Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block \_\_\_\_\_\_\_\_\_

PROTEIN SYNTHESIS: TRANSCRIPTION AND TRANSLATION

**Background Information:**

DNA is the molecule that stores the genetic information in your cells. That information is coded

in the four bases of DNA: C (cytosine), G (guanine), A (adenine), and T (thymine). The DNA

directs the functions of the cell on a daily basis and will also be used to pass on the genetic

information to the next generation. Because of its critical role in all the functions of the cell, DNA

is kept protected in the nucleus of your cells.

DNA is organized in sections called genes. Genes code for proteins, and it is proteins that do

all the work in the cell. They function as structural proteins — serving as the building blocks of

cells and bodies. And they function as enzymes — directing all the chemical reactions in living

organisms.

Proteins are made in the cytoplasm by ribosomes. Since DNA cannot leave the nucleus, the

information from DNA must be transmitted from the nucleus to the cytoplasm. During

transcription, each gene on the DNA is read and codes directly for a messenger RNA

(mRNA) molecule. The mRNA is made by matching its complementary bases — C, G, A, and U

(uracil) — to the DNA bases. This process is called transcription, because the message is

going from one version of nucleic acid language (DNA code) to another version of nucleic acid

language (RNA code), so it is like transcribing from the key of G to the key of C in music. Before

leaving the nucleus, this primary mRNA transcript is modified in several ways. Introns

(intervening non-coding units) are edited out and exons (expressed coding sequences) are

spliced together. In addition, a 5" GTP cap and a 3" poly-A tail are added to the mRNA to

protect it from the enzymes in the cytoplasm. This mature mRNA transcript then leaves the

nucleus and carries the code for making the protein from the DNA gene in the nucleus to the

ribosome in the cytoplasm.

During translation, the ribosome reads the sequence of bases on the mRNA in sets of three —

the triplet codons. Another type of RNA — transfer RNA (tRNA) — brings the protein building

blocks — amino acids — to the ribosome as they are needed. The ribosome bonds the amino

acids together to build the protein coded for by the gene back in the nucleus. This process is

called translation, because the message is going from nucleic acid language (DNA/RNA code)

to the completely different amino acid language (protein code), so it is like translating another

language.

**Procedures:**

1. As a group decide on who will be:

* Card Sorter/Organizer – The card sorter/organizer will be responsible for the movement of the cards for the group.
* Recorder – The recorder will record the data from each sequence. Then, they will take a picture using their phone.
* Codon Interpreter/Guide – The codon interpreter/guide will be responsible for the codon chart as well as a guide to refer back to the notes as needed for the group.

Note: Each member is a team collaborator! This means each team member will be participate in transcribing and translating the data.

1. Organize the template cards as follows:

* DNA Template
* RNA Template
* Protein

1. Order the DNA sequence onto the table.
2. Transcribe the DNA template to mRNA.
3. Translate the mRNA into an amino acid.
4. Take a picture and record each template.
5. Inform me when you complete the 10 sequences to receive the interactive model.
6. Construct your paper model of protein synthesis on card stock.

Note: Card Sorter/Organizer will organize and glue the materials onto the card stock. The recorder will record the answers for the questions. The codon interpreter/guide will help refer back to the resources to build the model. Each team member will assist in cutting the pieces.

1. Complete the questions.

DNA Sequences:

1. TAC GGA CCT ACT
2. CAC CGA GGA ATT
3. TAC CGC TCT ATC
4. AAC CCA GGA ACT
5. TAC ATA CAG GAG
6. AAC TCG CCT CGT
7. TAC GGG TTG GGC
8. CAC ACC GCA GAT
9. TAC GTT CAT GTG
10. CAC AAG CCG TGG

mRNA Sequences:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sequence 1. |  |  |  |  |
| Sequence 2. |  |  |  |  |
| Sequence 3. |  |  |  |  |
| Sequence 4. |  |  |  |  |
| Sequence 5. |  |  |  |  |
| Sequence 6. |  |  |  |  |
| Sequence 7. |  |  |  |  |
| Sequence 8. |  |  |  |  |
| Sequence 9. |  |  |  |  |
| Sequence 10. |  |  |  |  |

Amino Acids:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sequence 1. |  |  |  |  |
| Sequence 2. |  |  |  |  |
| Sequence 3. |  |  |  |  |
| Sequence 4. |  |  |  |  |
| Sequence 5. |  |  |  |  |
| Sequence 6. |  |  |  |  |
| Sequence 7. |  |  |  |  |
| Sequence 8. |  |  |  |  |
| Sequence 9. |  |  |  |  |
| Sequence 10. |  |  |  |  |

Interactive Model Questions:

1. The mRNA sequence built in this activity has \_\_\_\_ nucleotides and \_\_\_ codons.
2. Which enzyme is a catalyst for transcription?
3. What is an anticodon?
4. What is the function of tRNA?
5. What are the amino acids utilized in this interactive model?