A stochastic model for intracellular active transport

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intracellular active transport, Markov chain, moving targets, moving obstacles

We develop a stochastic model for an intracellular active transport problem. Our aims are to calculate the probability that a molecular motor reaches a hidden target, to study what influences this probability and to calculate the time required for the molecular motor to hit the target (mean first passage time).

We will study different biologically relevant scenarios, which include the possibility of multiple hidden targets (which breed competition), the presence of moving targets and moving obstacles. The purpose of including obstacles is to illustrate actual disruptions of the intracellular transport (which can result, for example, in several neurological disorders [1])

From a mathematical point of view, the intracellular active transport is modelled by two independent continuous-time, discrete space Markov chains: one for the dynamics of the molecular motor in the space intervals and one for the domain of target. The process is time homogeneous and independent of the position of the molecular motor.

References

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