Bhagalpur National College, Bhagalpur

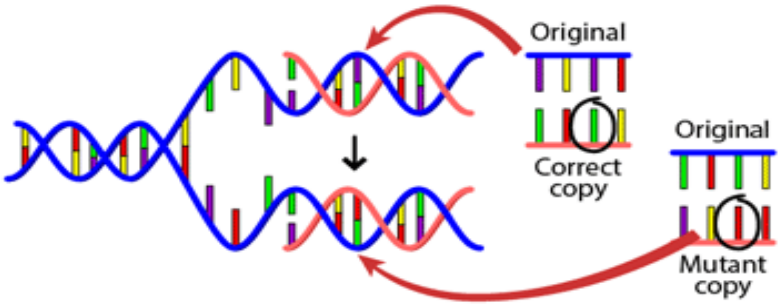
MUTATION

Presented by - Dr. Amit Kishore Singh
Department of Botany
B.N. College, Bhagalpur

MUTATION

INTRODUCTION

- MUTATION- Any sudden change occurring in hereditary material is called as mutation.
- They may be harmful, beneficial or neutral.
- DNA is highly stable molecule that replicates with amazing accuracy some errors of replication do occur.

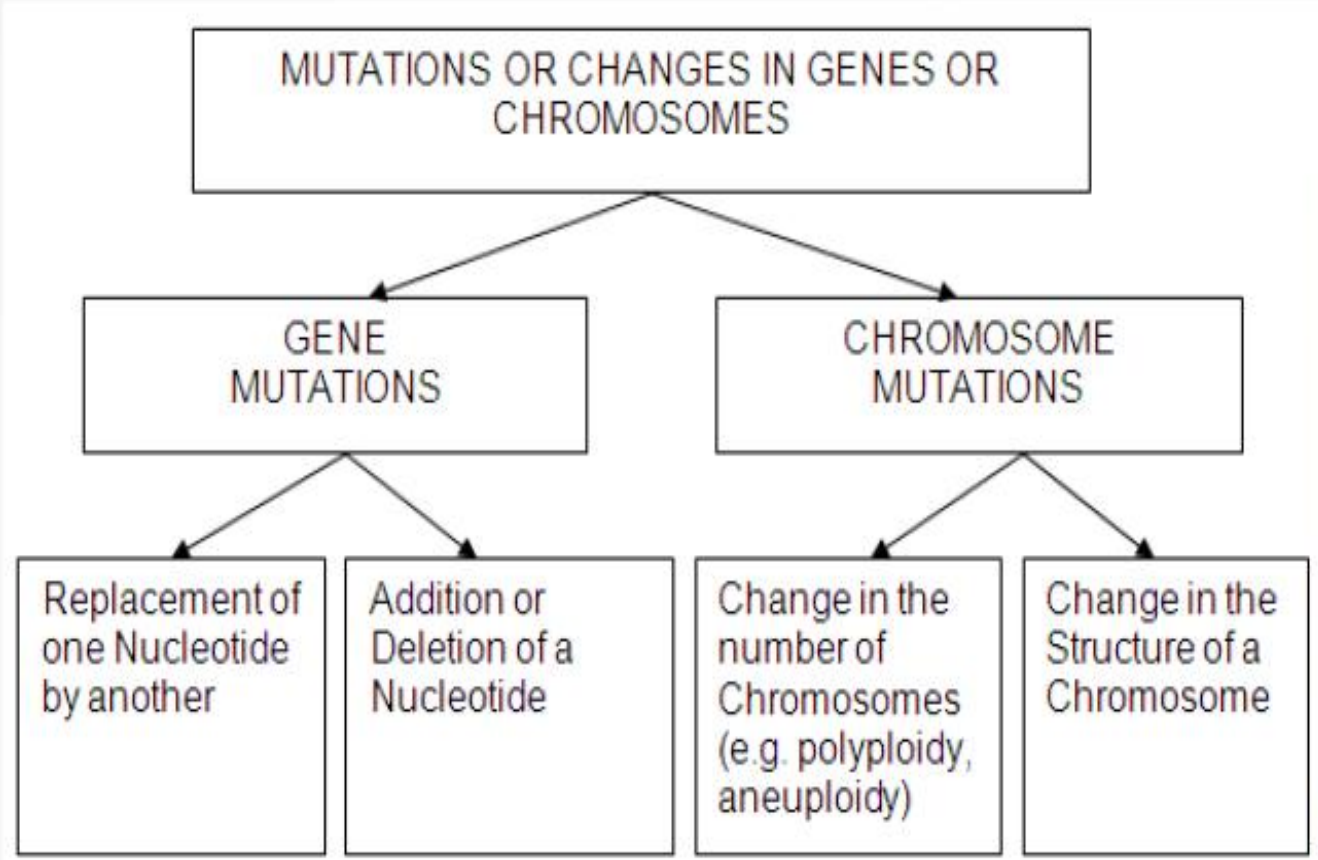


HISTORY

- 1901: Hugo de Vries first used the term mutation to describe the sudden heritable phenotypic changes in evening primrose *Oenothera lamarckiana*.
- 1904: T.H. Morgan reported white eyed drosophila in the population of red eyed flies.
- 1928: H.J. Muller first used x-rays to induce mutation in fruit fly.

Thomas Hunt Morgan

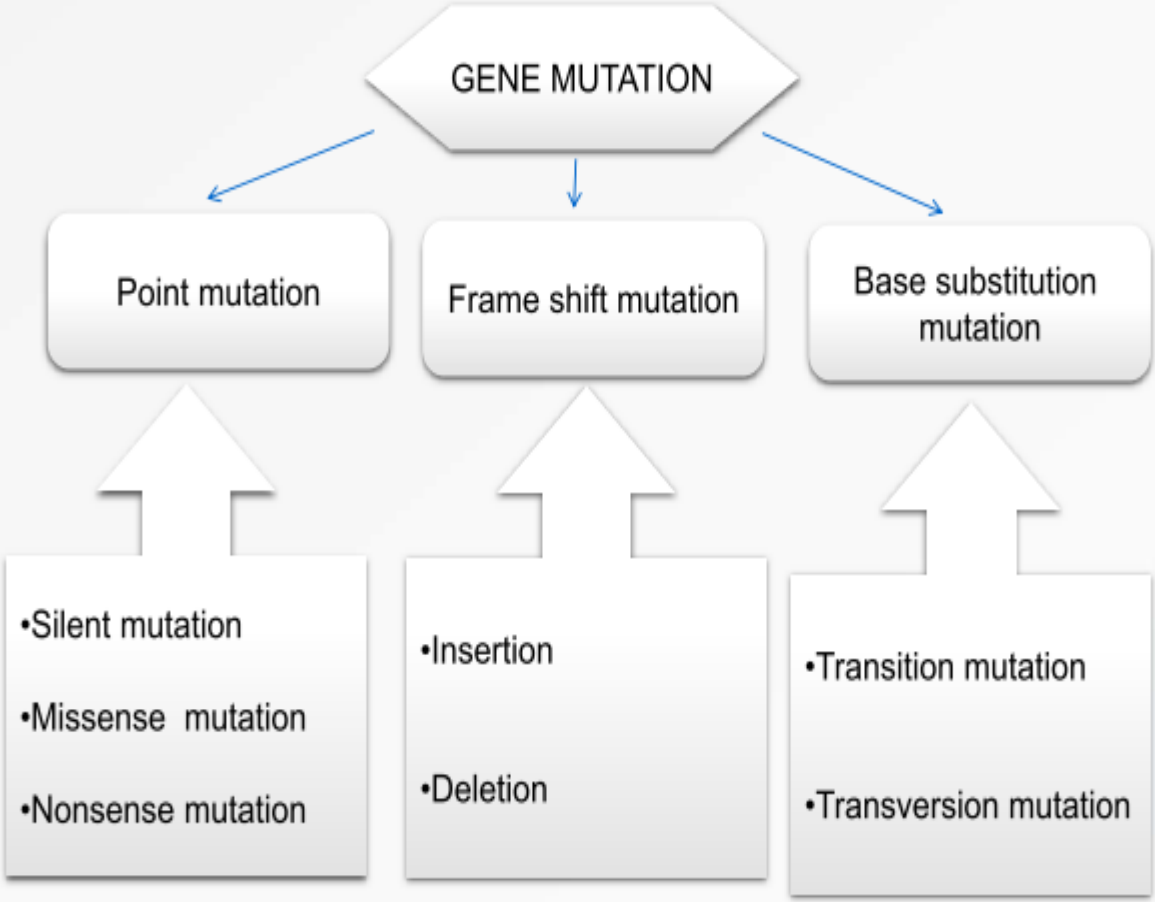
TYPES OF MUTATION



GENE MUTATION

- A gene mutation is defined as an alteration in the sequence of nucleotides in DNA.
- This change can affect a single nucleotide pair or larger gene segment of a chromosome.

TYPES OF GENE MUTATION

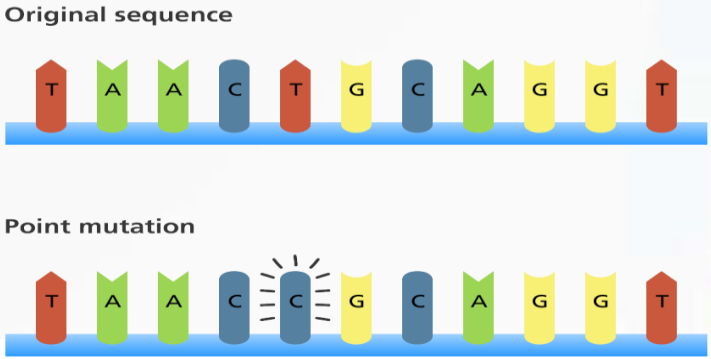


1. POINT MUTATION

- Point mutations are the most common type of gene mutation.
- Also known as base pair substitution.
- Change in a single nucleotide base pair.

Point mutation can be categorized into three types:

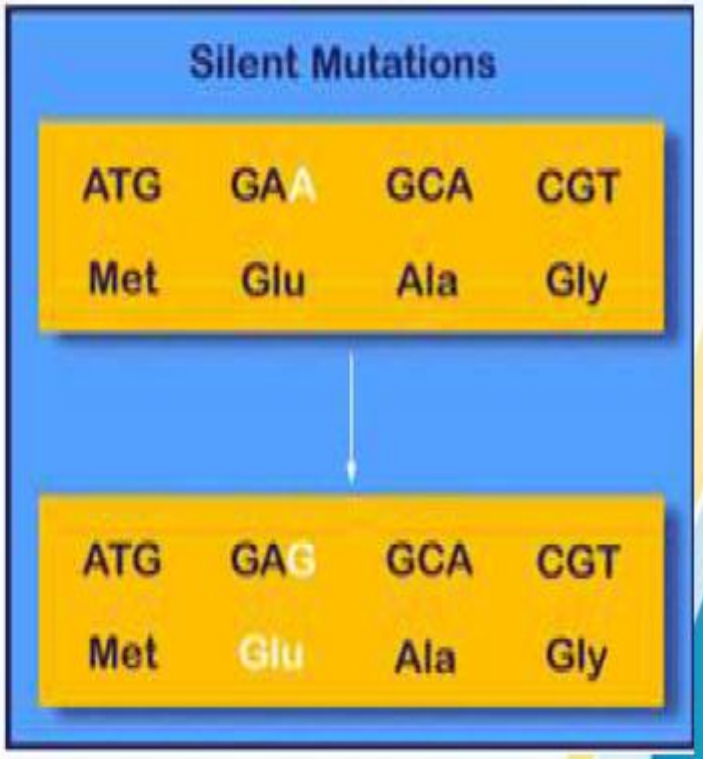
- Silent mutation
- Missense mutation
- Nonsense mutation



SILENT MUTATION

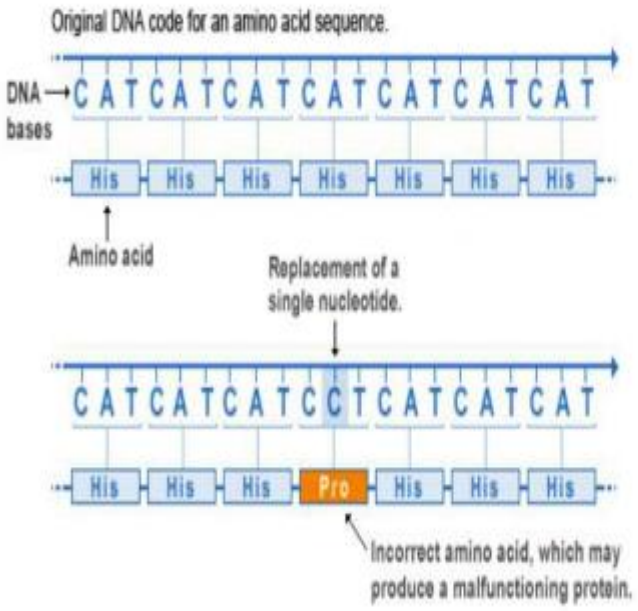
The change in one codon for an amino acid into another codon for that same amino acid .

Silent mutations are also referred to as synonymous mutations.



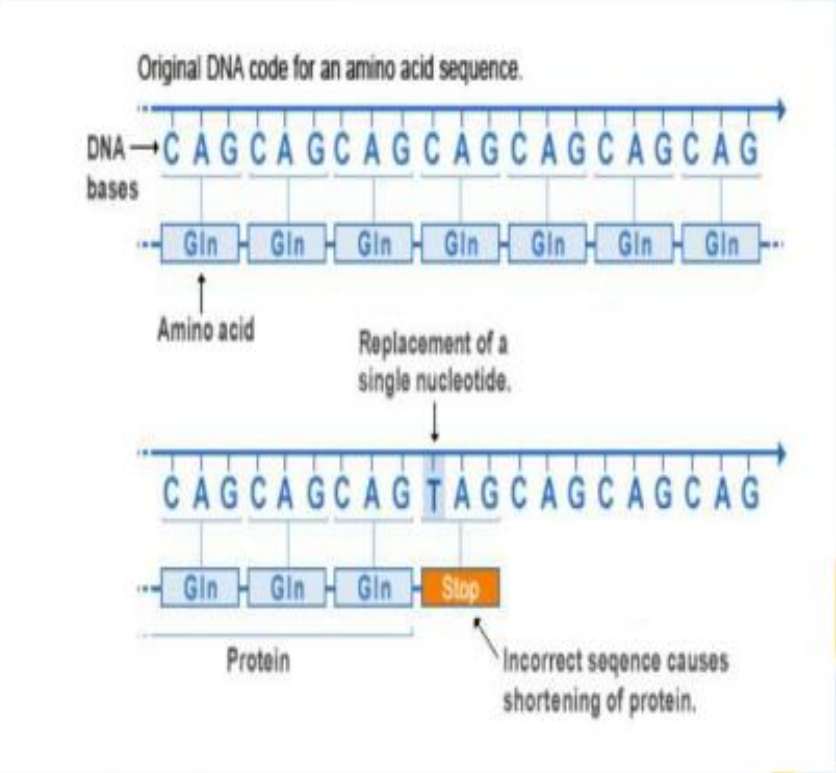
MISSENSE MUTATION

- The codon for one amino acid is changed into a codon for another amino acid.
- Missense mutations are sometimes referred to as non-synonymous mutations.



NONSENSE MUTATION

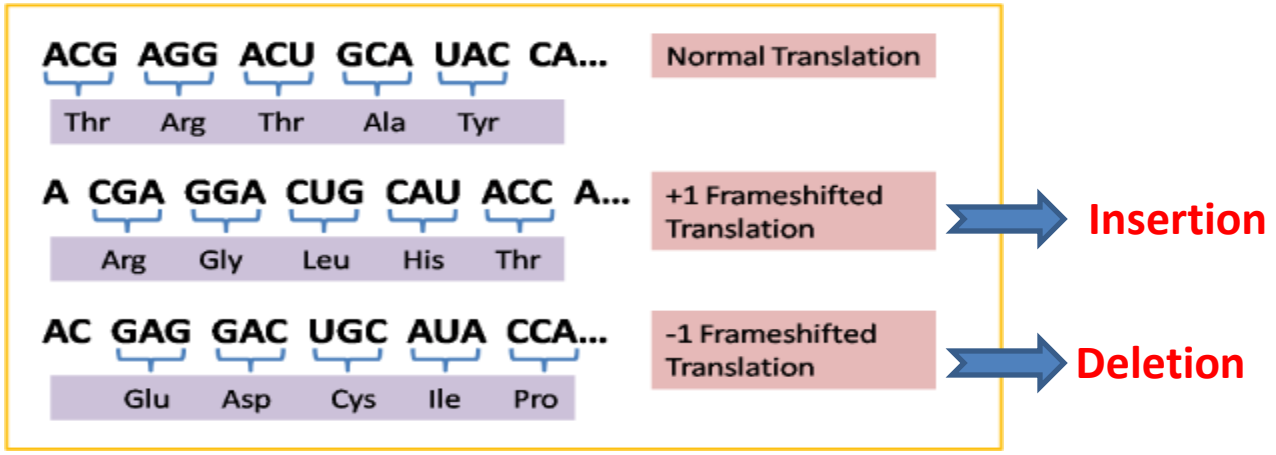
The codon for one amino acid is changed into a translation termination (stop) codon.



FRAME SHIFT MUTATIONS

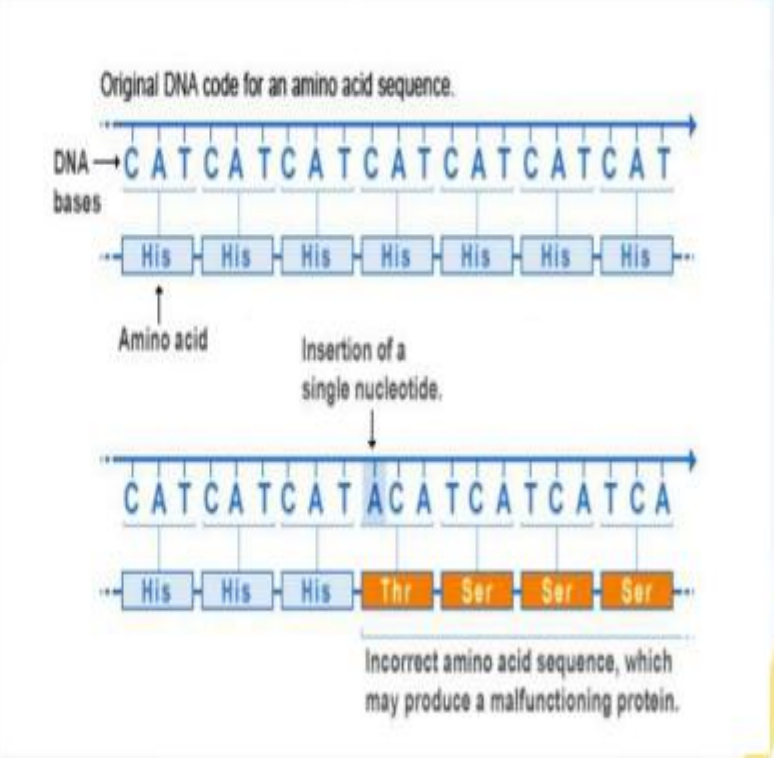
- This type of mutation occurs when the addition or loss of DNA bases changes a gene' s reading frame. A reading frame consists of 3 bases, each code for one amino acid.
- A frame shift mutation shifts the grouping of these bases and changes the code for amino acids.
- The resulting protein is usually nonfunctional.

Insertions and deletion can all be frame shift mutations.



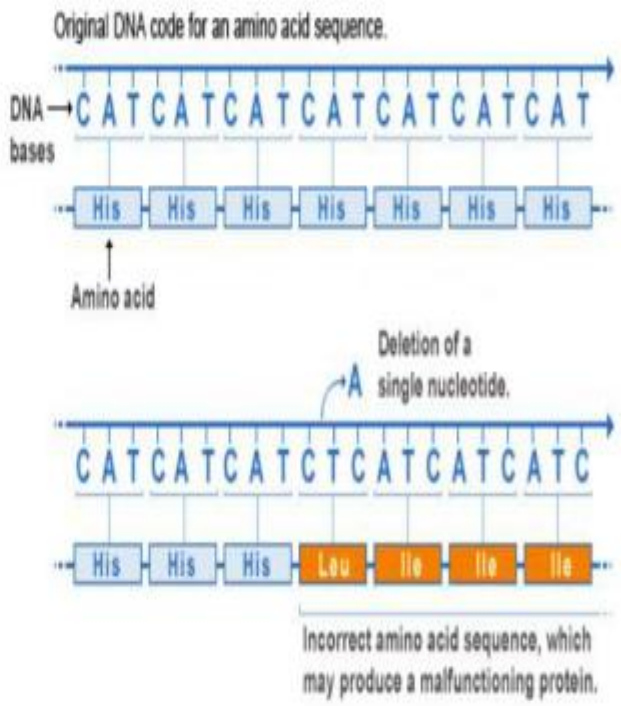
INSERTION

An insertion changes the number of DNA bases in a gene by adding a piece of DNA. As a result, the protein coded by the gene may not function properly.



DELETION

- A deletion changes the number of DNA bases by removing a piece of DNA.
- Small deletion may remove one or few base pairs within a gene .
- Larger deletions can remove one entire gene or several neighboring genes. The deleted DNA may alter the function of the resulting protein.

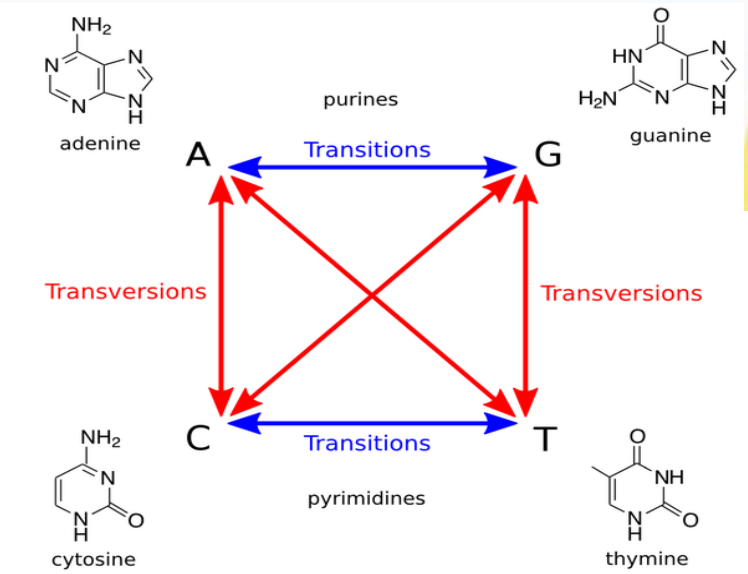


BASE SUBSTITUTION MUTATION

3. Base substitution are mutation in which one base pair is replaced by another.

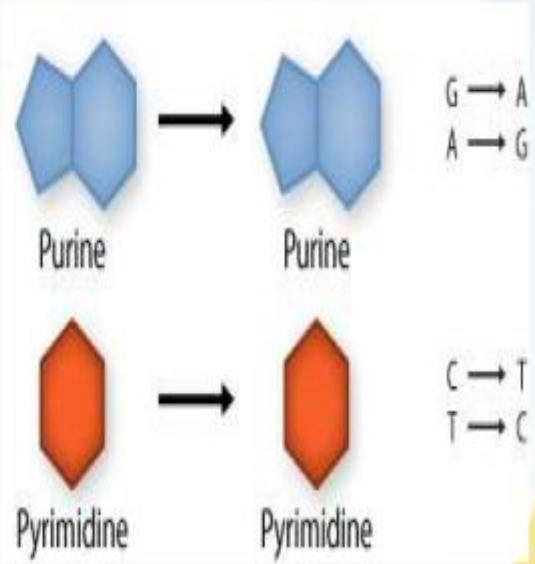
Base substitutions can be divide into two subtype

- ❑ transition mutation
- ❑ transversion mutation



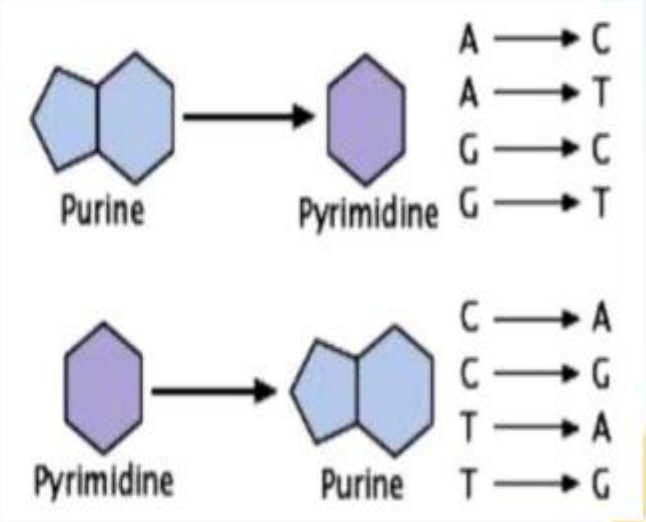
TRANSITION MUTATION

A transition is the replacement of a base by the other base of the same chemical.



TRANSVERSION MUTATION

A transversion is the opposite the replacement of a base of one chemical category by a base of the other.

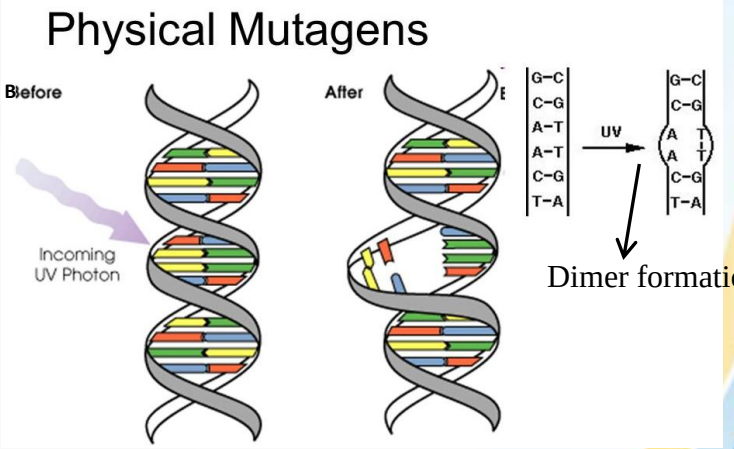


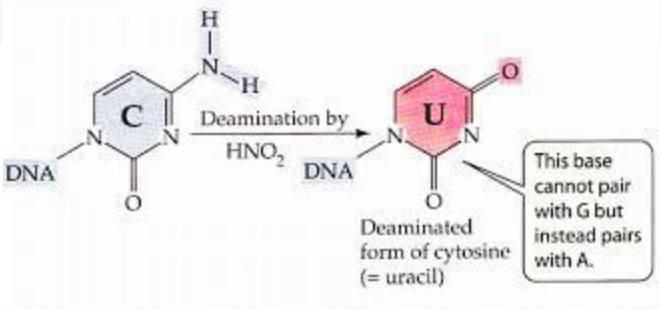
MOLECULAR MECHANISM OF MUTATION

- Spontaneous mutation
  - ❖ Tautomerism
  - ❖ Depurination
  - ❖ Deamination
- Induced mutation
  - ▪Physical mutagens

    Radiation
    a. Ionizing (X- rays, Gamma rays)
    b. Non ionizing(UV rays)
  - ▪Heat
  - ▪Chemical mutagens

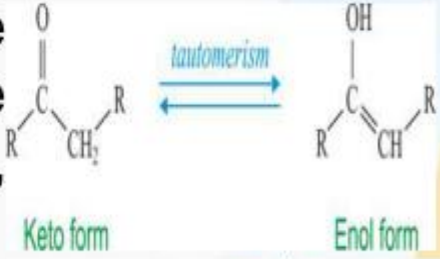
    Base analogs, alkylating agent, intercalating agent



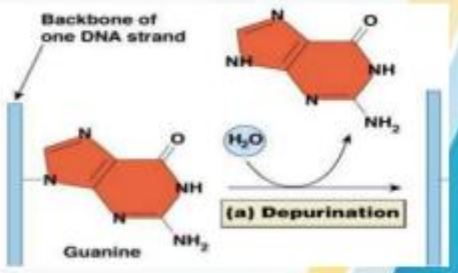


SPONTANEOUS MUTATION (Natural process)

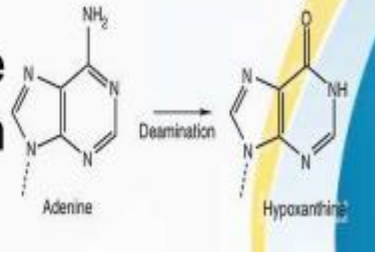
- Tautomerism- A base is changed by the repositioning of a hydrogen atom, altering the hydrogen bonding pattern of that bases, resulting in an incorrect base pairing replication.



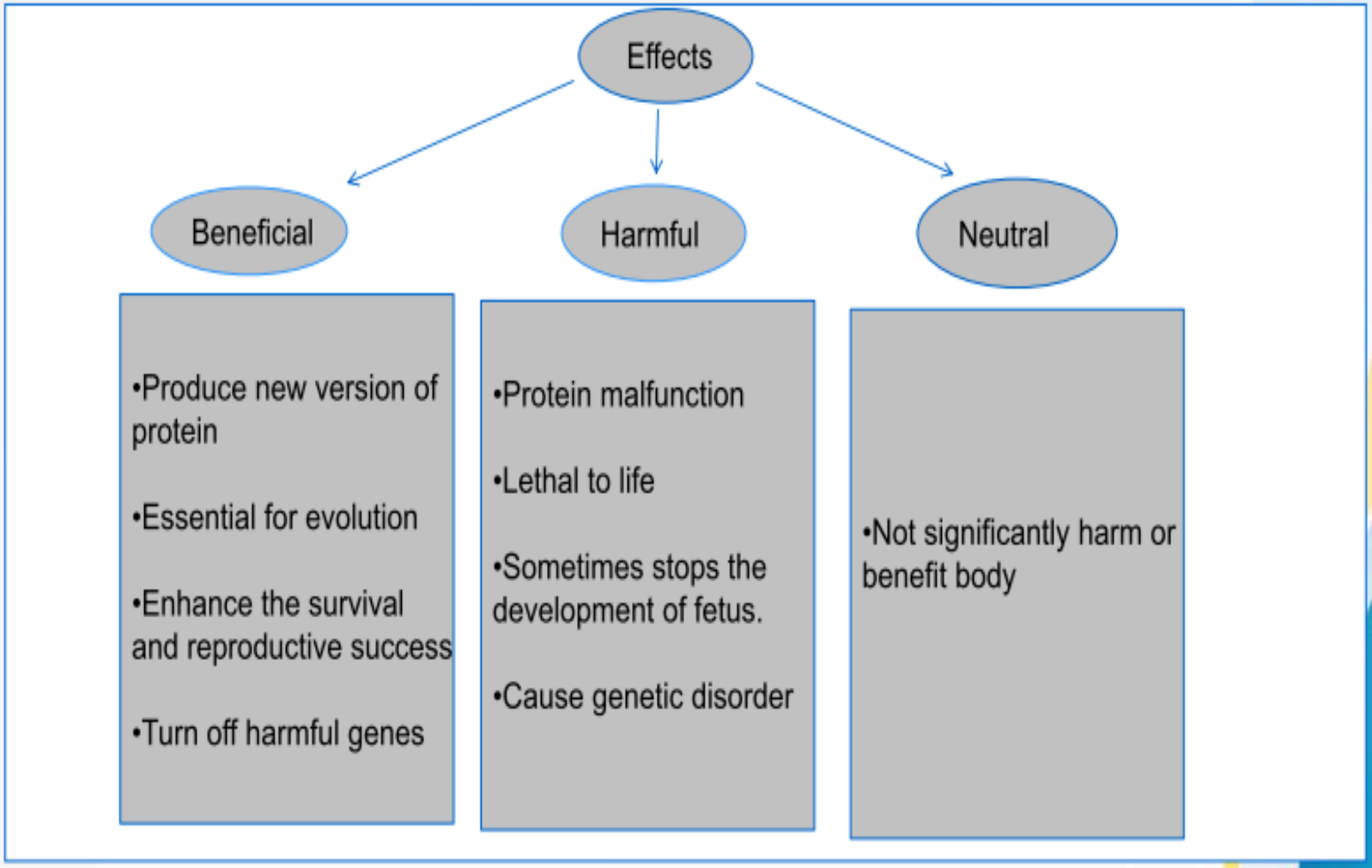
- Depurination- Loss of purine base (A or G) to form an apurinic site.



- Deamination- Hydrolysis changes a normal base to an a typical base containing a keto group in place of the original amino acid.



EFFECTS OF GENE MUTATION

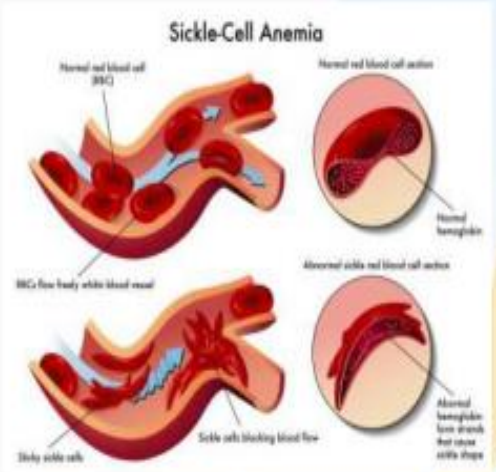


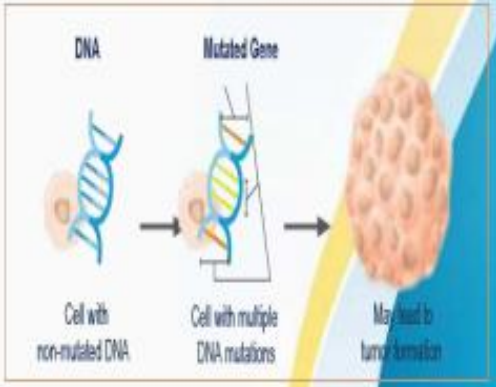
GENETIC DISORDER

- Mutation can lead to missing or malformed proteins that can lead to diseases.
- Some well known inherited genetic disorders

  Sickle cell anemia

  Cancer
- All these disorders are caused by the mutation of a single gene.






Blue eyes are a genetic mutation

B. N. College, Bhagalpur

(A Constituent unit of Tilka Manjhi Bhagalpur University.)

Department of Botany

Presentation prepared by: Dr. Amit Kishore Singh

Asst. Professor (Dept. of Botany)
B. N. College Bhagalpur
Contact (whatsApp) no. 9123326893