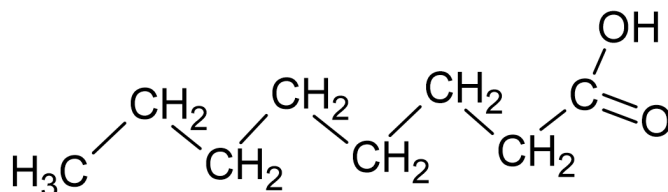


BIOLOGY
 Topic Summary

LT1 - LIPIDS OVERVIEW

Lipids are a diverse group of molecules that are crucial for the function of cells and organisms as a whole. They form an important part in many structural features in cells, are used in metabolic processes to release energy and can be used as signalling molecules, e.g. in hormones.



▲ Example of a lipid molecule (octanoic acid)

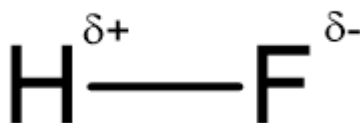
Properties of lipids:

There are 3 key elements that make up most of a lipids structure; these are hydrogen (H), carbon (C) and oxygen (O). Since they contain carbon, they are also classified as organic compounds.

A lipid's structure mainly consists of hydrocarbon chains, these are molecules that are only made of hydrogen and carbon. This means that lipids are very non-polar molecules because electrons are shared equally throughout the structure. Lipids are therefore insoluble in water, however, they are soluble in some other non-polar substances. *Polarity is explained below.*

Polarity and solubility in water:

Some elements attract electrons in a bond more strongly than others, these elements are said to be highly 'electronegative'. If one element in a bond is more electronegative than the other the electrons shared in the bond will move closer to the more electronegative element. This causes the more electronegative element to have a slight negative charge (represented by δ^-), while the less electronegative element has a slight positive charge (represented by δ^+). This type of bond is said to be 'polar'.



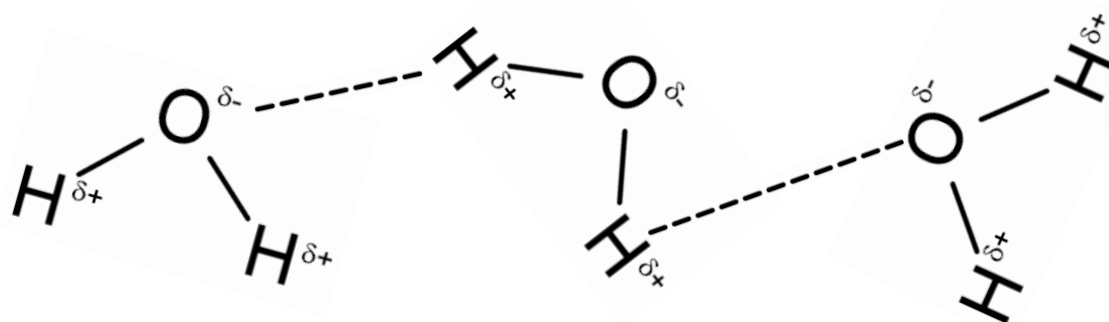
▲ Example of a polar bond, Fluorine is more electronegative so it has a partial negative charge.

Non-polar bonds occur when the elements in the bond have little to no difference in electronegativity, this means the electrons are shared equally and there are no partial charges. Hydrogen-Carbon bonds are non-polar, which in turn means that lipids are very non-polar.

In water the Hydrogen-Oxygen bonds are polar, with oxygen having the partial negative charge. This means there is an attraction between the negative oxygen atoms and the positive hydrogen atoms between water molecules, these attractions are called hydrogen bonds.

NOTE FOR CHEMISTS:

Hydrogen bonds only happen when a hydrogen atom is bonded to either nitrogen, oxygen or fluorine as these are the only elements electronegative enough to make the bond polar enough. The attractions are also between the partially positive hydrogen atoms and a lone pair of electrons on another atom, **not** between the opposite partial charges.



▲ Water molecules with hydrogen bonds (dashed lines) acting between the partially negative oxygen and partially positive hydrogen atoms

Anything that is polar enough to overcome water's hydrogen bonds will dissolve in water because the partial charges on each water molecule will be attracted to the opposite charges on the substance. Water molecules will be attracted to them and surround each molecule, hence dissolving them. However, lipids are very non-polar so they cannot overcome water's hydrogen bonding, therefore they are insoluble.

Skeletal Formulae:

Lipids are often drawn using skeletal formula because they are large molecules. Skeletal formula is the same as displayed formula except all Hydrogen-Carbon bonds are removed, and carbon atoms are represented by vertices in a line or the end of a line if there are no other atoms. Every other bond is still shown. For example:

