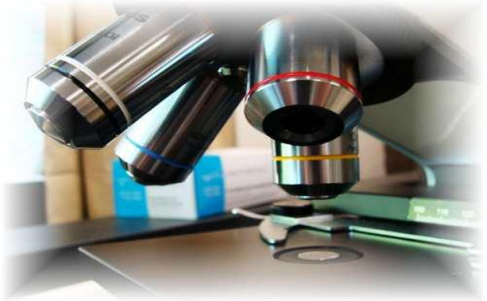

About Science Prof Online PowerPoint Resources

• Science Prof Online (SPO) is a free science education website that provides fully-developed Virtual Science Classrooms, science-related PowerPoints, articles and images. The site is designed to be a helpful resource for students, educators, and anyone interested in learning about science.

• The SPO Virtual Classrooms offer many educational resources, including practice test questions, review questions, lecture PowerPoints, video tutorials, sample assignments and course syllabi. New materials are continually being developed, so check back frequently, or follow us on Facebook (Science Prof Online) or Twitter (ScienceProfSPO) for updates.

• Many SPO PowerPoints are available in a variety of formats, such as fully editable PowerPoint files, as well as uneditable versions in smaller file sizes, such as PowerPoint Shows and Portable Document Format (.pdf), for ease of printing.

• Images used on this resource, and on the SPO website are, wherever possible, credited and linked to their source. Any words underlined and appearing in blue are links that can be clicked on for more information. PowerPoints must be viewed in *slide show mode* to use the hyperlinks directly.

• Several helpful links to fun and interactive learning tools are included throughout the PPT and on the Smart Links slide, near the end of each presentation. You must be in *slide show mode* to utilize hyperlinks and animations.

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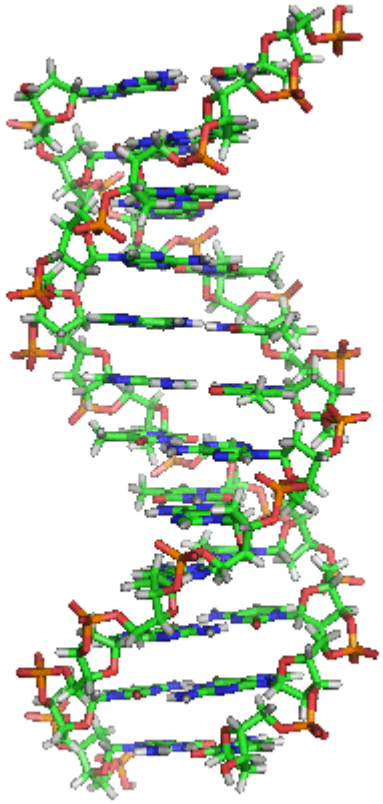
Image: Compound microscope objectives, T. Port

Organic Chemistry



For additional resources on this lecture topic, see the Organic Chemistry Main Page on SPO.

Image: DNA, Richard Wheeler

? Inorganic vs Organic Molecules ?

- **Inorganic Molecules >** Molecules that *don't* have Carbon Hydrogen (C-H) bonds.

- The major organic macromolecules (big molecules with carbon-hydrogen bonds) found in living things are:

1. _____
2. _____
3. _____
4. _____

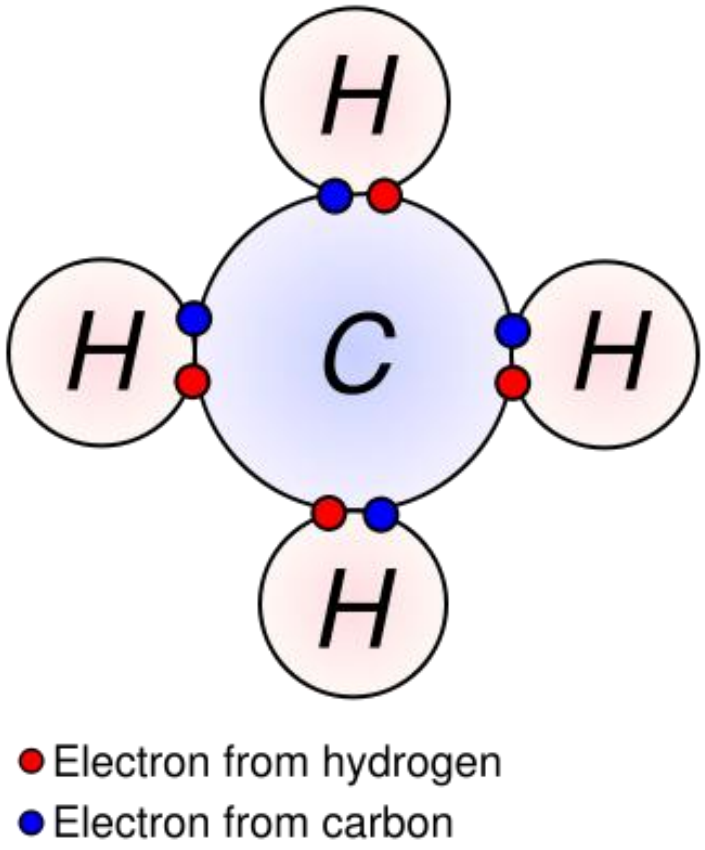
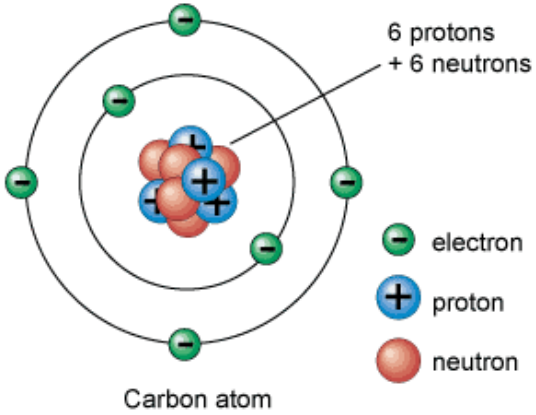


Image: Methane Covalent Bonds, Dynablast, Wiki

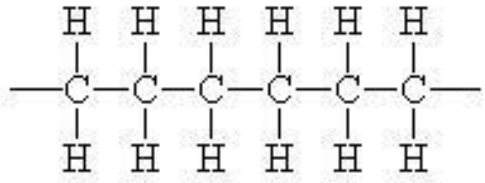
Carbon

Little Atom, Big Deal



The chemical basis of life. Abundant in all known life forms.

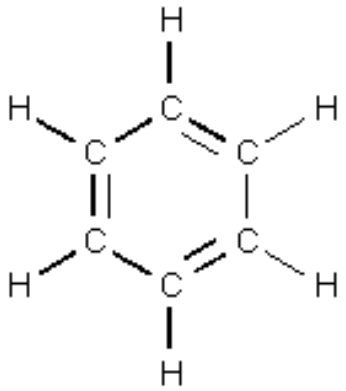
Essential to complex organic macromolecules, because each carbon atom can form _____ bonds (usually involving hydrogen , oxygen and/or nitrogen).



Polyolefin

Able to form polymers (big organic molecules).

- The atoms can bond with each other to form long chains.
- Sometimes the ends of these chains join together to form a ring.



Double bonds form when atoms share two electrons (two covalent bonds).

Images: Carbon, Universe Today Website

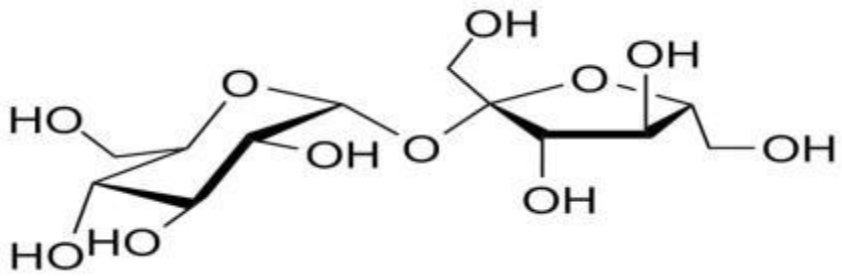
Study Table of Organic Macromolecules

(We will fill this in as we go through the rest of the lecture.)

Macromolecule (polymer)	Made of what type of monomer?	Is there another name for this polymer?	Examples
1.			
2.			
3.			
4.			

Organic Molecules - Carbohydrates

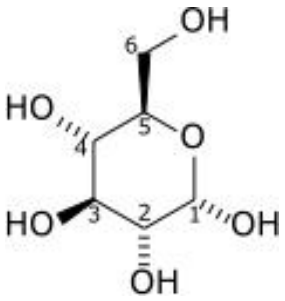
- "_____ hydrates"
- One carbon molecule to one water molecule (_____)n.
- _____ is a synonym for carbohydrate.
- The prefixes on the word "saccharide" relates to the size of the molecule (mono-, di-, tri- poly-).

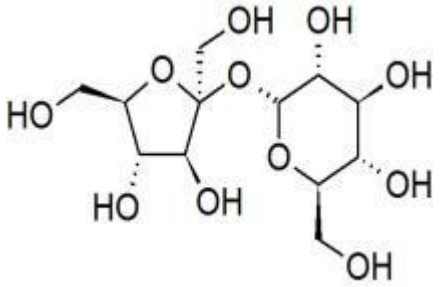


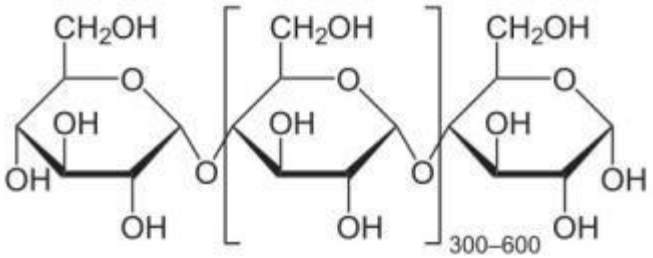
You probably know that chocolate cake is full of refined sugars…carbs. You may not know that boogers contain carbs as well. Boogers are dried-up mucus and dirty nose debris. Mucus is made mostly out of sugars and protein. Looks like this little punkin is double dipping. Bon appetite!

Image: Sucrose, Wiki

Organic Molecules - Carbohydrates







Monosaccharides

- _____ sugars (one molecule)
- simplest
- *_glucose_, fructose

Disaccharides

- _____ sugars
- combination of two monosaccharides
- *_____ = glucose + fructose
- *_____ = glucose + galactose

Polysaccharides

- Are macromolecules; _____ composed of several sugars
- Can be same monomer (many of same monosaccharide) or mixture of monomers
- _____ carbohydrates: ***glycogen*** (animals) ***starch*** (plants)
- _____ carbs: ***chitin*** (animals), ***cellulose*** (plants)

From the Virtual Cell Biology Classroom on ScienceProfOnline.com

Organic Molecules - Proteins

Proteins are macromolecules, **polymers** composed of monomers called…

_____ contain a:

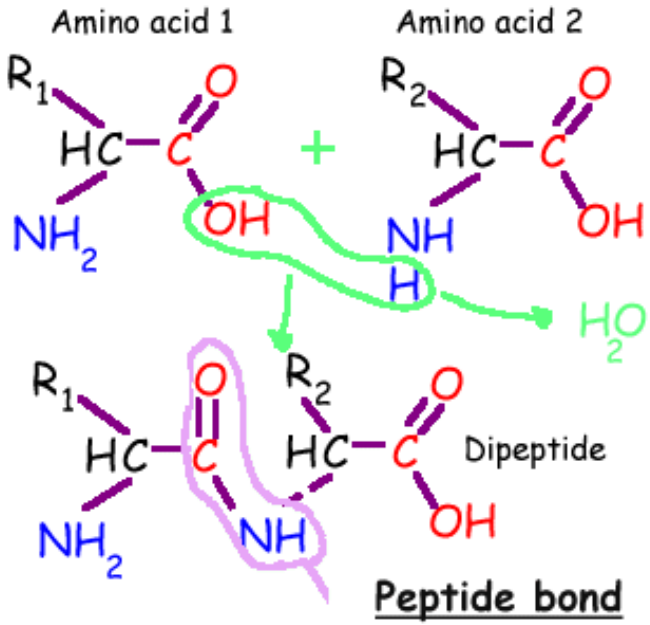
1. base amino group ($-NH_2$)
2. acidic carboxyl group (-COOH)
3. hydrogen atom

…all attached to same carbon atom (the a – carbon…alpha carbon).

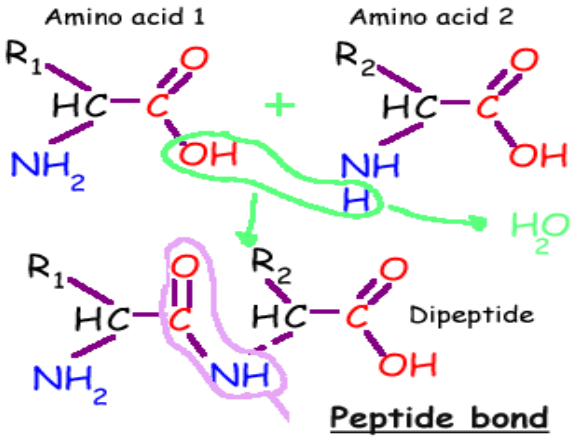
Fourth bond attaches a-carbon to a side group (--R) that varies among different amino acids.

There are hundreds, but most organisms use only 21 amino acids to build proteins.

Side groups important … affects the way a proteins amino acids interact with one another, and how a protein interacts with other molecules.



Organic Molecules – Proteins



? _____ ?

Link amino acids together in chains, like the beads on a necklace.

Q: *Do you think bonds connecting amino acids are ionic or covalent? Why?*

A **dipeptide** is 2 amino acids linked together.

A **polypeptide**, more than two.

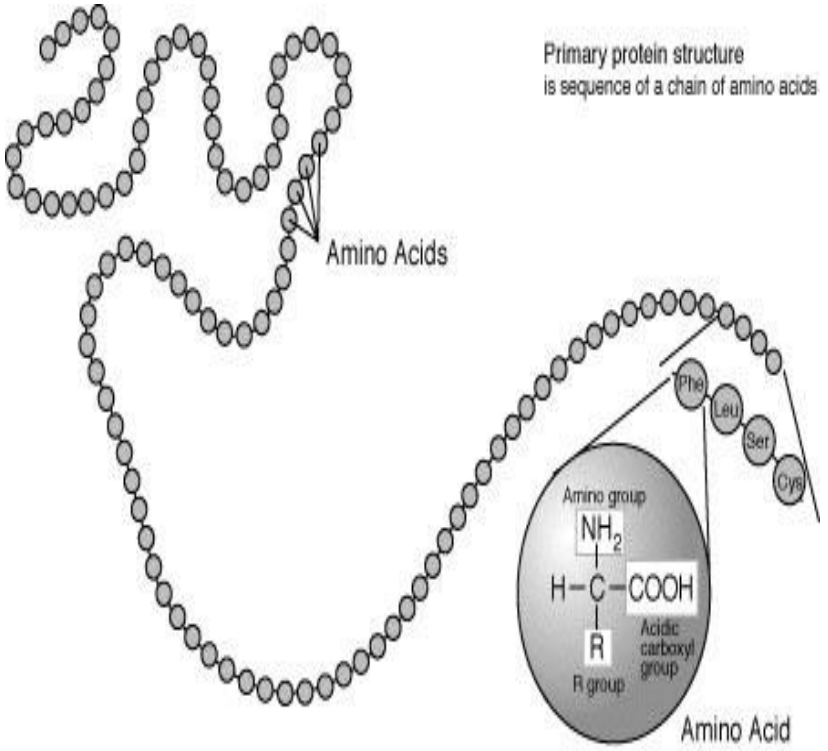


Image: Protein Primary Structure, Wiki

Protein Structure

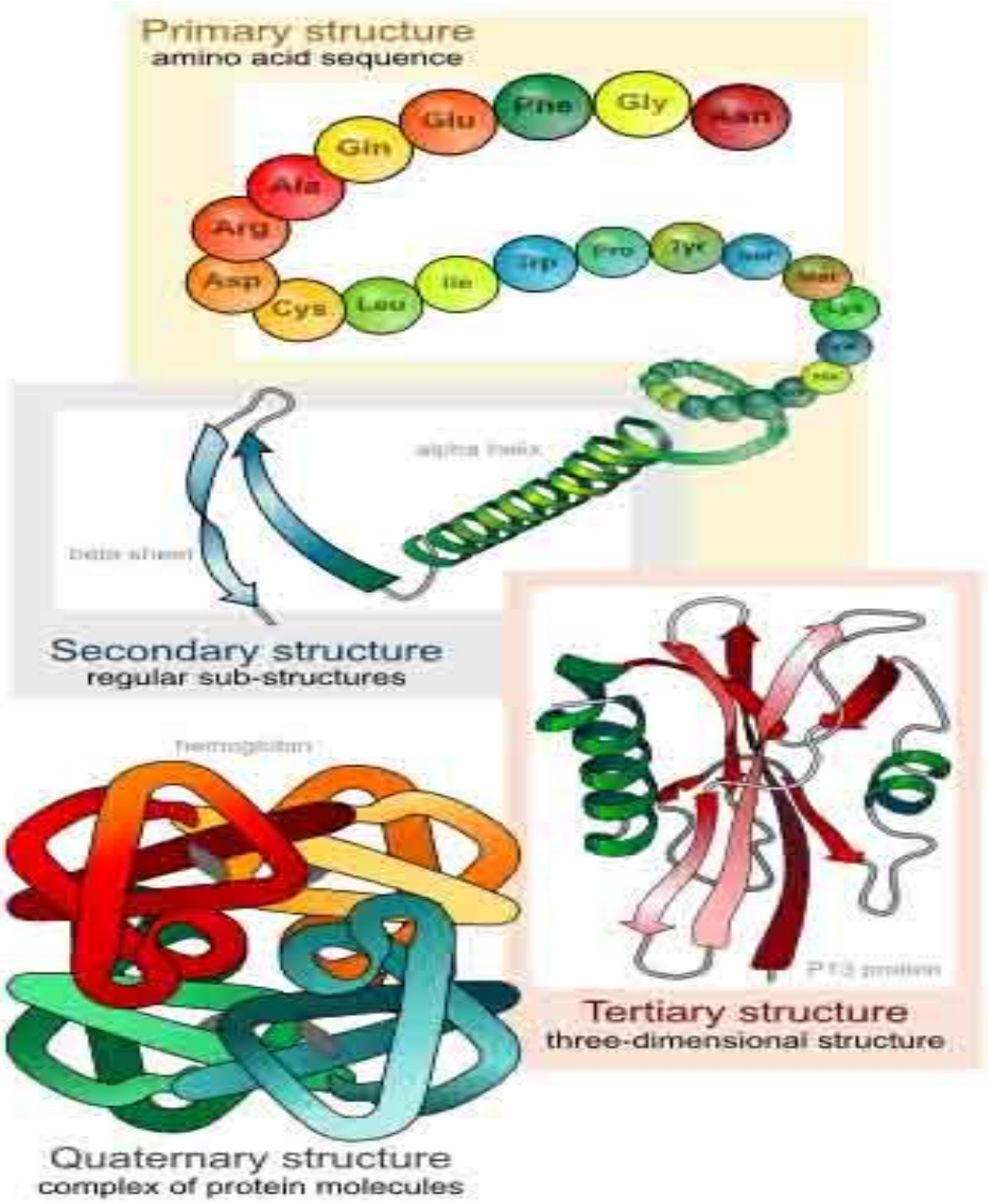
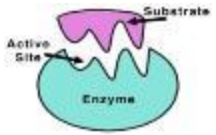


Image: Levels of protein structure, M Ruiz

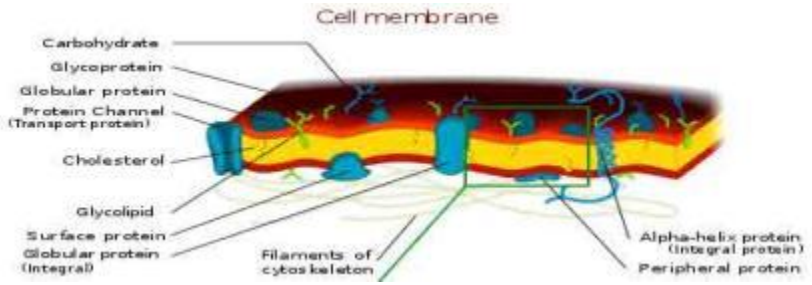
Organic Molecules - Proteins



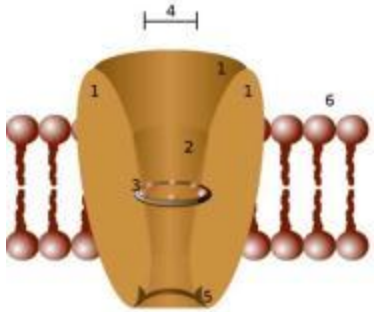
Complex organic macromolecules fundamental to living cells.

Composed of one or more chains of amino acids.

Proteins perform many functions in cells, including:



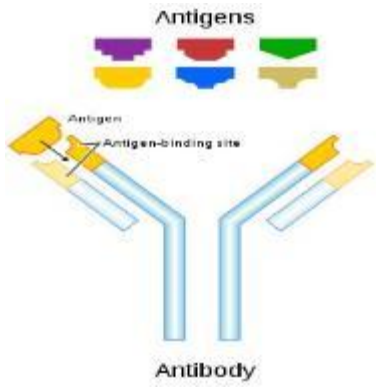
1. _____
   - Components in cell walls, membranes, and within cells themselves.



2. _____
   - Chemicals that speed up a chemical reaction.
   - The catalysts in cells are called enzymes.

3. _____
   - Some regulate cell function by stimulating or hindering either the action of other proteins or the expression of genes.

4. _____
   - Some act as channels and "pumps" that move substances into or out of cells.

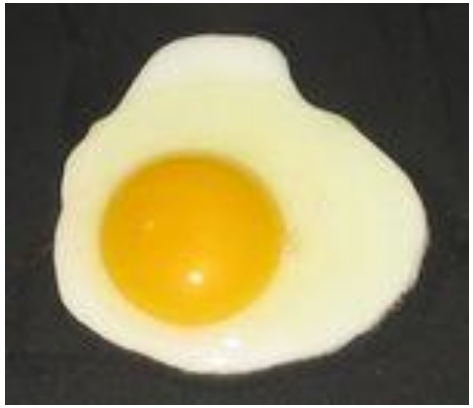


5. _____
   - Antibodies = proteins that defend your body against microorganisms
   - Some bacteria produce proteins (bacteriocins) that kill other bacteria.

Images : Cell Membrane, Wiki; Channel Protein, Wiki; **Antibody**, **Wiki**

How do you sabotage a protein?

_____ _____!



- Alteration of a protein shape through some form of external stress

- Example, by applying heat, acidic or alkaline environment

- Denatured protein can't carry out its cellular function .

Irreversible egg protein denaturation caused by high temperature (while cooking it).

Organic Molecules – Nucleic Acids

Nucleic acids (both RNA and DNA) are macromolecules; polymers made up of monomers called _____.

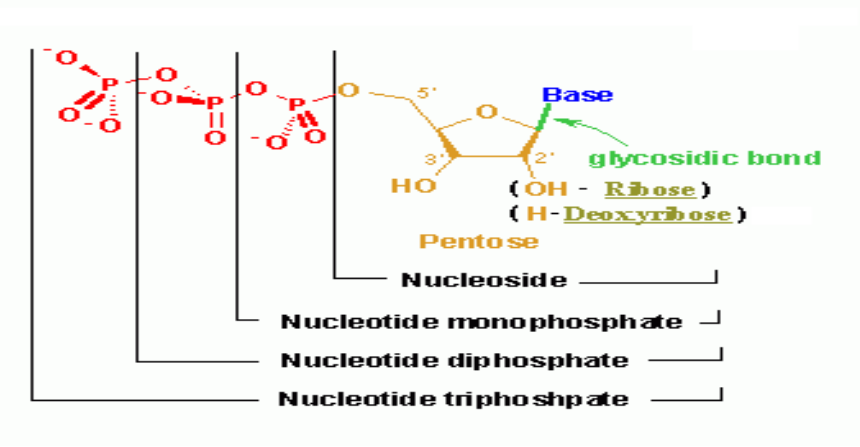
Nucleic acids **deoxyribonucleic acid** (DNA) and **ribonucleic acid** (RNA) = genetic material of cells.

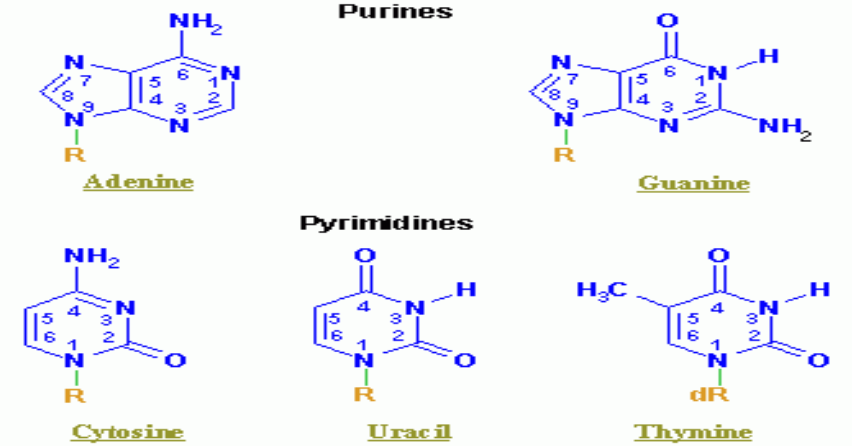
Names derived from type of **sugar** contained within molecules = **ribose**

Nucleotides

Each monomer of nucleic acid is a **nucleotide** and consists of 3 portions:

- a _____
- one or more _____
- one of five cyclic _____
  - +adenine, guanine (double-ringed purines)
  - + cytosine, thiamine or uracil (single-ringed pyrimidines)





From the Virtual Cell Biology Classroom on ScienceProfOnline.com

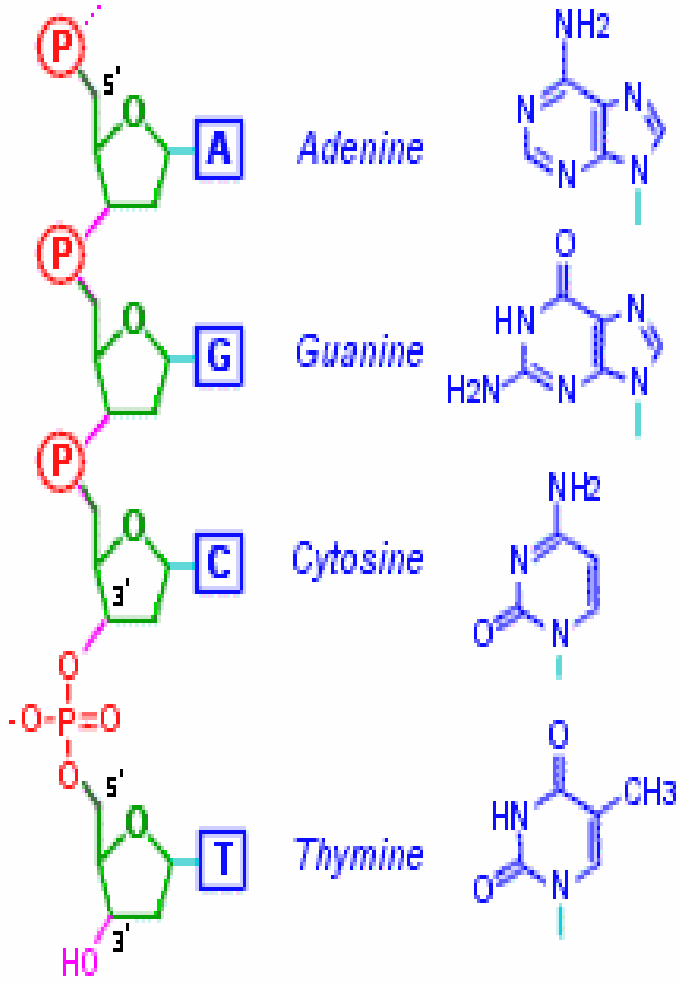
Image: Nucleotide Structure, Wikipedia

Organic Molecules – Nucleic Acids

Nucleic Acid Structure

Nucleotides linked by covalent bonds between _____ of one nucleotide and _____ of next *(sugar-phosphate backbone).*

Nitrogenous _____ extending from it like teeth of a comb.



Nucleic Acids - DNA

DNA is a double stranded molecule, analogous to a ladder.

The "ladder" =

- two deoxyribose-phosphate chains form the "**side rails**"
- base pairs, linked by hydrogen bonds, form the "**rungs**".

Purine Bases (double ring)
Adenine & Guanine

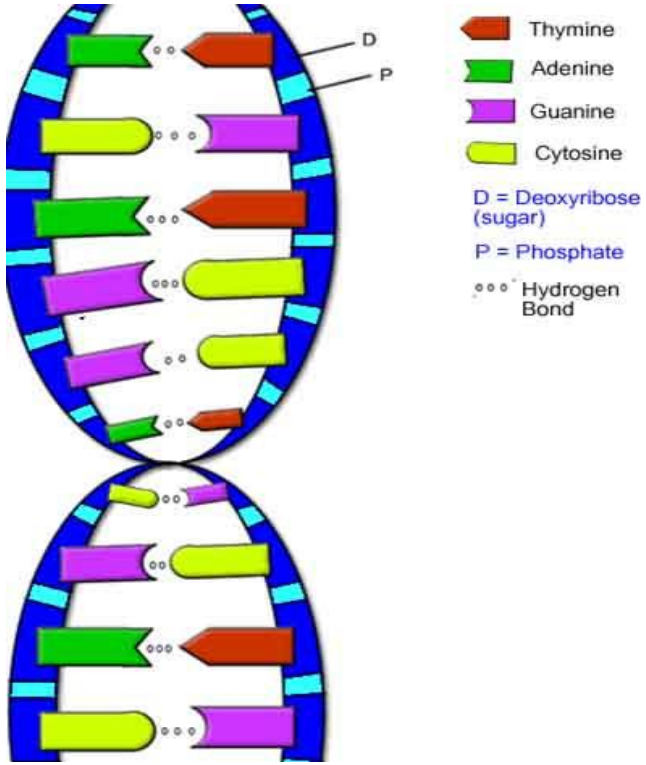
Pyrimidine Bases (single ring)
Cytosine & Thymine

Base Pairs *(purine always pairs with pyrimidine):*

Adenine + Thymine
Cytosine + Guanine

<< ***Q:*** *How do I remember this?*

_____ **attract the bases** from one strand to the bases on the other strand and also **twist the phosphate-sugar backbones** into a helix.



Images: Model of DNA Molecule, Field Museum, Chicago, T. Port DNA, Biology Corner Website

DNA molecule

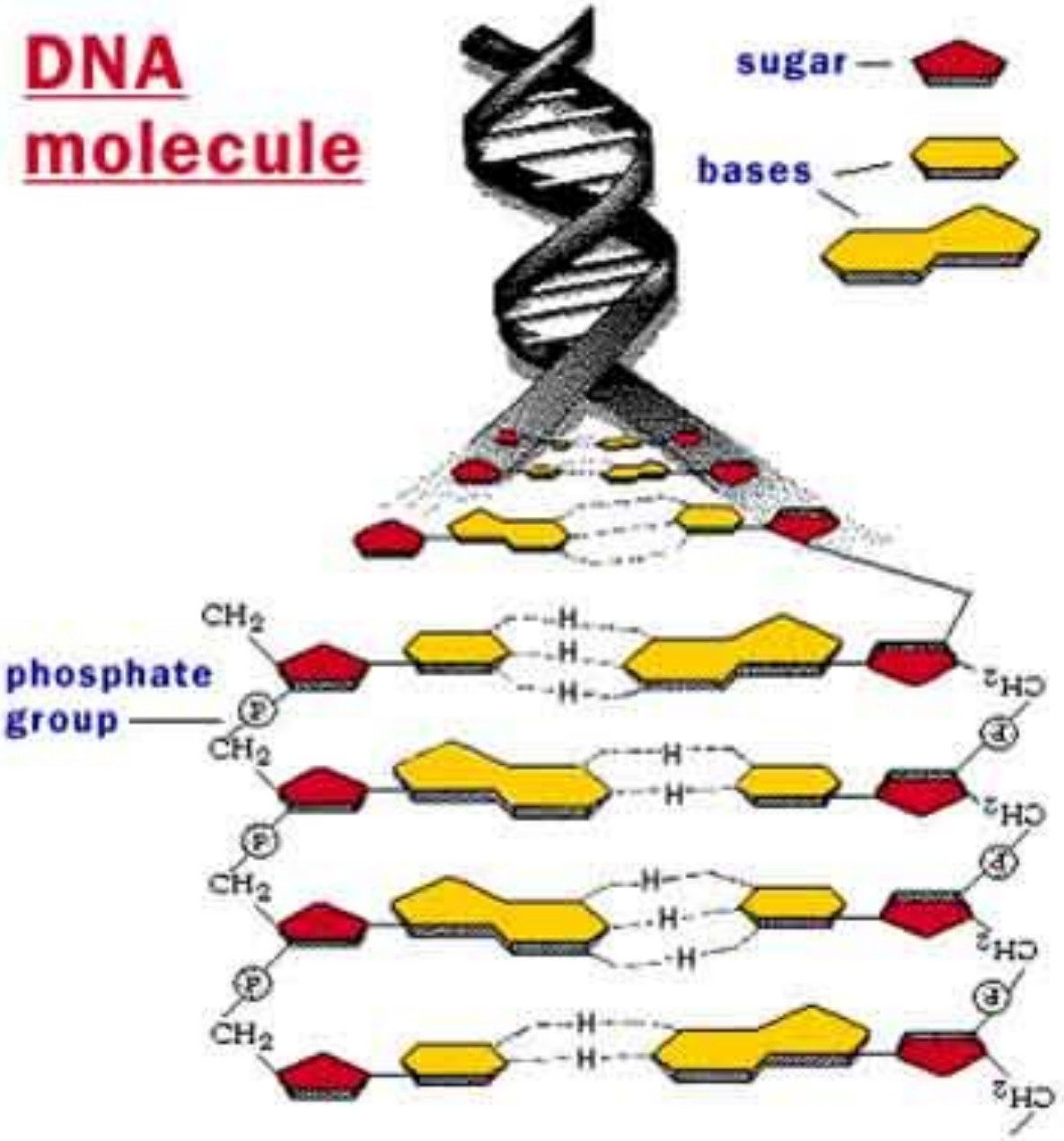
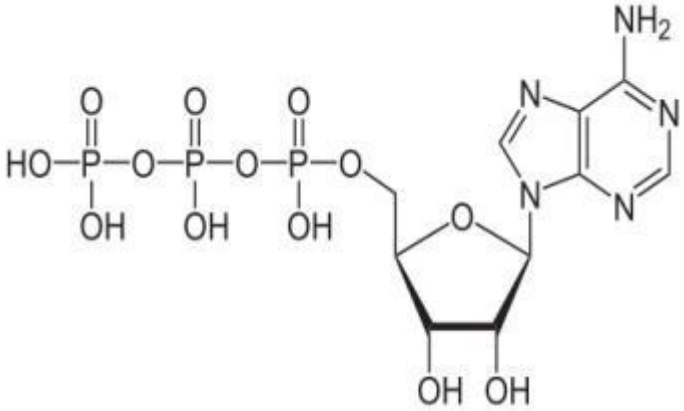


Image: DNA Molecule, National Science Foundation

ATP Production and Energy Storage

- ***Q:*** *This molecule has a sugar, a base and three phosphate groups. What kind of monomer is it?*
- Adenosine 5'-triphosphate
- Multifunctional "molecular currency" of intracellular energy transfer.
- Organisms release energy from nutrients; can be concentrated and stored in high-energy phosphate bonds of ATP.
- Transports chemical energy within cells for metabolism.
- Produced as energy source during _____ and _____.
- Consumed by many enzymes and a multitude of cellular processes



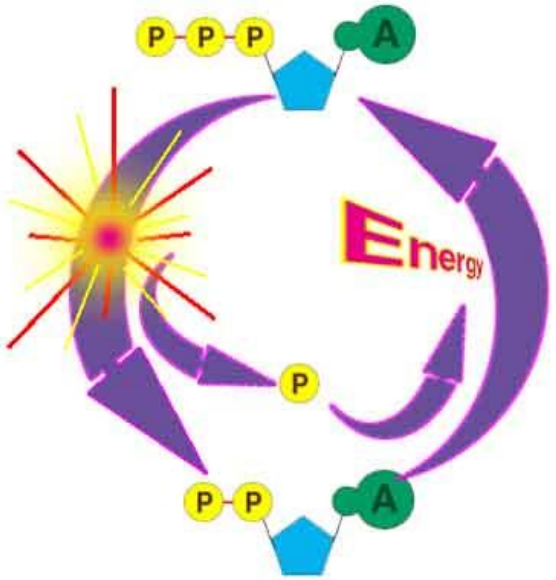


Image: ATP Molecule, NEUROtiker; ATP-ADP Cycle, CUNY

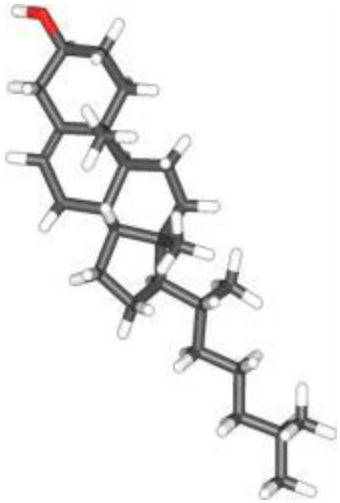
Organic Molecules – Lipids

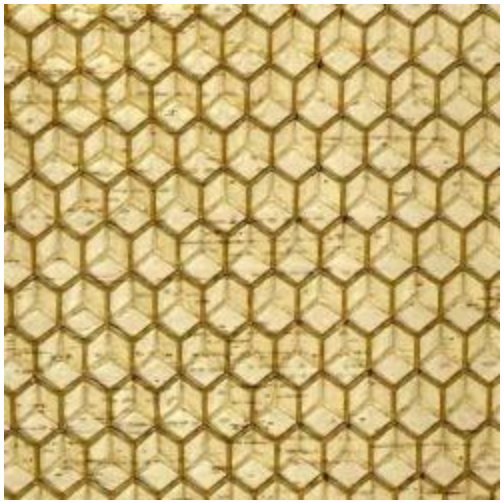
(Fats, Phospholipids, Waxes & Steroids)

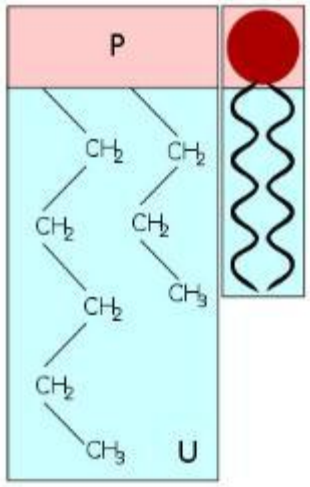
Hydrophobic macromolecules…insoluble in water.

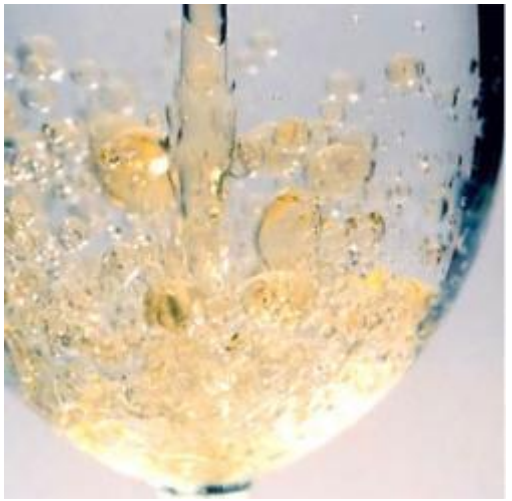
Not attracted to water because …

non-polar covalent bonds linking carbon & hydrogen aren't attracted to the *polar bonds of water*.





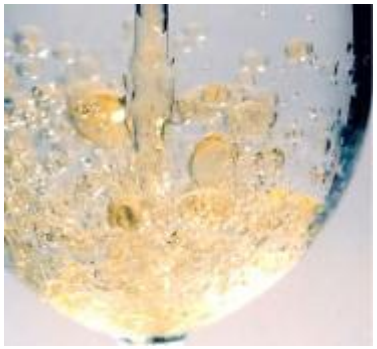




Images: Cholesterol, Wiki; Phospholipid Structure, Bryan Derksen. Wiki Honeycomb, Wikii; Oil & Water, Kidipede

Organic Molecules – Lipids

*(**Fats**, Phospholipids, Waxes & Steroids)*



Fats

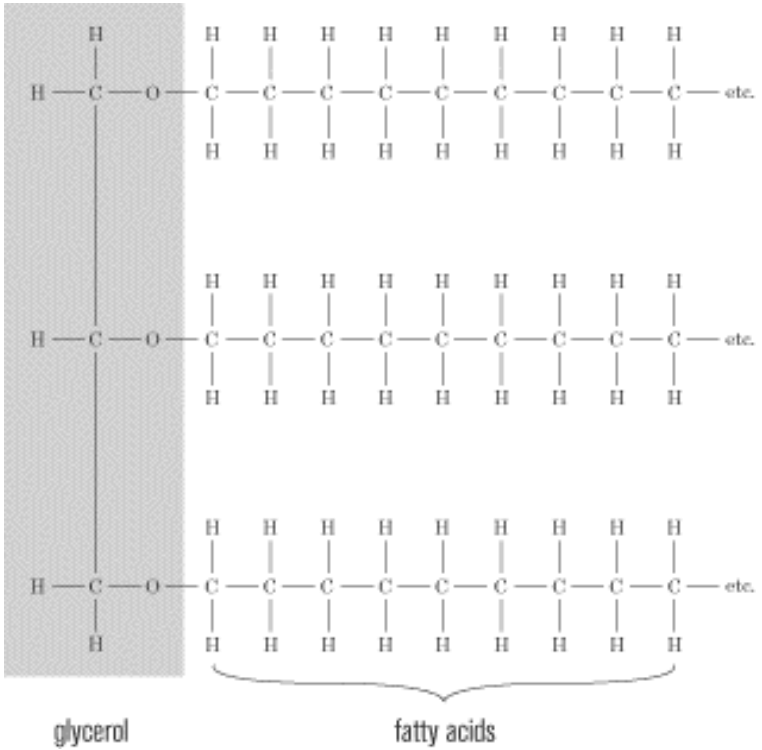
Fats and oils are made from two kinds of molecules:

- _____

(a type of alcohol)

- _____

(triglycerides)



Images: Oil & Water, Kidipede

Organic Molecules – Lipids

*(Fats, **Phospholipids**, Waxes & Steroids)*

Phospholipids

- Phospholipids are a major component of all cell membranes.
- Most phospholipids contain a diglyceride as the tail, and a phosphate group for head.
- Hydrocarbon tails _____, but phosphate heads are _____.
- So phospholipids are soluble in both water and oil.
- Tails from both layers facing inward and the heads facing outward = _____.

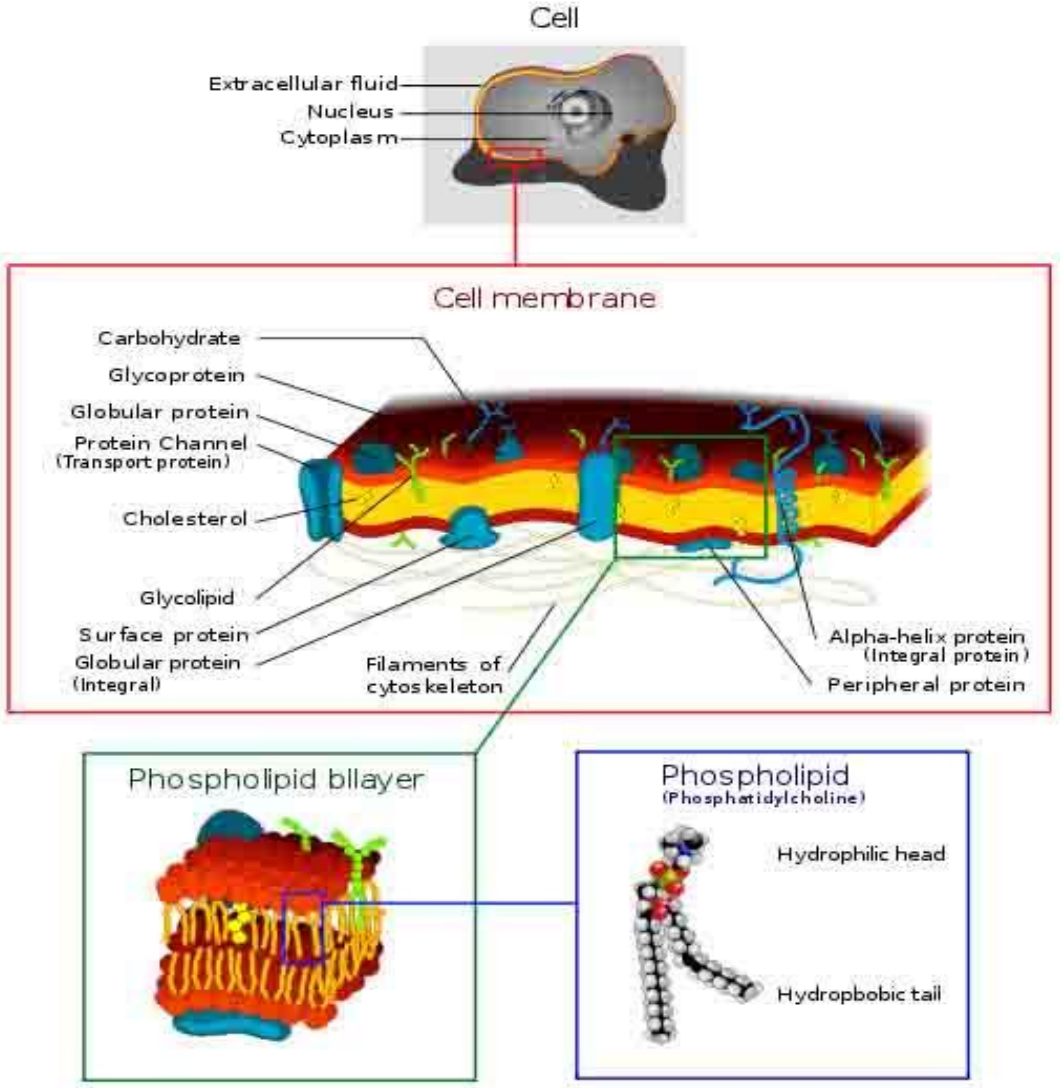
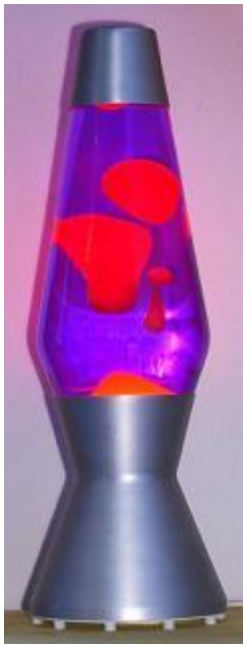


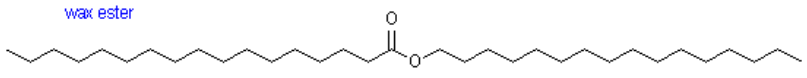
Image: Cell Membrane, Wiki;

Organic Molecules – Lipids

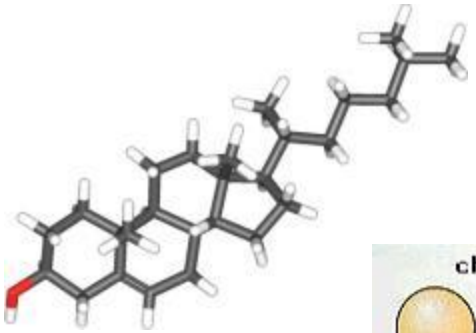
*(Fats, Phospholipids, **Waxes & Steroids**)*



Waxes



- Do not have a hydrophilic head: so completely water insoluble.



Steroids

- The central core of a cholesterol molecule (4 fused rings) is shared by all steroids.
- Cholesterol is precursor to our _____ hormones and Vitamin ___.
- Our cell membranes contain cholesterol (in between the phospholipids) to help keep membrane "fluid" even when exposed to cooler temperatures.

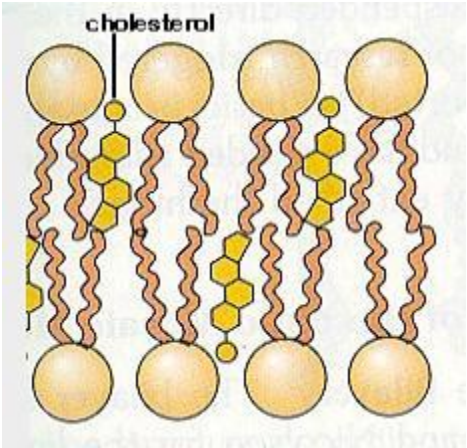


Image: Lava Lamp, Wiki; Cholesterol molecule, Wiki; Phospholipids & Cholesterol, Cytochemistry.net

Confused?

Here are some links to fun resources that further explain Chemistry:

Smart Links

- Organic Chemistry Main Page on the Virtual Cell Biology Classroom of Science Prof Online.
- "What Kind of Bonds Are These?" song and slide show by Mark Rosengarten
- Macromolecules interactive science tutorial.
- DNA Structure Cell Biology Animation from John Kyrk.
- Build a DNA Molecule from University of Utah.
- "Chemistry" a song by Kimya Dawson.
- Redox Reactions video lecture by Kahnacademy
- "Sugar, Sugar" song by The Archies.
- Chem4Kids website by Rader.
- "Better Living Through Chemistry" a song by Queens of the Stone Age.
- "Chemistry" a song by Rush.

(You must be in PPT slideshow view to click on links.)

Assignment

See the ScienceProfOnline Virtual Cell Biology Classroom: **Organic Chemistry Lecture** for a printable Word .doc of this assignment.

- At the end of most lectures, I will give you some type of in-class assignment or homework to evaluate your understanding of that day's topic.
- This assignment will always be open-book.
- Today, if assigned, you will be completing *essay question* on the topic of **Organic Chemistry**.

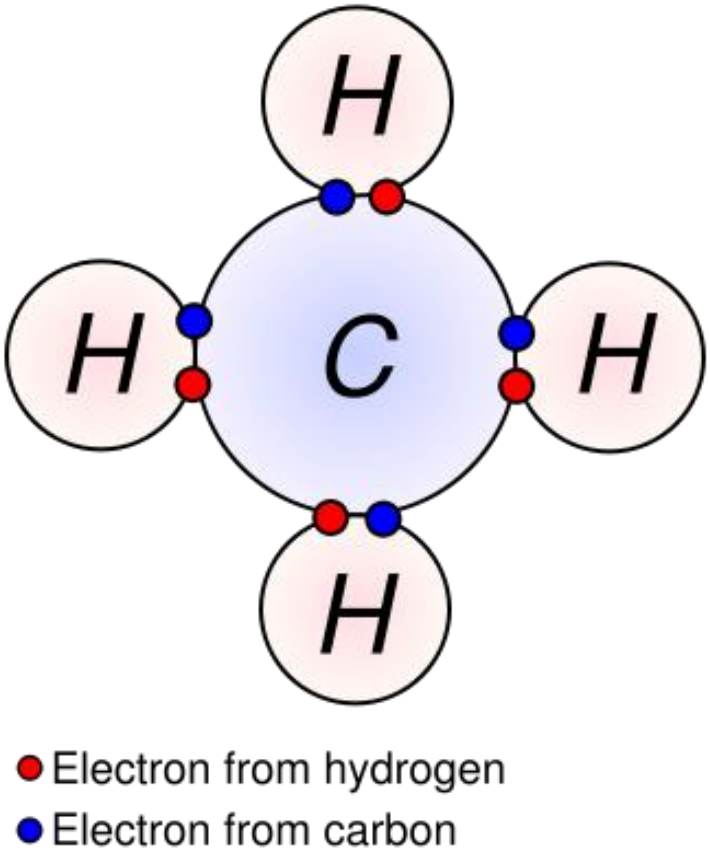
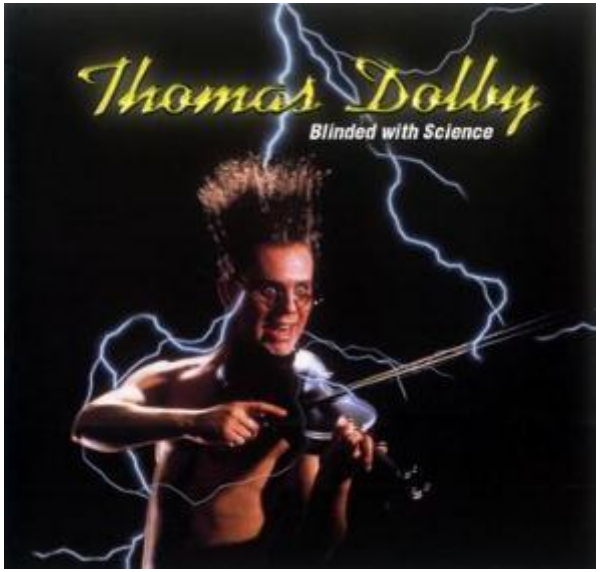


Image: Methane Covalent Bonds, Dynablast, Wiki



Are you feeling blinded by science?

Do yourself a favor. Use the…

Virtual Cell Biology Classroom *(VCBC)*!

The VCBC is full of resources to help you succeed, including:

- practice test questions
- review questions
- study guides and learning objectives
- PowerPoints on other topics

You can access the VCBC by going to the Science Prof Online website
www.ScienceProfOnline.com

Images: Blinded With Science album, Thomas Dolby; Endomembrane system, Mariana Ruiz, Wiki