



Faculty Search Biology Seminar

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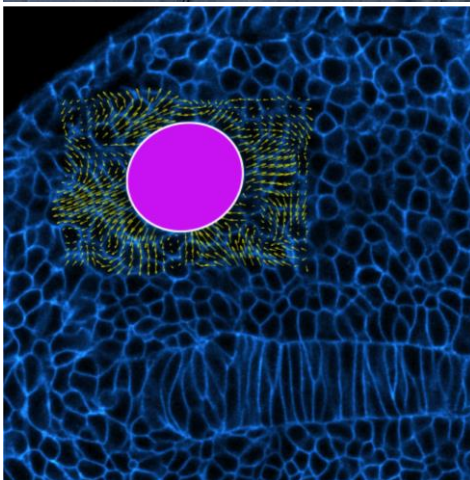
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Mechanics of anteroposterior axis formation in vertebrates



Wednesday, February 24, 2021

12:00 PM PST



Measuring cell-generated forces and tissue mechanical properties *in vivo* and *in situ* has proven very difficult. For this reason, our understanding of how feedback loops between biochemical signaling and mechanics contribute to robust multicellular morphogenesis is still poor. To address this limitation, I helped develop a technique based on ferrofluid droplets which allows to measure multiple mechanical parameters at time- and length-scales relevant for embryonic development. Employing this technique, I have recently provided biophysical evidence that a *fluid-to-solid* tissue transition occurs in the zebrafish presomitic mesoderm (PSM). Critically, I found that the parameters regulating this transition *in vivo* are the very same controlling fluid/solid transitions in inert materials. I will detail my work on the spatiotemporal control of fluid-like vs. solid-like behavior in the PSM, which gives rise to the axial musculoskeletal system. Specifically, I will discuss how these opposite tissue states are achieved at the cellular level and why this transition is required for proper axis elongation in zebrafish. I will further present some preliminary work in chicken that addresses how mechanical properties and forces may be tuned by the extracellular matrix to guide proper morphogenesis of the posterior body axis. Finally, I will discuss our recent attempt to measure the mechanical properties that zebrafish PSM cells perceive in their native microenvironment, during differentiation of the mesodermal lineage. While it is now clear that multiple mechanical parameters influence cell behavior *in vitro*, very little is known about the mechanical parameters of the microenvironment that

cells perceive *in vivo*, the structures that cells mechanically probe and how these mechanical cues affect cell behavior within developing 3D tissues. As alteration of tissue mechanics has been proposed as an early signature of malignant transformation, this quantitative approach to study mechanics *in vivo* opens new avenues for a more mechanistic understanding of tissue stiffening in solid tumors and tissue fluidification at the onset of metastasis.

Seminar Speaker Host: Clemens Cabernard

