

# Systems Chemistry in the Chemical Origins of Life: The 18<sup>th</sup> Camel Paradigm

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## ABSTRACT

Developing an understanding of the prebiotic chemical *Origins of Life* has long been defined and dominated by various biology-driven hypotheses, such as the RNA-first world or metabolism-first world or lipid-first world, or protein-first world, each of which then gave rise to the other classes of compounds and, then, set the stage for the appearance of life. These ‘one-after-the-other’ concepts are a result of a ‘top-down’ view that extrapolates extant biological paradigms and processes, linearly backward in time, relying largely on molecular phylogenetic analysis for clues to seek evolutionary historical relationships in biochemical pathways. As a result, the focus has been *only* on the chemical origins of the biological building blocks of RNA, proteins, metabolites *etc.*, at the expense of ignoring the roles of other prebiotically relevant molecules. However, in recent times, this one-dimensional reductionist thinking has been slowly, but surely, challenged by the influence of *Systems Chemistry* in prebiotic chemistry – leading to a ‘bottom-up’ co-existence and co-evolution of various molecules that can give rise to a (dynamic) network of interacting entities capable of chemical evolution. This personal review describes how our research program, which was once driven by the reductionist-linear approaches, has been increasingly influenced by the principles and paradigms of Systems Chemistry. And how it, in turn, has led to fundamental changes in our approaches to investigating the chemical Origins of Life by considering alternative prebiotic molecules and chemistries that may have played a role in getting the prebiotic chemistry started, but have not been retained in their original forms in extant biology. This has led to a “18<sup>th</sup> camel paradigm” in our research – one that is providing unconventional venues and alternative perspectives to comprehending some of the long-standing issues in this field.

**Keywords:** origin of life, depsipeptides, DNA, peptides, prebiotic Chemistry, RNA, Systems Chemistry.

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