



Biological Molecules

These are molecules that are essential to life



Define the following

Use Douchy's Biology podcast to do this Episode 11.2-The chemistry between us

- Atom
- Element
- Molecule
- Compound
- Pure Substance
- Ions
- Organic compounds
- Polar Compound
- Inorganic compound
- Ionic compounds
- Covalent compounds
- Hydrogen bonds

Other terminology

- Macromolecules
- Monomers
- Polymers
- Amino Acids
- Protein
- Carbohydrates(poly saccharides)
- Nucleic Acids
- lipids

Biological Molecules include:

Macromolecules

- Carbohydrates (Polysaccharides)
- Proteins (made up of amino acids)
- Lipids
- Nucleic Acids

Other important molecules

- Water
- Minerals
- Vitamins

Organic Molecules

Organic Molecules Associated With Living Things

These are called biomacromolecules. These are large molecules found in living cells.

Main Types are.....

Carbohydrates

Lipids

Nucleic Acids

Proteins

Organic molecules

- Contain carbon
- and hydrogen bonds
- All biological macromolecules are organic molecules

Carbohydrates

- Contain the elements carbon, hydrogen and oxygen.

Examples of Carbohydrates

1. Can be made up of one “sugar unit” such as glucose and fructose. These are monosaccharides .
2. Can be made up of two “sugar units” such as sucrose and lactose. These are disaccharides.
3. Can be made up of many “sugar units” such as starch, glycogen, cellulose.

TABLE 4.3 CARBOHYDRATES AND THEIR FUNCTION**Carbohydrate****Example****Description**

Transport Disaccharides



Lactose



Glucose is transported within some organisms as a disaccharide. In this form, it is less readily metabolized because the normal glucose-utilizing enzymes of the organism cannot break the bond linking the two monosaccharide subunits. One type of disaccharide is called lactose. Many mammals supply energy to their young in the form of lactose.

Storage Polysaccharides



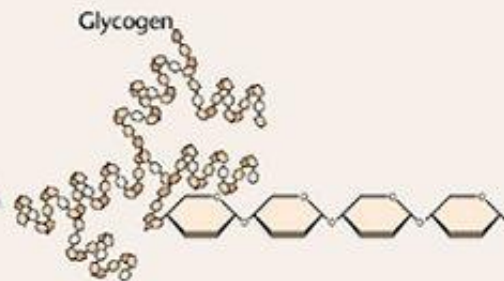
Starch



Organisms store energy in long chains of glucose molecules called polysaccharides. The chains tend to coil up in water, making them insoluble and ideal for storage. The storage polysaccharides found in plants are called starches, which can be branched or unbranched.



Glycogen



In animals, glucose is stored as glycogen. Glycogen is similar to starch in that it consists of long chains of glucose that coil up in water and are insoluble. But glycogen chains are much longer and highly branched.

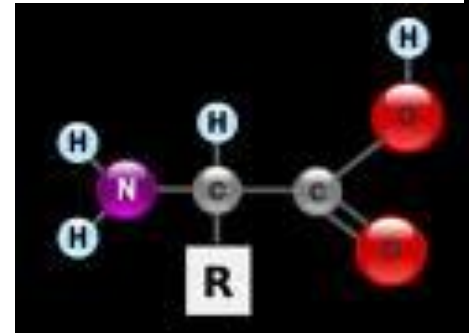
Role of Carbohydrates

1. As an energy source. Glucose is broken down to release energy (ATP) for cell use.
2. As a storage for energy. Starch in plants and glycogen in mammals.
3. As the main structural component (cellulose) of the cell walls of plants.
4. As a part of the receptors on the cell membranes of cells.

Proteins

- contain the following elements carbon, hydrogen, oxygen and nitrogen.
- are natural polymers
- Made up of monomers or building blocks called amino acids
- 21 Essential amino acids i.e. cannot be made)

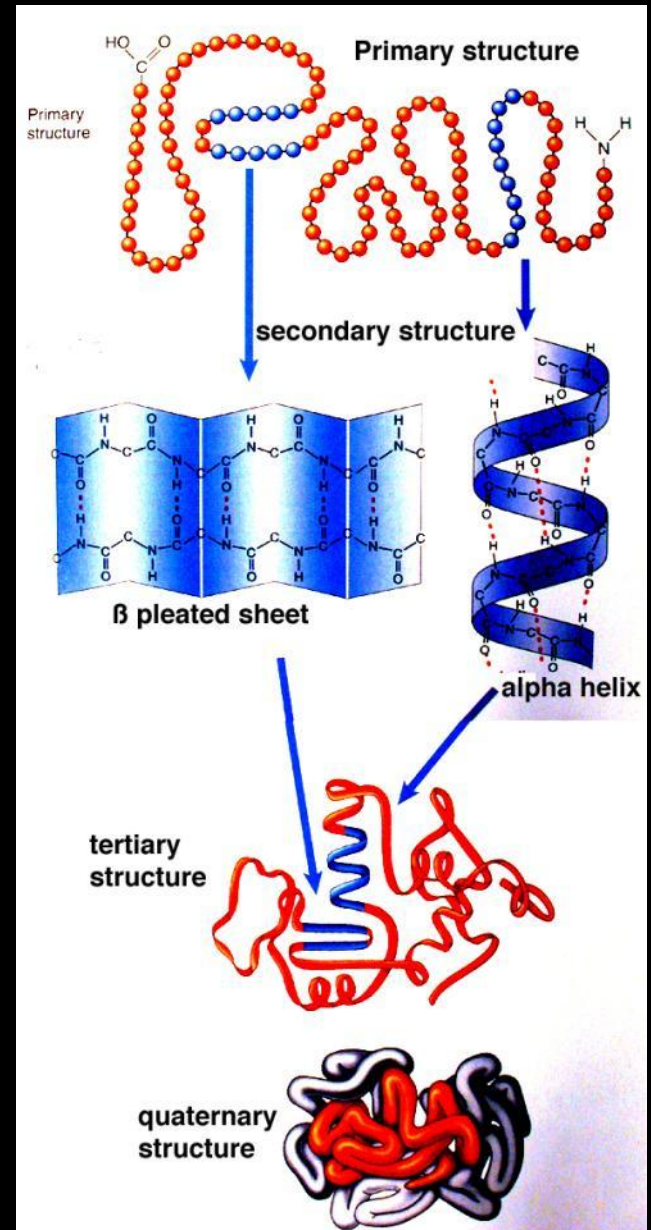
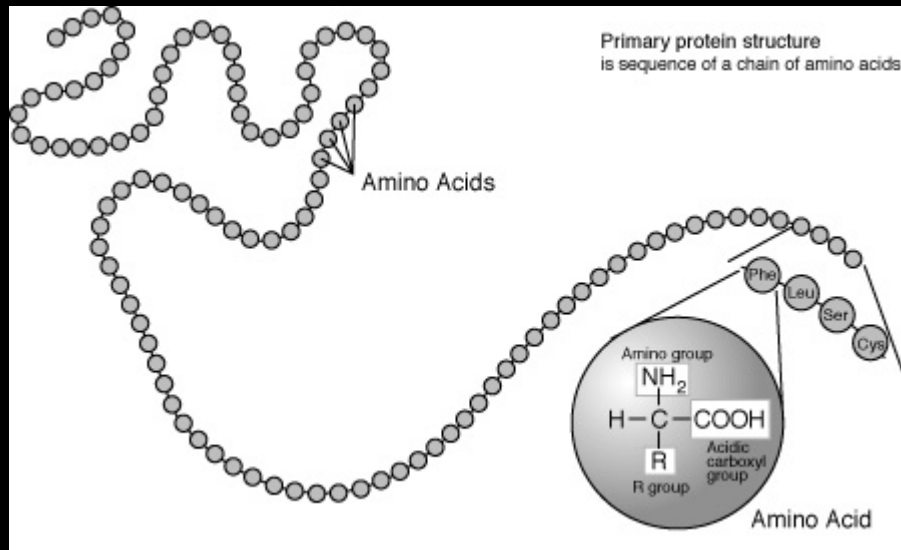
| Essential | Nonessential |
|------------------|--------------|
| Isoleucine | Alanine |
| Leucine | Arginine* |
| Lysine | Aspartate |
| Methionine | Cysteine* |
| Phenylalanine | Glutamate |
| Threonine | Glutamine* |
| Tryptophan | Glycine* |
| Valine | Proline* |
| Histidine* | Serine* |
| Tyrosine* | Asparagine* |
| Selenocysteine** | |



(*) Essential only in certain cases.^{[1][2]}

(**) Truly unclassified. Added to sustain the 21 Numbers of Essential Amino Acids.

Making proteins



Functions of proteins

- Enzymes – biological catalysts e.g. pepsin, amylase, catalase (found in cells breaks down hydrogen peroxide)...
- Hormones – chemical released by a cell in one part of the body that sends messages that effects cells in another part of the body e.g. insulin
- Antibodies – involved in defending the body from antigens.
- Structural proteins – fibrous and stringy provide support e.g. keratin, collagen, elastin...

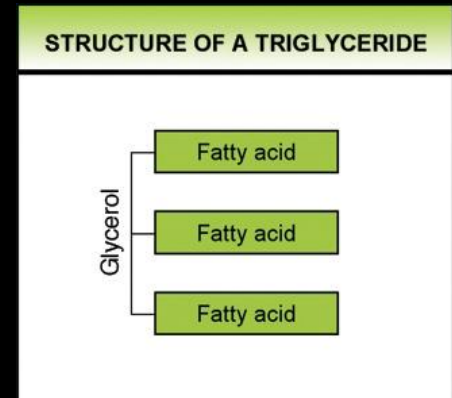
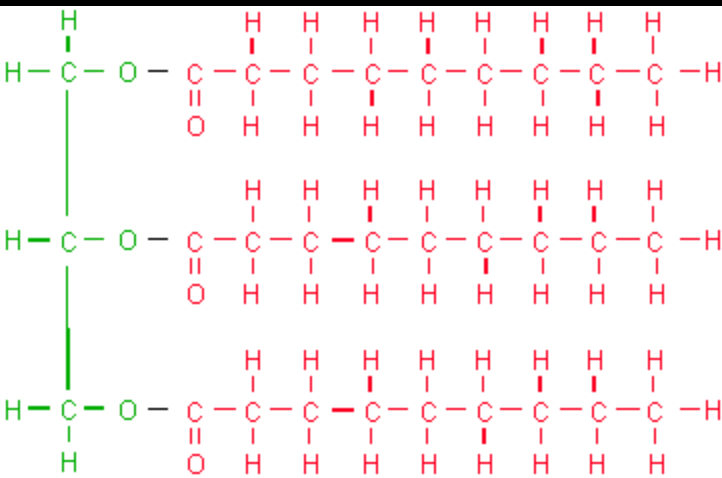
Lipids

- Contain the elements carbon, hydrogen and oxygen.
- Refers to a variety of compounds.
- Examples include fats, waxes, cholesterol.
- Phospholipids are lipids that have a phosphate component.



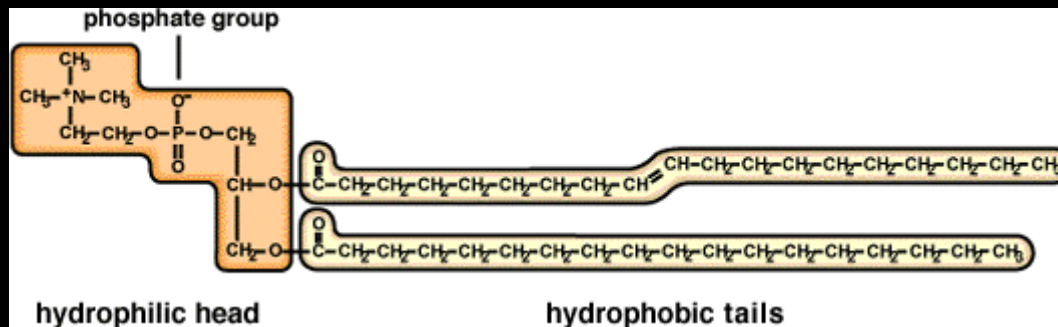
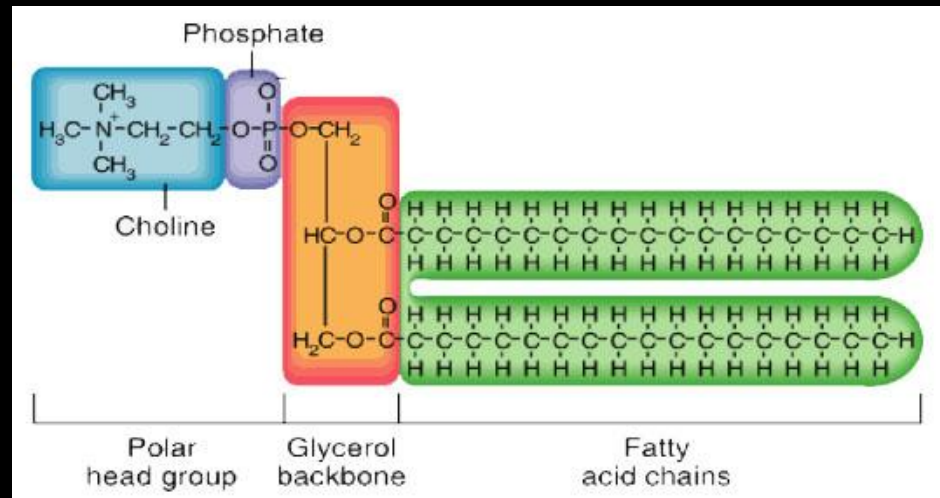
Triglycerides

- Triglycerides are a typical type of lipid.
- They consist of three fatty acids and glycerol

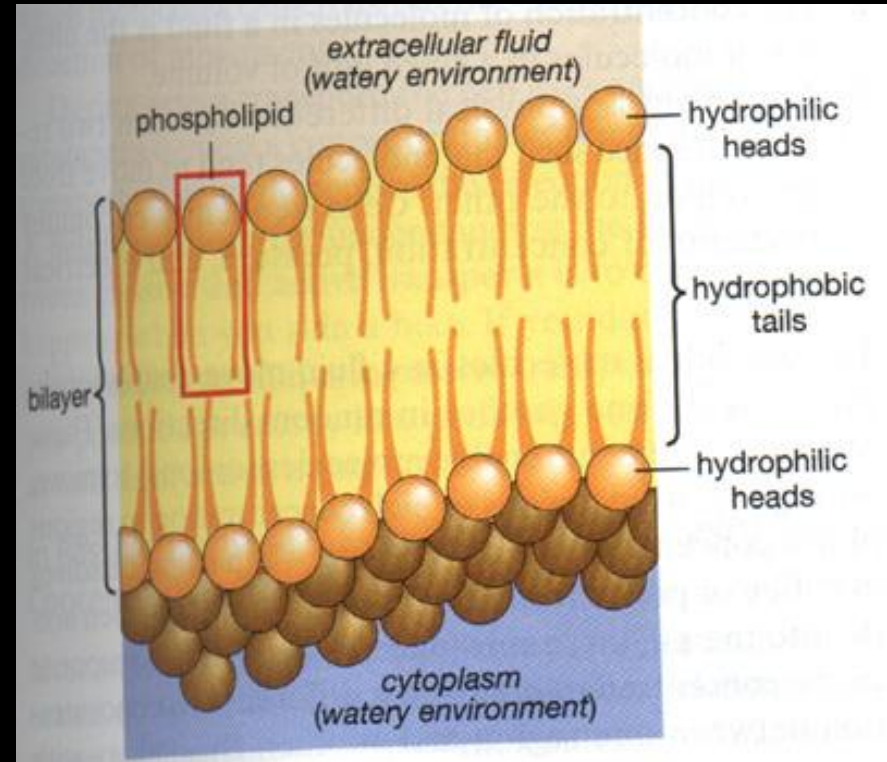
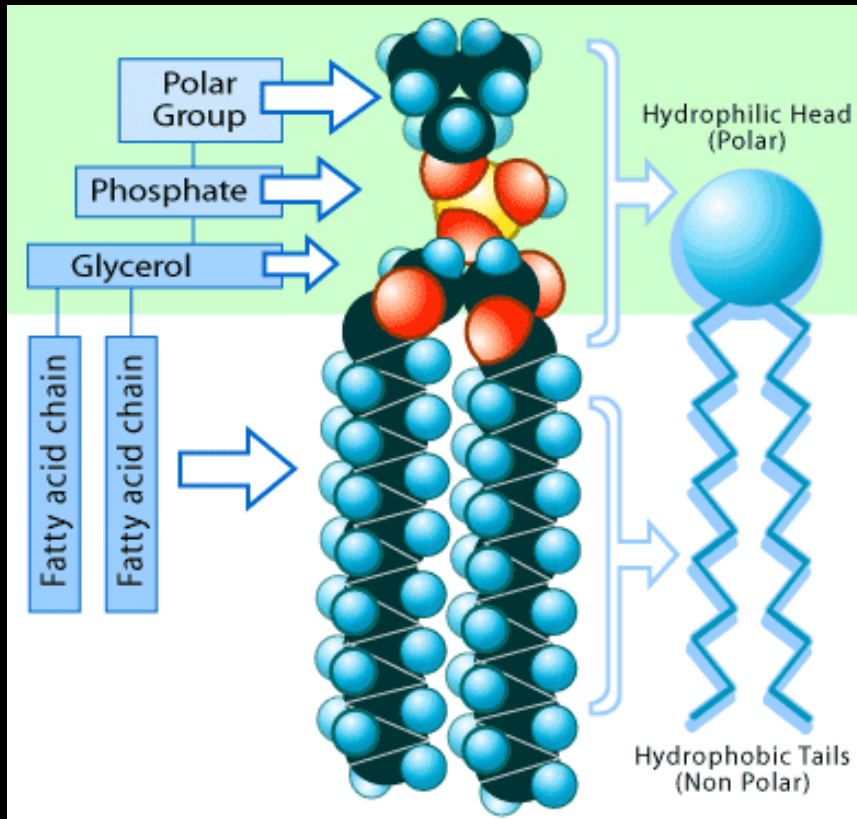


Phospholipids

- These make up the main part of cell membranes.
- Can be made by removing a fatty acid from a triglyceride and adding a phosphate component.

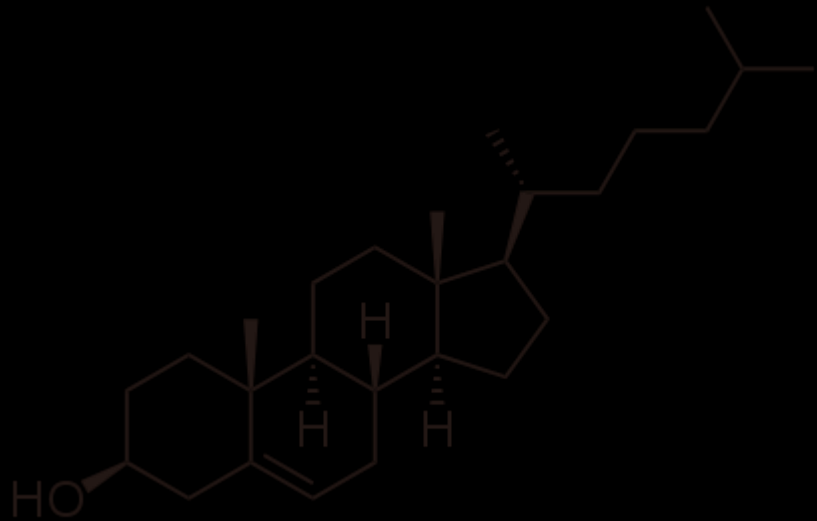


Let's simplify it!



Cholesterol

- Is a waxy steroid (category of lipid).
- It provides membrane permability and fluidity.
- Found in mammalian cells.

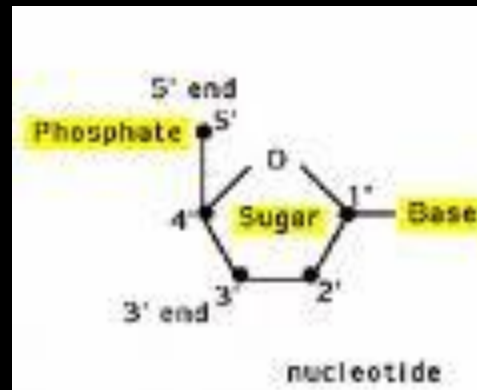
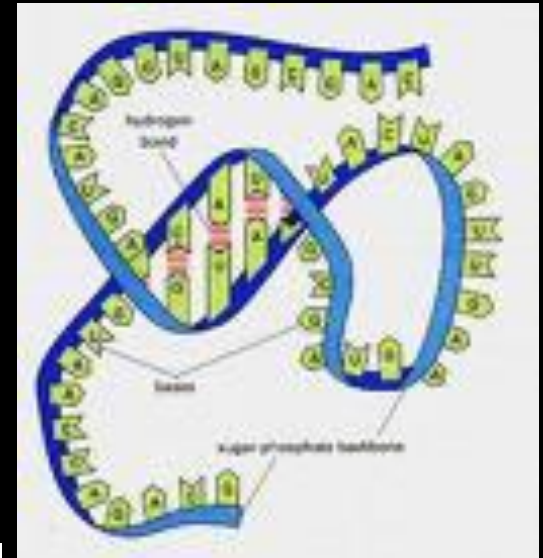


Functions of Fats and oils

- 1. Energy storage. Fats are a more compact fuel than starch.
- 2. Cushions and insulates the body and nerves.
- 3. Forms key parts of cell membranes

Nucleic Acids

- Contain carbon, hydrogen, oxygen and phosphorus.
- Building blocks for genetic material DNA and RNA most common.
- Made of monomers called nucleotides.
- Nucleotides consist of a sugar, phosphate group and base.



Biozone

- Biological Molecules p 38
- Carbohydrates p 39 (Please note another name for Carbohydrates are Polysaccharides)
- Lipids p 40
- Nucleotides and Nucleic acids
- Amino Acids p42 and Proteins p 43

Inorganic Molecules

Other Biological molecules

Inorganic Molecules do not contain Carbon and hydrogen bonds. Some biological molecule examples are:

- H_2O (Water)
- CO_2 (Carbon dioxide)
- O_2 (Oxygen)
- NH_3 (Ammonia)
- Minerals

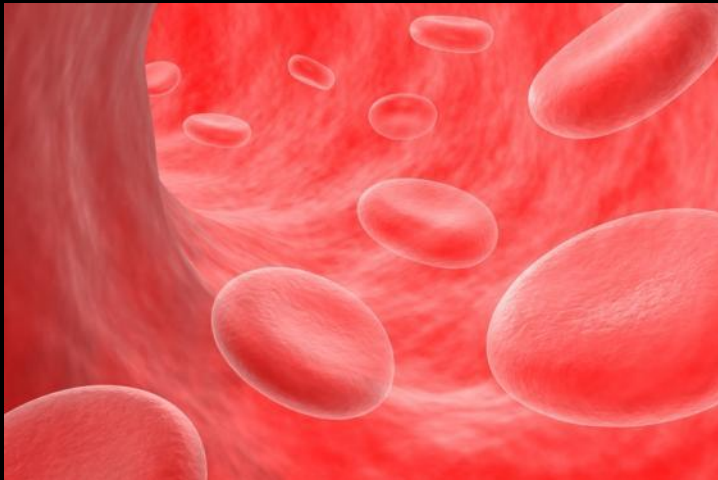
Water is a Biomolecule

Properties of water that make it essential for life.

1. Viscosity- refers to how oily a liquid is. Water has a low viscosity. Oil has a high viscosity.

Having a low viscosity allows water (blood) to flow easily through blood vessels.

Animals that swim through water can do so relatively easily.



2. Transparent: light can pass through easily.
This allows photosynthesis to occur for plants
Animals can see when underwater.



3. Universal Solvent: water can dissolve a large number of molecules. Many reactions occur in the water (cytosol) of cells.



4. Ice floats rather than sinks. Ice can insulate the water underneath and keep it relatively warm.

This allows habitat on the surface of very cold areas, in the water below and on the seabed.



Minerals

- Inorganic compounds
- Essential for cellular activity
- Provide essentials that body cannot make e.g. sodium, potassium and iron ions.

Other Molecules

Vitamins

Can be organic or inorganic in nature.

- Example Vitamin A, B C....
- Some of these body can make e.g. vitamin D with sunlight
- Many we need from our diet.
- Essential for body functions e.g. Vitamin B essential for healthy nervous system, without Vitamin C can develop Scurvy