Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class Period:\_\_\_\_\_\_\_\_\_

**Genetics-** *Mutation Lab*

**Pre Lab-** *Define the following terms:*

Mutate-

Insert-

Delete-

Substitute-

In genetics, a **mutation** is a change in the base sequence of a gene. Genes are segments of **DNA** that code for proteins. The specific sequence of DNA bases is translated into a single strand of **mRNA**. The mRNA message leaves the nucleus and goes to the **ribosome**, the organelle where proteins are synthesized, or made.

1. What is a mutation?
2. Which organelle stores the genetic information?
3. Which organelle makes proteins?
4. What is the direct source of instruction used by the ribosome for making a protein?
5. What is the indirect source of instruction for making a protein?

**Part 1-** *Mutations:*

**Card 1 Card 2 Card 3**

There are three types of mutations that can occur. An **insertion** is when an extra base, or sequence of bases is added to the DNA code. This results in a DNA code that is longer than the original sequence. A **deletion** is when a base, or sequence of bases is removed from the DNA code. This results in a gene that is shorter than the original sequence. A **substitution** is when a base, or group of bases is replaced by different letters. This results in a gene sequence of the same length, but with different bases.

1. What type of mutation occurred in the first activity?
2. What happened to every student after the first mutated student?
3. What type of mutation occurred in the second activity?
4. What type of mutation occurred in the third activity?
5. What is mitosis, and when does mitosis occur?
6. How would a mutation in a single cell affect an organism?
7. How would a mutation in a zygote affect an organism?
8. What are some environmental factors that can increase the chance of a mutation in the DNA of an embryo?
9. Why are the first 8 weeks of life so important for development?
10. What else might change as a result of a mutation in the genetic code?

**Part 2-** *The effects of DNA mutation on protein production:*

Use the following template strand of DNA to make a complementary strand of DNA. Then, use the complementary strand to form a single strand of mRNA. Be sure to bracket your codons (every **3** bases) This will help prevent any mutations of the DNA.

Template Strand ATG GTT GCT GAG GGC CCT CTT GGG

Complementary Strand \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

mRNA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sequence of amino acids \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Mutation 1-** A deletion has occurred. The first base of your **complementary strand** should be “T.” Remove the “T.” Rewrite the new sequence of the mutated DNA below.

Mutated DNA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

mRNA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sequence of amino acids \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Mutation 2-** The following strand has also been mutated from your original complementary strand. A substitution mutation occurred at the 6th base. An “A” was replaced with a “C.” A deletion also occurred. The “A” 7 bases from the end was deleted. Furthermore, an insertion mutation added an “A” as the last base of the sequence. The points of mutation have been underlined for you to see.

Mutated DNA TAC CAC CGA CTC CCG GG\_ GAA CCCA

mRNA \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sequence of amino acids \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Genetics-** *Mutation Lab Analysis*

1. Describe the effects of the first mutation on the final protein.
2. Describe the effects of the second mutation on the final protein.
3. Each amino acid is coded for by several codons. For example, the amino acid *Pro* is coded for when the ribosome reads CCU, CCC, CCA, or CCG. Describe how this is advantageous for organisms with cells that read, replicate, and translate millions of copies of DNA every day.
4. Which type of mutation do you think would typically be more harmful- a deletion, or substitution, and why?
5. How does a change in the amino acid sequence affect the final protein created? How could a mistake in the amino acid sequence cause an enzyme to be nonfunctional?