Macromolecules

Warm Up #8

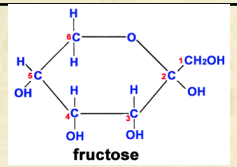
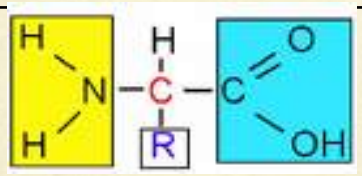
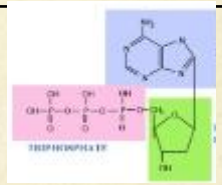
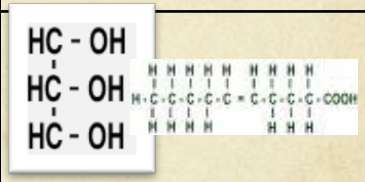
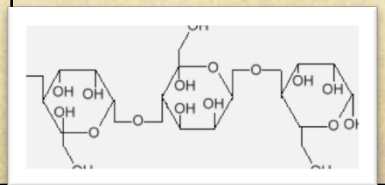
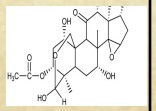
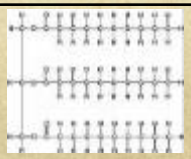
- What is a carbohydrate?
- What is a protein?

Read *Macromolecules*

- As you read the article, complete the accompanying Biomolecule Chart
  - This chart MUST be glued into your Notebook!
  - HINT: To complete the *Elements Present* line, look at the illustrations of the MONOMERS.
- When you have completed the reading, work on the Macromolecule Review Questions on the Handout at the front of the room.

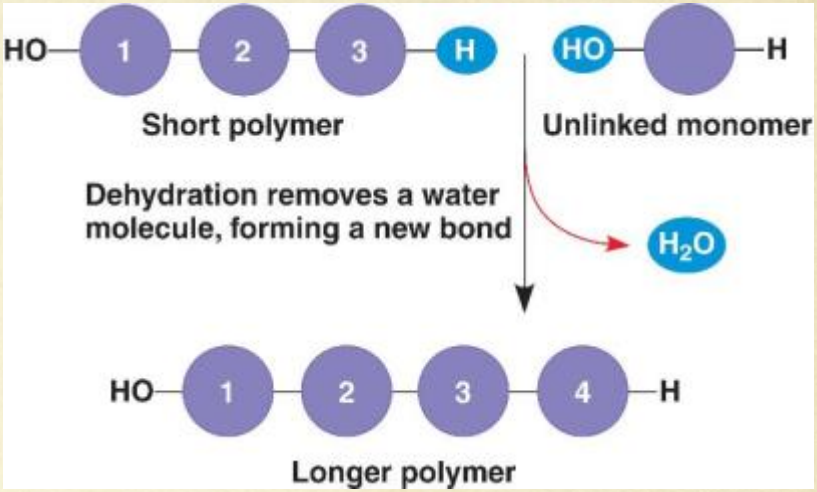
Warm-up #9

- Think back to your reading and review questions yesterday…what type of bonds hold polymers together?

Name of Macro-molecule	Carbohydrates	Proteins	Nucleic Acids	Lipids
Elements	C, H, O	C, H, O, N	C, H, O, N, P	C, H, O
Function	1˚ E Source, E storage (animals-glycogen, plants-start), Plant structure (cellulose)	Control rxn rate & cell processes, build body (bones, muslces, expression of DNA)	Store and transmit genetic info	Cell membranes, protect skin, hormones and vitamens, water-proofing, long-term E storate
Monomer name	Mono-saccharide/ Simple Sugar	Amino Acid	Nucleotide	Glycerol and fatty acids
Monomer Structure				
Polymer name	Disaccharide/ Polysaccaride/Starch/ Glycogen	Polypeptide/ Protein	Nucleic Acid (DNA, RNA)	Lipids, fats, oils, waxes
Polymer Structure		1- order aas, 2- folding, 3- 3D 4- >1 polypeptide 		

Dehydration Synthesis

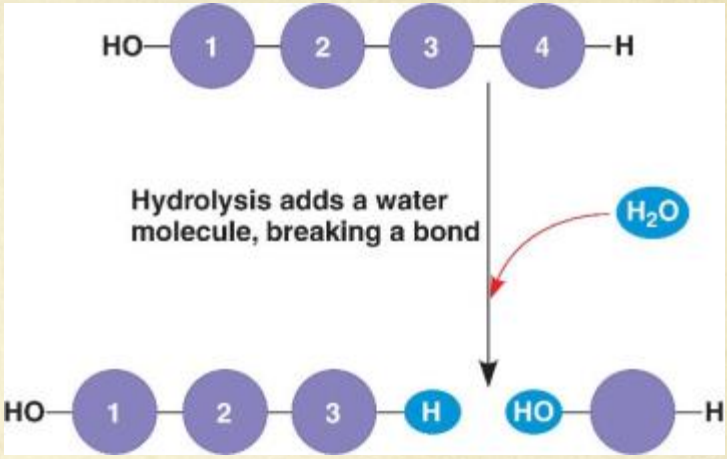
- The chemical reactions that bond together macromolecules are similar and REQUIRE water
- To allow a bond between monomers, a H atom and a OH molecule are removed from the ends of each monomer
  - The H and OH come together to form a water (H2O) molecule
- This is called **Dehydration Synthesis**



Dehydration – losing water
Synthesis – to create

Hydrolysis

- When macros. are consumed, they must be broken down during digestion
- To break the covalent bond btn polymers, a water molecule must be split and are used to fill the space created by the broken bond



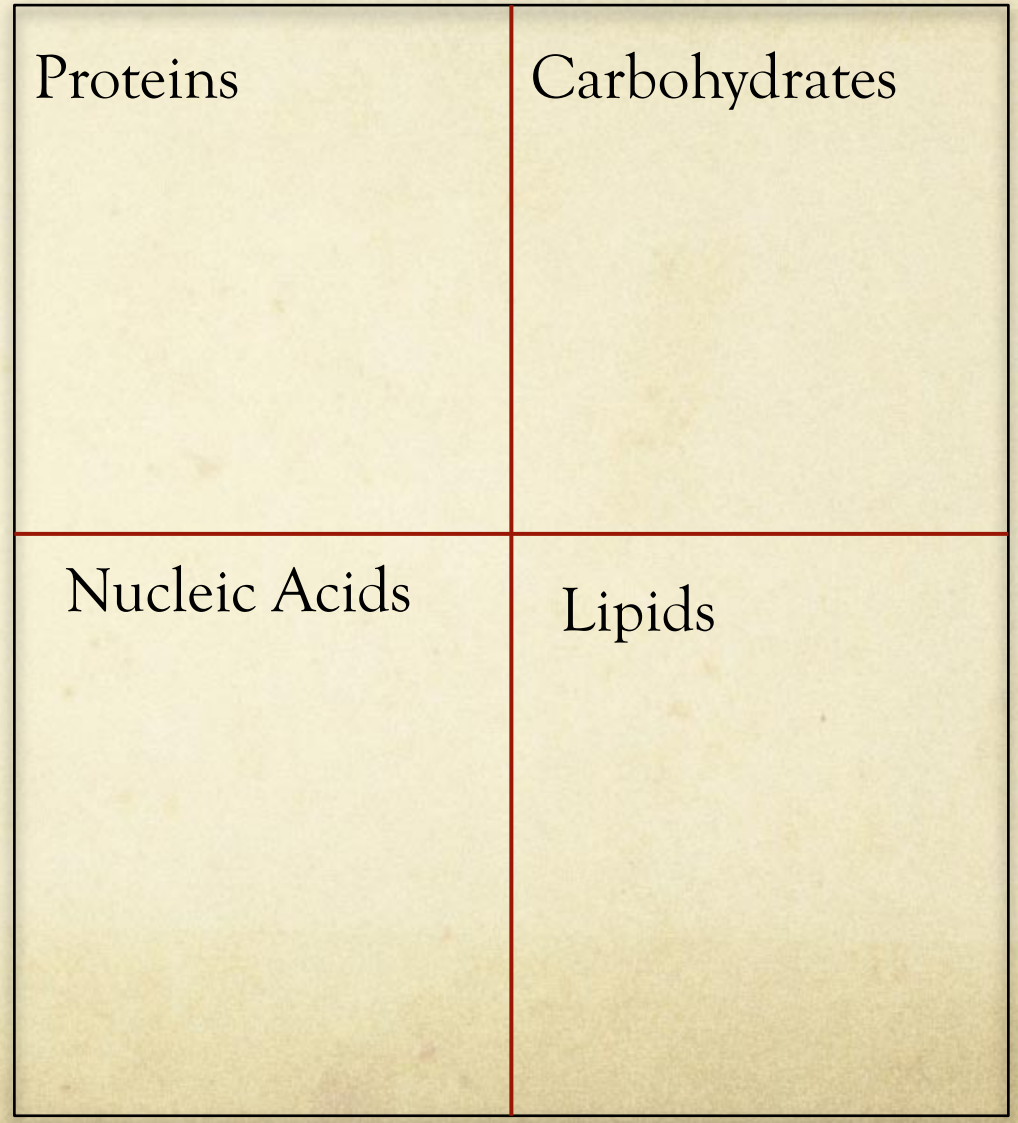
Hydro – water
Lysis- split apart

Building Macromolecules

- Our bodies are amazing machines capable of breaking down and building up complex molecules required for life. Since these molecules are microscopic, it is easier to understand how they are built using models. In this part of the activity, your team will be modeling dehydration and hydrolysis reactions to obtain a better understanding of these processes.

Building Macromolecules

- Divide a page in your Notebook to look like the demo page to the right
- Working with your elbow partner, gather the necessary supplies:
  - Instructions
  - Baggies of pieces

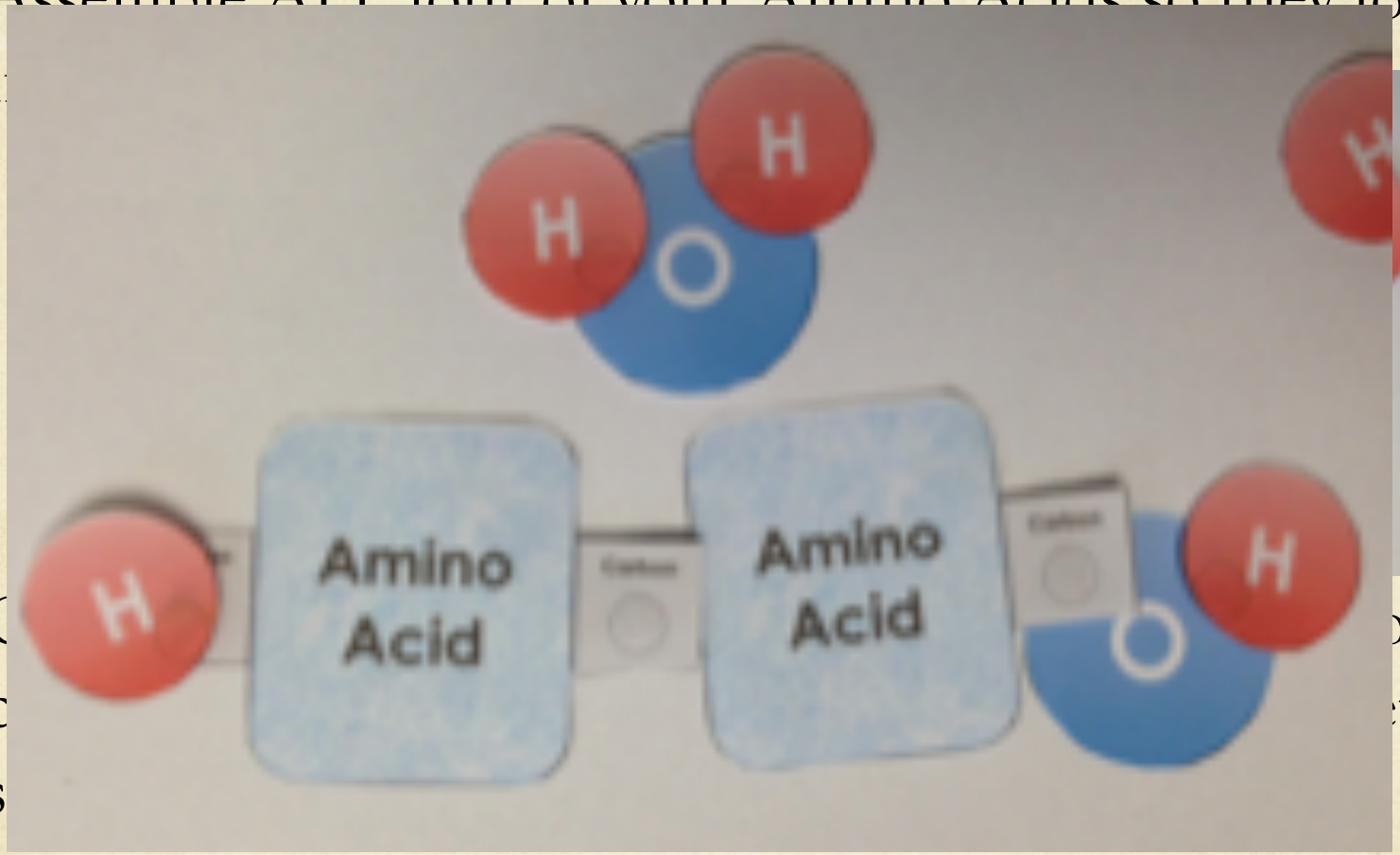


Building Macromolecules

- Following the provided instructions perform dehydration and synthesis reactions for the FOUR different Macromolecules
  - Be sure to answer the questions in the appropriate section of your page!
  - Each box should include illustrations!
- Once you have completed all reactions, work on the "Building Macromolecules" review questions

Building Macromolecules: Proteins

- Assemble ALL four of your Amino Acids so they look l



- C o
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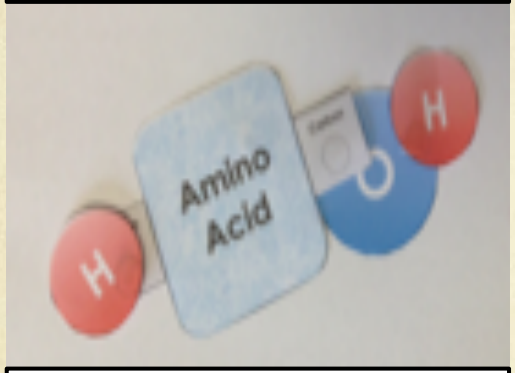
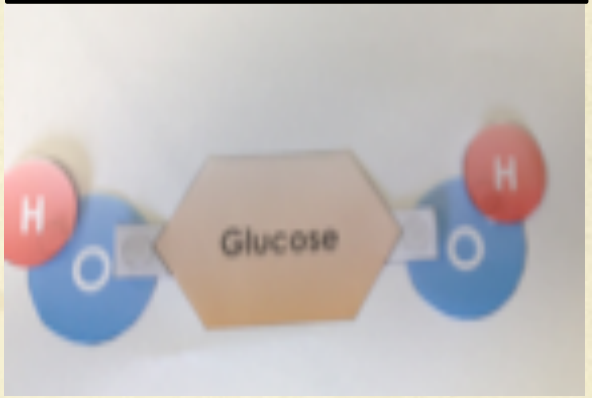
s

As you start each new section, you will need to rearrange your molecules to look like the diagrams below. It is ESSENTIAL that all FOUR of your monomers look like the monomers below before you start your dehydration and hydrolysis rxns!

Amino Acids

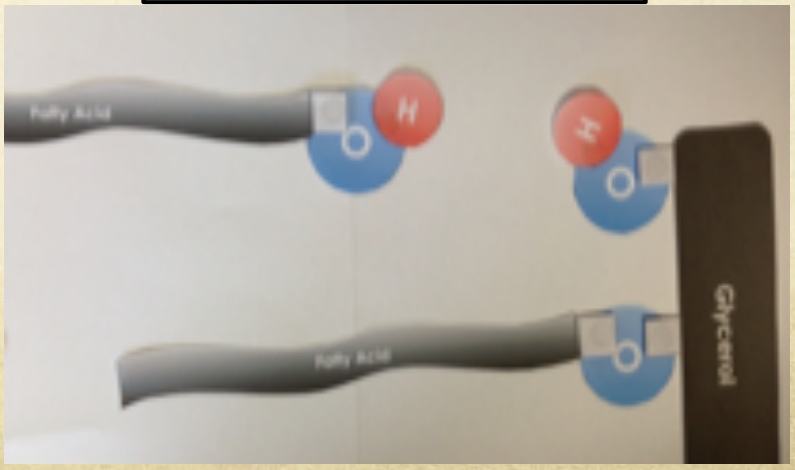


Carbohydrates



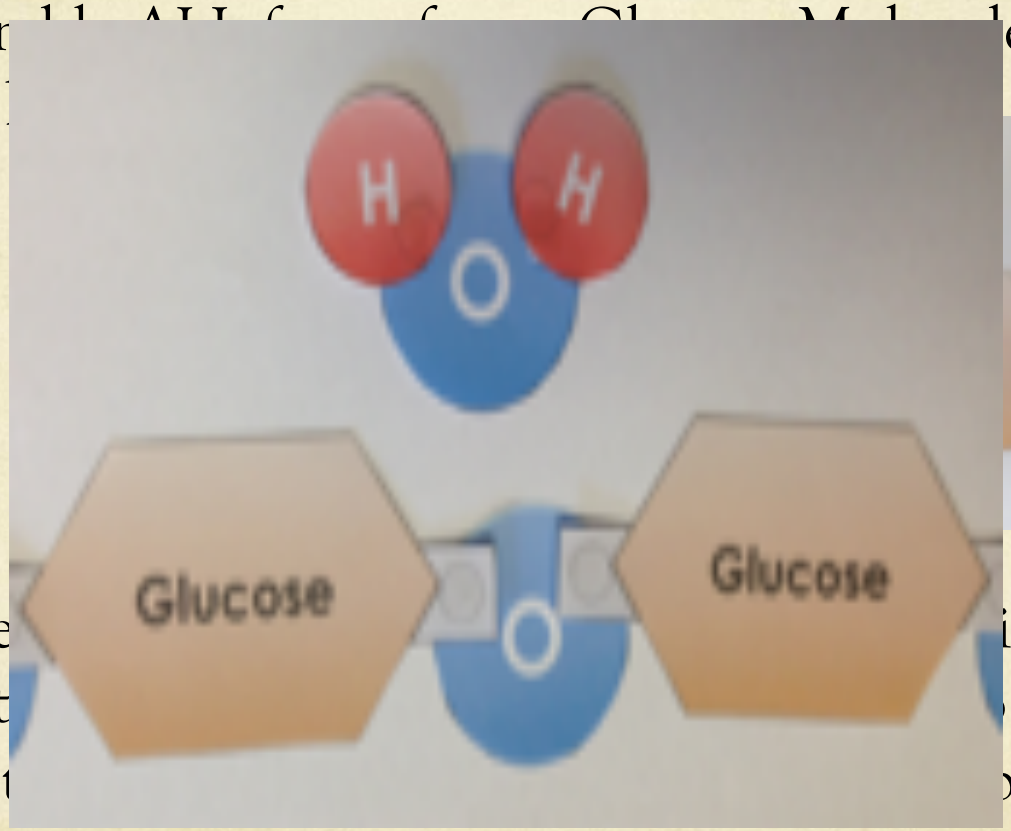
Nucleic Acids

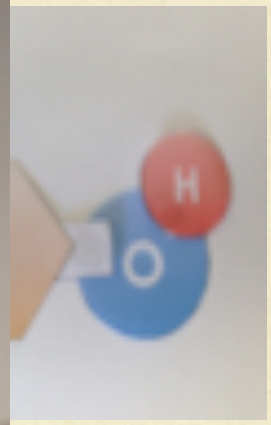
Lipids



Building Macromolecules: Carbohydrates

- Asser[illegible]es so they look [illegible]





- Once [illegible]ions to const[illegible] NOT forget[illegible]book!

Building Macromolecules: Nucleic Acids

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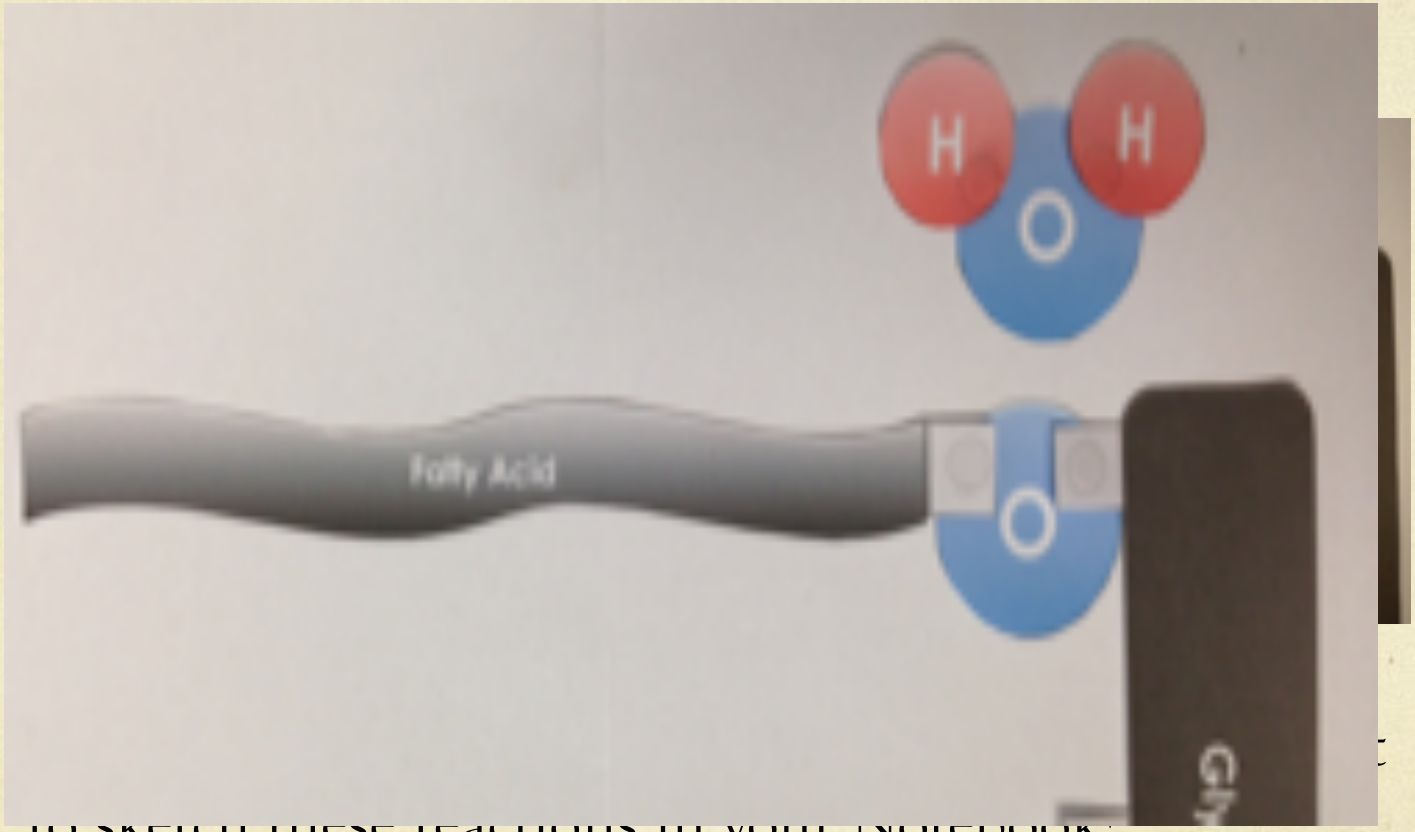
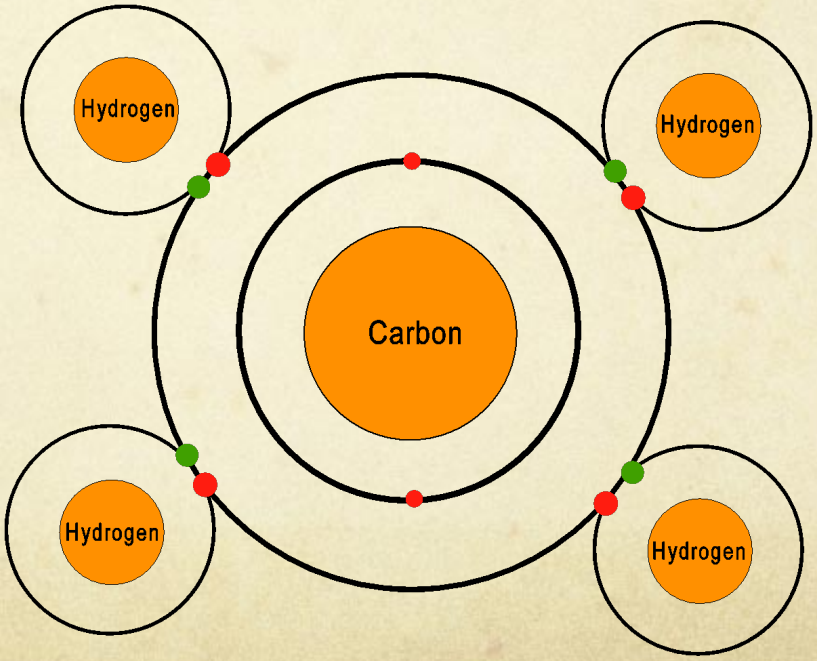
Building Macromolecules: Lipids



to sketch these reactions in your Notebook.

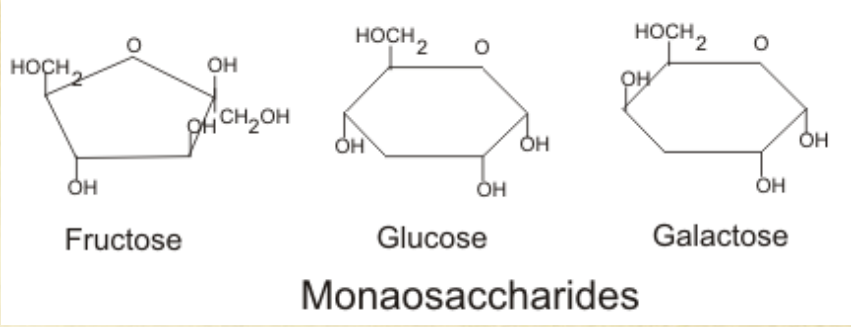
Carbon

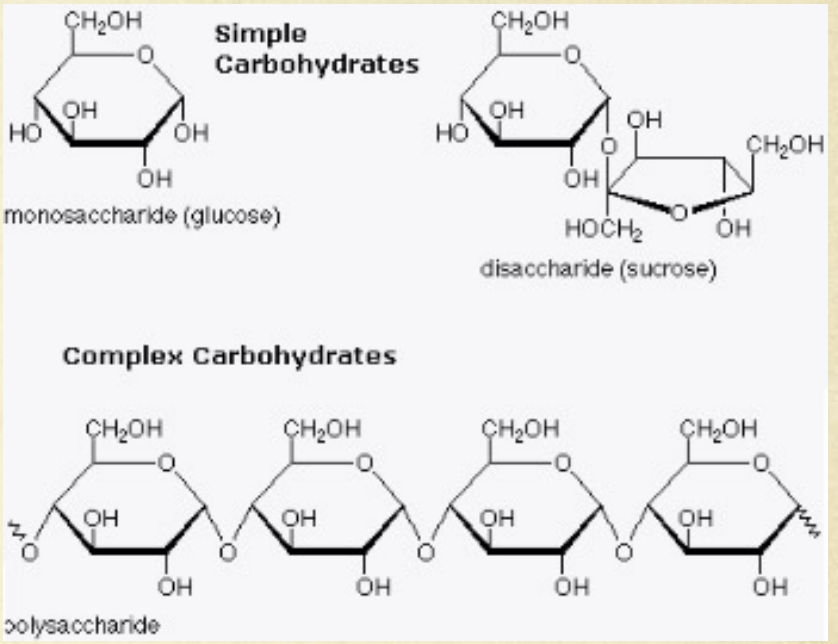
- C has 4 outer valence electrons meaning that it can form 4 bonds
- It can form single, double, triple, even quadruple bonds with other elements, making it a very unique and versatile elements

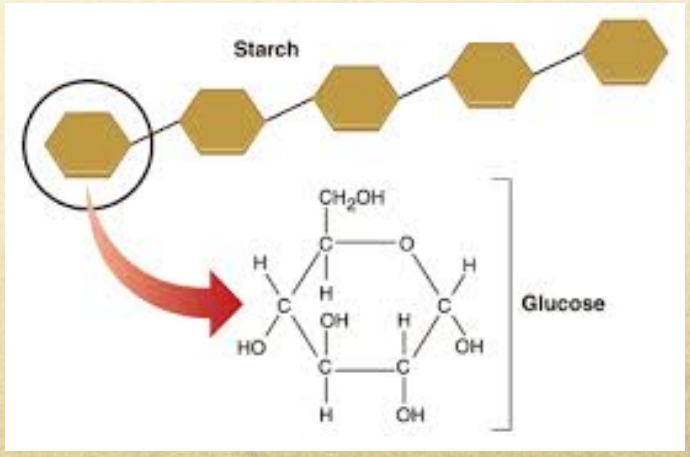


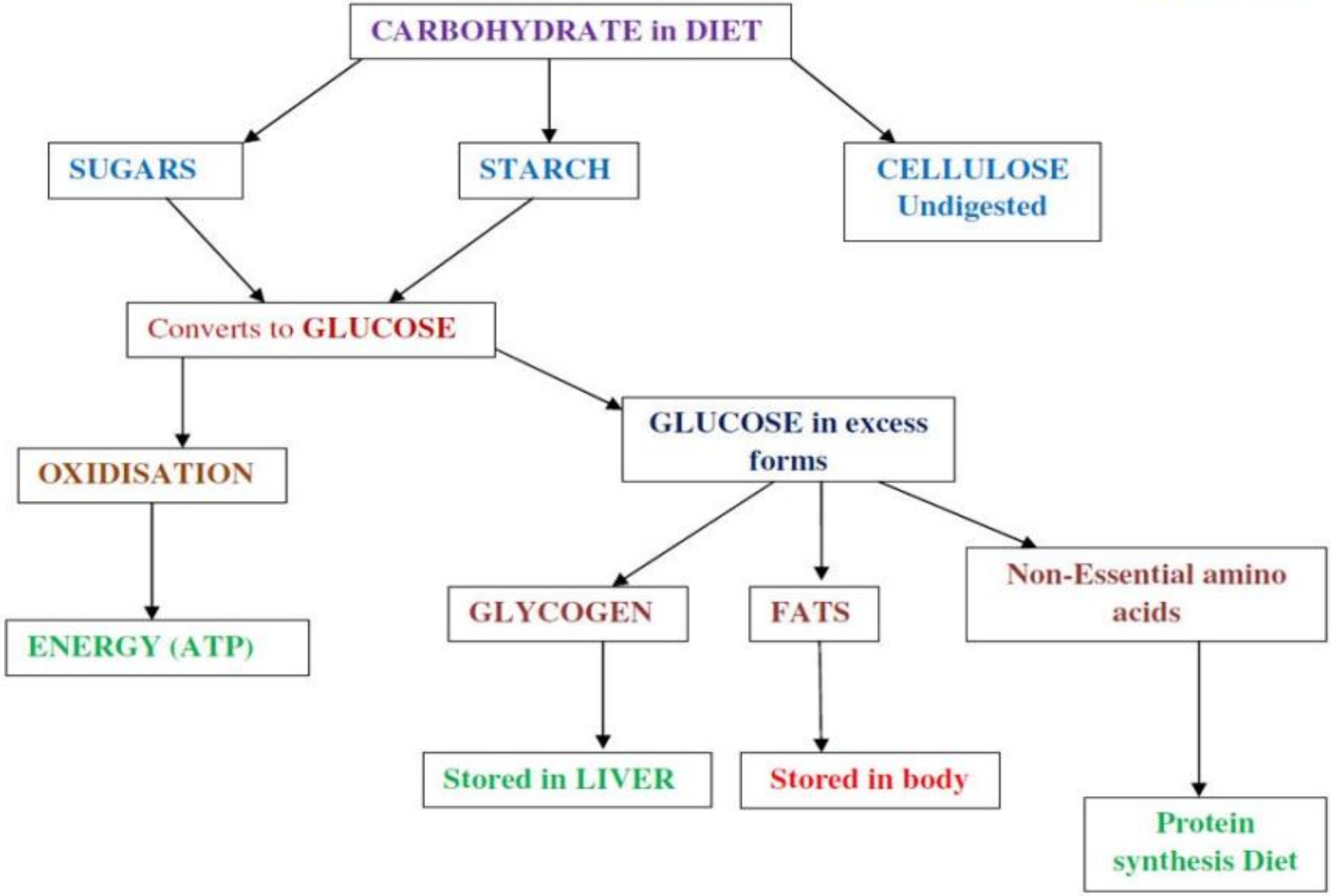
Carbohydrates

- Elements
  - Carbon, Hydrogen, and Oxygen
- Primary Energy source for cell (fuel for life)
- Monomer
  - Monosaccharides (major nutrients for cells)
- Disaccharides
  - 2 monosac.s linked together
- Polysaccharides: multiple monosac.s linked together









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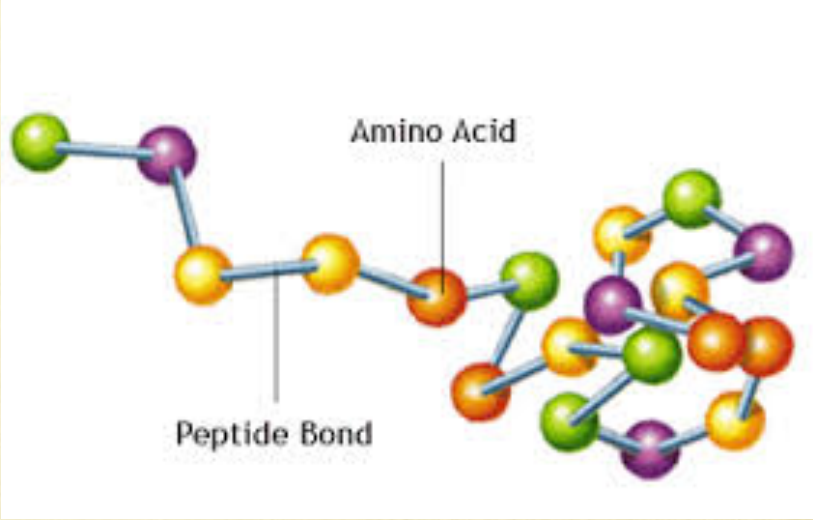
Proteins

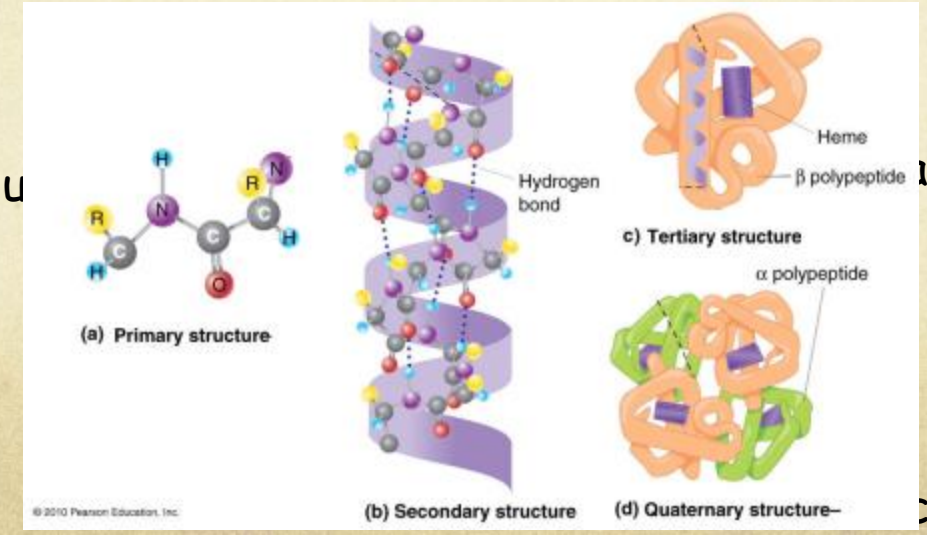
- Elements
  - Carbon, Hydrogen, Oxygen, and Nitrogen
- Function
  - Control reaction rates and cell process
  - Build body (bones, muscle)
  - Physical expression of DNA!
- Monomer
  - Amino acids
- Polymer
  - Protein
- Amino Acids are joined together by PEPTIDE bonds to create proteins



Protein Structure

- 20 different Amino Acids
  - Humans naturally produce 10
  - The other 10 "Essential AA" b/c we must get them from our diet
- 4 Structural levels of polypeptides/proteins
  - Primary structure- order of amino acids
  - Secondary structure- coils/pleats (folds)
  - Tertiary structure- 3-D
  - Quaternary structure- more than 1 polypeptide

Amino Grou



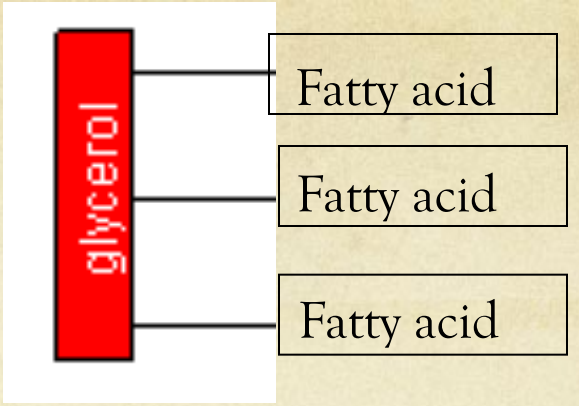
rboxyl Group

changes

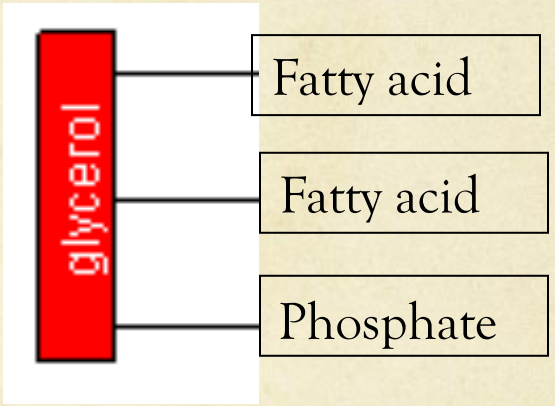
cids!

Lipids

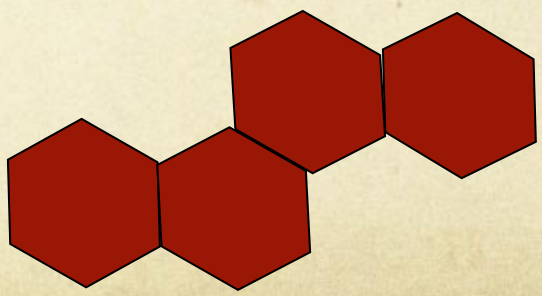
- Elements
  - Carbon, Hydrogen, and Oxygen
- Function
  - Essential components of all cells (cell membrane)
  - Energy storage/reserve
- Monomers
  - Glycerol
  - Fatty Acids
- Three major lipids in the body
  - Triglycerides, phospholipids, and cholesterol



Triglyceride



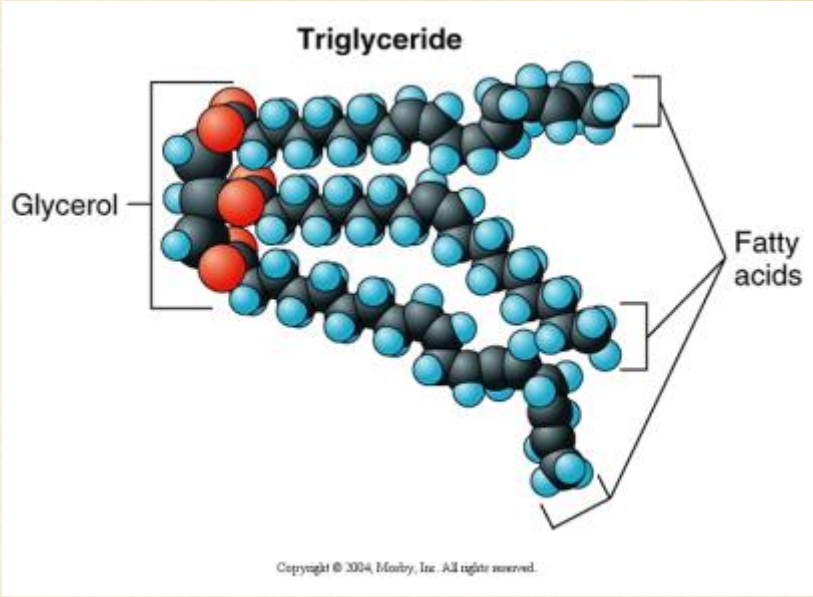
Phospholipid



Cholesterol

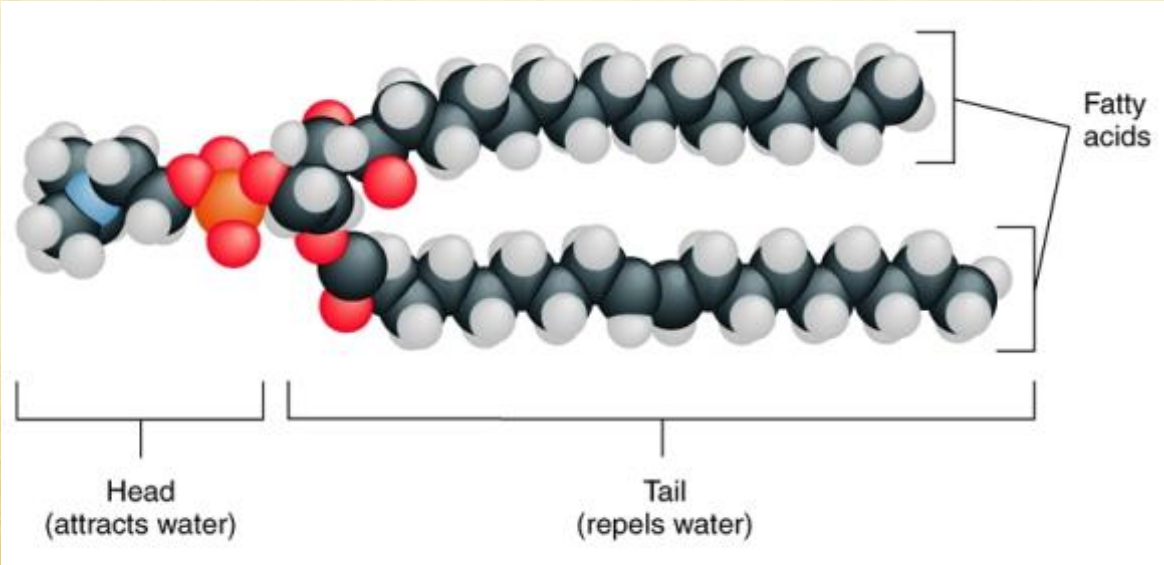
Triglycerides

- Formed from two building blocks
  - Glycerol and fatty acids
- Store a great deal of energy for the body
  - When you eat, your body converts any calories it doesn't need to use right away into tri.
  - The tri are stored in your fat cells
  - Hormones release tri for energy btn meals



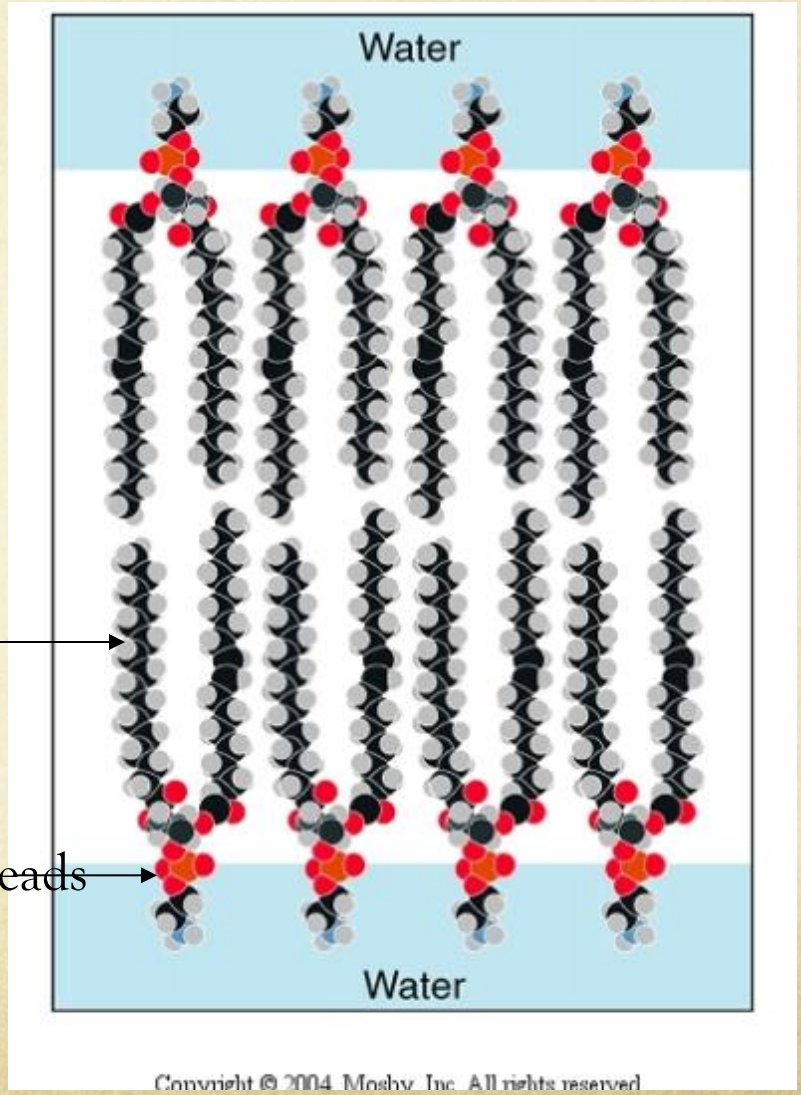
Phospholipids

- Similar to triglyceride
  - Third fatty acid is replaced by a phosphate group
- Phosphate end = hydro**philic** (loves water)
- Fatty acid end = hydro**phobic** (fears water)
- Form cell membranes



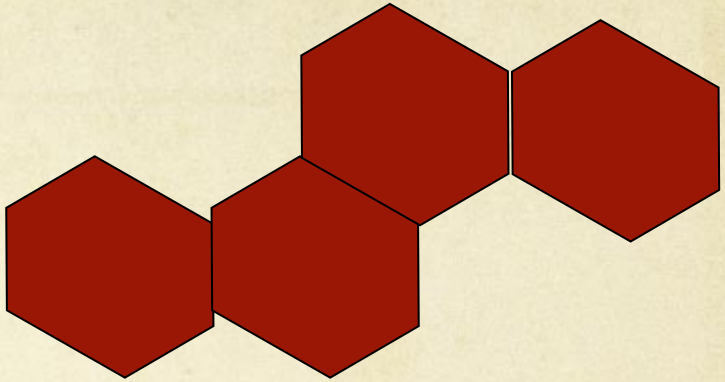
Phospholipid Bilayer

- When phospholipids are mixed in water, they will form a stable bilayer structure
  - Phosphate heads facing the water
  - Water fearing fatty acid tails facing each other



Cholesterol

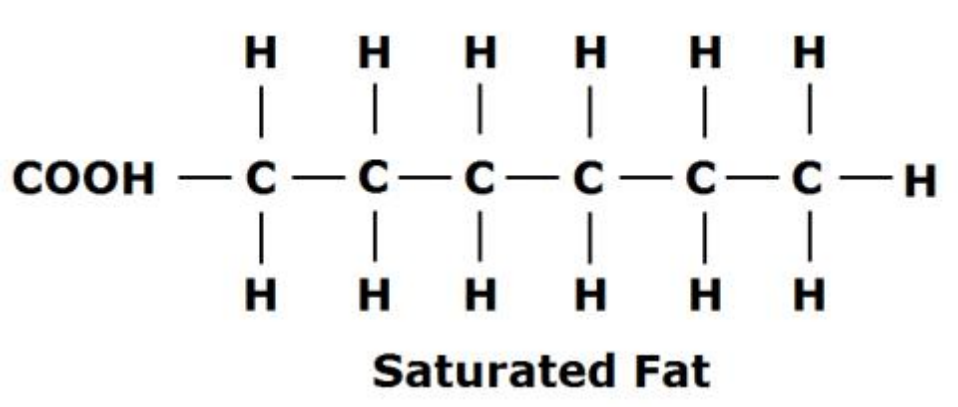
- Made up of 4 rings of C atoms
- Functions in the structure of the plasma membranes of cells
- Used to manufacture hormones
- High cholesterol and triglycerides in the blood are major cause of heart disease



Cholesterol molecule

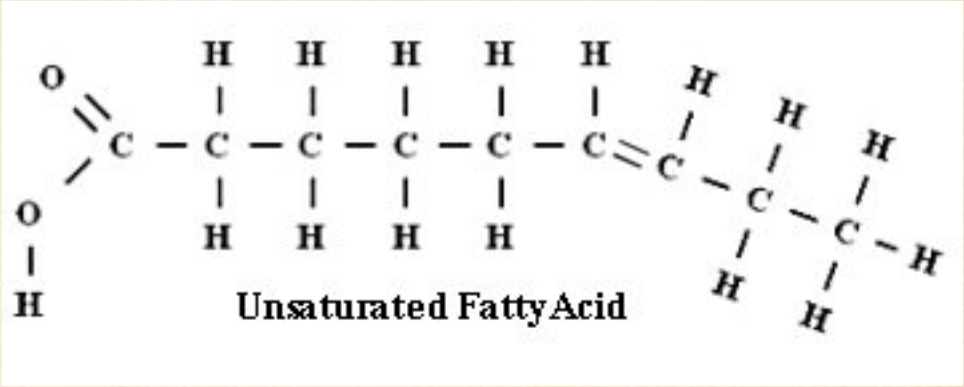
Saturated Fats

- Fat molecule that are "saturated" with hydrogen molecules
- Typically solid at room temperature
- Can raise level of cholesterol in blood
- Majority come from animal sources inc. meat and dairy products



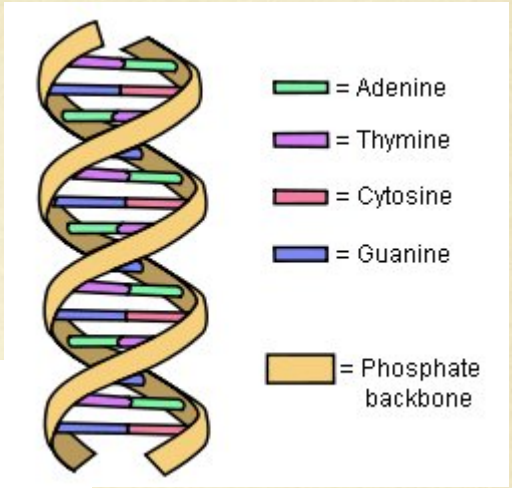
Unsaturated Fats

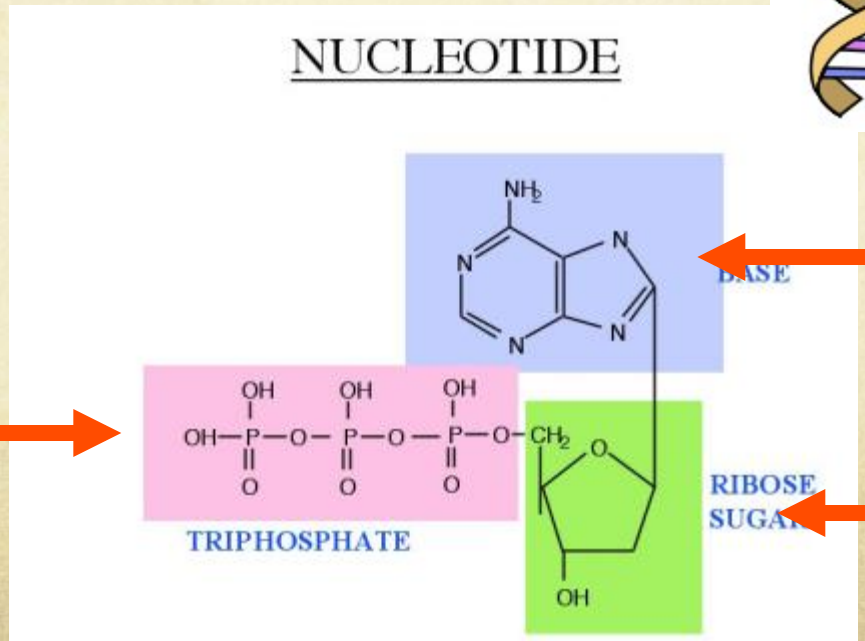
- One or more double bond in the fatty acid chain
  - Monounsaturated = 1 double bond
  - Polyunsaturated = >1 double bond
- Liquid at room temp
- Examples include avocado, nuts, canola, and olive oils



Nucleic Acids

- Elements
  - Carbon, Hydrogen, Oxygen, Nitrogen, and Phosphorus
- Function
  - Store and transmit heredity/genetic info
- Monomer
  - Nucleotides
- Polymers
  - DNA and RNA





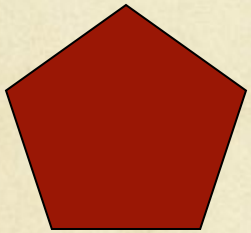
Nitrogenous Base

Phosphate Group

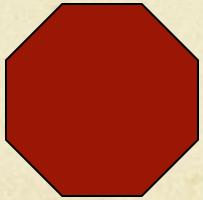
5-Carbon Sugar

DNA

- LARGE macromolecule
- Double stranded
- Stores heredity information that controls the activities of EVERY cell in the body



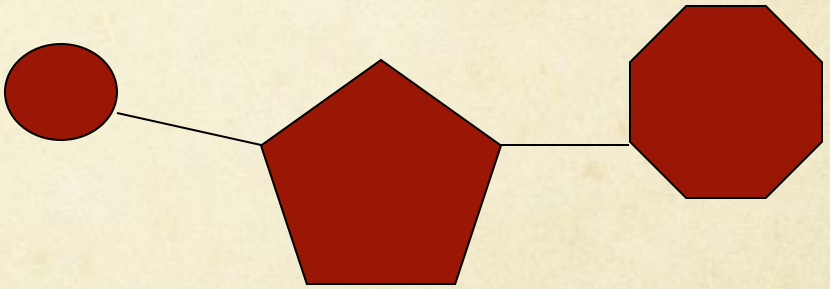
deoxyribose sugar



nitrogen base

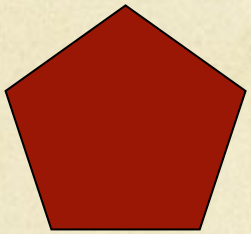
phosphate

A DNA Nucleotide

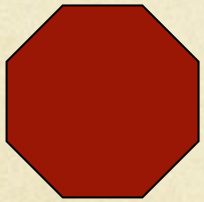


RNA

- Single stranded
- Carries coded heredity information from the nucleus to the cytoplasm



ribose sugar



nitrogen base

phosphate

An RNA Nucleotide