Genetic code – dictionary for protein synthesis

TABLE 10.1 The Genetic Code[a]

FIRST (5′) LETTER	SECOND LETTER: U	SECOND LETTER: C	SECOND LETTER: A	SECOND LETTER: G	THIRD (3′) 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 *Ochre* (terminator)	UGA *Opal* (terminator)	A
	UUG Leu	UCG Ser	UAG *Amber* (terminator)	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 Ileu	ACU Thr	AAU Asn	AGU Ser	U
	AUC Ileu	ACC Thr	AAC Asn	AGC Ser	C
	AUA Ileu	ACA Thr	AAA Lys	AGA Arg	A
	AUG Met (initiator)	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 (initiator)	GCG Ala	GAG Glu	GGG Gly	G

[a]Each triplet nucleotide sequence or codon refers to the nucleotide sequence in **mRNA** (not DNA) that specifies the incorporation of the indicated amino acid or polypeptide chain termination.

Genetic code – dictionary for protein synthesis

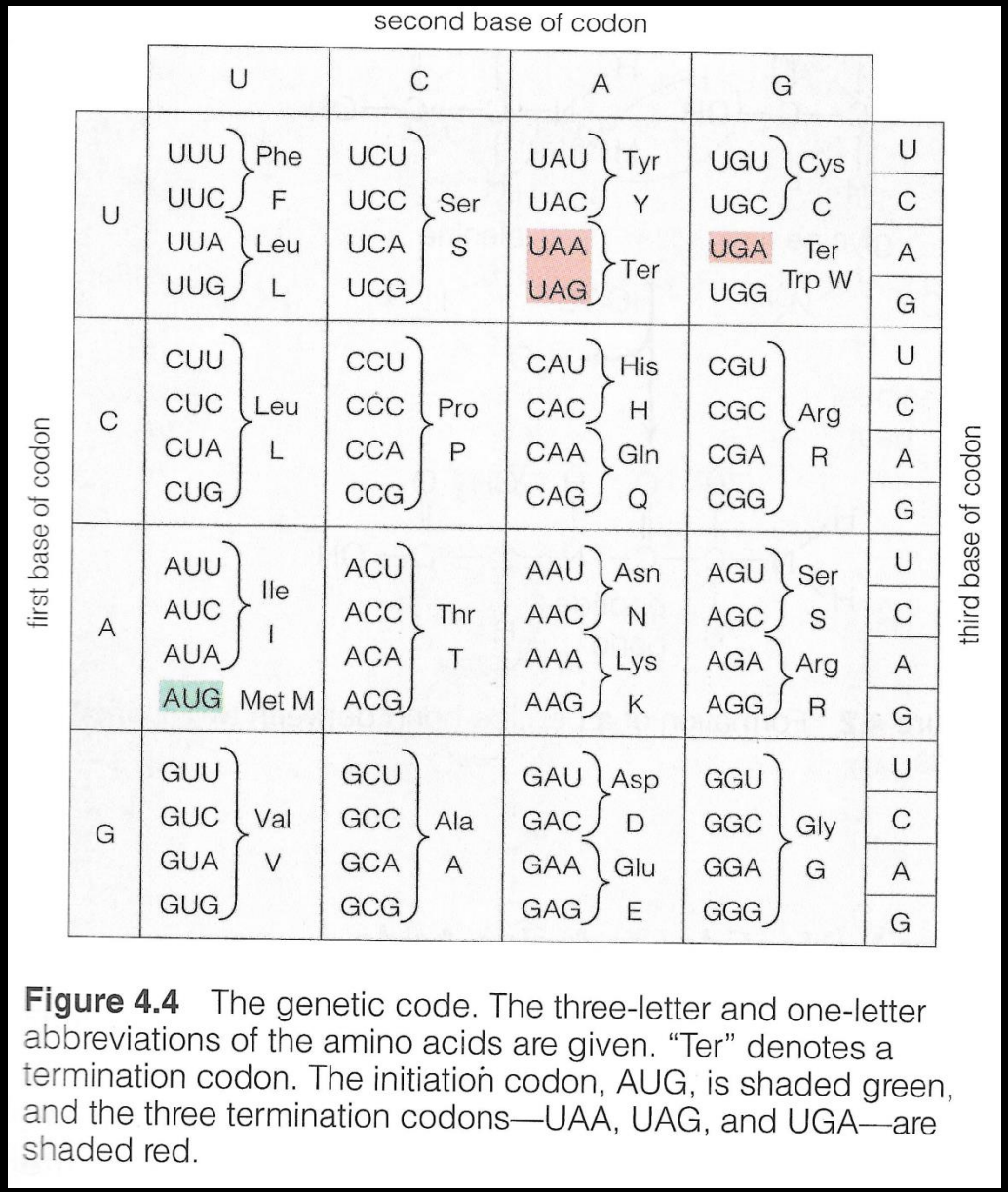


Figure 4.4 The genetic code. The three-letter and one-letter abbreviations of the amino acids are given. "Ter" denotes a termination codon. The initiation codon, AUG, is shaded green, and the three termination codons—UAA, UAG, and UGA—are shaded red.

Cracking the genetic code

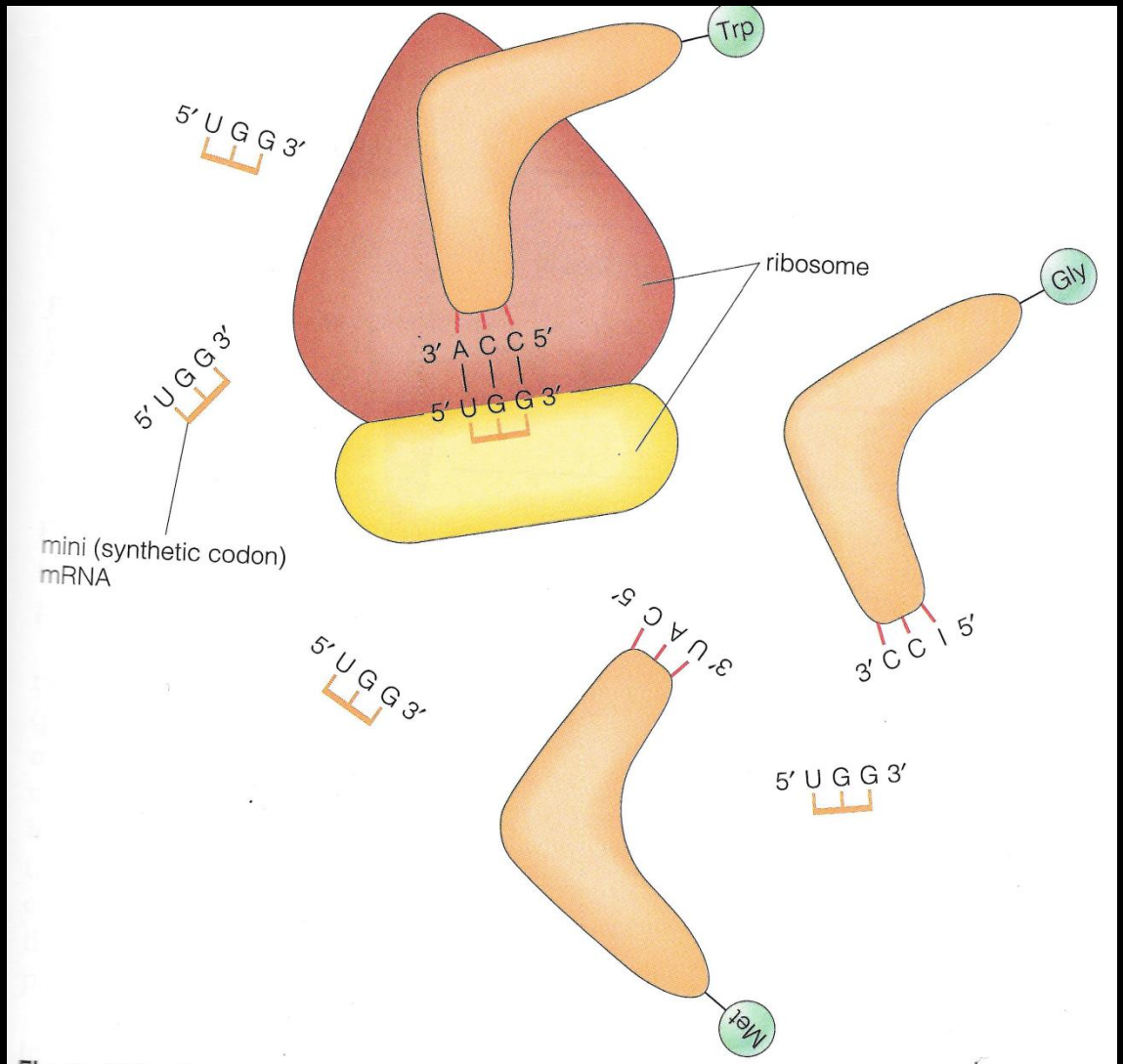


Figure 4.21 Representation of Nirenberg and Leder's experiments with mini mRNAs to decipher the genetic code. In this example, the only mini mRNA in the reaction mixture is UGG, which binds only with a tryptophan tRNA.

Post transcriptional modifications in t-RNA

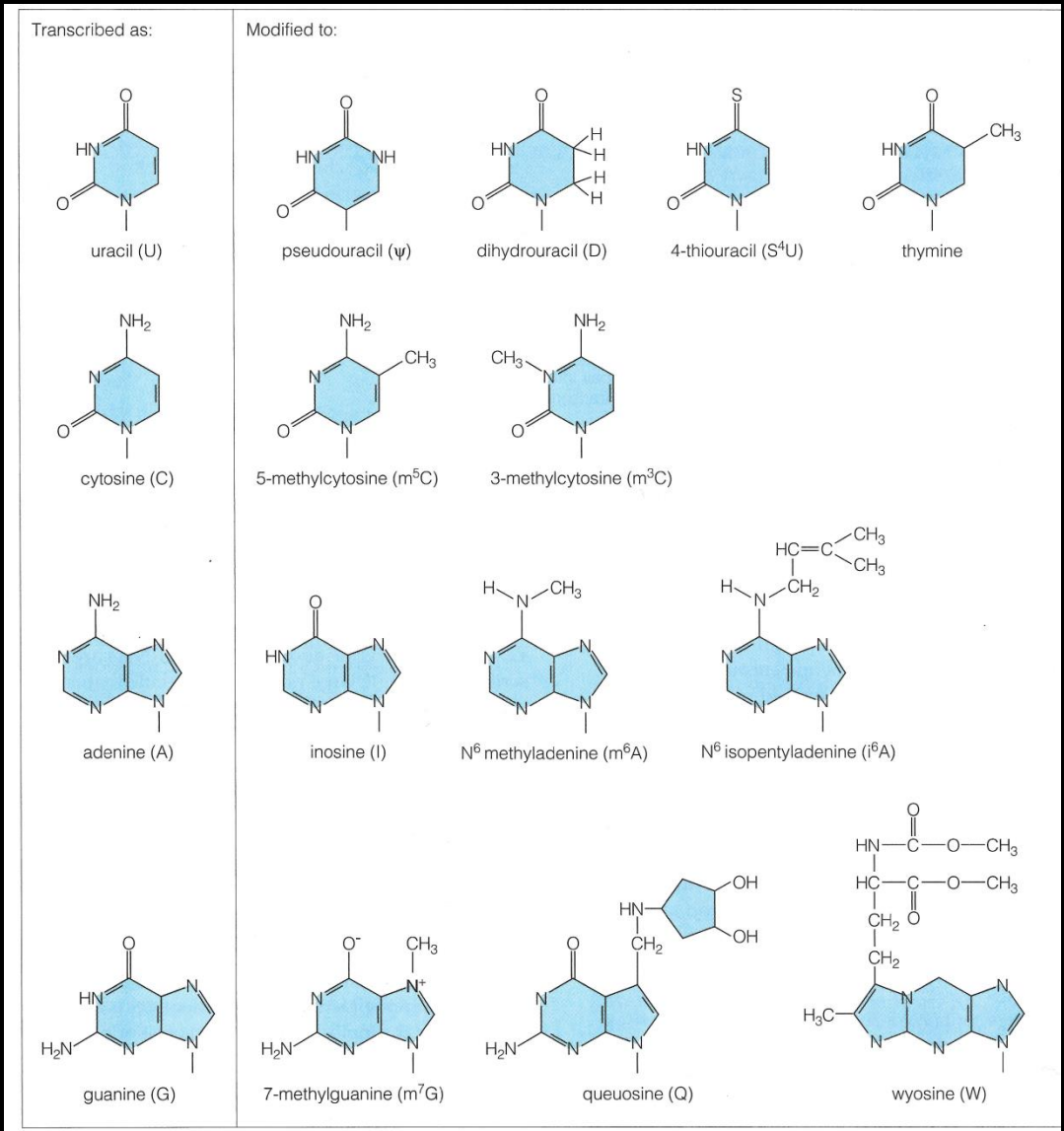
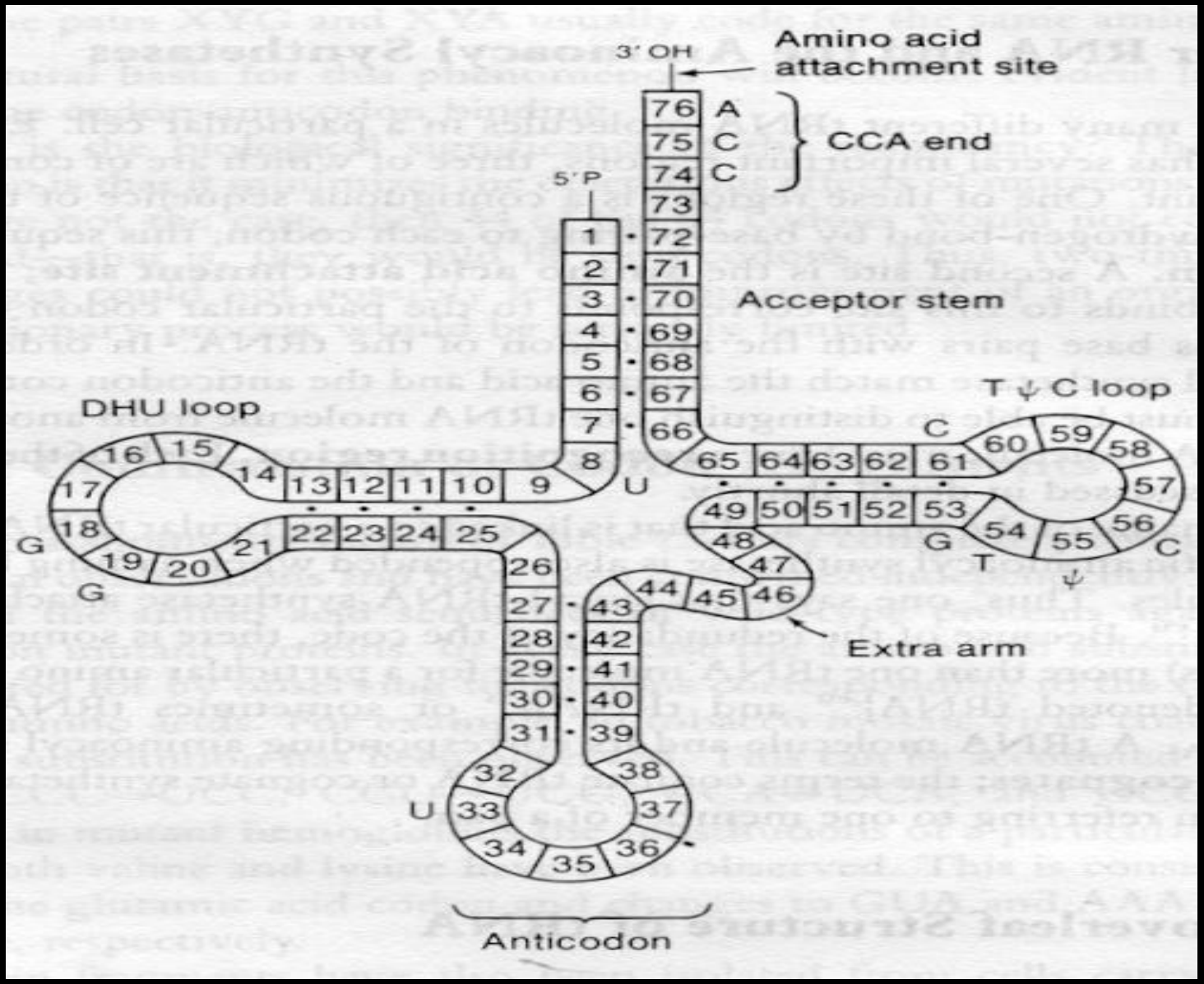


Figure 3.26 Examples of base modifications in the nucleotides of tRNA. In the left-hand column are the bases as they are originally transcribed. In the right-hand column are some common modifications.

Cloverleaf model of t-RNA



Cloverleaf model of t-RNA

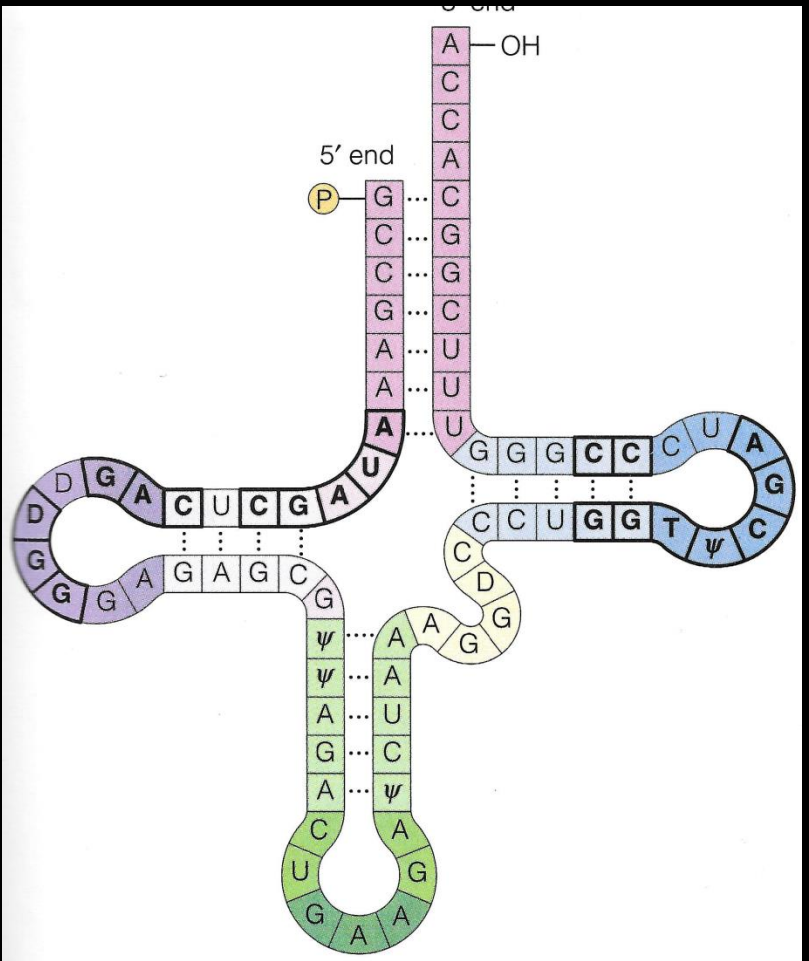


Figure 4.11 A mammalian phenylalanine tRNA as an example of the cloverleaf representation of base pairing in tRNAs. The modified bases are: D = dihydrouracil, T = thymine, and ψ = pseudouracil, all originally transcribed as uracil.

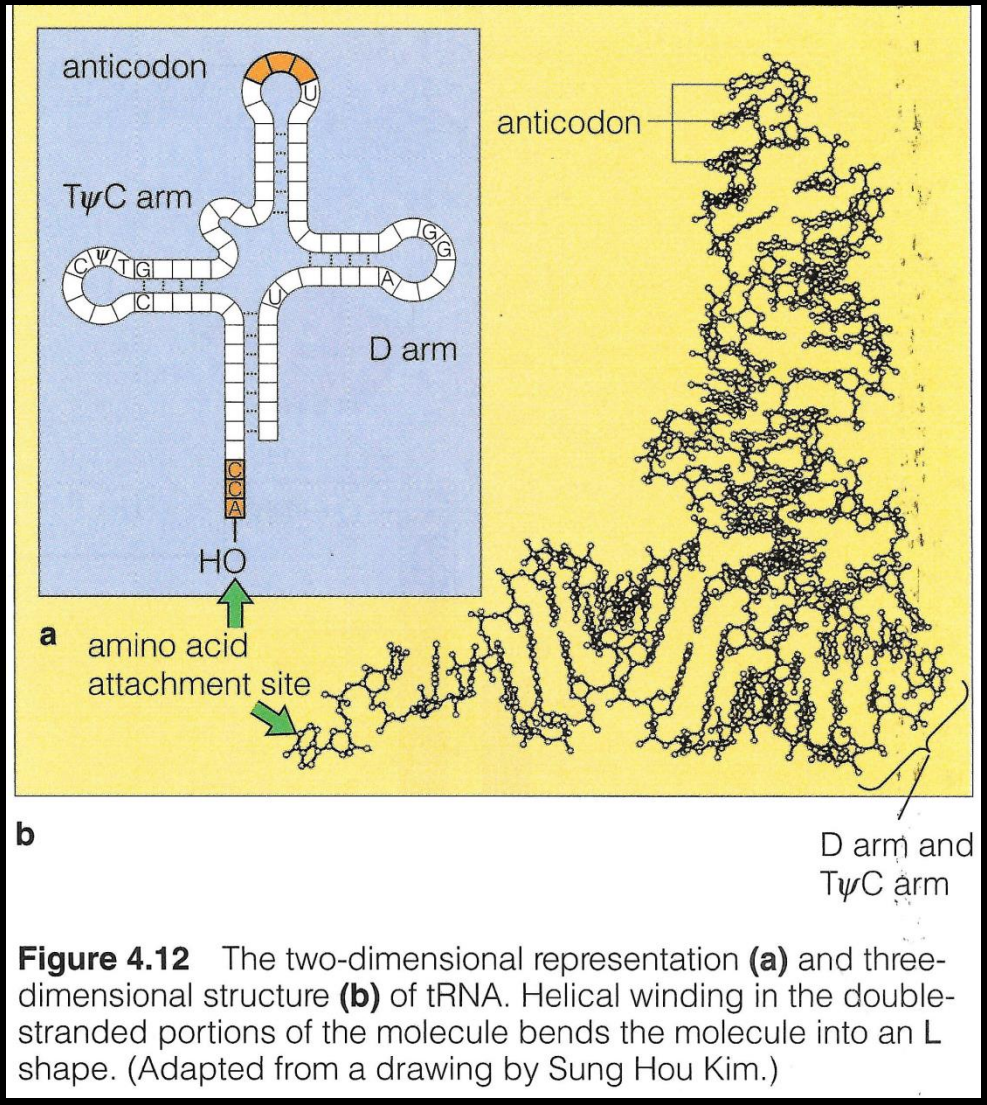


Figure 4.12 The two-dimensional representation **(a)** and three-dimensional structure **(b)** of tRNA. Helical winding in the double-stranded portions of the molecule bends the molecule into an L shape. (Adapted from a drawing by Sung Hou Kim.)

Aminoacylated or Charged t-RNA

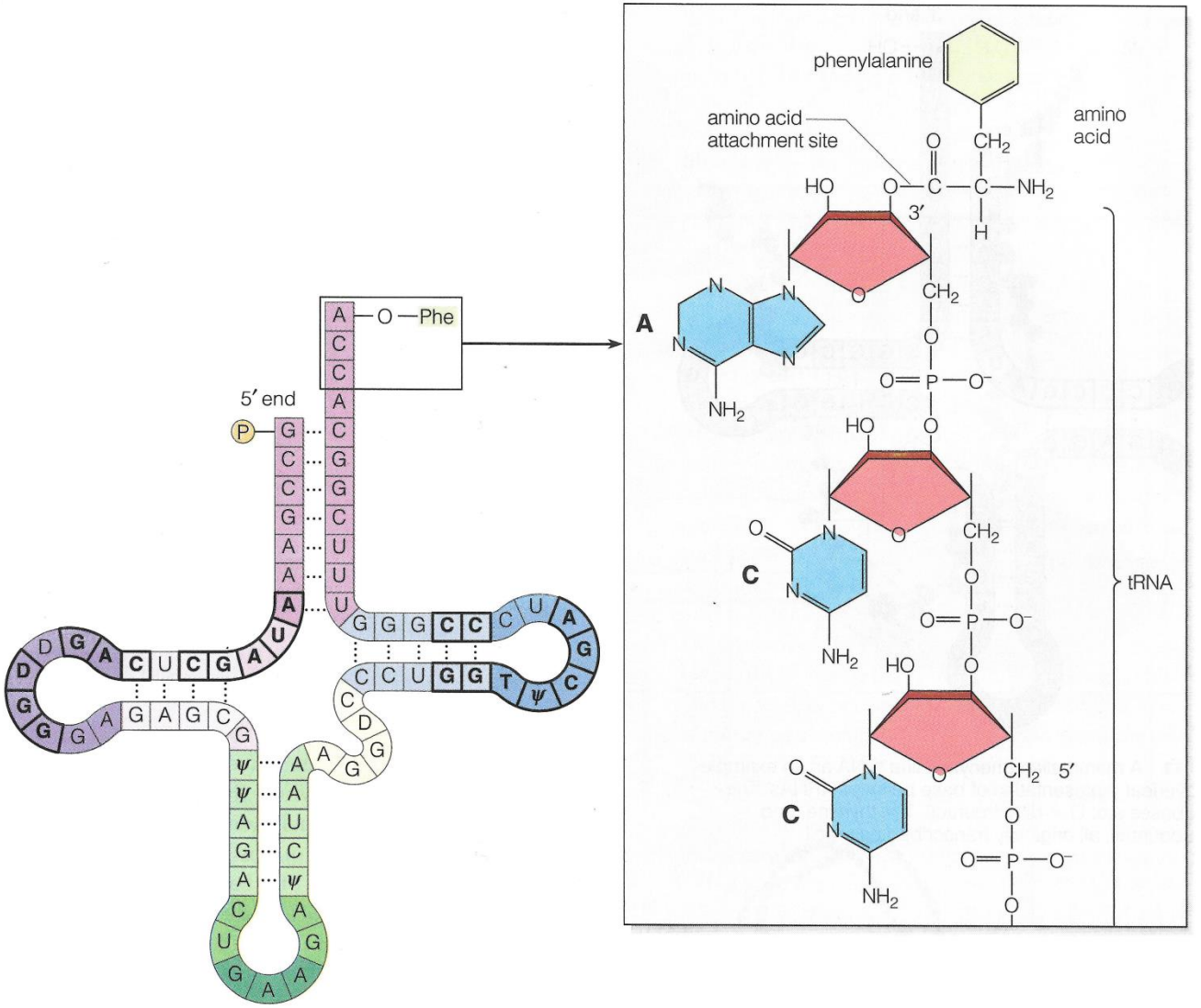


Figure 4.13 A charged tRNA. The inset highlights the bond between the amino acid (in this case, phenylalanine) and the amino acid attachment site on its tRNA. The 3′ end of each tRNA ends with the nucleotides CCA. The 2′ or 3′ OH group of the terminal nucleotide, A, binds to the carboxyl group of the amino acid.

Steps in Aminoacylation of t-RNA

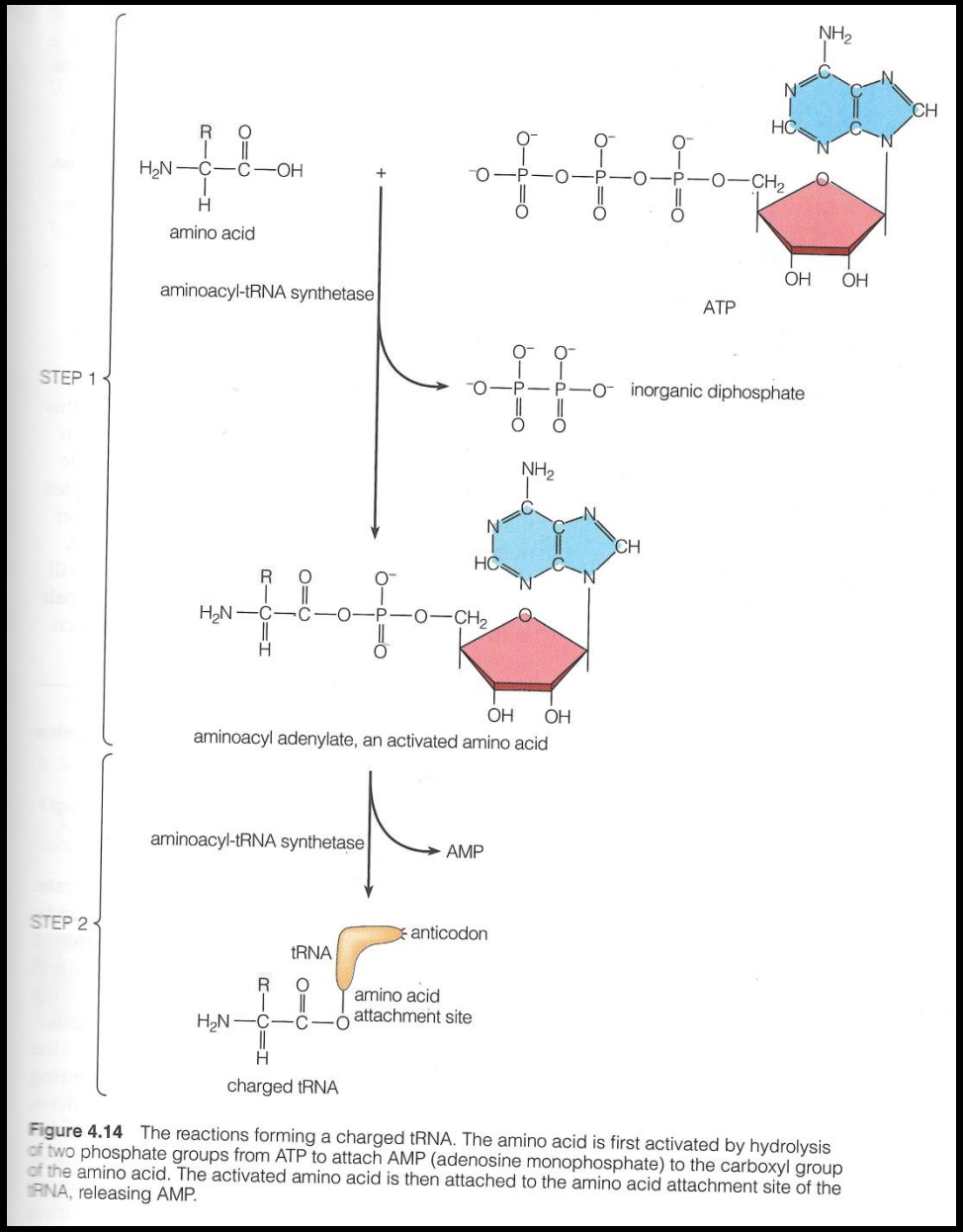


Figure 4.14 The reactions forming a charged tRNA. The amino acid is first activated by hydrolysis of two phosphate groups from ATP to attach AMP (adenosine monophosphate) to the carboxyl group of the amino acid. The activated amino acid is then attached to the amino acid attachment site of the tRNA, releasing AMP.

Genetic code – Wobble hypothesis

TABLE 10.2 Base-pairing between the 5′ Base of the Anticodon of tRNAs and the 3′ Base of Codons of mRNAs According to the Wobble Hypothesis

BASE IN ANTICODON	BASE IN CODON
G	U or C
C	G
A	U
U	A or G
I	A, U, or C

Table 4.2 Codon-Anticodon Pairing at the Third Position in the Codon According to the Wobble Hypothesis

5′ Nucleotide in Anticodon	3′ Nucleotide in Codon
U	A or G
C	G
A	U
G	U or C
I	U, C, or A

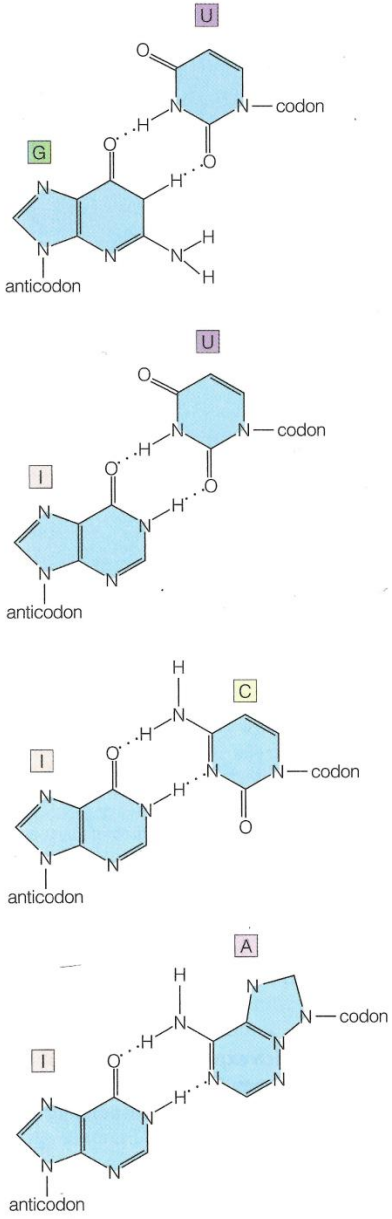


Figure 4.17 Examples of codon-anticodon base pairing at the third position of the codon according to the wobble hypothesis.