Lesson 5.4 Mutation

Name

Date

Period

anticodon	codon	transfer RNA (tRNA)	translation

Engage I: Think back to lesson 4.4 where you first learned about mutations

1. What is a mutation?

2. What do you think causes mutations?

Explore I

Everyone acquires some changes to their DNA during the course of their lives. These changes occur in a number of ways. Sometimes there are simply copying errors that are introduced when DNA replicates itself. Other changes are introduced as a result of DNA damage through environmental agents including sunlight, cigarette smoke and radiation. Our cells have built in mechanisms that catch and repair most of the changes that occur during DNA replication or environmental damages, however as we age, these mechanisms are not as effective.

Another concept in understanding mutations is being aware of the consequences of when a mutation occurs. A mutation that occurs during the development of sex cells, such as sperm or egg cells, has a chance of being passed down to offspring in future generations. If a mutation occurs in a somatic cell, which are all other cells in your body, then the mutation is limited to all cells in your body being replicated from the mutated cell. However, it does not alter the genetic information in your sex cells. For example, in your early twenties suppose you spend a lot of time outside, enjoying the California sunshine. At age 29, you develop skin cancer, and have it treated. At 34, you are now happily married and have your first child on the way. Your child does not now have a higher chance of getting skin cancer just because you had it.

Explain I

3. What two ways does our DNA change?

4. What happens over time that prevents are ourselves from fixing our DNA?

5. If you had a mutation in your liver due to damage from a Hepatitits infection and ended up with liver cancer, does this mean that your five children will all now have a higher chance of getting liver cancer? Explain.

Explore I - Types of Mutations

A gene is essentially a sentence made up of the four nitrogenous bases that describe how to make a protein. Each protein has a specific arrangement of bases. Any change to that sequence can alter the

gene's meaning and change the protein that is made or how or when a cell makes a protein. There are many different ways to alter a gene just as there are many ways to introduce typos into a sentence.

I. Point Mutation is a simple change in one base of the gene sequence. This is the same as changing one letter in a sentence. For example Sickle Cell Anemia is a point mutation.

II. Frame-shift Mutation is where one or more bases are inserted or deleted. This is the same as adding or removing letters in a sentence. The result is changing all the words in a sentence following the mutation. Typically, this type of mutation makes DNA meaningless and results in shortened proteins. For example Tay Sachs is due to frameshift mutation.

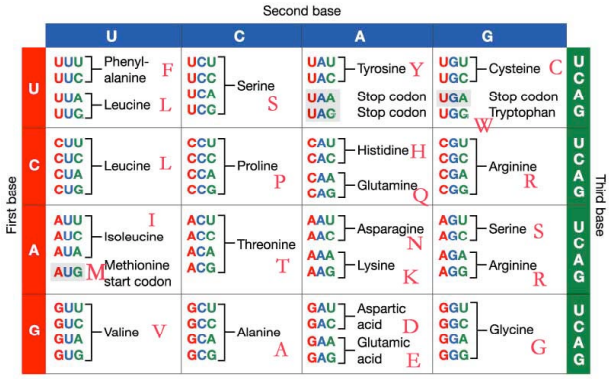
Explain II

For questions #5 and #6 determine whether there was a point mutation or a frameshift mutation using the sentence," the fat cat ate the wee rat" as a sample gene AND <u>underline</u> where the mutation occurs.

6. The fat caa tet hew eer at

7. The fat hat ate the wee rat

Now instead of using a protein sentence using English words, we will use amino acid sequences.



View the short DNA sequence below. This is our original, un-mutated DNA strand.

9. TRANSCRIBE it into mRNA.
original DNA: TAC – GGG – ACC – GAC – TTA – ATC

mRNA: __ __ __ - __ __ __ -__ __ __ -__ __ __ -__ __ __ -__ __ __

10. TRANSLATE this mRNA into amino acids:

Protein #1: _____ - _____ - _____ - _____ -

Now let's mutate this DNA strand with a <u>point mutation</u> where only *one* base is changed.

TRANSCRIBE it into mRNA.

TAC –-GGG –-ACC –-*C*AC – TTA –- ATC

11. mRNA: __ __ __ - __ __ __ -__ __ __ -__ __ __ -__ __ __ -__ __ __

TRANSLATE this mRNA into amino acids:

12. Protein #2: _____ - _____ - _____ - _____ - _____ - _____

13. How is protein #2 different from protein #1?

14. Are they the same protein since they came from almost the same sequence of DNA?

Let's go back to our original DNA strand and do another <u>point mutation</u> with a different base will be changed.
TRANSCRIBE it into mRNA.

TAC –- GG*T* –- ACC –- GAC – TTA – ATC

15. mRNA: __ __ __ - __ __ __ -__ __ __ -__ __ __ -__ __ __ -__ __ __

TRANSLATE this mRNA into amino acids:

15. Protein #3: _____ - _____ - _____ - _____ - _____ - _____

16. Is protein #3 different from protein #1? Why or why not?

17. Are they the same protein since they came from almost the same sequence of DNA?

Let's go back to our original DNA strand and do an insertion. Remember an insertion is a type of frame-shift mutation. TRANSCRIBE this DNA into mRNA.

TAC – AGG – GAC – CGA – CTT – AAT – C

18. mRNA: __ __ __ - __ __ __ -__ __ __ -__ __ __ -__ __ __ -__ __ __ - __

TRANSLATE this mRNA into amino acids:

19. Protein #4: _____ - _____ - _____ - _____ - _____ - _____ - _____

20. Is protein #4 different from protein #1? Why or why not?

21. Does the last "C" in the DNA strand code for anything? Explain your answer.

22. Which type of mutation do you think can cause more damage: a point mutation or an insertion? Explain.