

Multi-level evolutionary dynamics of nested Darwinian populations and the evolution of collective heredity

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Microbial collectives, such as communities and consortia, possess functions that are not achievable by their components in isolation. Key to evolution of collective function is the transmission of collective characters across generations. When collectives are composed of diverse competing types, e.g., different species, maintenance of characters is opposed by inevitable conflicts within collectives. In this talk, I will present a model for the eco-evolutionary multi-level population dynamics of nested branching processes, where both collectives and their composing particles die and reproduce. I show that selection, acting on the composition of a simple two-type community, drives the evolution of increasingly reproducible collective states by shaping interactions between types. The mechanism by which stochastic fluctuations in composition come to be corrected through collective 'development', and the conditions for the emergence inheritance of collective characters have implications both for the evolutionary origin of symbioses and for top-down engineering of microbial communities.