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Intracellular delay limits cyclic changes in gene expression. (English) Zbl 1109.92014

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Summary: Based on previously published experimental observations and mathematical models for Hes1, p53 and NF- κ B gene expression, we improve these models through a distributed delay formulation of the time lag between transcription factor binding and mRNA production. This description of natural variability for delays introduces a transition from a stable steady state to limit cycle oscillations and then a second transition back to a stable steady state which has not been observed in previously published models.

We demonstrate our approach for two models. The first model describes Hes1 autorepression with equations for Hes1 mRNA production and Hes1 protein translation. The second model describes Hes1 repression by the protein complex Gro/TLE1/Hes1, where Gro/TLE1 is activated by Hes1 phosphorylation. Finally, we discuss our analytical and numerical results in relation to experimental data.

MSC:

92C40 Biochemistry, molecular biology

34K60 Qualitative investigation and simulation of models involving functional-differential equations

Cited in **9** Documents

Keywords:

gene expression with negative feedback; distributed time delay; limit cycle oscillations

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