Chapter 9 Homework

Ch. 9: 12, 13, 17, 18, 20, 21a, 24, 27, 35, 40

12. Use the codon dictionary in Figure 9-5 to complete the following table. Assume that reading is from left to right and that the columns represent transcriptional and translational alignments.

C												DNA double helix
						T	G	A				
	C	A				U						mRNA transcribed
									G	C	A	Appropriate tRNA anticodon
			Trp									Amino acids incorporated into protein

Label the 5’ and 3’ ends of DNA and RNA, as well as the amino and carboxyl ends of the protein.

13. Consider the following segment of DNA:

5' GCTTCCCAA 3'
3' CGAAGGGTT 5'

Assume that the top strand is the template strand used by RNA polymerase.

a. Draw the RNA transcribed.
b. Label its 5' and 3' ends.
c. Draw the corresponding amino acid chain.
d. Label its amino and carboxyl ends.

17. Which anticodon would you predict for a tRNA species carrying isoleucine? Is there more than one possible answer? If so, state any alternative answers.

18. a. In how many cases in the genetic code would you fail to know the amino acid specified by a codon if you knew only the first two nucleotides of the codon?
    b. In how many cases would you fail to know the first two nucleotides of the codon if you knew which amino acid is specified by it?

20. If a polyribonucleotide contains equal amounts of randomly positioned adenine and uracil bases, what proportion of its triplets will encode (a) phenylalanine, (b) isoleucine, (c) leucine, and (d) tyrosine?

21a. You have synthesized three different messenger RNAs with bases incorporated in random sequence in the following ratios: **(a)** 1 U:5 C's, (b) 1 A:1 C:4 U's, (c) 1 A:1 C:1 G:1 U. In a protein-synthesizing system in vitro, indicate the identities and proportions of amino acids that will be incorporated into proteins when each of these mRNAs is tested. (Refer to Figure 9-5.)

Second letter

First letter	U	C	A	G	Third letter
U	UUU Phe	UCU Ser	UAU Tyr	UGU Cys	U
	UUC Phe	UCC Ser	UAC Tyr	UGC Cys	C
	UUA Leu	UCA Ser	UAA Stop	UGA Stop	A
	UUG Leu	UCG Ser	UAG Stop	UGG Trp	G
C	CUU Leu	CCU Pro	CAU His	CGU Arg	U
	CUC Leu	CCC Pro	CAC His	CGC Arg	C
	CUA Leu	CCA Pro	CAA Gln	CGA Arg	A
	CUG Leu	CCG Pro	CAG Gln	CGG Arg	G
A	AUU Ile	ACU Thr	AAU Asn	AGU Ser	U
	AUC Ile	ACC Thr	AAC Asn	AGC Ser	C
	AUA Ile	ACA Thr	AAA Lys	AGA Arg	A
	AUG Met	ACG Thr	AAG Lys	AGG Arg	G
G	GUU Val	GCU Ala	GAU Asp	GGU Gly	U
	GUC Val	GCC Ala	GAC Asp	GGC Gly	C
	GUA Val	GCA Ala	GAA Glu	GGA Gly	A
	GUG Val	GCG Ala	GAG Glu	GGG Gly	G

Figure 9-5
Introduction to Genetic Analysis, Eleventh Edition

24. The enzyme tryptophan synthetase is produced in two sizes: large and small. Some mutants with no enzyme activity produced exactly the same size enzymes as the wild type. Other mutants with no activity produced just the large enzyme; still others, just the small enzyme.

a. Explain the different types of mutants at the level of protein structure.
b. Why do you think there were no mutants that produced no enzyme?

27. A certain nonsense suppressor corrects a nongrowing mutant to a state that is near, but not exactly, wild type (it has abnormal growth). Suggest a possible reason why the reversion is not a full correction.

35. Explain why antibiotics that bind the large ribosomal subunit, such as erythromycin and Zithromax, do not harm us.

40. You are studying an *E. coli* gene that specifies a protein. A part of its 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?