

Abstract Submitted
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A kinetic theory for age-structured stochastic birth-death processes¹ TOM CHOU, Univ of California - Los Angeles, CHRIS GREENMAN, University of East Anglia — Classical age-structured mass-action models such as the McKendrick-von Foerster equation have been extensively studied but they are structurally unable to describe stochastic fluctuations or population-size-dependent birth and death rates. Conversely, current theories that include size-dependent population dynamics (*e.g.*, carrying capacity) cannot be easily extended to take into account age-dependent birth and death rates. In this paper, we present a systematic derivation of a new fully stochastic kinetic theory for interacting age-structured populations. By defining multiparticle probability density functions, we derive a hierarchy of kinetic equations for the stochastic evolution of an aging population undergoing birth and death. We show that the fully stochastic age-dependent birth-death process precludes factorization of the corresponding probability densities, which then must be solved by using a BBGKY-like hierarchy. Our results generalize both deterministic models and existing master equation approaches by providing an intuitive and efficient way to simultaneously model age- and population-dependent stochastic dynamics applicable to the study of demography, stem cell dynamics, and disease evolution.

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