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A stochastic model for virus growth in a cell population

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Abstract

A stochastic model for the growth of a virus in a cell population is introduced. The virus has two ways of spreading: either by allowing its host cell to live on and duplicate, or else by multiplying in large numbers within the host cell such that the host cell finally bursts and the viruses then have the chance to enter new uninfected host cells. The model, and in particular the probability of the virus population surviving, is analyzed using the theory of Markov processes together with a coupling argument. Our analysis shows that the optimal strategy of the virus (in terms of survival) is obtained when the virus has no effect on the host cell's life-cycle, in agreement with experimental data about real viruses.