BP 11: Evolutionary game theory (joint session SOE/BP)

Time: Tuesday 11:30–12:30 Location: H17

BP 11.1 Tue 11:30 H17

Evolutionary dynamics of multiple games — •Vandana Revathi Venkateswaran and Chaitanya S. Gokhale — Department of Evolutionary Theory, Max Planck Institute for Evolutionary Biology, August-Thienemann-Str. 2, 24306 Plön

Phenomena from bacterial population dynamics to evolution of social behaviour are being successfully described using evolutionary game theory. However, it has typically focused on a single game describing the interactions between individuals. Organisms are simultaneously involved in many intraspecies and interspecies interactions. Therefore, one should move from single games to multiple games. However, the interactions in nature involve many players. Shifting from two player games to multiple multiplayer games yield different interesting dynamics and help us get closer to naturalistic settings. A complete picture of multiple game dynamics (MGD), where multiple players are involved, was lacking. We present a complete and general method to study multiple games with many strategies and players, all at once. We provide a concise replicator equation, and analyse its resulting dynamics. We show that if the individual games involved have more than two strategies, then the combined dynamics cannot be understood by looking only at individual games. Moreover, in the case of finite populations, we formulate and calculate a basic and useful stochastic property, fixation probability. Our results reveal that even as interactions become increasingly complex, their properties can be captured by relatively simple concepts of evolutionary game(s) theory.

BP 11.2 Tue 12:00 H17

Control of biodiversity in evolutionary dynamics: extension to higher dimensions — •Jens Christian Claussen — Department of Mathematics, Aston University, Birmingham B4 7ET, U.K.

Cyclic dominance, as observed in biology and socio-economic systems, has frequently been investigated in its role towards stabilization of diversity of strategies [PRL 100, 058104], and it has been shown that the introduction of a parameter in the payoff matrix can lead to a stabilization of the symmetric state of coexistence. Recently, we had introduced a feedback control method which utilizes a feedback term derived from a conserved property of motion of the case of a neutral oscillation. This mechanism was discussed, analyzed and numerically demonstrated explicitly for the cyclic rock-paper-scissors game. Here, we discuss the generalization to cyclic dominance of M strategies and their implications. First, it is observed that the straightforward generalization leads again to payoff functions with polynomial degrees up to third order, multiplied by the feedback term which in this case is of order M, resulting in characteristic polynomials of order 2(M + 2), compared to order 4 without control, prohibiting closed eigenvalue expressions even for the fixed point stability. To circumvent this, alternative feedback functions are introduced which allow for lower orders. Finally, we discuss the applicability of this approach.