Macromolecules

- Finish functional groups
- Monomers and Polymers
  - dehydration and hydrolysis
- Carbohydrates
  - Sugars and starches
- Lipids
  - Fats and oils
  - Phospholipids
  - How soap works
- Nucleic Acids
  - Brief Overview only

Some functional groups form ions

\[
\text{R-COOH} \rightleftharpoons \text{R-COO}^- + \text{H}^+ \]

Each has a balance point

Ionizable Functional Groups

<table>
<thead>
<tr>
<th>Acids</th>
<th>Bases</th>
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<td>Carboxylic acid</td>
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<td>Most organic Acids 3 to 5</td>
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Understand the concept, but don’t memorize this

What happens when pH = 7.0?

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“Oily” Amines in fish

High pH
- Little H⁺
- NH₂ molecular form
- insoluble

Low pH
- Lots of H⁺
- NH₃⁺, ionized
- soluble

Macromolecules

- Carbohydrates
- Lipids
- Proteins
- Nucleic Acids
Macromolecules

Water

Proteins

Nucleic acids

Carbohydrates (polysaccharides)

Fats and lipids

Small molecules

Figure 5.2

(a) Dehydration reaction: synthesizing a polymer

Dehydration removes a water molecule, forming a new bond.

(b) Hydrolysis: breaking down a polymer

Hydrolysis adds a water molecule, breaking a bond.

Sugars

(Aldohexoses) (Ketohexoses)

Trioses: three-carbon sugars (C₃H₆O₃)

Glyceraldehyde

Dihydroxyacetone

Pentoses: five-carbon sugars (C₅H₁₀O₅)

Ribose

Ribulose

Hexoses: six-carbon sugars (C₆H₁₂O₆)

Glucose

Galactose

Fructose

Simple sugars can be linked by Dehydration reactions

Sucrose is a common disaccharide: Glucose + Fructose

Monosaccharides

Glucose

Ribose

Other common disaccharides

Sucrose (glucose and fructose)

Lactose (galactose and glucose)

Maltose (glucose and glucose)

Do not memorize
Cellulose

Small difference in structure, big difference in function.

Starch:

Cellulose:

Lipids (fats and oils)

Fats or triglycerides
(glycerol + 3 fatty acids)

Fried dough with lard . . . .

Fats or triglycerides
(glycerol + 3 fatty acids)

Fat molecule

What are trans fats?

Solid

Liquid

Saturated

Unsaturated or Polyunsaturated

hydrophilic or hydrophobic?
Polar (charged) Head

“Amphipathic”

Very Hydrophobic Tail

In water they can form a “micelle” -- why?

Fatty Acids

• Phospholipids
  – Glycerol + 2 fatty acids + phosphate

How will phospholipids behave in water?

Phospholipid Bilayer

Form Boundaries

Nucleic Acids

ATP

Nucleotides have three components

• Sugar
• Base
• Phosphate

Use dehydration reactions to connect these molecules

Nucleotides are the building blocks of the nucleic acids

SUGAR

Carbon’s in the sugar are numbered with primes

Nucleotides