Chapter 9 – Proteins & Their Synthesis.

Show all of your work in solving the questions below.

1. (p. 296, q. 8). Deduce what the six wild-type codons may have been in the mutants that led Brenner to infer the nature of the amber codon UAG.

2. (p. 297, q. 25). You are studying an E. coli gene that specifies a protein. A part of the sequence is:

   – Ala – Pro – Trp – Ser – Glu – Lys – Cys – His –

   You recover a series of mutants for this gene that show no enzymatic activity. By isolating the mutant enzyme products, you find the following sequences:

   Mutant 1:
   – Ala – Pro – Trp – Arg – Glu – Lys – Cys – His –

   Mutant 2:
   – Ala – Pro –

   Mutant 3:
   – Ala – Pro – Gly – Val – Lys – Asn – Cys – His –

   Mutant 4:
   – Ala – Pro – Trp – Phe – Phe – Thr – Cys – His –

   What is the molecular basis for each mutation? What is the DNA sequence that specifies this part of the protein?

3. You have synthesized message codons with polynucleotide phosphorylase and ribonucleotides adenine and uracil in a 3:1 ratio. What amino acids and in what ratios do you expect would be translated from these codons?
4. A double-stranded DNA molecule with the sequence shown below produces, in vivo, a polypeptide that is four amino acids long. Show the transcribed mRNA and translated amino acid sequences. Be sure to indicate all 3' and 5' ends and the directions of transcription/translation.

<table>
<thead>
<tr>
<th>ATC</th>
<th>TCA</th>
<th>ATG</th>
<th>AAT</th>
<th>CAT</th>
<th>TAC</th>
<th>TTA</th>
<th>GTA</th>
<th>TAG</th>
<th>CGG</th>
<th>ATT</th>
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</thead>
<tbody>
<tr>
<td>TAG</td>
<td>AGT</td>
<td>TAC</td>
<td>TTA</td>
<td>GTA</td>
<td>ATG</td>
<td>AAT</td>
<td>CAT</td>
<td>ATC</td>
<td>GCC</td>
<td>TAA</td>
</tr>
</tbody>
</table>

5. If a frameshift of –1 base-pairs occurs at the beginning of the second codon of the transcribed strand in #4, show the new transcribed mRNA and translated amino acid sequences.

NOTE: If you are answering this question during tutorial and are convinced that the preceding answer given for #4 was incorrect, be sure to provide and use your “correct” interpretation of #4 before continuing with your answer to #5.

6. Using leucine as your example, illustrate how multiple tRNA codons and wobble provide for degeneracy in the genetic code. Show all possible combinations of codons and anticodons, identify all 3' and 5' ends of all sequences and the direction of translation.

HINT: Figure 9-12 and Table 9-2 in your text partially answer this question for serine.