in which the expressed physical trait is a combination of the dominant and recessive phenotypes.



e.g.: ① **Flower Colouration in Snapdragon plants**: Incomplete dominance is seen in cross-pollination experiments between red and white snapdragon plants. The dominant allele (R) that produces red colour is not completely ~~expressed~~ dominant over the recessive allele (r) that produces the white colour. The resulting offsprings are pink. ② **Tay-Sachs disease in human**: lipid storage disorder - Mutation in Hexosaminidase A

Co. dominance

Both alleles are expressed completely i.e. the phenotype of both the alleles can be distinguished properly.

Incomplete Dominance

* The alleles are not expressed completely, i.e., the phenotype of the alleles are blended and a totally new phenotype is produced.