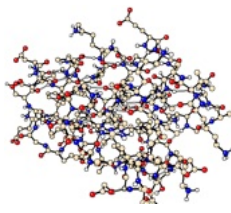


# Macromolecules

carbohydrates, lipids, proteins, nucleic acids

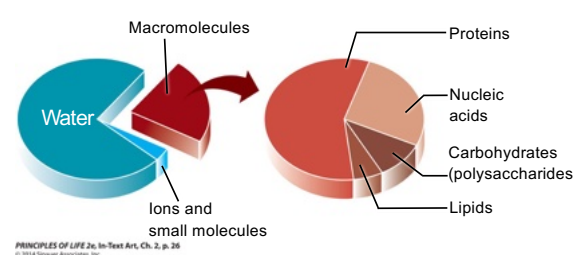


- Monomers and Polymers
  - dehydration reactions
- Carbohydrates
  - Sugars and starches
- Lipids
  - Fats and oils
  - Phospholipids
  - How soap works
- Start proteins, if time

8 Sept. 2023

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# Macromolecules



Water

Ions and small molecules

Proteins

Nucleic acids


Carbohydrates (polysaccharides)

Lipids

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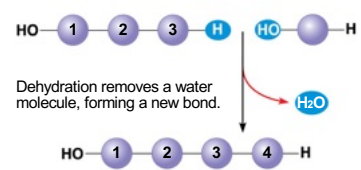
# Carbohydrates



3

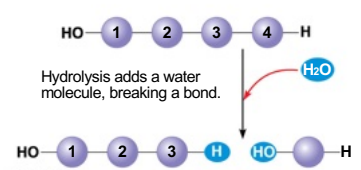
# Polymers

(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.

Figure 5.2

4

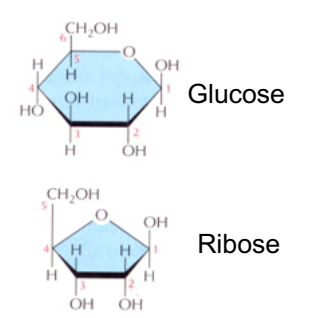
# Sugars

(Understand, but don't memorize structures)

Aldoses (Aldehyde Sugars)		Ketoses (Ketone Sugars)	
Trioses: three-carbon sugars (C <sub>3</sub> H <sub>6</sub> O <sub>3</sub> )			
Glyceraldehyde	Dihydroxyacetone	Glyceraldehyde	Dihydroxyacetone
Pentoses: five-carbon sugars (C <sub>5</sub> H <sub>10</sub> O <sub>5</sub> )			
Ribose	Ribulose	Ribose	Ribulose
Hexoses: six-carbon sugars (C <sub>6</sub> H <sub>12</sub> O <sub>6</sub> )			
Glucose	Galactose	Fructose	Fructose

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# Monosaccharides



Glucose

Ribose

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### Simple sugars can be linked by Dehydration reactions

**Sucrose is a common disaccharide:  
Glucose+Fructose**

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### Other common disaccharides

Do not memorize

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### Cellulose is a glucose polymer

Cellulose molecules

β Glucose monomer

Fig. 5-8

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### Starch and Cellulose are polymers of glucose

**Starch**

**Cellulose**

Small difference in structure, big difference in function!

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## Lipids (fats and oils)

Fried dough with lard . . .

http://www.johnnyjet.com/images/PicForNewsLetter1JulyMarch2005FRIEDDOUGHHLRD.JPG

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### Fats or triglycerides (glycerol + 3 fatty acids)

Dehydration reaction

(a)

**Fat molecule**

hydrophilic or hydrophobic?

Figure 5.11

12

**FATS**  
Solid

**WHY?**

**OILS**  
Liquid

stearic acid

oleic acid

This double bond is rigid and creates a kink in the chain. The rest of the chain is free to rotate about the other C-C bonds.

Saturated

Unsaturated or Polyunsaturated

Like Fig 5-12

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**What are trans fats?**

Hydrophilic heads

Hydrophobic tails

Soap micelle

Greasy mess on plate

- Grease is attracted to the interior of the micelle

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**Fatty Acids**

Polar (charged) Head

Very Hydrophobic Tail

“Amphipathic”

In water they can form a “micelle”

-- why?

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**Why soap works**

Hydrophilic heads

Hydrophobic tails

Soap micelle

Greasy mess on plate

- Grease is attracted to the interior of the micelle

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• Phospholipids  
– Glycerol + 2 fatty acids + phosphate

Hydrophilic head

Hydrophobic tails

Fatty acids

Choline

Phosphate

Glycerol

How will phospholipids behave in water?

Hydrophilic “head”

Hydrophobic “tails”

(a) Structural formula

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**Phospholipid Bilayer**

Hydrophilic head

Hydrophobic tails

Form Boundaries

phospholipid bilayer or membrane

phospholipid molecule

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