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ORIGIN OF FATTY ACIDS

The appearance of fatty acids and membranes is one of the most important events of the prebiotic world because genesis of life required the compartmentalization of molecules. Membranes allowed cells to become enriched with molecules relevant for their evolution and gave rise to gradients convertible into energy. By virtue of their hydrophobic/ hydrophilic interface, membranes developed certain enzymatic activities impossible in the aqueous phase. A prebiotic cell is an energy unit but it is also an information unit. It has a past, a present and a future.

The biochemistry of fatty acids involves acetylCoA, malonylCoA and an enzyme, acyl synthetase, which joins both molecules. After substitution of the acetyl group in place of the carboxyl group of malonyl derivatives, the chain is reduced and dehydrated to crotonyl derivatives. These molecules can again react with malonylCoA to form an unsaturated chain; they can also undergo a new reduction step to form butyryl derivatives which can react with malonylCoA to form a longer aliphatic chain. The formation of malonylCoA consumes ATP. The reduction step needs NADPH and proton. Dehydration requires structural information because the reduction product is chiral (D configuration). It is unlikely that these steps were possible in a prebiotic environment. Thus we have to understand how fatty acids could appear in the prebiotic era.

This hypothesis about the origin of fatty acids is based on the chemistry of sulfonium ylides and sulfonium salts. The most well-know among these molecules are S-methyl-methionine and S-adenosyl methionine. The simplest sulfonium cation is the trimethylsulfonium cation. Chemists have evidence that these products can produce olefin when they are heated or flashed with UV light in some conditions. I suggest that these volatile products can allow the formation of fatty acids chains in atmospheric phase with UV and temperature using methanol as starting material. Different synthetic pathways will be studied.