

Macromolecules

continued

Introducing : Lipids

What are Lipids ?

Lipids are a diverse group of macromolecules.

Most lipids are **hydrophobic** (“water hating”)

Some are **amphipathic** : meaning they have one side that is **hydrophobic** ,and one side that is **hydrophilic-** (water loving)

Types of Lipids

There are many types of lipids

We will focus on 3 important lipids:

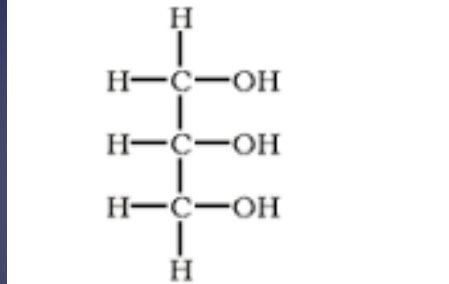
- Fats (also known or triglycerides, and fatty acids)
- Phospholipids
- Steroids

Structure of Fats

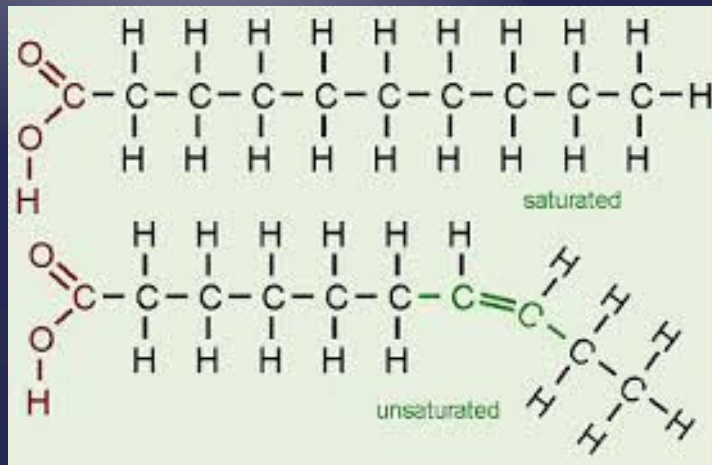
Consist of:

Glycerol: a 3-carbon molecule

Figure 1. Structure of Glycerol



(up to) **3 Fatty Acids**, each 8 – 22 carbons long



Fatty Acids can be **saturated** by hydrogen , (no double carbon bonds .

Fatty acids can also be **unsaturated** , at least 1 carbon to carbon double bond

Saturated Fatty Acids

Saturated fatty acids

- Contain only single covalent bonds between carbons
- Simplified structure can be shown as:
- Fats with saturated fatty acids are solid at room temperature.
- Examples: Butter, lard, margarine, animal fat
- Saturated fats can collect in the blood vessels and cause heart disease.

Unsaturated Fatty Acids

Unsaturated Fatty Acids

- Contain at least 1 double covalent bond
- Double covalent bonds make kinks in fatty acid:
- Liquid at room temperature (Example: Cooking oil)
- Cause fewer heart problems

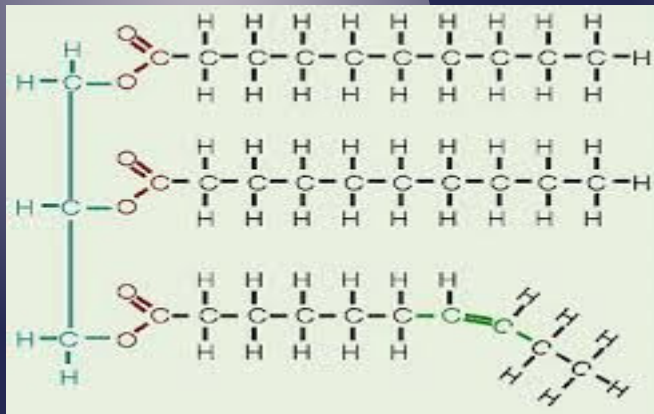
Trans Unsaturated Fatty Acids

- Double covalent bonds present, but arranged without kinks:
- Solid at room temperature, like saturated fats
- Cause heart problems like saturated fats

Fatty Acid Structure

The 3 fatty acids are attached to glycerol using condensation reactions.

An example of a fat with two unsaturated fatty acids:

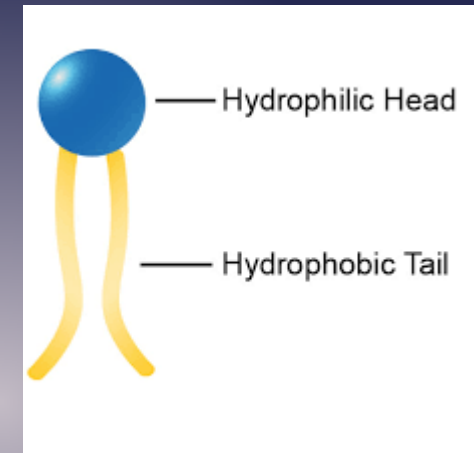


Fats are used also for **long-term energy** storage in plants and animals.

Phospholipids

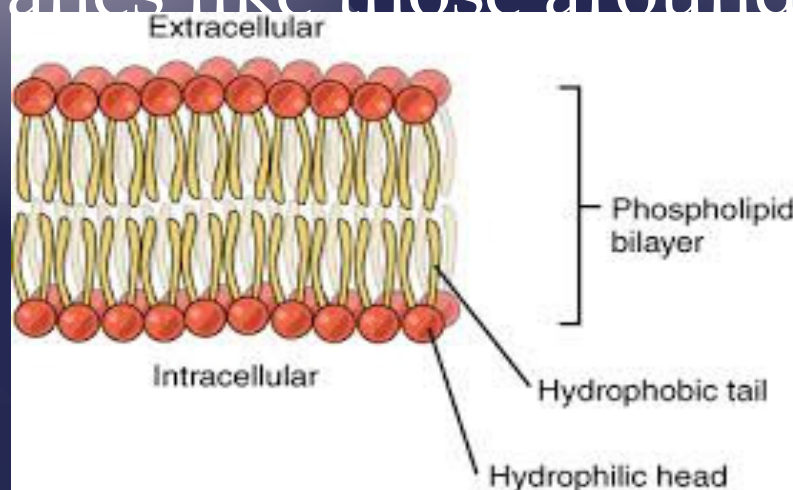
Consist of:

- Glycerol
- A phosphate group Water-loving “head”
- A nitrogen-containing group @ 2 fatty acids Water-hating “tails”
- **Hydrophilic** or water-loving head
- **Hydrophobic** or water-hating tails



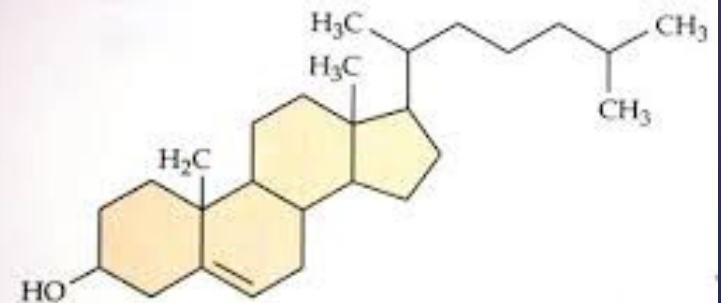
Phospholipids Make Up Membranes

- Membranes of all cells consist of a double layer of phospholipids, called a phospholipid “bilayer”
- Hydrophilic heads are pointed away from each other ☺ Tails form hydrophobic core
- Phospholipids make strong, flexible membranes like those around the yolk of an egg



Steroids

- **Steroids** are a class of lipids that include Cholesterol
- Sex hormones, such as testosterone and estrogen
- They have a common structure of 4 interconnected rings, as seen in cholesterol:



Cholesterol is a constituent of membranes and the source of steroid hormones.

Functions of Steroids

- Cholesterol maintains the flexibility of a cell membrane, when the temperatures rises or decreases
- We make cholesterol in our livers and eat it in our food.
- Steroid hormones direct our cells to do specialized tasks.
- Sex hormones affect the growth and function of reproductive organs
- Cortisone is active in carbohydrate metabolism and is used to treat allergic reactions.

Summary of LIPIDS

- **Fats**, made of glycerol and 3 fatty acids, are used for long-term energy storage. Saturated and trans fats are unhealthy.
- **Phospholipids** have a hydrophilic head and 2 hydrophobic tails. Cell membranes consist of a bilayer of phospholipids.
- **Steroids** consist of 4 interconnected rings. Cholesterol and the sex hormones are examples of steroids.