Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Signaling Delays Preclude Defects in Lateral Inhibition Patterning INGMAR RIEDEL-KRUSE, DAVID GLASS, XIAOFAN JIN, Stanford University, Bioengineering — Developmental biology is extraordinarily robust in its ability to self-organize spatiotemporal patterns despite an intrinsically noisy set of parts. Lateral inhibition is a classic example of a mechanism behind such precise emergent behavior. However, the models through which we understand lateral inhibition's capabilities usually assume that cells signal to one another without delay, a supposedly minor source of error at most. Here we explicitly investigate the effects of signaling delays as well as their relation to cis-interactions in lateral inhibition patterning. We reduce the patterning problem effectively to a two-parameter phase space (signaling delay and coupling strength), and we found that rather than being a source of error, signaling delays enable significant decrease of error rates. Together with cis-interactions, these delays lead to patterning that can be both fast and robust to noise and parameter variation. This suggests that overlooking time delays in developmental signaling does not just ignore a potential source of error, but rather ignores a knob with which evolution may tune patterning robustness in general.

Ingmar Riedel-Kruse
Stanford University, Bioengineering

Date submitted: 17 Nov 2014 Electronic form version 1.4