Experimental Challenges in the Study of the Origin and Post-origin of Life

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ABSTRACT

Due to the lack of direct evidence of how life started on Earth, some researchers take a practical approach to the origin of life by creating cell-like models in the laboratory. This is done by assembling various chemical molecules to make structures and systems that mimic the cell-like processes, *e.g.*, division and replication. Constructing such systems allows for interrogation of these models, often providing intriguing insights on the possible routes of how the chemical world could have evolved into the biological world. In addition, the top-down studies try to reduce existing life into its basic processes and information content. Examples include studies on an assortment of bacteria with the deficient division machinery (L-form), reduced and minimal genomes, and synthetic genetic codons. The simplification of bacterial cells reveals the possible routes from the origin of life to current cellular life, or what we call the post-origin of life. Both bottom-up and top-down approaches are summarized here, along with highlights of current experimental challenges in producing an essential element of the origin of life: self-replicating cell-like structures. Experiments are proposed using screening and artificial evolutionary approaches to explore both the origin and post-origin of life.

Keywords: synthetic cell, origin of life, post-origin of life, minimal genome, L-form

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