

How do Gene Mutations affect Proteins?

Name: _____ Per: _____

Background: A mutation is a change in the base sequence of DNA. It happens when the DNA is not copied correctly during replication. Sections of DNA that code for proteins are called genes. If a mutation occurs in a gene it may affect the protein that is assembled during protein synthesis. Enzymes are proteins that have specific shapes. The shape of the enzyme is based on the order of the amino acids. If you change the shape of the enzyme it will no longer work. Enzymes cause specific chemical reactions in the cell to occur. If the enzyme does not work, the chemical reaction will not take place. Ultraviolet light, X-Rays and Gamma Rays and some harmful chemicals can cause mutations in DNA. These are called mutagens.

Activity: Gene mutations often have serious effects on proteins. In this activity you will demonstrate how such mutations affect protein synthesis.

1) Normal DNA Sequence: Fill in the chart below

Codon #	1	2	3	4	5	6	7
Original DNA sequence	A A T	G C C	A G T	G G G	T C G	C A C	
mRNA sequence	U U A						
Amino Acid	Leu						

- 2) The following chart will demonstrate the effect of a **POINT MUTATION**. A point mutation occurs when one base on the DNA is switched to another base. (example ACC CCA switched to ACG CCA).

Change the FOURTH base in the original DNA strand from G to C, fill in the chart below. (Rewrite the DNA strand exactly as it is where it says "mutated DNA sequence". Only change the FOURTH base.

Codon #	1	2	3	4	5	6	7
Original DNA sequence	A A T	G C C	A G T	G G G	T C G	C A C	
Mutated DNA sequence	A A T	↑					
mRNA sequence	U U A						
Amino Acid	Leu						

- A) How did the point mutation affect the amino acid chain?

B) If the original DNA sequence coded for the enzyme lactase (which causes lactose to breakdown), will the body be able to breakdown lactose?

3) The following chart will demonstrate the effects of a **FRAME SHIFT MUTATION**. The example below will be an insertion frame shift mutation. A frame shift mutation happens when an extra nucleotide is added or a nucleotide is deleted. (example: ACC CCA become ACC GCC A)

If Guanine (G) is **added** to the original DNA strand AFTER the THIRD base, fill in the chart below:

Codon #	1	2	3	4	5	6	7
Original DNA sequence	A A T	G C C	A G T	G G G	T C G	C A C	
Mutated DNA sequence	A A T	G G C	C A G				
mRNA sequence	U U A						
Amino Acid	Leu						

A) How did the frame shift mutation affect the amino acid chain?

B) If the original DNA sequence codes for the enzyme lactase, will the body be able to break down lactose?

C) Which type of mutation would be more deadly to an organism- Point Mutation, or Frame Shift? WHY?

D) Name 3 mutagens.

E) "All mutations are harmful to organisms." Do you agree or disagree with this statement. Provide support for your answer.