

**GO TO LINK #1**

1. What is a substitution? Show an example of a DNA sequence with a substitution?
2. What is an insertion? Show an example of a DNA sequence with an insertion.
3. What is a deletion? Show an example of a DNA sequence with a deletion.
4. What is a frameshift? Show an example.
5. What are 2 causes of mutations?
6. Explain the effects of mutations.

Read the case study about sickle cell anemia.

7. What kind of a mutation causes Sickle Cell? (substitution, insertion, deletion, or frameshift)
8. How is the protein changed by this mutation?
9. How does this affect the red blood cells?
10. What are the negative effects on the organism? Positive effects?

**Go to LINK #2**

- 1) Click on the icon "Show DNA".
- 2) Then click the icon "Transcribe".
- 3) After a few moments, select "Translate" and then "Show Protein".

*Write the 11 amino acid sequence that makes up the protein below: **this is your original sequence!***

- 4) Press the "reset" button. On the DNA strand, select any nitrogen base. This will bring up a menu of different types of mutations. First select "Substitution Mutation" and repeat steps 2 and 3.

*Write the new 11 amino acid sequence of the new protein on the line below.*

- 5) Press the "reset" button. Select a different nitrogen base on the DNA strand then select the "Insertion Mutation" and repeat steps 2 and 3.

*Write the new 11 amino acid sequence of the new protein below.*

- 6) Finally, repeat step 5 but select "Deletion Mutation".

*Write the new 11 amino acid sequence of the new protein below:*

- 7) How similar/different were each protein compared to the original protein?