



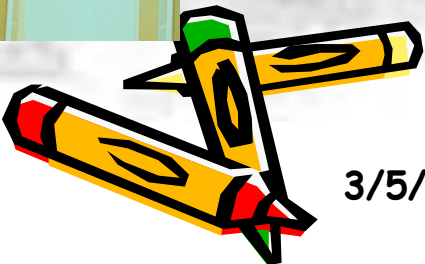
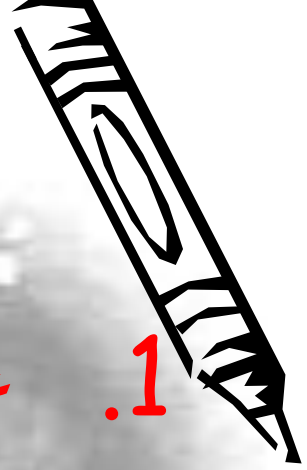
# Virus Mutation

3/5/2020



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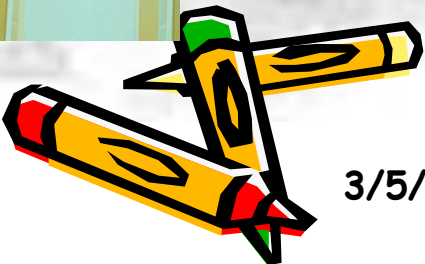
# Mutation

## Definition:

Errors in copying the viral nucleic acid that occur during replication are called **Mutation**

Whether a particular mutation is lethal to the virus, it depends on the resulting phenotypic characteristics

**Plaque technique** could be used for studying and isolating virus variants

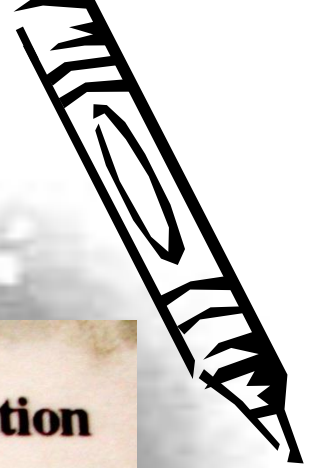


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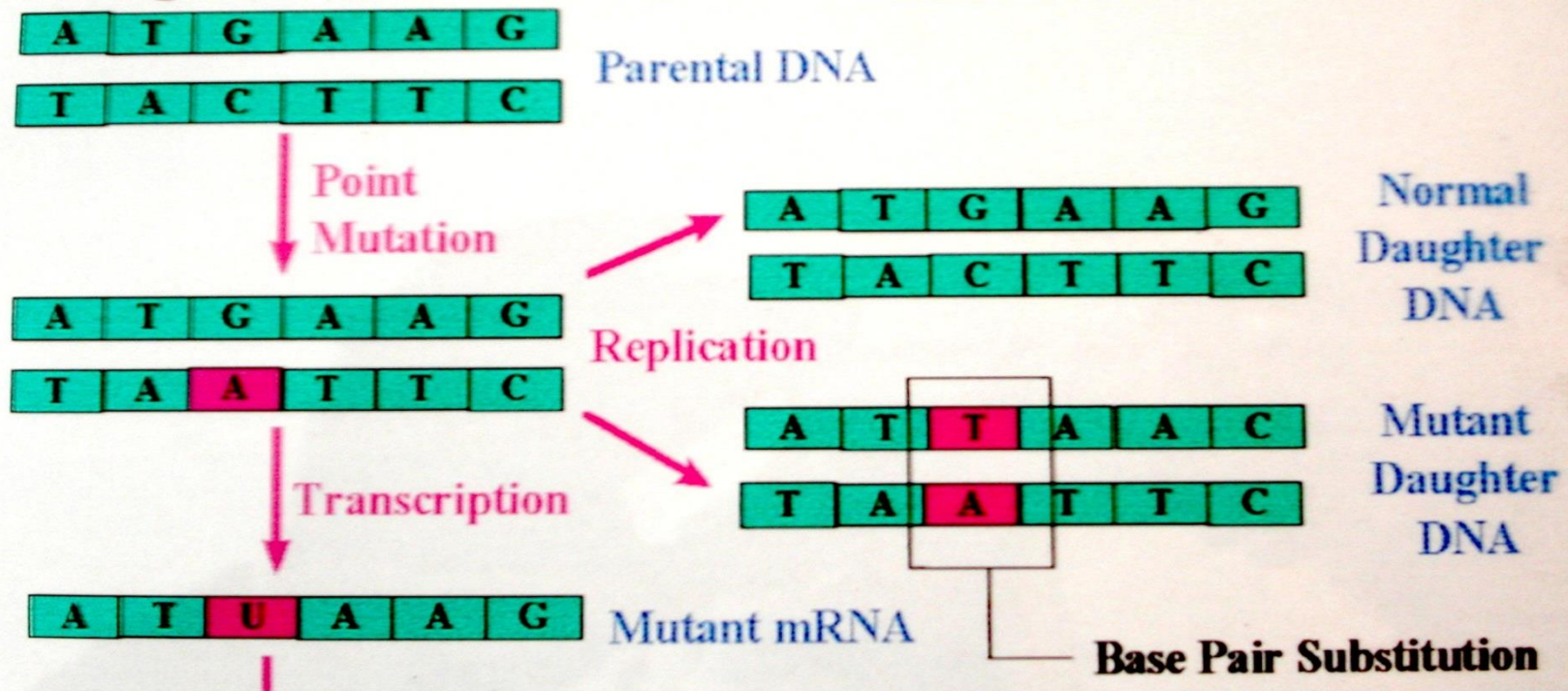


# Types of Mutation



## A. Genotypic

1. mutation, also called a **base substitution** occurs when a single nucleotide is replaced with a different nucleotide. A point mutation results in a base pair substitution after replication and possibly a mutant protein after transcription and translation.



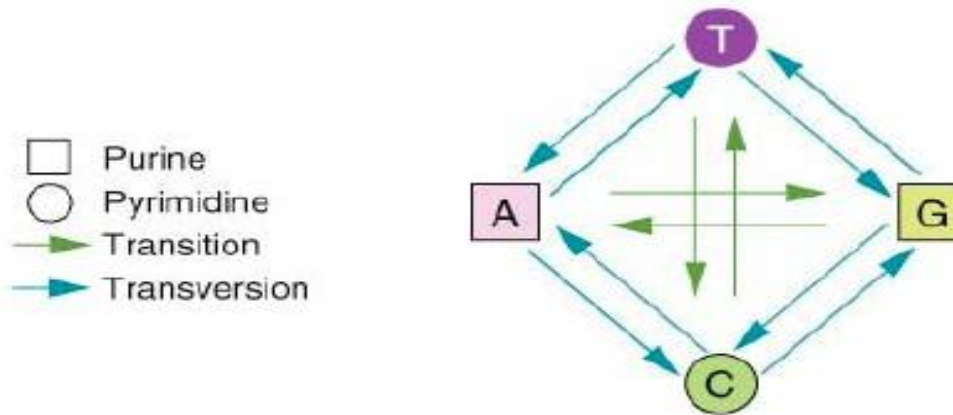
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# Types of Mutation (Cont.)

## Base substitutions



(a) Twelve different base substitutions can occur in DNA.

**Two main types of base subst.:**

**1) Transition (purine → purine or pyrimidine → pyrimidine) Ex.- A → G or T → C**

**2) Transversion (purine → pyrimidine or pyrimidine → purine)**

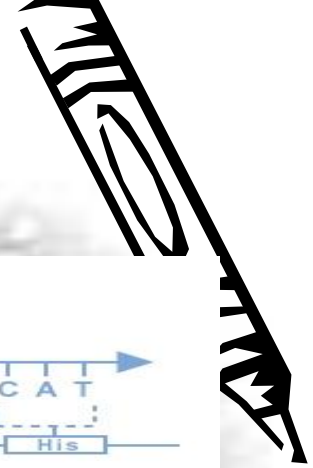
***Transitions are more common.***

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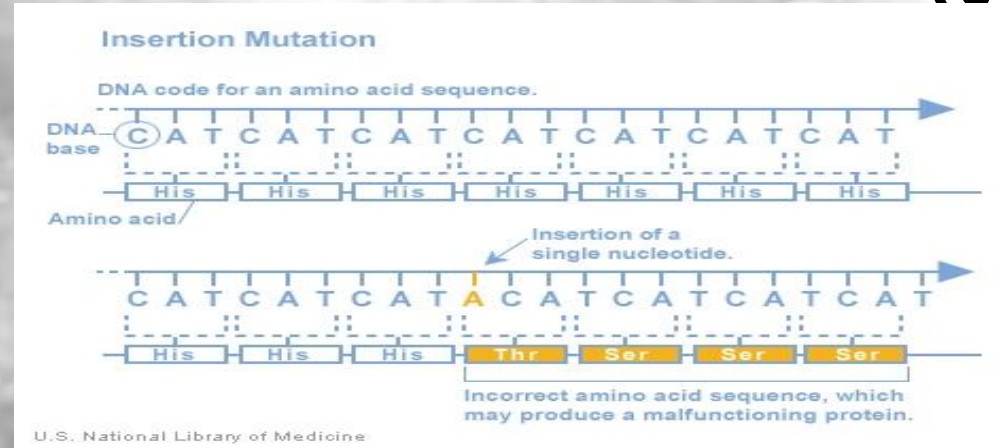
# Types of Mutation



## A. Genotypic(Cont.)

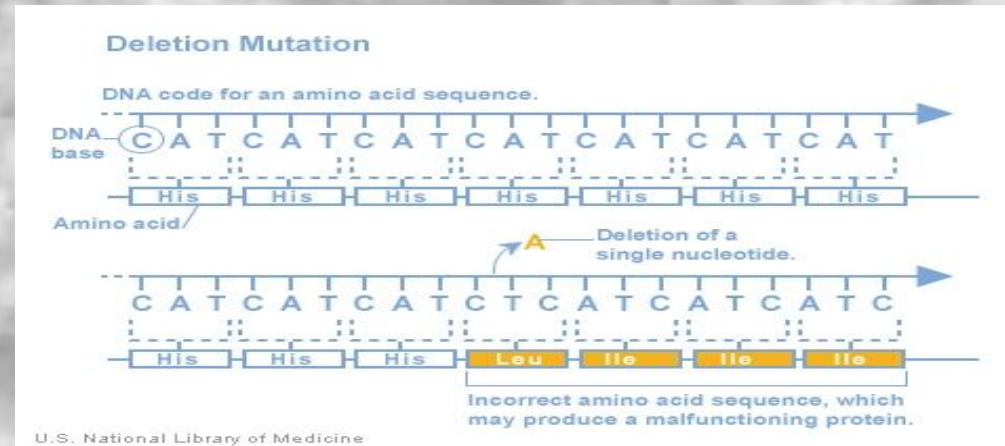
### 2. Insertion mutations:

Extra base pair(s) are inserted into a new place in the DNA



### 3. Deletion mutations:

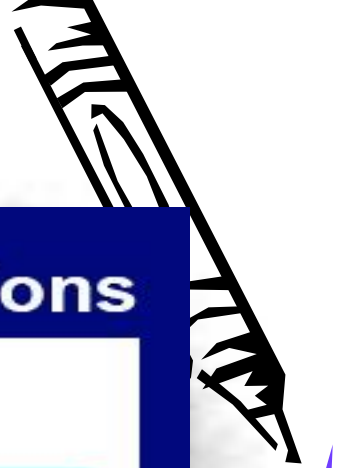
One or more of base pairs are deleted.



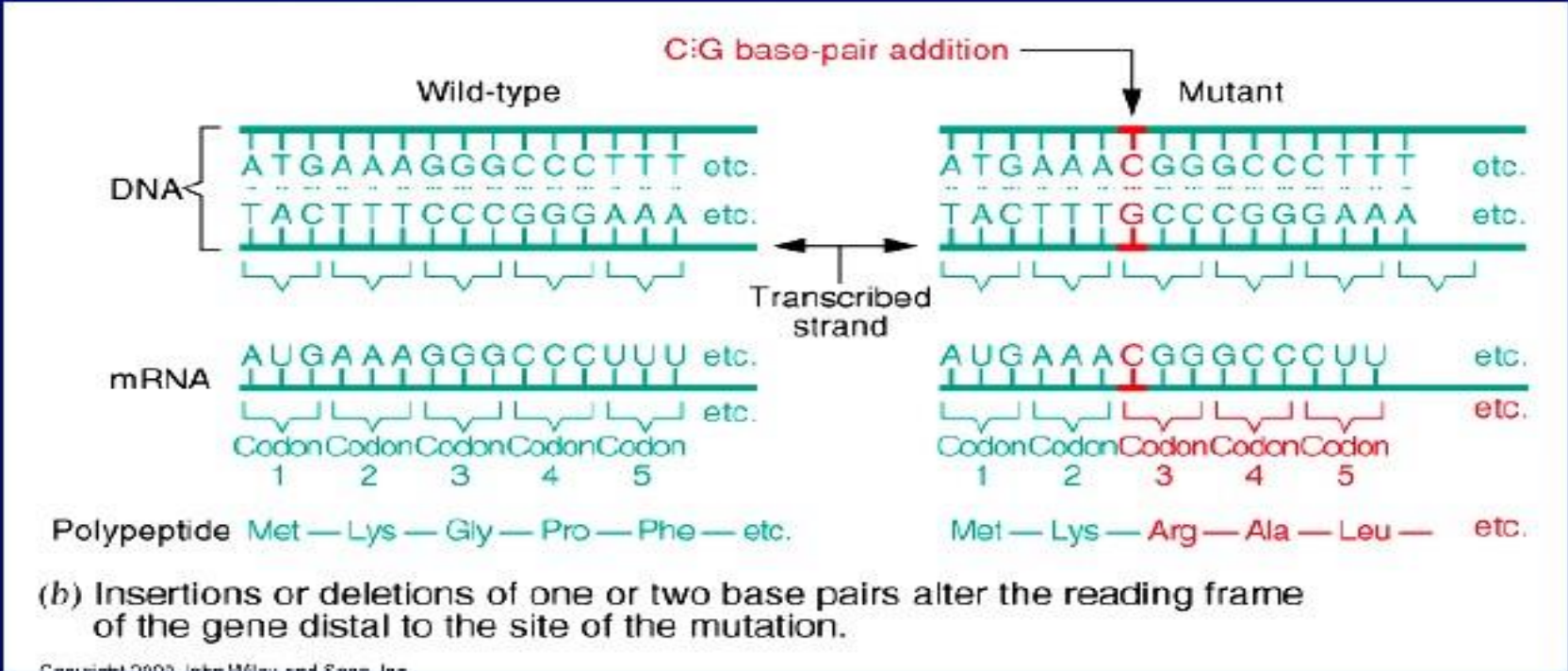
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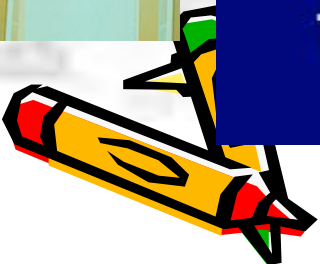
# Types of Mutation (Cont.)



## Insertion and deletion mutations

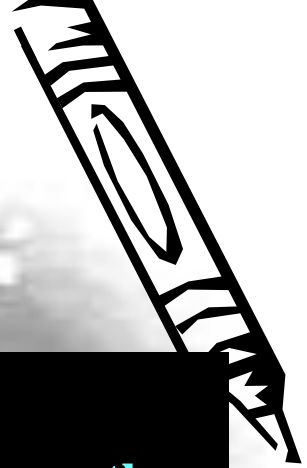


**Insertion or deletion of one or two bases changes the reading frame. +1, +2, -1, or -2 Frameshift.**





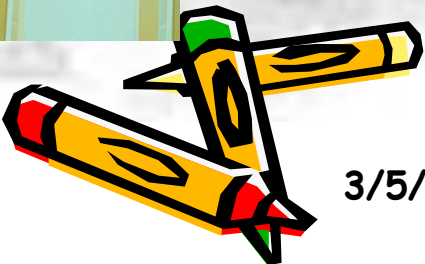
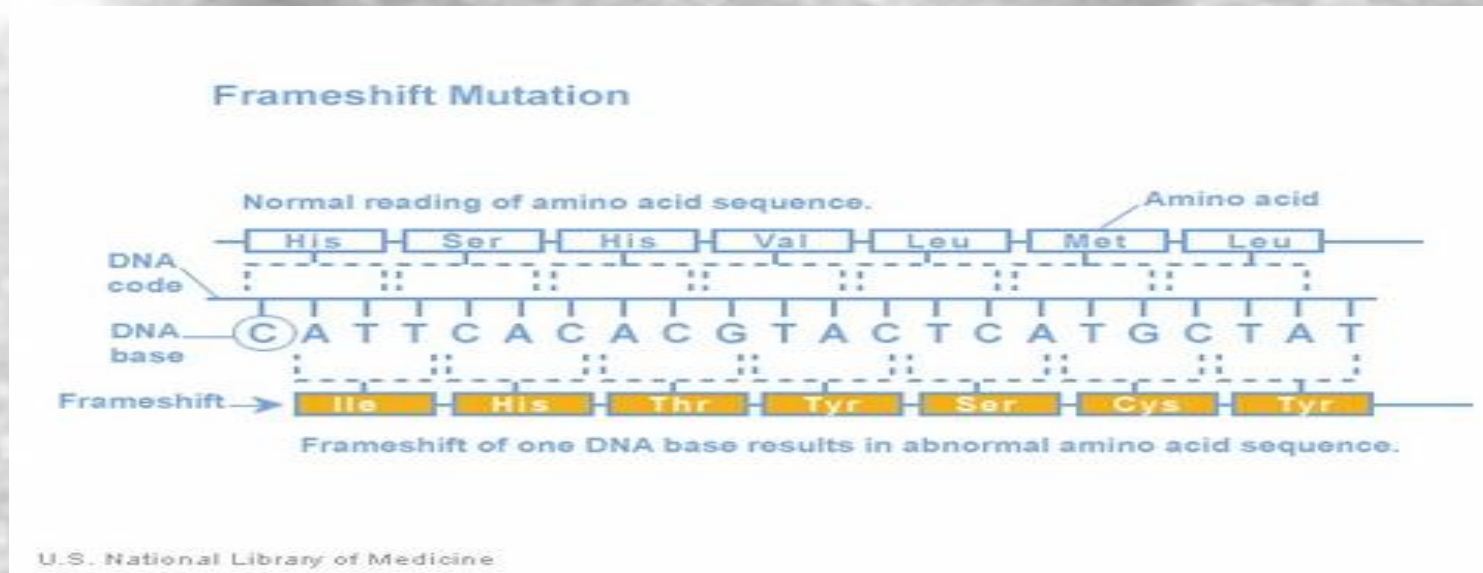
# Types of Mutation (Cont.)



## A. Genotypic(Cont.)

### Frame-Shift Mutation:

Error occurs at the DNA level, causing the codons to be parsed incorrectly.



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# Types of Mutation (Cont.)



## B. Phenotypic Changes:

### 1. CONDITIONAL LETHAL:

Multiply under some conditions but not others

Wild-type (wt) grows under both sets of conditions

Examples:

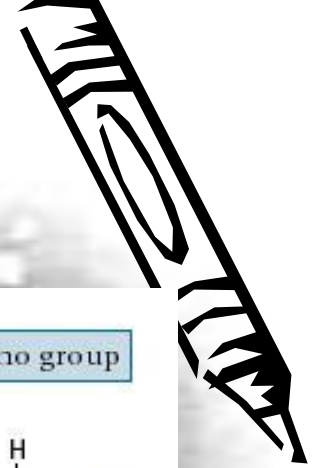
- temperature-sensitive (ts) mutants do not grow at higher temperature.
- host-range mutants do not grow in all the cell types that the wt does.



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# Mutagenesis



## A. Spontaneous Mutation:

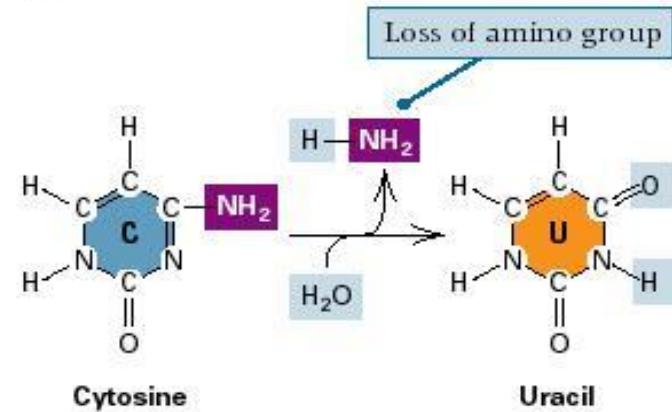
### 1. Errors in Replication:

Transitions and Transversions that occur during replication and can result from deamination of Cytosine (A&B).

### 2. Spontaneous Lesions:

- Depurination.
- Deamination.
- Oxidative Damage to DNA.

(A)



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# Mutagenesis



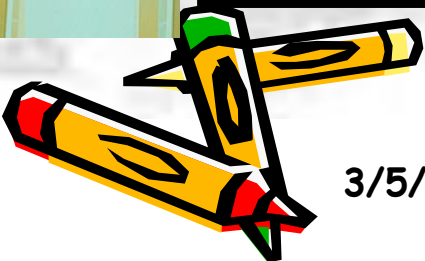
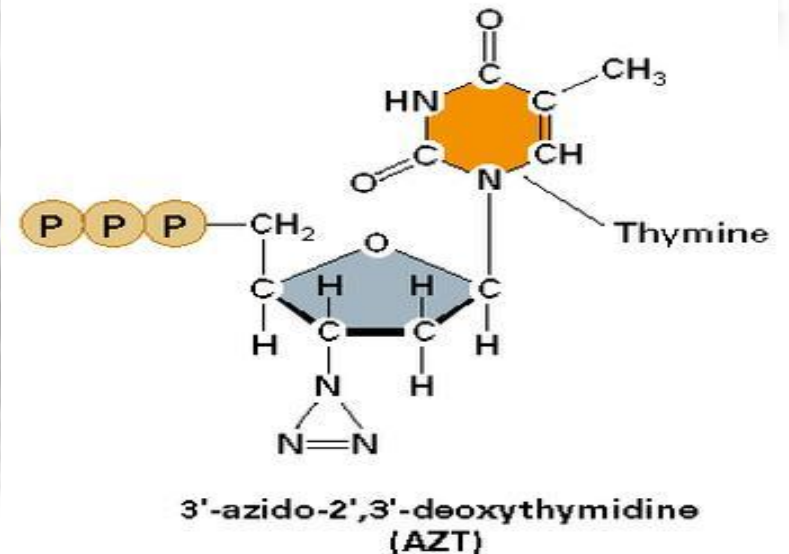
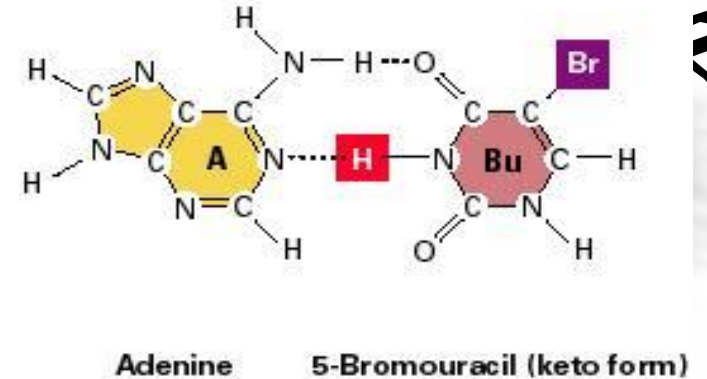
## B. Induced Mutation:

### 1. Base-Analog Mutagens:

5-Bromo-uracil can substitute for T, and then wind up binding with G (B) and results in miscoding.

AZT a nucleotide analog that can result in Chain Termination.

(B) A-Bu base pair



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# Mutagenesis



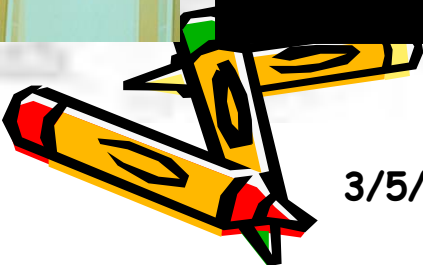
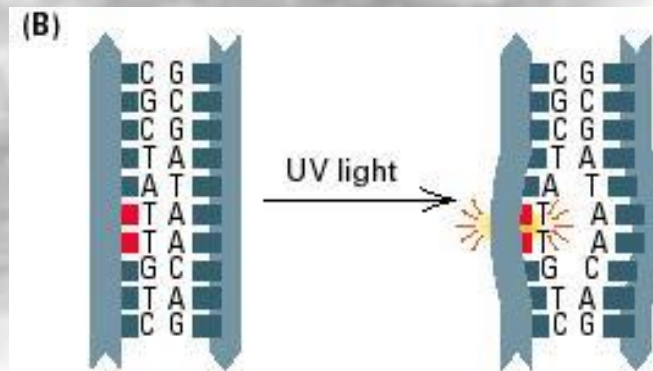
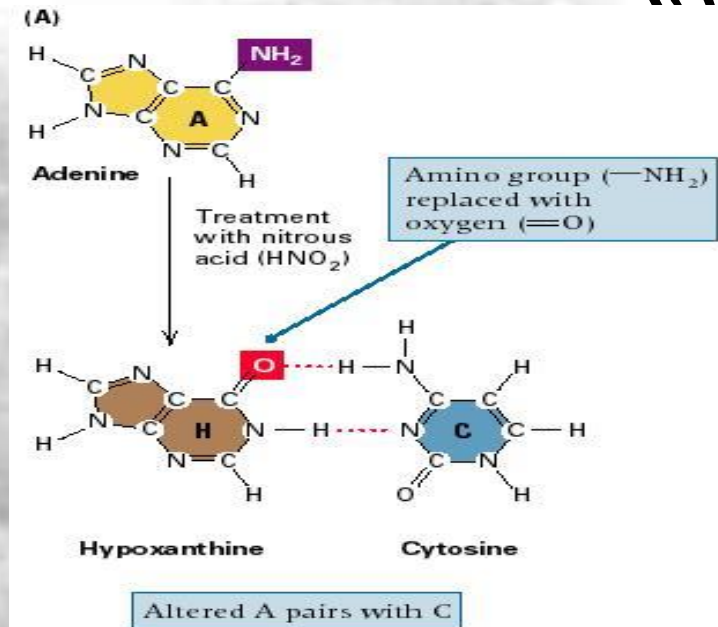
## B. Induced Mutation:

### 2. Chemical Agents:

Such as nitrous oxide or nitrosoguanidine.

### 3. UV and Ionizing Irradiation:

Crosslinks between adjacent thymines (thymine dimer)



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# Genetic Changes

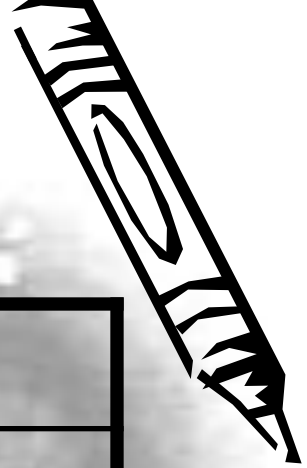
- Mutation.
- Recombination: Exchange of information between two genomes.
- Interaction between viral Gene Products: this may involve not only their nucleic acids but also their proteins; the products of such interactions may affect the viral Phenotype.



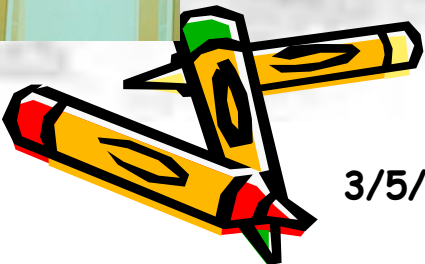
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## Genetic Changes and Recent Evidences of Viral Evolution



Mechanism	Example
Point Mutation	Avian Influenza (H5N2).
Intramolecular Recombination	
Genetic Reassortment	Pandemic Human Influenza H1N1 (1918) originated by gaining genes from avian viruses.
Intramolecular Recombination and Mutation	Polio vaccine virus, reversion to virulence following vaccination.



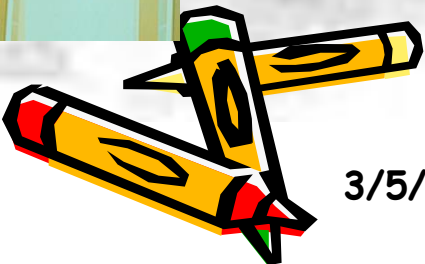
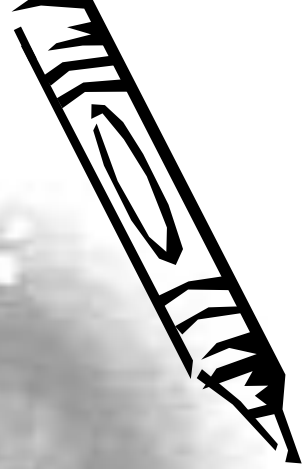
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# Questions:

- ❖ What's the definition of the mutation?
- ❖ Mention the types of the genotypic mutation?



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