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Inhibitor-induced transitions in pattern formation and their role in morphogenesis robustness

Development relies on the finely coordinated expression of morphogens, proteins driving cell differentiation and organ formation. Cell fate specification is achieved thanks to the establishment of morphogen patterns, which act as signals for cells in a concentration dependent manner. By the aid of reaction-diffusion systems, intense studies over the past decades were dedicated to the identification of the underlying microscopic processes leading to robust pattern formation and the classification of the emergent different mechanisms induced by these. In this work, we show that the presence of negative feedbacks in reaction-diffusion systems can lead to a transition in the modes of pattern formation during morphogenesis and induce memory and robustness. We apply this to the study of zebrafish early morphogenesis and show that the aforementioned mechanisms can indeed be found in this system.

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