

Lipids I

Lipids fats oils.... Greasy molecules, mmmmm donuts.

Several levels of complexity:

- Simple lipids - a lipid that cannot be broken down to smaller constituents by hydrolysis.
 - Fatty acids, waxes and cholesterol

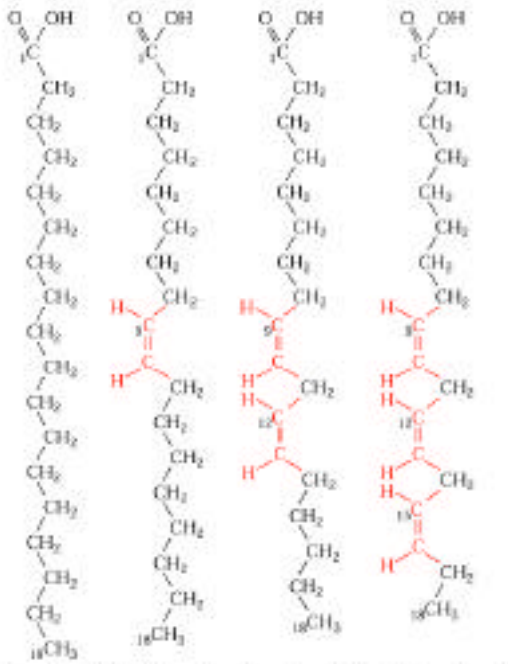
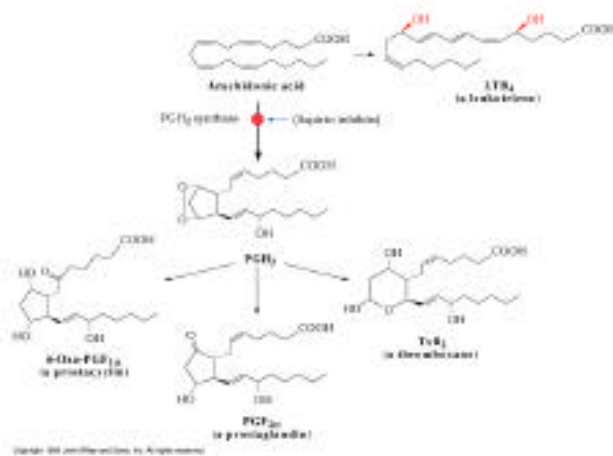


Figure 3-1. The structural formulas of some C₁₈ fatty acids.
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- Complex lipids - a lipid composed of different molecules held together mostly by ester linkages and susceptible to cleavage reactions.
 - acylglycerols - mono, di and triacyl glycerols (fatty acids and glycerol)
 - phospholipids (also known as glycerophospholipids) - lipids which are made of fatty acids, glycerol, a phosphoryl group and an alcohol. Many also contain nitrogen
 - glycolipids (also known as glycosphingolipids): Lipids which have a spingosine and different backbone than the phospholipids
- Precursor and derived lipids - these include several of the initial long chain hydrocarbons and other molecules that make up lipids, such as ketone bodies.

Properties of fatty acids

- Typically found as esters , mono, di and tri -acylglycerols (good old fashioned fat)
- Free fatty acids are found associated with carrier proteins such as albumin in blood
- These are amphipathic molecules with various carbon chain lengths
 - Can be up to 30 carbons long but generally less than 20
 - Saturated fatty acids are saturated with hydrogen. No double bonds.
 - Unsaturated fatty acids contain at least one double bond separated by a methyl group. These are typically cis- in nature.



Trans unsaturated fatty acids have been linked to cancer and heart disease. (the strength of the proof is not clear).

- Polyunsaturated fatty acids - duh
- Eicosanoids - derived from arachidonic acid. Important in many physiological roles. Examples are prostaglandins, thromboxanes, and leukotrienes
- Nomenclature
 - Common name most commonly used
 - The systematic name for saturated acids ends in **-anoic**. Unsaturated fatty acids ends in **-enoic**.
 - The number one carbon is the carboxyl carbon
 - Carbon #1 = carbon
 - Carbon #2 = carbon
 - Carbon #3 = carbon
 - Omega vs. delta fatty acids
 - Double bonds counted from the first carbon are delta desaturations
 - Double bonds counting from the methyl end are the omega desaturations
- Melting points and membrane fluidity. Both length and level of unsaturation determine the stability of the hydrophobic interactions and thus shift the transition phase - melting point of membranes
 - Double bonds - usually cis. This results in bends the chain.
 - Reductions in hydrophobic effect reduce energy required to disrupt the crystalline structure of a membrane or oil. Think of animal fat with lower unsaturated fatty acids - butter and plant oils that are polyunsaturated, corn oil.
 - The longer the fatty acids the higher the melting point.
 - Again the more hydrophobic interactions effects the more the energy it takes to break the order. Decreases in the packing efficiency decreases the mp
 - The van der Waals forces then come apart more easily at lower temperatures.
 - Animal alter the length and unsaturated level of the fatty acids in lipids (cholesterol too) to deal with the cold temps