

Comparisons of models to analyze each type of repression in a negative feedback system

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ABSTRACT

A negative feedback loop (NFL) interacting among activator proteins, repressor proteins, and genes can generate sustained oscillations. In NFL, we distinguish three types of repression: (1) sequestration, in which repressor protein binds to activator protein and sequesters it not to activate gene (2) blocking, in which repressor protein binds to activator protein binding with gene and inhibits activator-dependent transcription (3) displacement, in which repressor protein displaces activator protein from gene. To describe these repression mechanisms, we develop ordinary differential equation (ODE) models based on mass action kinetics. Interestingly, by comparing each of models reduced by a quasi-steady-state approximation (QSSA), we show that their characteristics of transcriptional activity (i.e. ultrasensitivity) are totally different depending on repression types they describe. Furthermore, we argue that this approach may be extended to more complex biological systems regulated by NFL.