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Title

Mutualism between auto-catalysis and motion

Abstract

Biological systems have unique characteristics – like the ability to move, adapt and grow – that are difficult to incorporate into synthetic mimics of minimal life-forms, because this requires coupling chemistry to physical processes at all scales. Based on how fundamental replication is to biology, self-replicating and auto-catalytic systems, where molecules facilitate their own formation or “make themselves” must have played a central part in the emergence of life. Here, we show that self-reproducing lipids drive the movement of droplet protocells. The rate of lipid formation is enhanced through an emerging, previously unknown mutualistic effect between the movement and the chemistry, with droplets actively seeking resources to fuel their motion. The emergence of the movement points towards a case of kinematic catalysis, as movement accelerates homogenization through the faster production of the lipid. Our results show that communication between chemical systems and their environment can achieve complex function – which will be useful in designing increasingly sophisticated models of living systems. Further, we envision potential impact for motion-enhanced reaction rates.

