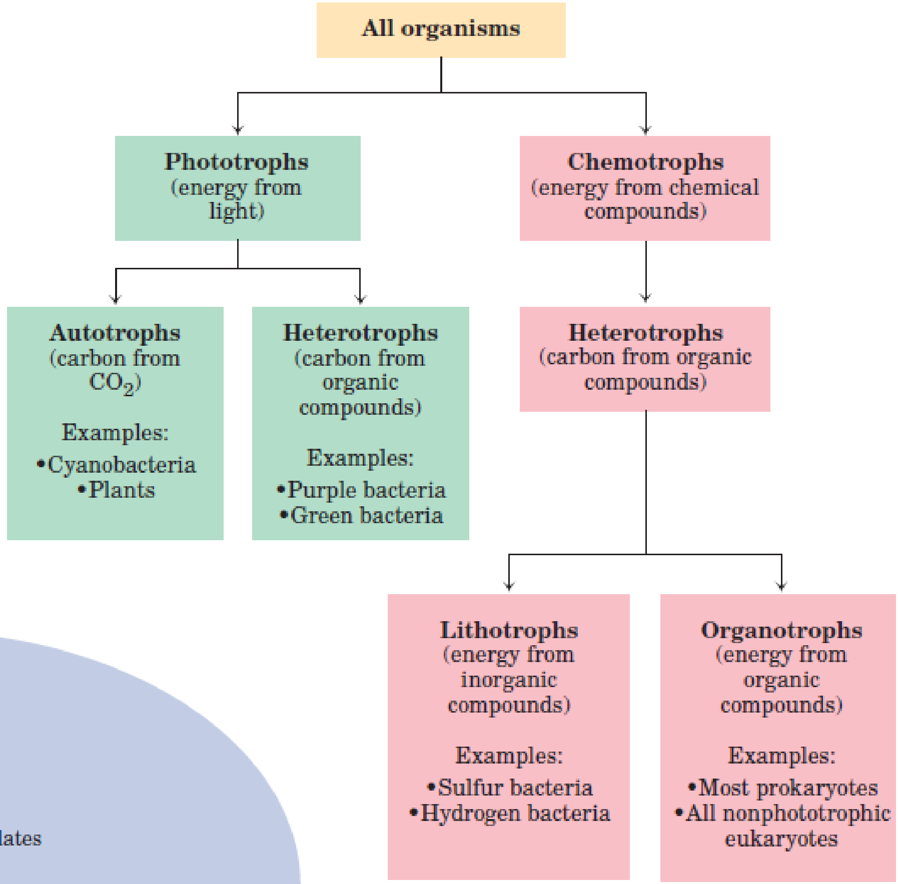
Disciplina: SLC0673

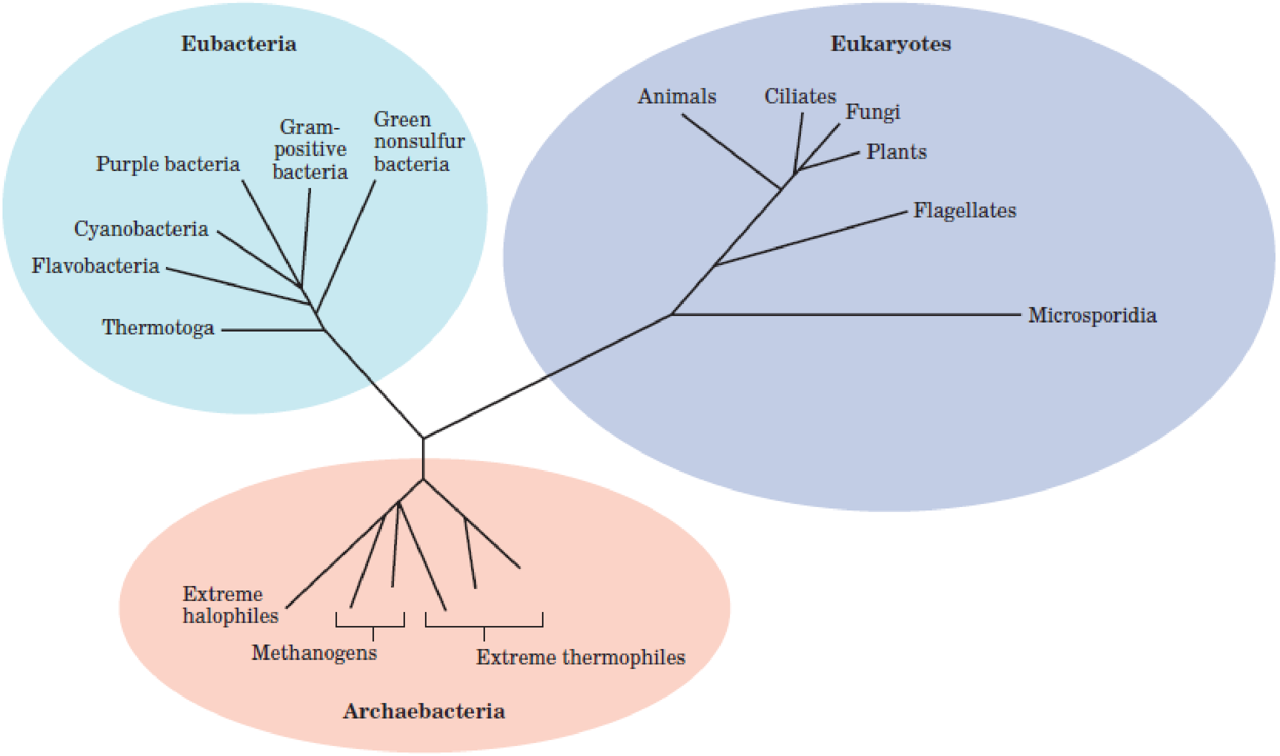
Introdução a bioquímica

Prof. Dr. Andrei Leitão

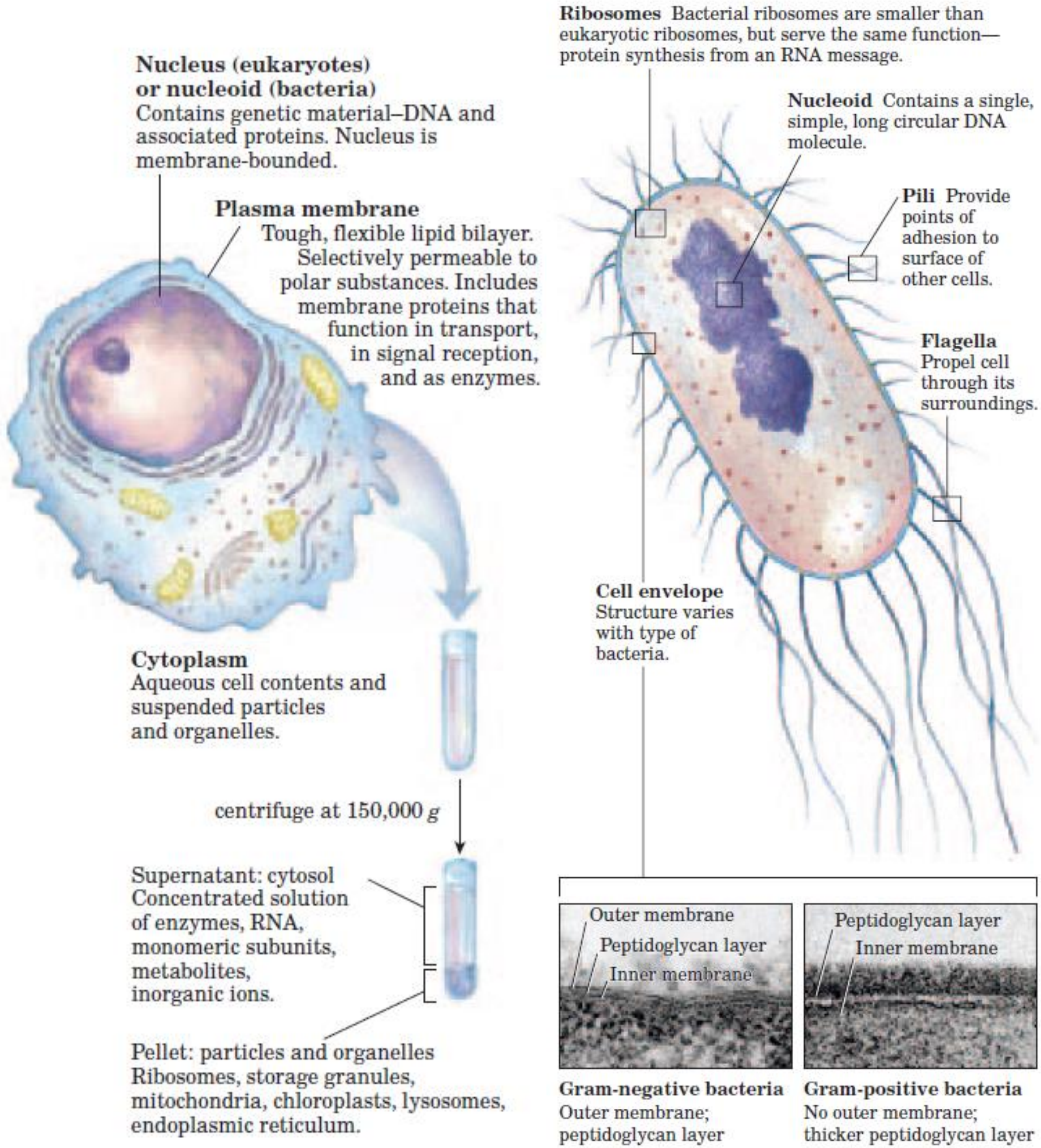
Introduction

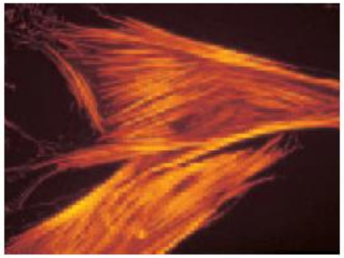
Biochemistry describes in molecular terms the structures, mechanisms, and chemical processes shared by all organisms and provides organizing principles that underlie life in all its diverse forms, principles we refer to collectively as ***the molecular logic of life***.

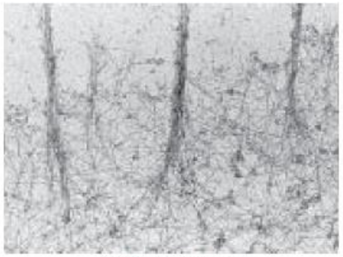


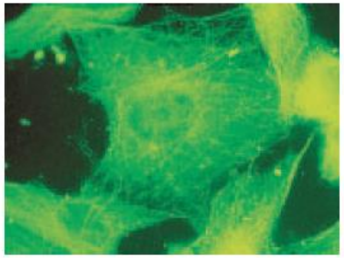


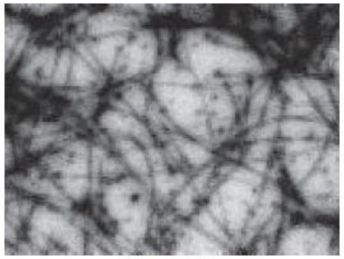
Cell constitution





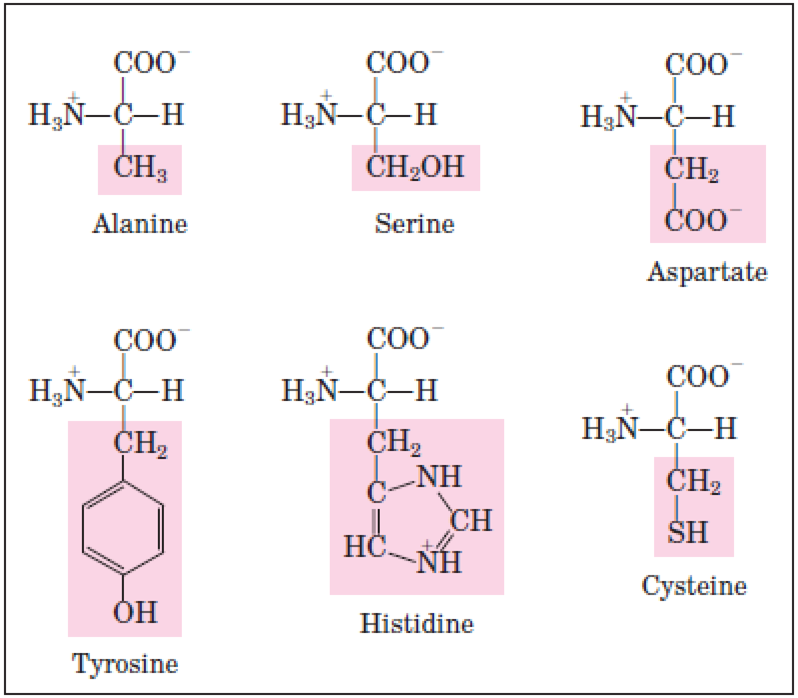

Actin stress fibers



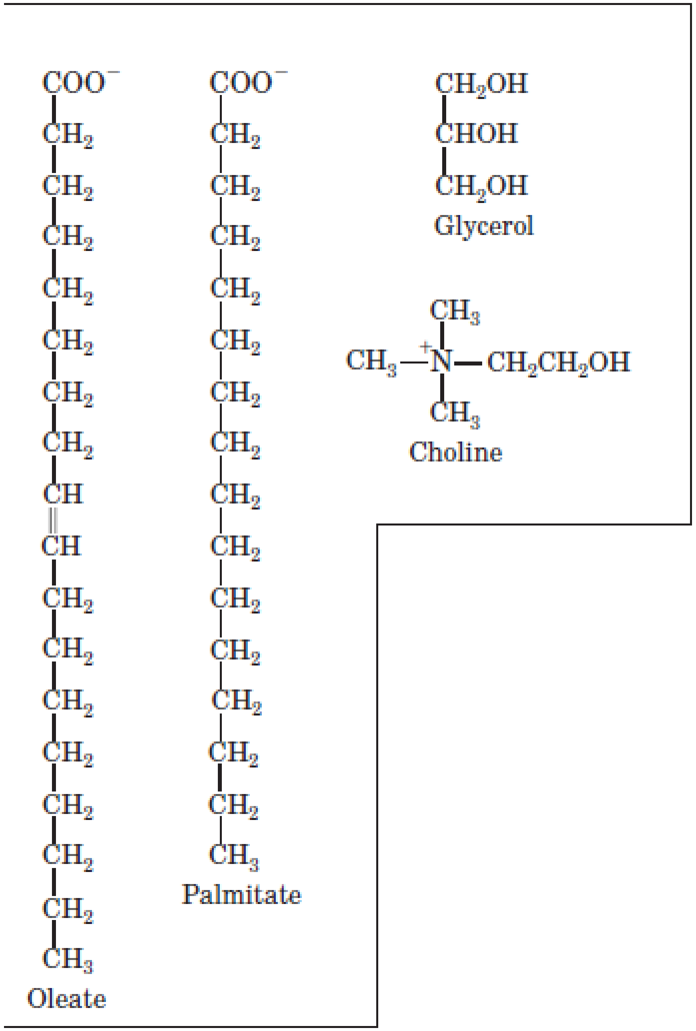

Microtubules

Some chemical constituents

Some amino acids of proteins

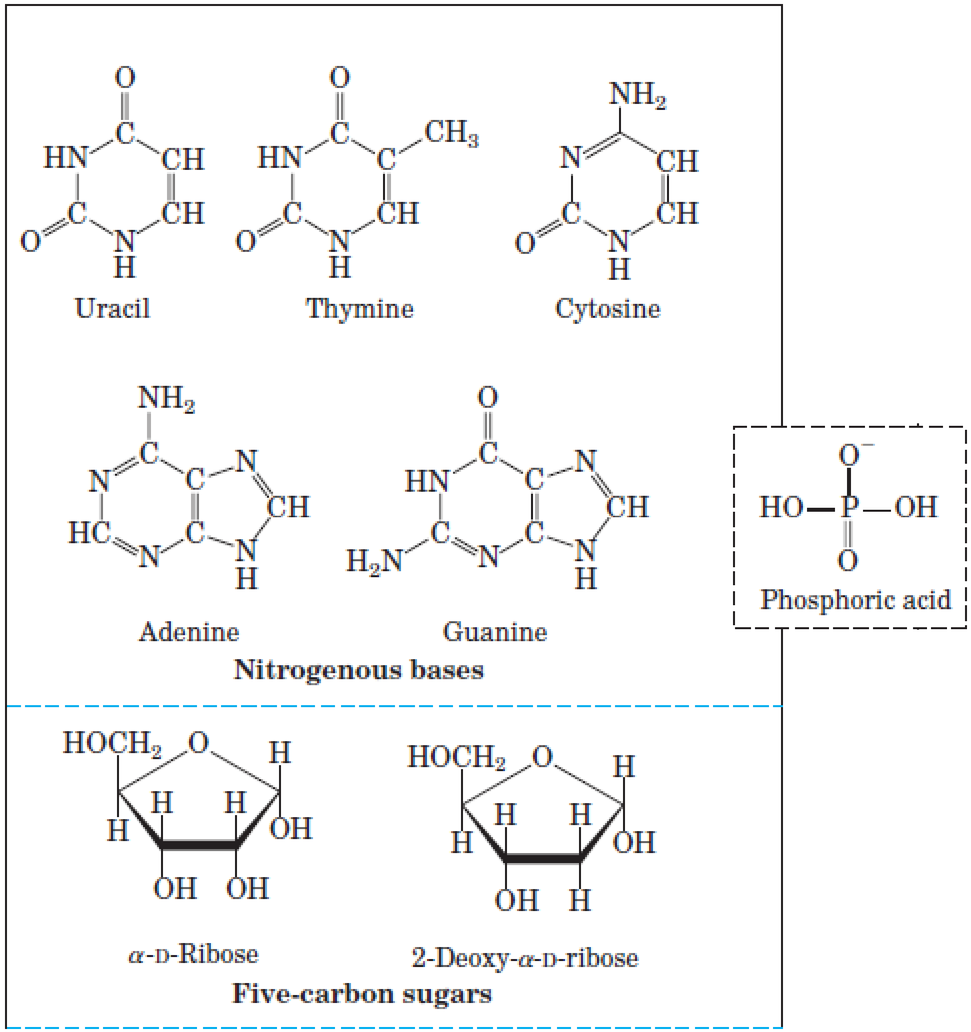


Some components of lipids

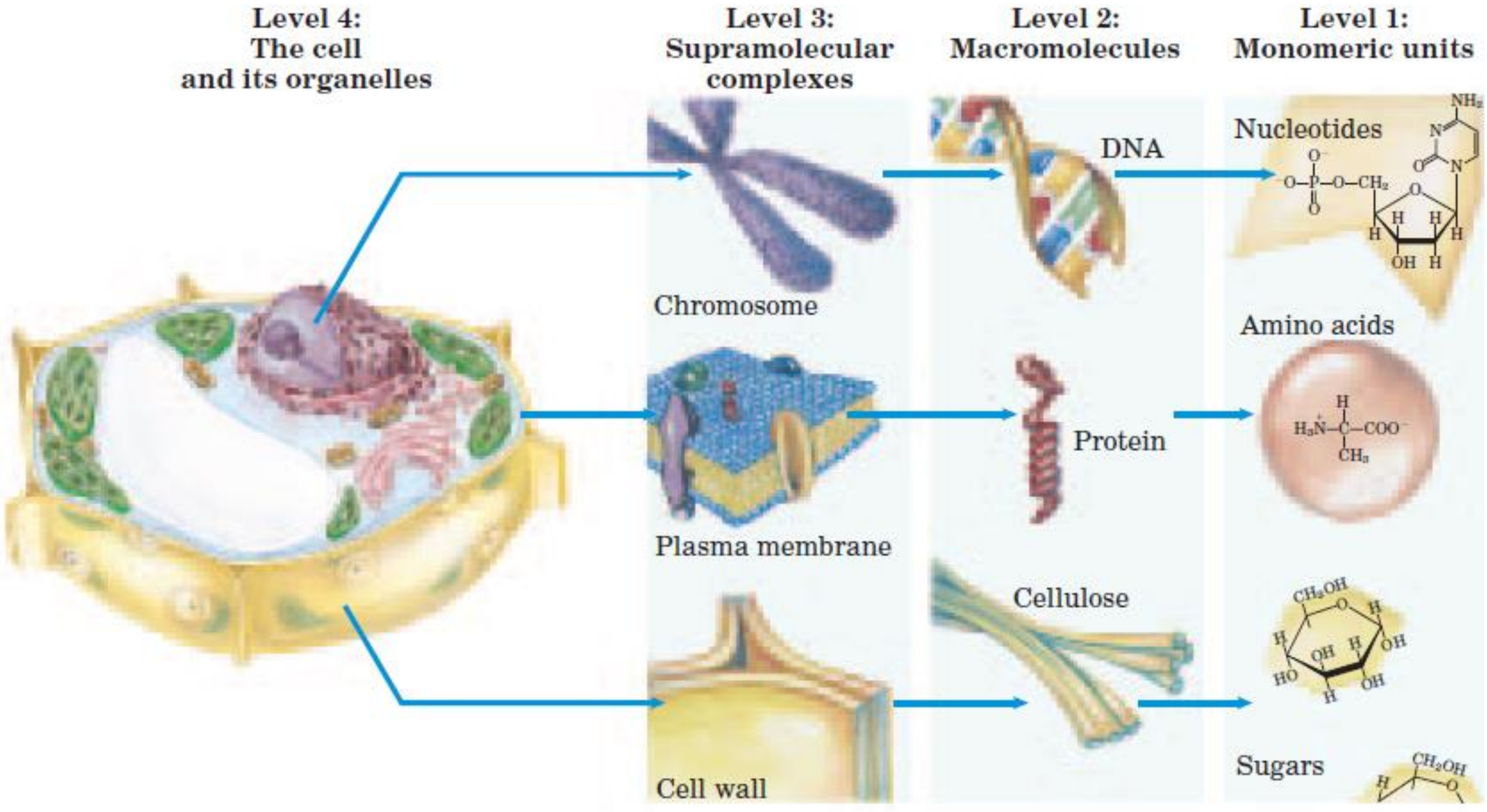


Some chemical constituents

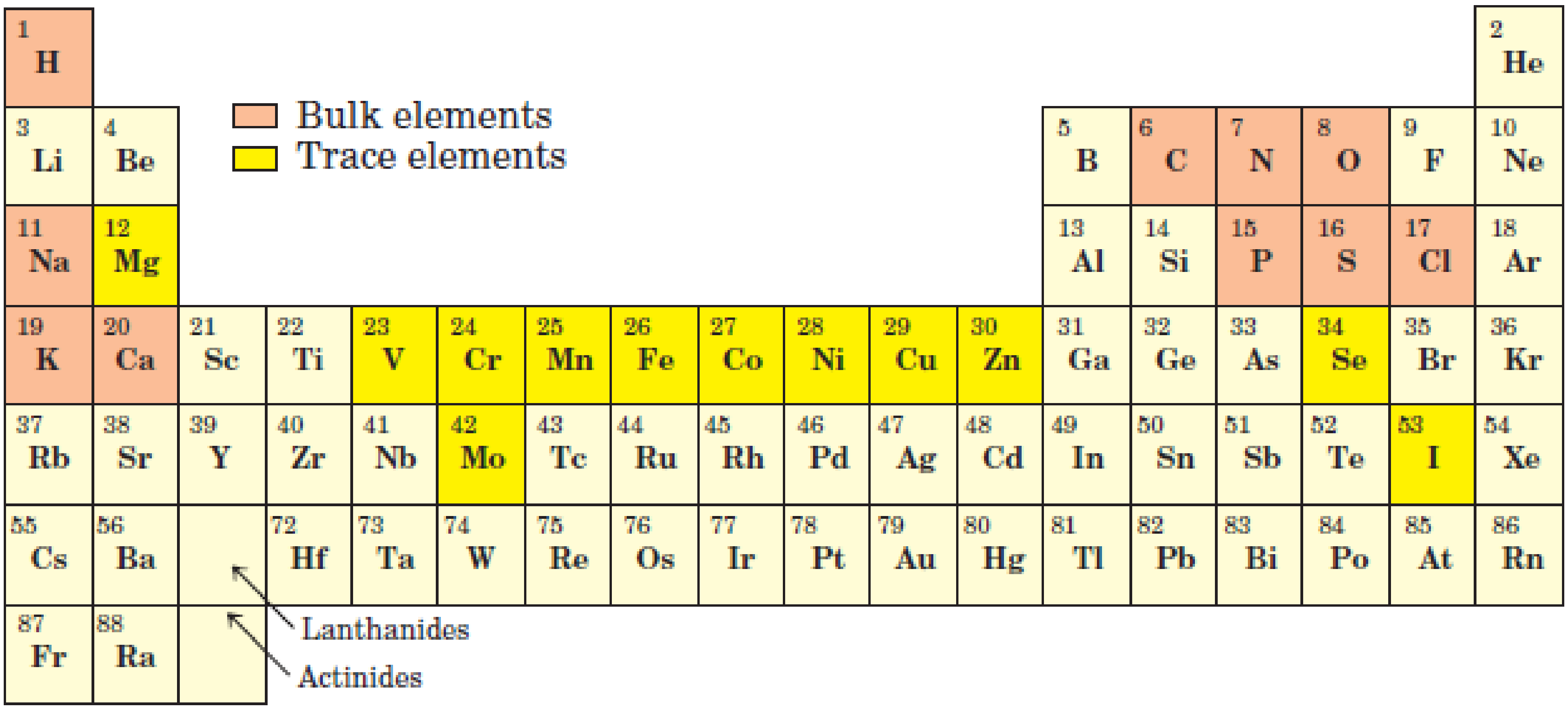
The components of nucleic acids



Hierarchical levels



Chemistry


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

Organic chemistry

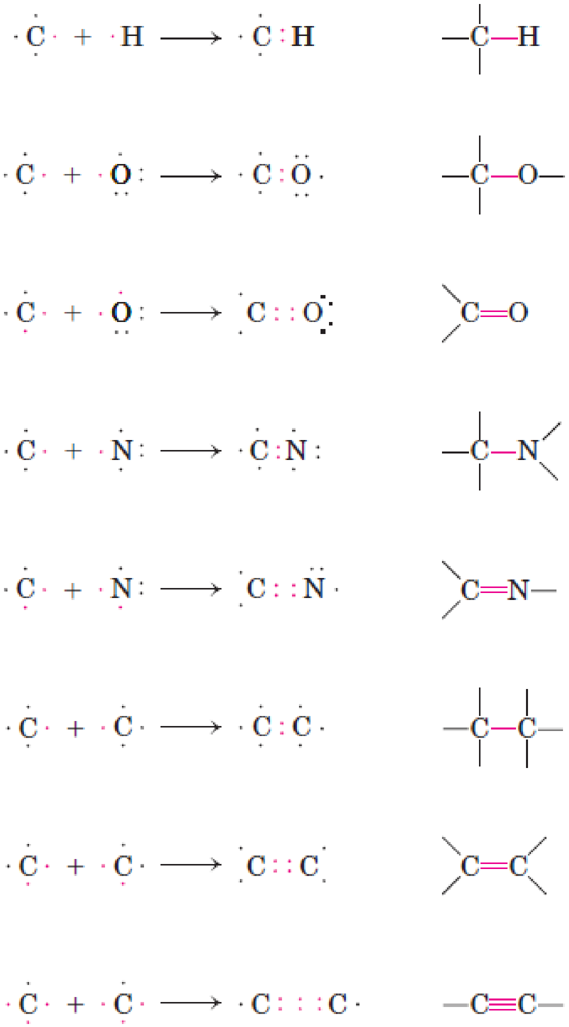
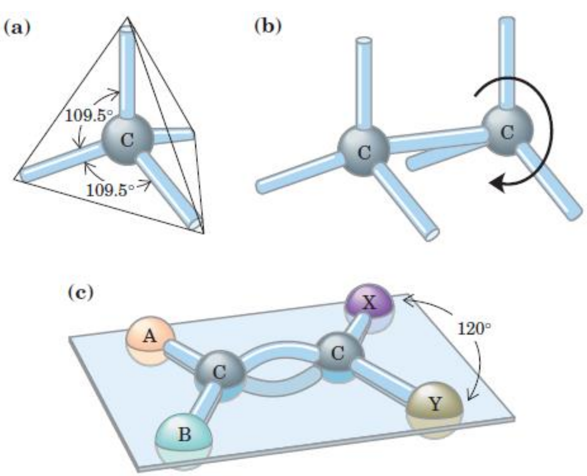


TABLE 1–1 Strengths of Bonds Common in Biomolecules

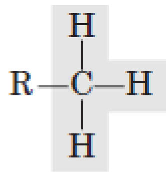
Type of bond	*Bond dissociation energy* (kJ/mol)*	*Type of bond*	*Bond dissociation energy (kJ/mol)*
Single bonds		**Double bonds**	
O—H	470	C═O	712
H—H	435	C═N	615
P—O	419	C═C	611
C—H	414	P═O	502
N—H	389		
C—O	352	**Triple bonds**	
C—C	348	C≡C	816
S—H	339	N≡N	930
C—N	293		
C—S	260		
N—O	222		
S—S	214		

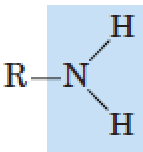
*The greater the energy required for bond dissociation (breakage), the stronger the bond.

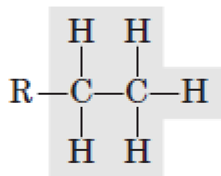
Geometries of carbon

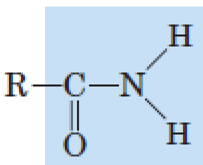


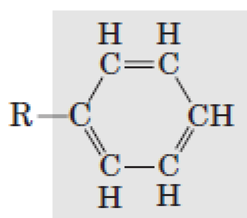
Common functional groups (1)

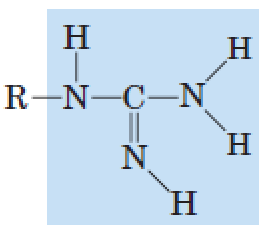
Methyl 

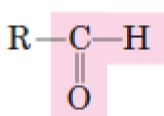
Amino 

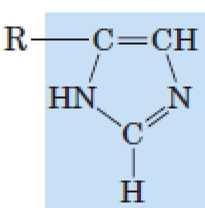
Ethyl 

Amido 

Phenyl 

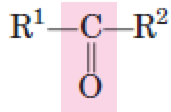
Guanidino 

Carbonyl (aldehyde) 

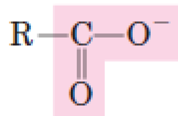
Imidazole 

Common functional groups (2)

Carbonyl (ketone)

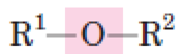


Carboxyl

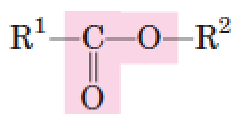


Hydroxyl (alcohol)

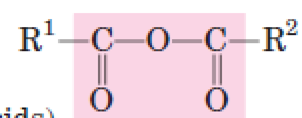
Ether



Ester



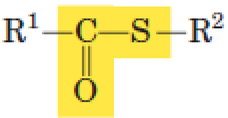
Anhydride (two carboxylic acids)



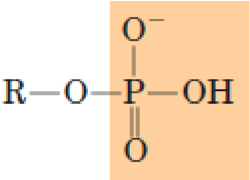
Sulfhydryl

Disulfide

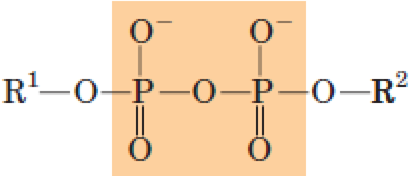
Thioester



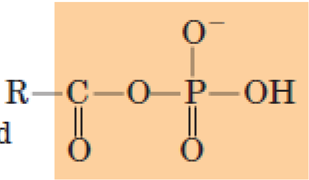
Phosphoryl



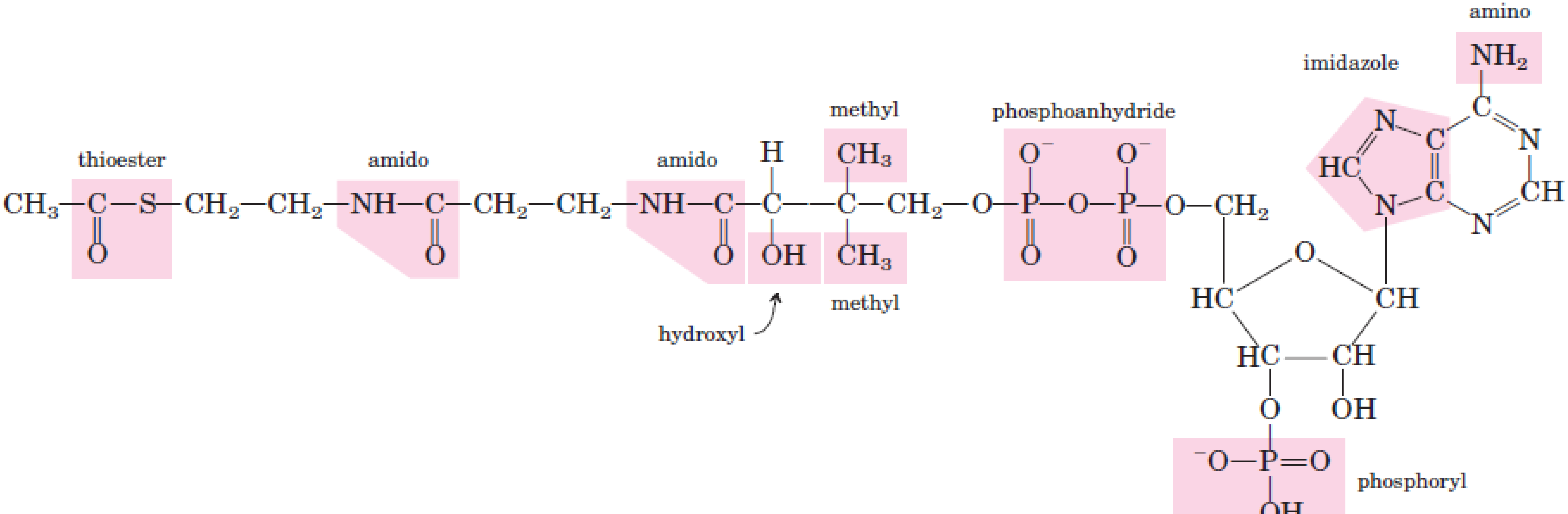
Phosphoanhydride



Mixed anhydride (carboxylic acid and phosphoric acid; also called acyl phosphate)

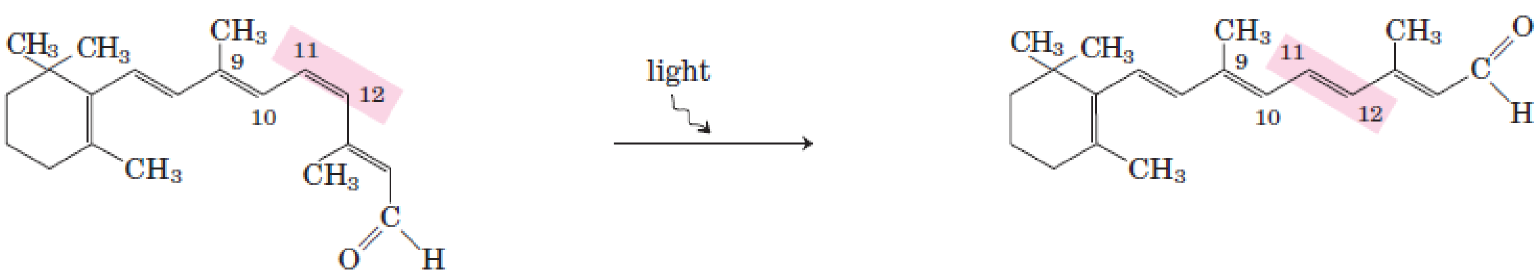


Biomolecules



Acetyl-coenzyme A

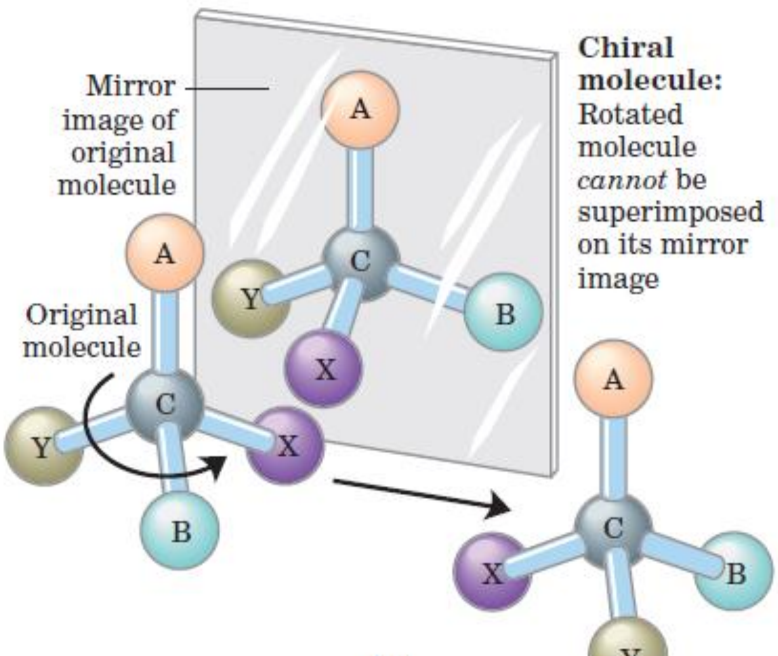
Triggering the light detection inside our retine



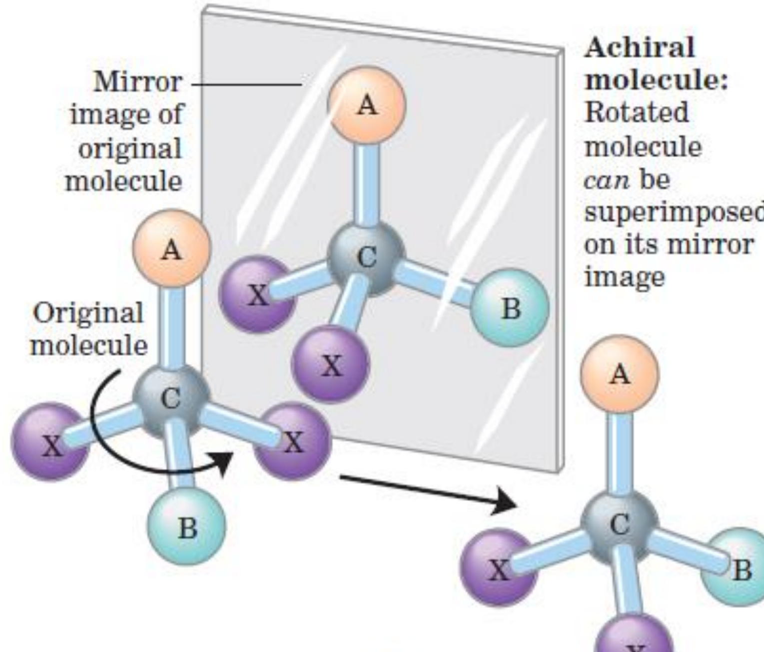
11-*cis*-Retinal

All-*trans*-Retinal

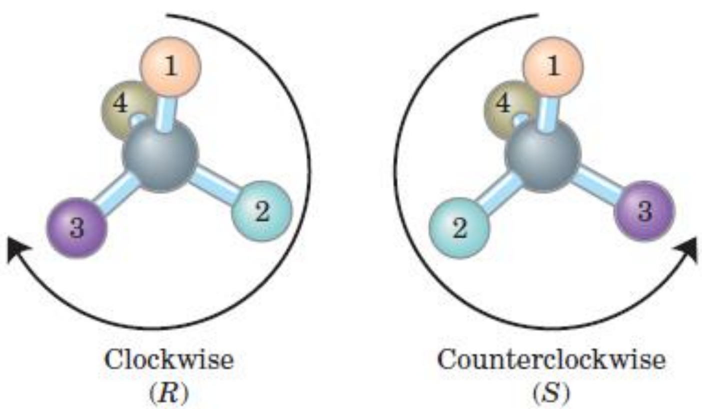
Chirality

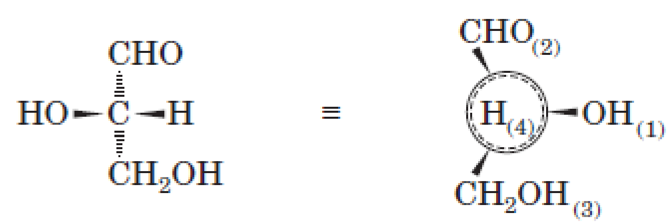


(a)



(b)

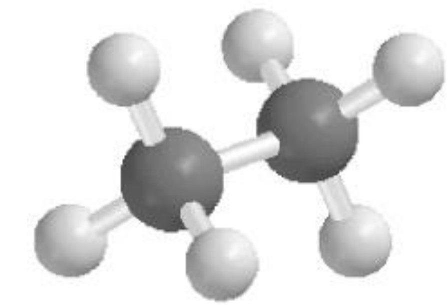


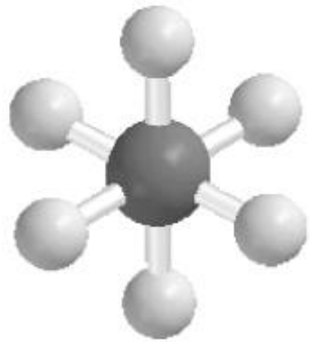


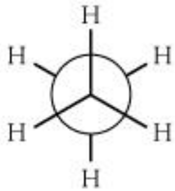
L-Glyceraldehyde

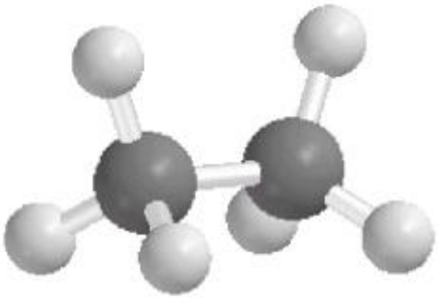
(*S*)-Glyceraldehyde

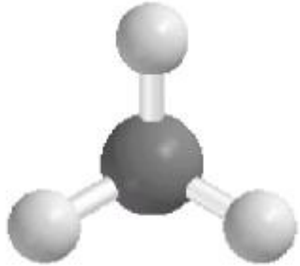
Conformation

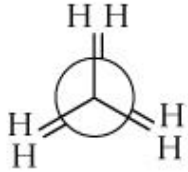


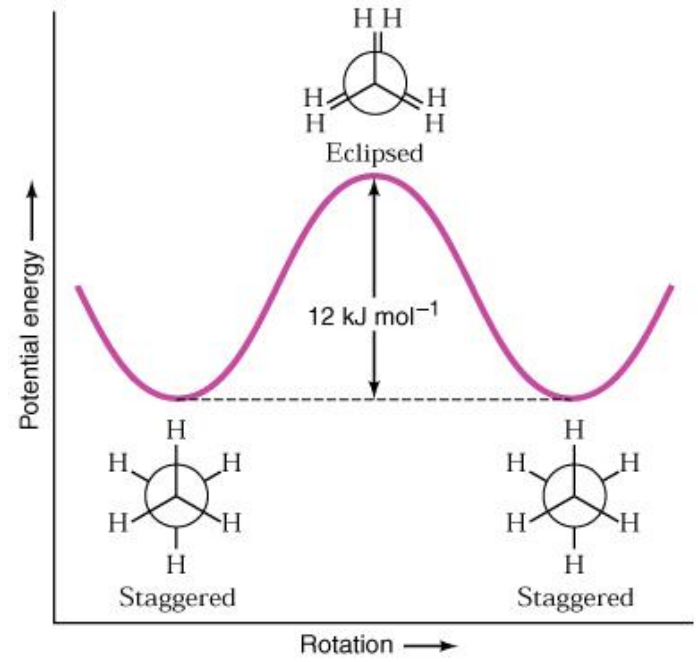










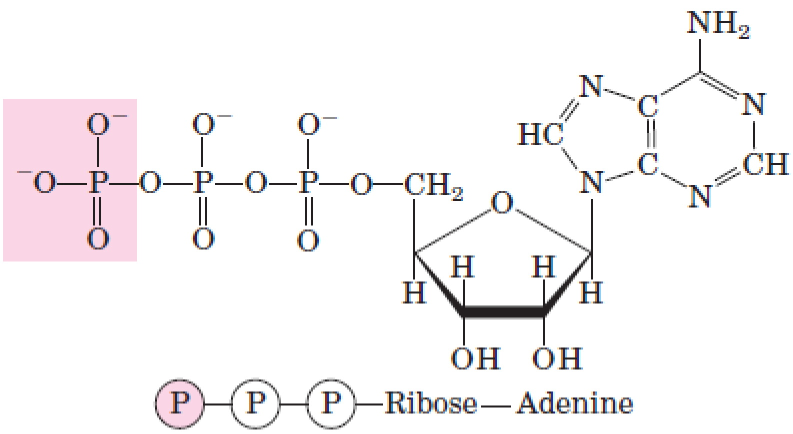


Energy sources and Gibb's free energy

$$C_6H_{12}O_6 + O_2 \longrightarrow 6CO_2 + 6H_2O + \text{energy}$$

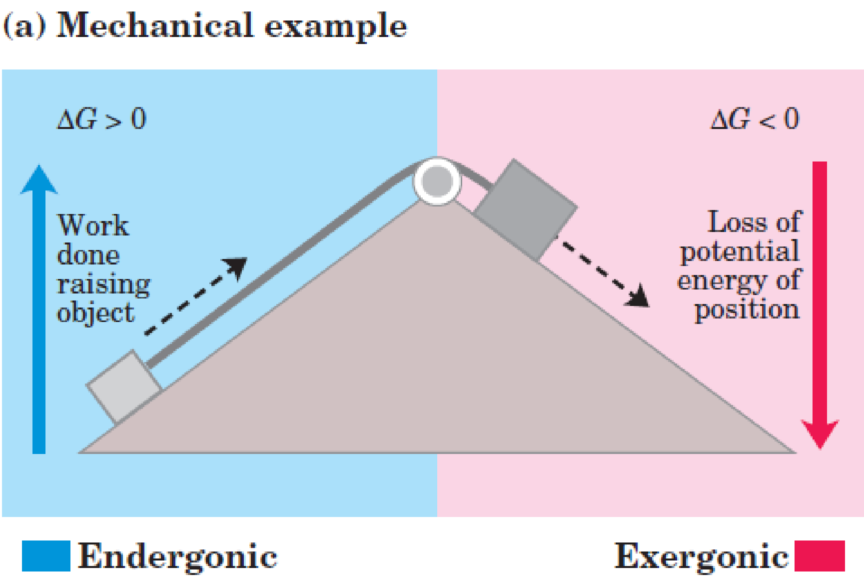
(energy-yielding oxidation of glucose)

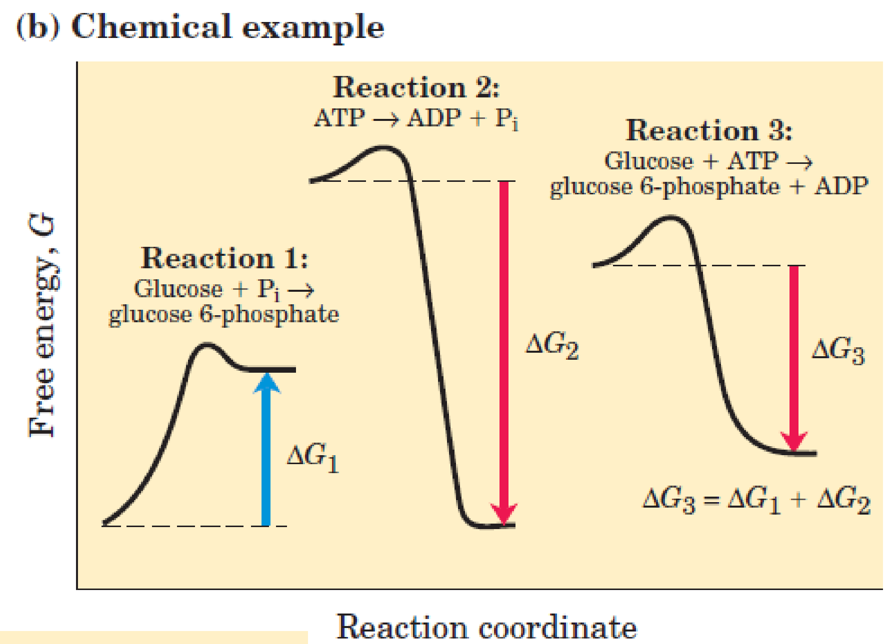
ATP



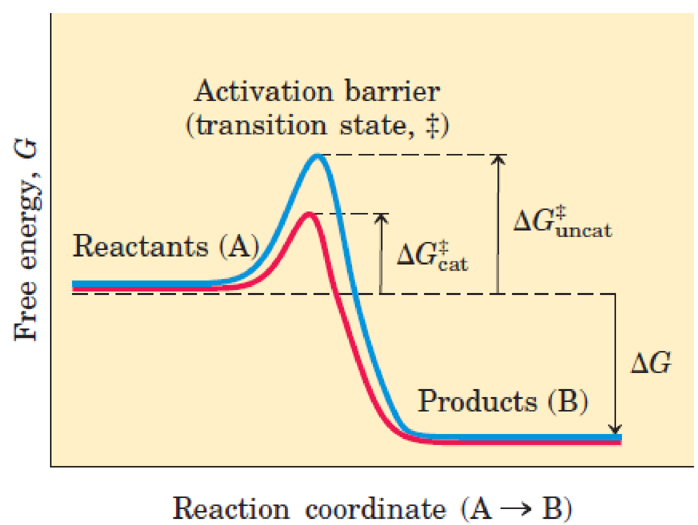
$$\Delta G = \Delta H - T\,\Delta S$$

Energy sources and Gibb's free energy

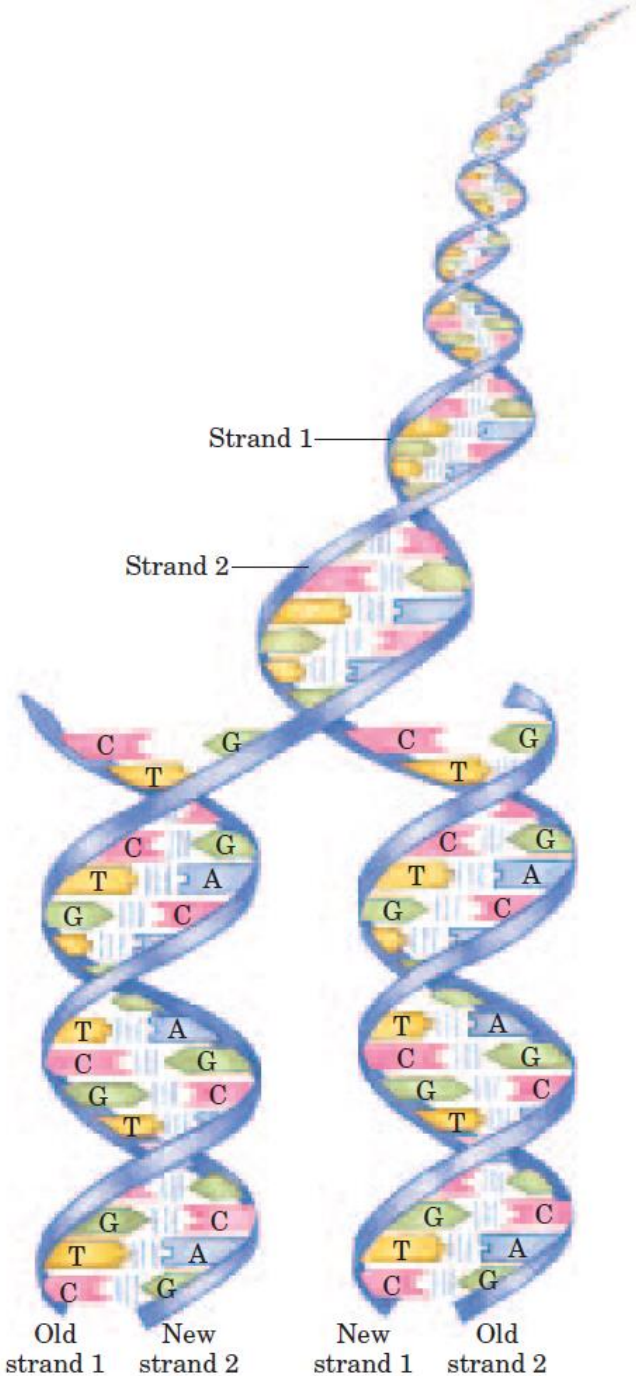


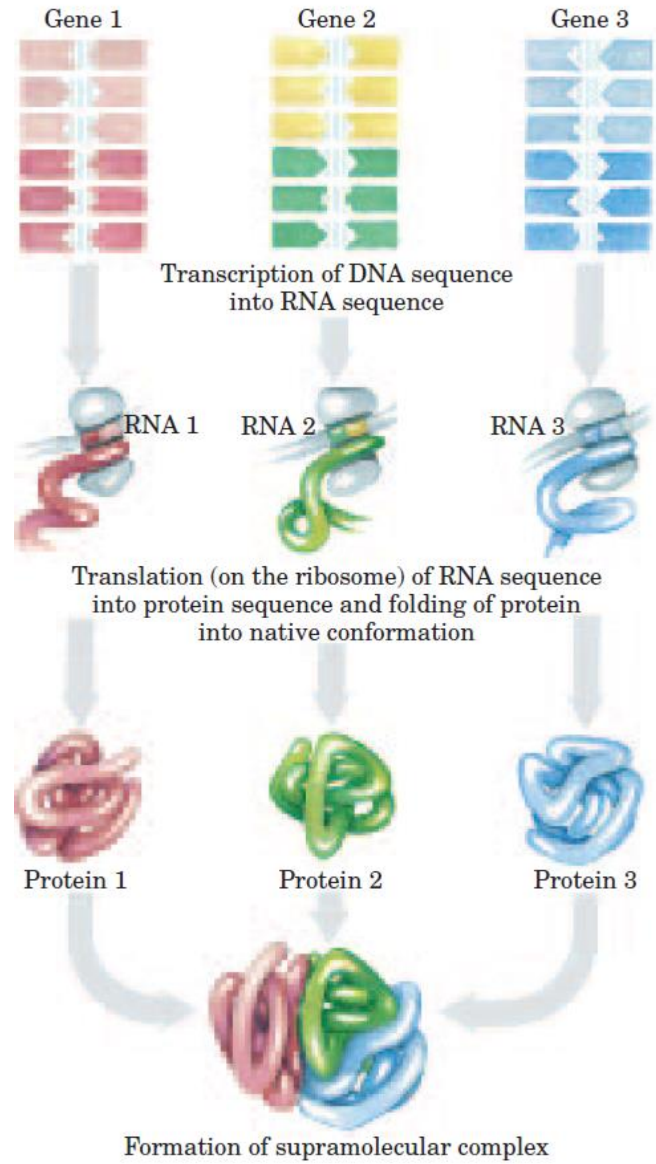


Enzyme catalysis:

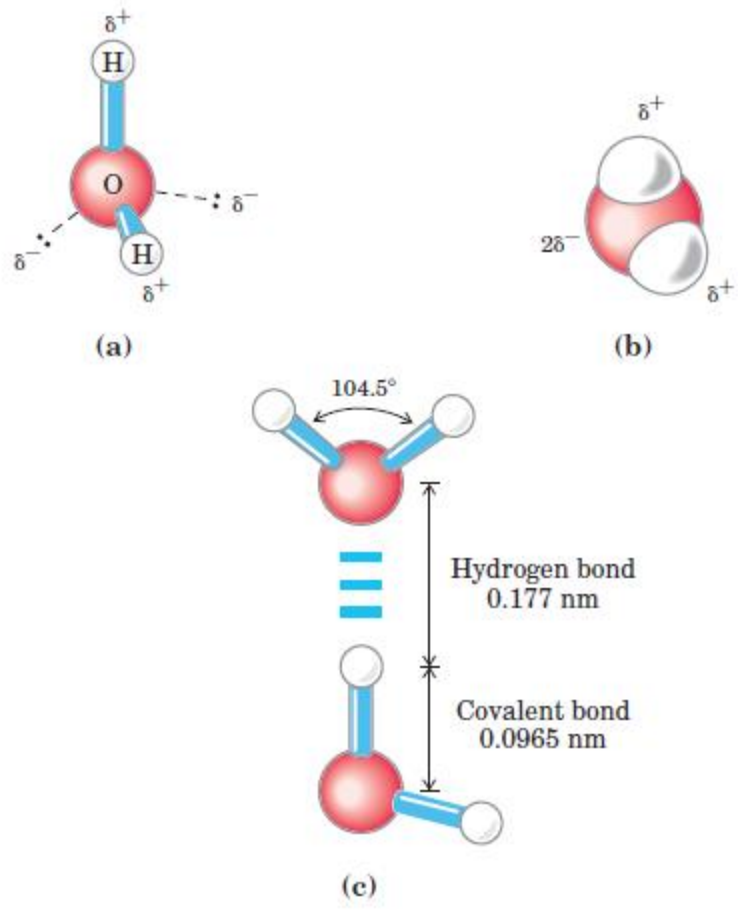


From DNA to protein





The role of water



Ice structure