Mathematical Methods and Models in Biosciences
June 15–20, 2025, Sofia, Bulgaria
https://biomath.math.bas.bg/biomath/index.php/bmcs

Positive feedback from growth burden in stochastic protein expression

Jakub Poljovka[1], Iryna Zabaikina[1], Pavol Bokes[1], Abhyudai Singh[2]

[1]Faculty of Mathematics, Physics and Informatics,
Comenius University, Slovakia
poljovka4@uniba.sk
iryna.zabaikina@fmph.uniba.sk
pavol.bokes@fmph.uniba.sk

[2]Electrical and Computer Engineering,
University of Delaware, USA
absingh@udel.edu

We study a protein that is stochastically expressed and imposes a fitness cost when overproduced by slowing down cell growth. This growth burden creates an inherent positive feedback loop: higher protein levels reduce cellular growth, which slows dilution, thereby sustaining higher protein levels. We develop a discrete-state model to capture this feedback mechanism, integrating stochastic simulations with differential equation approaches. Our analysis explores both single-cell dynamics and population-level behavior, revealing how noise and feedback together shape protein expression distributions.

References

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