

ORIGINS OF LIFE SYSTEMS CHEMISTRY

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How can chemistry morph into biology? This is the key question about the origin of life, be it on our planet several billion years ago, or elsewhere and so we need to think about chemistry in the context of planetary science if we want to know where we came from and whether or not we are likely to be alone in the Universe.

The chemistry used by biology to fabricate its various components is by and large hopelessly inefficient in the absence of enzyme catalysts, so we need to look for different chemistry that can make the same componentry efficiently without enzymes. But where do we look?

One approach is to guess at the environment and then use laboratory simulation to investigate its chemistry. The problem with this is the guesswork – there were presumably many different environments on early Earth and it is not obvious what chemistry they might be associated with. An alternative approach is to explore chemistry in a pretty much unconstrained way to try and find out if all the molecules needed to kick-start biology can be made under similar conditions from plausible feedstocks. If they can and the conditions required correspond to a particular environment on early Earth then that environment is strongly implicated and can further guide chemical investigations. In this lecture, I will present the results of this latter approach and demonstrate how hellish conditions on Hadean-Archean Earth could have set the stage for the transition from chemistry to biology.