



Stochastic resonance in a self-repressing gene with transcriptional memory

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Biochemical reaction networks are subjected to large fluctuations due to small molecule numbers, yet underlie reliable biological functions. Most theoretical approaches describe them as purely deterministic or stochastic dynamical systems, depending on which point of view is favored. Here, we investigate the dynamics of a self-repressing gene using an intermediate approach based on a moment expansion of the master equation, taking into account the binary character of gene activity. We thereby obtain deterministic equations which describe how nonlinearity feeds back fluctuations into the mean-field equations, providing insight into the interplay of determinism and stochasticity. This allows us to identify a region of parameter space where fluctuations induce relatively regular oscillations.

Subjects: **Molecular Networks (q-bio.MN)**; Quantitative Methods (q-bio.QM)

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