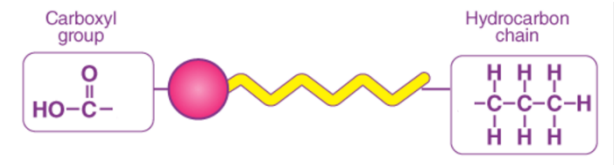
Lipids

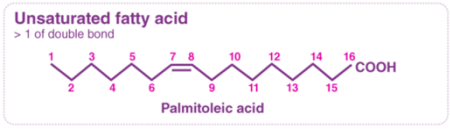
Lipids are molecules made of carbon, hydrogen and oxygen. Compared to carbohydrates, they have a higher proportion of hydrogen atoms compared to oxygen.
Lipids are insoluble in water, but soluble in organic solvents.

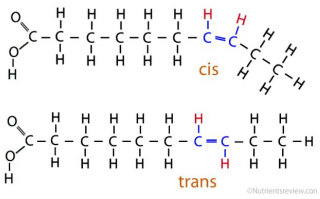
Fatty acids



A fatty acid is made of a long hydrocarbon chain with a carboxyl end (-COOH).

It is said to be saturated when the carbon atoms are all linked by C-C single bonds, and unsaturated when there is at least 1 C=C double bond.





The C=C double bonds can give either cis or trans isomers.
In the cis configuration, the 2 adjacent hydrogen atoms of the double bond stick out on the same side of the chain. Each cis double bond introduces a bend to the molecule, reducing the flexibility of the chain.
In the trans configuration, the 2 adjacent hydrogen atoms of the double bond stick out on opposite sides of the chain. The shape of a trans fatty acid is straight.

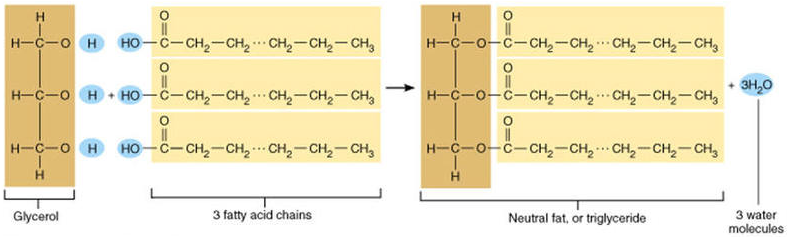
Saturated fatty acids	Unsaturated fatty acids
no double bonds	one or more double bonds
abundant in fats	abundant in oils
more reduced	less reduced
more energy	less energy
high melting point	low melting point

Note: Most naturally occurring unsaturated fatty acids have a cis configuration. Trans fatty acids are the result of human processing.

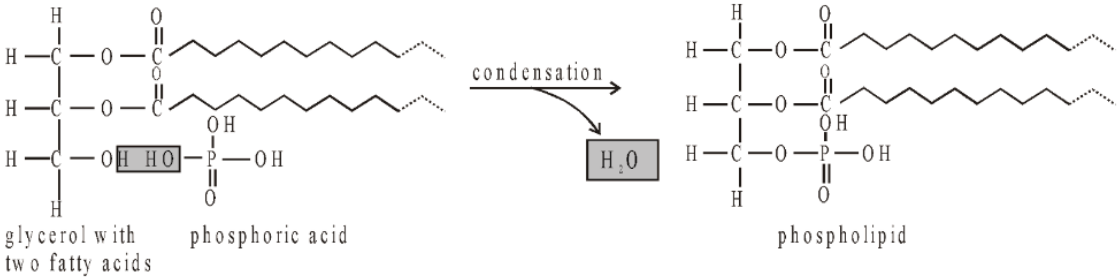
From monomer to polymer

Fatty acids can be joined through condensation reactions with a **glycer**ol molecule, forming di**glycer**ides or tri**glycer**ides.

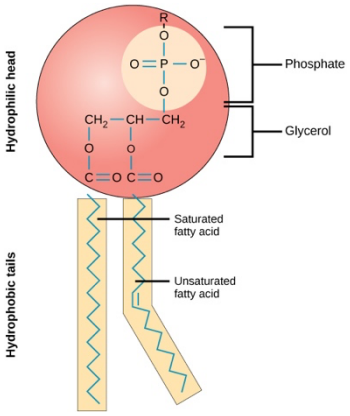
Ex: *Triglycerides are an important storage of energy for animals in fat, and for plants in their seeds.*

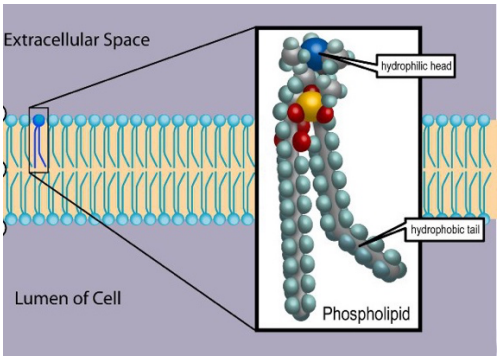


When one of the -OH groups of glycerol reacts with phosphoric acid instead of a fatty acid, it leads to the formation of a phospholipid.



Phospholipids have hydrophobic tails (the carbon chains of the fatty acids) and a hydrophilic head (the phosphate group derived from the phosphoric acid). These 2 antagonistic properties explain that they are an important structural component for cells, in the formation of the different membranes (cell, nuclear, mitochondrial, …)





Nutrition, lipids and consequences

Our body needs cholesterol to function properly, mainly for the production of hormones and vitamin D, and it supports digestion.
The liver generates enough cholesterol to handle these tasks, and this cholesterol is transported through the organism by lypoproteins. Low Density Lypoproteins (LDL) bring cholesterol to the arteries for cell repair, while High Density Lypoproteins (HDL) bring cholesterol back to the liver to be released.

However, our body doesn't just get cholesterol this way: Food is the main source of cholesterol, especially meat and dairy. And the quality of our diet has an impact on the relative abundances of HDLs and LDLs in our body.

	HDL	LDL
Effect	Encourages the transport of cholesterol and fats to the liver for excretion or re-use.	Encourages the accumulation of cholesterol in tissues and arteries. Leads to build up of plaque and atheromes
Diet	HDL tend to increase where diets are rich in omega-3 fatty acids, polyunsatyrated fatty acids, and fibre	LDLs tend to increase where diets are rich in trans fats, refined carbohydrates, cholesterol and saturated fatty acids
	"Good cholesterol"	"Bad cholesterol"