The life of our Last Universal Common Ancestor

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The earliest evolution of life included a series of transition from non-living matter, through prebiotic organic synthesis and chemical evolution, towards the Last Universal Common Ancestor of all life. Our work focuses on the immediately-pre-life stage of evolution, when chemistry became biology. We create synthetic minimal cells that exhibit some key properties of life, without being entirely alive. Those cells express proteins inside phospholipid liposomes, using cell-free protein expression systems. Thus, represent the latest stage of prebiotic evolution, after the establishment of the Central Dogma. Those cells do not exhibit active homeostasis, but they can maintain separate internal environment, they can grow, divide and evolve. The controllability and flexibility of those minimal cells allow us studying chemical processes underlying major transitions in evolution. Synthetic minimal cells express complex genetic pathways, with membrane proteins facilitating communication with external environment. Together, this creates a comprehensive system to study the advent of cellular processes on the boundary between prebiotic and Darwinian evolution.