**Gene Mutations-Academics**

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| Any change in DNA is called a mutation. Mutations can be caused by exposure to chemicals radiation, certain retroviruses or just random copy errors-it happens! The mutations can be small (as in a single nucleotide is changed) or large (as in an entire extra or lost chromosome). Not all mutations affect the protein that is formed. Of those that **do** change the protein; some changes are neutral, some are harmful and still others are beneficial. |

**Purpose:**

Which mutation is more damaging, *changing* one nucleotide or *deleting* one nucleotide?

**Independent Variable:**

**Dependent Variable:**

**Constants:**

**Hypothesis:**

If, then, because

**Procedure:**

Normal (Wild Type DNA)

 1. Copy the DNA strand into you notebook

 2. Transcribe (copy) the original DNA into mRNA

 3. Translate the original mRNA into amino acids (your protein strand) using the code wheel

|  |  |
| --- | --- |
| Original DNA | TAC | AAA | GAT | CGT | TAG | TCT | ACC | CCG |
| Original mRNA  |  |
| Original Protein |  |

Mutation #1 & 2-change a nucleotide

 4. Copy the original DNA again and label it as changed nucleotides.

 5. Using a colored pencil cross out the G in the 3rd codon and change it to a T.

 6. Again using a colored pencil make another mutation, this time crossing out the G

in the 5th codon and changing it to a T.

 7. Transcribe the DNA into mRNA.

 8. Translate the mRNA into amino acids using your code sheet. Use a colored pencil or highlighter to highlight which mRNA codons were changed and which amino acids were changed

Mutation #3-delete a nucleotide

 9. Again copy the entire original DNA again and label it as deleted nucleotide.

 10. Using a colored pencil, cross out the G in the 3rd codon again, but this time it is just gone with no replacement

 11. Using a colored pencil, draw a new codon break lines to show where the new codons will be due to the missing nucleotide

 12. Transcribe into mRNA, translate into amino acids and highlight all the places that were changed in both your mRNA and your protein

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Follow Up Questions

1. These were both mutations. What IS a mutation AND what causes mutations to happen?
2. Which genetic mutation was more damaging to the protein and why?
3. In the lab, these were both different types of **gene** **mutations**. What is a gene? How many proteins are damaged by a gene mutation like these?
4. Not all mutations will change the amino acid made. Give an example of how this happened in lab and use your code sheet to find another example. Why did this happen (how can you mutate the DNA and not change the amino acid)?
5. Proteins must fold up into their functional shape- many proteins are enzymes with active sites. Why might a mutation in a protein cause it to not function correctly? Explain.
6. Using your notes, define a point mutation. Which of the mutations that we made were point mutations? Why is this a good name for this type of mutation?
7. Using your notes, define a frame shift mutation. Which of the mutations that we made was a frame shift?
8. What is the “frame” for a frame shift mutation? Why is this a good name for this type of mutation?

Extensions

1. Is an amino acid more likely affected if you change the first, the second or the third nucleotide in a codon?
2. Chromosomal mutations may also happen when a bigger piece of DNA is damaged (like a large section of a chromosome is flipped upside down, cut out or an entire missing chromosome). How many proteins may be affected