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Hydrodynamic flows can induce selective advantages among species FRANCESCA TESSER, Department of Physics, Eindhoven University of Technology, The Netherlands, ROBERTO BENZI, Dipartimento di Fisica, Universita' di Roma "Tor Vergata" and INFN, Roma, Italy, HERMAN J.H. CLERCX, Department of Physics, and J.M. Burgerscentrum, Eindhoven University of Technology, The Netherlands, DAVID R. NELSON, Lyman Laboratory of Physics, Harvard University, USA, PRASAD PERLEKAR, Centre for Interdisciplinary Sciences, TIFR, India, FEDERICO TOSCHI, Department of Physics, and J.M. Burgerscentrum, Eindhoven University of Technology, The Netherlands — Evolutionary forces such as genetic drift, selection, mutation and spatial diffusion act to change the genetic composition of populations. Such problems can be modeled as a system of binary reactions between competing individuals, involving births and deaths, and progressing at specific rates. An inhomogeneous or time-dependent spatial structure has the effect of modulating the interaction between individuals. To explore this problem further, we consider the dynamics and evolution of genetically diverse populations in a fluid environment where a flow field transports individuals in combination with birth and death processes [1], thus driving genetic inhomogeneities. An individual-based model in continuous space with spatial diffusion implements stochastic demographic rules for a fluctuating population size and introduces the advection of simple realistic flow fields. The system is analyzed in terms of fixation probabilities and fixation times as well as the behavior of spatial correlations. Provided organismic reproduction times are faster than the characteristic time scales of the flow, fluid ecosystems can by themselves induce spatially non-homogeneous selective advantages.

[1] Pigolotti et al. Theoretical Population Biology 84, 72 (2013)

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