

A Brief Description of DNA Mutagens and its Mutation

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MUTAGENS

Agents in the environment such as certain chemicals and radiations which directly bring about mutation are called mutagens.

Chemical Mutagens

One of the many chemicals known to be mutagen is Nitrous acid. Exposure of DNA to nitrous acid can convert the base adenine to a form that no longer pairs with instead it pairs with cytosine. When DNA containing such modified adenine replicates one daughter DNA molecule will have base pair sequence different from that of parent DNA eventually some AT base pairs of parent will have been changed to GC base pair in the grand daughter cells. Nitrous acid makes a specific base pair change in DNA like all mutagens it alter DNA at random locations.

Another type of chemical mutagen is nucleoside analogue. These molecules are structurally similar to normal nitrogenous base but they have slightly altered base pairing property. For example 2-amino purine and 5-bromouracil are analogue to adenine and thymine nucleotide respectively.

Aflatoxins produced by *Aspergillus flavus* is a frame shift mutagen

Radiations:

x-rays and gamma rays are form of potent mutagens because of their ability to ionize atoms and molecules the penetrating rays of ionizing radiations cause electrons to pop out of their usual cells. These electrons bombard other molecules and cause more damage. Many of the resulting ions and free radicals are very reactive. Another form of mutagenic radiations is UV light a non-ionizing component of ordinary sunlight. The most important effect of

direct UV light on DNA is the formation of harmful covalent bond between certain bases adjacent T in DNA strand can cross link to form T dimers unless repaired may cause serious damage or death to the cell because it can not properly transcribe or replicate such DNA.

Mutation

It is a change in the base sequence of DNA. Such change in the base sequence of a gene will some time cause a change in the product encoded by that gene e.g. When a gene for an enzyme mutates the enzyme encoded by the gene may become inactive or less active because its amino acid sequence has changed.

Types of mutation

1. Base substitution or point mutation:

At one point a single base is replaced in DNA sequence by a different base. When this DNA replicates it results in substituted base pairing. It has two types.

- **Missense mutation:** if a base substitution results in amino acid substitution in the synthesized protein, this change is known as missense mutation. The effect of such kind of mutation can be dramatic e.g. sickle cell disease is caused by a single change in the gene of globin which is a protein component of hemoglobin. A change from A to T at a specific site results in change from glutamic acid to valine in the protein. The effect is that the shape of the hemoglobin molecule changes under low O₂ altering the shape of the RBCs such that the movement of cell through the small capillaries is greatly impeded.
- **Non sense mutation:** if base substitution results in the creation of nonsense or stop codon in the middle of mRNA molecules thus it stops protein synthesis. This type of base substitution is known as nonsense mutation.

2. Frame shift mutation:

If one or few nucleotides are deleted or inserted in the DNA then it can shift the translation reading frame e.g. deleting one nucleotide pair in the middle of a gene cause change in many amino acids downstream from the site of mutation. Frame shift mutation always result in a long stretch of altered protein or amino acid and the production of an inactive protein from a mutated gene.