Structured population model of fitness selection during cell differentiation

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Self-renewal is a constitutive property of stem cell behavior. Testing the cancer stem cell hypothesis requires investigation of the impact of self-renewal on cancer expansion. To understand better this impact, we propose a mathematical model describing dynamics of a continuum of cell clones structured by the self-renewal potential. The model includes a nonlinear feedback mechanism regulating cell differentiation. It takes a form of integro-differential equations. We analyze the model in the space of nonnegative Radon measures with flat metric and prove that the model solutions converge to Dirac deltas. Consequently, we show that cells with superior self-renewal potential have an advantage in comparison to their counterparts which leads to expansion of this cell subpopulation.

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