# Mutations

**Mutations:**

**Causes of Genetics Mutations:**

1- **Spontaneous Mutations**

2- **Induced Mutations**

Slipped Intermediate DNA

A. Loop-out in leading nascent strand

B. Loop-out in lagging template strand
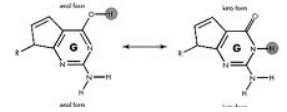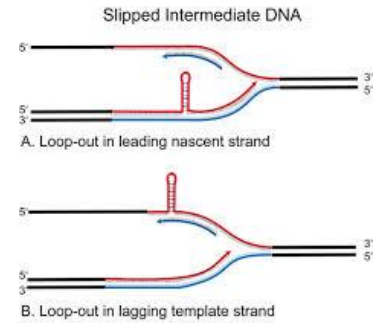
**Types of Mutations:**

**1. Point Mutations: Substitution**

**Silent Mutation**

**Missense Mutations**

**Nonsense Mutation**

**Wild type**

mRNA 5′ A U G A A G U U U G G C U A A 3′
Protein Met Lys Phe Gly Stop
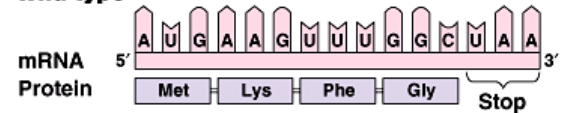
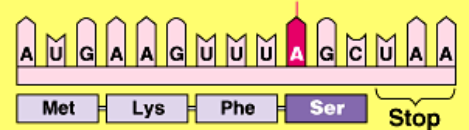**Base-pair substitution**

No effect on amino acid sequence
U instead of C
A U G A A G U U U G G U U A A
Met Lys Phe Gly Stop

**Missense**
A instead of G
A U G A A G U U U A G C U A A
Met Lys Phe Ser Stop
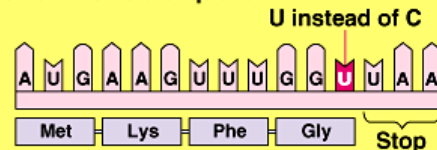
**Nonsense**
U instead of A
A U G U A G U U U G G C U A A
Met Stop
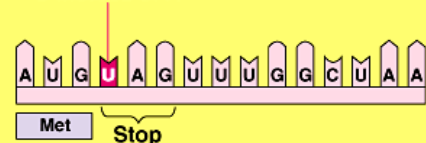
## 2. Point Mutations: Frameshift

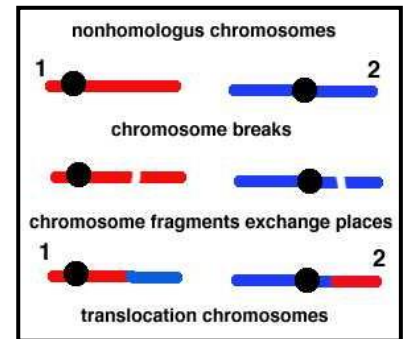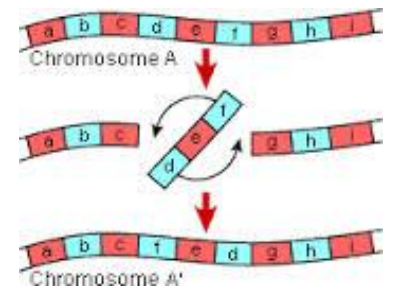**Insertion or Deletion**
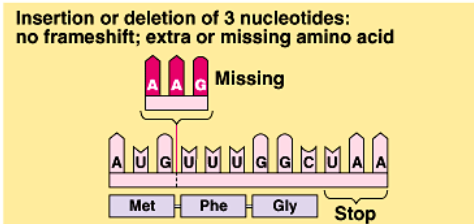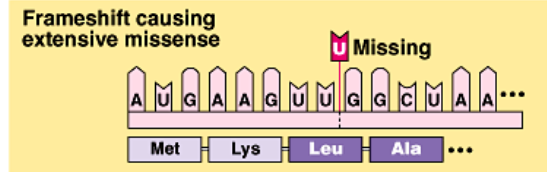


## 3. Chromosomal Mutations:

**Translocation**



**Inversion**



**Trasposable**