GENE · MUTATION.

INTRODUCTION:- "Like tends to beget alike" It is an universal and an old belief. but Sometimes it does not happen. The offsprings are found to be born with a little differences in their characters in Comparison to their parents. Such differentiation may be either variation or Mutation. Variation is defined as gradual and small change. where as mutation is defined as a drastic and sudden change.

The term mutation is used to designate both the process by which hereditary changes arise and outcomes or endo products of such process (Mutants). The first Mutation theory was given by de Vries (1848-1935) According to which the new forms evolved suddenly by larger changes rather than by gradual accumulation of smaller variation.

classification of Mutation:-

Mutation Can be divided into two Major Categories:-

(a) Gene or point Mutation.
(b) chromosomal Mutation (or abberation)

Gene Mutation affects only one or few nucleotides within a gene while chromosomal Mutation affects the numbers of chromosome or arrangement of genes on the chromosome.

Gene Mutation:-

The Concept of the gene has largely lost his origin meaning. The chemical structure of D.N.A has led to a new theory of Cause of mutation. As gene is Composed of D.N.A, Mutation is due to change within the gene or D.N.A ~~Mutated~~ Molecule have Coded information in

the form of particular sequence of its base pairs (purine and pyrimidines). A change in the sequence of its base pair changes the function of the gene causing a change in the phenotype. So the gene Mutation is the result of an alternation in the sequence of purine and pyrimidine pair in D.N.A.

Methods Causing gene Mutation:- According to Watson & Crick mistakes in pairing might have occured at the time of duplication of D.N.A. Gene Mutation occure by the following Methods:-

1. **Substitution:-** This Methods takes place by the following two Methods:-

a). **Transition:-** Transition involves the Conversion or replacement of one purine base to another purine or a pyrimidine to a pyrimidine. During D.N.A replication, the different purine or pyrimidine having altered base pairing property guides an incorrect base into position. Thus one normal base pair is replaced by another pair which is genetically incorrect.

$$A = T \longleftarrow\!\!-\!\!-\!\!-\!\!\rightarrow G \equiv C.$$

$$G \equiv C \longleftarrow\!\!-\!\!-\!\!-\!\!\rightarrow A = T.$$

b) **Transversion:-** Transversion involves the substitution of a purine by a pyrimidine or vice-versa. The substituted pyrimidine normally pairs with the pyrine resulting in the replacement of pyrine-pyrimidine base pair by a pyrimidine-pyrine base pair. i.e,

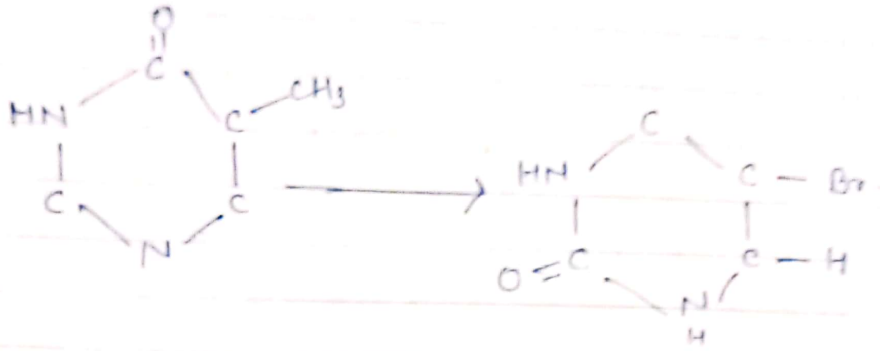
$$A = T \longrightarrow C = G$$

$$\Big| \qquad\qquad \Big|$$

$$T = A \longrightarrow G = C.$$

② **Base analogous:-** In many cases analogy can have the natural substances in some biological reactions. for example, 5-Bromouracil (B.U) is an analogue of thymine and is known as the mutagenic in bacteriophage and Bacteria.

In E. Coli it is deprived of thymine and growing in (B.U). The later is incorporated the D.N.A and under appropriate condition all the thymine can be replaced with its analogy.



5-Bromouracil.

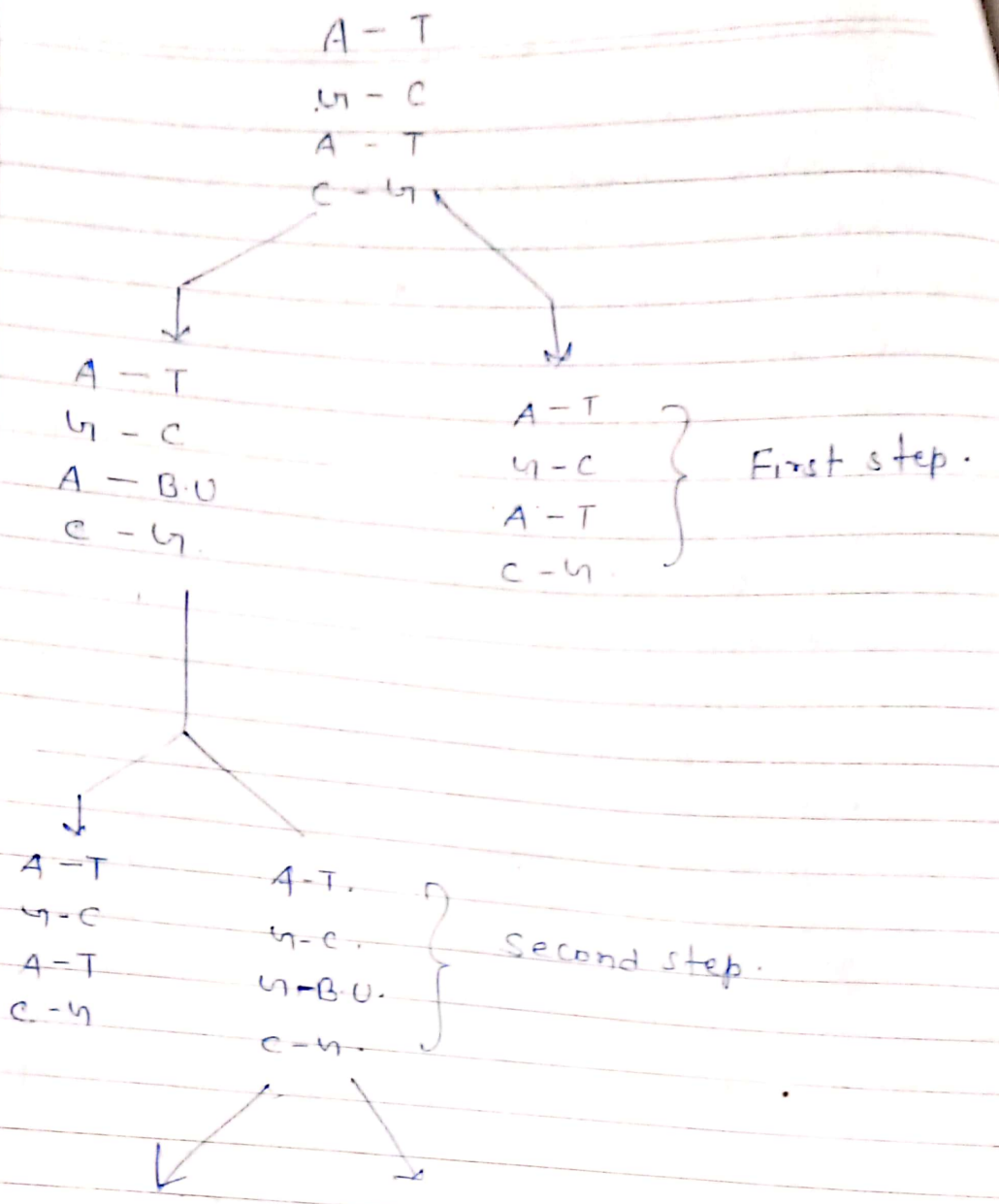
Supporting to the sequence of base within a gene is -

A — T.
G - C.
A — T.
G - C.

A Mutation will be a change in the sequence resulting by:-

A - T
G - C.
G - C
C - G.

In the above third Nucleotide pair has been changed from A-T to G-C. Analogy like 5-Bromouracil can being above this change in three steps at the point of D.N.A duplication.



In first duplication A becomes paired with B.U which paired with G in the next stage. At third replication stage. G paired with C. This change from A-T to G-C is the result of an error in the second step, when analogy B.U pairs with G instead of A.

3. **Tautomerism:-** Each of four bases of D.N.A can

exist in rare or abnormal states because of the redistribution of electrons and protons in the Molecule. These changes are known as tautomeric changes. In this Method the tautomeric adenine can form a bond with normal cytosine. Similarly rare or tautomeric thymine pairs with normal guanine. The result of this type of pairing is the formation of a D.N.A Molecule that Contains exceptional base pair and naturally a forbidden base pair shown as below:

C - A.

G - T.

4. **Additions & Delation:-**

The mutagens like acridine is found to Cause addition or delation of bases. The acridine molecule is first inserted between two successive bases of DNA strand thereby stretching the strand lengthwise. The stretching of the strand by the molecule of the mutagen can shift one of the bases in such a fashion that an unequal Crossing over would occur As a result one chain will have one Nucleotide more than it should be.

On the other hand, if the acridine is present during replication it may get inserted in the new strand and may be released thereby deleting the normal base of the opposite strand. The new strand will have one nitrogenous bess less than the normal.

These both Methods Causes a changes in gene which Causes a change in its phenotype.

Important types of gene Mutation:- There are some important types of gene mutations which are as follows:

a) **Non Sense Mutation:-** This exist in any Codon except the last three termination Codon (UAA, UAG and UGA) Change in any Codon to any of these termination Codon is Called nonsense Mutation. This result is incomplete poly-peptide Synthesis and changed enzyme This ultimately affects the phenotype.

b) **Missense Mutation:-** when one of the base of a Codon is changed. the mutation is called as missense mutation. If UUC meant for phenylalanine gets one U changed for G then the Codon UGC Now produces its amino acid. which is cystein. Thus the protein formed before or after mutation being identical having only cystein in place of phenyl-alanine.

c) **Silent Mutation:-** when a gene Mutation occurs which shows no change in phenotypic character it is called silent Mutation. We know that both Codon AGA and AGG specify the amino acid arginine. If the Second Codon AGG to changes AGA it will also specify arginine like the first Codon and due to this mutation. there is no change in amino acid sequence of protein formed. This is Silent Mutation.

d) **Biological Mutation:-** In this type of gene Mutation, organism Can not Synthesize an essential amino acid due to lack of one particular enzyme Cause change in phenotype.

Causes of Mutation:- H. J. Muller (1927) showed that tremendous physical and chemical agent. which are reffered as Mutagenic agents. Can be used to induced Mutation in Drosophila These may be the following:

X-Rays:- In 1927 Muller induced Mutations by x-Rays in Drosophila. while after a year ago Stadler could induced Mutation in Barley.

b) Radium - Radium produces α- β and γ- Rays. In 1928 Muller Hoyt and Hanson alle showed that γ-Rays would produce induce Mutation.

c) Heat & Temprature:- Muller pointed that the Heat & temprature have very low effects to causes Mutation. But Plough child D. gives that heat and temprature would increase the mutation rate.

d) chemical induction:- Averbach (1942) found the mustered is a powerful Mutagen. Demerec (1952) said that bacteria are greatly increased by treatment with mangenese and ferous Compound.

CONCLUSION:- Keeping in view all the point given above it can be Concluded that Mutation is basically due to change in D.NA structure and the change in structure can be brought about by various Mutagenic agent.