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Forms of life on Early Earth as model for Exoplanets?

Karin Moelling
Int of med Microbiology, University Zürich, Zürich, Switzerland (moelling@molgen.mpg.de)

The recent discovery of exoplanets with putative habitable zones which may be as frequent as 10^{25} stimulate the interest in the origin of life on the exoplanets but also on the Earl Earth (EE). Meteorites and missions to Mars or Moon teach us about their composition, and make us think about the origin of life in general. Prebiotic molecules such as amino acids, nucleosides, and fullerenes arrived from extraterrestric space and cyanobacteria and archaea are inhabitants of the EE. They exhibit properties such as protein synthesis, which requires advanced machineries adapted to our Earth. What could be early precursors of such mechanisms. What kind of life can we envision in its simplest form? Molecules which can replicate, mutate, and evolve are signatures of life.

The simplest such biomolecules on Earth may be non-protein-coding (nc)RNA catalytic RNA, the ribozymes and viroids, which can fulfill many protein functions, including replication, evolution, and are a prerequisite for peptide synthesis. Ribozymes/viroids can evolve to higher complexity. Archaea and bacteria resemble giant viruses suggesting a continuous transition from dead to living matter. Archaea are extremophiles which revolutionalized our view on what life can be like in respect to environmental conditions and specialized metabolic pathways. Some exotic spots on Earth can teach us about other habitable zones. Meteorites help to understand chemical compositions on other planets and the consequences for life. During evolution loss and gain of of genetic information are important evolutionary driving forces. Viroids are discussed as models for potentially other forms of life. Simulators of Mars environment are under study to determine possible effects on biological sepcimens.

Ref: Broecker and Moelling Geosciences (2019), Annals NY Acad Sci. (2019), Frontiers Microbiol (2019). Book: Moelling:Viruses more friends than foes World Scientific Press (2017)