Anna Ochab-Marcinek
Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland
e-mail: ochab@ichf.edu.pl
Marcin Tabaka
Institute of Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland

How stochasticity in gene expression differentiates phenotypes without changing genotypes

Bimodal gene expression (the statistical distribution of gene products that has two maxima), as an effect contributing to phenotypic diversity in genetically identical cell populations, enhances the survival of cells in a fluctuating environment. We study a theoretical model of gene expression in a minimal gene cascade, in which the regulatory gene produces transcription factors that have a nonlinear effect on the activity of the target gene. We show that a unimodal distribution of transcription factors over the cell population can generate a bimodal steady-state output without cooperative transcription factor binding and without feedback loops. We introduce a simple method of geometric construction that allows one to predict the onset of bimodality. A. Ochab-Marcinek, M. Tabaka, Bimodal gene expression in noncooperative regulatory systems , PNAS 107(51) (2010) 22096-22101