Gene Expression- Transcription & Translation

Why?
DNA is often referred to as a genetic blueprint. In the same way that blueprints contain the instructions for construction of a building, the DNA found inside the nuclei of cells contains the instructions for assembling a living organism. The DNA blueprint carries its instructions in the form of genes. So, what is the language of these instructions and how are they read and decoded by the cell organelles? This activity will focus on the decoding of genes in eukaryotic cells.

Model 1- Transcription & Translation

1. Consider the eukaryotic cell in Model 1.
   a. Where in the cell does transcription take place?  
      Nucleus  
   b. What is synthesized, or created, from DNA during transcription?  
      mRNA  
   c. DNA is a double stranded molecule. How would you describe the appearance of mRNA?  
      Single-strand  
   d. Where does mRNA travel to after transcription?  
      Cytoplasm  

2. Consider that DNA contains all instructions for the cell, but it cannot leave the nucleus to reach other parts of the cell. mRNA, or messenger RNA does leave the nucleus. What do you think is the purpose of mRNA?  
   Carry a message from a gene on DNA to make a protein  

Read This!

Transcription is similar to DNA replication except that in mRNA, the base Thymine (T) is no longer used. Instead, the base Uracil (U) pairs with Adenine (A). See the example below:

DNA sequence -  C G A T C  
mRNA sequence -  G C U A G  

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Model 2- Transcription (DNA to mRNA)

3. Consider Model 2.

a. Complete the statement below to describe the base pairing rule for DNA.
   In DNA, Adenine (A) always pairs with __________ (7), and Cytosine (C) always pairs with __________ (51).

b. Fill in the missing bases of the double stranded DNA molecule. (see the three examples)

c. Complete the statement below to describe the base pairing rule for mRNA.
   In mRNA, Adenine (A) always pairs with __________ (U), and Cytosine (C) always pairs with __________ (G).

d. Fill in the missing bases of the single stranded mRNA molecule using the bottom strand of DNA as the template. (see the three examples)

This is the end of the first step of gene expression, **transcription**, now let's take a closer look at the second step of gene expression, **translation**.

4. Consider the eukaryotic cell in Model 1.

a. Where in the cell does translation take place?
   __________

b. What cellular structures attaches to the mRNA in order to assemble proteins?
   __________

**Read This!**

The second step in decoding genetic messages is translation. The order of bases in mRNA is a set of instructions that came from DNA in the nucleus. When a ribosome is attached to an mRNA sequence, codons, or groups of three bases, are read by the ribosome. Each codon specifies for a particular amino acid used to create a protein.
5. Consider the diagrams in Model 3.

a. These diagrams determine which amino acid is coded for by each codon. While their appearances differ, they will both yield the same results. For an assessment, you can either codon chart. The codon chart on the left is a simpler representation; start on the inside and work your way out. For example, the codon CAC codes for the amino acid Histidine, which we can abbreviate as “His.”

b. Complete these models by determining the missing amino acids.