

Influence of Time Delay on Dynamics of Gene Regulation by MicroRNAs

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MicroRNAs (miRNAs) are endogenous small RNA molecules that regulate gene expression (transcription and translation) by specific interaction with messenger RNAs (mRNAs). In this way miRNAs involve in pathways of development, programmed cell death, and cancer. It is well-known that miRNAs silence a target gene or a set of target genes, but the exact mechanism by which gene silencing is achieved has remained elusive.

In this study we re-consider a well known mathematical model of gene expression, regulated by miRNAs. The model is presented by a system of four ordinary differential equations (ODEs). Taking into account that some steps of the gene expression process are faster than others we put time delay in the equations of above-mentioned system. Next, we attempt to clarify how the inclusion of time delay alters the dynamic properties of the considered genetic process. For the purpose a stability analysis of delay differential equations (DDEs) is accomplished using nonlinear dynamics theory. We confirm our analytical results by numerical simulations.

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