PDE formulation and delay equation formulation of a cyclin structured cell population model

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Abstract

We present two models for a cell population divided into proliferative and quiescent cells. The first one is a nonlinear cyclin content structured pde model for which, under suitable hypotheses, we show existence and uniqueness of a steady state by using positive linear semigroup theory. We also show, for particular values of the parameters, the existence of solutions that do not depend on the cyclin content. For the general case, we make numerical simulations obtaining, for some values of the parameters convergence to the steady state, but for others oscillations of the population.
For the second model we use the delay equation formulation of structured population dynamics to derive a system of two renewal equations from individual-level assumptions concerning a cyclin structured population. Nonlinearity arises from the assumption that the rate at which quiescent cells become proliferating is determined by feedback. We characterize steady states and establish the validity of the principle of linearized stability.

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