

NAME _____

Mutations Worksheet - Deletion, Insertion & Substitution



There are several types of mutations:

- **DELETION** (a base is lost/deleted)
- **INSERTION** (an extra base is added/inserted)
 - Deletion & insertion may cause what's called a **FRAMESHIFT** mutation, meaning the **reading "frame"** changes, thus changing the amino acid sequence from this point forward
- **SUBSTITUTION** (one base is substituted for another)
 - If a substitution **changes** the amino acid, it's called a **MISSENSE** mutation
 - If a substitution **does not change** the amino acid, it's called a **SILENT** mutation
 - If a substitution **changes the amino acid to a "stop,"** it's called a **NONSENSE** mutation



Complete the boxes below. Classify each as **Deletion**, **Insertion** or **Substitution** **AND** as either **frameshift**, **missense**, **silent** or **nonsense** (**Hint**: Deletion & Insertion will always be frameshift).

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 type 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 type 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 type 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 type of mutation is this? _____

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 #5 T A C A C C T T G G 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 type of mutation is this? _____

1. Which type of mutation is responsible for **new variations** of a trait? _____

2. Which type of mutation does **not** result in an abnormal amino acid sequence? _____

3. Which type of mutation stops the **translation** of an mRNA molecule? _____



Sickle Cell Anemia

Sickle cell anemia is the result of a type of mutation in the gene that codes for part of the **hemoglobin** molecule. Recall that hemoglobin carries **oxygen** in your **red blood cells**. The mutation causes these red blood cells to become stiff & sickle-shaped when they release their oxygen. The sickled cells tend to get stuck in blood vessels, causing pain and increased risk of stroke, blindness, damage to the heart & lungs, and other conditions.

--- Analyze the DNA strands below to determine what amino acid is changed **AND** what type of mutation occurred

Normal hemoglobin DNA C A C G T A G A C T G A G G A C T C ...

Normal hemoglobin mRNA

Normal hemoglobin AA sequence

Sickle cell hemoglobin DNA C A C G T A G A C T G A G G A C A C ...

Sickle cell hemoglobin mRNA

Sickle cell hemoglobin AA sequence

4. What type of mutation is this? Please explain why.
