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Self-organized spatiotemporal patterns of PIP_3 and PTEN during spontaneous cell polarization[1] FABIAN KNOCH, MARCO TARANTOLA, Max Planck Institute for Dynamics and Self-Organization, WOUTER-JAN RAPPEL, University of California San Diego, EBERHARD BODENSCHATZ, Max Planck Institute for Dynamics and Self-Organization — During spontaneous cell polarization of Dictyostelium discoideum cells, PIP3 (phosphatidylinositol (3,4,5)-triphoshpate) and PTEN (phosphatase tensin homolog) have been identified as key signaling molecules, which govern the process of polarization in a self-organized manner. Gerisch et al. have shown that randomly triggered excitable PIP3 waves regulate the anti-correlated PTEN concentration. Here we show that this requires a switch-like dynamics of the overall membrane bound PTEN concentration in combination with two species of PTEN differing in their dephosphorylation rates. A quantitative modeling with a coupled reaction-diffusion system shows excellent agreement with experimental results and predicts a ratio σ of dephosphorylation rates acting on PIP3 of $\sigma \approx 80 - 100$. Our quantitative analysis suggests that surface-attached cell membrane spanning PIP3 waves are necessary for resetting the global actin network. This is evidenced by the experimentally observed delay between polarization-cycles also quantitatively captured by our analysis.

[1]Max Planck Society and Center for Theoretical Biological Physics

Eberhard Bodenschatz
Max Planck Institute for Dynamics and Self-Organization

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