

# Switch and template pattern formation in a discrete reaction diffusion system inspired by the *Drosophila* eye

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We examine a spatially discrete reaction diffusion model based on the interactions that create a periodic pattern in the *Drosophila* eye imaginal disc. This model is capable of generating a regular hexagonal pattern of gene expression behind a moving front, as observed in the fly system. In order to better understand the novel switch and template mechanism behind this pattern formation, we present here a detailed study of the model's behavior in one dimension, using a combination of analytic methods and numerical searches of parameter space. We find that patterns are created robustly provided that there is an appropriate separation of timescales and that self-activation is sufficiently strong, and we derive expressions in this limit for the front speed and the pattern wavelength. Moving fronts in pattern-forming systems near an initial linear instability generically select a unique pattern, but our model operates in a strongly nonlinear regime where the final pattern depends on the initial conditions as well as on parameter values. Our work highlights the important role that cellularization and cell-autonomous feedback can play in biological pattern formation.

Subjects: **Molecular Networks (q-bio.MN)**; Pattern Formation and Solitons (nlin.PS); Cell Behavior (q-bio.CB)

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