Abstract Submitted
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A PDE Model For Protocell Evolution And The Origin Of Chromosomes Via Multilevel Selection[1] DANIEL COONEY, University of Pennsylvania, FERNANDO ROSSINE, Harvard University, DYLAN MORRIS, University of California, Los Angeles, SIMON LEVIN, Princeton University — The origin of chromosomes was a major transition in the evolution of complex cellular lie. In this talk, we model the origin of chromosomes by considering a simple protocell composed of two types of genes: a "fast gene" with an advantage for gene-level self-replication and a "slow gene" that replicates more slowly at the gene level, but which confers an advantage for protocell-level reproduction. Using a PDE to describe how the composition of genes within protocells evolves over time under within-cell and between-cell competition, we find that the gene-level advantage of fast replicators casts a long shadow on the multilevel dynamics of protocell evolution: no level of between-protocell competition can produce coexistence of the fast and slow replicators when the two genes are equally needed for protocell-level reproduction. By introducing a "dimer replicator", a linked pair of the slow and fast genes, we see that coexistence between the two genes can be promoted in multilevel competition between fast, slow, and dimer replicators. Our results suggest that genetic linkage can work in concert with deterministic multilevel selection to faciliate coexistence of two genes that are complementary at the protocell level but compete at the level of individual gene-level replication.

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