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Stochastic models for cell division EVGENY STUKALIN, SEAN SUN, Department of Mechanical Engineering, The Johns Hopkins University, Baltimore, MD 21218 — The probability of cell division per unit time strongly depends of age of cells, i.e., time elapsed since their birth. The theory of cell populations in the age-time representation is systematically applied for modeling cell division for different spreads in generation times. We use stochastic simulations to address the same issue at the level of individual cells. Our approach unlike deterministic theory enables to analyze the size fluctuations of cell colonies at different growth conditions (in the absence and in the presence of cell death, for initially synchronized and asynchronous cell populations, for conditions of restricted growth). We find the simple quantitative relation between the asymptotic values of relative size fluctuations around mean values for initially synchronized cell populations under growth and the coefficients of variation of generation times. Effect of initial age distribution for asynchronous growth of cell cultures is also studied by simulations. The influence of constant cell death on fluctuations of sizes of cell populations is found to be essential even for small cell death rates, i.e., for realistic growth conditions. The stochastic model is generalized for biologically relevant case that involves both cell reproduction and cell differentiation.

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