MPIDS Colloquium

MAX-PLANCK-GESELLSCHAFT

Guiding development via optically-induced cytoplasmic flows

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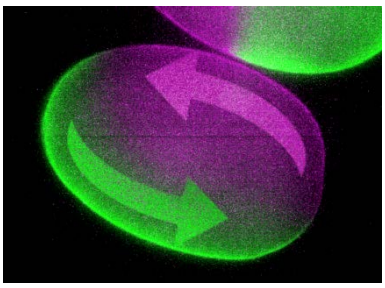
Throughout the last decades, access to genetic perturbations, fluorescent labels and modern microscopy tremendously advanced our molecular understanding of cellular and developmental processes. The spatio-temporal organization of cells and developing embryos is widely believed to depend on physical processes, such as diffusion, and intracellular flows. However, due to the lack of suitable perturbation methods it remains a challenge to experimentally test the physiological role of these physical transport processes for structure formation.

Here, we exploit thermoviscous expansion phenomena to optically induce hydrodynamic flow in single cells and developing embryos. By controlling such flows inside the cytoplasm of the C. elegans zygote, we gain control over central developmental processes. As an example, induced flows allow us to probe the role of cytoplasmic flows during PAR polarization, and even enable to invert the body axis of embryos. Furthermore, we utilize flow perturbations for probe-free active micro-rheology in the cytoplasm and the mitotic nucleus.



Mittasch et al., Nature Cell Biology 20 (2018)
Kruse, Chiaruttini, and Roux, Nature Cell Biology 20 (2018)
Mittasch et al, bioRXiv ID296566 (2018)

Video preview: https://tinyurl.com/yaa9lh8c

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MPIDS, Seminar room 0.79, Am Faßberg 17, Göttingen

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