

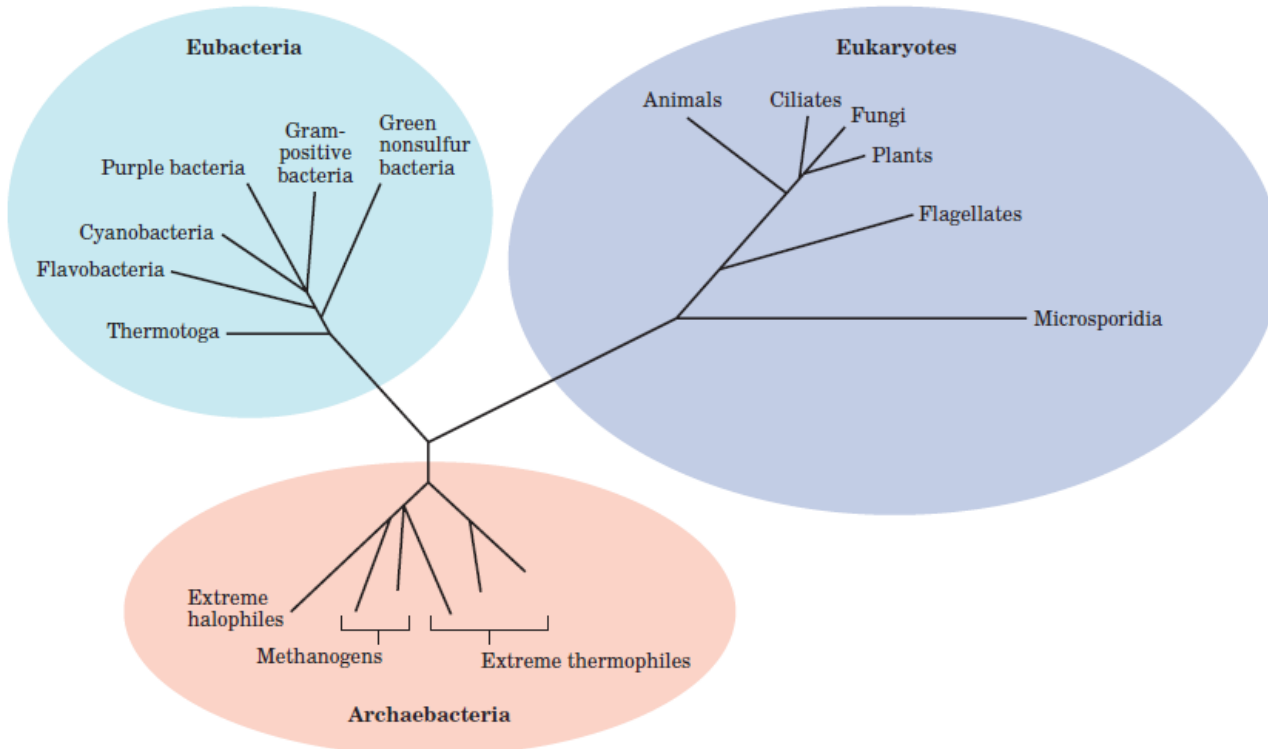
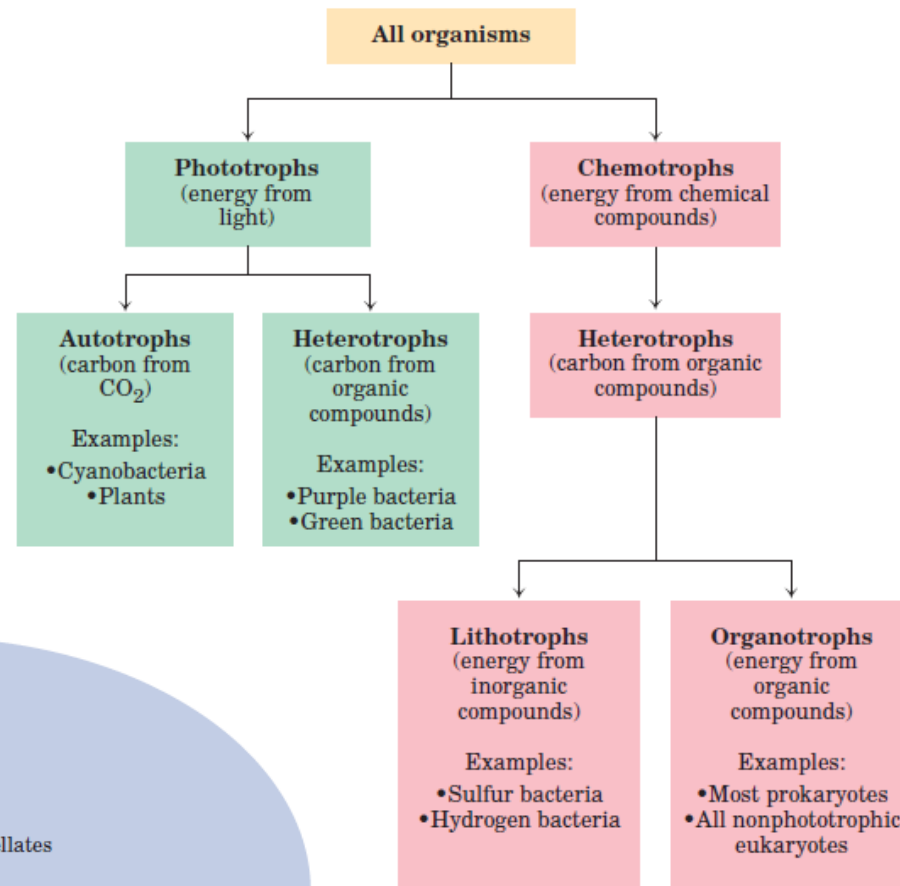
Disciplina: SLC0673

Introdução a bioquímica

Prof. Dr. Andrei Leitão

Introduction

Biochemistry describes in molecular terms the structures, mechanisms, and chemical processes shared by all organisms and provides organizing principles that underlie life in all its diverse forms, principles we refer to collectively as *the molecular logic of life*.



Cell constitution

Nucleus (eukaryotes) or nucleoid (bacteria)

Contains genetic material—DNA and associated proteins. Nucleus is membrane-bounded.

Plasma membrane

Tough, flexible lipid bilayer. Selectively permeable to polar substances. Includes membrane proteins that function in transport, in signal reception, and as enzymes.

Cytoplasm

Aqueous cell contents and suspended particles and organelles.

centrifuge at 150,000 *g*

Supernatant: cytosol
Concentrated solution of enzymes, RNA, monomeric subunits, metabolites, inorganic ions.

Pellet: particles and organelles
Ribosomes, storage granules, mitochondria, chloroplasts, lysosomes, endoplasmic reticulum.

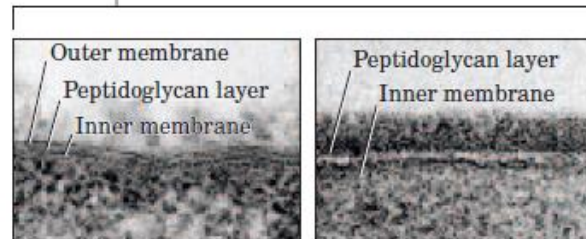
Ribosomes Bacterial ribosomes are smaller than eukaryotic ribosomes, but serve the same function—protein synthesis from an RNA message.

Nucleoid Contains a single, simple, long circular DNA molecule.

Pili Provide points of adhesion to surface of other cells.

Flagella Propel cell through its surroundings.

Cell envelope
Structure varies with type of bacteria.

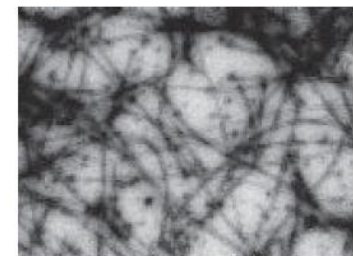
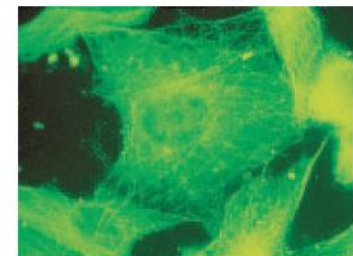
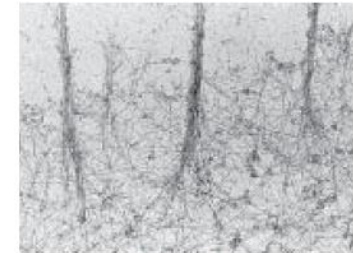


Gram-negative bacteria
Outer membrane; peptidoglycan layer

Gram-positive bacteria
No outer membrane; thicker peptidoglycan layer



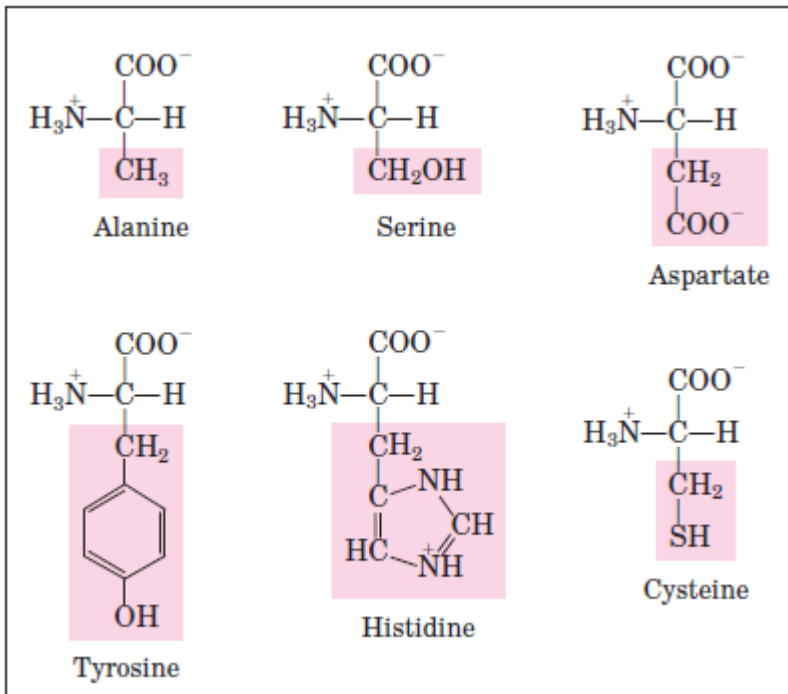
Actin stress fibers



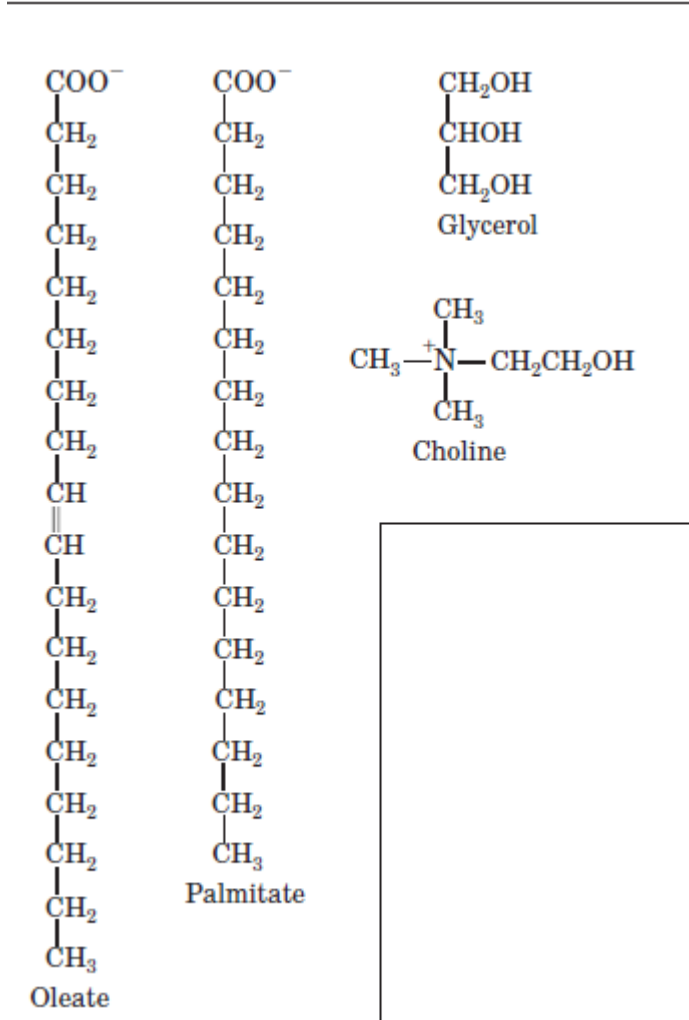
Microtubules

Some chemical constituents

Some amino acids of proteins

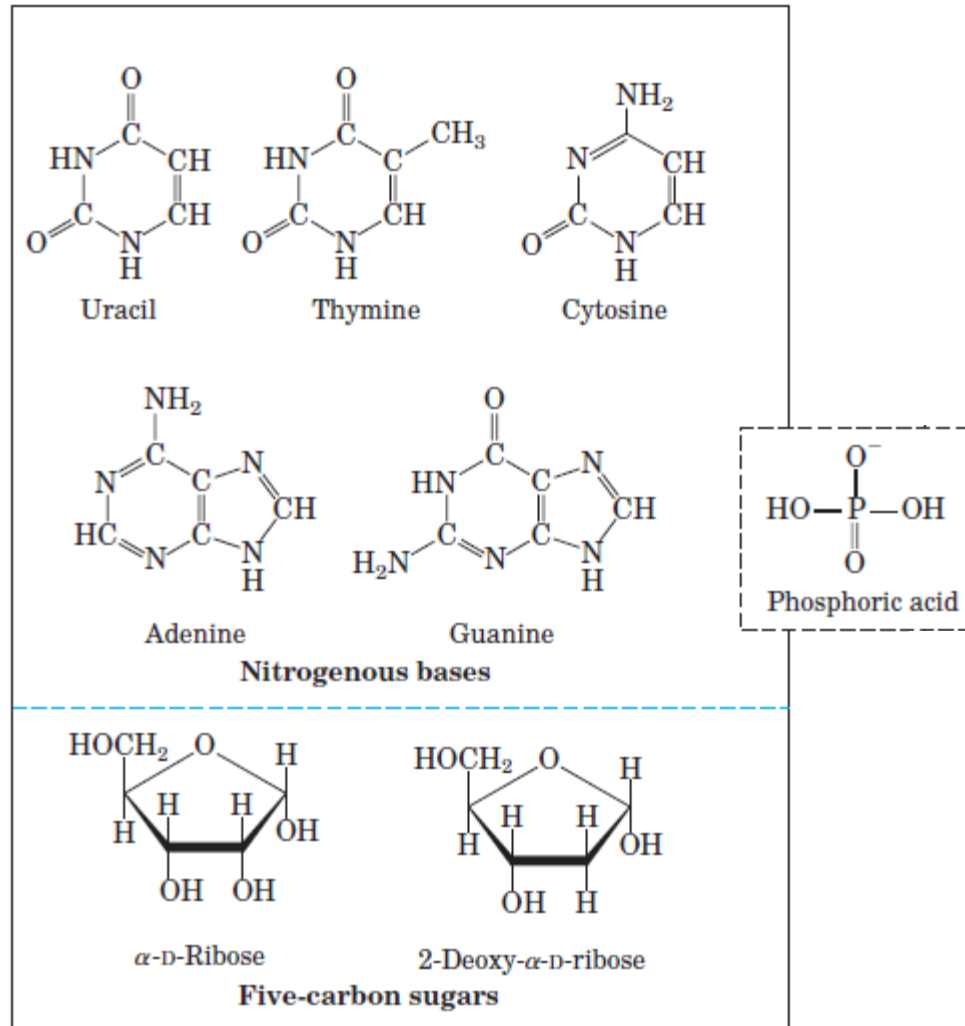


Some components of lipids

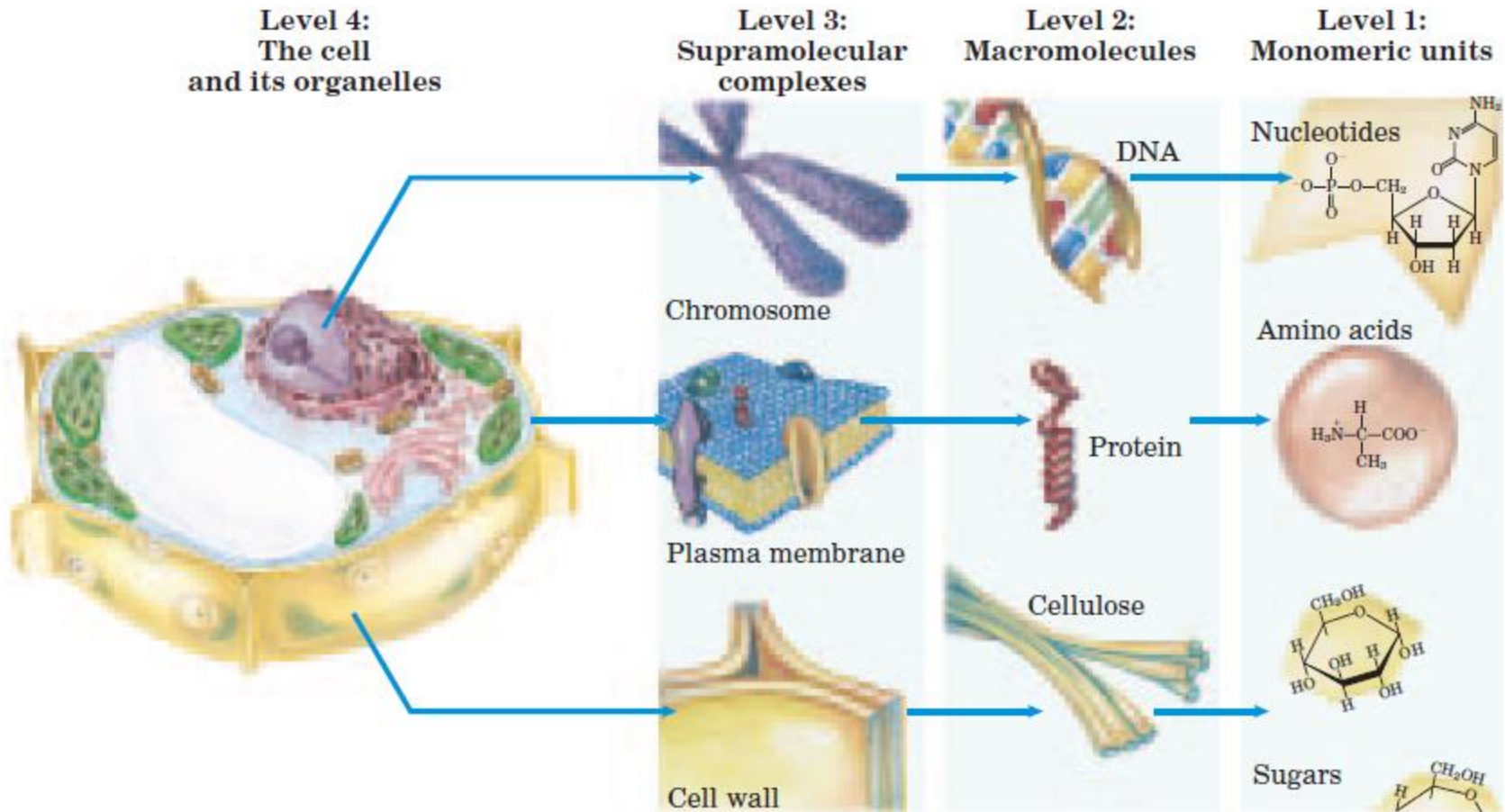


Some chemical constituents

The components of nucleic acids



Hierarchical levels



Chemistry

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		<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> <p>↖ Lanthanides</p> <p>↖ Actinides</p> </div> </div>														

Bulk elements
 Trace elements

Organic chemistry

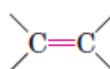
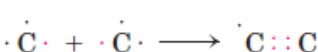
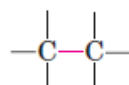
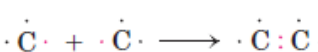
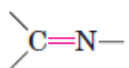
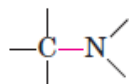
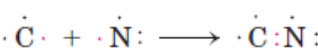
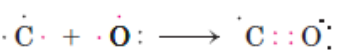
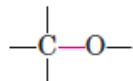
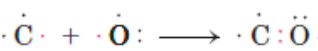
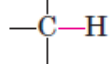
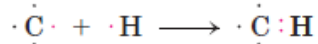
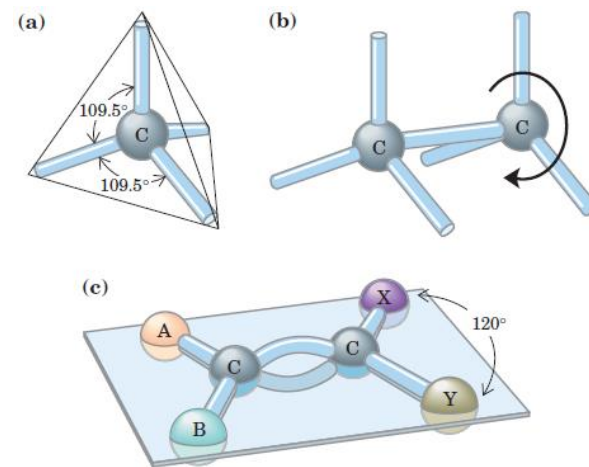


TABLE 1-1 Strengths of Bonds Common in Biomolecules

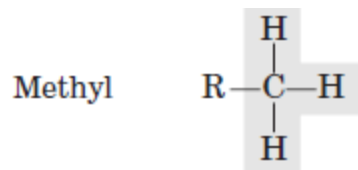
Type of bond	Bond dissociation energy* (kJ/mol)	Type of bond	Bond dissociation energy (kJ/mol)
Single bonds		Double bonds	
O—H	470	C=O	712
H—H	435	C=N	615
P—O	419	C=C	611
C—H	414	P=O	502
N—H	389	Triple bonds	
C—O	352	C≡C	816
C—C	348	N≡N	930
S—H	339		
C—N	293		
C—S	260		
N—O	222		
S—S	214		

*The greater the energy required for bond dissociation (breakage), the stronger the bond.

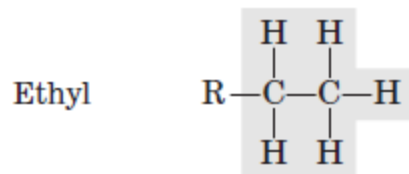
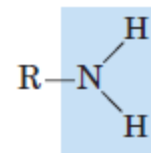
Geometries of carbon



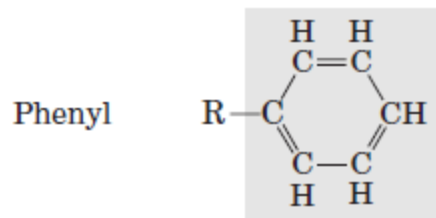
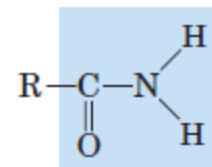
Common functional groups (1)



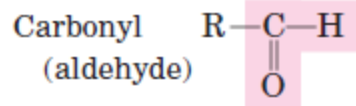
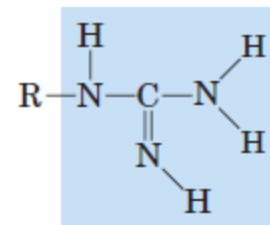
Amino



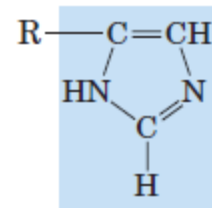
Amido



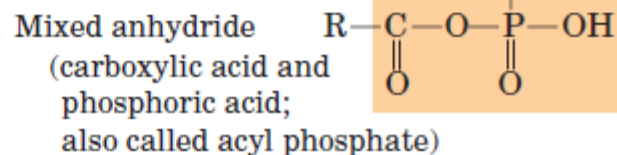
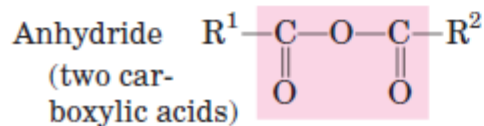
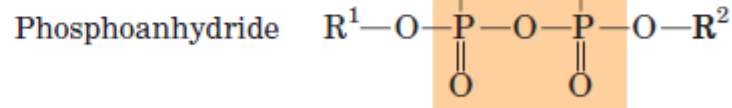
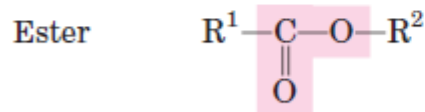
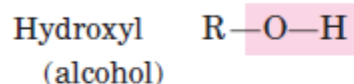
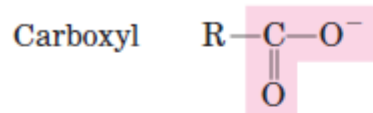
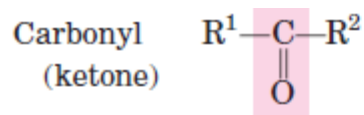
Guanidino



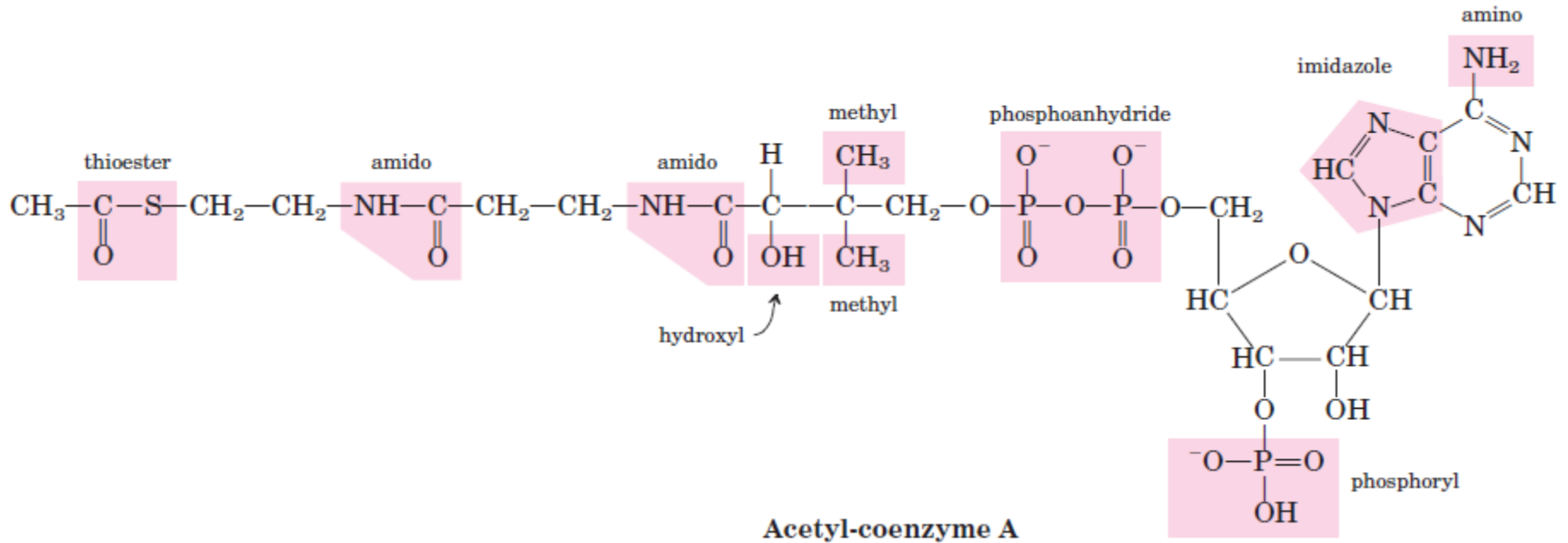
Imidazole



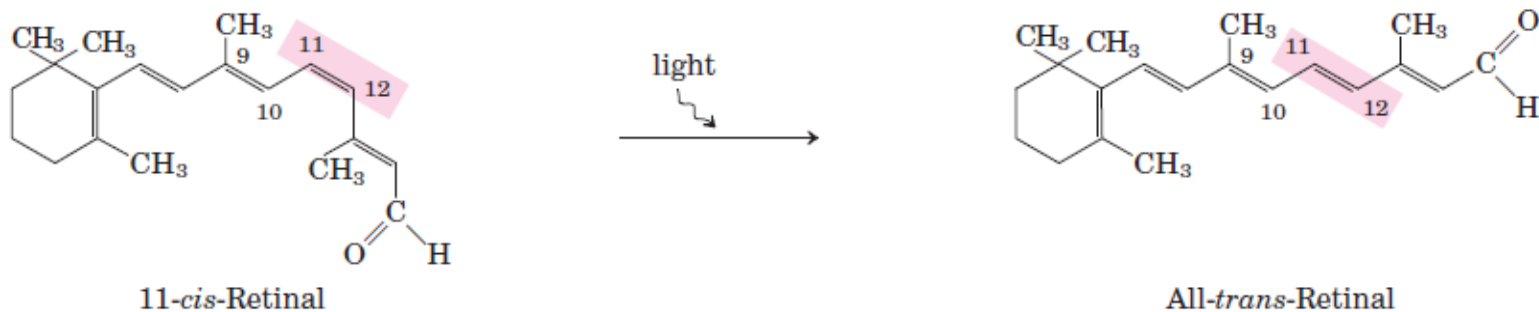
Common functional groups (2)



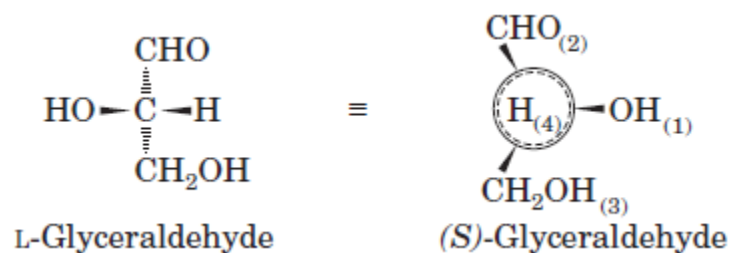
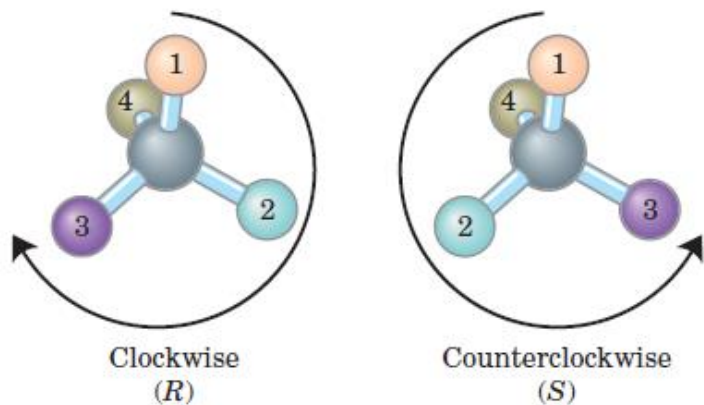
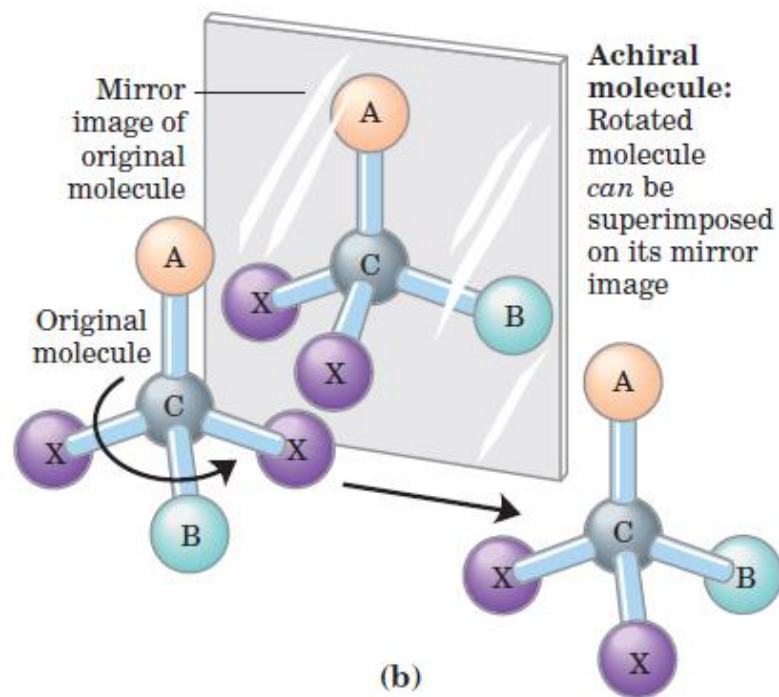
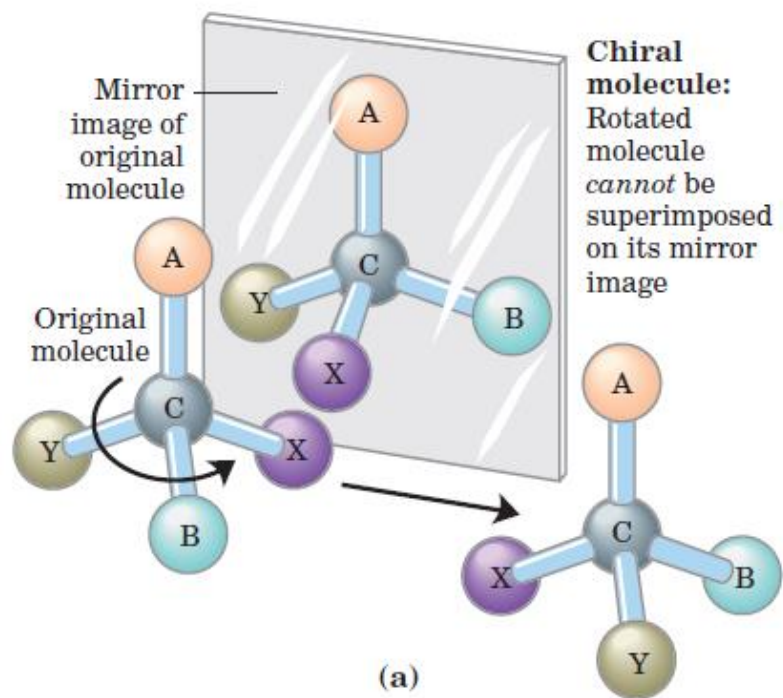
Biomolecules



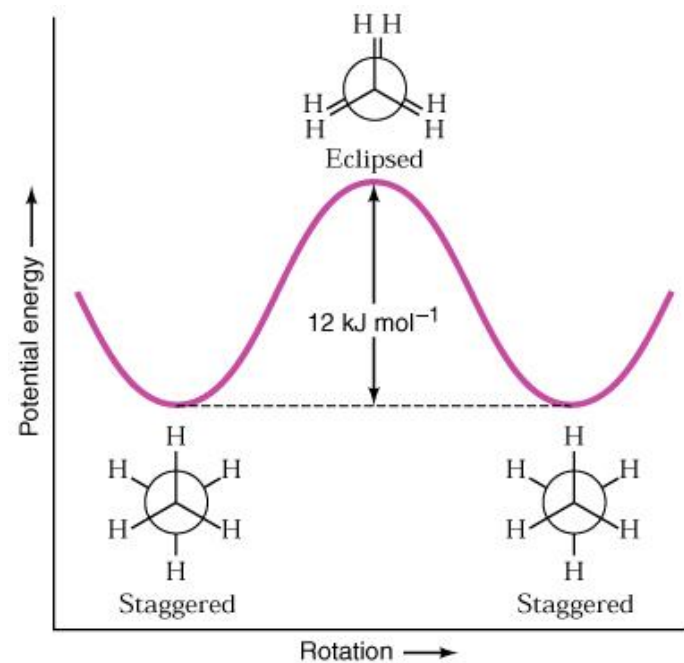
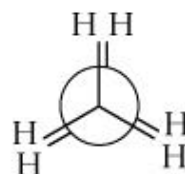
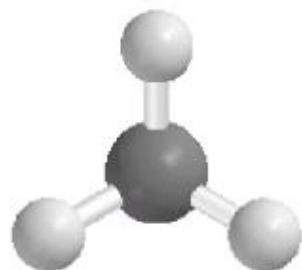
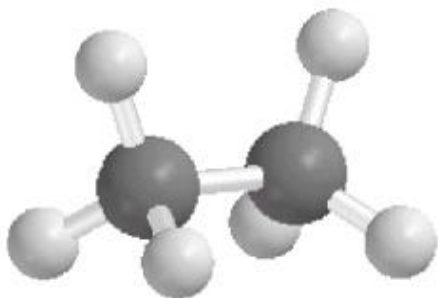
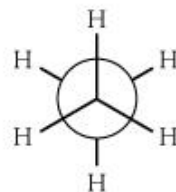
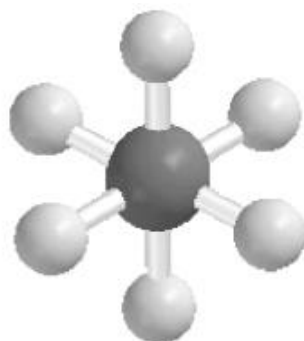
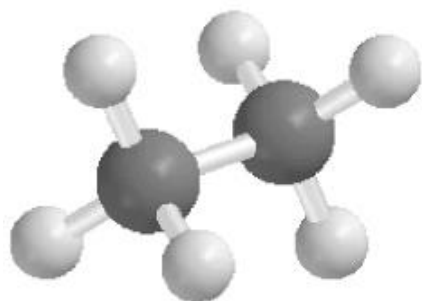
Triggering the light detection inside our retina



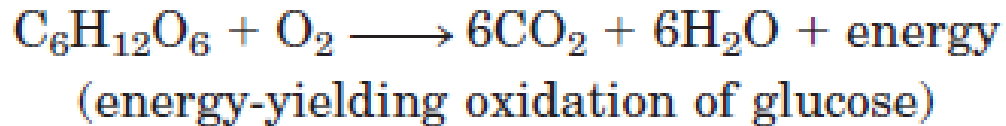
Chirality



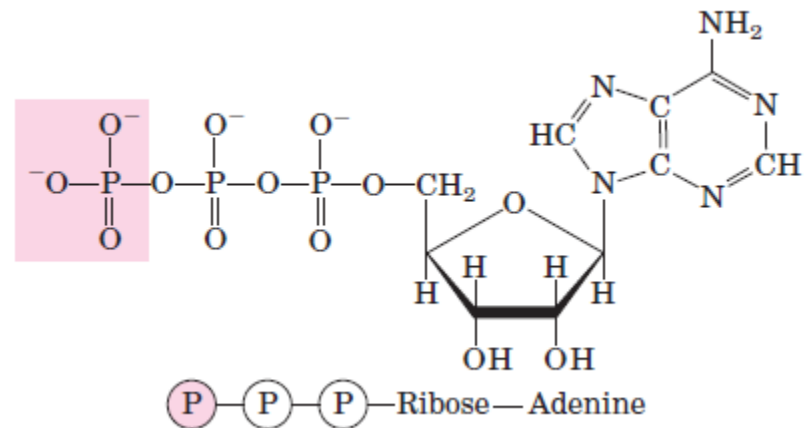
Conformation



Energy sources and Gibb's free energy



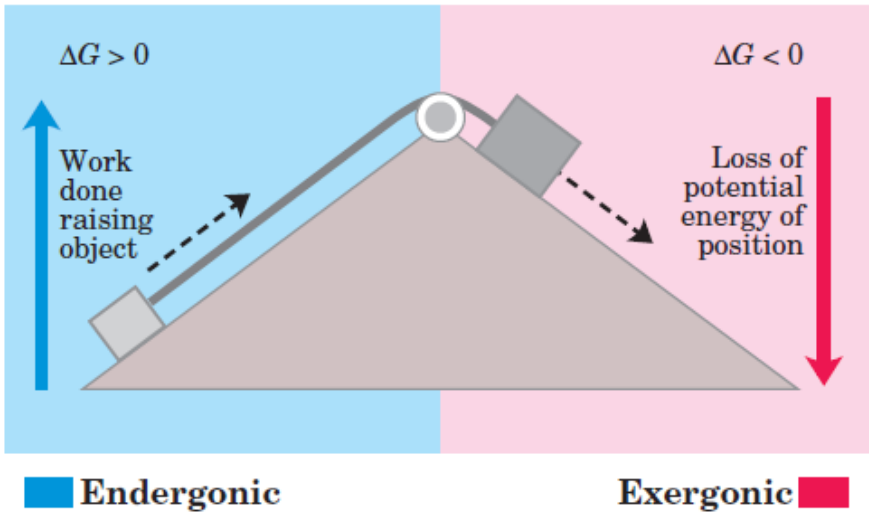
ATP



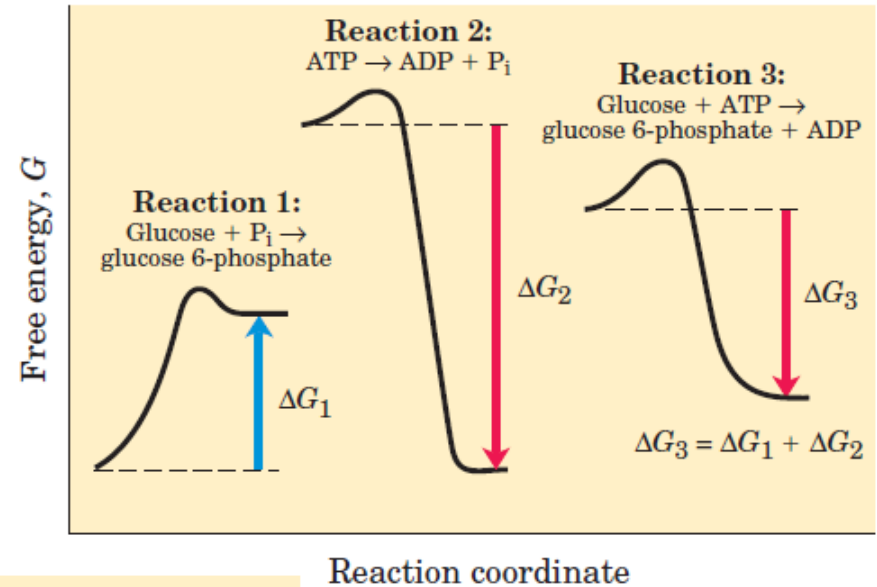
$$\Delta G = \Delta H - T \Delta S$$

Energy sources and Gibb's free energy

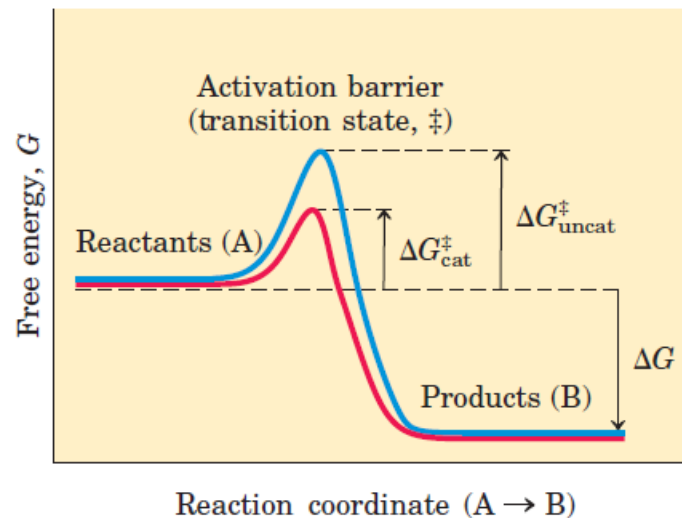
(a) Mechanical example



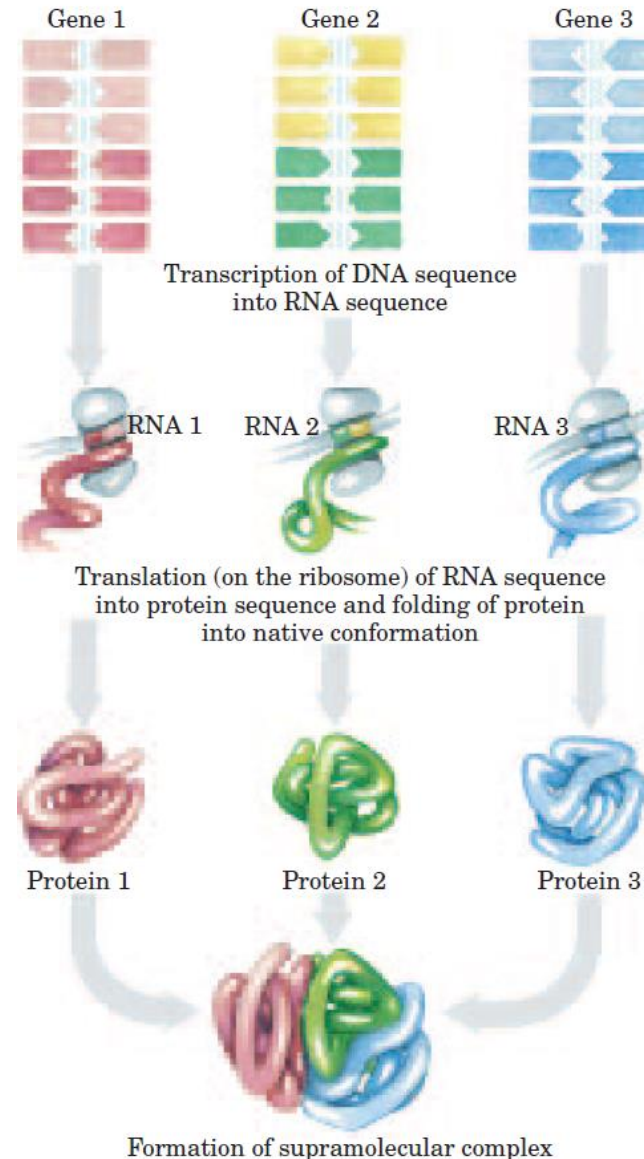
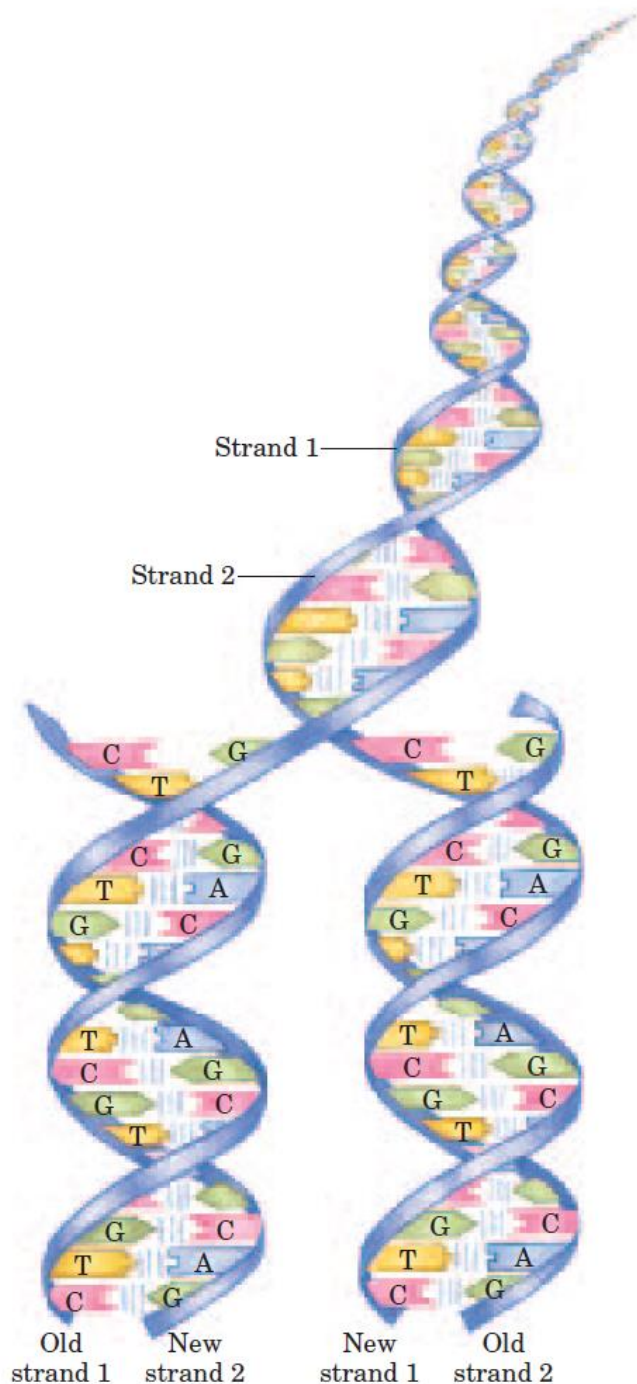
(b) Chemical example



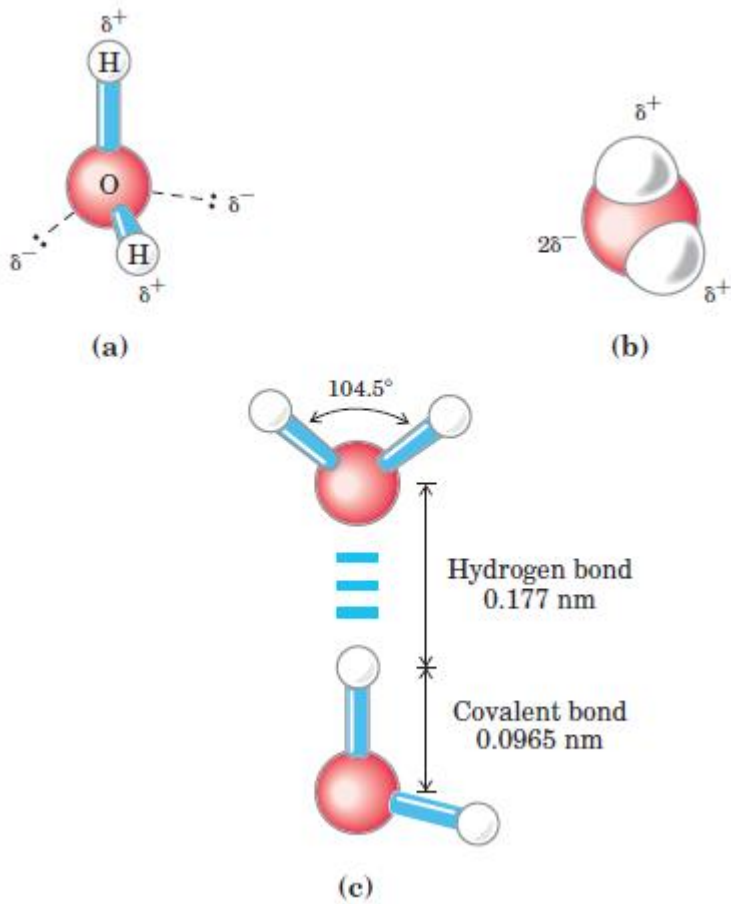
Enzyme catalysis:



From DNA to protein



The role of water



Ice structure

