2025
Internship project

Tissue compaction and shape emergence during chicken axial morphogenesis

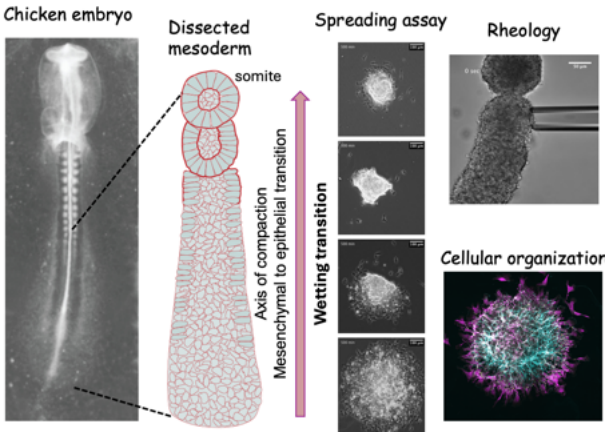
Laboratoire de Physique des cellules et Cancer – UMR168
Institut Curie, Paris

Candidate profile: We are looking for a motivated student with a background in biophysics, physics, bioengineering, biology, or a closely related field, and a creative mindset and willingness to develop new skills at the interface of physics and biology to join our studies on **mechanics of embryonic morphogenesis** at the **interface of physics and developmental biology**.

Introduction

The general theme of our research is to understand how **mechanical cues, and possible feedback between mechanics and biochemical pathways**, shape structures during vertebrate embryonic development.

We focus on **somite generation process**, where the cells from the posterior mesoderm undergo mesenchymal to epithelial transition, condense into balls of epithelial cells called the somites, and detach from the rest of the tissue, reminiscent to drop formation from a water jet.
During this process, morphogen gradients act as biochemical signals to differentiate the mesoderm and define the position of the future somites. The mechanics of the mesoderm, its interactions with the surrounding tissues, and the extracellular matrix, are necessary components for tissue sorting and emergence of somites. The details of this process are not yet well understood.
We have shown that dissected mesoderm acts as a liquid in long time scales and undergoes a wetting transition on adhesive substrates, along the anterior-posterior axis. Whether similar transitions take place *in vivo* during somite formation remains to be studied. Next, **we aim to study the impact of the extracellular matrix on mesoderm mechanics as a more realistic mimic of the *in vivo* conditions.**



Ex vivo mesoderm mechanics along the anterior-posterior axis. *Wetting transition along the axis. Micromanipulation technique to measure tissue viscosity and surface tension. Organization of actin network in a somite and the epithelial layer.*

Internship project: We will develop an experimental setup to study tissue mechanics in quasi 3D conditions. **The student joining our team** will:

i) Setup and optimize the 3D growth conditions
ii) Study the role of morphogens on spreading dynamics
iii) Quantify the rheology and surface tension using micropipette aspiration technique

Acquired skills: The student will learn several techniques such as microdissection and tissue culture, phase contrast and spinning microscopy, video-microscopy, micropipette aspiration, spreading assays, time-lapse image analysis, data analysis, immunolabeling.

Keywords: tissue rearrangements, morphogenesis, biophysics, cell contractility, mechanobiology, tissue dynamics, signaling

Open to M1 or M2 students. For M2 students, possibility to continue as a PhD thesis.
The internship will be under the supervision of Karine Guevorkian

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