

Mutations

**What are Mutations?**

- Changes in the \_\_\_\_\_ sequence of DNA
- May occur in \_\_\_\_\_ cells (aren't passed to offspring)
- May occur in \_\_\_\_\_ (eggs & sperm) and be passed to offspring
- Changing amino acid sequence can mess up protein \_\_\_\_\_ or the organism's \_\_\_\_\_

**Are Mutations Helpful or Harmful?**

- Mutations happen regularly
- Almost all mutations are \_\_\_\_\_
- Chemicals & UV radiation cause mutations
- Many mutations are repaired by \_\_\_\_\_ (DNA Polymerase)
- Some type of skin cancers and leukemia result from \_\_\_\_\_ mutations
- Some mutations may \_\_\_\_\_ an organism's survival (beneficial)

**Types of Mutations**

**1) Chromosome Mutations**

May Involve:

- Changing the \_\_\_\_\_ of a chromosome
- The loss or gain of part of a chromosome

**Five types exist:**

Deletion:

- Due to \_\_\_\_\_
- A \_\_\_\_\_ of a chromosome is **lost**

Inversion

- Chromosome segment **breaks off**
- Segment flips around \_\_\_\_\_
- Segment \_\_\_\_\_

Duplication

- Occurs when a gene **sequence is repeated**
- \_\_\_\_\_

Translocation

- Involves **two chromosomes** that aren't homologous
- **Part** of one chromosome is **transferred to another** chromosomes

Nondisjunction

- \_\_\_\_\_ of chromosomes to \_\_\_\_\_ during meiosis
- Causes gamete to have \_\_\_\_\_ or too few **chromosomes**
- **Disorders:**
  - **Down Syndrome** – three 21<sup>st</sup> chromosomes
  - **Turner Syndrome** – single X chromosome
  - **Klinefelter's Syndrome** – XXY chromosomes

**Gene Mutations**

- Change in the **nucleotide sequence** of a gene
- May only involve a single nucleotide
- May be due to **copying errors, chemicals, UV radiation, viruses, etc.**

**Original Chromosome**



**Duplication**



**Deletion**



**Inversion**



**Inversion**



Mutations

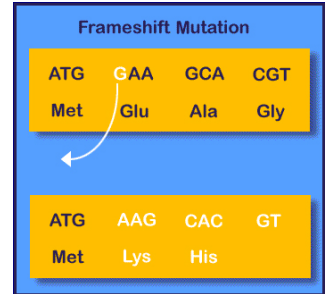
Type of \_\_\_\_\_ Mutations

• Include:

- \_\_\_\_\_ Mutations
  - Change of a single nucleotide
  - Includes the \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_ of \_\_\_\_\_ nucleotide in a gene
  - Sickle Cell disease is the result of \_\_\_\_\_ nucleotide substitution
    - Occurs in the hemoglobin gene

- **Frameshift Mutation**

- Inserting (INSERTIONS) or deleting (DELETIONS) one or more nucleotides
- Changes the “\_\_\_\_\_” like changing a sentence
- Proteins built incorrectly
- Original:  
The fat cat ate the wee rat.
- Frame Shift ( “a” added):  
The fat caa tat eth ewe era t.



There are three main types of mutations: point missense mutations, point nonsense mutations, and frameshift mutations. In each of the following DNA sequences, you will use the mRNA and amino acid sequences to identify the mutation that occurred and the effects of each on, if any. Look and analyze carefully!

**Original DNA Sequence:** T A C A C C T T G G C G A C G A C T  
**mRNA Sequence:** \_\_\_\_\_  
**Amino Acid Sequence:** \_\_\_\_\_

**Mutated DNA Sequence #1:** T A C A T C T T G G C G A C G A C T  
 What's the mRNA sequence? (Circle the change) \_\_\_\_\_  
 What will be the amino acid sequence? \_\_\_\_\_  
 Will there likely be effects? \_\_\_\_\_  
 What kind of mutation is this? \_\_\_\_\_

**Mutated DNA Sequence #2:** T A C G A C C T T G G C G A C G A C T  
 What's the mRNA sequence? (Circle the change) \_\_\_\_\_  
 What will be the amino acid sequence? \_\_\_\_\_  
 Will there likely be effects? \_\_\_\_\_  
 What kind of mutation is this? \_\_\_\_\_

**Mutated DNA Sequence #3:** T A C A C C T T A G C G A C G A C T  
 What's the mRNA sequence? (Circle the change) \_\_\_\_\_  
 What will be the amino acid sequence? \_\_\_\_\_  
 Will there likely be effects? \_\_\_\_\_  
 What kind of mutation is this? \_\_\_\_\_

**Mutated DNA Sequence #4:** T A C A C C T T G G C G A C T A C T  
 What's the mRNA sequence? (Circle the change) \_\_\_\_\_  
 What will be the amino acid sequence? \_\_\_\_\_  
 Will there likely be effects? \_\_\_\_\_  
 What kind of mutation is this? \_\_\_\_\_

**Mutated DNA Sequence #1:** T A C A C C T T G G C G A C G A C T  
 What will be the corresponding mRNA sequence? \_\_\_\_\_  
 What will be the amino acid sequence? \_\_\_\_\_  
 Will there likely be effects? \_\_\_\_\_  
 What kind of mutation is this? \_\_\_\_\_