Control of mechanochemical self-organization during cell polarization

Biological pattern formation often relies on self-organization, integrating chemical with mechanical patterning processes. Guiding cues ensure that the correct pattern forms at the right time and place in development, but how they control processes of self-organization to steer pattern formation remains unknown. We have investigated cell polarity establishment in Caenorhabditis elegans zygotes by combining measurements of the spatial distribution of protein numbers and fluxes with physical theory. We have characterized the handover from a pre-pattern to mechanochemical self-organization, and discovered that guiding cues from the centrosome steer a patterning system comprised of cell polarity proteins and the actomyosin cortex to a transition point beyond which the patterned state becomes self-organized. The mechanism of controlled pattern formation I will describe integrates mechanical and molecular aspects of biological pattern formation with guiding cues.

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