NAME _____ **Mutations Worksheet**

*(staff.fcps.net/**einman**/biology/**Mutations**WS.doc)* **Deletion, Insertion & Substitution**

There are several types of mutation:

- **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 …**

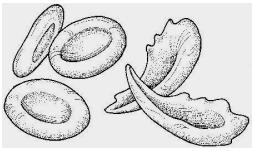
What's the **mRNA** sequence?_____(*Circle the change*)

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 bloods 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.
