Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pd: \_\_\_\_\_\_\_\_\_\_\_

**Simulating Protein Synthesis**

**Pre-Lab Discussion**

Genes are the units that determine inherited characteristics, such as hair color and blood type. Genes are specific segments of DNA sequence that provide instructions for building protein. The sequence of nucleotide bases in a gene determines the sequence of amino acids in a protein. The sequence of amino acids, in turn, determines the 3D structure of the protein.

In a process called **transcription**, which takes place in the nucleus of a cell, the DNA nucleotide sequence is “read” and used to create single-stranded messenger RNA (mRNA) that carries the same instructions as the DNA. The mRNA carries this information in the form of a code to the ribosomes, where protein synthesis takes place. The code specifies the order in which the amino acids are joined together. However, amino acids cannot “read” the mRNA code directly. Another type of RNA, transfer RNA (tRNA), “reads” the mRNA and brings the amino acids to the ribosome. As the code carried by mRNA is “read” in the ribosome, the correct tRNA molecules arrive in turn and drop off the amino acids they carry to the growing protein chain. This process of using the mRNA sequence to create a protein is called **translation**.

In this investigation, you will simulate the mechanism of protein synthesis and thereby determine the traits of imaginary organisms called CHNOPS. CHNOPS have only one chromosome and are members of the animal kingdom. There are six genes on the CHNOPS chromosome—A, B, C, D, E, and F. Each gene provides instruction for one specific trait.

**Procedure**

1. To determine the trait for Gene A of your CHNOPS, fill in the information in the box labeled Gene A on your Data Table. Notice the sequence of nucleotides in the DNA. On the line provided, transcribe this DNA sequence into mRNA.
2. In order to determine the sequence of amino acids, use your codon chart to translate the mRNA. On the line provided in your data table, write down the sequence of amino acids.
3. Once you have the amino acid sequence, use the table provided to determine the trait. Different amino acid sequence specify different traits. Record the trait in your data table.
4. Repeat steps 1-3 for each gene.
5. Once you have determined all of your CHNOPS’s traits, sketch your CHNOPS in the space provided.

|  |  |
| --- | --- |
| **Amino Acid Sequence** | **Trait** |
| W-P-I | Curly fur |
| W-S-I | Straight fur |
| S-A | Four-legged |
| A-S | Three-legged |
| P-S-F-G | Blue skin |
| S-S-F-G | Orange skin |
| K-F | Two fangs |
| K-L | Four fangs |
| P-A-Y | Long nose |
| P-A-A | Short nose |
| Y-Y-D | One horn |
| Y-D-Y | Two horns |

**Data Table**

|  |  |  |
| --- | --- | --- |
| **Gene A** DNA: A C C G G T T A T  mRNA:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Amino Acid Sequence:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Trait: | **Gene B**  DNA: A G C C G A  mRNA:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Amino Acid Sequence:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Trait: | **Gene C**  DNA: T T T A A C  mRNA:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Amino Acid Sequence:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Trait: |
| **Gene D**  DNA: G G A C G C A T G  mRNA:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Amino Acid Sequence:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Trait: | **Gene E**  DNA: A G C A G G A A A C CC  mRNA:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Amino Acid Sequence:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Trait: | **Gene F**  DNA: A T G A T G C T A  mRNA:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Amino Acid Sequence:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Trait: |

**Draw your CHNOPS Here!**

**Questions**

1. What is the difference between transcription and translation?
2. Where does transcription take place? Where does translation take place?
3. If a nucleotide were changed in your CHNOPS DNA, would your CHNOPS look different? Explain why or why not.
4. What would cause one CHNOPS to look different than another CHNOPS?