Role of mechanical instabilities during axial patterning of vertebrate embryos

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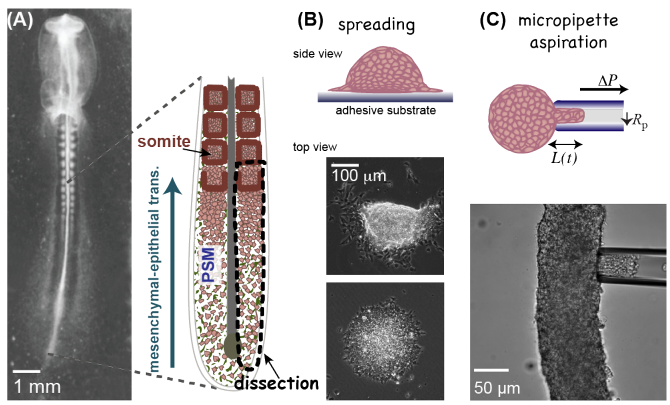
A Masters internship is available at the interface of physics and biology to study the mechanics of tissue patterning and shape emergence in vertebrate embryos. We are interested in understanding how mechanical cues and possible feedback between mechanics and biochemical pathways result in the formation of structures during the axial morphogenesis of vertebrate embryos. More specifically, **we focus on somite generation process, where packets of epithelial cells emerge from the posterior mesoderm, as the cells undergo mesenchymal to epithelial transition under the action of morphogens**. We develop experimental biophysical techniques and approaches borrowed from soft matter physics to quantitatively study the interplay between mechanical forces, signaling, and physico-chemical properties of the environment during this process.



(A) Somitogenesis in chicken embryo. Schematic of the PSM and the somites. (B) Spreading dynamics reveal variations in tissue mechanics along the axis.(C) Rheological measurements using the micropipette aspiration technique.

In this project, we will study the mechanical properties of the mesoderm as it differentiates along the axis, in *ex vivo* controlled conditions. By developing spreading assays, we will evaluate how the tissue flow evolves as the mesoderm differentiates. Our preliminary results show that the mechanics of PSM differentiation can be captured from dynamic profiles of spreading assays. We will quantify these observations and assess how they depends on morphogen concentrations and substrate rigidity. Micromanipulation techniques will be used to evaluate the rheology of the tissue, which combined with the spreading assay, will allow us to describe our observations in a theoretical framework. The findings of this project will help us better understand the origin of the mechanical instability that we observe at the time of the separation of the somite.

Techniques used: Microdissection and tissue culture, spreading assays, videomicroscopy, image analysis, immunolabeling, micropipette aspiration.

Possibility of continuation as a PhD thesis if funding is secured.

If interested, please contact Karine Guevorkian karine.guevorkian@curie.fr for further information.