Origin of Life on earth by RNA and viruses

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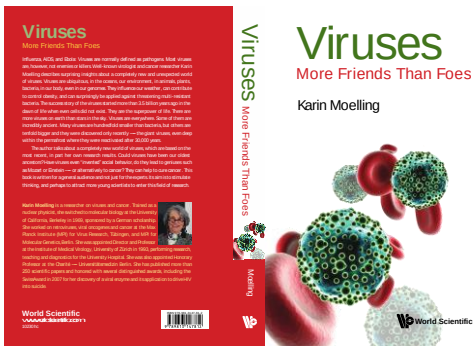
1. Introduction

The origin of life started under extreme conditions presumably at the hydrothermal vents in the oceans 3.8 bio years ago. Can one extrapolate from that to other extreme conditions and habitable zones outside of our planet?

2. An additional section

The first biomolecle on the earth are replicating RNA molecules. They are biologically active, able to cleave and join, mutate and evolve under extreme conditions at hydrothermal vents. They are designated today as catalytic RNA, riboszymes. They arose before cells existed and metabolized on chemical energy supplied by the environment, without sun or cellular background. Only later viruses depended on cells. Ribozymes lack genetic code information and rely on structural information such as hairpin-loops. The ribozymes evolved to the catalytic centres of the ribosomes, the protein synthsis machinery today. “Ribosomes are ribozymes”, consisting today of about 100 proteins as scaffolds for protein sysnthesis. Ribozymes exist still today and are closely related to small naked viruses, the viroids. A major contribution to protein synthesis is based on tRNAs, also highly structured non-coding RNAs. The majority of the genomes of even the most complex forms of life, the humans, consist of 98% of non-coding sequnces. Thus our genomes evolved from non-coding to coding RNA sequences, which is reflected today in rapidly evolving RNA viruses, such as Influenza. A major driver of evolution are the viruses, most specifically the retroviruses (such as HIV today), which also contributed to generate the more stable DNA from the versatile mutagenic RNA. More than 50% of the human genome consists of retrovirus-related sequences. One retrovirus candidate form the human genome was revitalized under laboratory conditions, Phoenix, which existed 35Mio years ago. These propertis are still reflected in the virus world today. Most recently giant viruses have been discovered which are bigger than many bacteria and may be a transition form of earlier life to bacteria and archaea. Archaea can be considered as the most innovative organisms, named the extremphils- however the evolution of novel metabolic pathways takes time. I will discuss, what we can possibly learn and extrapolate from our world, starting from replicating molecules to LUCA, microorganisms and life on our planet today. Tardigrades are certainly far too advanced a species for survial of life. As reference I will give my recent book on “Viruses, more friends than foes” (World Scientific Press), which describes and explains all of what is mentioned here for non-spcialists and contains recent literature for further reading [1].

3. Figures



4. References

[1] K. Moelling: Viruses More Friends than Foes, World Scientific Press, Singapore, 2017.

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Short Summary

The origin of life based on RNA and viruses.