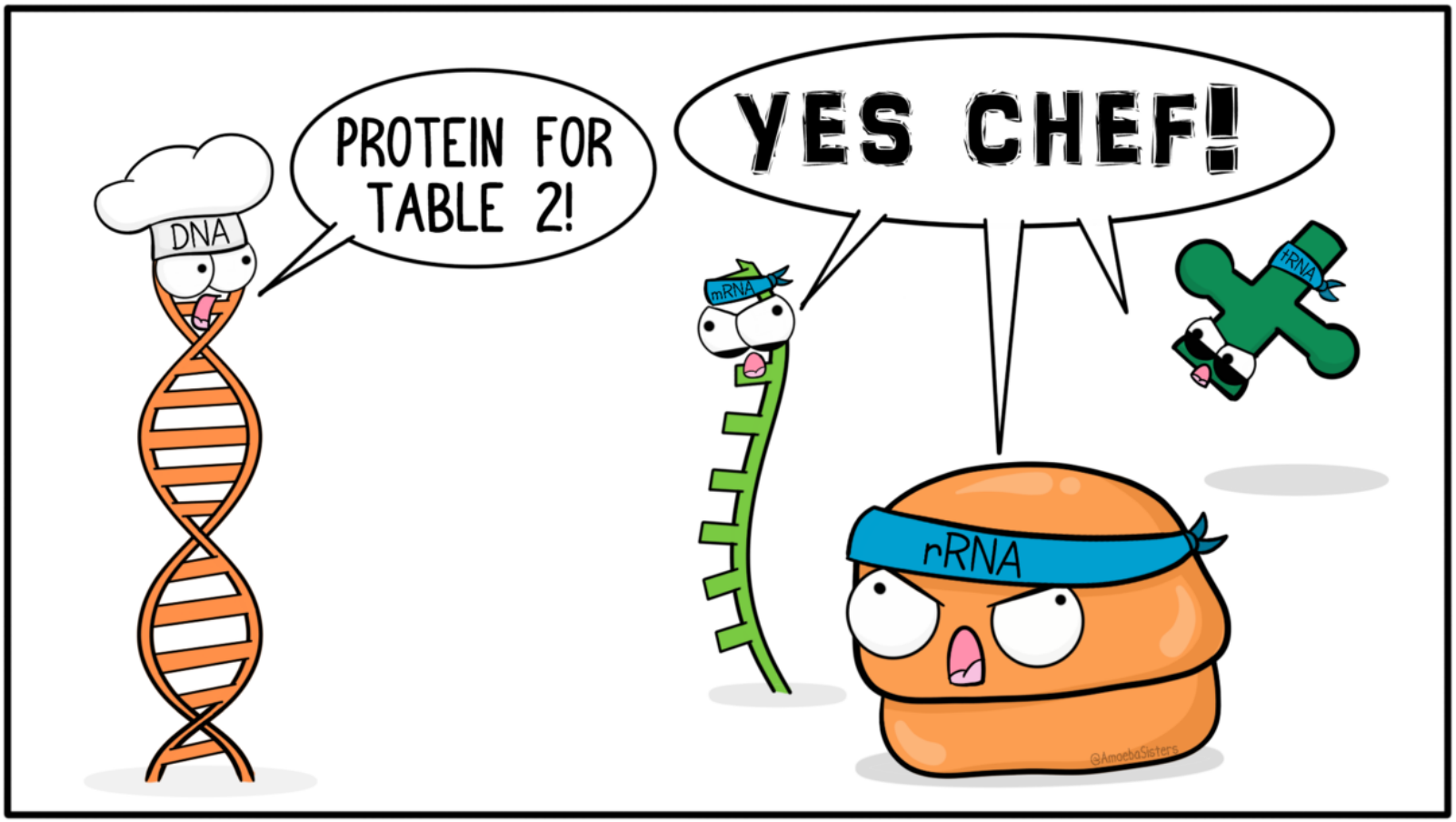
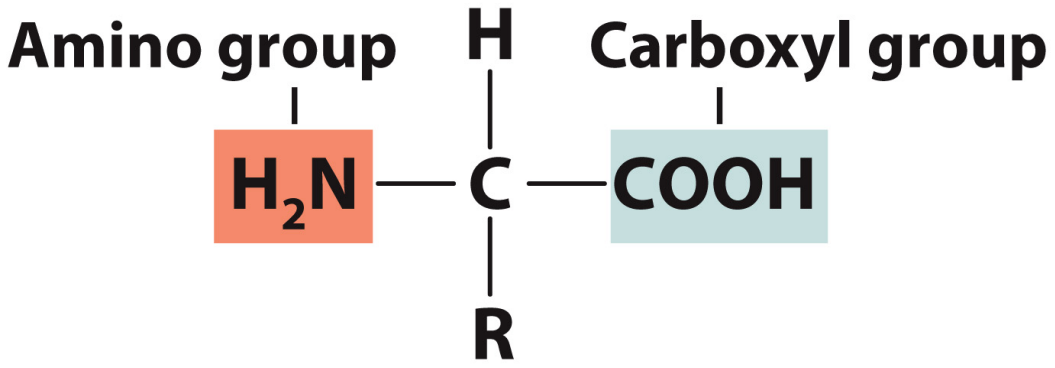
Paramecium Parlor

@AmoebaSisters



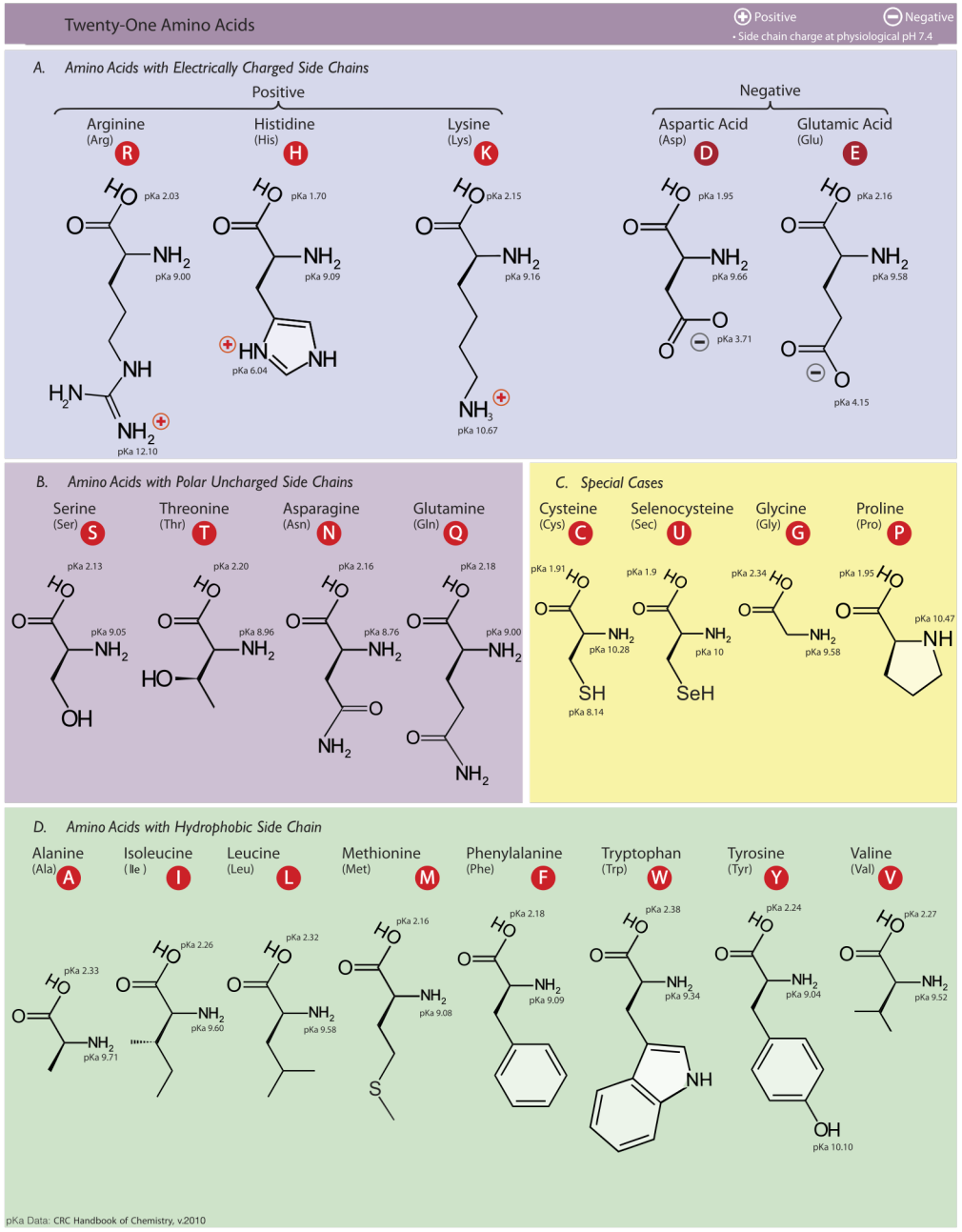
RNA: If you can't help make proteins, get out of the kitchen.

Amino acid building blocks



Unnumbered 9 p322
Introduction to Genetic Analysis, Eleventh Edition

Amino acid general structure: R groups



Dan Cojocari, Department of Medical Biophysics, **University of Toronto**, 2010

The peptide bond and primary protein structure

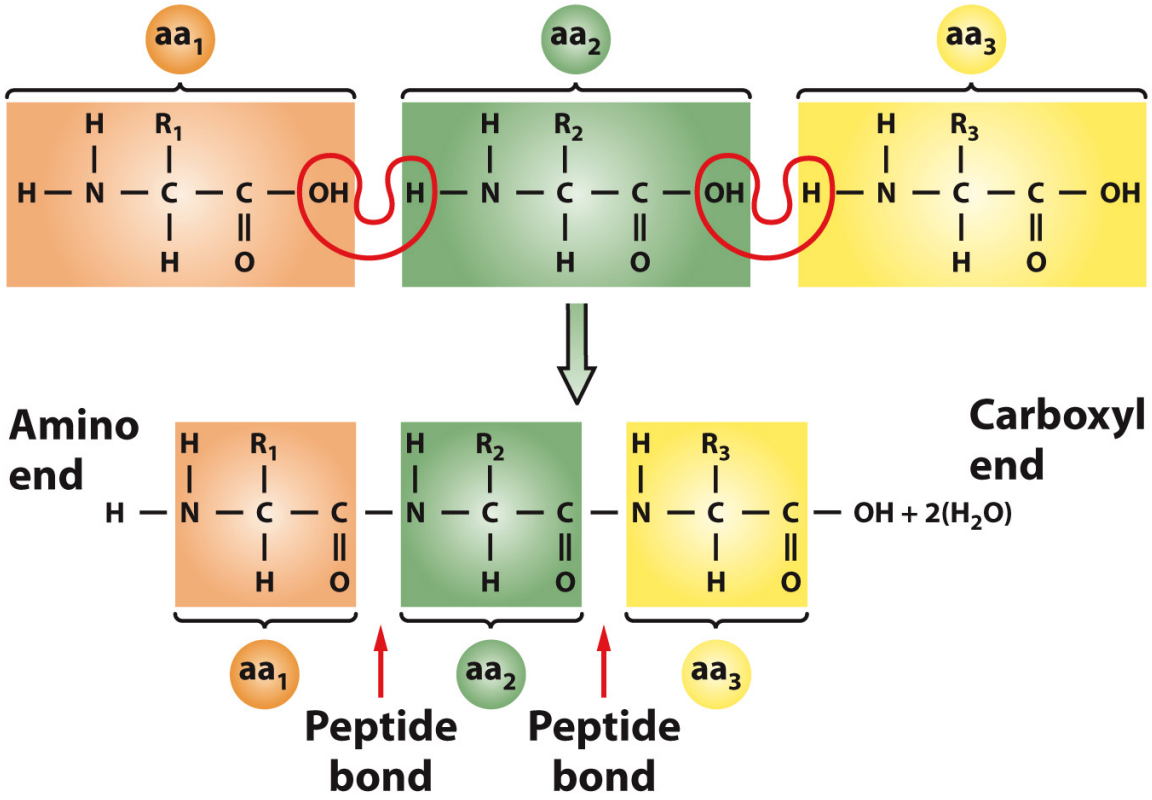


Figure 9-2a
Introduction to Genetic Analysis, Eleventh Edition

Levels of protein structure – primary structure coded in mRNA

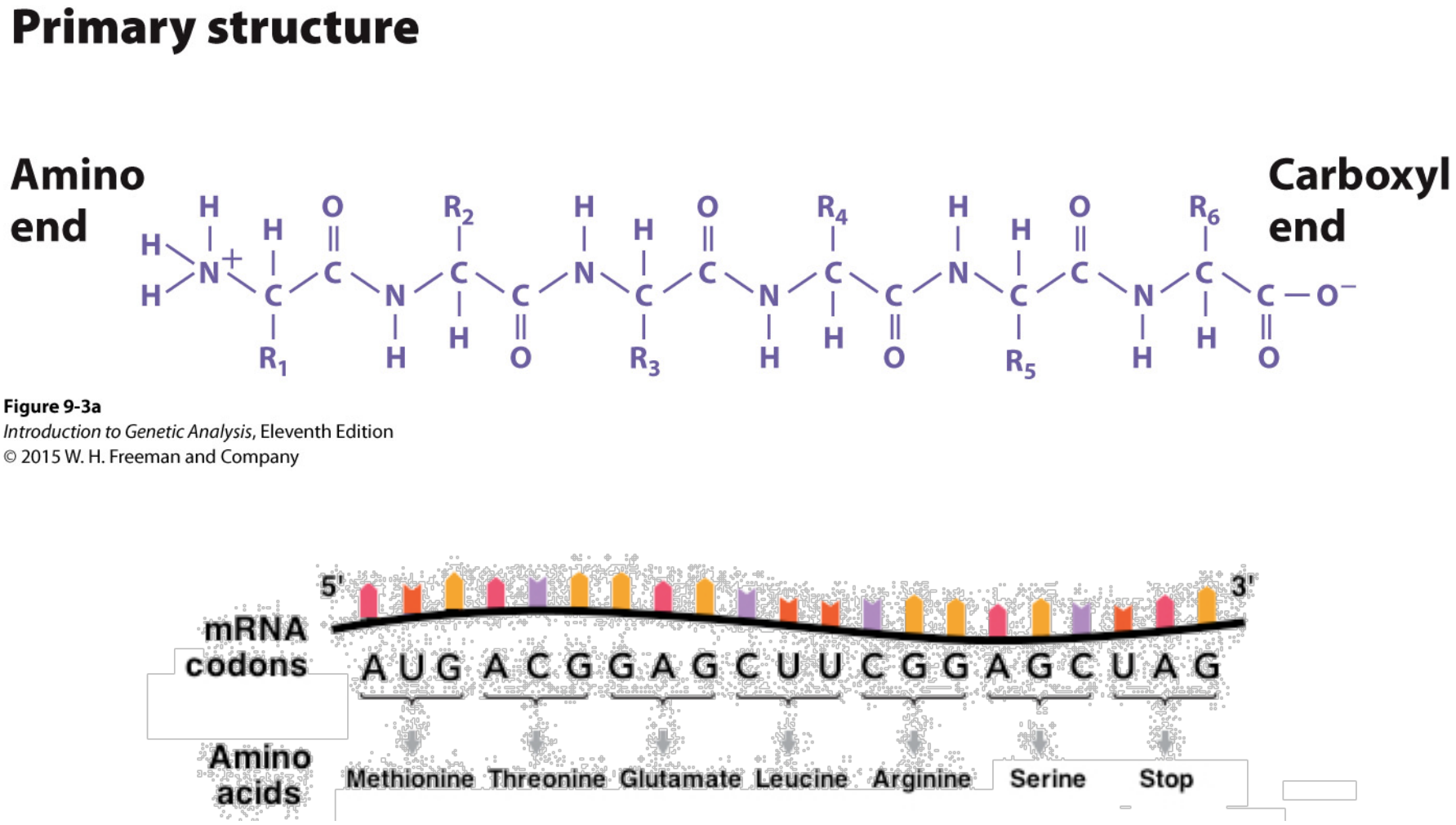


Figure 9-3a
Introduction to Genetic Analysis, Eleventh Edition

Levels of protein structure – determined by R groups!

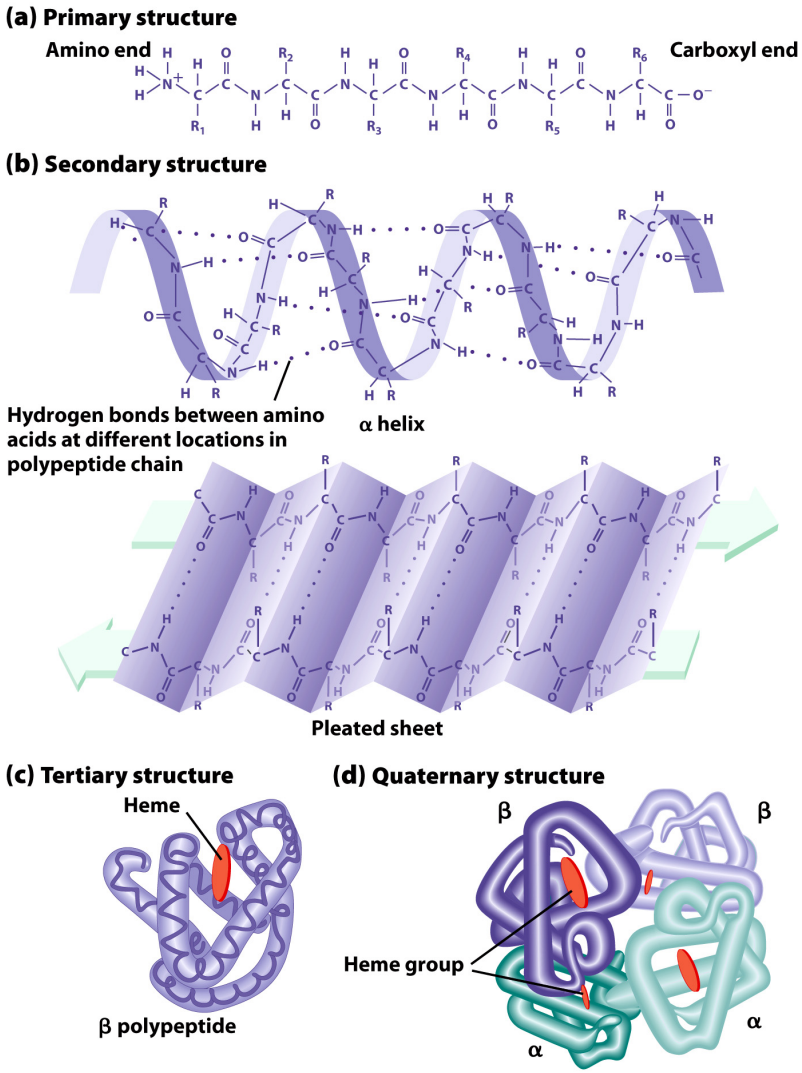


Figure 9-3
Introduction to Genetic Analysis, Eleventh Edition

Overlapping versus non-overlapping genetic codes: We do not overlap!

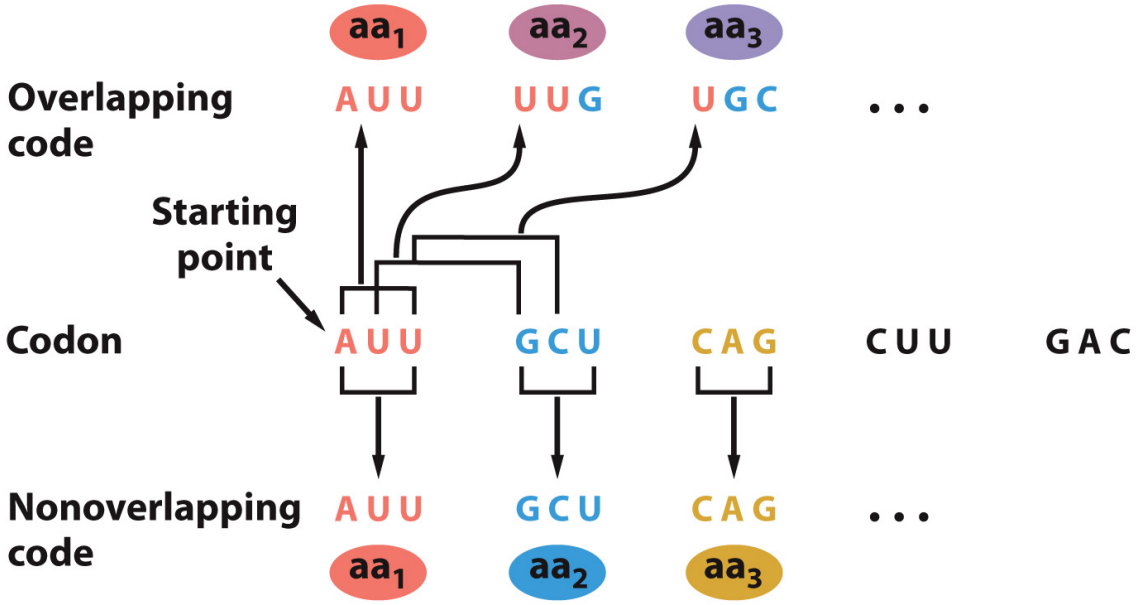


Figure 9-4
Introduction to Genetic Analysis, Eleventh Edition

The genetic code

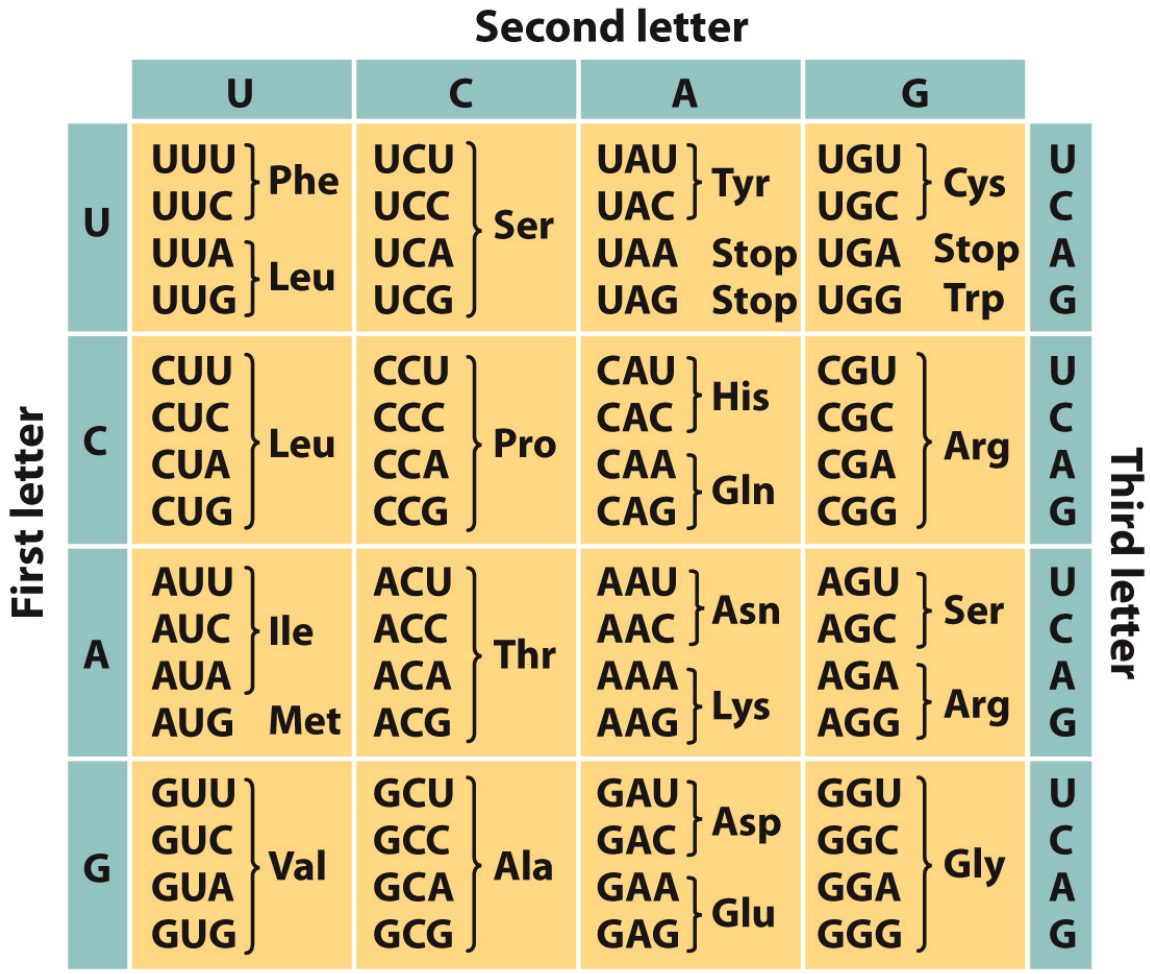


Figure 9-5
Introduction to Genetic Analysis, Eleventh Edition

The structure of transfer RNA (tRNA)

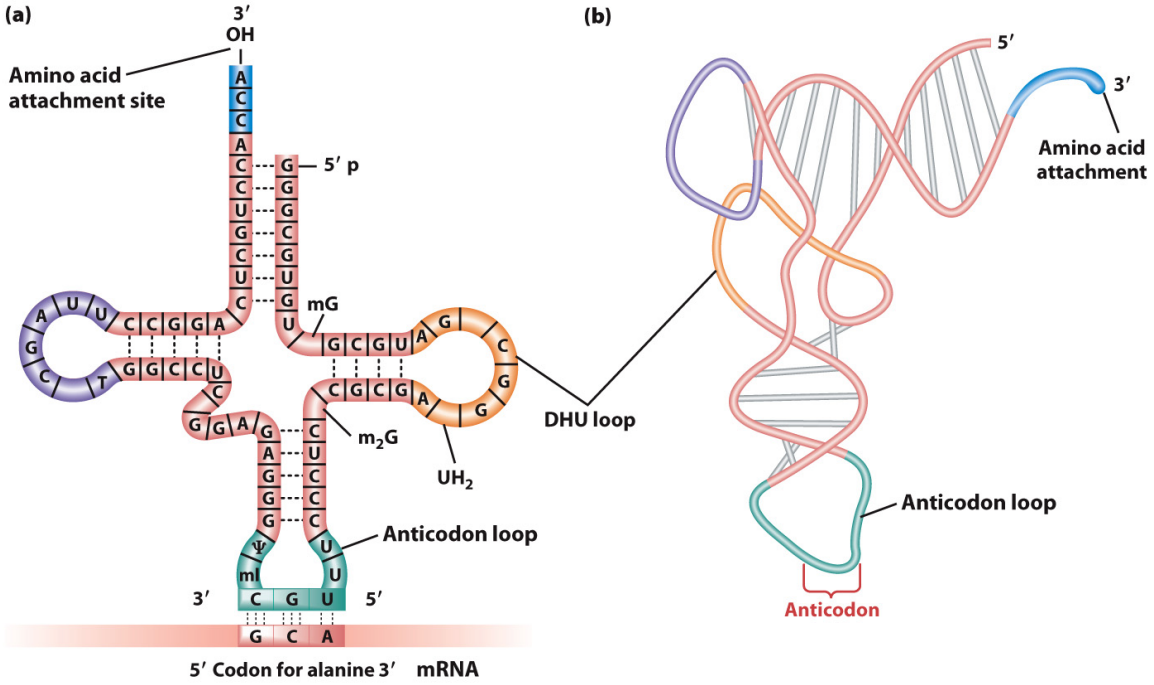


Figure 9-6
Introduction to Genetic Analysis, Eleventh Edition

Wobble allows tRNA to recognize two codons

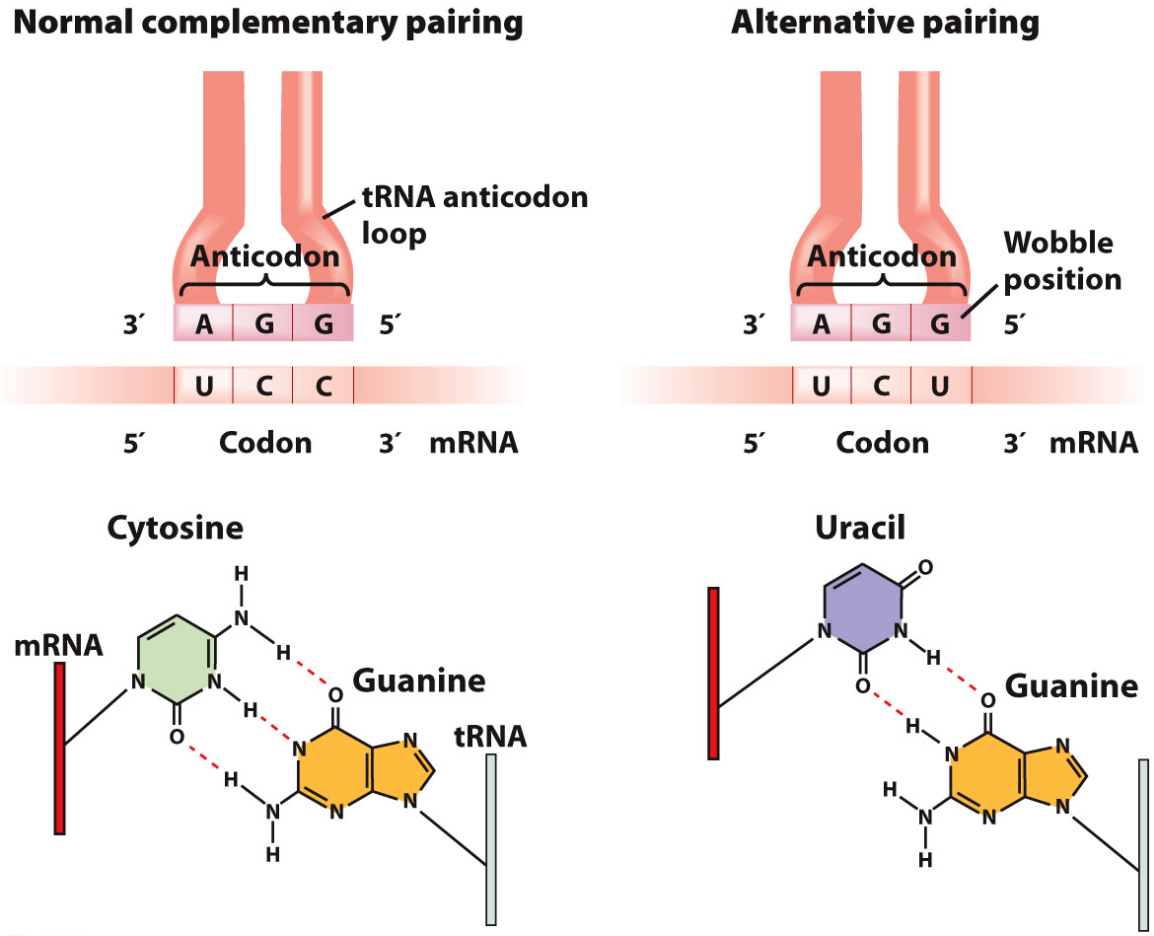


Figure 9-9
Introduction to Genetic Analysis, Eleventh Edition

Codon–Anticodon Pairings Allowed by the Wobble Rules

TABLE 9-1 Codon–Anticodon Pairings Allowed by the Wobble Rules

5′ end of anticodon	3′ end of codon
G	C or U
C	G only
A	U only
U	A or G
I	U, C, or A

Table 9-1
Introduction to Genetic Analysis, Eleventh Edition

Two subunits of a ribosome are comprised of rRNA (1-3 types) and many proteins (up to 50!)

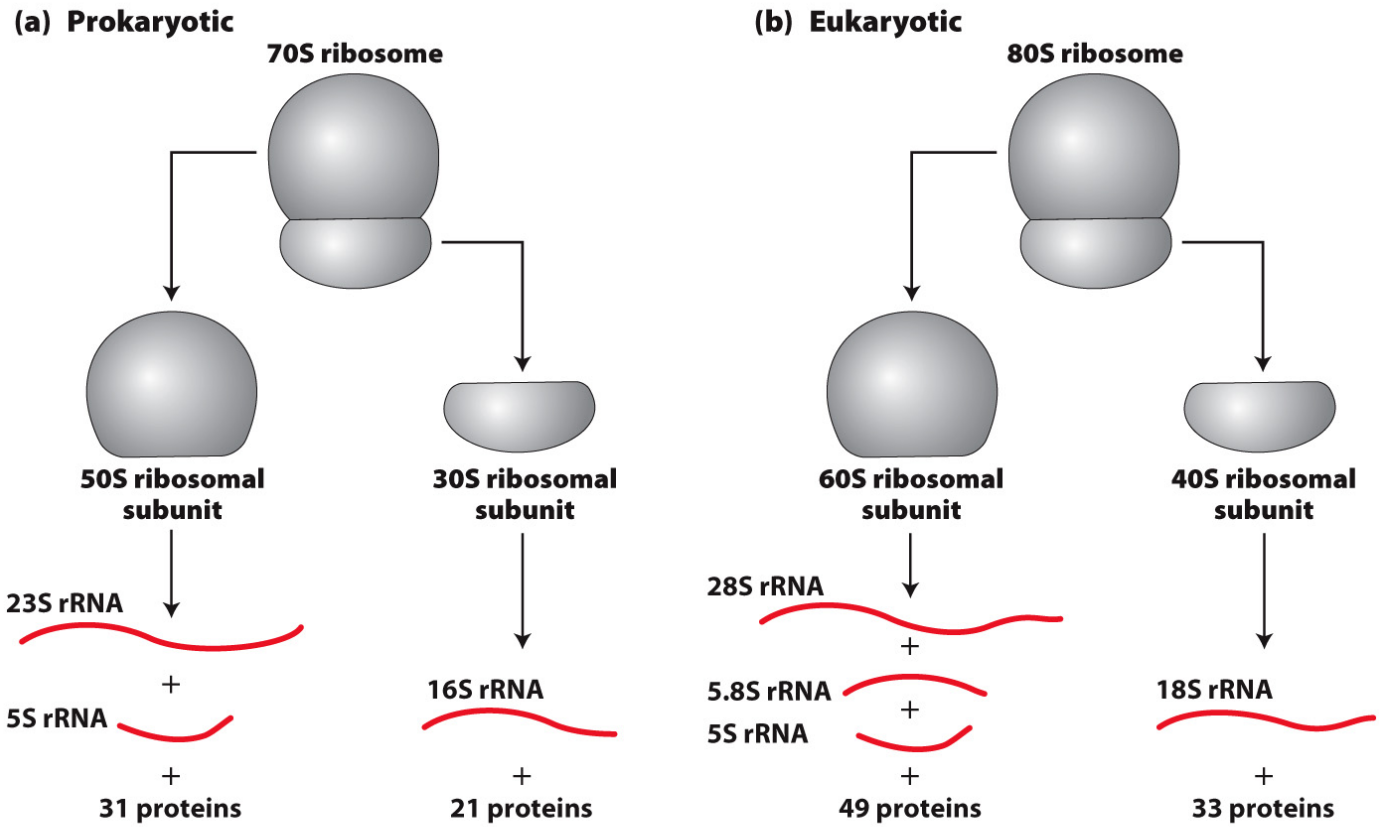


Figure 9-10
Introduction to Genetic Analysis, Eleventh Edition

Shine–Dalgarno sequence

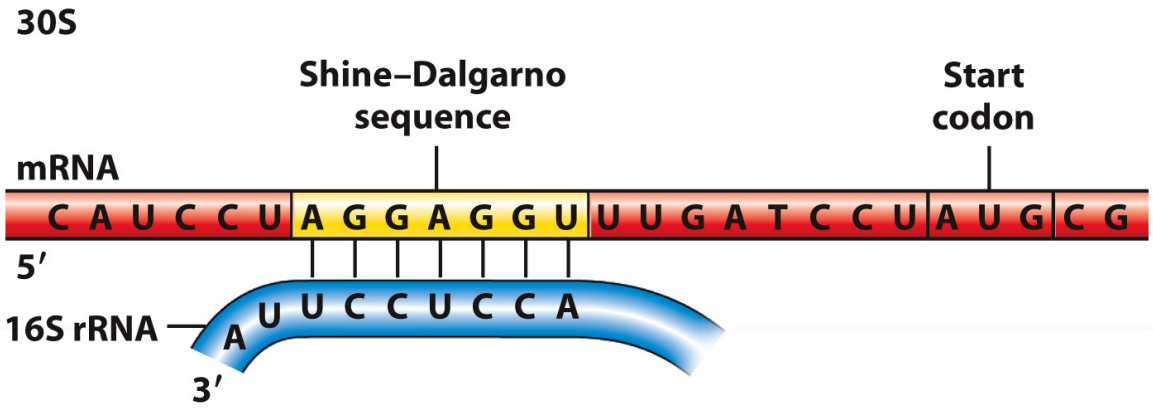


Figure 9-13
Introduction to Genetic Analysis, Eleventh Edition

Translation initiation in prokaryotes

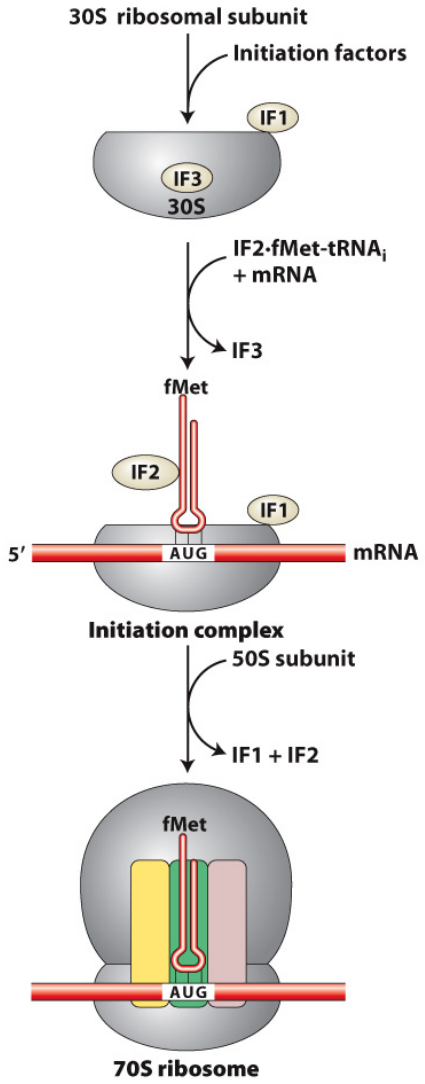


Figure 9-14
Introduction to Genetic Analysis, Eleventh Edition

Translation initiation in eukaryotes

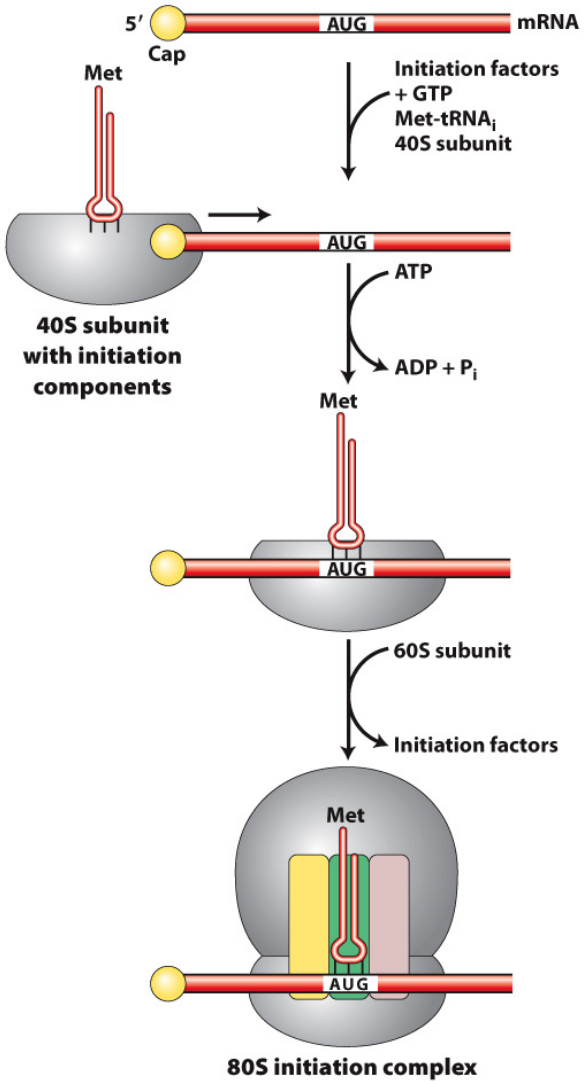
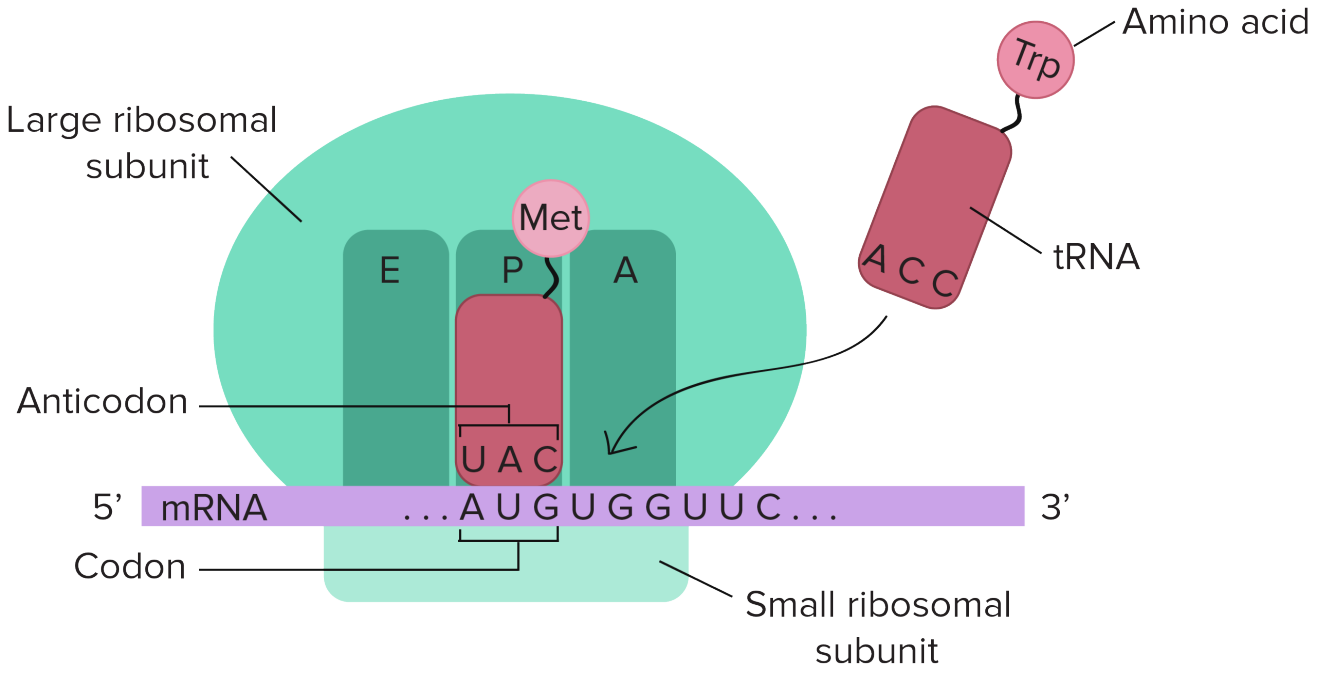


Figure 9-15
Introduction to Genetic Analysis, Eleventh Edition


Amino acid
Trp
Large ribosomal subunit
Met
E
P
A
A C C
tRNA
Anticodon
U A C
5’
mRNA
. . . A U G U G G U U C . . .
3’
Codon
Small ribosomal subunit

Schematic model

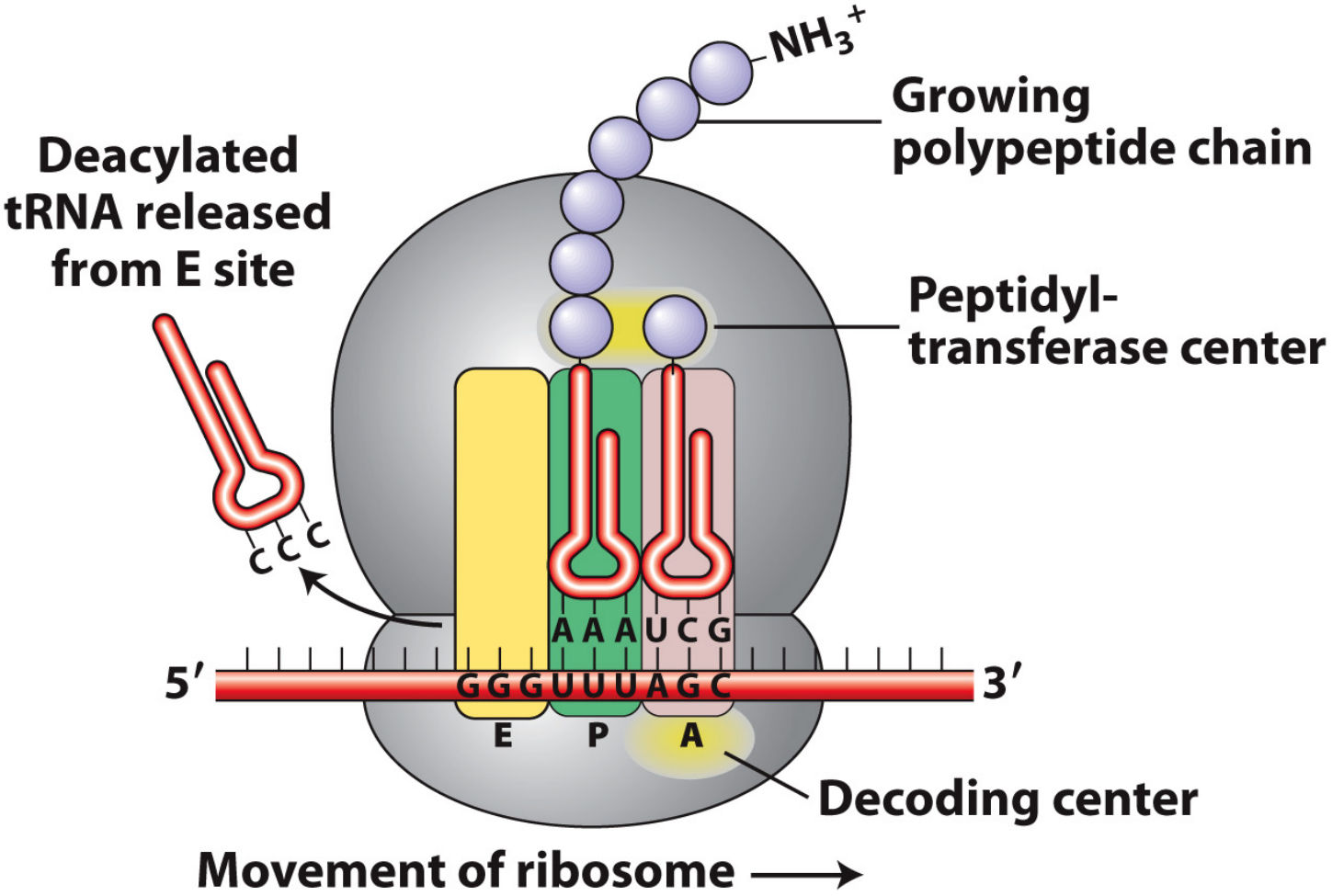


Figure 9-12b
Introduction to Genetic Analysis, Eleventh Edition

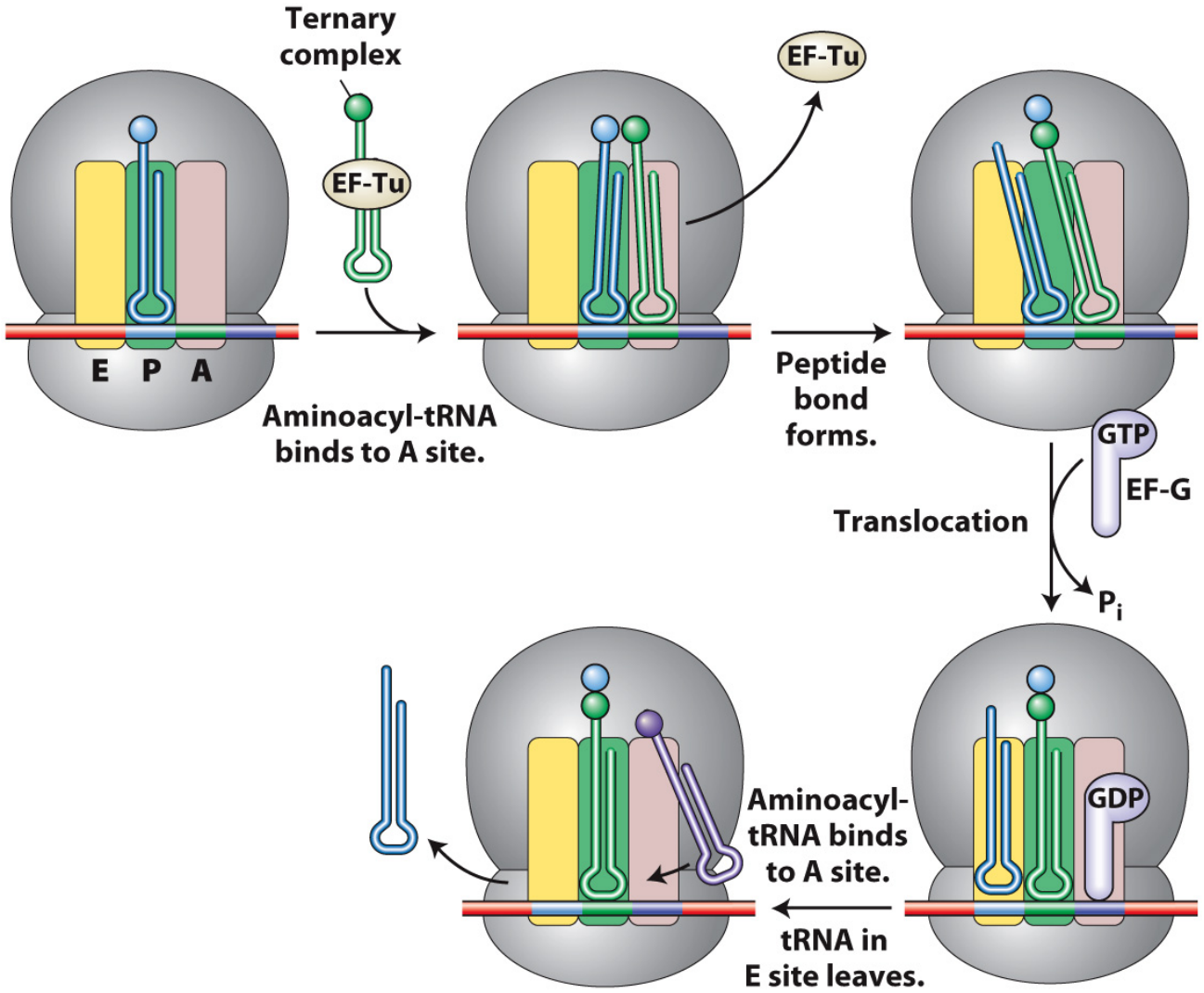


Figure 9-16
Introduction to Genetic Analysis, Eleventh Edition

Termination of translation

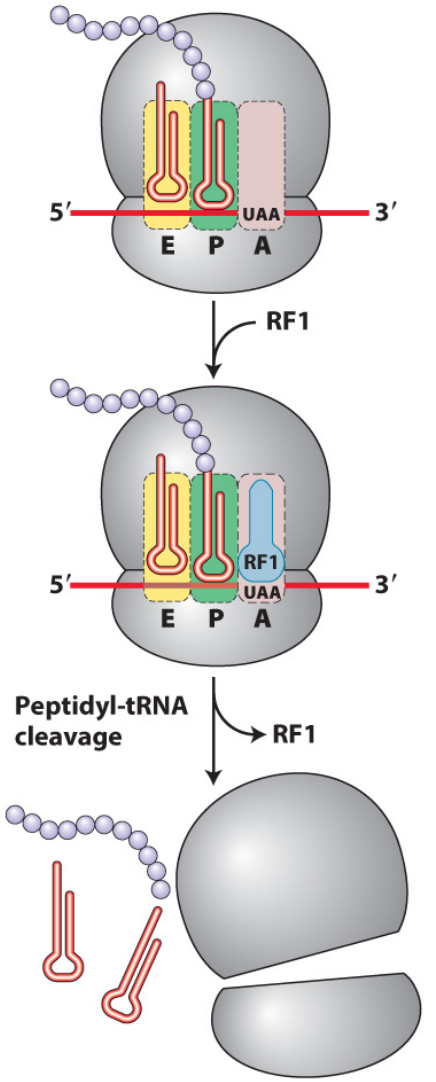


Figure 9-17
Introduction to Genetic Analysis, Eleventh Edition

A suppressor counteracts the effects of a nonsense mutation

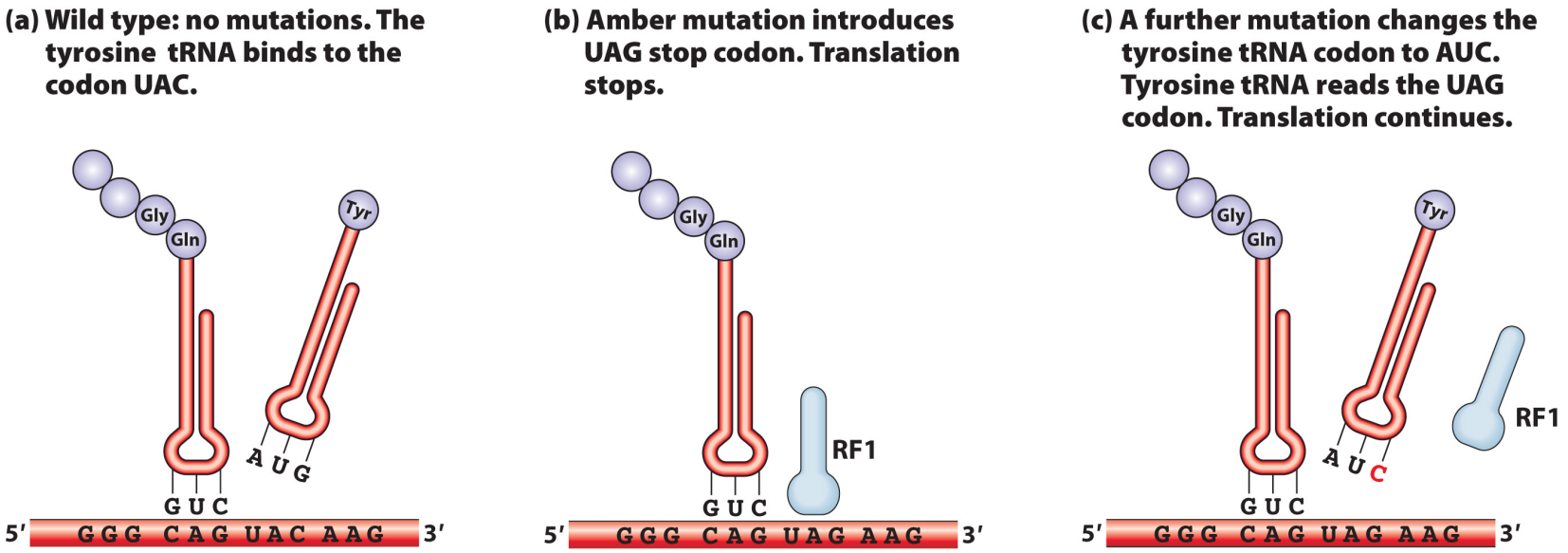
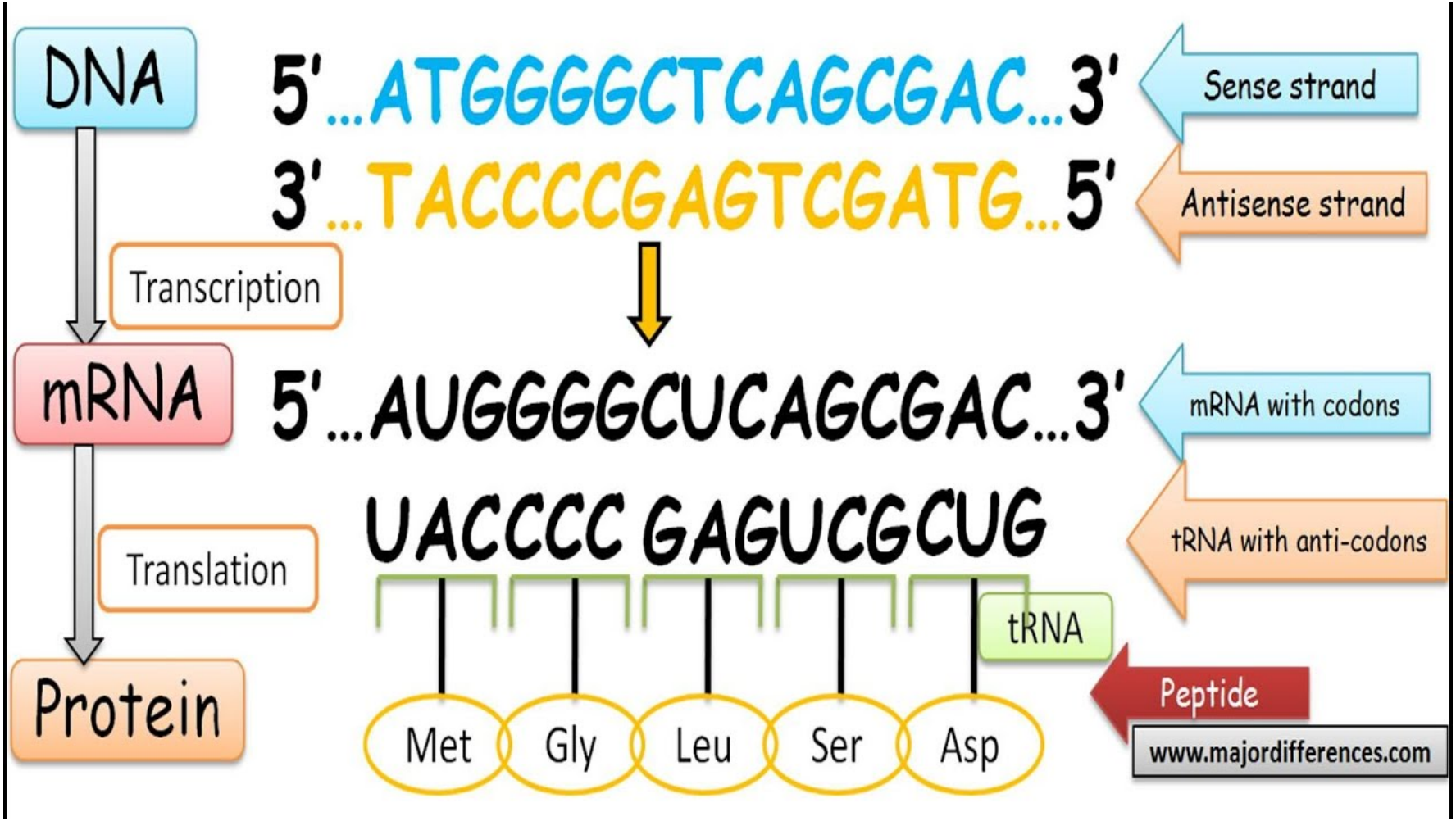


Figure 9-18
Introduction to Genetic Analysis, Eleventh Edition


DNA
5'...ATGGGGCTCAGCGAC...3'
Sense strand
3'...TACCCCGAGTCGATG...5'
Antisense strand
Transcription
mRNA
5'...AUGGGGCUCAGCGAC...3'
mRNA with codons
UACCCC GAGUCGCUG
tRNA with anti-codons
Translation
tRNA
Protein
Peptide
Met
Gly
Leu
Ser
Asp
www.majordifferences.com

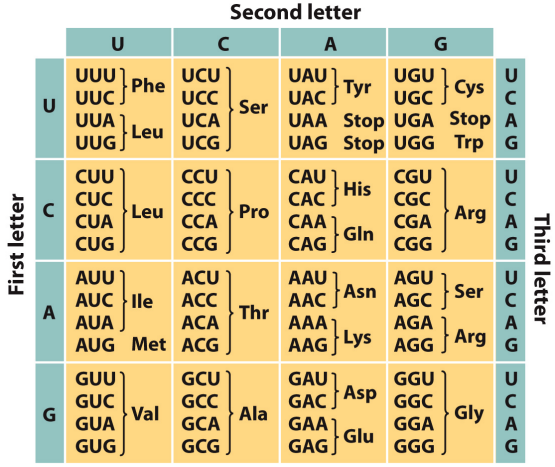


Figure 9-5
Introduction to Genetic Analysis, Eleventh Edition

Fill in the table below with the appropriate nucleotides and amino acids. Label the polarity and/or the amino and carboxyl ends of each molecule type.

				T										DNA template strand
							C	T	T					DNA non-template strand
										U				
					G	U					C	U		tRNA anticodon
	MET													Amino acids

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.

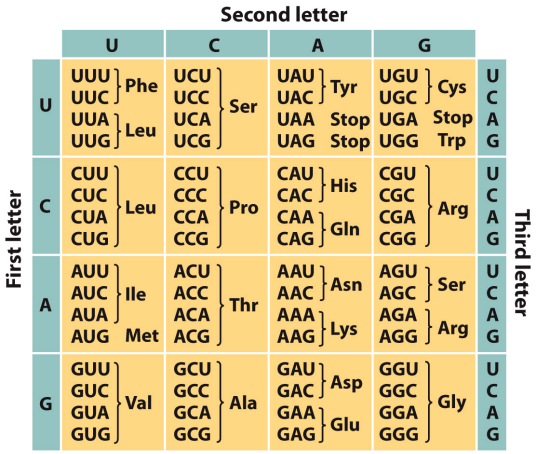


Figure 9-5
Introduction to Genetic Analysis, Eleventh Edition

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.

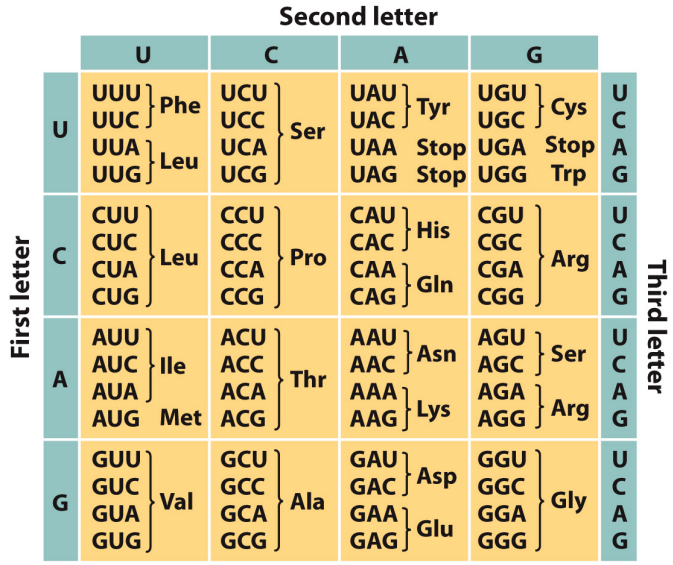


Figure 9-5
Introduction to Genetic Analysis, Eleventh Edition

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?

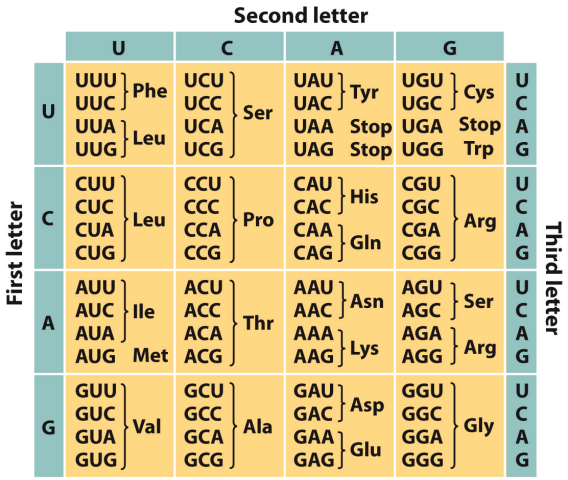


Figure 9-5
Introduction to Genetic Analysis, Eleventh Edition

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.

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?

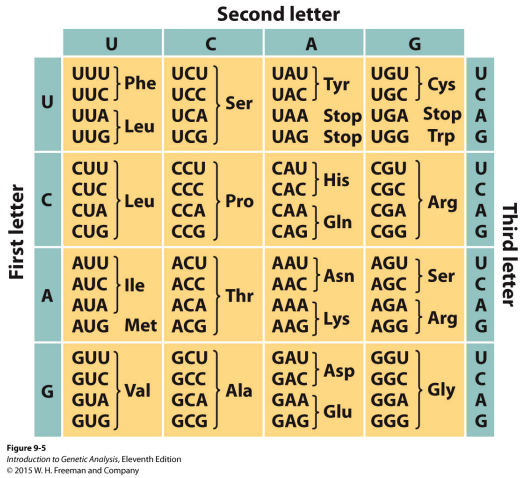


Figure 9-5
Introduction to Genetic Analysis, Eleventh Edition

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.

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.)

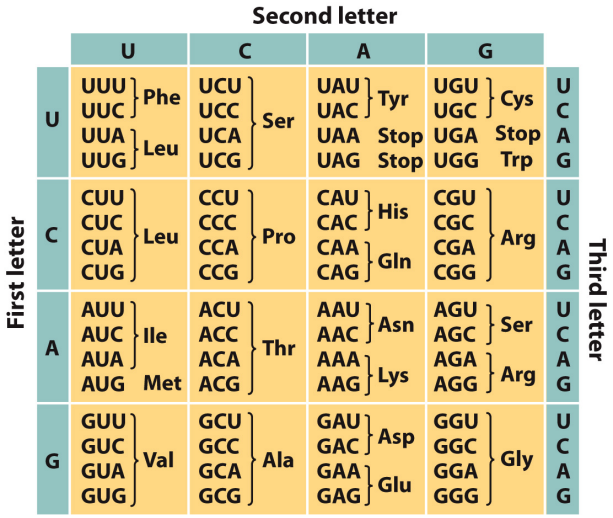


Figure 9-5
Introduction to Genetic Analysis, Eleventh Edition

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?

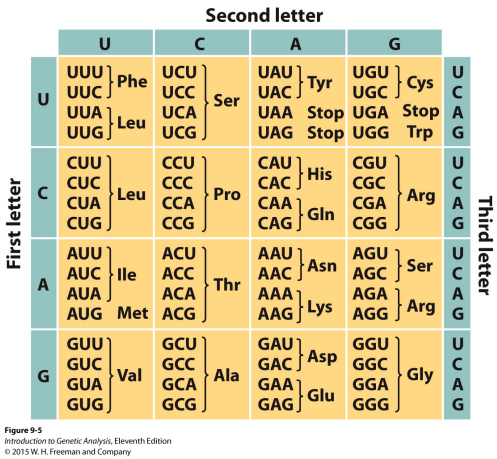


Figure 9-5
Introduction to Genetic Analysis, Eleventh Edition