

Name: \_\_\_\_\_

# RESEARCH BASICS: DNA MUTATION

**BACKGROUND INFORMATION:** Many rare diseases, cancers, and genetic conditions can be traced to a mutation in DNA. Although there is research occurring on how mutations occur, it is known that the leading causes of mutations are radiation and carcinogens. When DNA is mutated, it disrupts protein synthesis and causes proteins to be formed incorrectly or not at all. Proteins are essential for all processes within the cell including regulation of the cell cycle, cell respiration, metabolism, and synthesis. Through this activity, you will see how different mutations affect proteins.

There are two main categories of mutations. A **point mutation** occurs when one nucleotide is changed. For example, an adenine is exchanged for a thymine. Point mutations can be harmless but can also cause issues in protein formation. A **frameshift mutation** occurs when there is either an insertion or deletion of nucleotides.

**DIRECTIONS:** For each sequence of DNA, break the code down into 3-letter codons. Next, transcribe the DNA code into mRNA code. Finally, use the mRNA code box below to translate the sequence into a polypeptide of amino acids.

|   | U                                                     | C                                        | A                                                            | G                                                          |                  |
|---|-------------------------------------------------------|------------------------------------------|--------------------------------------------------------------|------------------------------------------------------------|------------------|
| U | UUU } Phe - F<br>UUC }<br>UUA } Leu - L<br>UUG }      | UCU }<br>UCC } Ser - S<br>UCA }<br>UCG } | UAU } Tyr - Y<br>UAC }<br><b>UAA Stop</b><br><b>UAG Stop</b> | UGU } Cys - C<br>UGC }<br><b>UGA Stop</b><br>UGG } Trp - W | U<br>C<br>A<br>G |
| C | CUU }<br>CUC } Leu - L<br>CUA }<br>CUG }              | CCU }<br>CCC } Pro - P<br>CCA }<br>CCG } | CAU } His - H<br>CAC }<br>CAA } Gln - Q<br>CAG }             | CGU }<br>CGC } Arg - R<br>CGA }<br>CGG }                   | U<br>C<br>A<br>G |
| A | AUU }<br>AUC } Ile - I<br>AUA }<br><b>AUG Met - M</b> | ACU }<br>ACC } Thr - T<br>ACA }<br>ACG } | AAU } Asn - N<br>AAC }<br>AAA } Lys - K<br>AAG }             | AGU } Ser - S<br>AGC }<br>AGA } Arg - R<br>AGG }           | U<br>C<br>A<br>G |
| G | GUU }<br>GUC } Val - V<br>GUA }<br>GUG }              | GCU }<br>GCC } Ala - A<br>GCA }<br>GCG } | GAU } Asp - D<br>GAC }<br>GAA } Glu - E<br>GAG }             | GGU }<br>GGC } Gly - G<br>GGA }<br>GGG }                   | U<br>C<br>A<br>G |

## NORMAL DNA

|                |      |                                                            |
|----------------|------|------------------------------------------------------------|
| Amino<br>Acids | mRNA | DNA                                                        |
|                |      | TACATAAGAAAATCACCAGGGCCCCCTTTAAGATGACGGGGGCGTTTGAGCACACACT |
|                |      |                                                            |

Each of the following DNA sequences is mutated. Circle or highlight the area of the DNA that is mutated. Complete transcription and translation on each sequence and determine the effect on the protein.

|                |      |                                                            |
|----------------|------|------------------------------------------------------------|
| Amino<br>Acids | mRNA | DNA                                                        |
|                |      | TACATAAGAAAGTCACCAGGGCCCCCTTTAAGATGACGGGGGCGTTTGAGCACACACT |
|                |      |                                                            |

1. Which type of mutation(s) occurred above?
2. How did the mutation affect the amino acid sequence?

Amino  
Acids

mRNA

DNA

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