



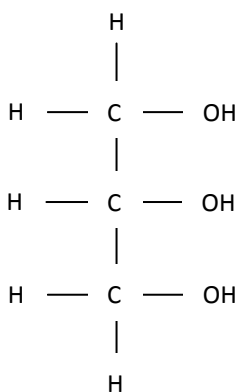
LIPIDS

Triglycerides, phospholipids, cholesterol and other chemically-similar biomolecules

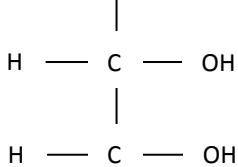
The **lipid** group is a variable group. Lipids tend to be insoluble in water and all contain the elements carbon, hydrogen and oxygen, like carbohydrates, except the ratio of hydrogen:oxygen is not a 2:1 ratio as with carbohydrates. Lipids have a H:O ratio which is much higher than this. Some lipids will also contain other chemicals as well. Some of the most important groups of lipids are **fats** and **oils, waxes, steroids** and **phospholipids**.

A **triglyceride** is a lipid which falls under the fats and oils group. Chemically, they are all very similar, as in they all only contain 6 atoms of oxygen (e.g. $C_{54}H_{98}O_6$ and $C_{44}H_{84}O_6$). Physically, they are insoluble in water, but soluble in *ethanol*, and they are less dense than water (they float). Oil is liquid at room temperature, whereas a fat is a solid. Both oils and fats act as good insulators – both electrical and thermal.

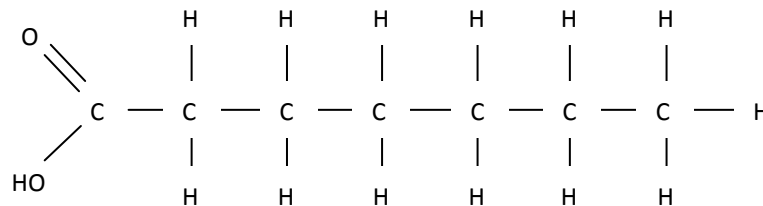
One triglyceride molecule contains the molecule **glycerol** and three **fatty acids**.



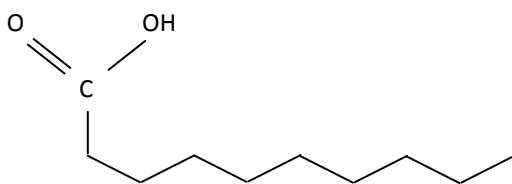
A glycerol molecule consists of three **alcohol groups** and the elements carbon, hydrogen and oxygen only. The glycerol molecule is *always the same* in any triglyceride, whereas the fatty tails can vary. The diagram to the left shows a glycerol molecule.



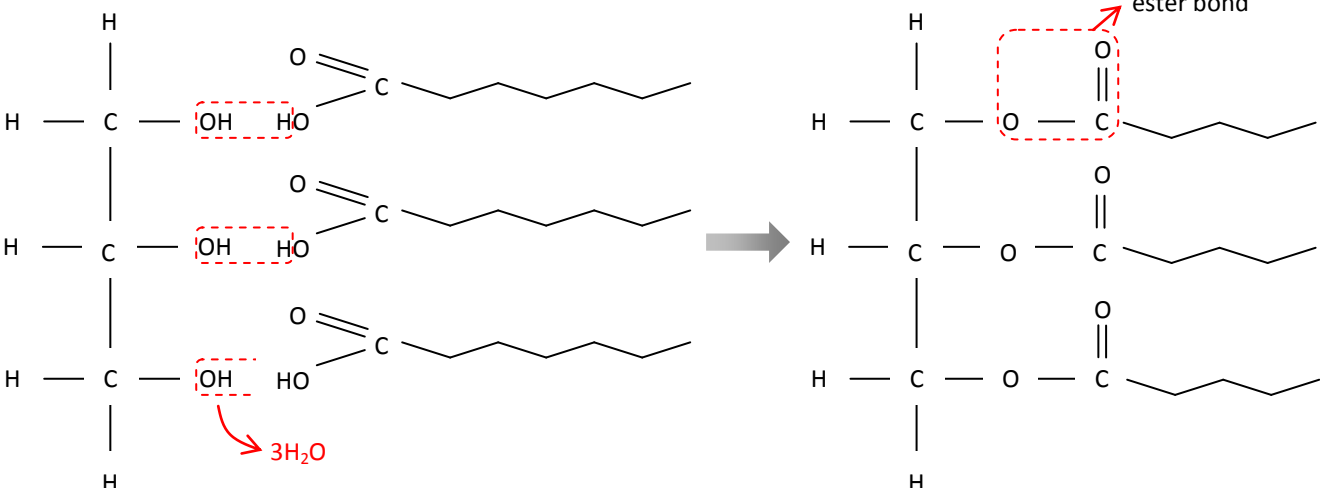
A fatty acid molecule consists of two parts: an **acid group** at one end, and a **hydrocarbon chain** at the other. The acid group is made from one carbon atom bonded with a hydroxyl group and a sole oxygen atom. The hydrocarbon chain is a long chain of purely carbons bonded together and with hydrogen atoms.



A fatty acid can also be drawn in a more simplified version for diagram purposes:



Three fatty acids and one glycerol molecule join together in a **condensation** reaction. Three molecules of water are released in this reaction, and the resultant product is one O – C – O covalent bond for each carbon (called an **ester bond**). This attaches one fatty acid to each carbon atom.



CHOLESTEROL

Cholesterol is also a class of lipid, even though it does not form from fatty acids and glycerol like triglycerides and phospholipids do. It is a small molecule made from *four carbon-based rings*. Cholesterol is a small structure which is very hydrophobic. It is found in all biological membranes, and these features allow it to sit nicely between the fatty acid tails.

This molecule is vital to living organisms, so many cells (especially those in the liver) can manufacture it. Excess cholesterol can cause health problems. A condition known as **familial hypercholesterolemia (FHC)**: high blood cholesterol levels that run in families) is a genetic disorder, where cells manufacture and secrete cholesterol even though there is already sufficient in the blood to provide for the organism's requirements. This happens because the cells do not obey the signals to stop cholesterol production, as they lack a particular cell surface **receptor**.

