

Mechanism of mutation of gene

(1) Tautomerisation of bases -

Normal form (stable)

- (1) Adenine $\rightarrow$ Amino form
- (2) Guanine $\rightarrow$ keto form
- (3) Thymine $\rightarrow$ keto form
- (4) Cytosine $\rightarrow$ Amino form

Rare form (unstable)

Imino form

Enol form

Enol form

Imino form

Normally

$A = T$

$\rightarrow$

In rare form.

$A^* = C$

$G \equiv C$

$\rightarrow$

$G^* \leftrightarrow T$

$T = A$

$\rightarrow$

$T^* \leftrightarrow G$

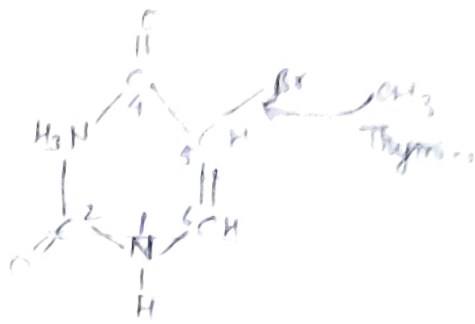
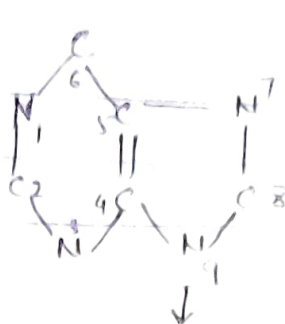
$C \equiv G$

$\rightarrow$

$C^* \leftrightarrow A$

$\hookrightarrow$ Base pairing potentiality changes.

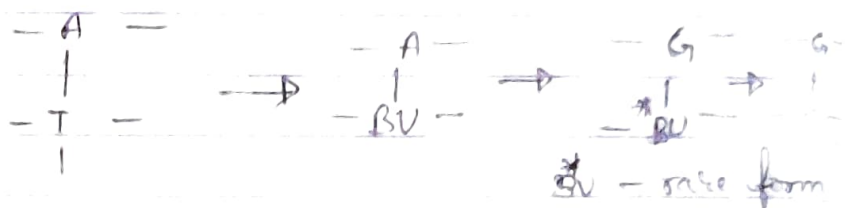
$A^* \quad G^* \quad T^* \quad C^* \rightarrow$ Rare form



9th N will add to sugar

Thymine is 5-methyl uracil.

→ 5-BU is analogue of thymine base. It can be incorporated in chain in place of thymine



→ Rare form of BU is more stable than normal form i.e. enol form is more stable than keto form.

→ After replication in next step A-T bp is replaced by G-C base pair. It is transition mutation.

(1) 2-Amino purine:

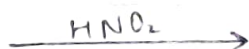
→ It is analogue of adenine base.

→ It can be substituted in ~~adenine base~~ DNA chain in place of adenine.

(2) Nitrous acid - (HNO_2)

It causes oxidative deamination of nitrogenous bases.

Adenine



Hypoxanthine

(amino group found)



It can pair with cytosine.

Guanine $\xrightarrow{\text{HNO}_2}$ Xanthine
 $\updownarrow$ It's base pairing potentiality
 C doesn't change

Cytosine $\xrightarrow{-\text{NH}_2, +\text{O}_2}$ Uracil
 $\downarrow$
 It pairs with guanine $\downarrow$
It pairs with adenine

(3) Hydroxyl amine -

- It act upon only on cytosine.
- In normal condition
 $\text{C} \equiv \text{N}$

But in presence of hydroxyl amine
 $\text{C} \longleftrightarrow \text{A}$
 pairs with

(4) Alkylating agents -

- ~~Nitrogen~~ Nitrogen mustard → World war II
- Firstly discovered mutagen
- Aurebach - discoverer
- They add methyl or ethyl group
 e.g. Ethyl methane sulphonate.

(5) Acridine -

- It is a dye → Acridine, proflavin, eufavin.
- This causes frameshift mutation
- ~~Frame~~

(6) Physical mutagen -

(1) Radiation -

- It is of 2 types.
- (a) Non-ionizing radiation
- (b) Ionizing radiation

(a) Non-ionizing radiation -

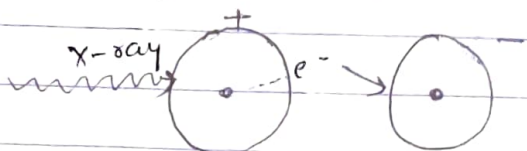
→ UV rays = UV-A, UV-B, UV-C
(320-400nm) (280-320nm) (100-280nm)
↓ ↓
less damaging lethal

Wavelength $\propto \frac{1}{\text{energy}}$ $\propto \frac{1}{\text{lethality}}$

↓

(b) Ionizing radiation -

- X-ray, cosmic rays, γ -rays
- These are high energy radiation.
- When they collide from one atom or molecule.



It ionizes ~~due~~ due to its high energy content.

- UV shows two types of effect in DNA.
 - (1) Formation of pyrimidine hydrate.
 - (2) " " " " dimers. (more prominent)

It forms thymine dimers more frequently by co-valent bonding. It causes DNA bending and this causes hindrance in DNA replication by blocking action of DNA polymerase.

Application of induced mutation -