Genetic Code and Central Model Pencil and Paper Exercise
September 7, 2017

1 The sequence below is a DNA double helix from a ***prokaryote***. (HINT: some of the answers can be found in Figure 7-9 on the PowerPoint slides).

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5′-agtgtattgacatgatagaagcactctactatattctcaatattcctaggaggtttgacctatgattgaacttgaa...aataccatggtataacccagccgccagttccgctggcggcattttaac-3′
3′-tcacataactgtactaagatggtgagatgatataagagttataaggatcctccaaactggatactaacttgaactt...ttatggtaccatattgggtcggcggtcaaggcgaccgccgtaaaattg-5′
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1. The grey boxes are highlighting special sequences that occur in a gene. Label the boxes with the special names given to these sequences.

2. How does the RNA polymerase know where to begin transcription?

3. How does the RNA polymerase know where to end transcription?

4. Which strand (top or bottom) will serve as the template for transcription of this gene? Which strand (top or bottom) is the "mRNA-like" strand? Draw an arrow to show the direction that the RNA polymerase will travel when synthesizing an mRNA from this gene.

5. Write the sequence of the mRNA that would be transcribed from this gene in the space below. Write it in the 5'→3' direction and be sure to label your mRNA sequence at the 5' and 3' ends.

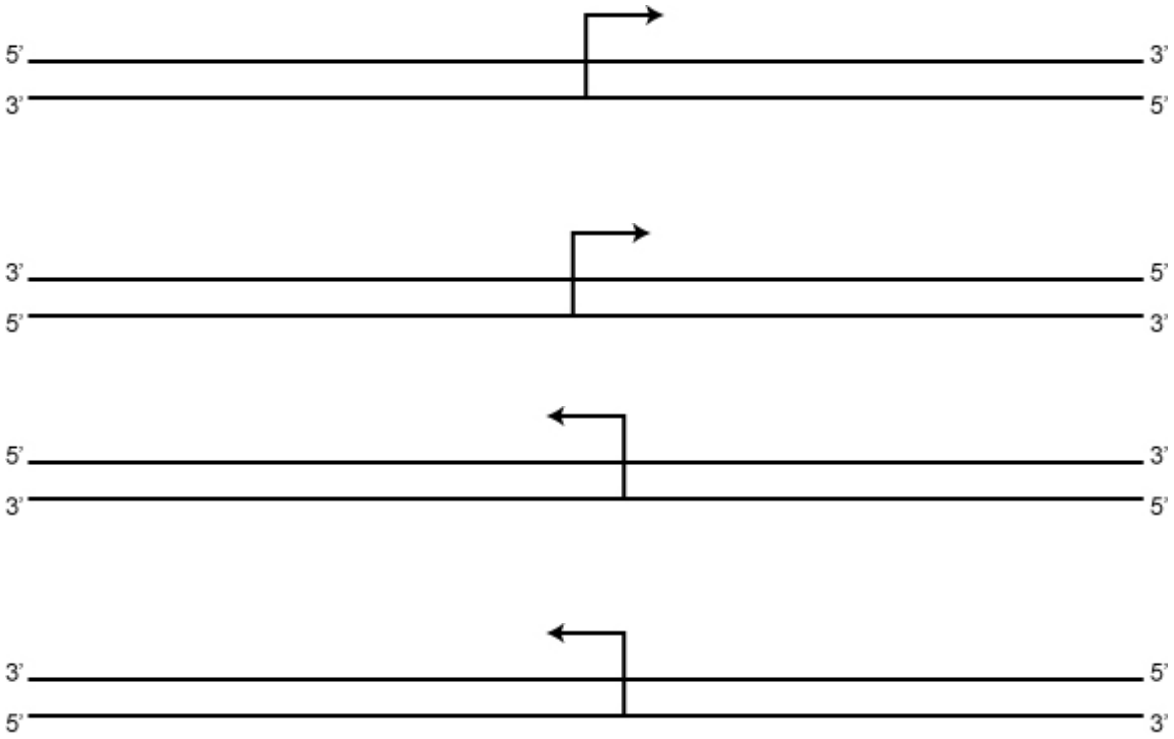
6. How would this mRNA be different if it was a ***eukaryotic*** mRNA?

7. How does the ribosome know where to begin translation?

8. How does the ribosome know where to end translation?

9. Write the amino acid sequence of the protein made from the mRNA transcribed from this gene. Use the genetic code handout to translate the codons in the mRNA to the amino acid sequence. Write the amino acid sequence from the N-terminus to the C-terminus and label the two ends "N-ter" and "C-ter." You can use either the three-letter or single-letter abbreviations for the amino acids.

2. Each of the four drawings below represent a double-stranded DNA sequence. The arrow shows the location of the transcription start site and direction that RNA polymerase travels along a gene. Write the letters corresponding to the ***eukaryotic*** gene elements listed below on each of the diagrams where they would appear relative to the transcription start.



a. an intron that interrupts the open reading frame
b. 3'UTR
c. promoter
d. stop codon
e. nucleotide to which the cap is added
f. start codon
g. terminator
h. 5' UTR
i. polyA addition site
j. ribosome binding site

Also, mark which strand is the template strand and which strand is the mRNA-like strand for each.