Artificial selection in small bacterial communities

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Our lab studies a small bacterial community that can grow on and degrade toxic industrial waste fluids. While this community is relatively efficient, it can still only degrade 40% of the waste. We now ask if we can breed new communities with increased degradation efficiency and between-species cooperativity, i.e. higher yield or stronger degradation in co-culture than in monocultures, even while the species compete for resources. Previous attempts to experimentally evolve microbial communities have shown mixed success. Such evolutionary experiments are fraught with difficulties, including the risk of inadvertent selection for growth or yield, defining the community function and ensuring selection for desired traits. The purpose of the present project is to develop in-silico simulations of the experiments to evaluate the impact of experimental design and parameter choice before starting time-consuming evolutionary experiments in the lab. The first results show that our design can explore the combinatorial space of small communities and select for both waste degradation and cooperative traits. We will now include mutations and investigate to what extent our first observations depend on model parameters. Our results will inform the experimental design for artificial community selection, and hopefully contribute to our understanding of group selection theory.