

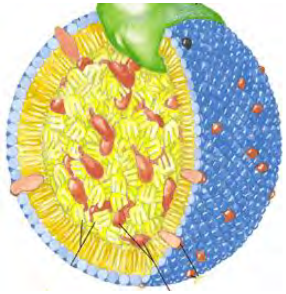


BIOCHEMISTRY REVIEW

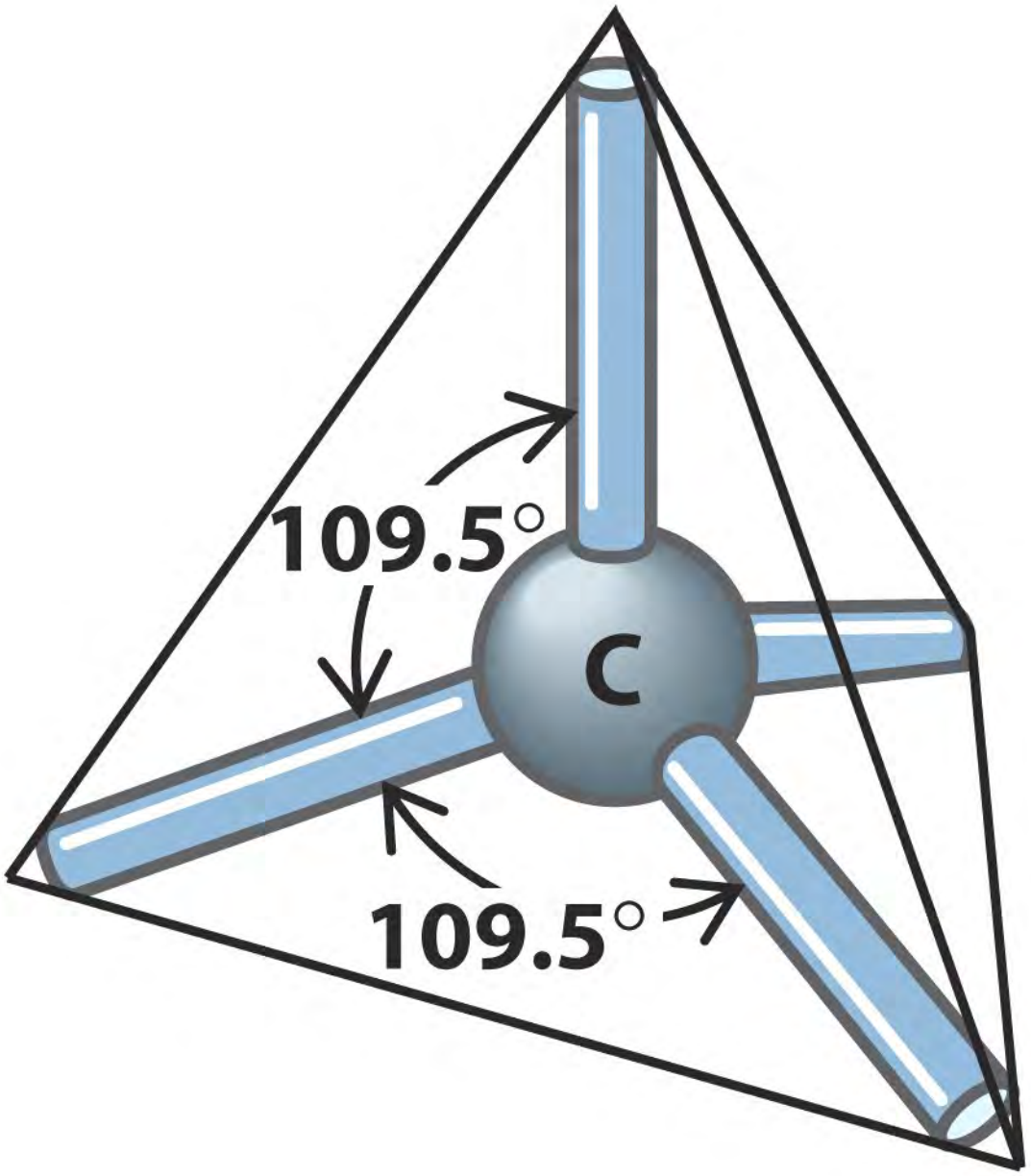
Overview of Biomolecules

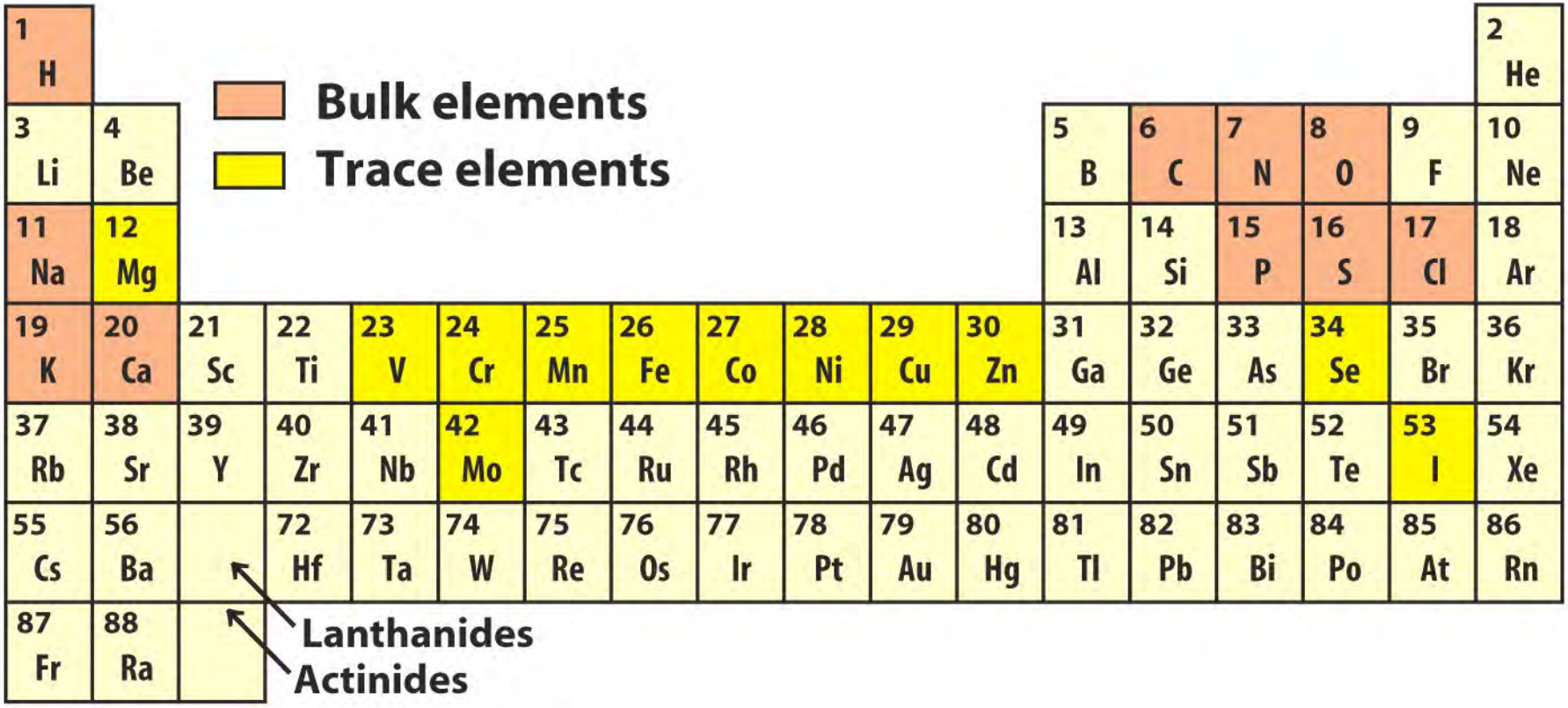
Chapter 1

Introduction to Biomolecules

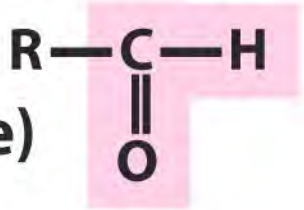




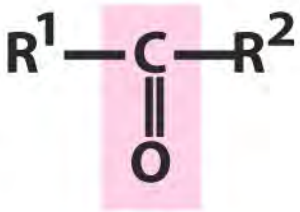

109.5°
C
109.5°


Bulk elements
Trace elements
1 H
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
Lanthanides
Actinides

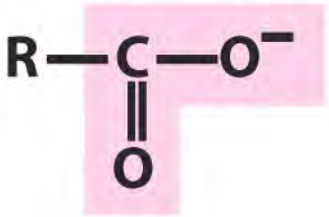
Carbonyl (aldehyde)



Carbonyl (ketone)



Carboxyl



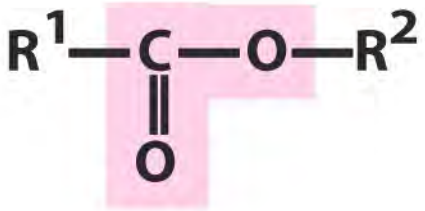
Hydroxyl (alcohol)



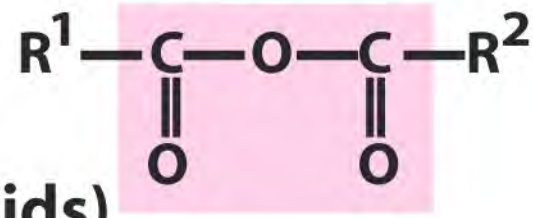
Ether



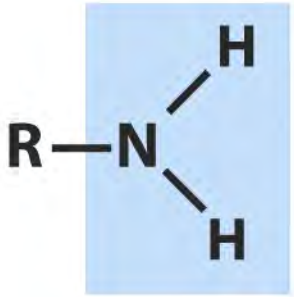
Ester



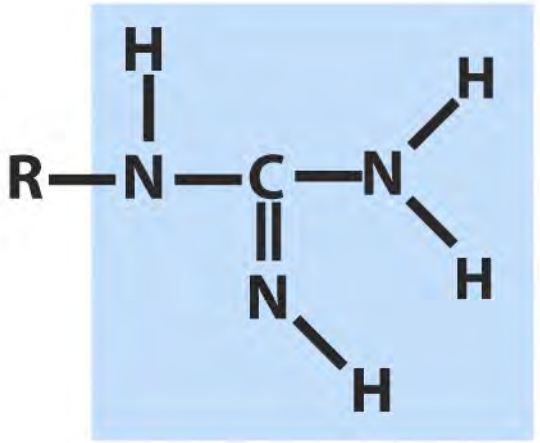
Anhydride (two carboxylic acids)



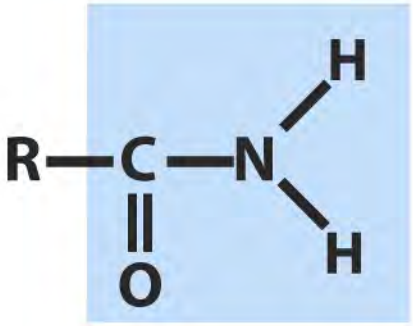
Amino



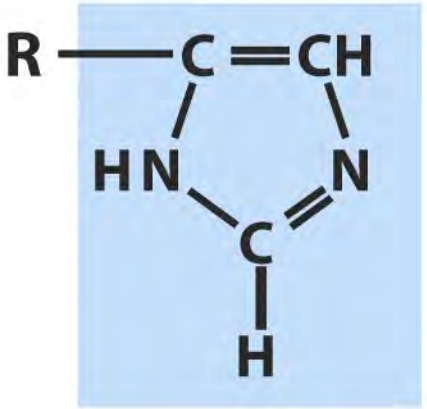
Guanidino



Amido



Imidazole



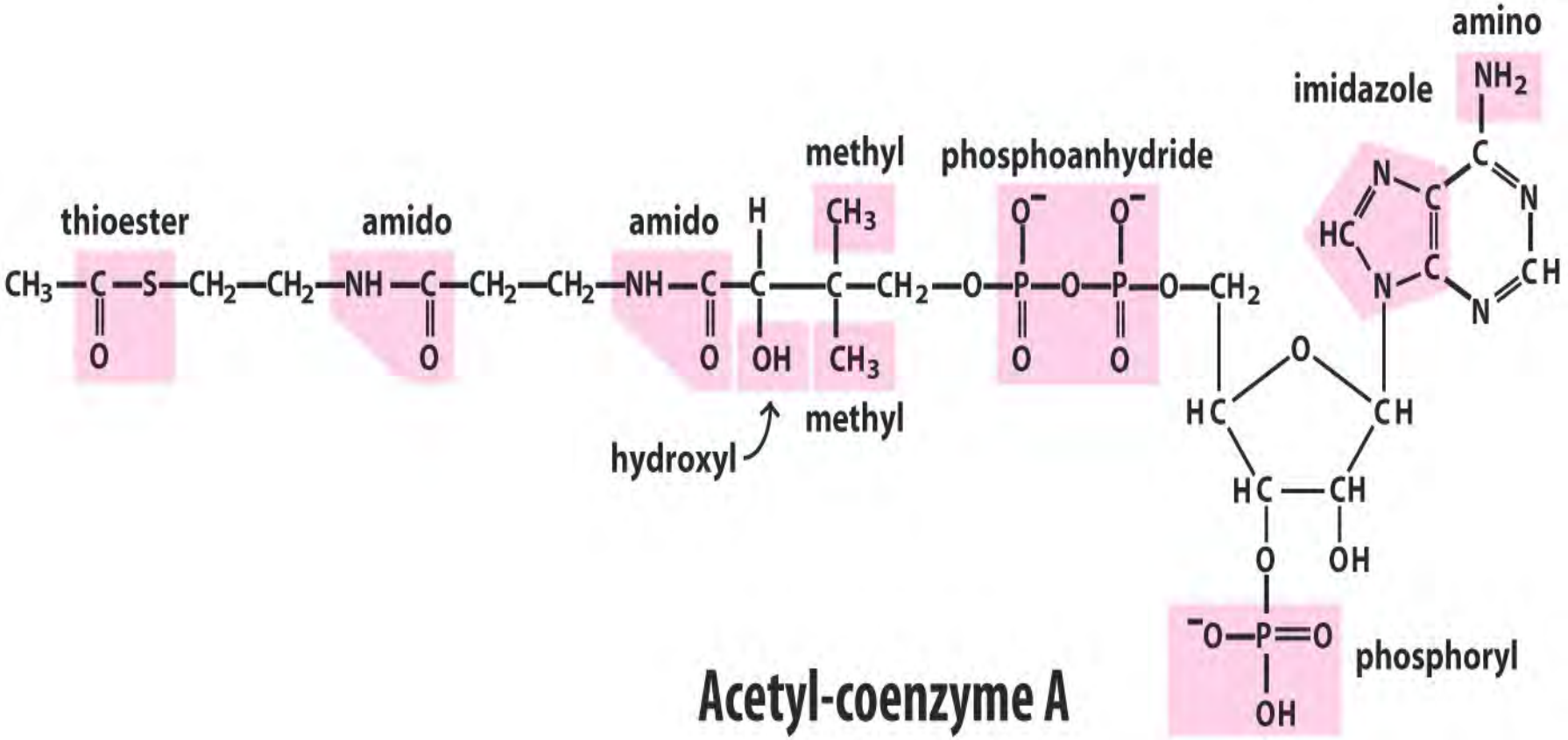
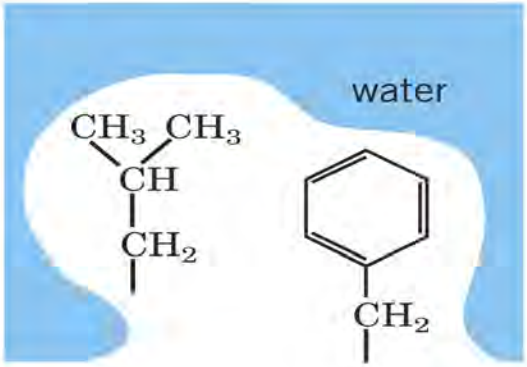
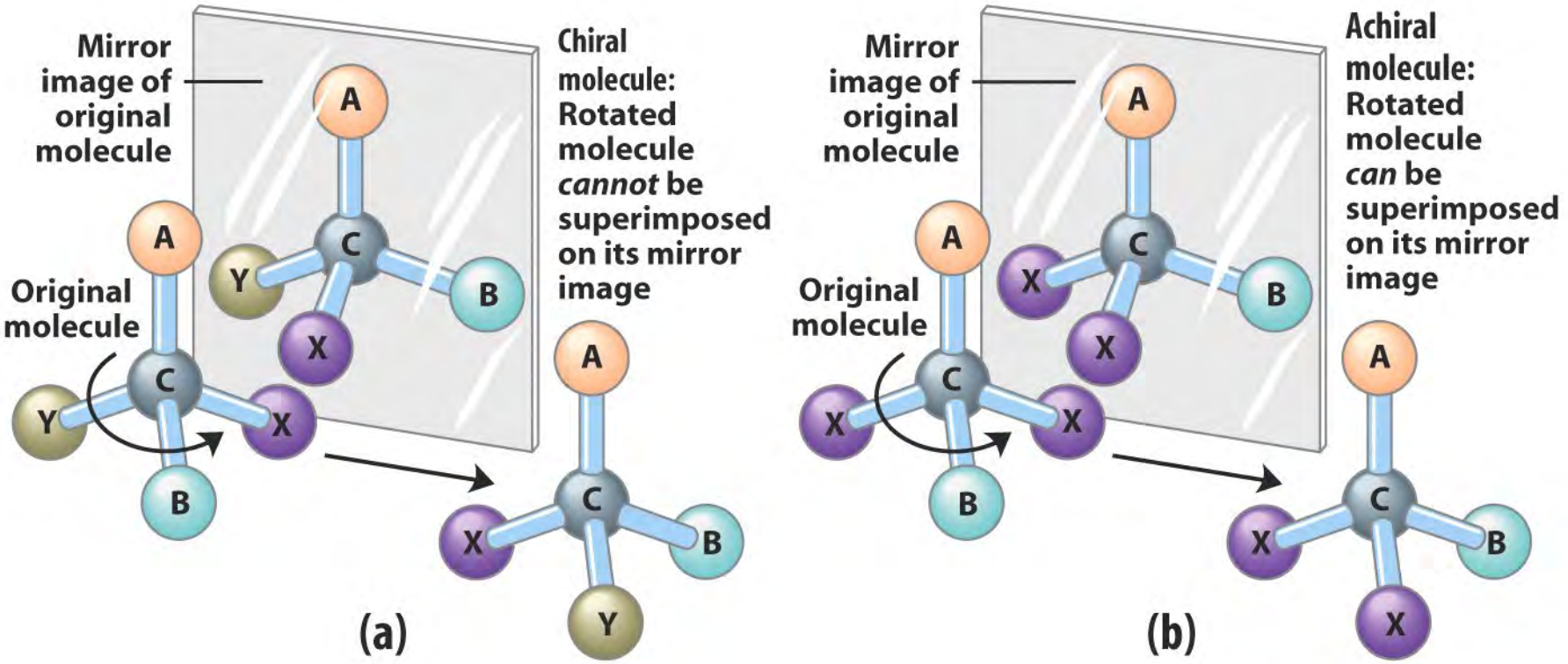
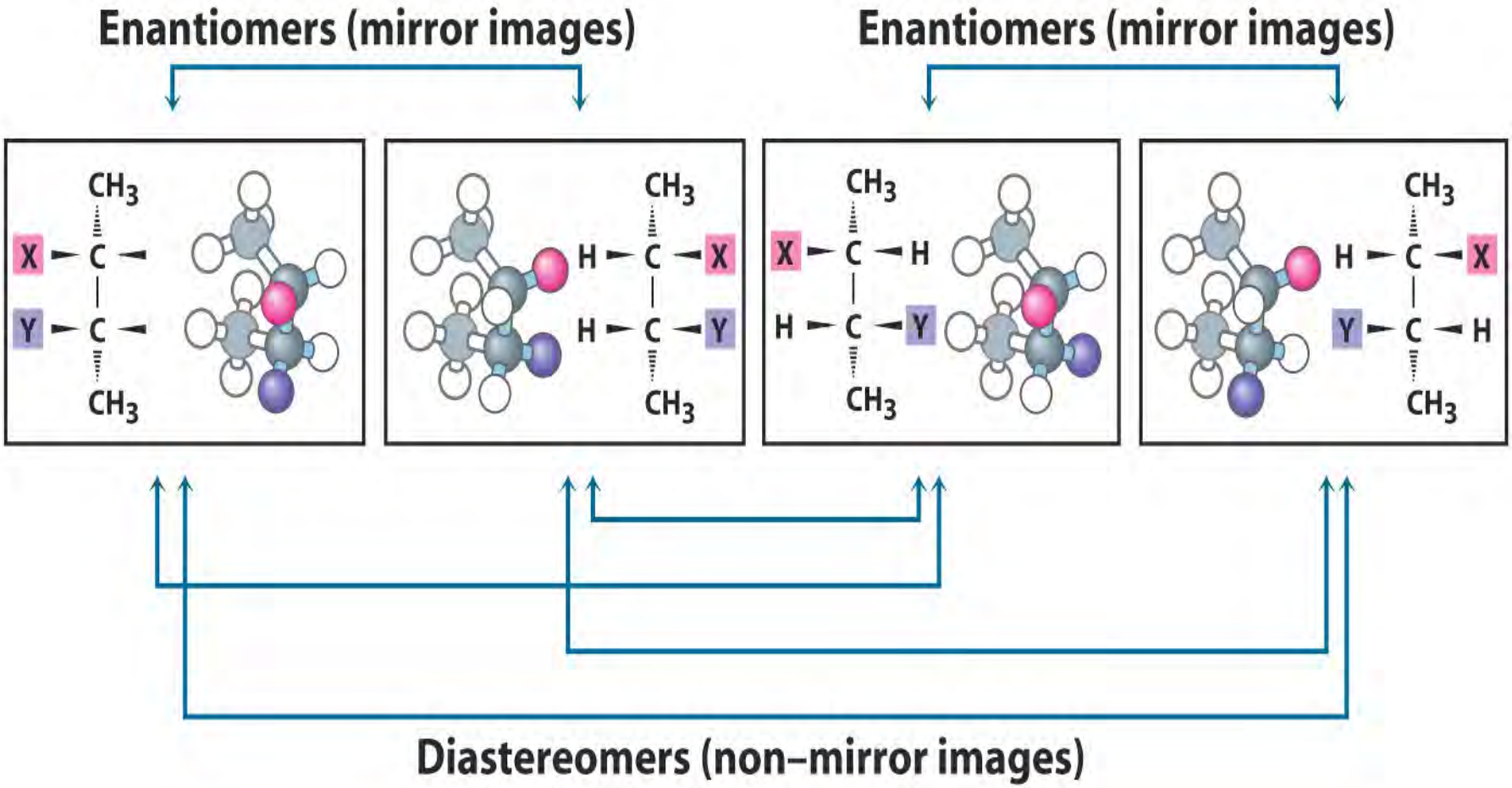

amino
imidazole
methyl
phosphoanhydride
thioester
amido
amido
hydroxyl
methyl
phosphoryl
Acetyl-coenzyme A

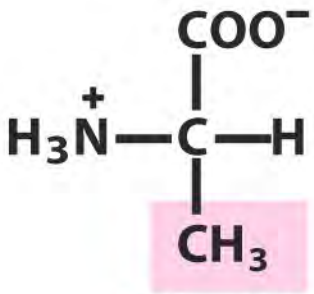
TABLE 2–5 **Four Types of Noncovalent ("Weak") Interactions among Biomolecules in Aqueous Solvent**

Hydrogen bonds	
Between neutral groups	
Between peptide bonds	
Ionic interactions	
Attraction	
Repulsion	
Hydrophobic interactions	
van der Waals interactions	Any two atoms in close proximity

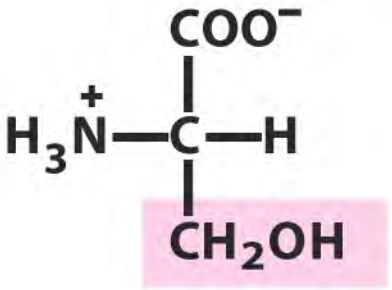

Mirror image of original molecule
Chiral molecule: Rotated molecule *cannot* be superimposed on its mirror image
Original molecule
A
B
C
X
Y
(a)
Mirror image of original molecule
Achiral molecule: Rotated molecule *can* be superimposed on its mirror image
Original molecule
A
B
C
X
(b)


Enantiomers (mirror images)
Enantiomers (mirror images)
CH3
X
C
Y
C
CH3
H
C
X
H
C
Y
CH3
X
C
H
H
C
Y
CH3
H
C
X
Y
C
H
CH3
Diastereomers (non–mirror images)

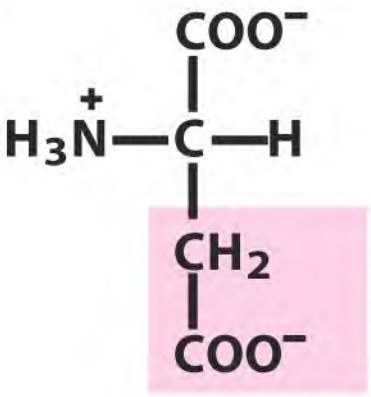
(a) Some of the amino acids of proteins



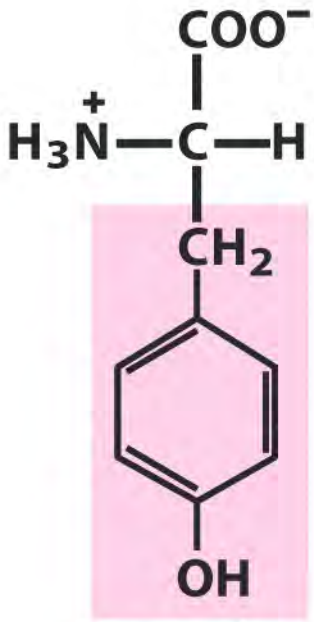
Alanine



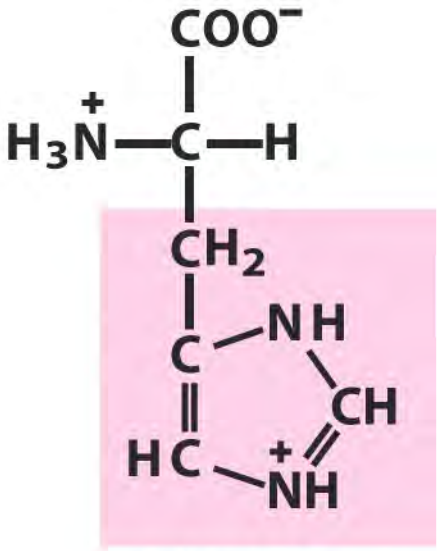
Serine



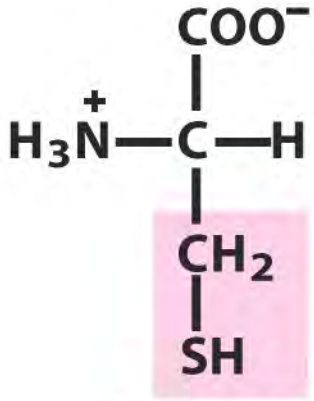
Aspartate



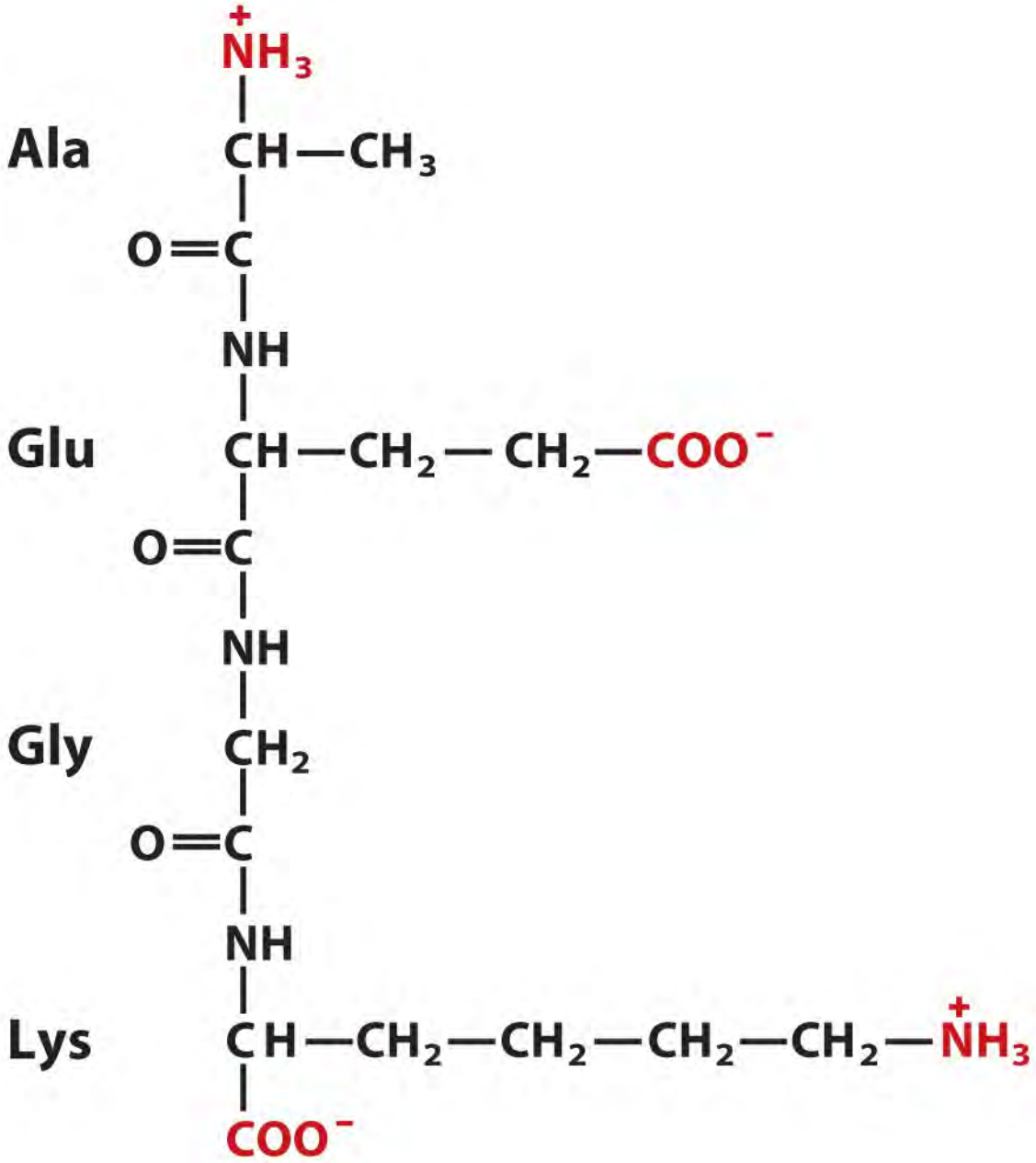
Tyrosine

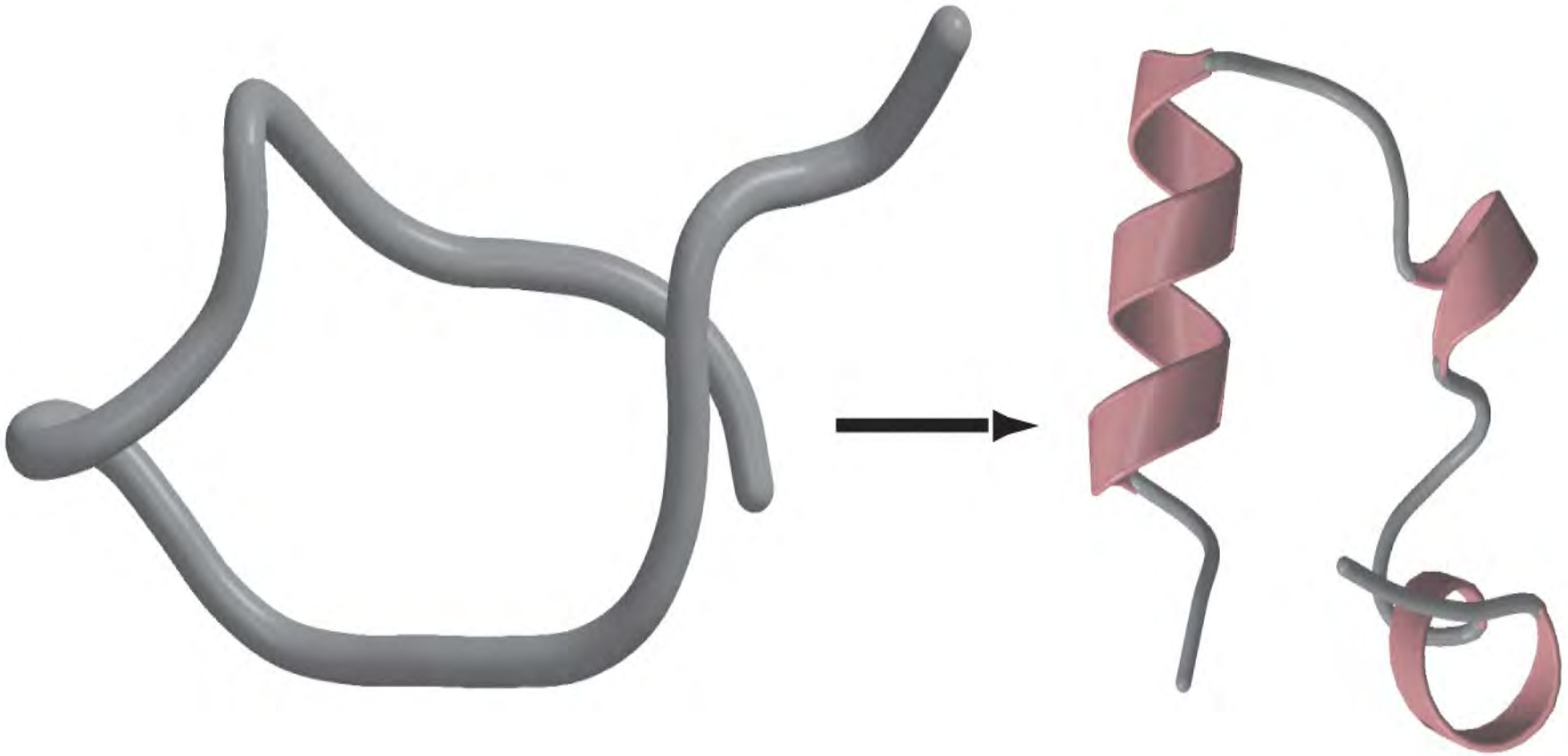


Histidine

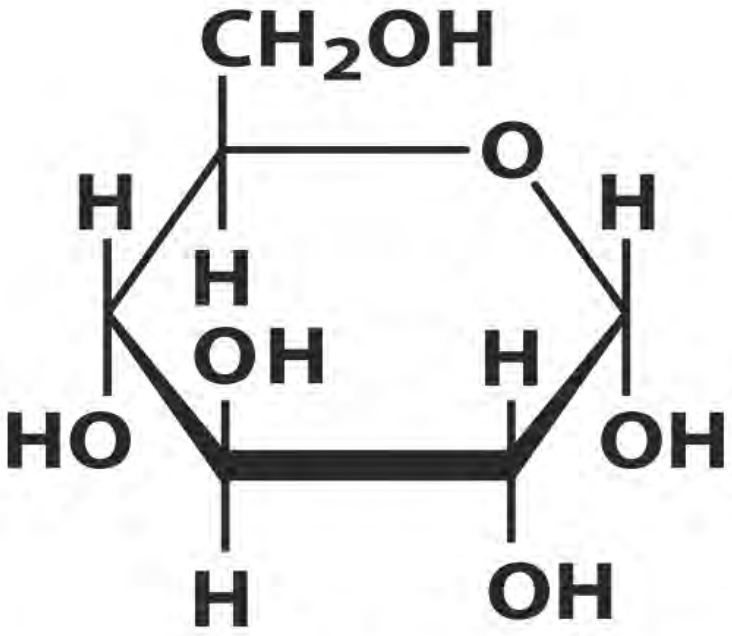


Cysteine

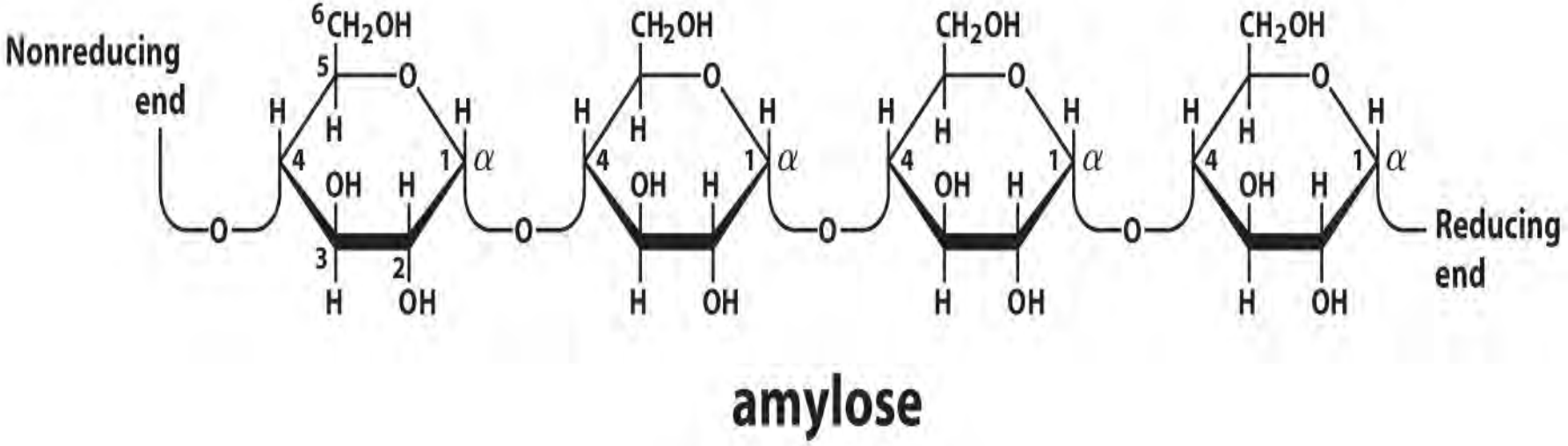

Ala
Glu
Gly
Lys



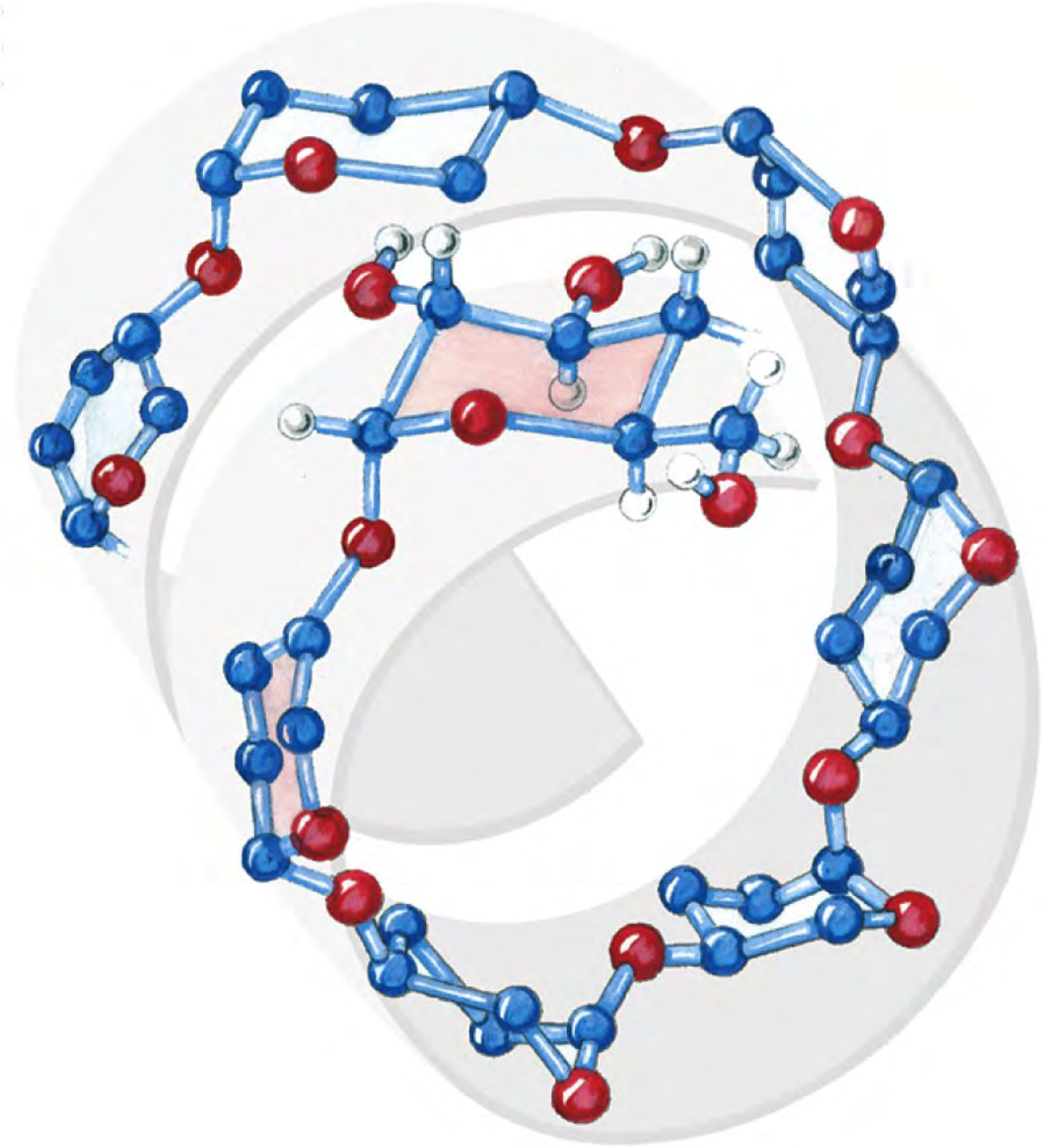
The parent sugar



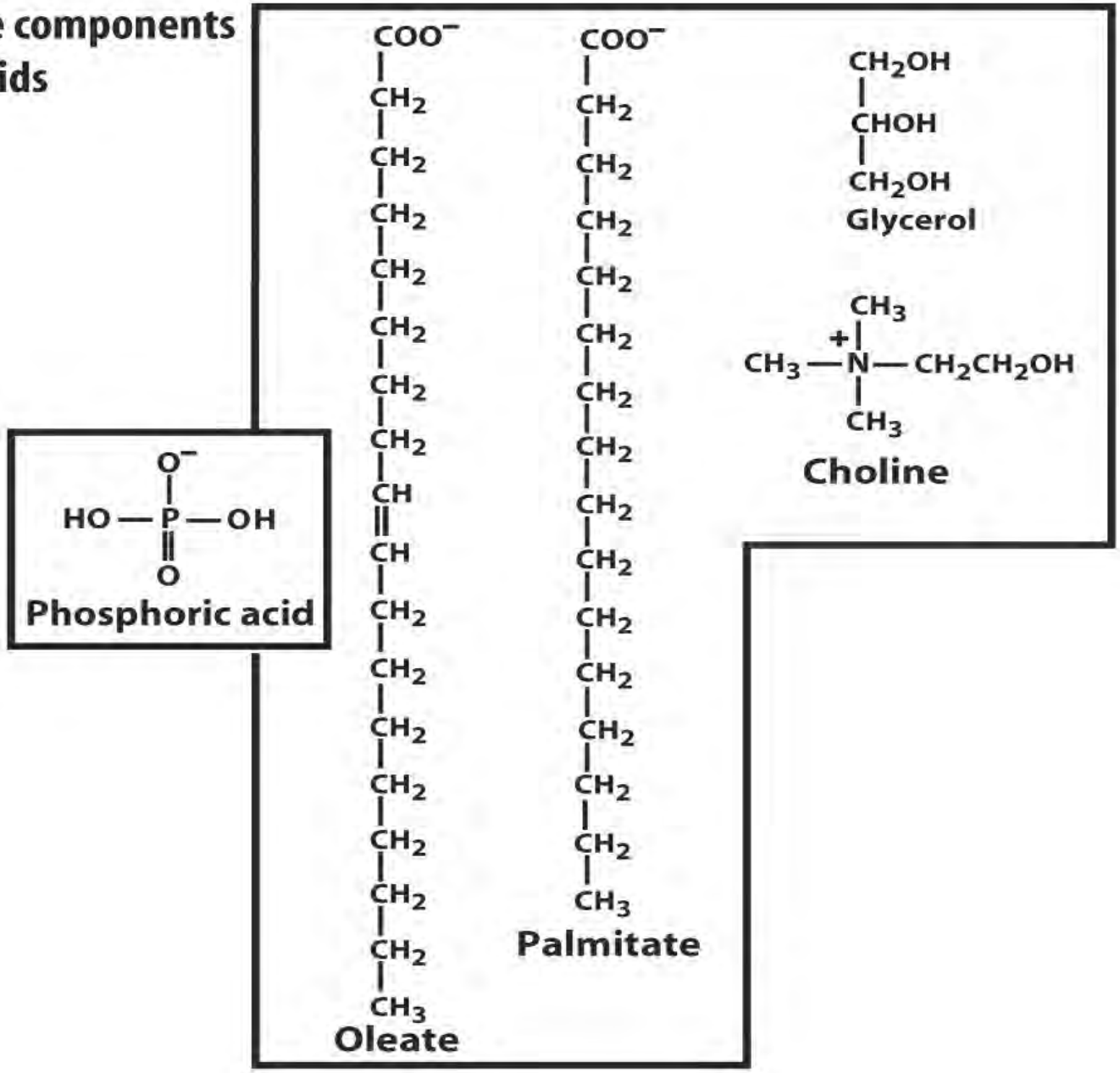
α-D-Glucose


Nonreducing end
6CH2OH
5
O
H
H
4
OH
H
1
α
3
2
H
OH
O
CH2OH
Reducing end

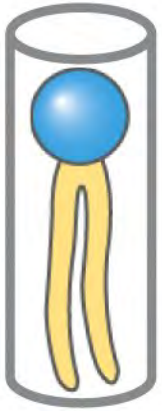
amylose



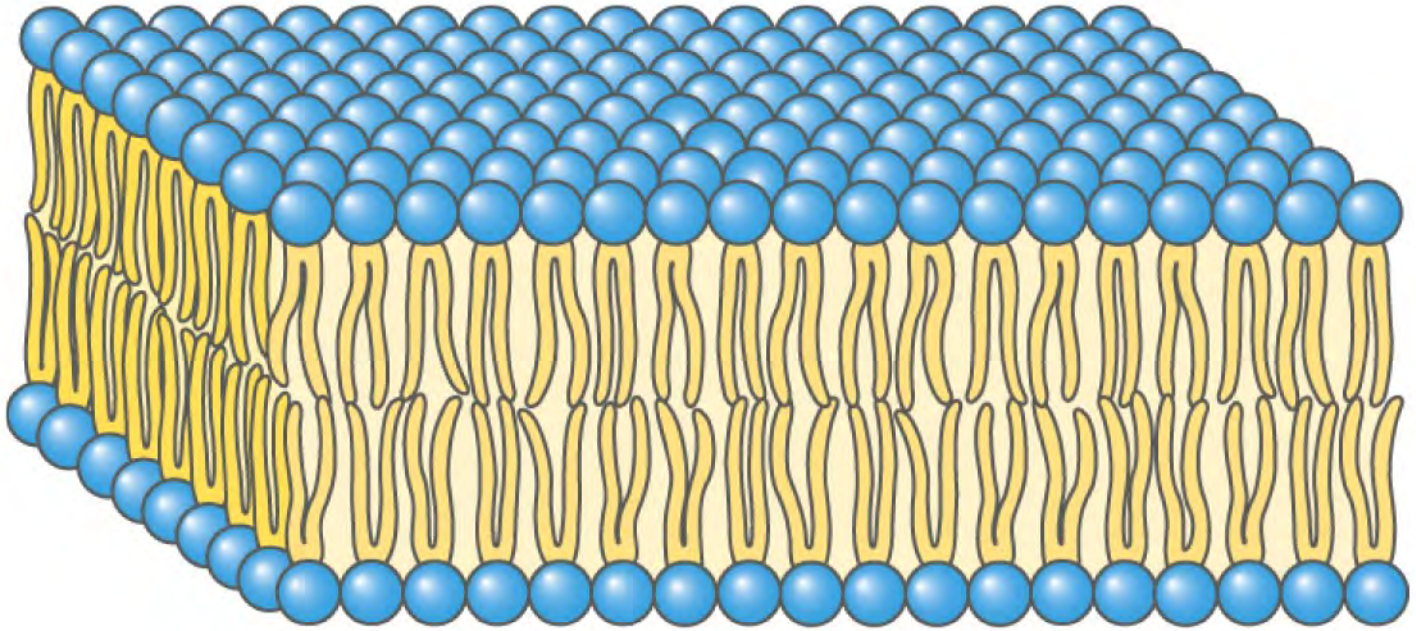
Some components of lipids

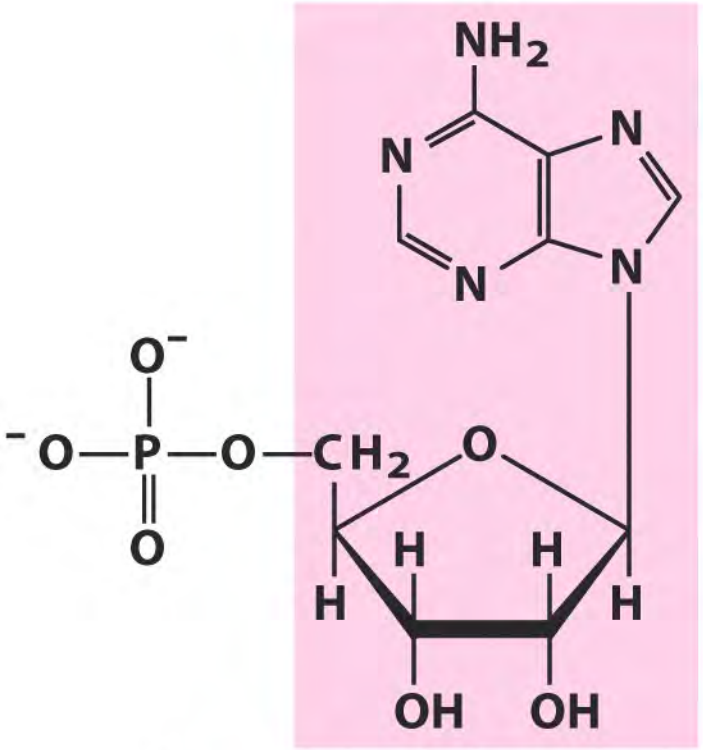


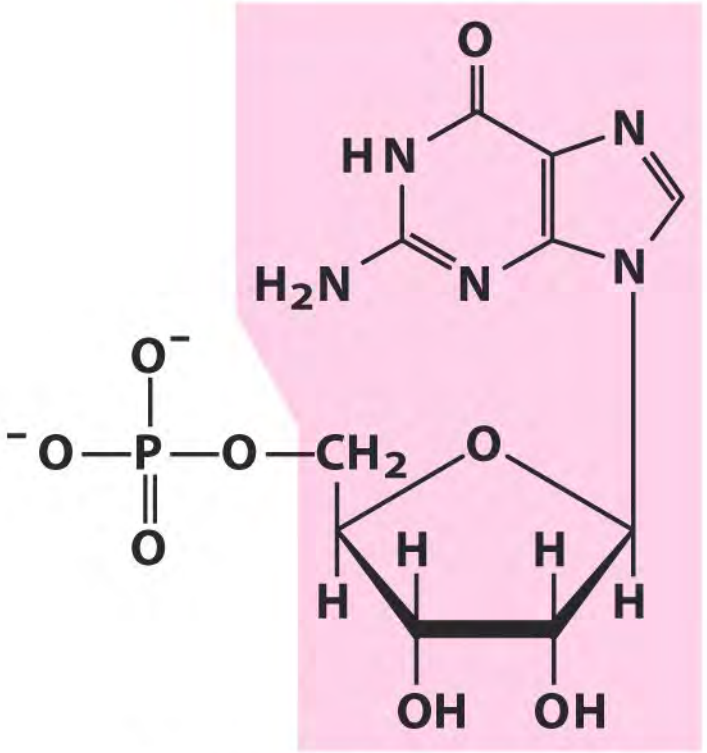
(b) Bilayer



Individual units are cylindrical (cross section of head equals that of side chain)

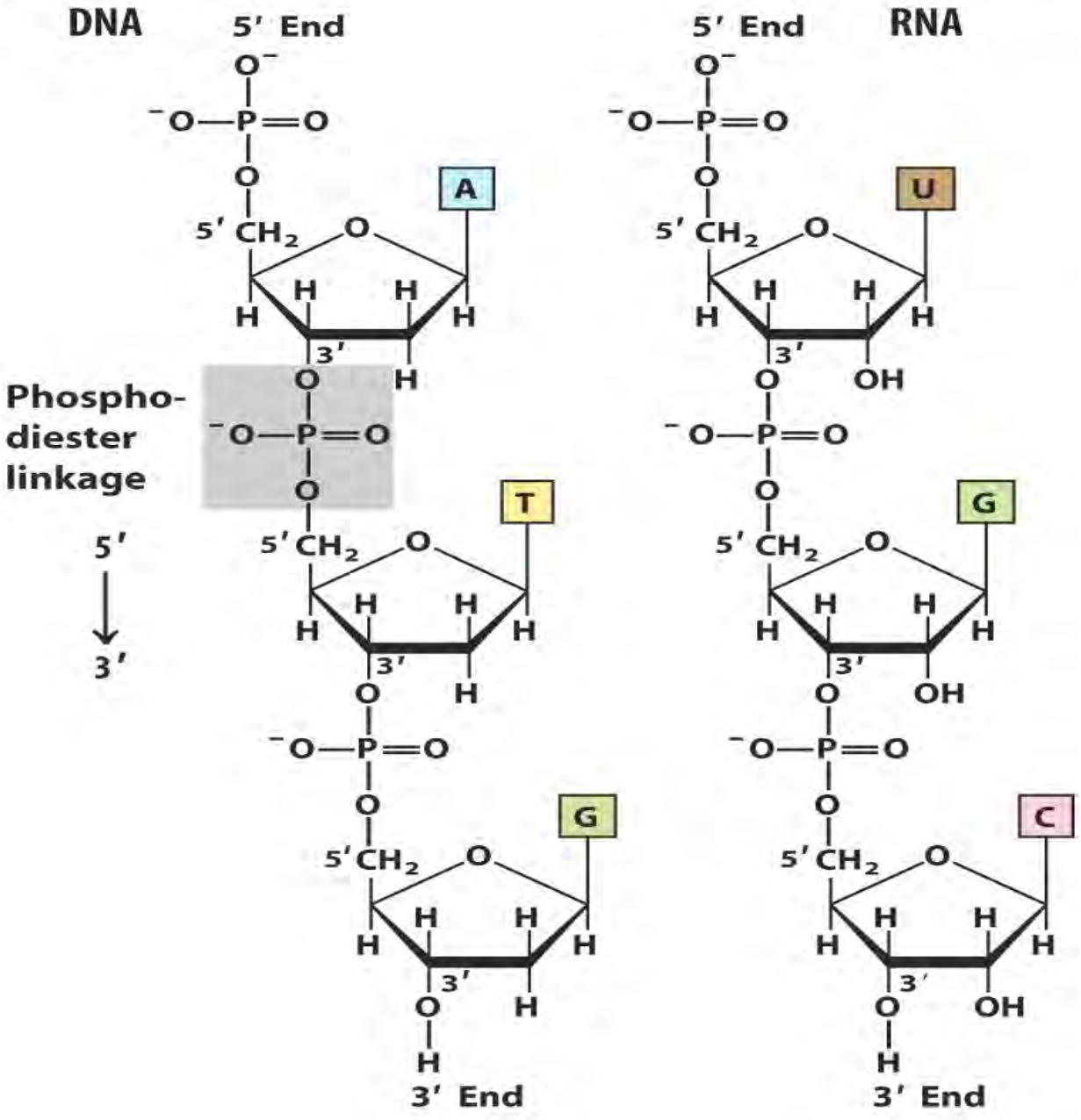






Nucleotide:	Adenylate (adenosine 5′-monophosphate)	Guanylate (guanosine 5′-monophosphate)
Symbols:	A, AMP	G, GMP
Nucleoside:	Adenosine	Guanosine

(b) Ribonucleotides


DNA
5′ End
RNA
5′ End
A
U
T
G
G
C
Phospho-
diester
linkage
5′
3′
3′ End
3′ End

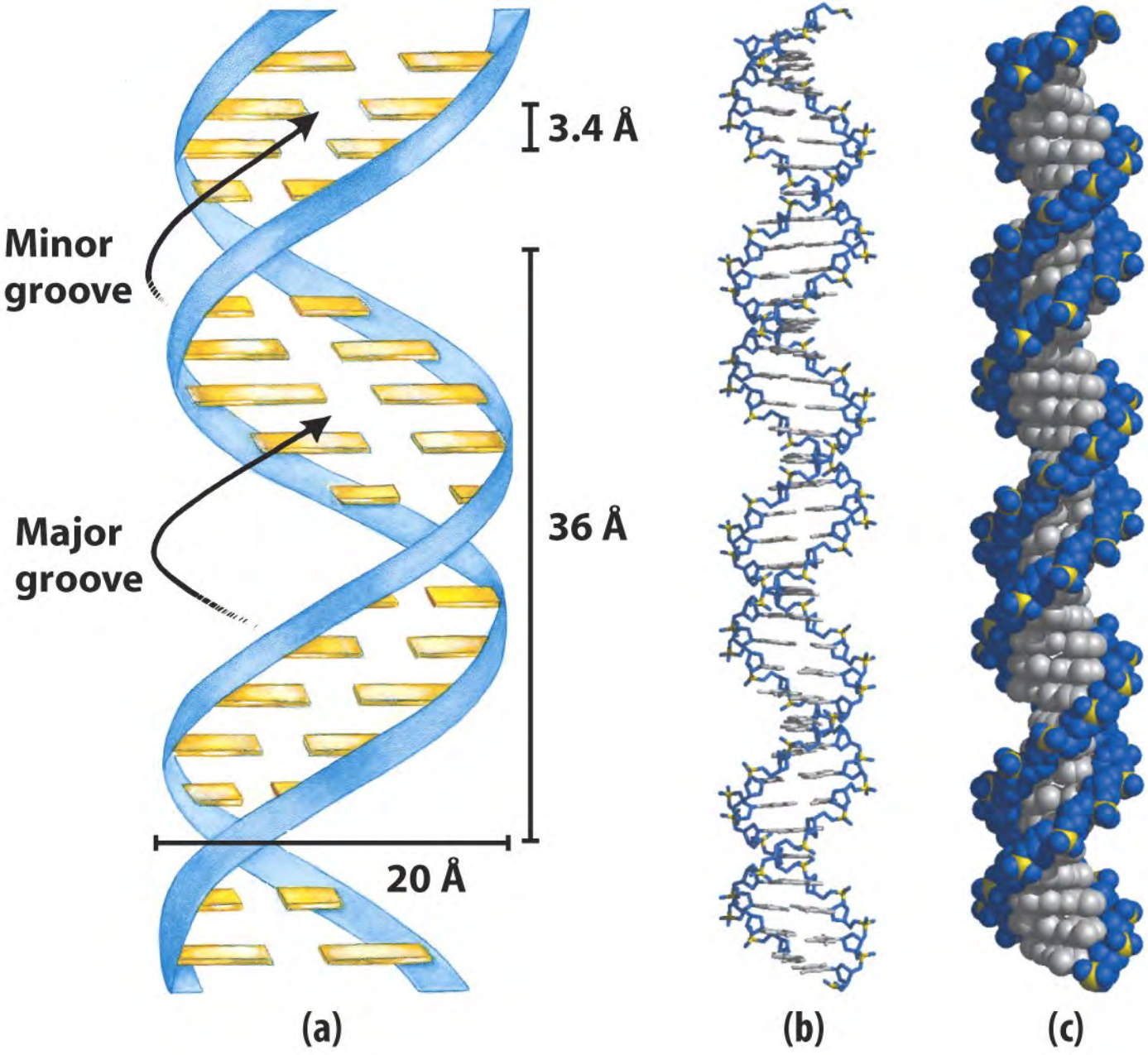

3.4 Å
Minor groove
Major groove
36 Å
20 Å
(a)
(b)
(c)

TABLE 1–2 Molecular Components of an *E. coli* Cell

	Percentage of total weight of cell	*Approximate number of different molecular species*
Water	70	1
Proteins	15	3,000
Nucleic acids		
DNA	1	1
RNA	6	>3,000
Polysaccharides	3	5
Lipids	2	20
Monomeric subunits and intermediates	2	500
Inorganic ions	1	20