Chemistry of life from the perspective of Earth being a cooling star.

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Abstract:

This paper explores the chemistry of life origin from the perspective of Earth being a cooling star.

Current understanding.

In Science, current understanding of life formation chemistry has always been Earths earlier atmosphere. In this atmosphere molecules formed chemically that can be considderd lifes precursors. And in a puddle all these chemicals came together to sproute life.

Other scientists claim life or lifes chemical blocks (precursors) came from outerspace where they were made in astrochemical processes.

Problem with this understanding.

*) a free (elemental) nitrogen understanding. Although nitrogen could have been ionized through electric discharges (lightning) it is an extreme reactive component. The only way sufficient nitrogen could have been freed to create the molecules we now compose of is that we take this from a elemental perspective from the very start. And afterwards Nitrogen gets freed with huge lightning discharges as Saturn or Jupiters atmospheres have. So Earth at one point should have had the same atmospere as a Saturn or a Jupiter.

*) Reducing atmosphere. It is argued that Earths atmosphere did not contained a reductive (Hydrogen,carbon monoxide atmosphere) so the experiments conducted by Urey-Miller could never have been taken place.

*) In outerspace no more then 150 different types of molecules have been observed.

*) Formation of molecules in outerspace takes ages. It takes processes up to 80 million years to form a single molecule.

*) In just a puddle not enough material can come together to form a complex protein structure.

*) A puddle can not fold a proteinstructure in such a way that it will be capable of polymerisation a new genetic chain.

I hope in this paper to explain why it is best to view this entire life formation process from another perspective then just the vision that Earth used to be just a bit hotter and a little different in composition. It was very very hot and it had a huge atmosphere that caused a huge amount of chemistry. Earth was a star that captured a lot of material and cooled to its current state.

Enthalpy and Entropy.

In order to first visualize the stages and locations of the chemical reactions i drew 2 pictures to first visualize the presence of elements and molecules.

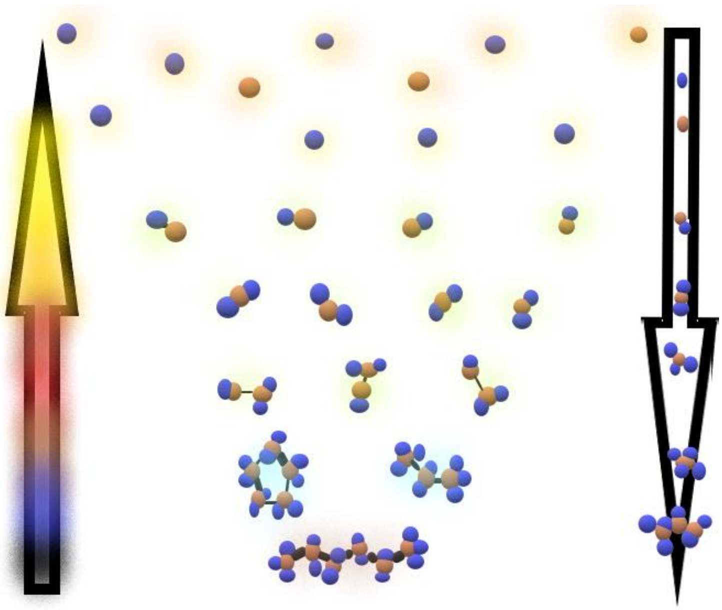


Figure 1. Top. High enthalpy (high energy), Low entropy. Bottom. Low enthalphy, High entropy. (Complexity of molecules).

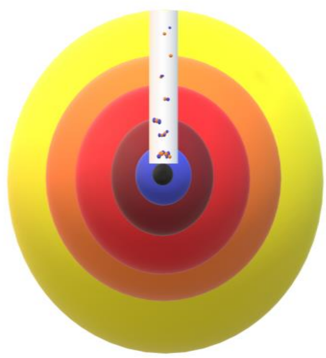


Figure 2. Occurrence of chemical reactions during a stars life.

Defyning the chemical stages for life requirement.

Plasmatic stage.

Here we find elements in the most simple form available in the Universe. Their plasmatic state.

We start in a system at a very high enthalpy (A lot of ``kinetic energy, temperature, chaos``).

Hydrogen, Carbon, Nitrogen, Iron, Nickel, etc. Etc. Are in their elemental state.

Material entering a star will get completely ionized due to availability of gravitational (molecules and elements hitting eachother) ,chemical, thermal and electrical energy.

Meteorites will therefore become a plasma.

Recombination stage.

From a Plasma it will go to a recombination stage. Enormous amounts of different molecules will form when a star cools. Best evidence of a cooling star is Jupiter`s red spot, as it is an example of Le Chatelier`s principle. See

phosphorylation.

Simple molecules (small lipids) will go through a phosphorylation stage. Because a phosphate group attaches lipids these molecules will now dissolve in water. Phosphorylation is also required for the presence of nucleic acids.

Dissolved

From a dissolved state. Many more molecules will form. Further in this paper i will point to the formation of Adenine which happens in an aquatic solution.

Enclosed state.

Water will be removed from molecules forming a variety of polymerisation reactions. Here life will form. From the first micelle formation, molecules like RNA, DNA, AMP, ADP, ATP can now enter the micelle and form a protocell. A micelle can be regarded as an enclosed state.

Chemical equilibrium.

There is no such thing as a chemical equilibrium in a stars life. During a stars life many stages can be present simultanously.

https://vixra.org/pdf/1608.0072v1.pdf. Chemical Equilibrium in Stellar Metamorphosis. Jeffrey J. Wolynski.

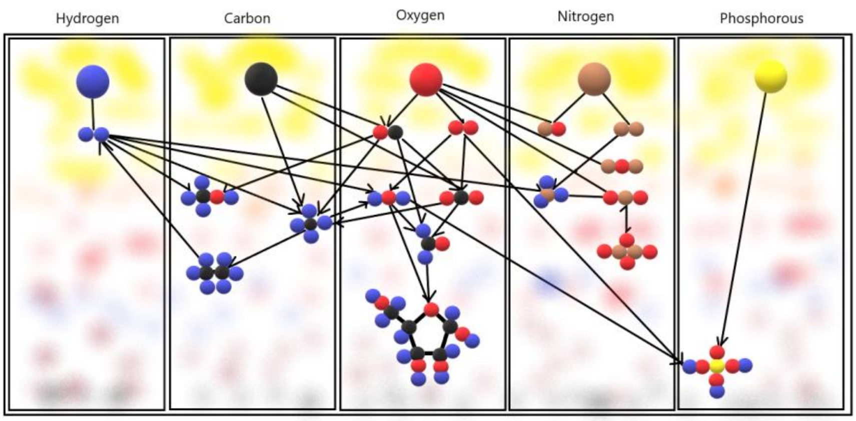


Figure 3. A few chemical reactions that occur in stars are drawn .

Enormous amounts of chemical reactions take place inside a (cooling) star. Here (for life generating purposes) the most important route is placed under Oxygen in which Ribose is generated.

Aside from the cheer amount of chemical reactions that take place there is also an enormous surface area where these reactions happen.

Ribose is the backbone of RNA, DNA and (for a part) the energy of a cell through AMP, ADP, and ATP). Phosphorylation is essential.

For lots of chemical reactions catalysts are required. (Fe, Ni, Si and smaller amounts Zn and Ti). They enter stars in meteorites.

The amount of catalysts required and where reactions exactly take place under what circumstances needs to be figured out.

The higher the carbon chain the more catalyst is required.

Amino acids for nucleus.

Short intro on from a chemical perspective what is required for RNA, DNA

RNA: Phosphate- Ribose- Base

DNA: Phosphate-Deoxyribose-Base.

Base component: 4 (5) aminoacids required.

Adenine (A), cytosine (C), guanine (G), and Thymine (T) (Becomes uracil (U) in RNA.)

Spacial orientation:

*) RNA

Singlestrand.

*) DNA is double helix.

C locks on G (hydrogenbond)

T locks on A (hydrogenbond)

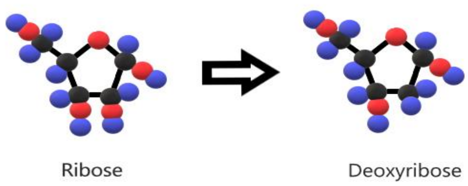


Figure 4 .From Ribose to Deoxyribose.

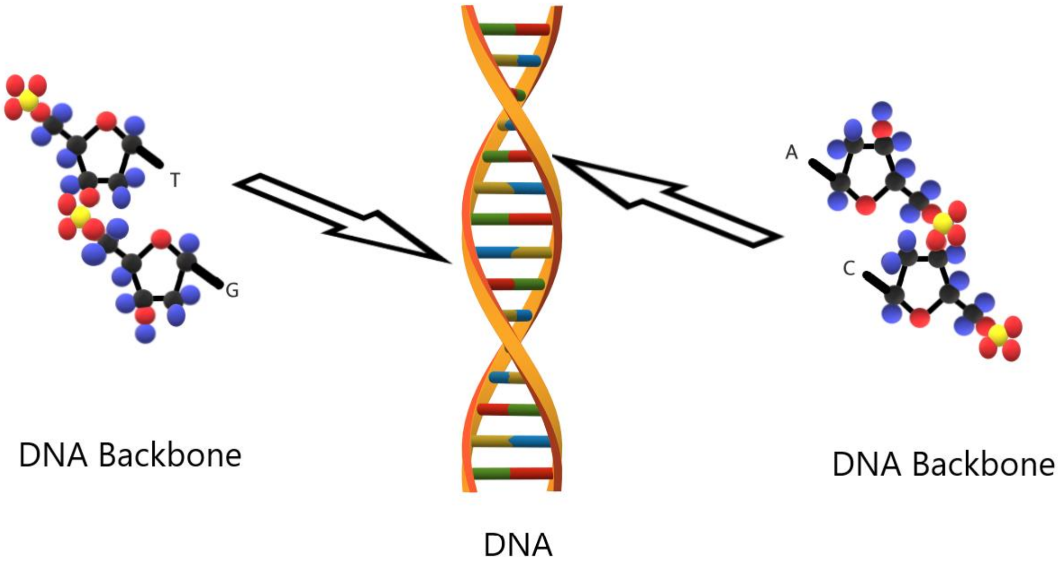


Figure 5.

The backbone of DNA is build from deoxyribose and a phosphate group.

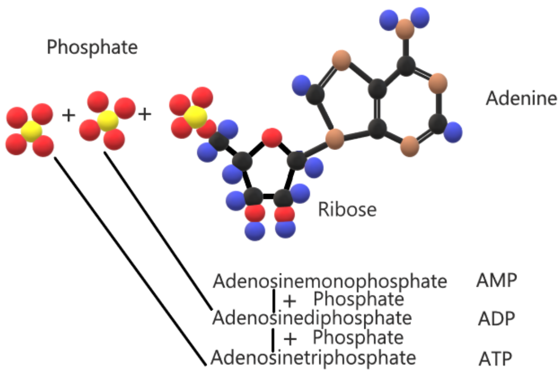


Figure 6.

Ribose and phosphate in AMP, ADP, ATP.

Chemistry for life (2.0). Where life originated hypothesis.

In this part of the paper i would like to discuss where life started from a star perspective.

Geologicaly wise a lot of life and its simple varieties emerged in the precambrian era. For life formation processes it is wise to study those type of rocks to determine what pressure, temperature and chemical conditions/requirements were present during life formation processes. But in order to get to them one doesnt always have a grand canyon at its disposal.

In Russia they drilled the deepest hole on Earth called the Kola superdeep borehole. They drilled into a third of the Earths crust to 12226m m deep (equivalent to 2.7 to 2.8 Billion years ago) and found enormous amounts of hydrogen, lots of diamonds and (to much) heat along the way down. Enormous evidence for Earths past as a very big (cooling) star.

What they also found up to 6.7km deep were plankton microphossiles (scientists found 22 species). On top of these microphossiles was a layer of organic carbon and nitrogen compounds.

Bear in mind there are a lot of living organismen under our feet.

The Subterranean biosphere is the largest biotoop we have on our cooling star and it is largely undiscovered. Living organismen are found up to 5 km below the Earths surface.

Plankton microbes can be considdered Earths earliest forms of life. As they can utilize (infrared) light (electric discharges) as a primary energy source.

The star. Trajectory of elements/molecules.

If enthalpy in a star decreases the entropy (complexity of molecules) increases. When molecules become heavier they will move downward towards to the centre of a star due to gravitational collapse.

Many molecules insoluble to water hit the ocean surface and will remain there till they get phosphorilated making them dissolve in water. Phosphorylation can also occur it the atmosphere due to meteorites entering the star. Once phorsphorilated they move towards the bottom of the ocean floor. Here these molecules are subject to not only gravity but also great pressure from all the water above it. The ocean floor itself is not still as many more molecules (like silicate) are also on their way down (from formation SiO_4) and Earth is subject to underwater volcanous and earthquakes because Earth is still cooling. A large portion of Earths crust still need to be formed. Molecules as oil and natural gas also get enclosed.

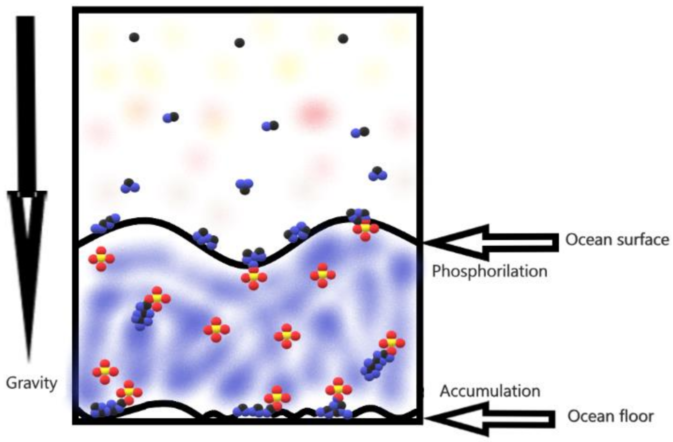


Figure 7. Motion of Carbon and nitrogen compound towards the bottom of Earth ocean floors surface.

The enclosed state.

Once (phosphorilated) molecules get enclosed with dirt they are not subjected anymore to the temperatures of the hot ocean or the acidity of it. Water can get removed through bonding of aminoacids (they form peptides). There are many ways how to remove water but how this exactly occurs is yet unknown. Due to gravity of the star it is possible that a lot of salt ions make the way to the oceanfloor to. A very salty (high halofillic environment) can extract water and give rise to polymerisations of molecules . It is described that halofillic environments are required for the proper folding of proteins in life formation processes.

L. M. Longo, J. Lee, M. Blaber. **Simplified protein design biased for prebiotic amino acids yields a foldable, halophilic protein**. *Proceedings of the National Academy of Sciences*, 2013; 110 (6): 2135 DOI: 10.1073/pnas.1219530110.

The pressure of the ocean above an enclosed state can squeeze these molecules into a unique folding to. Micell forms because phosphate lipid groups now clump together and RNA gets pushed into these micelles. A micelle itself is hydrophilic on the outside and hydrophobic on the inside. Water could be expelled from the micelle giving rise to extra polymerisation reations. Once the first protocell is born it will divide against the gravity and oceanic pressure because more nucleotides are being pushed into the micell then a single cell can handle.

Interesting questions/experiments to conduct to validate this hypothesis.

How does phosphorilation of lipids occur.? Through phosphorous material in ocean or rain? Do we even have a oceans surface as lots of rain will occur during grey-ocean world stages of stars? Are there catalysts required for various phoshorylation reactions?

Will the new RNA (to much present in one micelle form a new cell when we push more RNA/DNA material into a single cell through huge pressure. (What happens to the cell?)

Chemistry for life (3.0)

Subject: Polymerisation reactions in life formation processes.

*) Sugar polymerisations (no water extraction).

As i drew in figure 3 a Formose reaction occurs where formaldehyde via glyceraldehyde is converted into Ribose (a C5 carbon sugar). The start of this reaction is not exactly known but there are scientific articles devoted to this reaction because of its part in life generation.

-)Hydrothermal formose reaction.

TY - JOUR, AU - Kopetzki, Daniel,AU - Antonietti, Markus,PY - 2011/09/01, SP - 1787, EP - 1794, T1 - Hydrothermal formose reaction,VL - 35, DO - 10.1039/C1NJ20191C, JO - New J. Chem. ER -

Describes the reaction happening under hydrothermal temperatures at 200 degrees celcius.

-) Schreibersite: an effective catalyst in the formose reaction network
S Pallmann *et al* 2018 *New J. Phys.* **20** 055003

Describes the use of meteorite material schreibersite (capable of releasing soluble and reactive phosphorous oxyanions) to catalyze the aldol reaction forming larger sugar molecules.

Shreibersite contains phosphor, Iron and Nickel.

Many minerals more can enter a star through gravity. Phosphorite and Apatite minerals contain also a lot of Phosphorous material that once ionized gets back to their elemental state.

95% of all meteorites on Earth contain iron and nickel . These meteorites made it through Earths atmosphere because ionization processes (gravity, thickness of atmosphere, huge electric discharges) decline over time during a stars life. If a similar size Phosphorite meteorite would strike Earth most of it will be destroyed before it can hit the Earths surface.

*)Polymerisation of molecules to aminoacids.(without water extraction but in an aquatic solution.)

Just as Ribose can be generated from a formose reaction, adenine can be formed out of a polymerisation reaction from ammonia and hydrogen cyanide in an aquatic solution. This reaction has been described by Joan Oró.

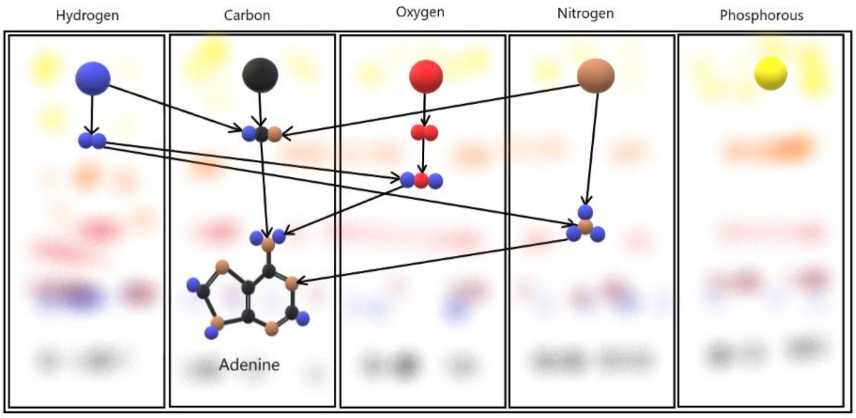


Figure 8. How a star cools down and thereby forming Adenine.

There are 20 aminoacids that form most of life on Earth. A star will build many more then 20 aminoacids. Just as in the Urey-Miller experiment other amino acids also can be generated.

See: A production of amino acids under possible primitive earth conditions SL Miller - Science, 1953 - faculty.jsd.claremont.edu.

A lot of the other aminoacids are not capable of forming thermal stable proteins. R-aminoacids (mirror of L-aminoacids) can not polymerise on a L chain aminoacid chain due to geometric orientation. What has happened to the abundance of non-life forming aminoacids is a mysterie. Personally i would argue that most of the non protein forming aminoacids have been converted in microbial life to usable aminoacids.

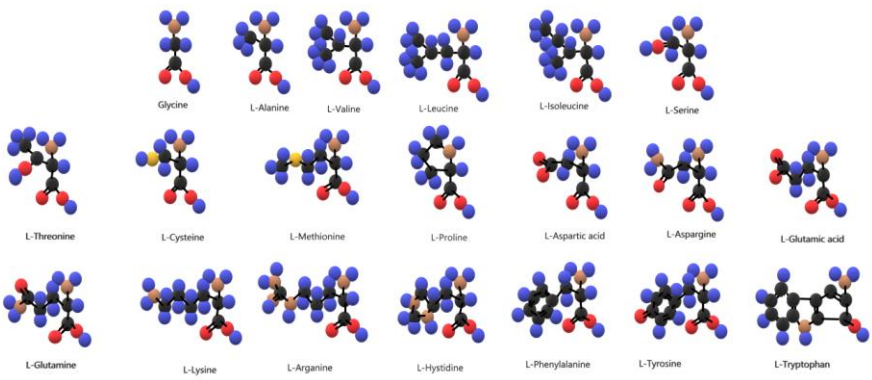
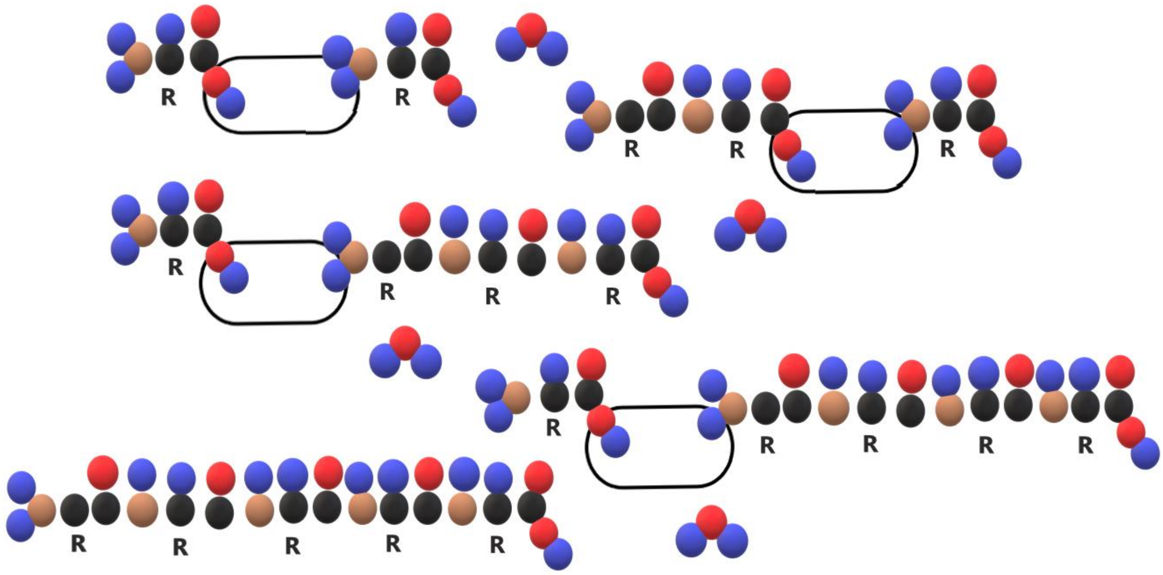


Figure 9. 20 aminoacids that play a vital role in Earths life.

*) Aminoacids polymerisation. (Protein formation through water extraction)



Figrure 10. Because of removal of water aminoacids polymerise to a protein.

*) RNA/DNA Polymerisation. (Water extraction)

From a chemical perspective life itself is an adaptive polymerisation reaction of heridatery material.

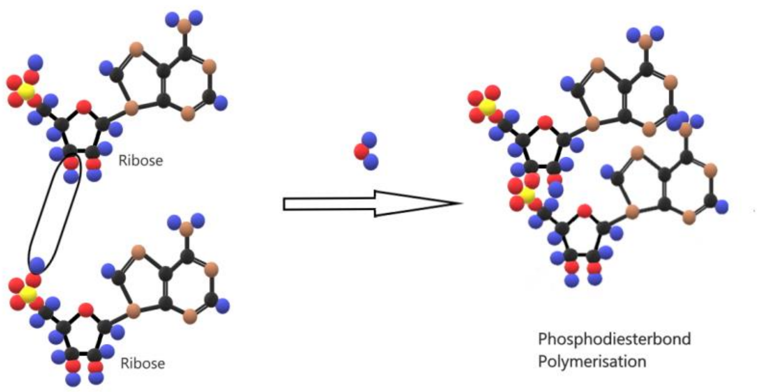


Figure 11. 2 AMP molecules are forming a little bit of RNA. Through water extraction a phosphodiester bond is formed.

*)Phospholipid formation through polymerisation of free fatty acids (water extraction).

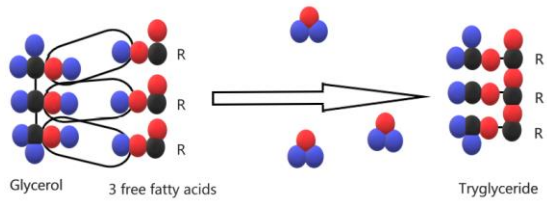


Figure 12. Polymerisation of free fatty acids and glycerol to tryglyceride (water extraction).

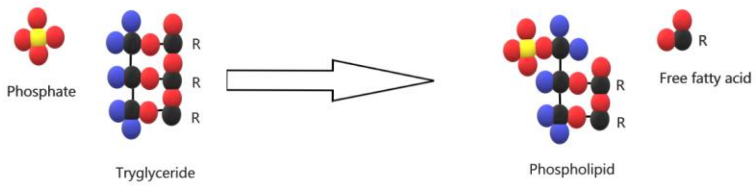


Figure 13. From Tryglycerides to Phospholipids.

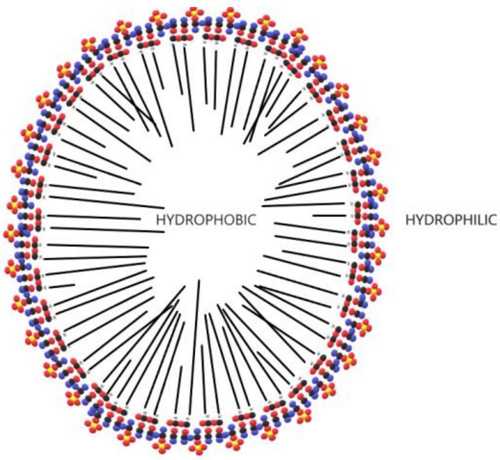


Figure 14. Phospholipids forming a micelle.

*) Sugar polymerisation (through waterextraction.)

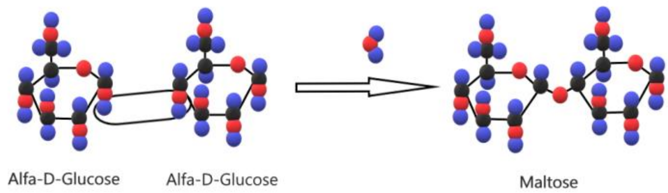


Figure 15. 2 monosaccharides are forming a disaccharide through water extraction.

Polysaccharides can be made from monosaccharides through water extraction.

From all these waterextraction polymerisations it is understandable that science has looked into the ``everything started in a puddle`` theory where water was removed through evaporation.

But huge pressure, temperature, hygroscopic rocks and (very) salty environments could be key to the very origens of life.

This small paper is just an illustration of what can and will be discovered in the future and should motivate and inspire (bio)chemists to look at the stars.

Earth used to be a huge star under which chemical reactions took place that eventually led to life.

Without proper catalytic reactions and tremendous availability of electricity, heat, energy, pressure we would now not been breathing. The puddle theory where life formed should be disregarded as the chemistry for life can not take place in just a puddle. Life also did not come from outerspace as in outerspace only 150 different types of molecules have been found. Earth has tens of thousands of different types of molecules. Some of them are made by you and me right now.

Life is direct evidence that you are standing on what once was an enormous star. Earth.

In order to advance our understanding of life`s origin i recommend sending probes to our neighbour cooling stars Saturn, Jupiter, Uranus and Neptune`s interiors as these stars are chemically building the key ingredients for Life.

Thanks to 3d paint library community for providing a DNA graphic.

References:

-) A production of amino acids under possible primitive earth conditions
SL Miller - Science, 1953 - faculty.jsd.claremont.edu

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-) Hydrothermal formose reaction.

TY -JOUR, AU- Kopetzki, Daniel,AU - Antonietti, Markus,PY - 2011/09/01, SP - 1787, EP- 1794, T1- Hydrothermal formose reaction,VL - 35, DO- 10.1039/C1NJ20191C, JO- New J. Chem. ER -

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-) L. M. Longo, J. Lee, M. Blaber. **Simplified protein design biased for prebiotic amino acids yields a foldable, halophilic protein**. *Proceedings of the National Academy of Sciences*, 2013; 110 (6): 2135 DOI: 10.1073/pnas.1219530110

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-) Wikipedia. List of interstellar and circumstellar molecules. Joan Oró.