

Exploring Point Mutations Activity

Procedure

1. Transcribe and translate the DNA sequence provided.
 - a. You will need to use the codon table found in your textbook or found on your "Breaking the Code" worksheet.
2. Mutate nucleotide #10 in the DNA sequence provided, according to the rules in table 1.
 - a. Your instructor will provide you with dice, so you can simulate what happens when the DNA sequence is mutated – if the number you roll does not result in a change in nucleotide #10, keep rolling until the nucleotide changes.
 - b. Every student at your table should roll the die to mutate their own DNA. In this way, there will be more outcomes to compare.
3. Write down your newly mutated DNA sequence.
4. Determine and record the mRNA and the protein sequence coded by the mutated DNA sequence.
5. Mutate nucleotide #16 in the DNA sequence provided, according to the rules in table 1.
6. Write down your newly mutated DNA sequence.
7. Determine and record the mRNA and the protein sequence coded by the mutated DNA sequence.

Nucleotide #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
DNA Sequence	T	A	C	A	T	A	C	G	A	C	G	T	C	T	A	C	G	T	A	C	T

1. **TRANSCRIPTION:** Write the **mRNA sequence** for the DNA sequence above.

2. **TRANSLATION:** Write the **amino acid sequence** (polypeptide) of the mRNA sequence above.

Table 1: Rules for determining which kind of mutation will take place

If you toss a ...	Then you must ...
1	Substitute your nucleotide with an A
2	Substitute your nucleotide with a C
3	Substitute your nucleotide with a G
4	Substitute your nucleotide with a T
5	Delete the nucleotide
6	Insert a nucleotide right after the #10 nucleotide (Toss the die again until you get 1–4 to determine which letter nucleotide to insert.)

MUTATION #1

3. **MUTATION:** In the space below, write the complete new **DNA sequence** with the mutation at nucleotide #10 position.

4. **TRANSCRIPTION:** Write the **mRNA sequence** from mutated DNA above.

5. **TRANSLATION:** Write the **amino acid sequence** (polypeptide) of the mRNA sequence above. Circle any differences from the original protein.

MUTATION #2

6. **MUTATION:** Keeping the mutated nucleotide from Mutation #1, mutate nucleotide #16 following the rules outlined in table 1. In the space below, write the complete new **DNA sequence** with the mutation at nucleotide #16 position. (The DNA sequence should now have two mutations.)

7. **TRANSCRIPTION:** Write the **mRNA sequence** from mutated DNA above.

8. **TRANSLATION:** Write the **amino acid sequence** (polypeptide) of the mRNA sequence above. Circle any differences from the original protein.

Analysis

1. If a mistake is made during transcription, will that mistake be permanent? During translation? Why or why not? Will it be passed on to the next generation of cells? Explain your answers.
2. Why do you think you used a die to determine the mutations? Why did you keep the first mutation when mutating the sequence a second time? In other words, why didn't you "fix" it?
3. Did everyone in your group get the same mutation(s)? Explain. What are the odds of two people rolling the same number? Of rolling the same mutation?
4. Differentiate between the following types of point mutations:
 - a) Substitution
 - b) Deletion
 - c) Insertion
5. Explain the statement: "A mutation causes a change in the genotype, but that change does not always cause a change in the phenotype".