***BiologyWorksheet: Mutations Practice***

There are three ways that DNA can be altered when a mutation (change in DNA

sequence) occurs.

1. Substitution – one base-pairs is replaced by another:

*Example:* G to **C** or A to **T**

 C **G** T **A**

**This is also called a point mutation.**

2. Insertion – one or more base pairs is added to a sequence:

*Example:* CGATGG ––> CGA**A**TGG

 GCTACC GCT**T**ACC

3. Deletion – one or more base pairs is lost from a sequence:

*Example:* C**G**ATGG ––> CATGG

 G**C**TACC GTACC

**Insertion and deletion mutations are also called frameshift mutations!!!**

1. Below is the base sequence for the normal protein for normal hemoglobin and the base

 sequence for the sickle cell hemoglobin.

Normal: GGG CTT CTT TTT

Sickle: GGG CAT CTT TTT

a. Transcribe and translate the normal and sickle cell DNA.

Normal: GGG CTT CTT TTT

Sickle: GGG CAT CTT TTT

b. Identify this as a point or frameshift mutation. Explain.

c. If the base sequence read GGG CTT CTT AAA instead, would this result in sickle cell

 hemoglobin? Explain.

2. Look at the following sequence: THE FAT CAT ATE THE RAT. Delete the first H and

 regroup the letters in groups of three- write out the new groups of three. Does the sentence

 still make sense? What type of mutation is this an example of?

THE FAT CAT ATE THE RAT

3. Given the following three mRNA sequences, 2 code for the same protein. Which two?

a. AGU UUA GCA ACG AGA UCA

b. UCG CUA GCG ACC AGU UCA

c. AGC CUC GCC ACU CGU AGU

**4. Use the following DNA sequence to answer questions about the mutated DNA sequences;**

Mutated DNA Sequence #3: **T A C A C C T T G G G A C G A C T**

Circle the change.

What’s the mRNA sequence? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What will be the amino acid sequence? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How many amino acids were changed? \_\_\_\_\_\_\_\_

What kind of mutation is this? \_\_\_\_\_\_\_\_\_\_\_\_\_

Mutated DNA Sequence #2: **T A C A C C T T A G C G A C G A C T**

Circle the change.

What’s the mRNA sequence? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What will be the amino acid sequence? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How many amino acids were changed? \_\_\_\_\_\_\_\_

What kind of mutation is this? \_\_\_\_\_\_\_\_\_\_\_\_\_

Mutated DNA Sequence #1: **T A C G A C C T T G G C G A C G A C T**

Circle the change.

What’s the mRNA sequence? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What will be the amino acid sequence? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How many amino acids were changed? \_\_\_\_\_\_\_\_

What kind 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 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**