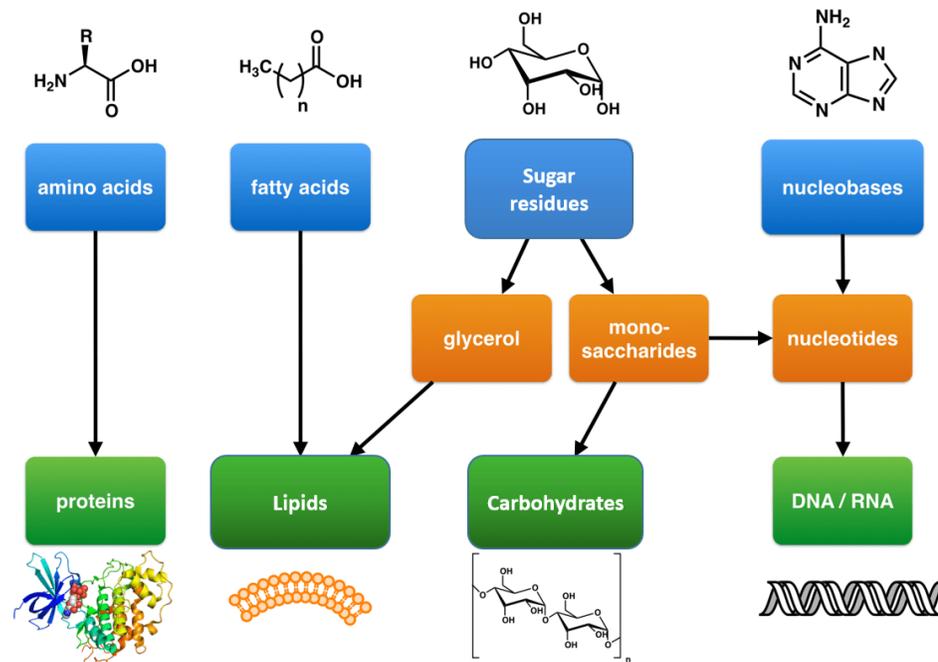


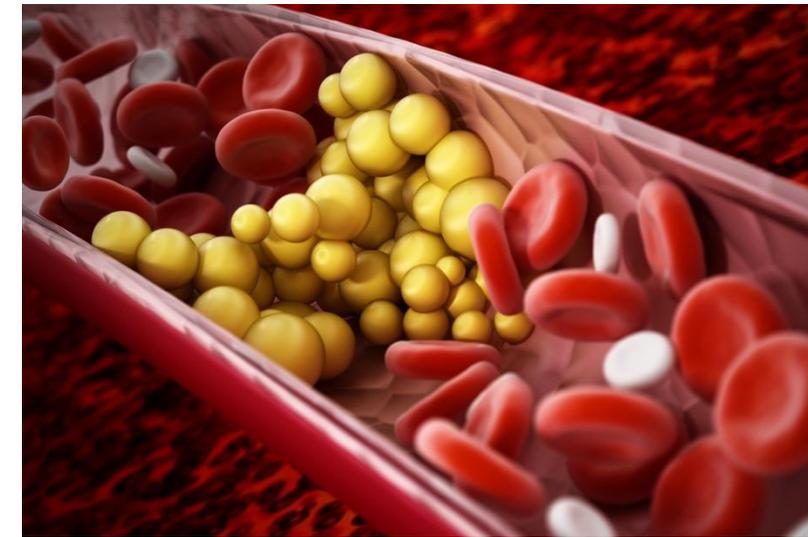
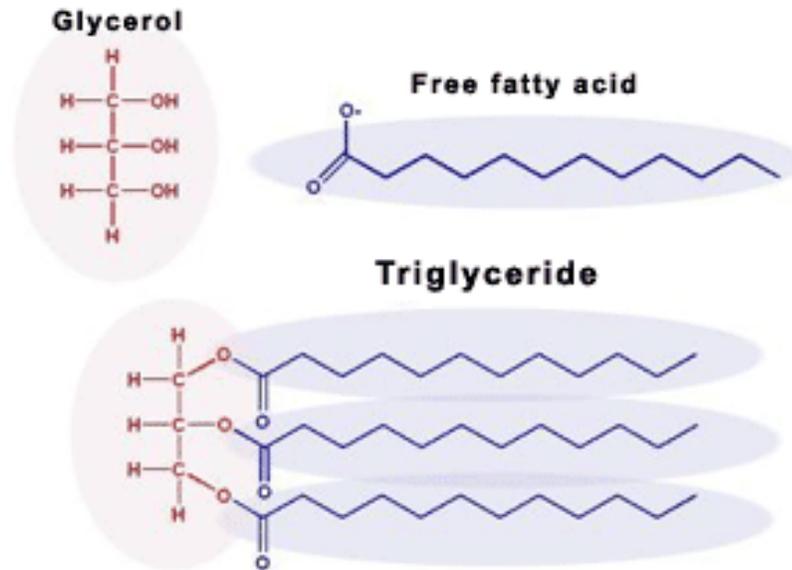
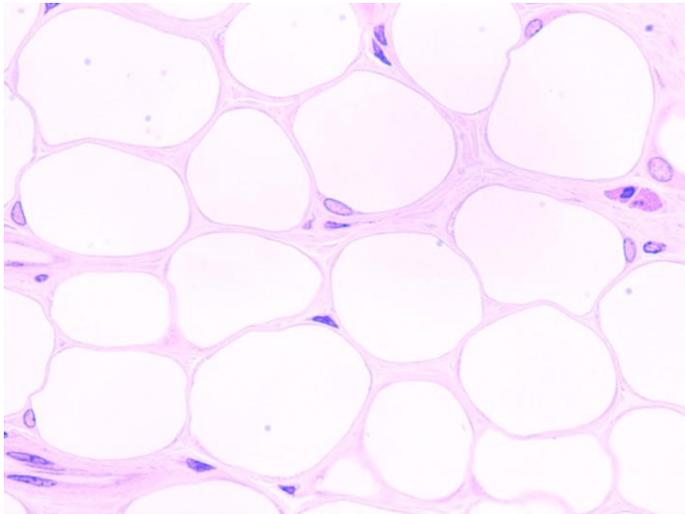
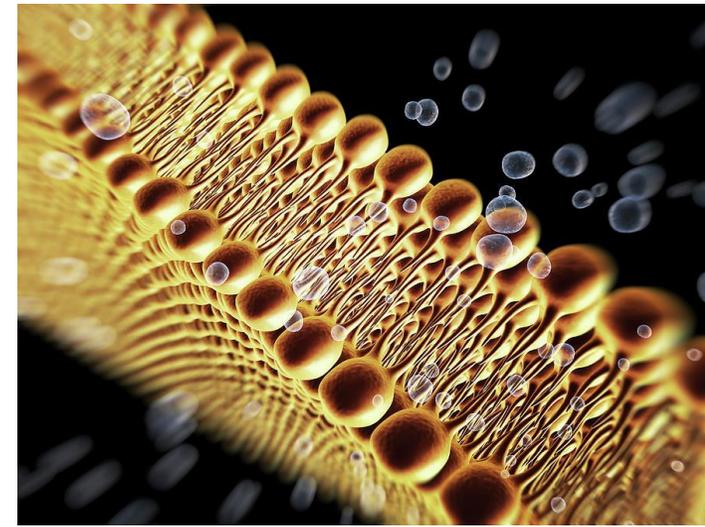
Lesson 2

Recognizing Macromolecules



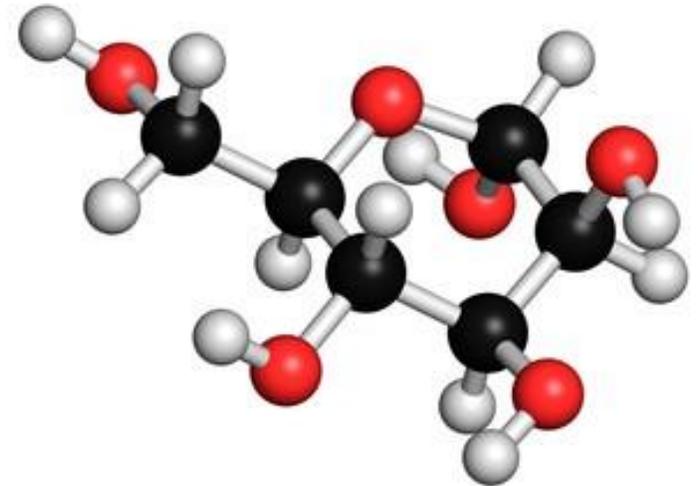
Recognizing macromolecules

- Macro = big → Macromolecules = BIG molecules
- 4 major classes of macromolecules in cells:
 - **Lipids**



Recognizing macromolecules

- Macro = big → Macromolecules = BIG molecules
- 4 major classes of macromolecules in cells:
 - Lipids
 - **Carbohydrates**



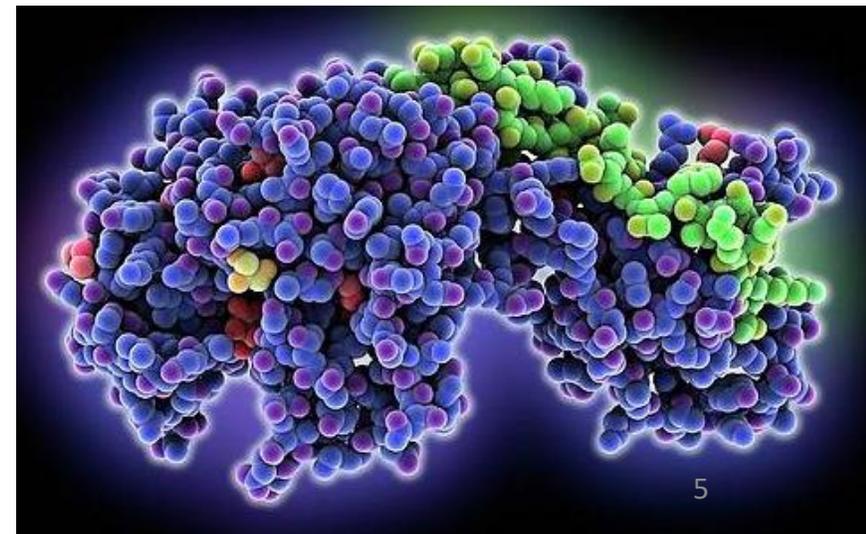
Recognizing macromolecules

- Macro = big → Macromolecules = BIG molecules
- 4 major classes of macromolecules in cells:
 - Lipids
 - Carbohydrates
 - **Nucleic acids**



Recognizing macromolecules

- Macro = big → Macromolecules = BIG molecules
- 4 major classes of macromolecules in cells:
 - Lipids
 - Carbohydrates
 - Nucleic acids
 - **Proteins**

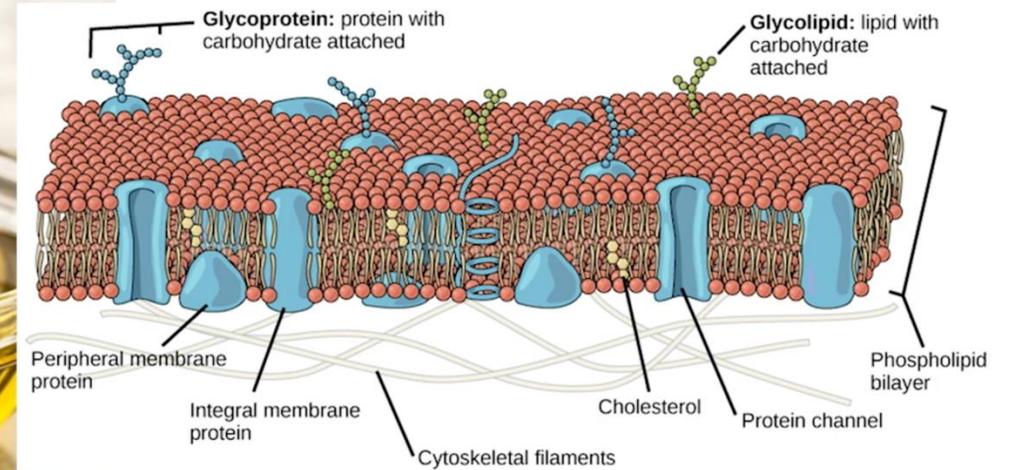


Recognizing macromolecules

- Macro = big → Macromolecules = BIG molecules
- 4 major classes of macromolecules in cells:
 - Lipids
 - Carbohydrates
 - Nucleic acids
 - Proteins
- They are often polymers → (monomer = M, polymer = M_n)

Lipids

- Membranes, signals, energy storage, protection
- Non-polar (hydrophobic) (**key attribute**)
- Or amphipathic (partly polar)
- Long chain or small



cell membranes

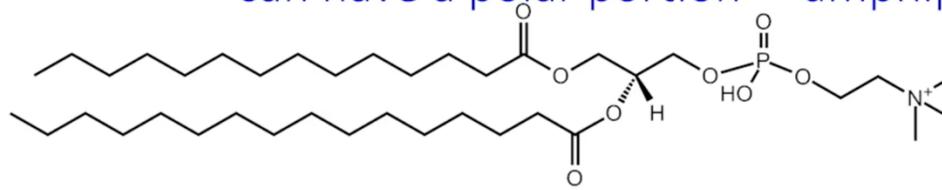
lipid functions

signaling

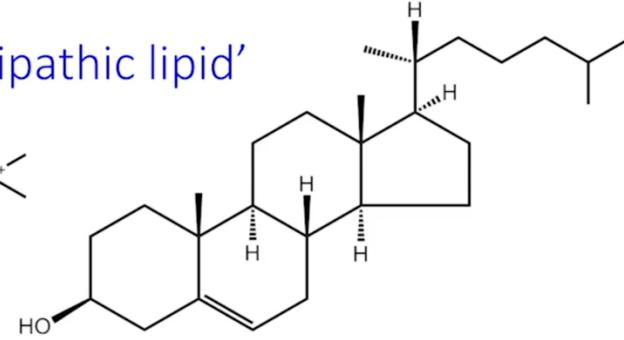


Lipids

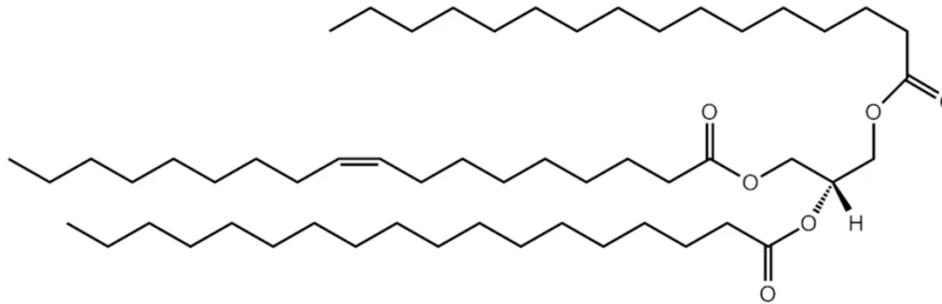
Lipids non-polar (hydrophobic)
can have a polar portion = 'amphipathic lipid'



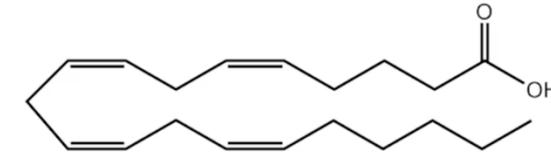
1-myristoyl-2-palmitoyl-*sn*-glycerophosphocholine
(Glycerophospholipids)



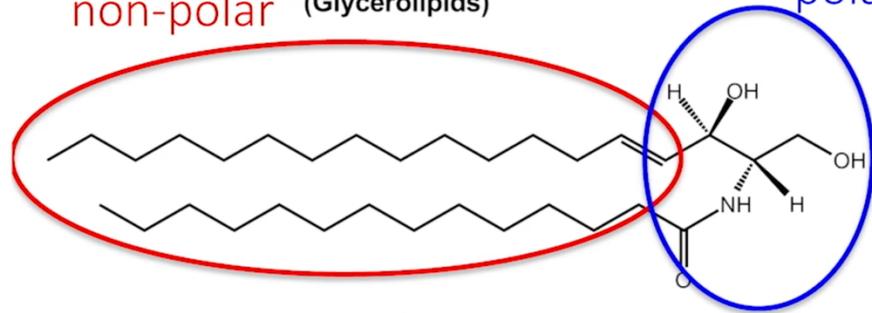
Cholesterol (Sterol lipids)



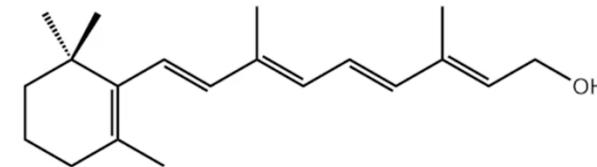
1-oleoyl-2-stearoyl-3-palmitoyl-*sn*-glycerol
non-polar (Glycerolipids)



Arachidonic acid (Fatty acyls)



N-myristoyl-sphing-4-ene
(Sphingolipids)



Retinol (Prenol lipids)

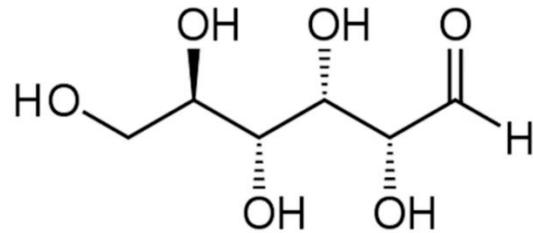
Carbohydrates

- Energy, information, structure
- Basic chemical formula CH_2O ($\text{C}_6\text{H}_{12}\text{O}_6$)
- Monomers (Ms) = monosaccharides (sugars)
- Polymers = polysaccharides (glycogen, starch, cellulose...)
- Ms joined by glycosidic bonds C-O-C

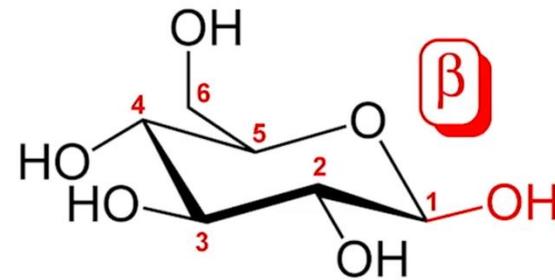
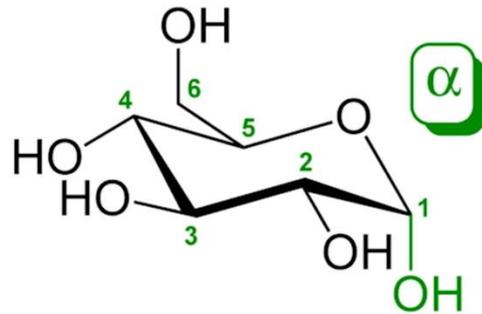
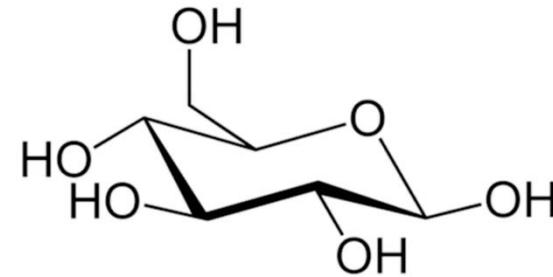


Carbohydrates

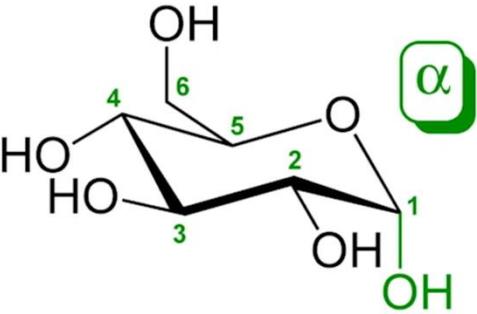
Glucose isomers



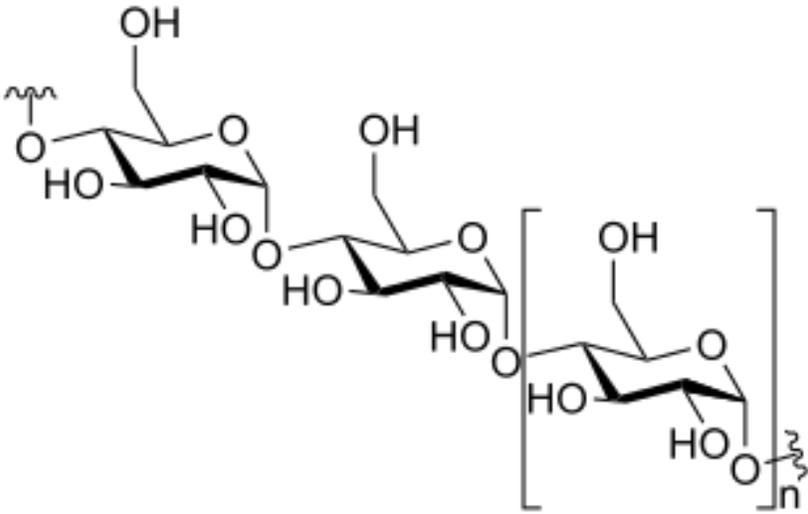
open chain



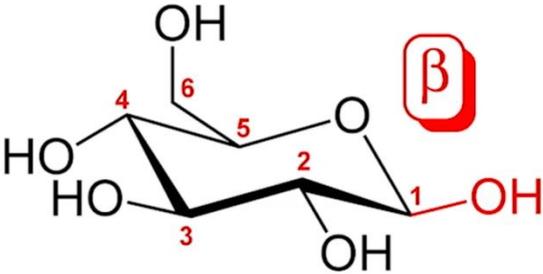
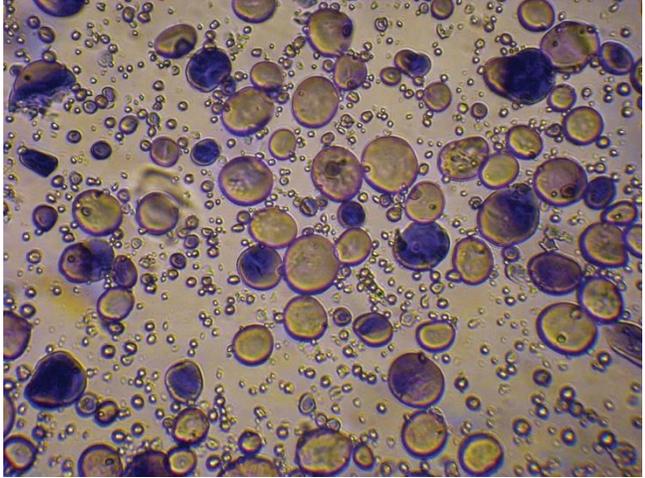
Carbohydrates



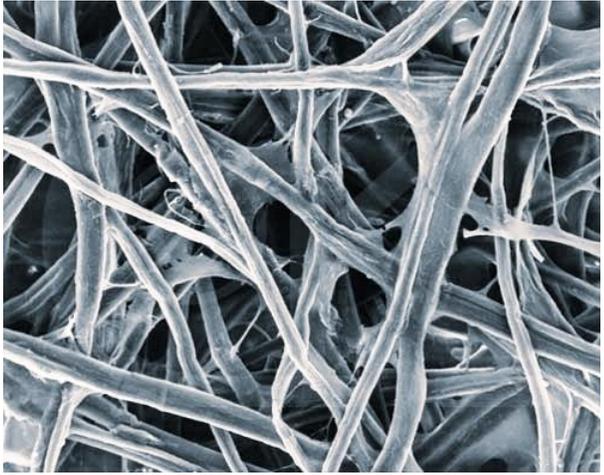
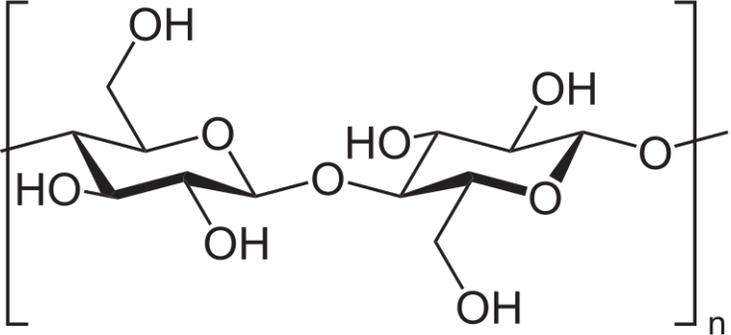
amylose



glycogen



cellulose



In starch \rightarrow α -1,4 in cellulose \rightarrow β -1,4. **WHAT CAN WE DIGEST AND WHY?**

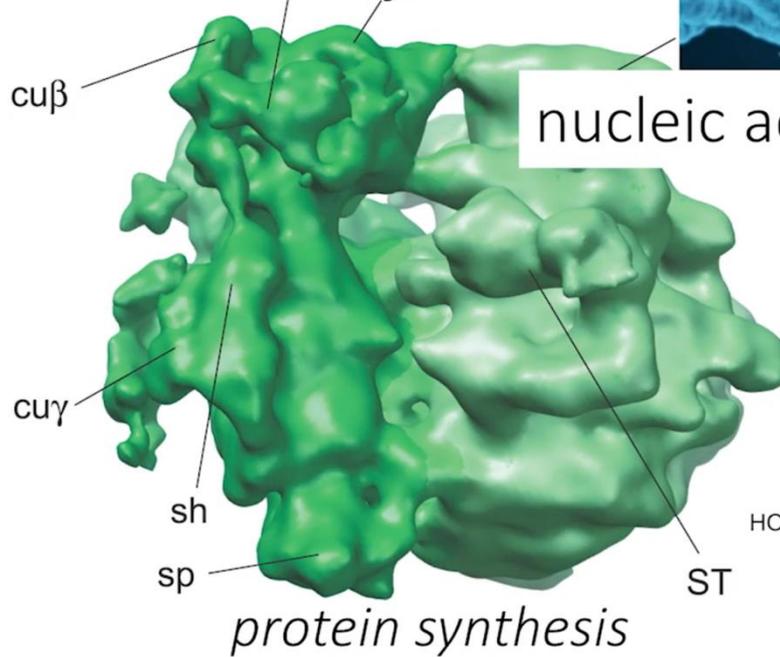
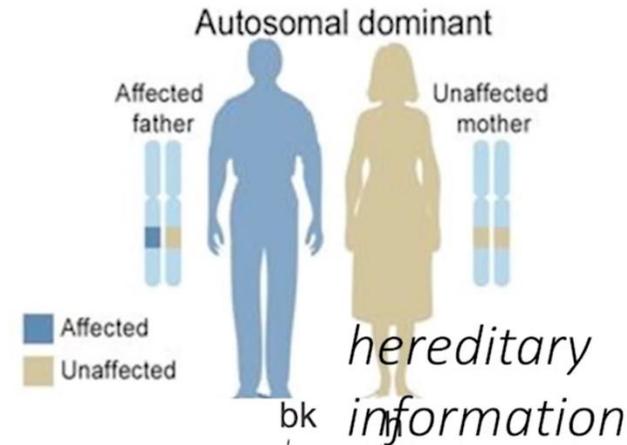
cellulose fibers

Nucleic acids

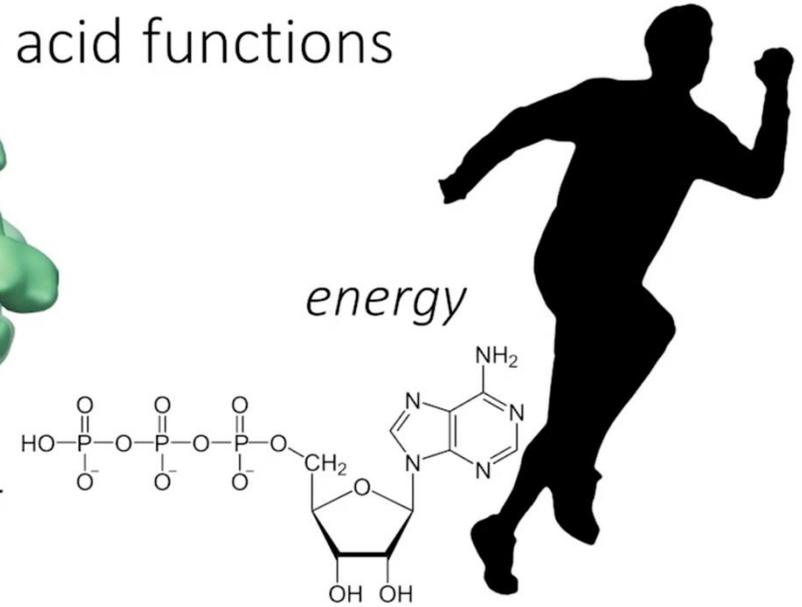
- Hereditary information (**genes**), energy
- Monomer (Ms) = nucleotides
- Polymers = DNA or RNA
- The nucleotide structure is stereotypical:

Phosphate-sugar-base (P-S-B)

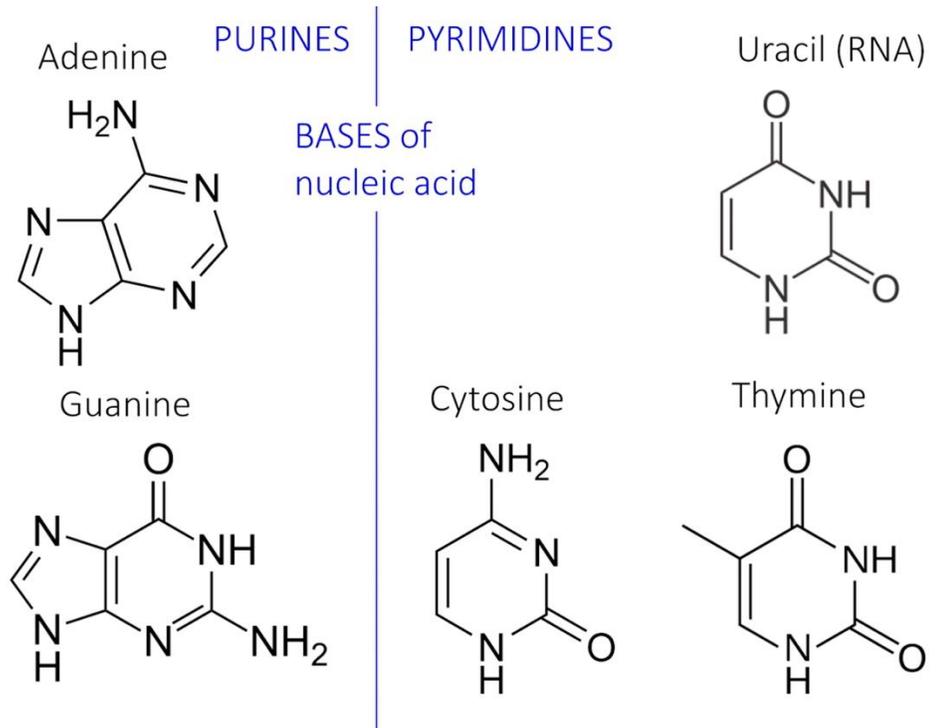
- Sugar = (5C) ribose (RNA) or deoxyribose (DNA)
- 5 bases:
 - **Adenine (A), Guanine (G) = PURINES**
 - **Cytosine (C), Thymine (T), Uracil (U) = PYRIMIDINES**
- **A,G,C,T = DNA**
- **A,G,C,U = RNA**



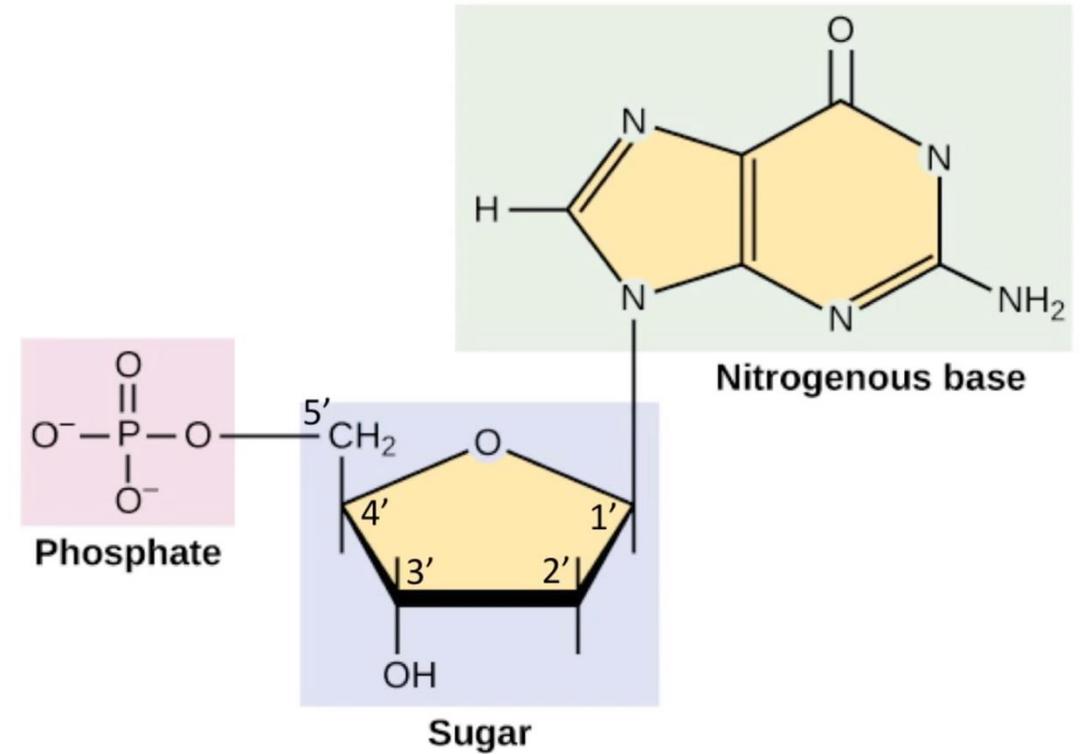
nucleic acid functions



Nucleic acids



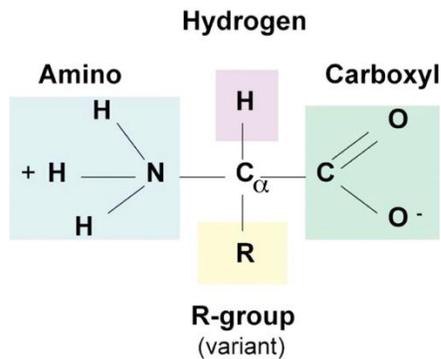
Nucleotide



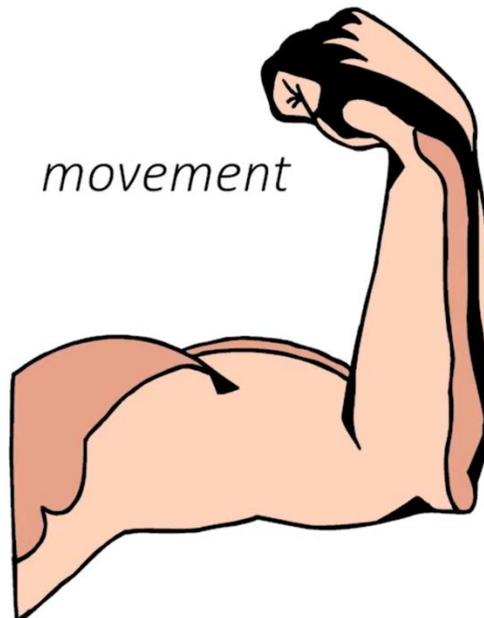
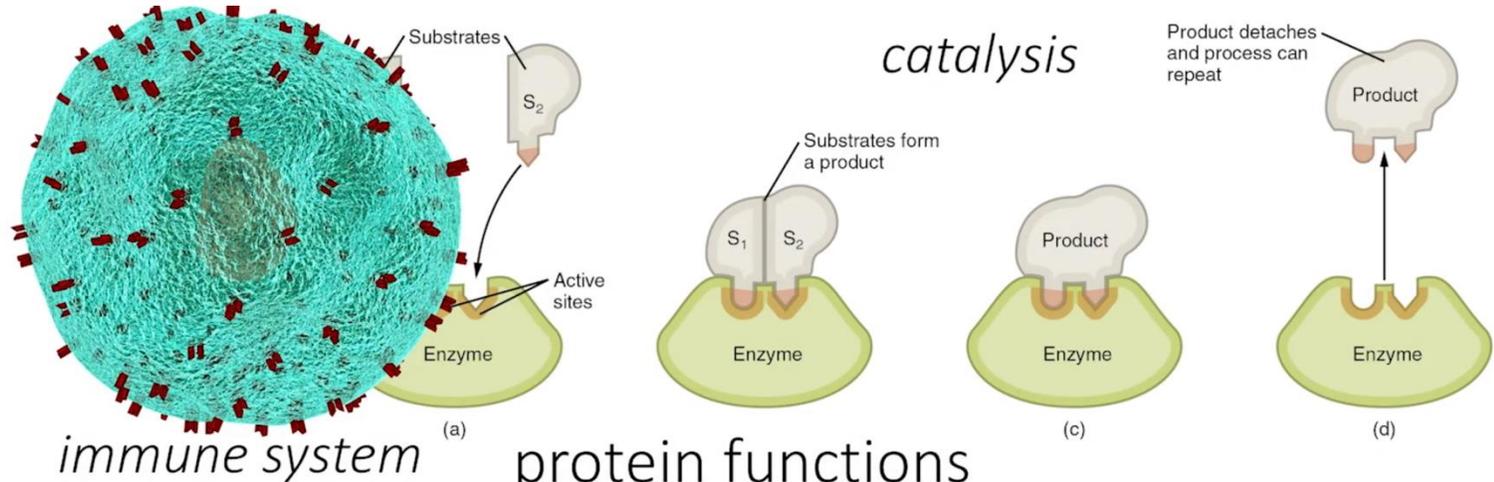
Note that the carbon atoms of the sugar are called C1', C2' etc
C1' is where the base attaches
C2' can have attached a H (as here, for DNA) or a OH group (for RNA)
C3' is very important and where the next nucleotide will join
C5' is where the phosphate group attaches

Proteins

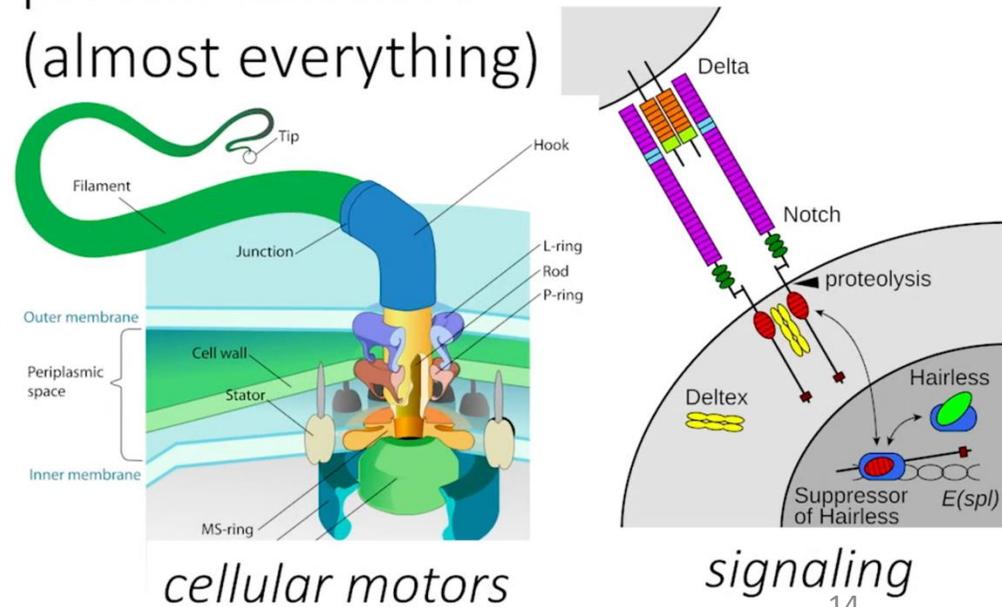
- Gene expression products
- Monomers (Ms) = amino acids
- **20 natural common amino acids**
- Polymer = protein
- Amino acid structure:
 $\text{Alpha C} + \text{NH}_2 + \text{COOH} + \text{R (side group)}$



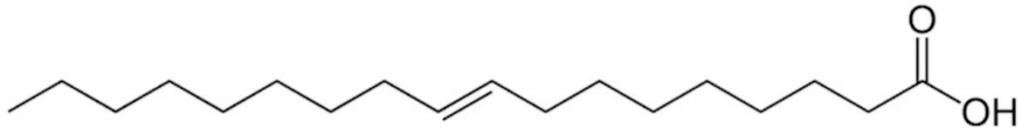
- R can be polar, non-polar, charged, uncharged
- Three or one letter code:
 - Valine = VAL
 - Valine = V



protein functions
(almost everything)

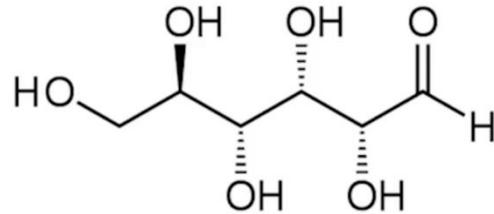


Recognizing macromolecules - review



trans-oleic acid

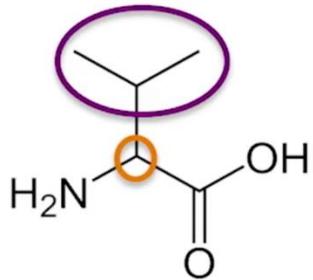
Lipids: **nonpolar**/hydrophobic



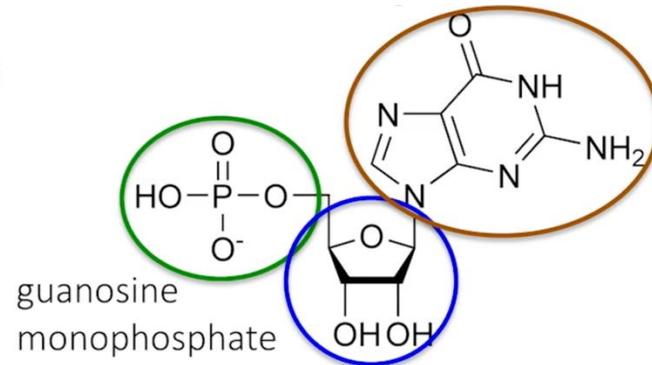
glucose

Carbohydrates: **CH₂O** formula/**polar**

valine



Proteins: M = **amino acid** = **α C** bonded to **NH₂, COOH**
and R, R = polar/nonpolar



guanosine
monophosphate

Nucleic acids: M = **nucleotide** = **phosphate + sugar + base, polar**