BiophysTO Lunchtime Seminar Series

Date

Tuesday, November 15 , 1 pm

Location

McLennan, MP606
60 St George st

Dr. Stephen Martiss

Memorial Sloan-Kettering Cancer Center

Eco-evolutionary feedback can stabilize diverse predator-prey communities

Predator-prey models describe the population dynamics of communities that consist of pairs of strongly interacting species, such as phage and bacteria. However, when the constituent populations are sufficiently phenotypically diverse (e.g. when the distribution of interaction rates is sufficiently broad) these models are known to be unstable, chaotic and extinction-prone. Crucially, these ecological models neglect evolution, which is central to the generation of phenotypic variation and which can act on timescales comparable to ecological change. Here, I couple an otherwise unstable ecological model of a phage-bacteria community to explicit high-dimensional evolutionary dynamics. I show that in this eco-evolutionary model, phenotypic diversity counter-intuitively stabilizes the population and delays extinction, in stark contrast to the classical ecological theory. Using both stochastic and deterministic simulations and theory based on the statistical physics of disordered systems, I show that this stabilizing effect is driven by a form of "eco-evolutionary feedback" which is regularized by demographic noise. I demonstrate that the stable phase of the dynamics corresponds with the clonal interference regime of population genetics. Importantly, it is expected that qualitative aspects of these results generalize to other evolving complex systems.

Host: Anton Zilman

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