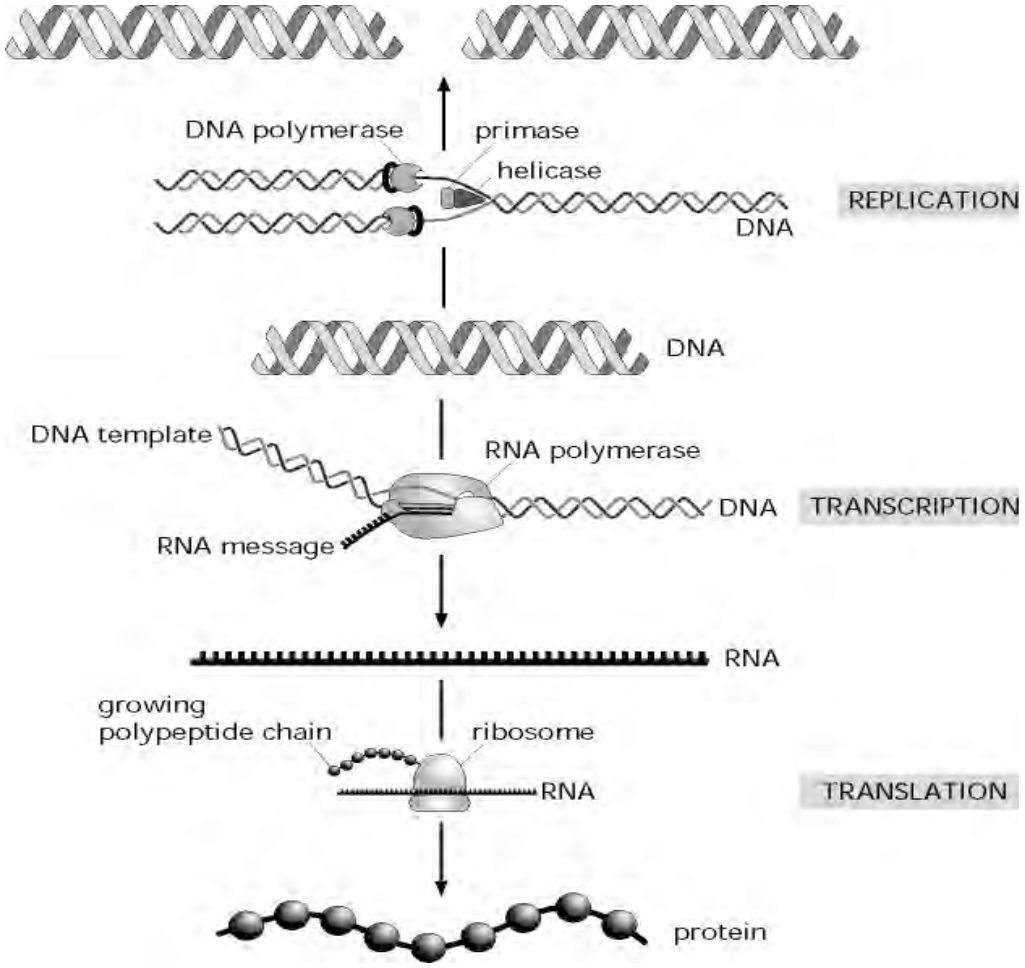
Biological Fidelity

Key point: Mistakes can be made in each of these processes. What limits the mistakes? Other examples of high biological fidelity are revealed in the immune system.



The Translation Process

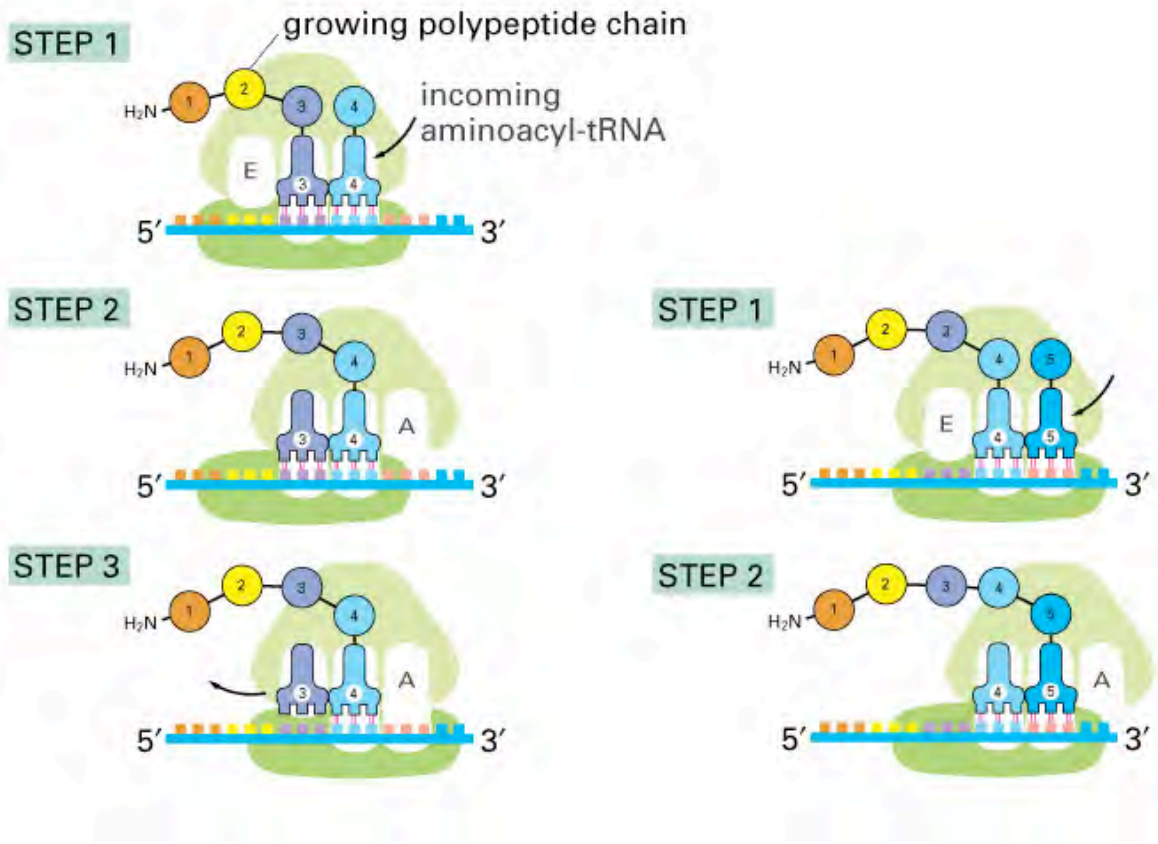


Figure 7-30 Essential Cell Biology, 2/e. (© 2004 Garland Science)

The Ribosome is an Amazing Machine

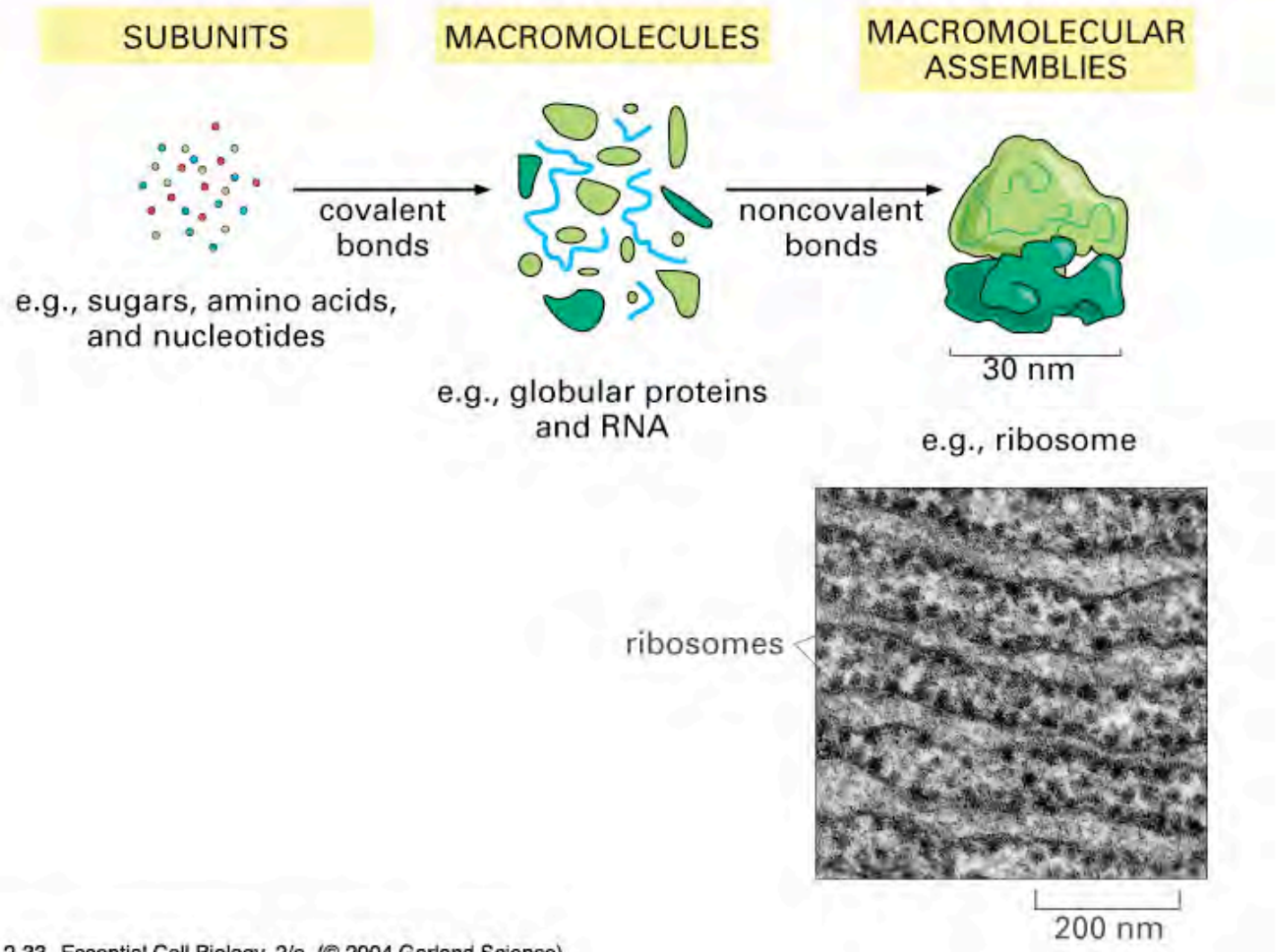


Figure 2-33 Essential Cell Biology, 2/e. (© 2004 Garland Science)

Mindblowing but True: The Ribosome Structure

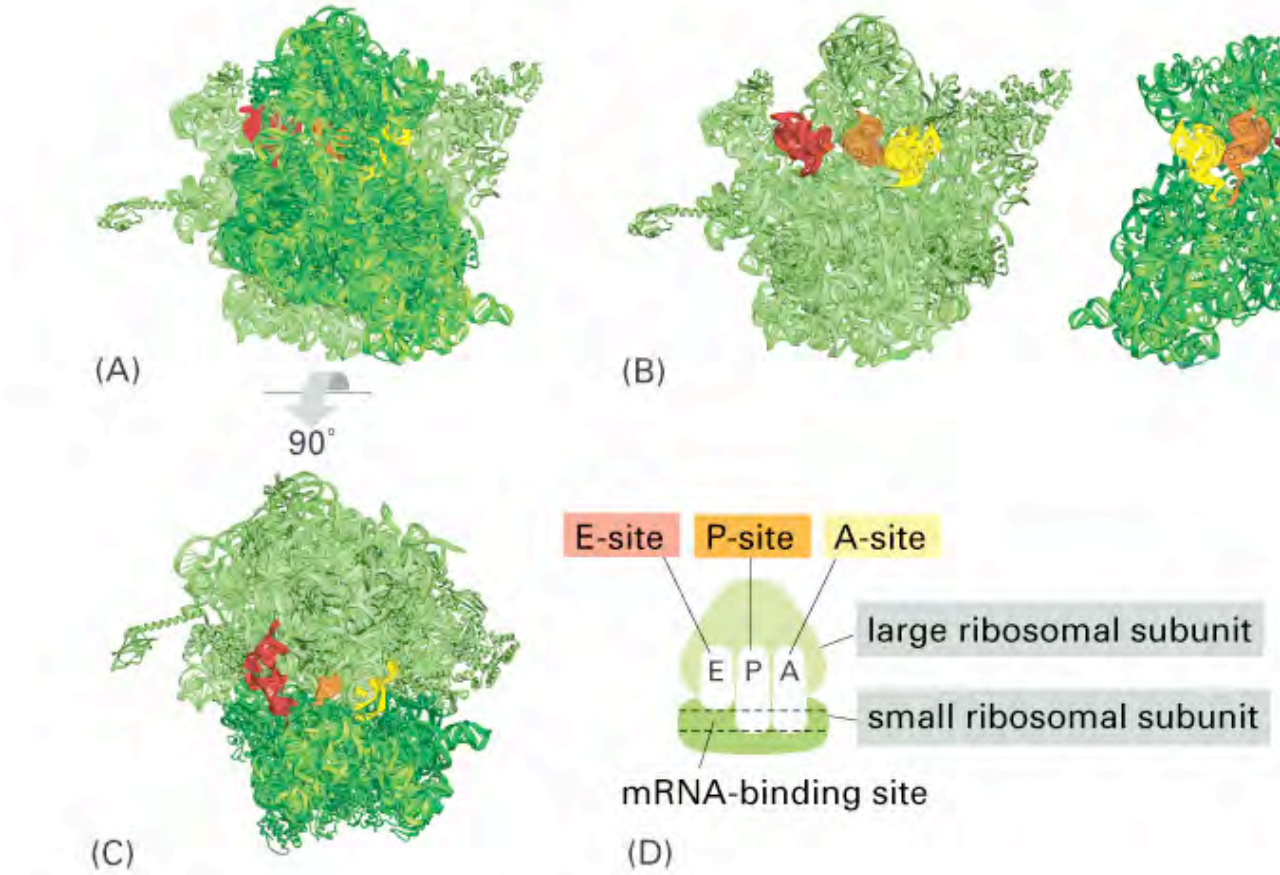


Figure 7-29 Essential Cell Biology, 2/e. (© 2004 Garland Science)

The Genetic Code

	AGA AGG									UUA UUG
GCA	CGA						GGA			CUA
GCC	CGC						GGC		AUA	CUC
GCG	CGG	GAC	AAC	UGC	GAA	CAA	GGG	CAC	AUC	CUG
GCU	CGU	GAU	AAU	UGU	GAG	CAG	GGU	CAU	AUU	CUU
Ala	Arg	Asp	Asn	Cys	Glu	Gln	Gly	His	Ile	Leu
A	R	D	N	C	E	Q	G	H	I	L
				AGC AGU						
			CCA	UCA	ACA			GUA		
			CCC	UCC	ACC			GUC		UAA
AAA		UUC	CCG	UCG	ACG		UAC	GUG		UAG
AAG	AUG	UUU	CCU	UCU	ACU	UGG	UAU	GUU		UGA
Lys	Met	Phe	Pro	Ser	Thr	Trp	Tyr	Val		stop
K	M	F	P	S	T	W	Y	V		

Figure 7-21 Essential Cell Biology, 2/e. (© 2004 Garland Science)

How Translation Works Informationally

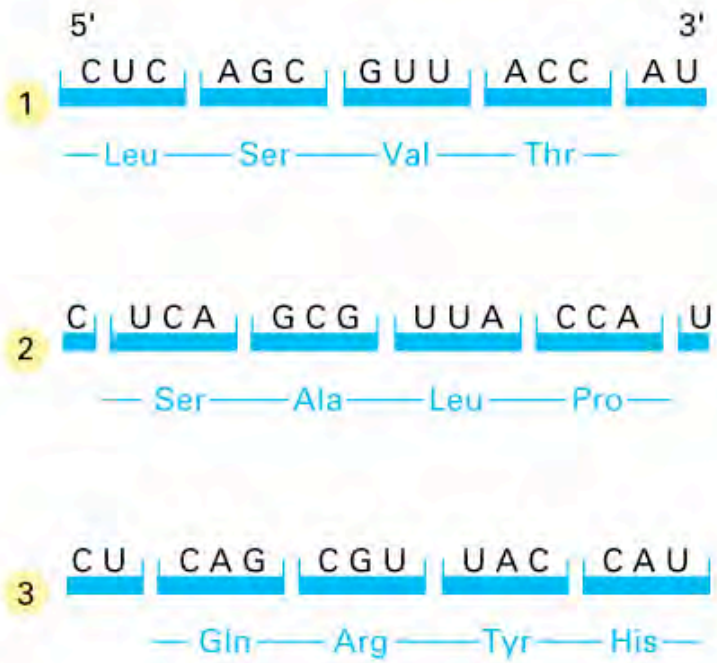


Figure 7-22 Essential Cell Biology, 2/e. (© 2004 Garland Science)

The Translational Adaptor: tRNA

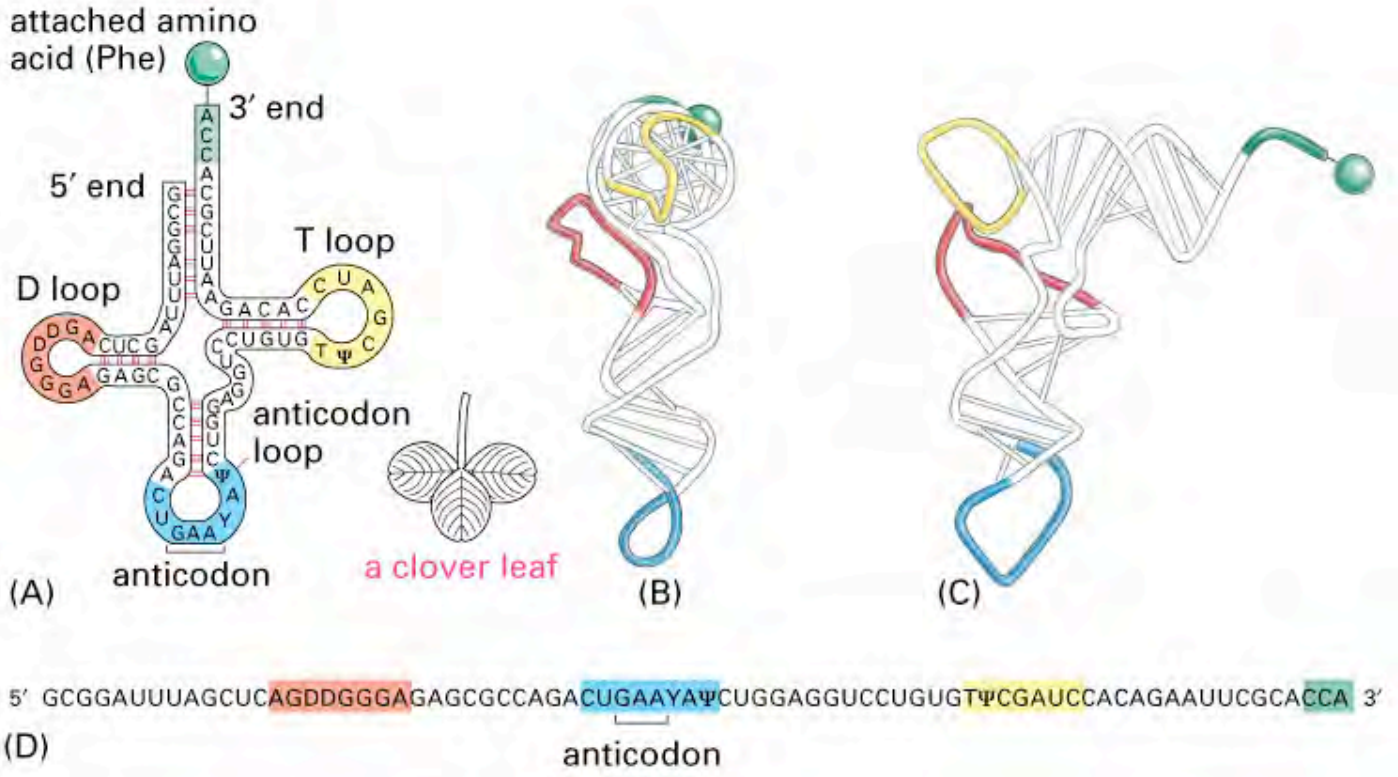


Figure 7-23 Essential Cell Biology, 2/e. (© 2004 Garland Science)

Amino Acid Specificity During Translation

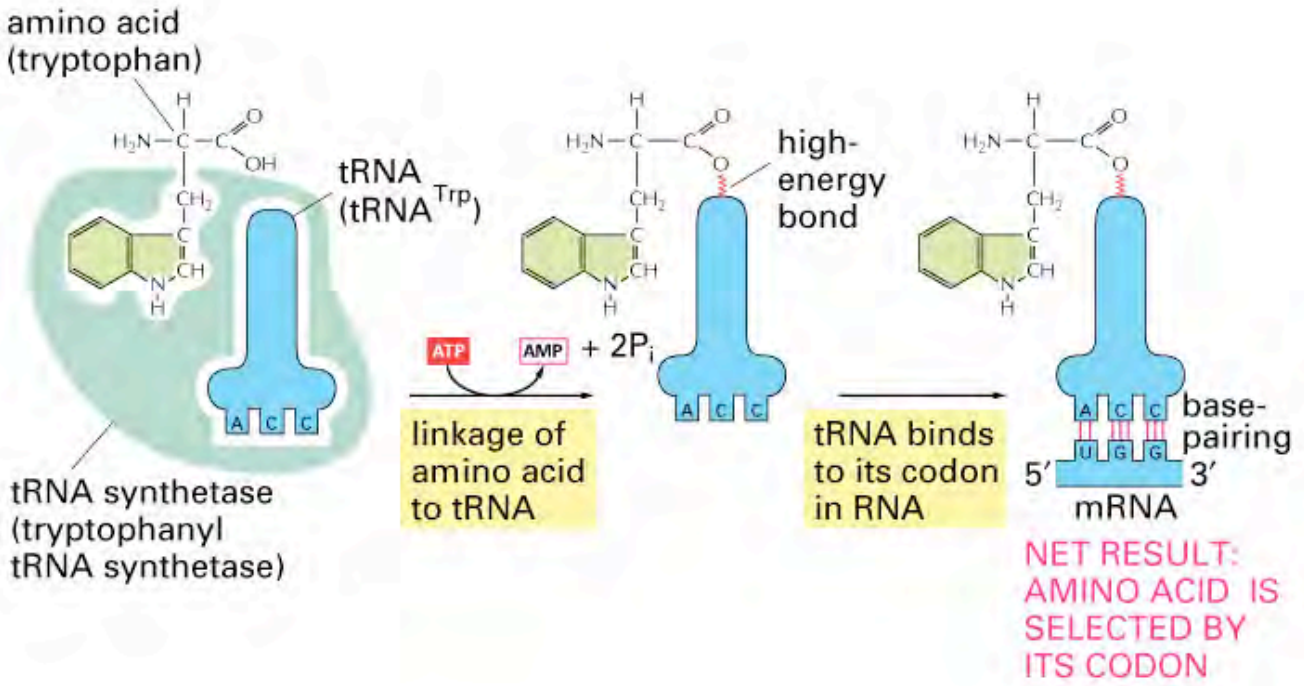


Figure 7-26 Essential Cell Biology, 2/e. (© 2004 Garland Science)

What Are the Amino Acids Like?

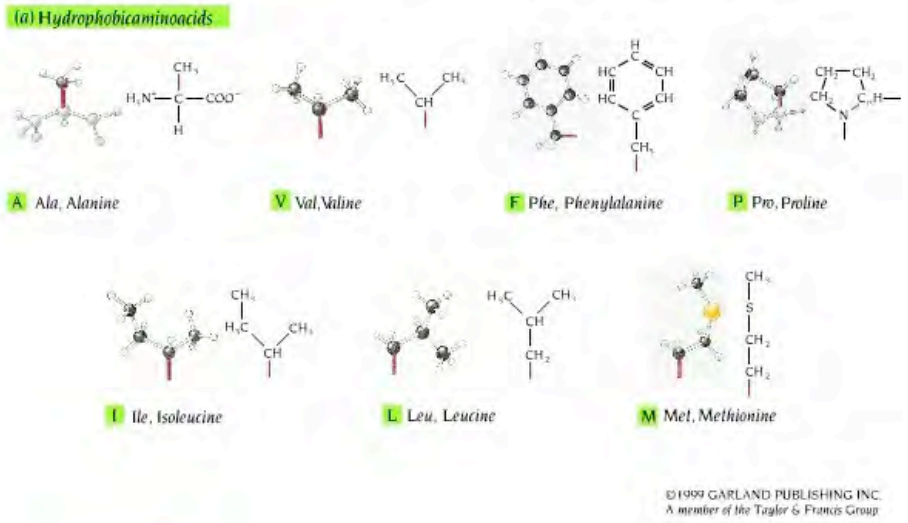
AMINO ACID			SIDE CHAIN	AMINO ACID			SIDE CHAIN
Aspartic acid	Asp	D	negative	Alanine	Ala	A	nonpolar
Glutamic acid	Glu	E	negative	Glycine	Gly	G	nonpolar
Arginine	Arg	R	positive	Valine	Val	V	nonpolar
Lysine	Lys	K	positive	Leucine	Leu	L	nonpolar
Histidine	His	H	positive	Isoleucine	Ile	I	nonpolar
Asparagine	Asn	N	uncharged polar	Proline	Pro	P	nonpolar
Glutamine	Gln	Q	uncharged polar	Phenylalanine	Phe	F	nonpolar
Serine	Ser	S	uncharged polar	Methionine	Met	M	nonpolar
Threonine	Thr	T	uncharged polar	Tryptophan	Trp	W	nonpolar
Tyrosine	Tyr	Y	uncharged polar	Cysteine	Cys	C	nonpolar

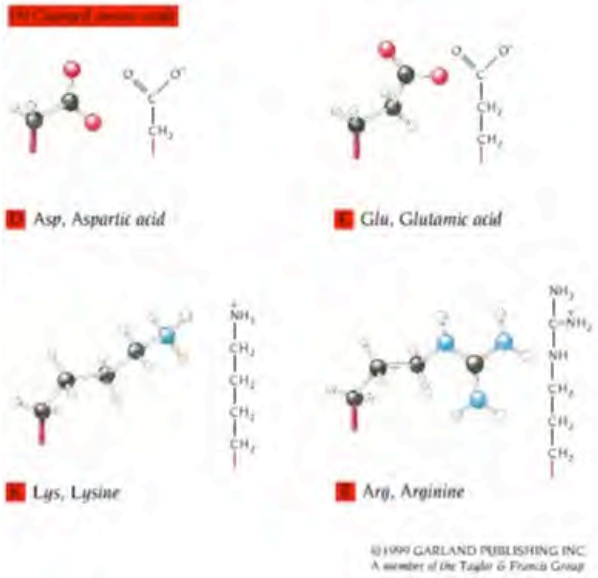
POLAR AMINO ACIDS

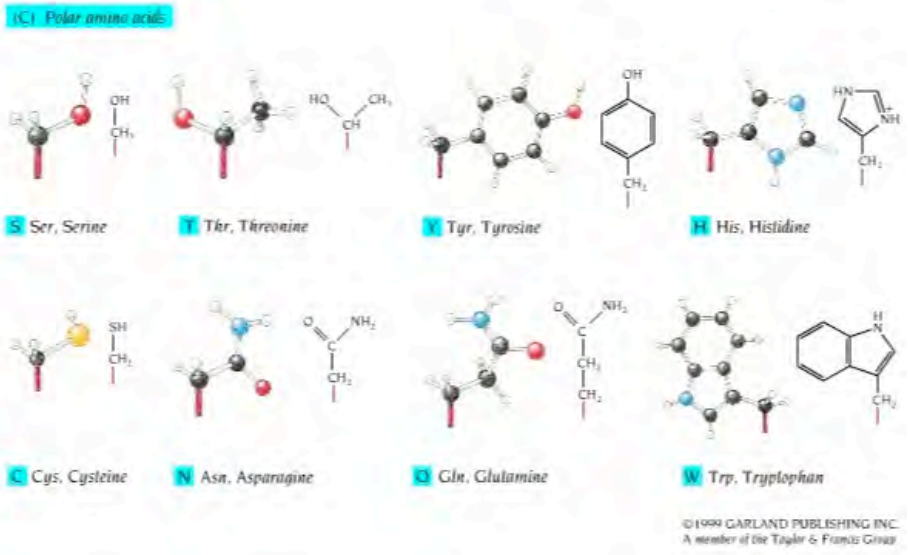
NONPOLAR AMINO ACIDS

Figure 4-3 Essential Cell Biology, 2/e. (© 2004 Garland Science)

The Amino Acids







HP Model

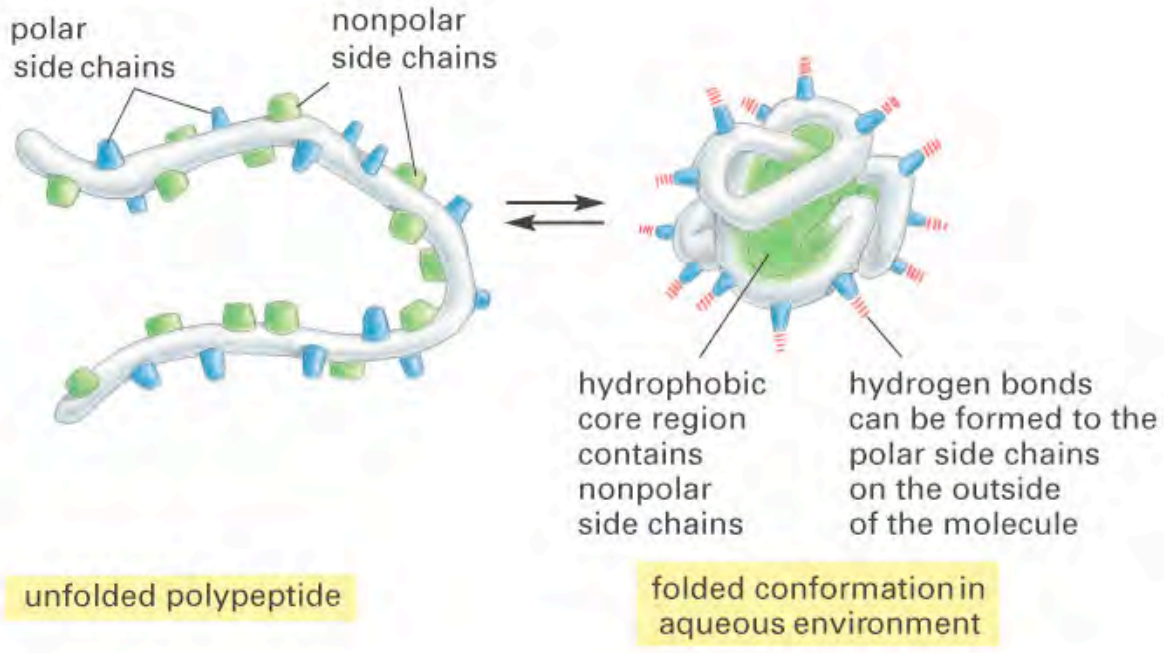
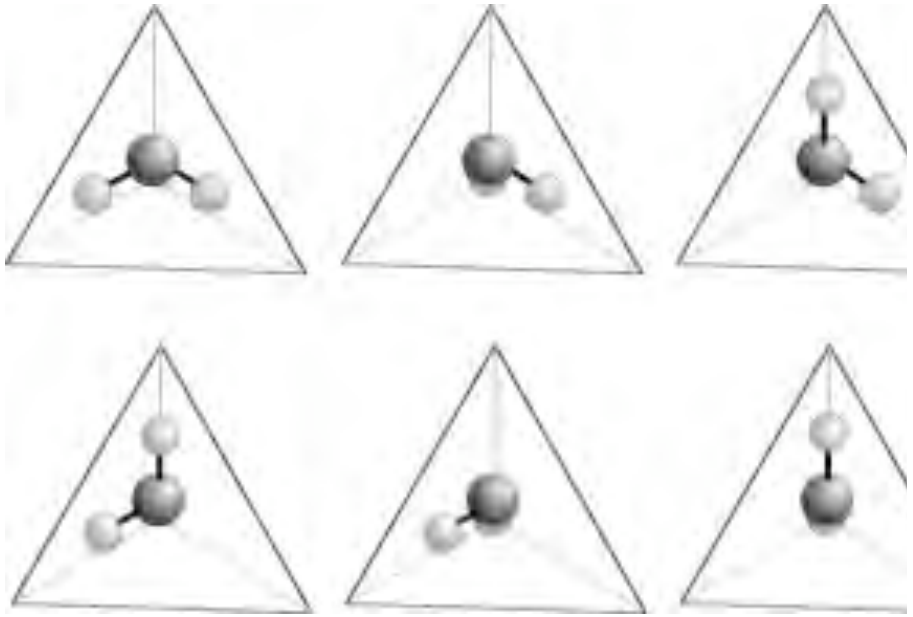


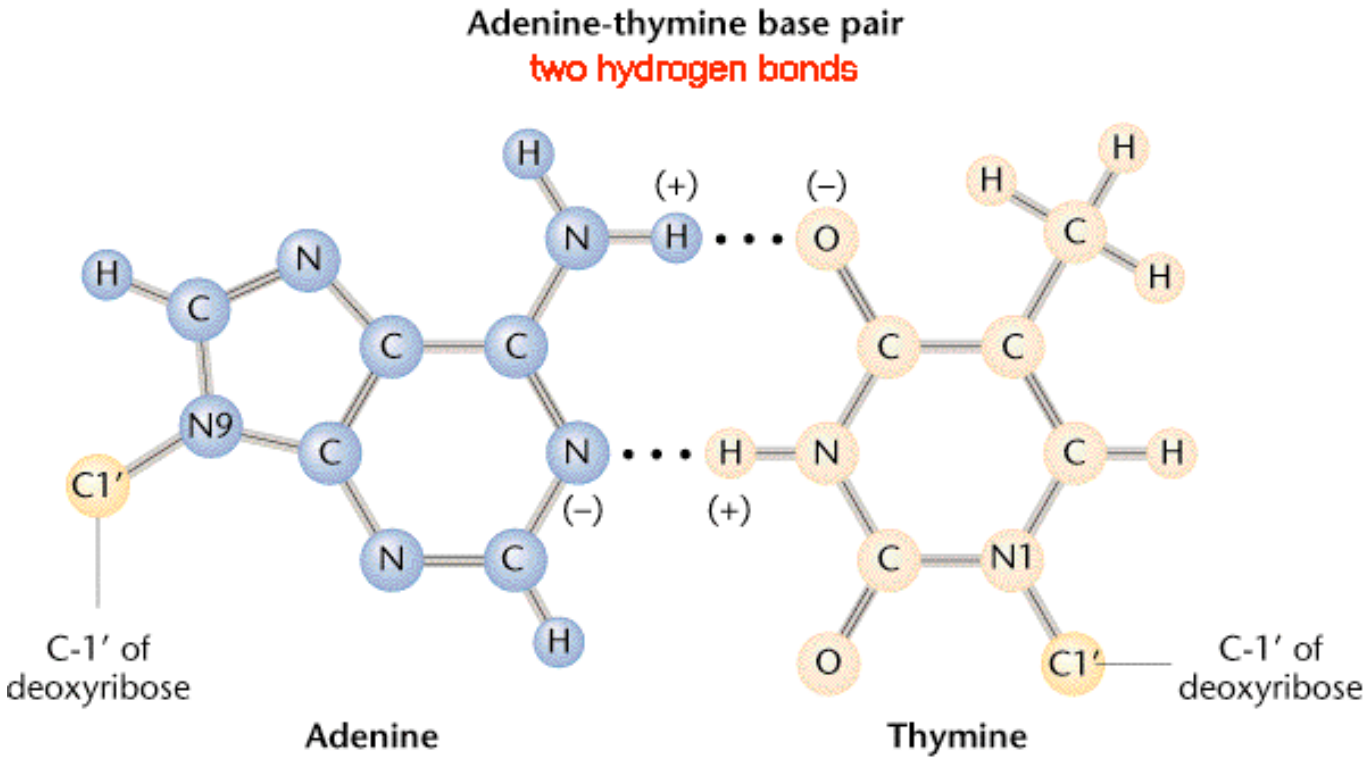
Figure 4-5 Essential Cell Biology, 2/e. (© 2004 Garland Science)

Name	3 letter code	1 letter
alanine	ALA	A
arginine	ARG	R
asparagine	ASN	N
aspartic acid	ASP	D
cysteine	CYS	C
glutamine	GLN	Q
glutamic acid	GLU	E
glycine	GLY	G
histidine	HIS	H
isoleucine	ILE	I
leucine	LEU	L
lysine	LYS	K
methionine	MET	M
phenylalanine	PHE	F
proline	PRO	P
serine	SER	S
threonine	THR	T
tryptophan	TRY	W
tyrosine	TYR	Y
valine	VAL	V

A Toy Model of Hydrophobicity



Hydrogen Bonds



(Klug & Cummings 1997)