



Chapters 4 and 5

Organic molecules and functional groups

Functional group	Class of compounds	Structural formula	Example
Hydroxyl -OH	Alcohols	R-OH	<chem>CCO</chem> Ethanol
Carbonyl -CHO	Aldehydes	R-C(=O)H	<chem>CC=O</chem> Acetaldehyde
Carbonyl >C=O	Ketones	R-C(=O)-R	<chem>CC(=O)C</chem> Acetone
Carboxyl -COOH	Carboxylic acids	R-C(=O)OH	<chem>CC(=O)O</chem> Acetic acid
Amino -NH ₂	Amines	R-NH ₂	<chem>CN</chem> Methylamine
Phosphate -OPO ₃ ²⁻	Organic phosphates	R-O-P(=O)(O ⁻) ₂	<chem>OC(=O)COP(=O)([O-])[O-]</chem> 3-phosphoglyceric acid
Sulphydryl -SH	Thiols	R-SH	<chem>CCS</chem> Mercaptoethanol

- 1 Which are polar?
- 2 Which act as acids?
- 3 Which act as bases?
- 4 Which can be found in proteins?
- 5 Which are found in DNA?
- 6 Which are found in ATP?

Enantiomers (isomers)
(Chiral molecules)

The two enantiomers of Thalidomide can and do interact metabolically different.

In the case of Thalidomide, it was discovered that only one of the two enantiomeric forms was responsible for the mutagenic effects seen.

Chapter 5

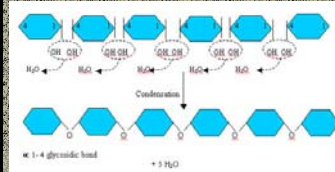
The Structure and Function of Macromolecules

Polymers: carbohydrates
lipids
proteins
nucleic acids

Their structures, sources, uses

Polymers

- polys (many) meris (parts)
- Built of monomers (single units)
 - monosaccharides
 - Amino acids
 - Nucleotides



Starch is a polymer made from

How polymers are made...

- Condensation (Dehydration) reaction**
Builds polymers. (H₂O is formed)
- Hydrolysis:**
Polymers are disassembled (H₂O is split)
hydro (water) lysis (break)
into (-H) (-OH)
- See fig. 5.2

FIG 5.2

Condensation = builds longer molecules. H₂O results

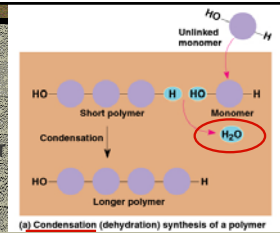
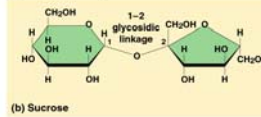
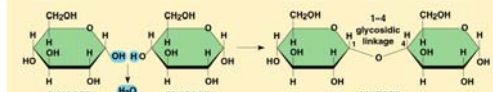
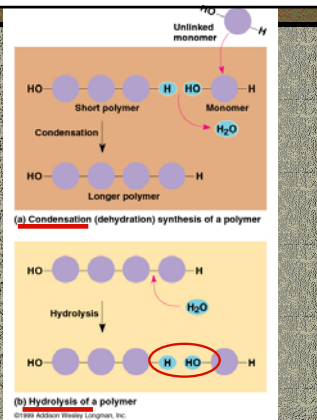


FIG 5.2
Condensation = builds longer molecules. H₂O results

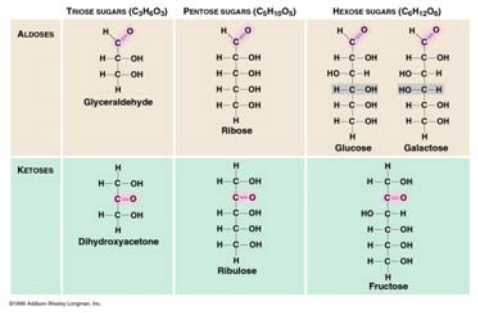
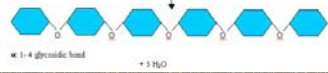
Hydrolysis = breaks H₂O bonds shortens molecules



- Disaccharide: condensation (dehydration)
- Glycosidic linkages
- Sucrose = glucose + fructose

Carbohydrates

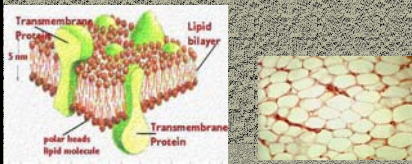
- mono-, di-, and polysaccharides
- CH_2O (basic formula)
- Body's uses: cellular respiration fuel, building blocks
- Glycosidic linkage** (the bond between monosaccharides to make di- and polysaccharides) (from condensation)



Monosaccharides Structural Isomers. (Aldoses, Ketoses)

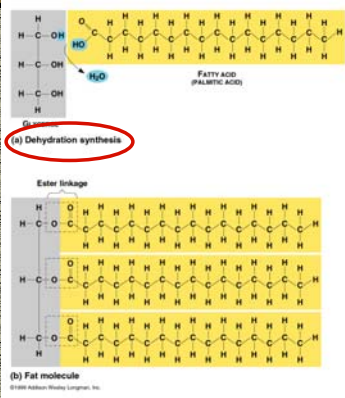
Lipids:

- Hydrophobic "water fearing"
- Mainly hydrocarbons (C & H)
- waxes, pigments, steroids, fats, phospholipids

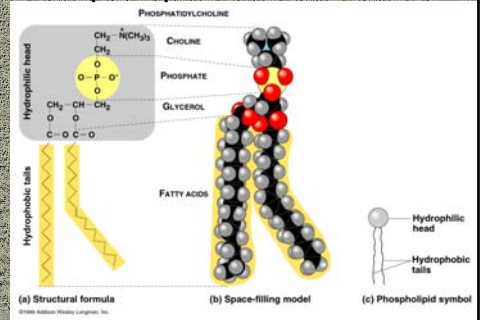


Lipids: FATS

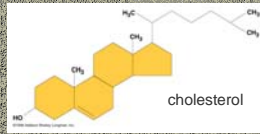
- Typical Fats = glycerol head and 3 fatty acid tails Fig 5.10
- Uses: High energy storage (long term fuel), cushions the body's organs, protection, insulation
- Atherosclerosis, arterio-, adipose cells
- Saturated v. unsaturated



Phospholipid (cell membranes)



Lipids: Steroids



Four fused rings (see fig 5.14)

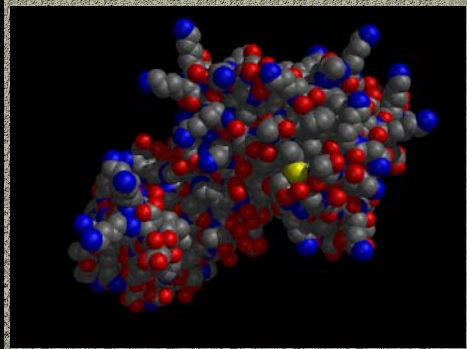
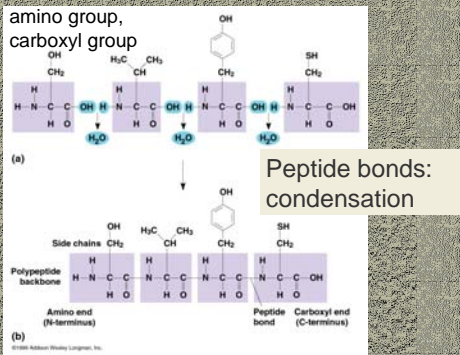
- Cholesterol (fig 4-8) and sex hormones
- **not made of polymers!**

NOTE: these are single units composed of 4 rings; they cannot be broken into smaller units.

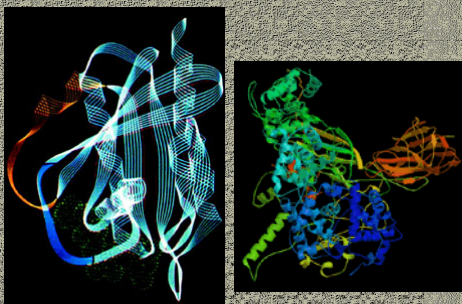
Proteins (peptides)

- Proteins (first place)
- For structural support, transport, signaling in the body, movement and defense against foreign substances, enzymes
- 20 amino acids; polypeptide chains

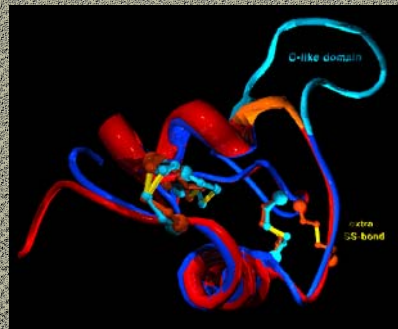
amino group,
carboxyl group



<http://merlin.mbc.berkeley.edu/3001/bcd/ForAll/Model/1c4r.gif>



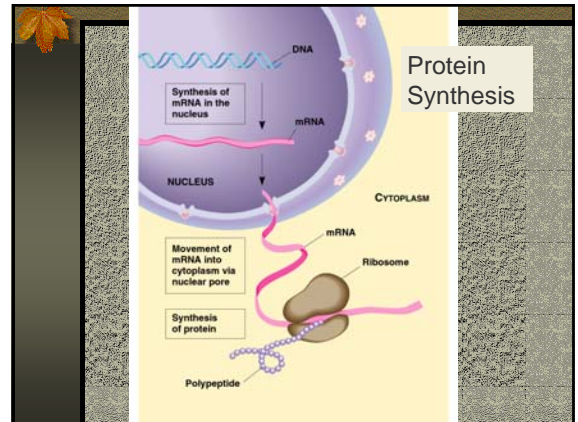
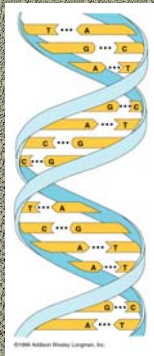
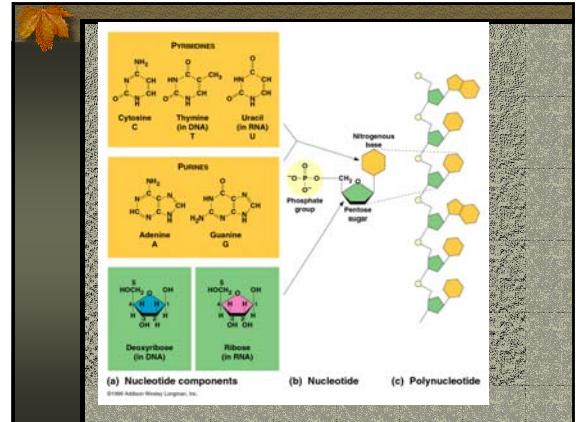
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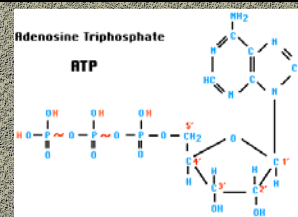
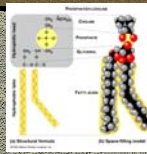
Nucleic acids:

- DNA (cell division) - double helix-1953
- RNA (protein synthesis) (ribosomes)
- Genes
- Know Figure 5.26, 5.27 !!
- What is a Nucleotide?
 - phosphate (negatively charged)
 - sugar (Ribose, deoxyribose)
 - base (pyrimidines C, T, U or purines A, G)
- DNA as tape measures of evolution (Table 5.2)
- ATP



Lipids: Phospholipids

- Only 2 fatty acid tails (C, H) & 1 phosphate group (- charge)
- Tails are hydrophobic, phosphates are hydrophilic (water-loving)
- micelle: **phospholipid bilayer**
- Selective: Cell membranes, brain tissue



- Adenosine (base)
- Ribose (sugar)
- Phosphates (3 of them)

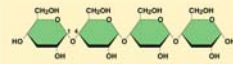
A few different movies with this chapter on the CD Rom



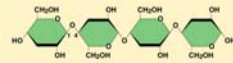
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Carbos. cont'd

- Polysaccharides
- Starch, glycogen, cellulose, chitin
- See also Fig 5.6



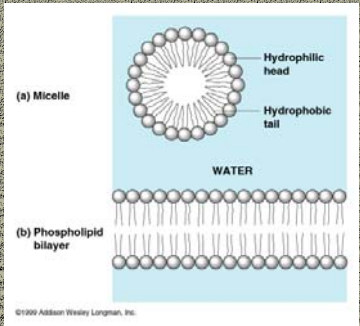
(b) Starch: 1-4 linkage of α glucose



(c) Cellulose: 1-4 linkage of β glucose

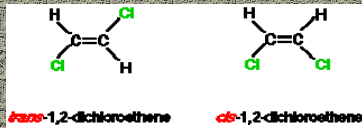
Starch and cellulose Fig 5.7

NAME SOME COMMON SOURCES OF CARBOS. IN OUR DIET



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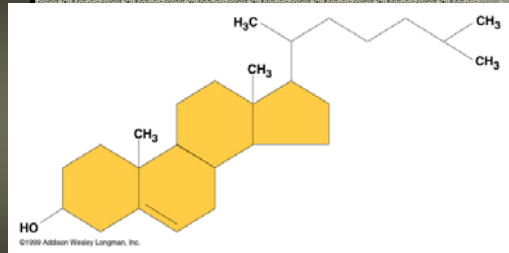
- Geometric isomer (involves a double bond)



trans-1,2-dichloroethene

cis-1,2-dichloroethene

Steroid example: cholesterol



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