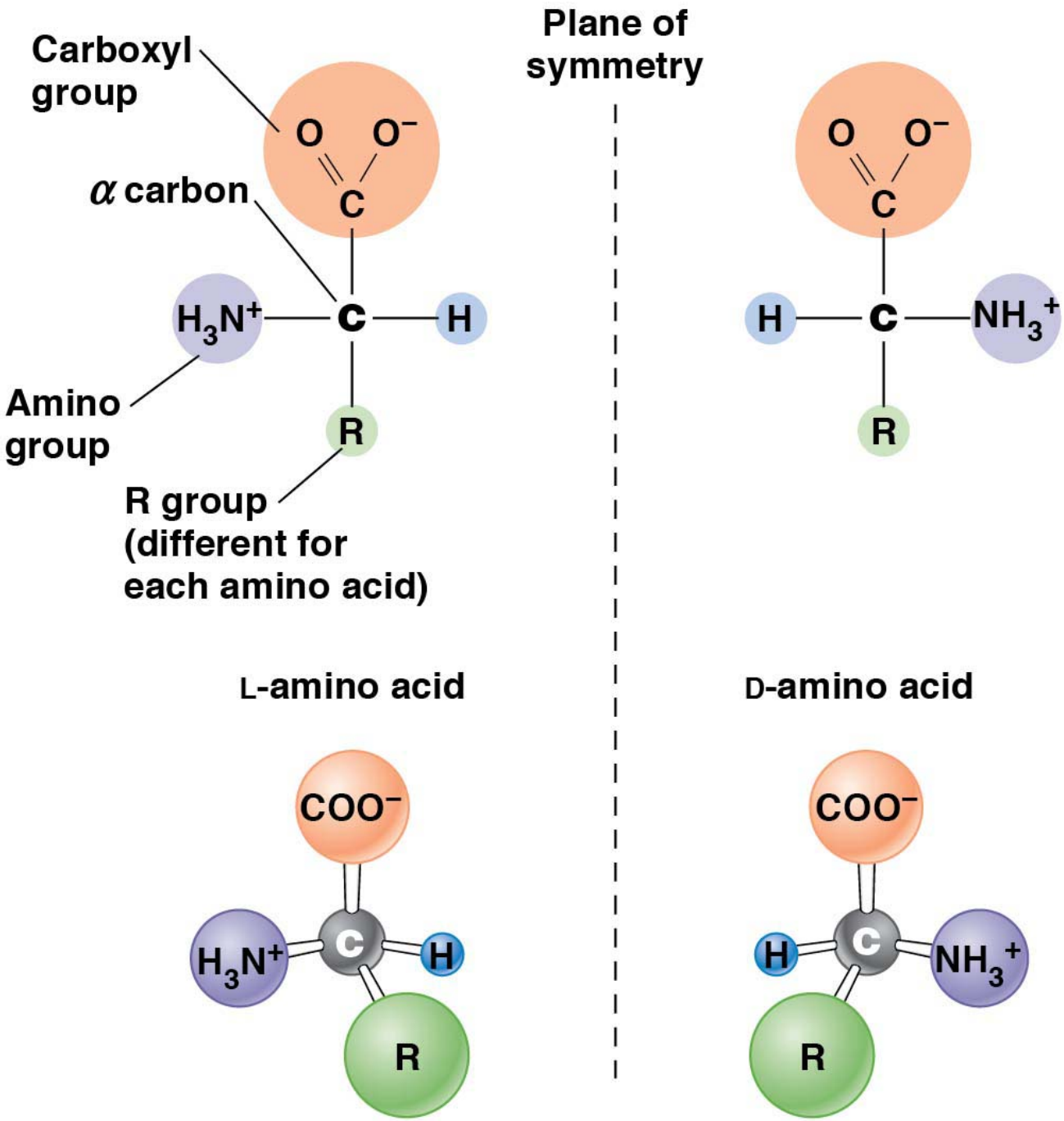
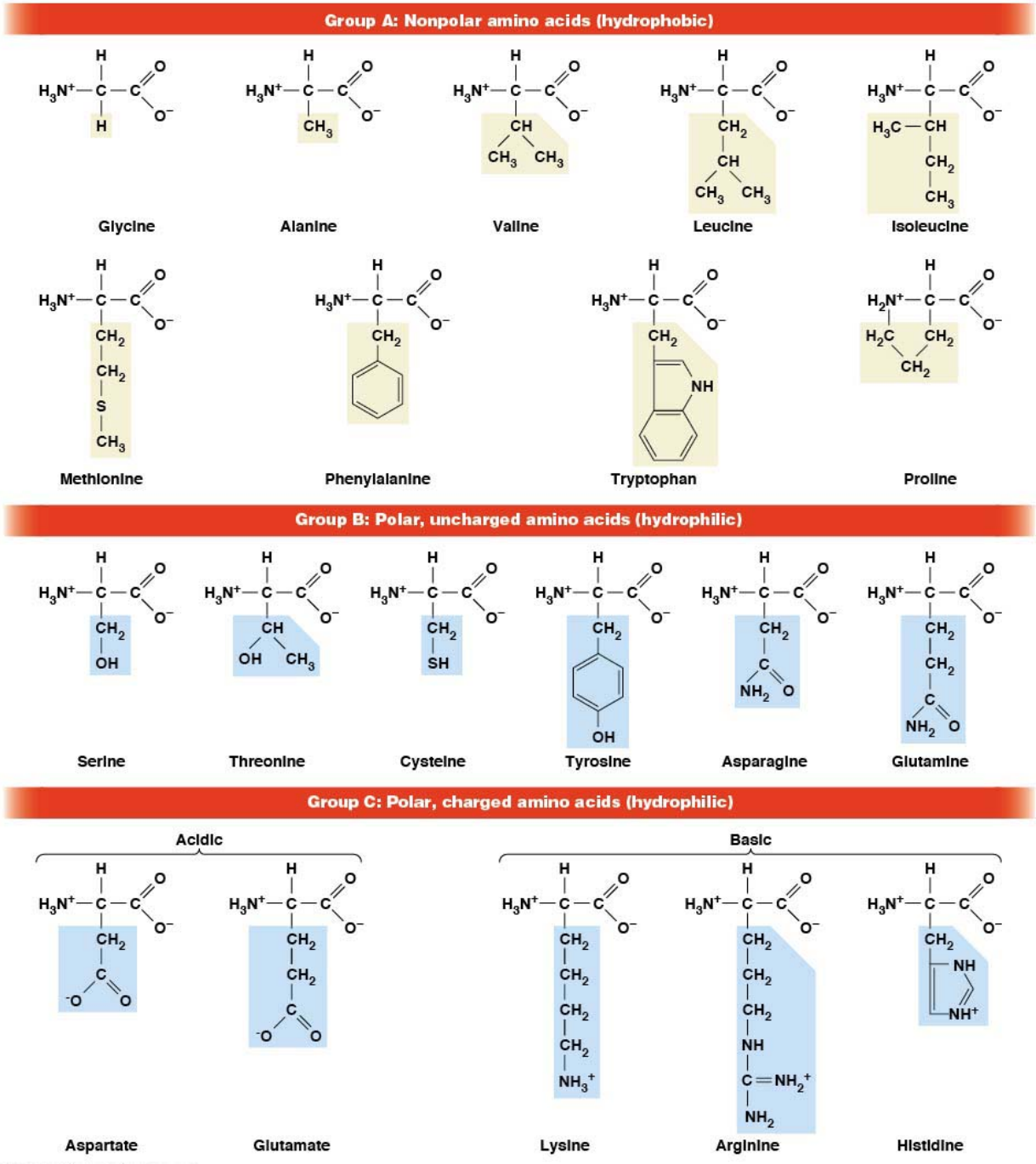
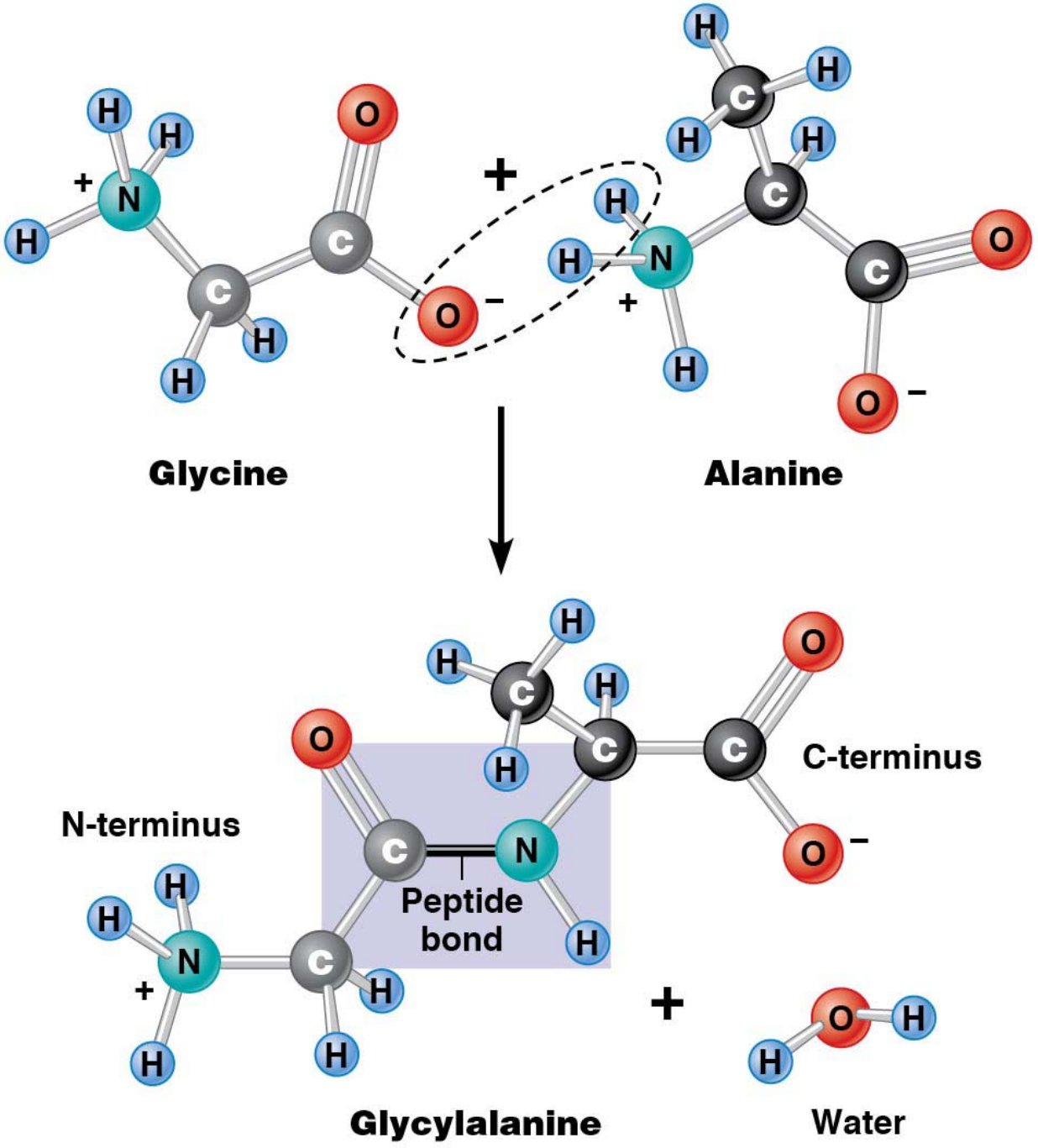
Table 3-1 Common Small Molecules in Cells

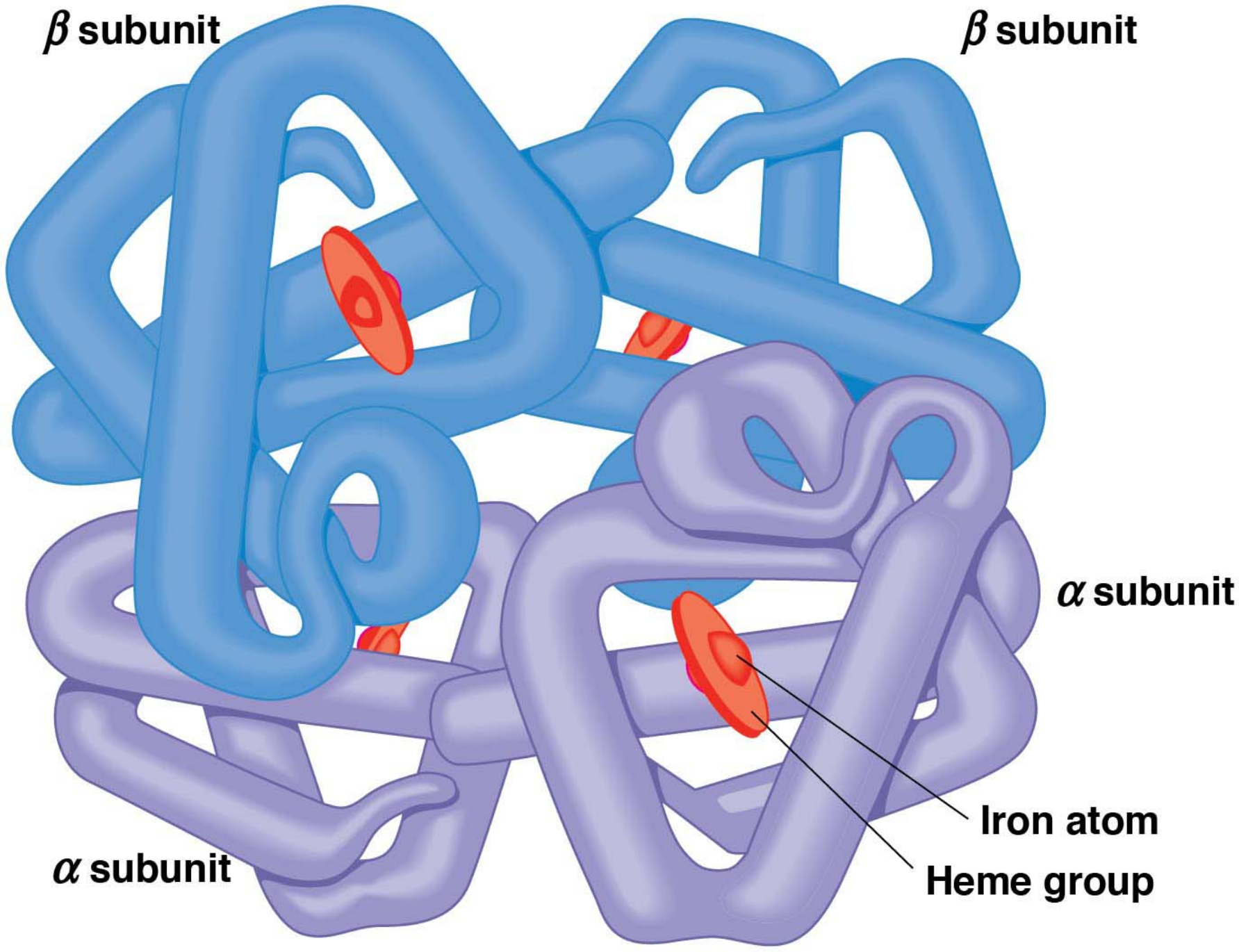
Kind of Molecules	Number Present	Names of Molecules	Role in Cell	Figure Number for Structures
Amino acids	20	See list in Table 3-2	Monomeric units of all proteins	3-2
Aromatic bases	5	Adenine	Components of nucleic acids	3-15
		Cytosine		
		Guanine		
		Thymine		
		Uracil		
Sugars	varies	Ribose	Component of RNA	3-15
		Deoxyribose	Component of DNA	
		Glucose	Energy metabolism; component of starch and glycogen	3-24
Lipids	varies	Fatty acids	Components of phospholipids and membranes	3-27a
		Cholesterol		3-27e

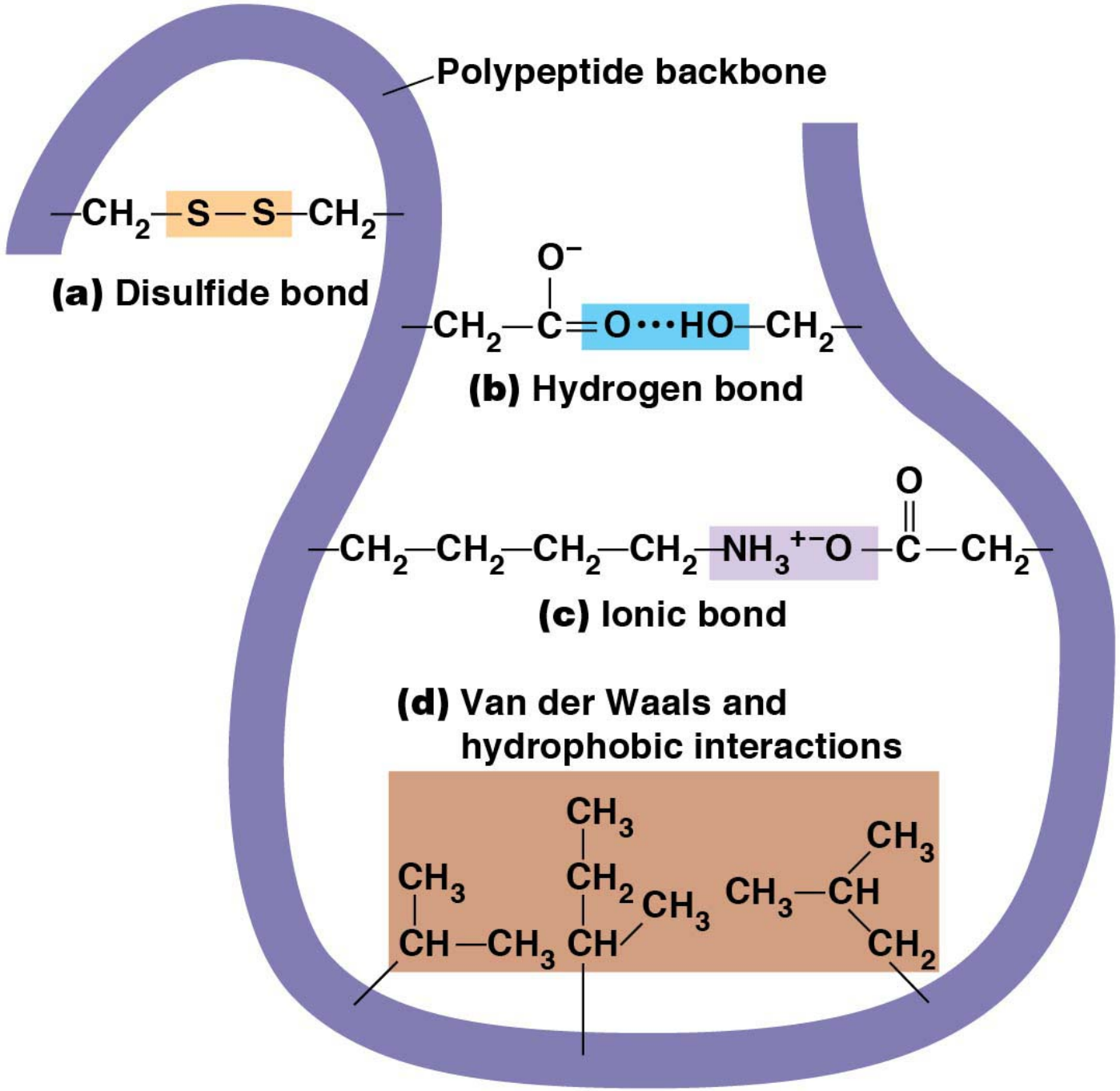
Source: Adapted from Wald, G. The origins of life. *Proc. Natl. Acad. Sci. USA* 52 (1994): 595.









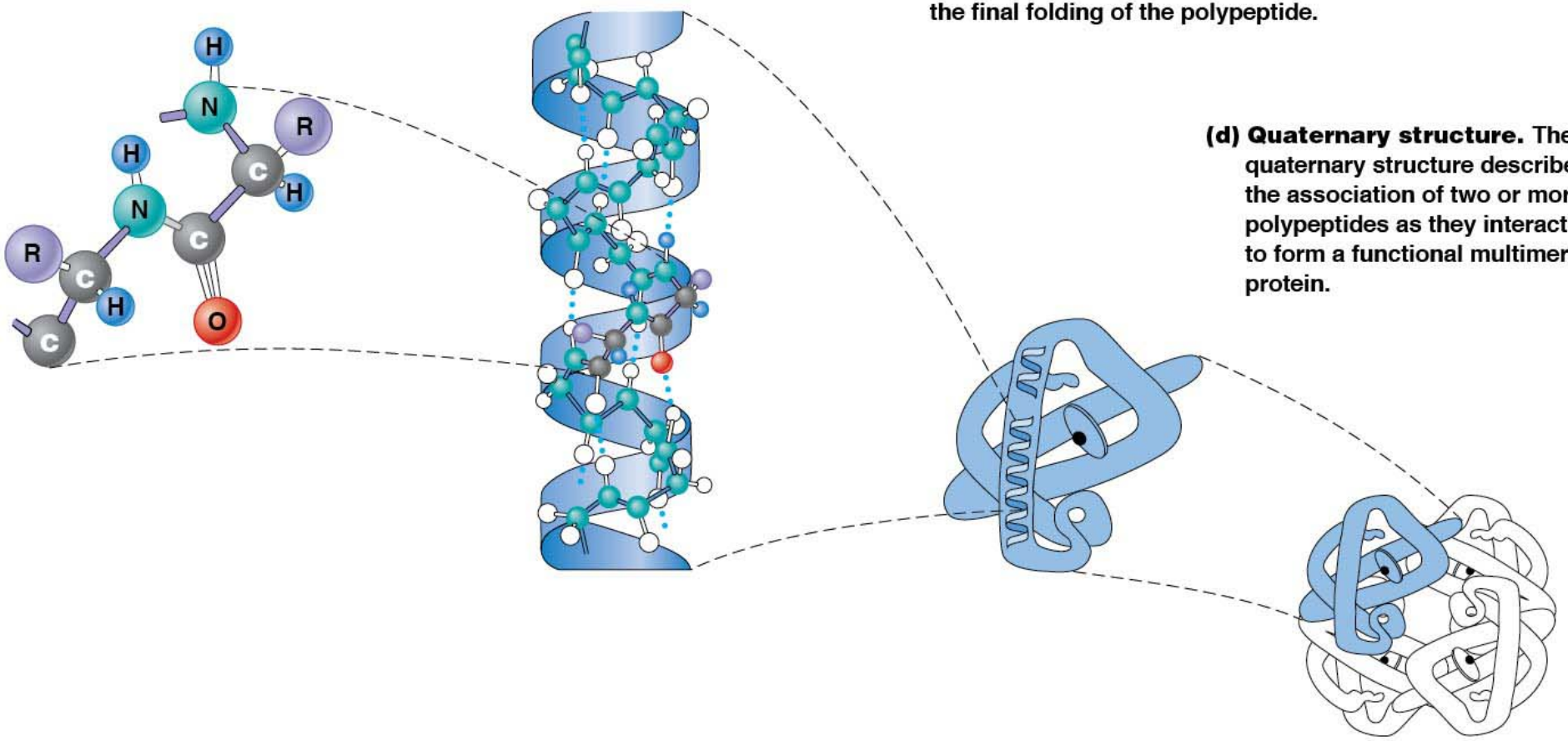


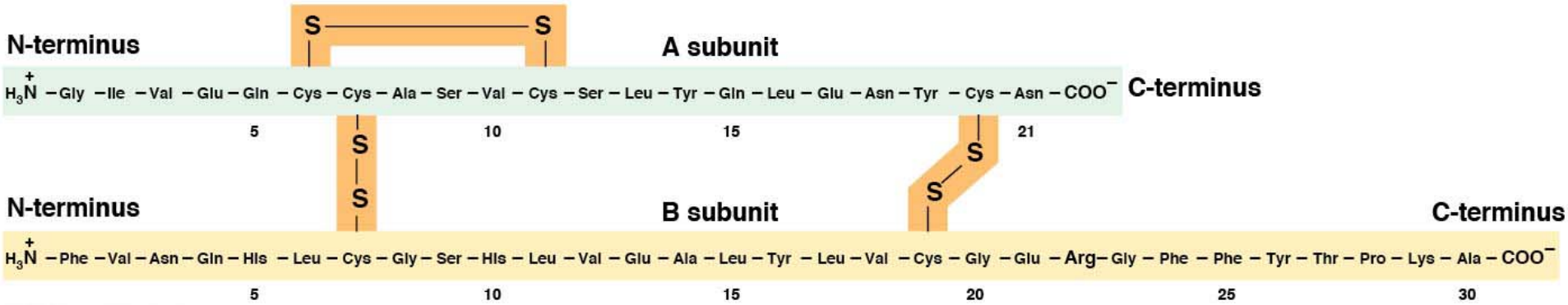
(a) Primary structure. The primary structure of a protein is a sequence of amino acids linked together by peptide bonds, forming a polypeptide.

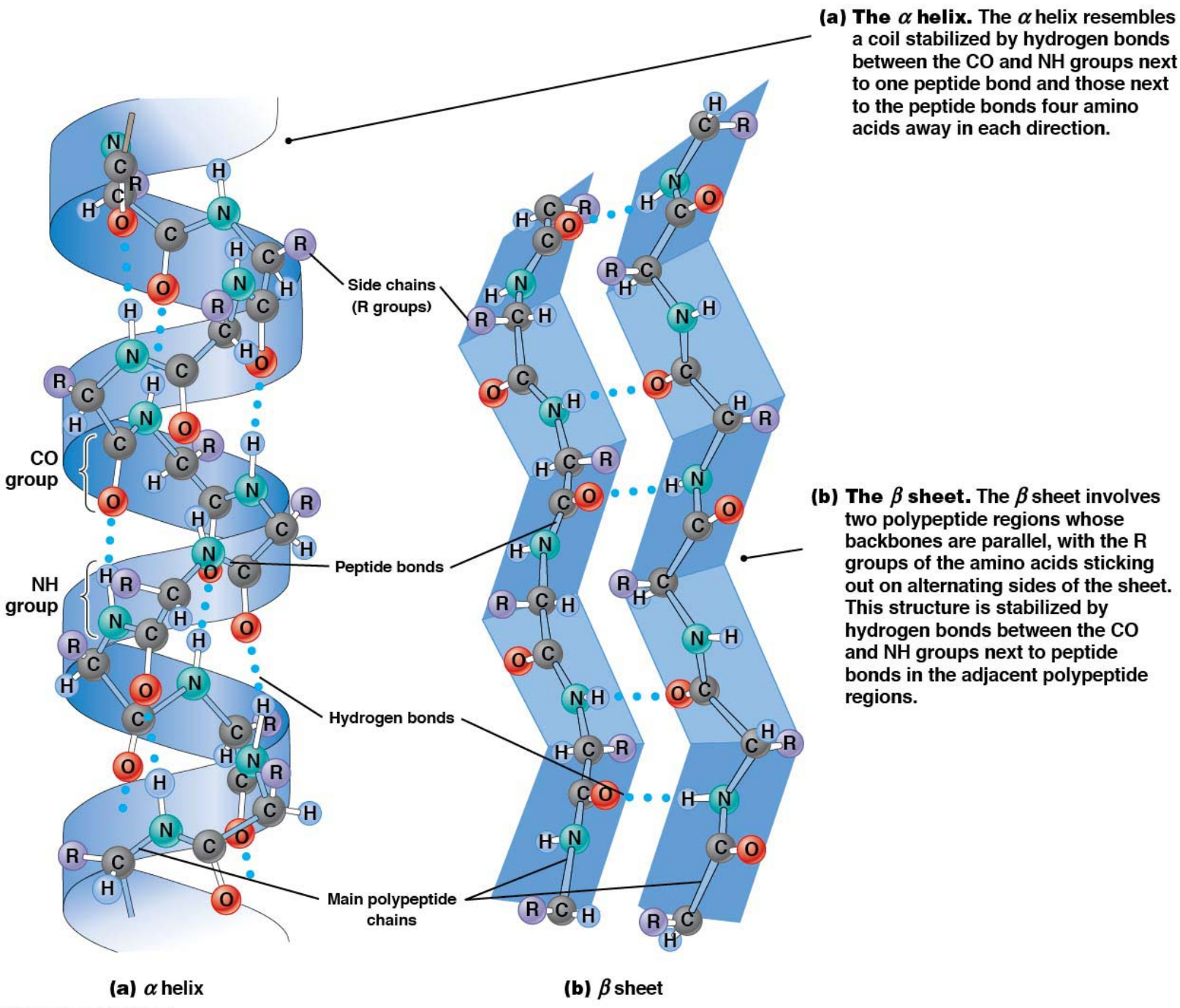
(b) Secondary structure. Local regions of the resulting polypeptide can then be coiled into an α helix, one form of secondary structure.

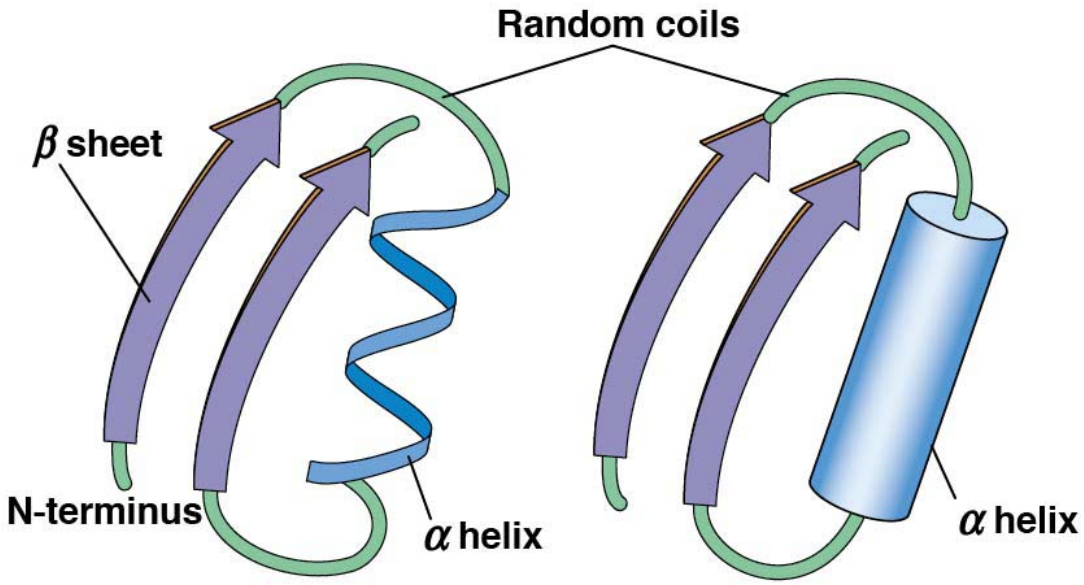
(c) Tertiary structure. Regions of secondary structure associate in a specific manner to form the tertiary structure, which describes the final folding of the polypeptide.

(d) Quaternary structure. The quaternary structure describes the association of two or more polypeptides as they interact to form a functional multimeric protein.

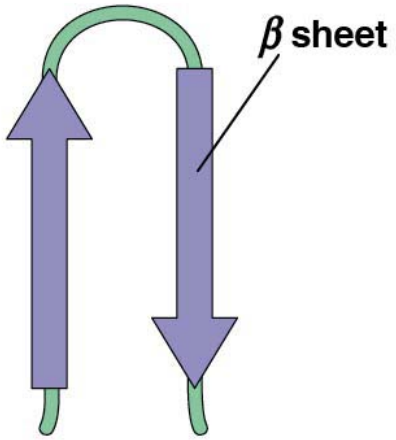




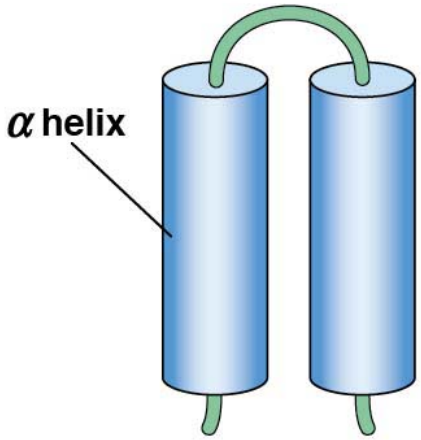




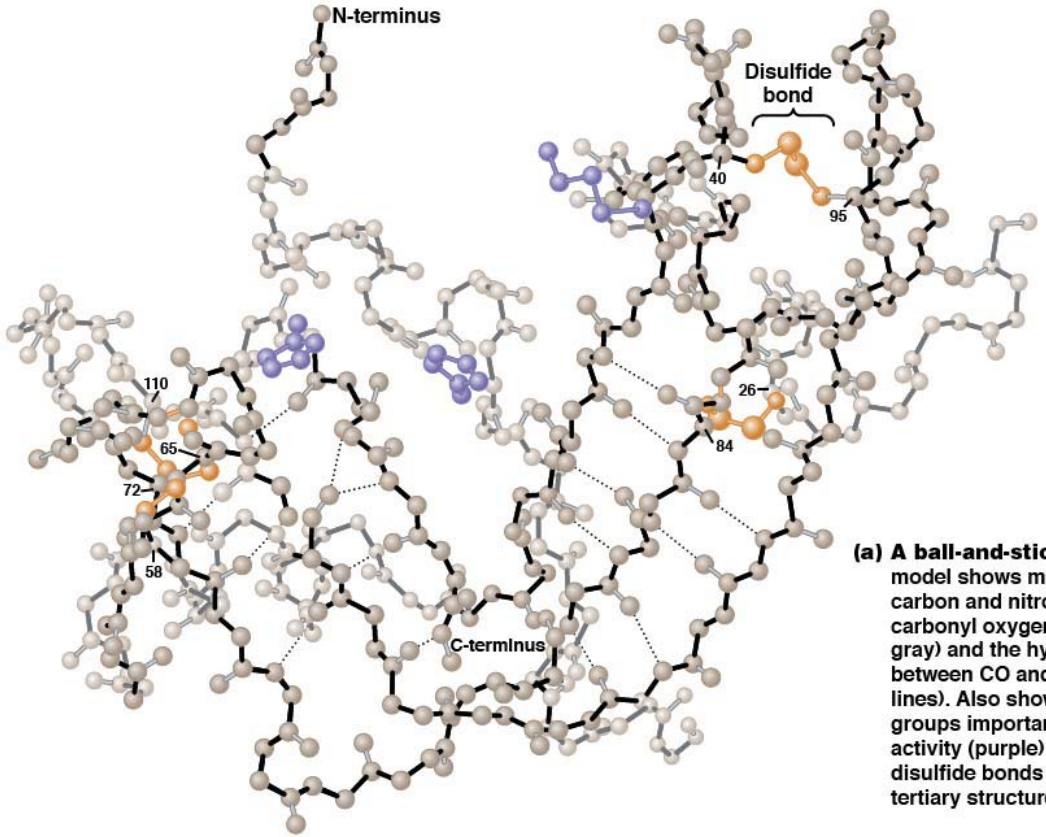
(a) β-α-β motif with α helix represented as a spiral (left) or a cylinder (right)



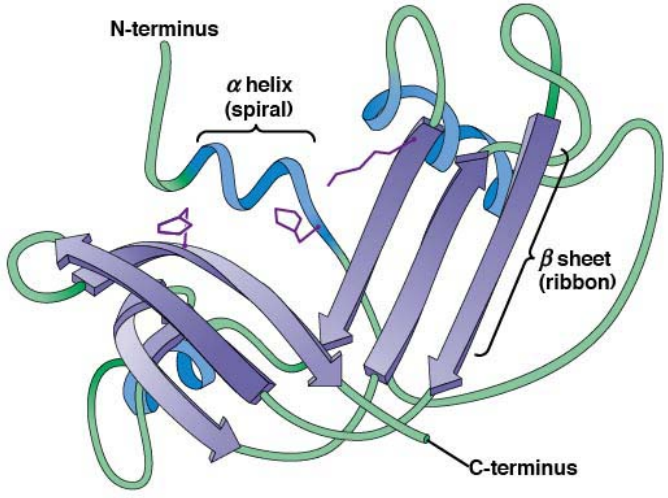
(b) Hairpin loop motif



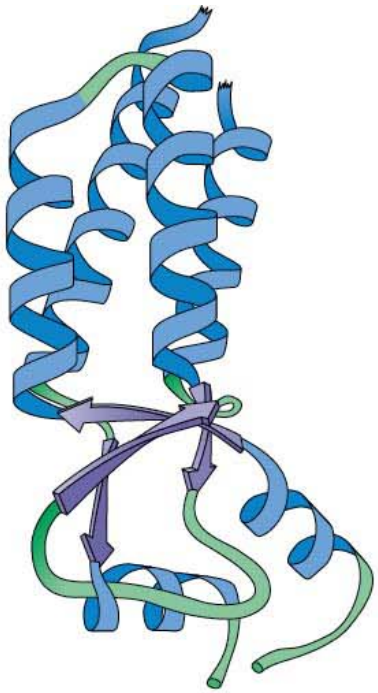
(c) Helix-turn-helix motif



(a) A ball-and-stick model. This model shows mainly the backbone carbon and nitrogen atoms plus the carbonyl oxygen atoms (all in light gray) and the hydrogen bonds between CO and NH groups (dotted lines). Also shown are three R groups important for catalytic activity (purple) and several disulfide bonds important for tertiary structure (gold).

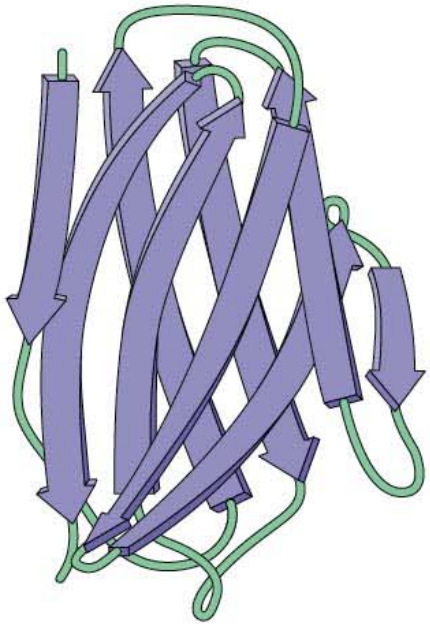


(b) A spiral-and-ribbon model. In this model, α-helical regions are shown as blue spirals and β-sheet regions are shown as purple ribbons with arrows pointing in the direction of the C-terminus. Amino acid R groups and disulfide bonds have been omitted for clarity. Notice that the β-sheet structure is antiparallel and highly twisted and occurs in two distinct sections.



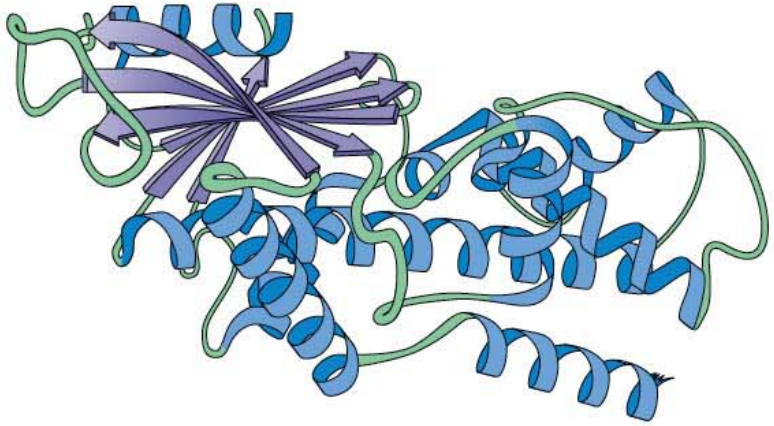
Tobacco mosaic virus coat protein

(a) Predominantly α helix



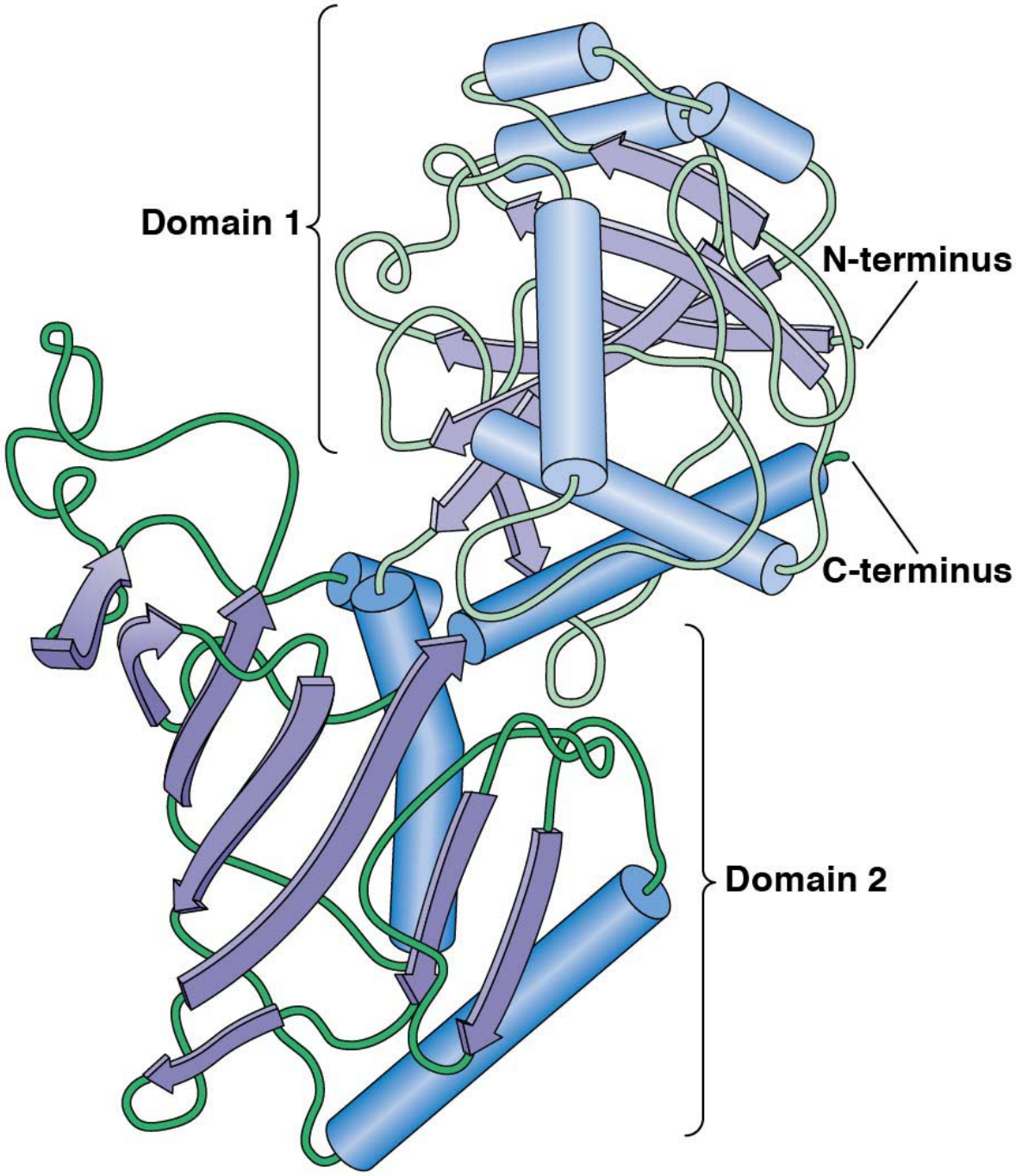
Immunoglobulin, V_2 domain

(b) Predominantly β sheet



Hexokinase, domain 2

(c) Mixed α helix and β sheet



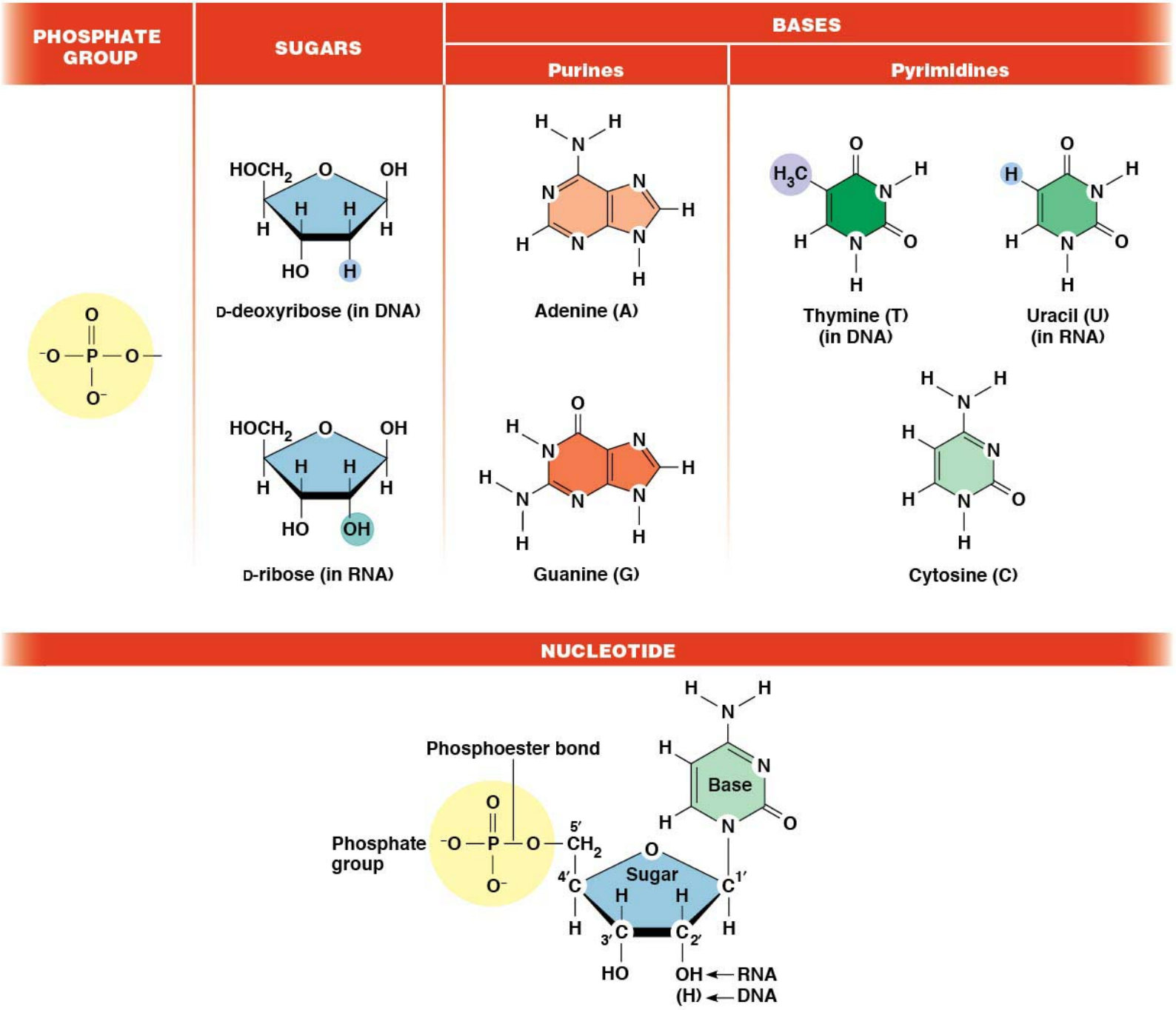
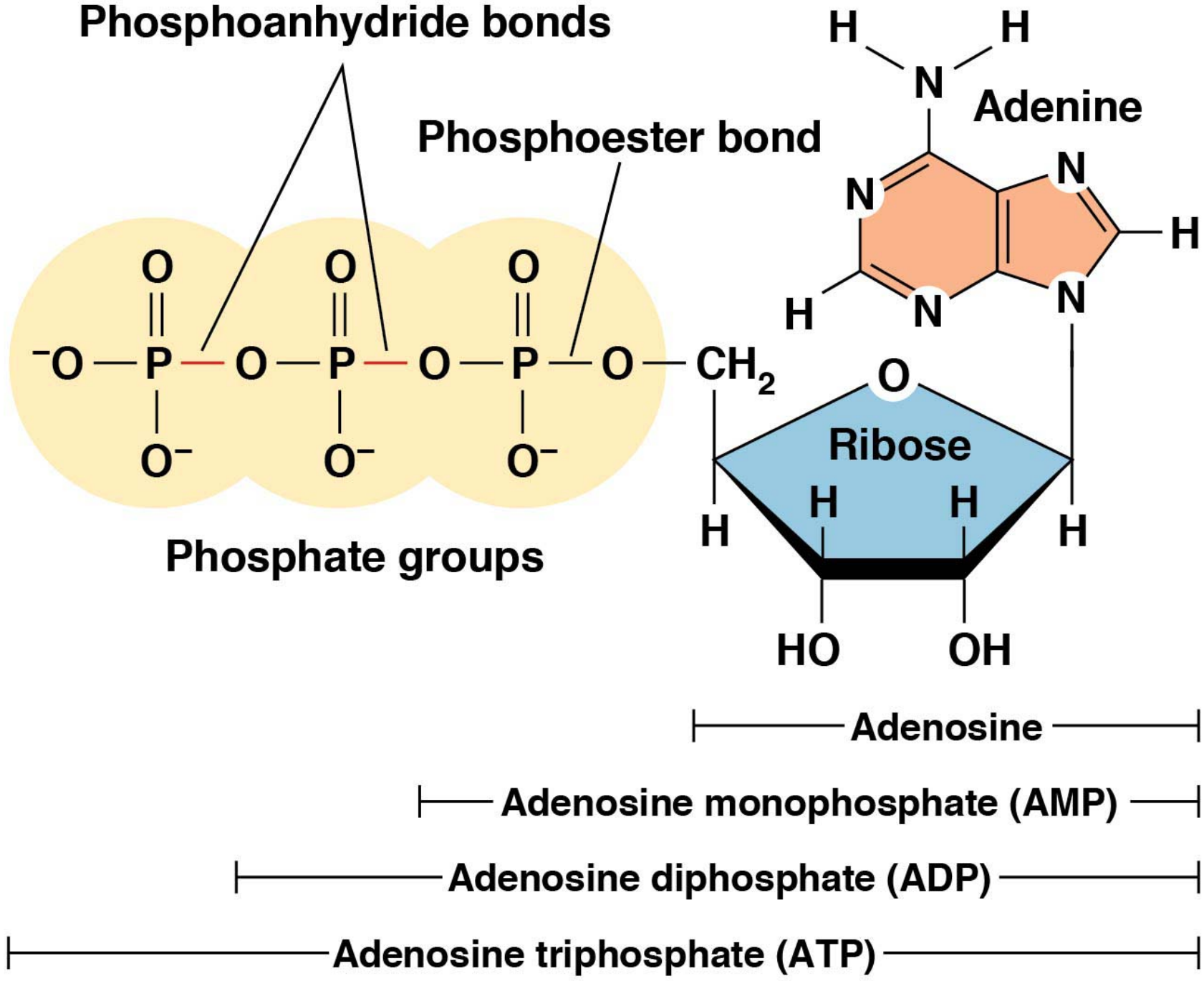
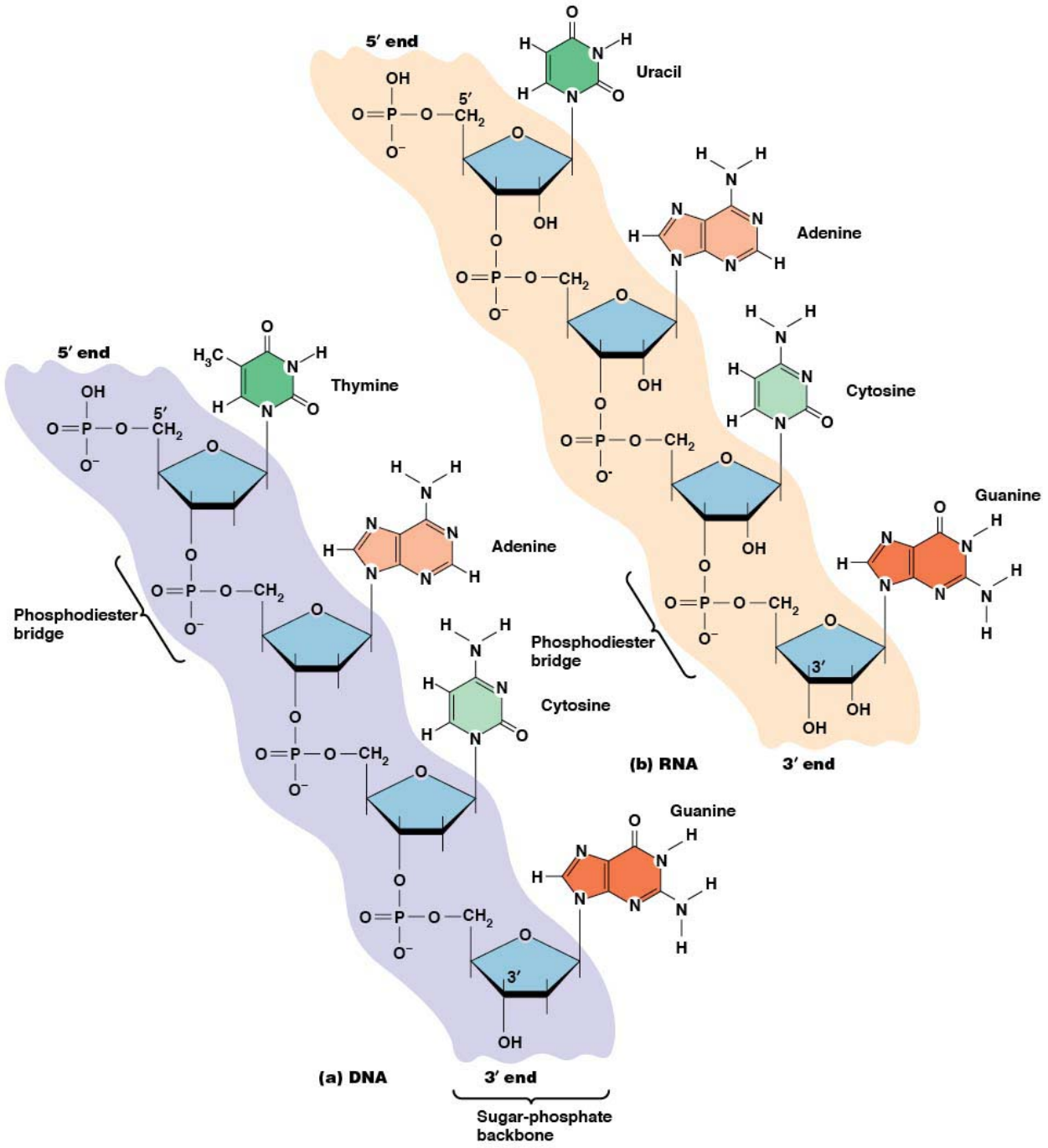
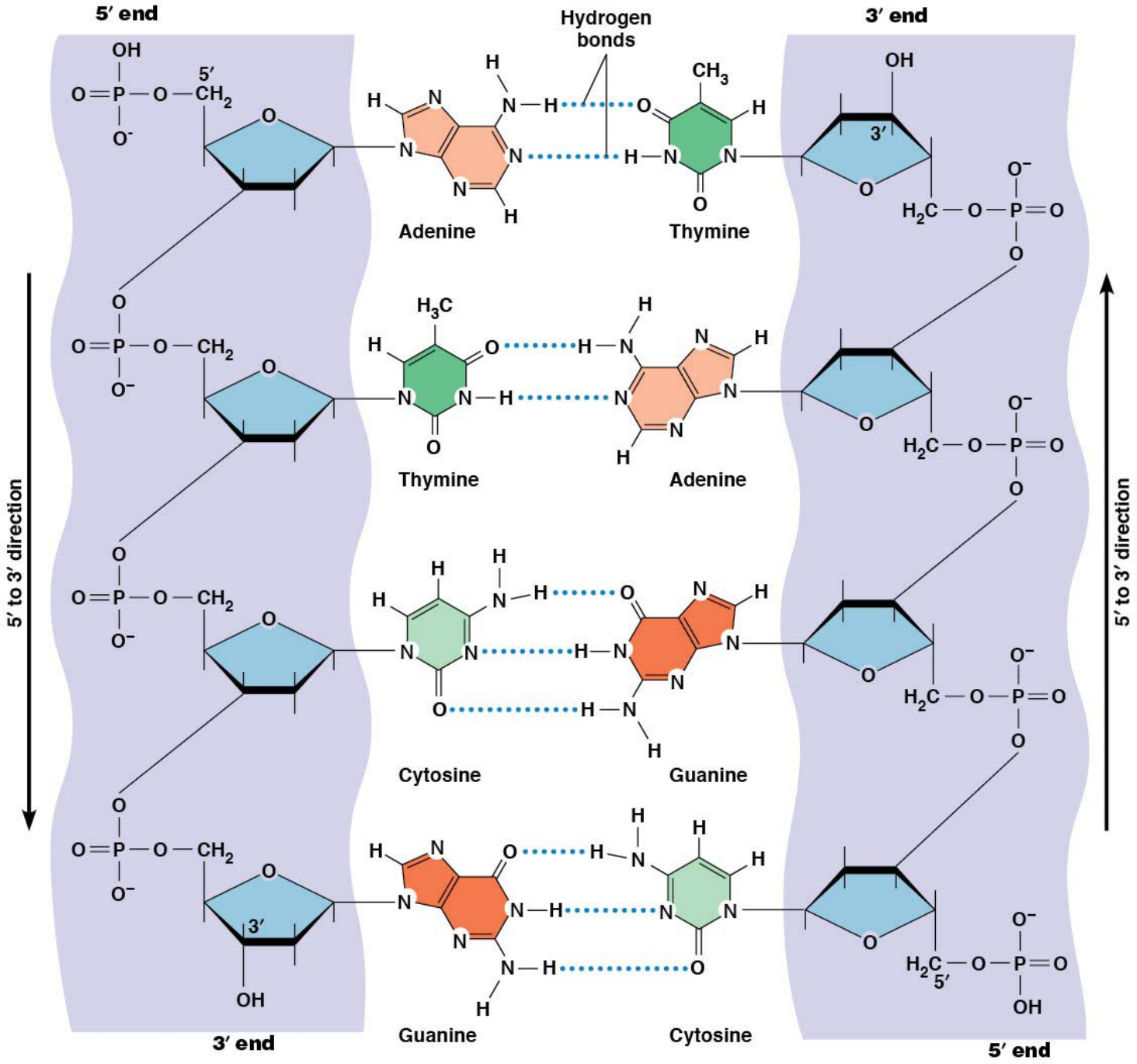


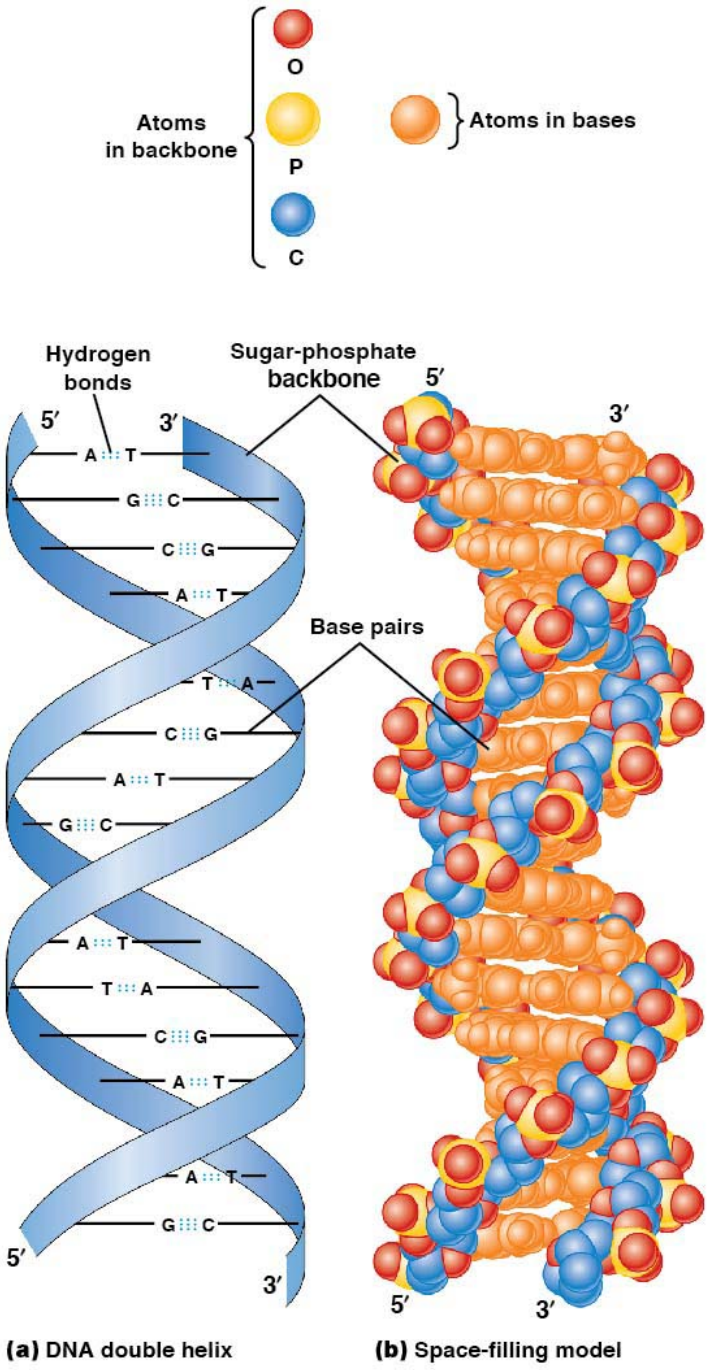
Table 3-4 The Bases, Nucleosides, and Nucleotides of RNA and DNA

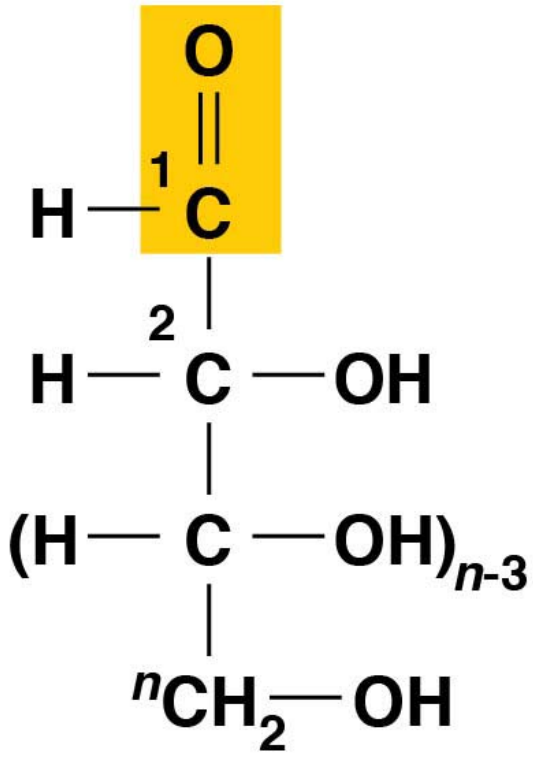
	RNA		DNA	
Bases	**Nucleoside**	**Nucleotide**	**Deoxynucleoside**	**Deoxynucleotide**
Purines				
Adenine (A)	Adenosine	Adenosine monophosphate (AMP)	Deoxyadenosine	Deoxyadenosine monophosphate (dAMP)
Guanine (G)	Guanosine	Guanosine monophosphate (GMP)	Deoxyguanosine	Deoxyguanosine monophosphate (dGMP)
Pyrimidines				
Cytosine (C)	Cytidine	Cytidine monophosphate (CMP)	Deoxycytidine	Deoxycytidine monophosphate (dCMP)
Uracil (U)	Uridine	Uridine monophosphate (UMP)	—	—
Thymine (T)	—	—	Deoxythymidine	Deoxythymidine monophosphate (dTMP)



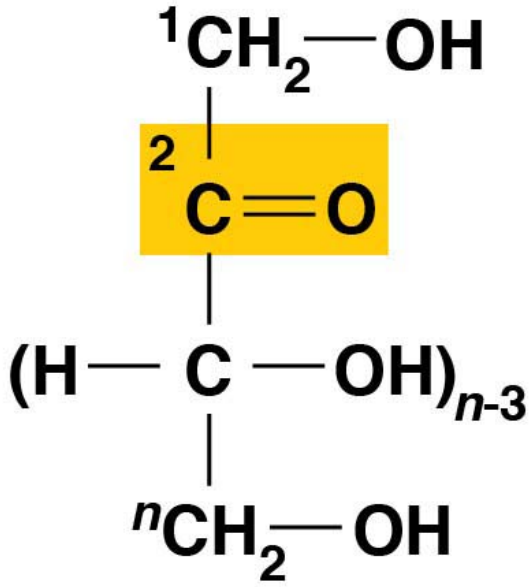




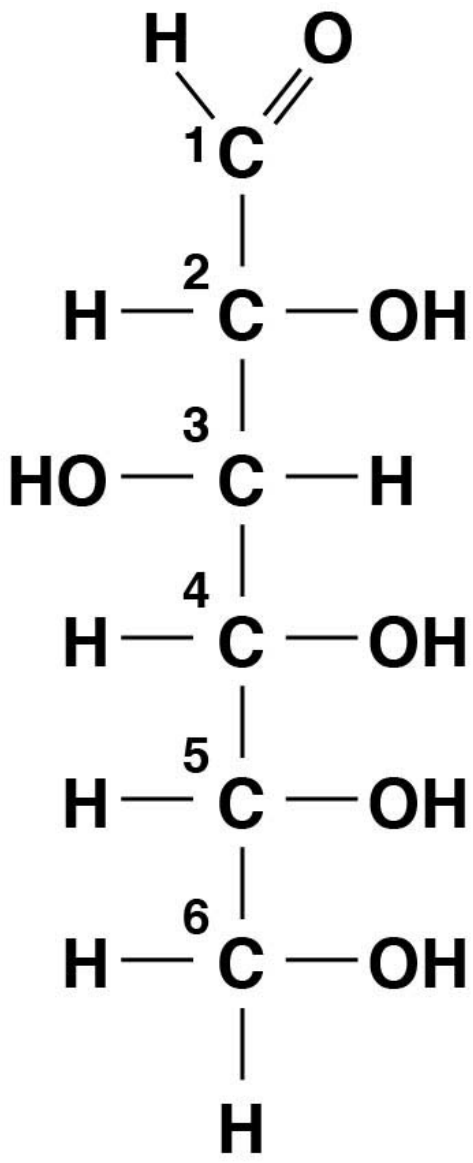




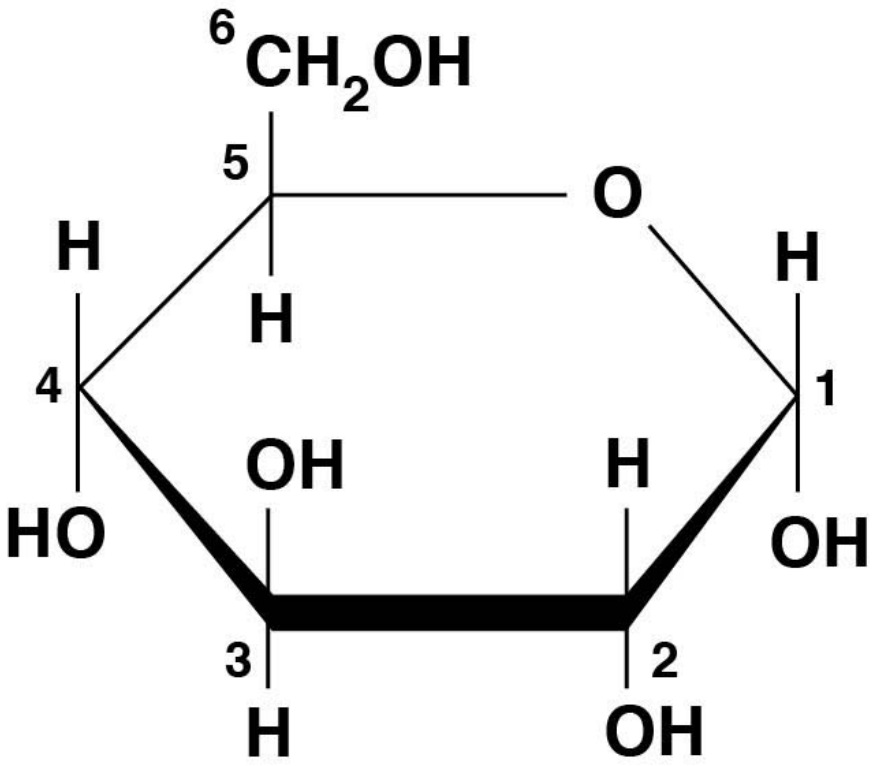
(a) Aldosugar



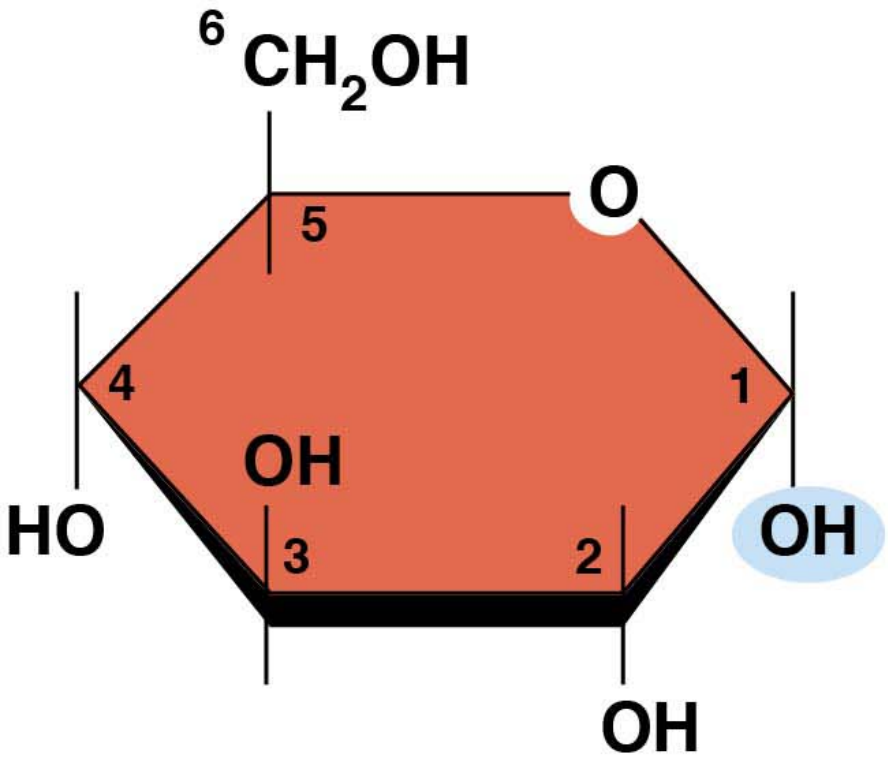
(b) Ketosugar



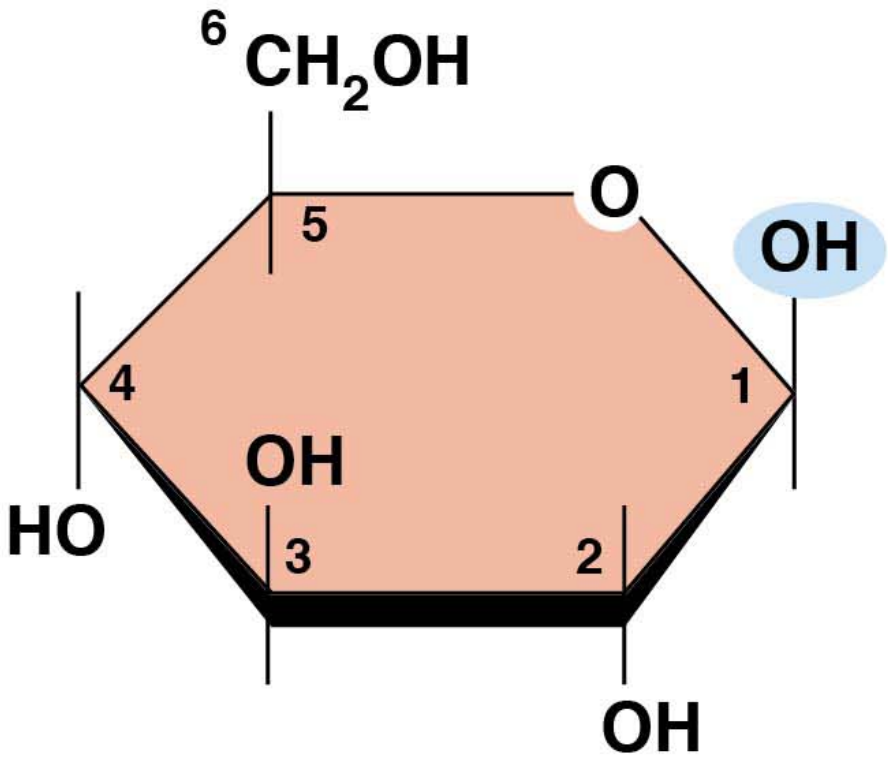
(a) Fischer projection



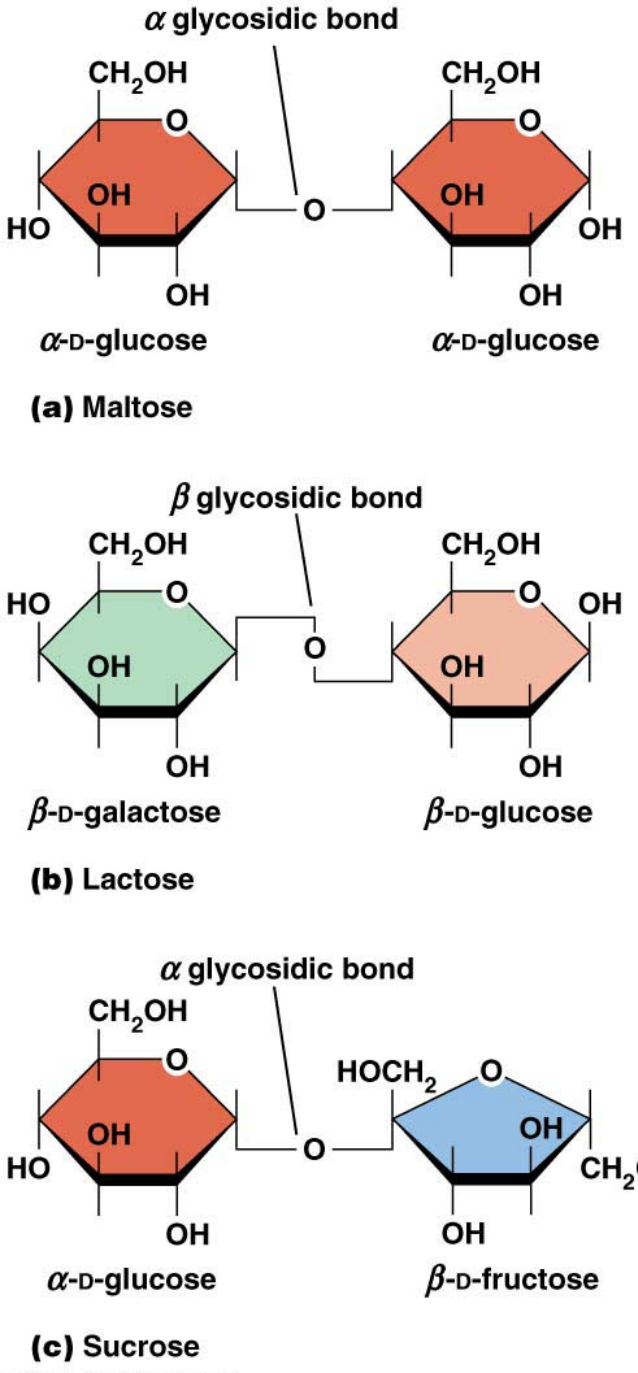
(b) Haworth projection

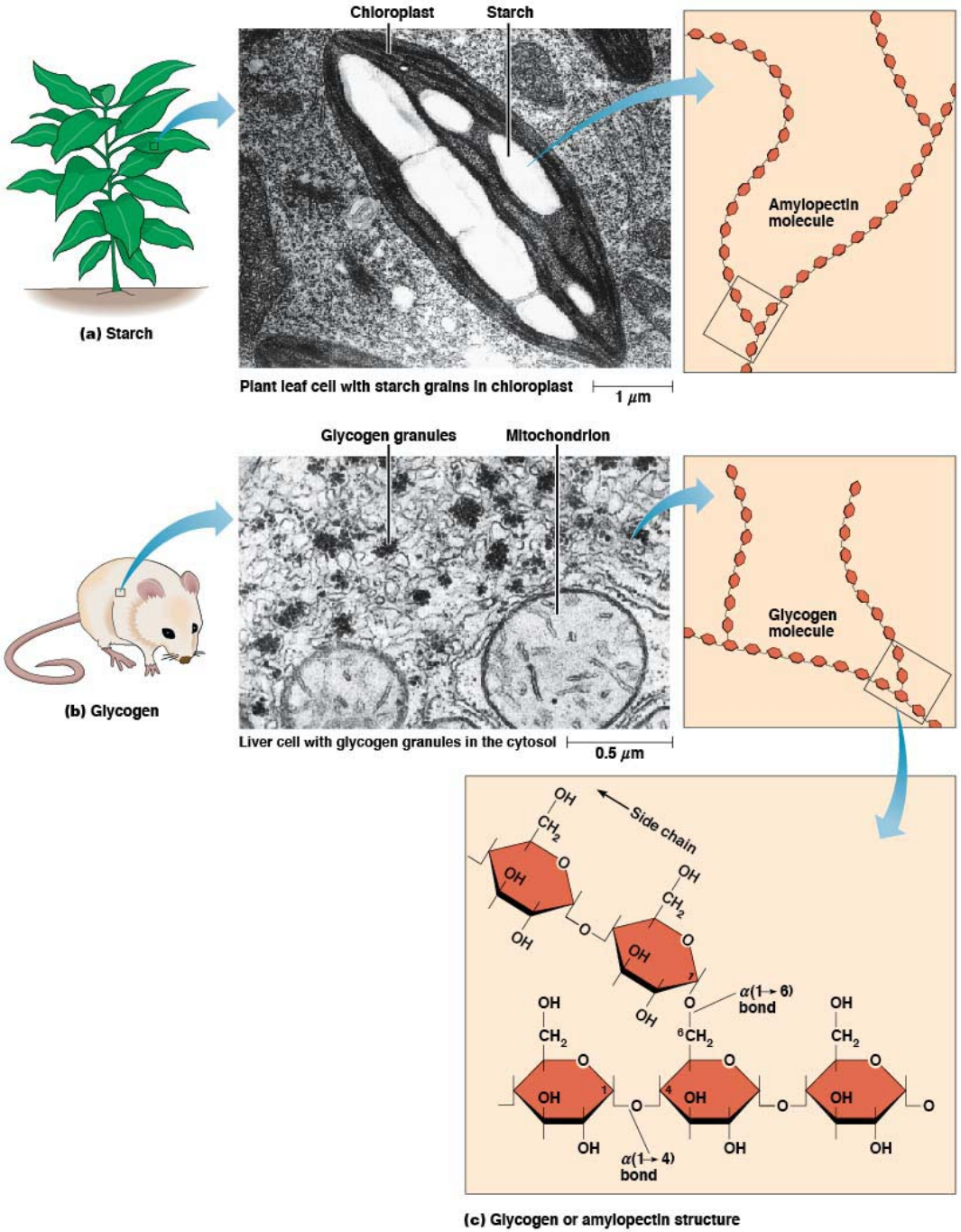


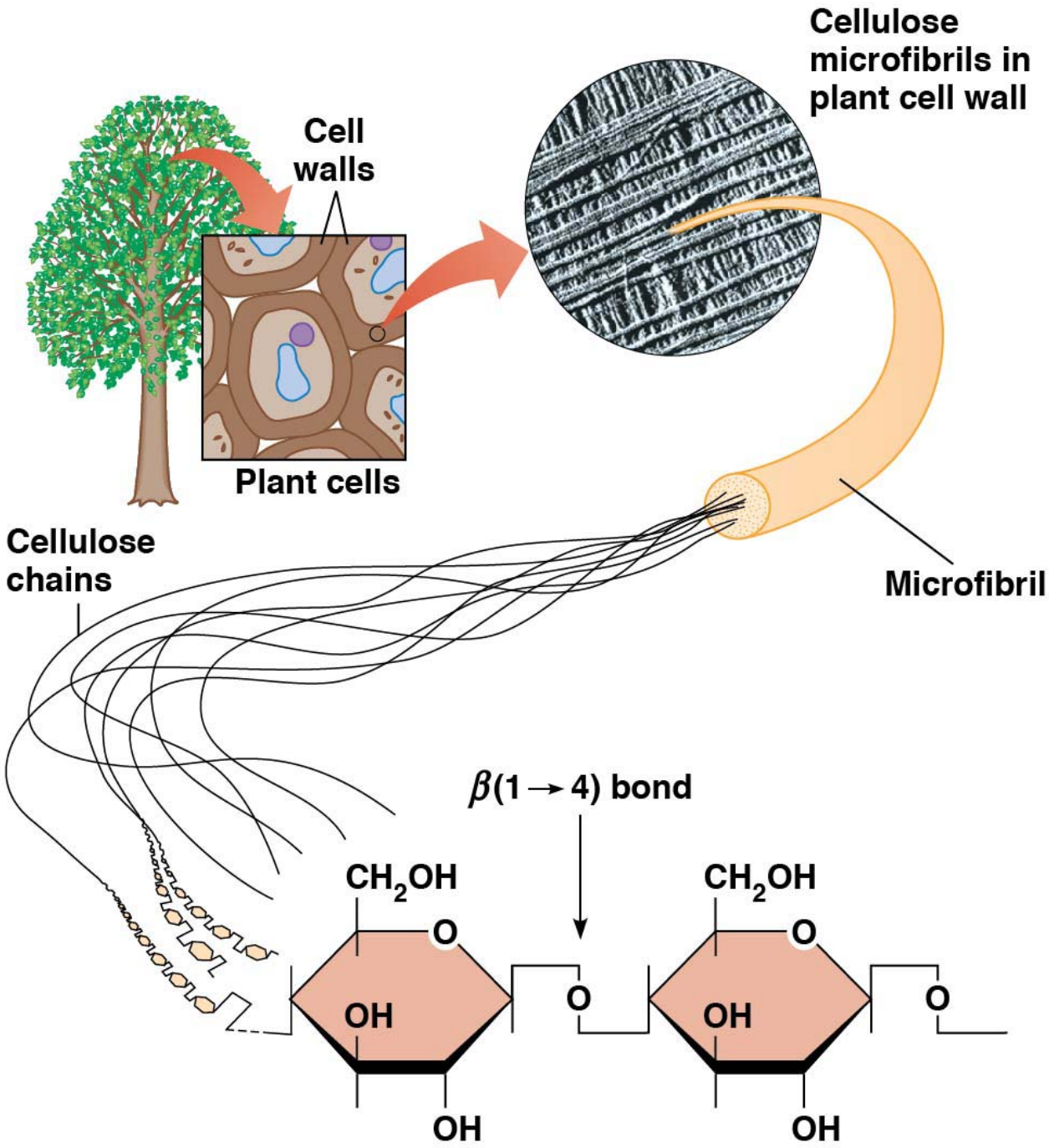
α-D-glucose, the repeating unit of starch and glycogen

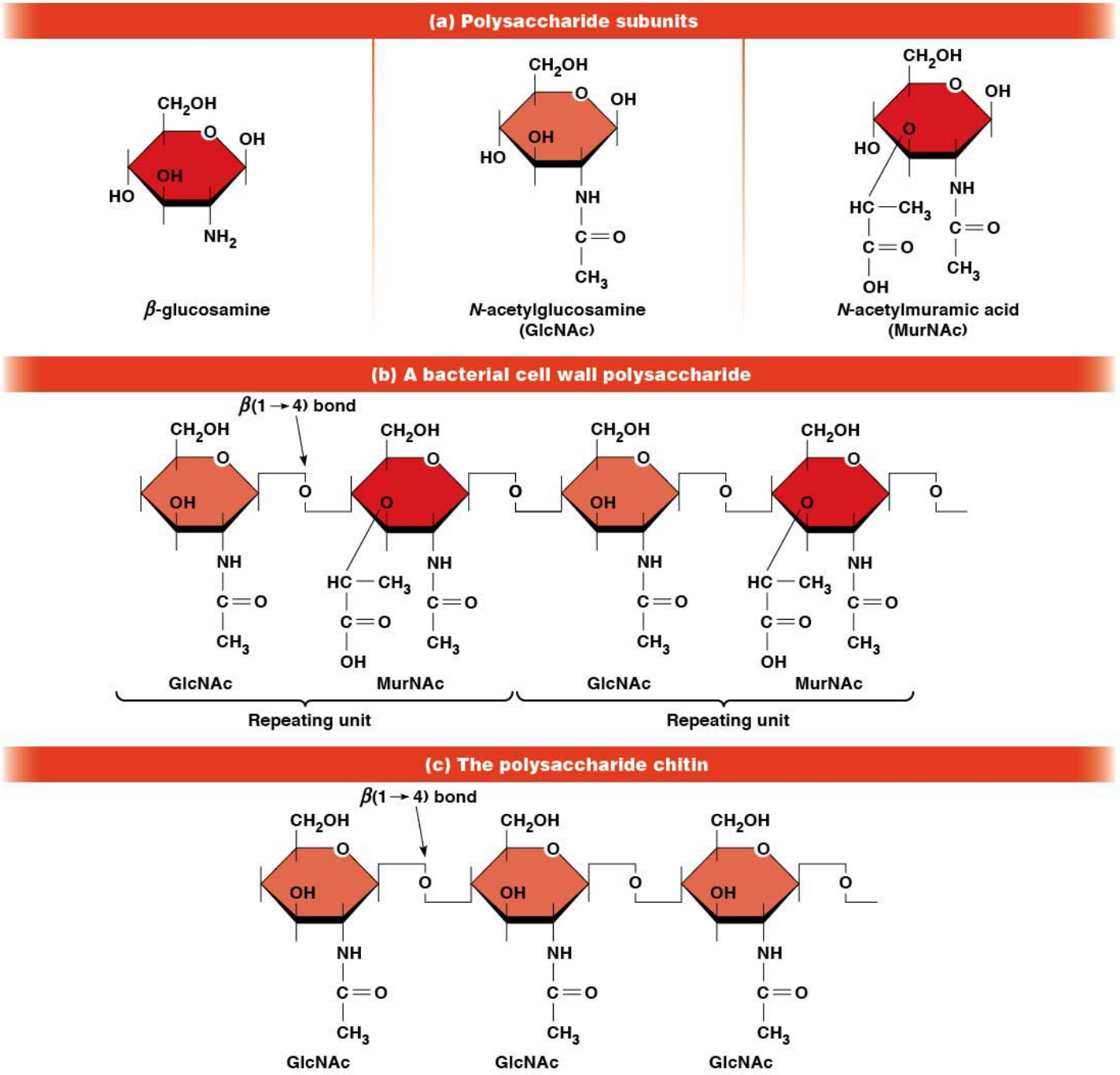


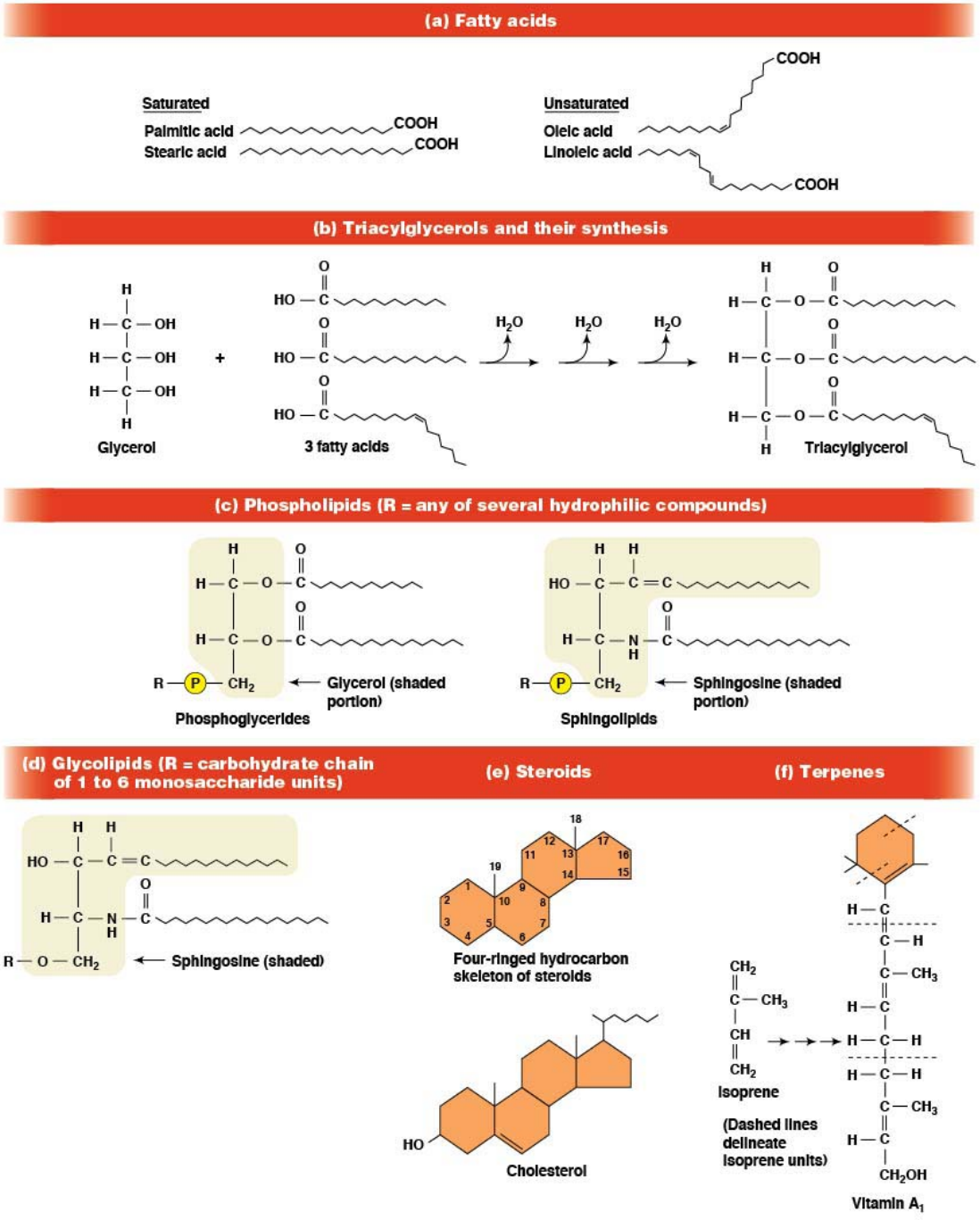
β-D-glucose, the repeating unit of cellulose

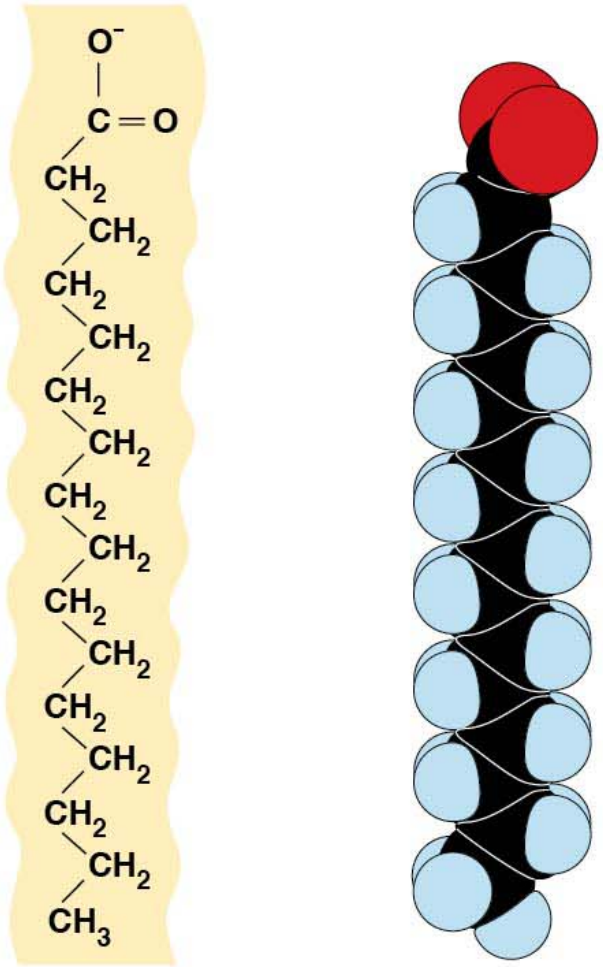




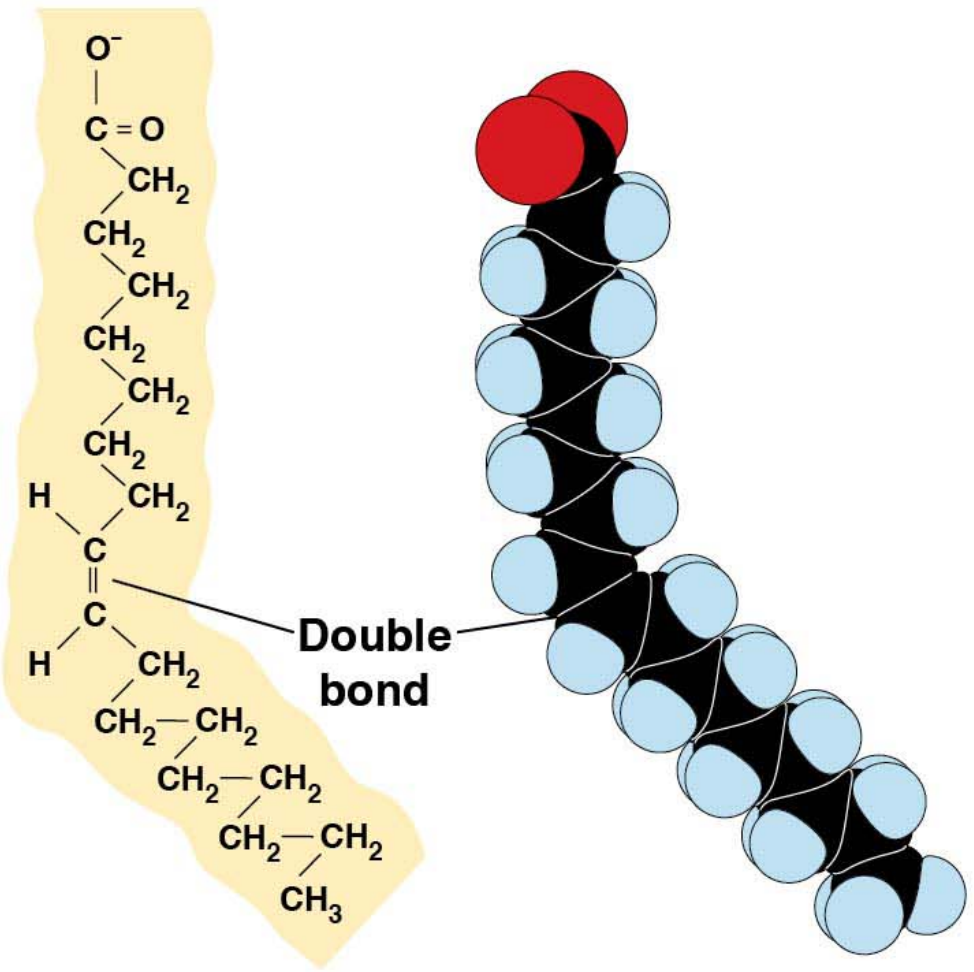




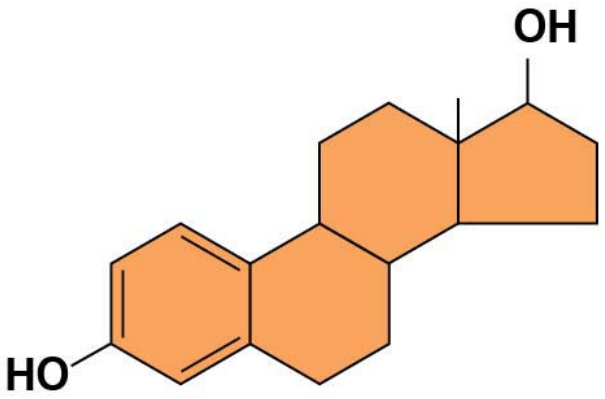




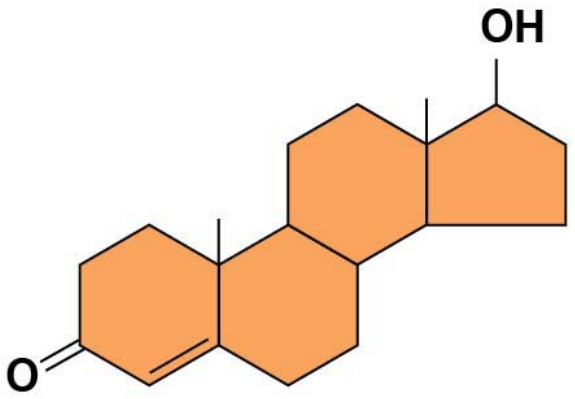
(a) Palmitate (saturated)



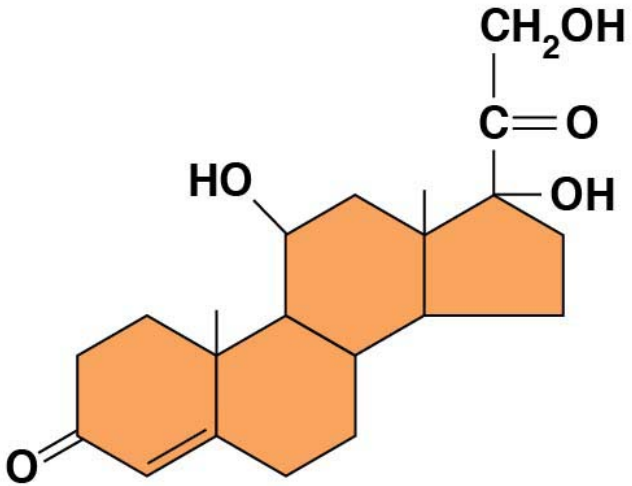
(b) Oleate (unsaturated)



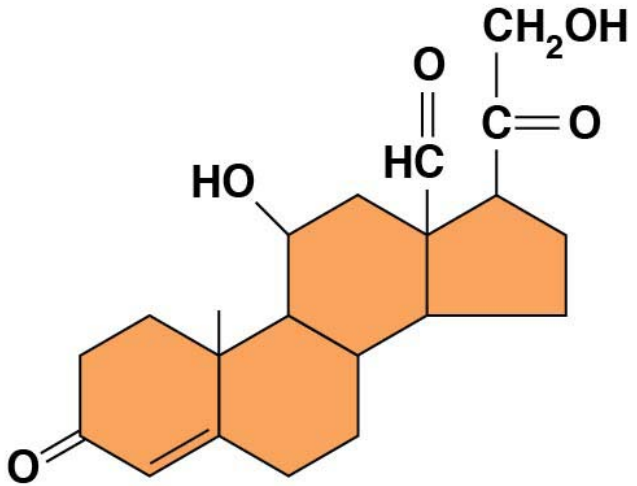
(a) Estradiol
(an estrogen)



(b) Testosterone
(an androgen)



(c) Cortisol
(a glucocorticoid)



(d) Aldosterone
(a mineralocorticoid)