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Assembly of a minimal protocell STEEN RASMUSSEN, Los Alamos National Laboratory, PROTOCELL ASSEMBLY TEAM TEAM — What is minimal life, how can we make it, and how can it be useful? We present experimental and computational results towards bridging nonliving and living matter, which results in life that is different and much simpler than contemporary life. A simple yet tightly coupled catalytic cooperation between genes, metabolism, and container forms the design underpinnings of our protocell, which is a minimal self-replicating molecular machine. Experimentally, we have recently demonstrated this coupling by having an informational molecule (8-oxoguanine) catalytically control the light driven metabolic (Ru-bpy based) production of container materials (fatty acids). This is a significant milestone towards assembling a minimal self-replicating molecular machine. Recent theoretical investigations indicate that coordinated exponential component growth should naturally emerge as a result from such a catalytic coupling between the main protocellular components. A 3-D dissipative particle simulation (DPD) study of the full protocell life-cycle exposes a number of anticipated systemic issues associated with the remaining experimental challenges for the implementation of the minimal protocell. Finally we outline how more general self-replicating materials could be useful.

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