**CHNOPS: Constructing a model of protein synthesis**

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

Genes are the units that determine inherited characteristics, such as hair color and blood type. Genes are lengths of DNA molecules that determine the structure of polypeptides (the building blocks of proteins) that our cells make. The sequence of nucleotides in DNA determines the sequence of amino acids in polypeptides, and thus the structure of proteins.

In a process called **TRANSCRIPTION,** which takes place in the nucleus of the cell, messenger RNA reads and copies the DNA’s nucleotide sequence in the form of a complementary RNA molecule. Then 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 to form the polypeptide. The code words, in mRNA, however, are not directly recognized by the corresponding amino acids. Another type of RNA called transfer RNA is needed to bring the mRNA and amino acids together. As the code carried by mRNA is “read” on a ribosome, the proper tRNAs arrive in turn and give up the amino acids they carry to the growing polypeptide chain. The process by which the information from DNA is transferred into proteins is known as **TRANSLATION.**

**In this investigation, you will simulate the mechanism of protein synthesis and thereby determine the traits inherited by fictitious organisms called CHNOPS. CHNOPS, whose cells contain only one chromosomes, are members of the kingdom Animalia. A CHNOPS chromosome is made up of 6 genes (A, B, C, D, E, F) each of which is responsible for a certain trait.**

**PROCEDURE:**

1. To determine the trait for Gene A of you CHNOPS, fill in information in the box labeled Gene A in the Data Table. Use the sequence of DNA to determine the sequence of mRNA (codon). Then, determine the sequence of tRNA (anticodon) that are complementary to mRNA.
2. Match each mRNA triplet (codon) with the specific amino acid in Table 1. Use a hypen (-) to separate each amino acid number.
3. Using Table 2, find the trait that matches the amino acid sequence.
4. Repeat steps 1-3 for the remaining genes.
5. Using all the inherited traits, sketch your CHNOPS on a piece of paper.

Table 1:

**1**

|  |  |
| --- | --- |
| **Codon** | **Amino Acid Number** |
| UGG | 20 |
| UCG | 16 |
| GCU | 2 |
| UUG | 4 |
| GCG | 3 |
| CCC | 5 |
| UCC | 7 |
| UUU | 8 |
| AAA | 9 |
| CCA | 12 |
| AUA | 13 |
| GGG | 1 |
| UAG | 6 |
| GAU | 10 |
| CCU | 11 |

Table 2:

|  |  |
| --- | --- |
| **Amino –Acid Sequence** | **Trait** |
| 20-11-13 | Hairless |
| 20-12-13 | Hairy |
| 20-21-21 | Plump |
| 13-14-15 | Skinny |
| 16-2 | 4-legged |
| 12-7-8-1 | Long nose |
| 5-7-8-1 | Short nose |
| 9-8 | No freckles |
| 9-4 | Freckles |
| 11-3-2 | Blue skin |
| 11-3-3 | Orange skin |
| 6-6-10 | Male |
| 6-6-13 | Female |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GENE A** | | **GENE B** | | **GENE C** | |
| **DNA** | ACC GGT TAT | **DNA** | AGC CGA | **DNA** | TTT AAC |
| **mRNA** |  | **mRNA** |  | **mRNA** |  |
| **tRNA** |  | **tRNA** |  | **tRNA** |  |
| **Amino Acid Sequence** |  | **Amino Acid Sequence** |  | **Amino Acid Sequence** |  |
| **Trait** |  | **Trait** |  | **Trait** |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **GENE D** | | **GENE E** | | **GENE F** | |
| **DNA** | GGA CGC CGA | **DNA** | GGG AGG AAA CCC | **DNA** | ATC ATC CTA |
| **mRNA** |  | **mRNA** |  | **mRNA** |  |
| **tRNA** |  | **tRNA** |  | **tRNA** |  |
| **Amino Acid Sequence** |  | **Amino Acid Sequence** |  | **Amino Acid Sequence** |  |
| **Trait** |  | **Trait** |  | **Trait** |  |

http://learn.genetics.utah.edu/content/begin/dna/transcribe/