Unit 3.2 Learning Targets

Preface

In the last lesson, students learned that Anna Garcia suffered from a disease called sickle cell anemia. Sickle cell anemia is a disease in which red blood cells form an abnormal crescent shape. The disease is a genetic disorder caused by inheriting a mutated gene that codes for the protein hemoglobin. In this lesson students will investigate how DNA codes for proteins and how mutations can lead to diseases like sickle cell anemia. Students will explore how the body uses DNA to produce proteins, a process called *protein synthesis.*They will apply their knowledge of transcription and translation to decode a secret message, investigate the effect that various mutations have on protein production, and look specifically at the genetic mutation that causes sickle cell disease. Finally, they will use computer simulations to visualize the interactions between amino acids and how these relate to protein structure, as well as visualize how changes in the b-globin protein are due to the mutation associated with sickle cell disease.

Understandings

1. Proteins are produced through the processes of transcription and translation.
2. Changes in the genetic material may cause changes in the structure and function of a protein and consequently the traits of an organism.

Knowledge and Skills

It is expected that students will:

- Recognize that the sequence of nucleotides in DNA determines the sequence of amino acids in a protein.
- Explain the process of protein synthesis.
- Explain how changes in the b-globin protein are due to the mutation associated with sickle cell disease.
- Demonstrate transcription and translation to create a simulated protein.
- Analyze the effect that base pair mutations have on a simulated protein.
- Manipulate computer simulated proteins to visualize the interactions between amino acids and analyze protein structural changes.

Essential Questions

1. What is the DNA code?
2. What is the connection between genes and proteins?
3. How are proteins produced in a cell?
4. How does the sequence of nucleotides in DNA determine the sequence of amino acids in a protein?
5. What is a mutation?
6. What determines the shape of a protein?
7. Is the shape of a protein affected by its surrounding environment?
8. How does a change in the DNA code affect the shape of a protein?
9. Can changing just one nucleotide in a gene change the shape of a protein?