

Mutation

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Ans:-

Sudden inheritable changes which altering the phenotype of an individual is known as Mutation [Hugo de Vries].

Now a days mutation covers only those changes which alter the chemical structure of gene at molecular level.

- ⊗ Both chromosomal and genic mutation can show the similar phenotypic effect but they can be differentiated after seeing the chromosome. The other difference is that genic mutation can be revert back to original (wild type) where as chromosomal mutation cannot.

(1751) Seth Wright was first to find a short legged lamb in a herd of long legged sheep and developed a line of short legged sheep called as American. (This character is due to recessive gene and individuals are homozygous for it.)

T. H. Morgan (1910) found a ^{white} ~~red~~ eye male in a Red eyed flock and produced a line of ~~red~~ ^{white} eye male and female flies.

Then in maize, snapdragon, pea, rodents, fowls man etc.

It is recent to be reported in microorganisms, like Bacteria, Neurospora, Aspergillus and bacteriophage.

- ⊗ They are very suitable.

Mutation may occur at —

- at any stage,
- in somatic as well as germinal cells
- spontaneously,
- naturally as well as induced,
- Harmful or useful,
- large or small
- recessive and rare
- lethal.

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There are different types of mutations on different basis -

- (A) Stages at which mutation can occur →
 - a) Pre-gametic, b) Gametic or Zygotic c) Post Zygotic
- (B) Type of cells → (a) Somatic (b) Generative.
- (C) Origin → (a) Natural or Spontaneous, (b) Induced.
- (D) Direction → (a) Forward, (b) Backward.
- (E) Magnitude at Phenotypic level → (a) Dominant, (b) Recessive.
- (F) Type of Chromosomes → (a) Autosomal
(b) Allosomal or Sex-chromosomal.
- (G) Size or Quantity (a) Gross or Chromosomal
(b) Point or Genic.

Artificial mutation can be induced by different agents which are known as Mutagenic agents or the simply Mutagens. They are also of different ~~be~~ as follows:-

(A) Physical → They are physical quantities →

a) Radiation - It is of two types →

(i) Ionizing → They are ionising particles e.g. α, β, γ & X-Rays.

(ii) Non-Ionising → They are non ionised i.e. without any charge → Neutron, Visible light, U-V rays (Ultra-Violet Rays).

b) Temperature → Thermionic shocks Sudden warming, or cooling i.e. 10°C rise in temperature increases the chances 2-3 times.

(B) Chemicals :- Only those chemicals which can enter the nucleus of the cell. e.g. Nitrous Acid (HNO_2), Ethyl Methane Sulphonate (EMS), Methyl Methane Sulphonate (MMS), Dimethyl Diethyl Sulphonate (DDS), Magnesium Chloride (MgCl_2); Caffeine, Acridine etc. Hydroxyl amine (HX); Hydrazine etc.

Role of Mutation

→ It is a cause of origin of new species, varieties and species of both. Some of the mutant

varieties are as follows:

Wheat → Sharbati Sonara, NP-836 Pusa Lerma	Rice → Reimei, Japonica Jaganath	Barley → RDB-1	Cactus → Aruna.
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Gene Mutation or Point Mutation or Inducible Mutation

The permanent alterations in the sequences of nucleotides (bases) in the nucleic acids, (which form the genetic material) There is a change in the normal base sequence of the DNA molecule. The unit of gene mutation is known as Mutation.

Defn:- The permanent alterations in the sequence of nucleotides (bases) in the nucleic acid (which forms the genetic material) leading to change in phenotype is known as Gene Mutation.

The unit of gene mutation is known as Mutation. Gene mutation occurs due to mistakes in replication of the DNA, leading to a change in chemical make up of a gene. It occurs due to →

- (A) Base pair Analogues &
- (B) Tautomerism.

(A) Base-pair-Analogues → There are a number of chemicals which resemble the normal bases. They are known as Base pair analogues e.g. (i) 5-Bromouracil (~~5-BmU~~ (5 Bu) or 5-Bromodeoxyuridine (BUdR) is an analogue of Base Thymine. Normally it pairs with Adenine, but it may pair with Guanine by mistake.

(ii) Similarly 2-Aminopurine (AP) can pair with Thymine or (C) Cytosine.

(B) Tautomerism:- It is The base pairs have an ability to exist in two forms. Normal form is known as Keto forms which show normal pairing, but the unusual form is known as Enol form in which they show abnormal pairing.

Normal → A = T ; C = G.

Abnormal → A - C ; G - T.

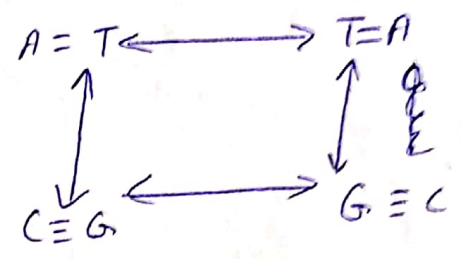
(A) Substitution Mutation & (B) Frame-shift Mutation may be classified as

Substitution Mutation :- It leads to two types of Gene mutations →

(a) Transition → Here purine is replaced by another purine or, Pyrimidine is replaced by another pyrimidine.



(b) Transversion → Here purine is replaced by pyrimidine or vice-versa.



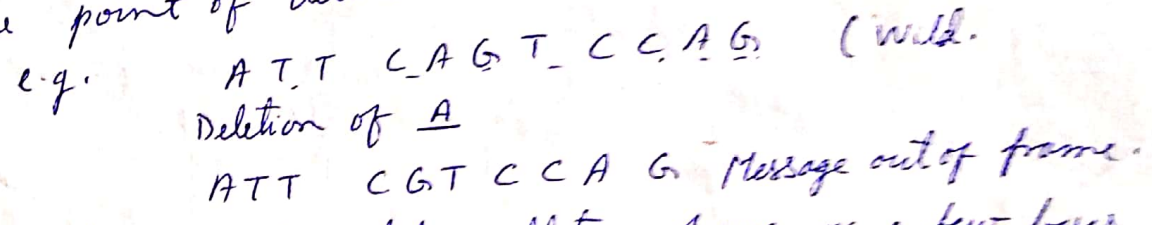
These are included as under Substitution or Base pair substitution mutation or St. & Swatches.

Inversion → It is another type of substitution reaction in which a segment of DNA is removed and reinserted in a reverse direction.

The other main type of Mutation is known as

[B] Frameshift Mutations:- It includes a shift in the reading frame backward or forward by one or two nucleotides. It includes, Addition, Deletion; Inversion (Addition)

1) Deletion → It is removal of one or a few bases from a nucleotide. Even a single base removal can change the message beyond the point of deletion.



2) Insertion:- It includes addition of one or a few bases, but the number of bases should not be multiple of three.

