

The role of multistability in biological pattern formation

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It is becoming increasingly clear that multistability plays an important role in cell signalling. Coupled with the diffusion process, it may give rise to spatial patterns in chemical and biological systems. Such processes lead to nonlinear dynamical models with multiple steady states, which differ from the usual reaction-diffusion systems. Also, processes containing switching between different pathways or states lead to new types of mathematical models, which consist of nonlinear partial differential equations of diffusion, transport and reactions, coupled with dynamical systems controlling the transitions. Diffusion tries to average different states and is the cause of spatio-temporal patterns. To investigate mechanism of pattern formation based on these concepts we propose a generic model consisting of a reaction-diffusion equation coupled with one ordinary differential equation. The proposed model shows how bistability and hysteresis in kinetic system may result in spatial patterning.