Laboratory name: **Physico-Chimie Curie**, **UMR168**
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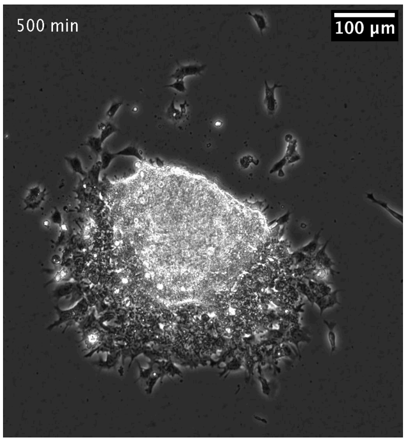
Thesis possibility after internship: **YES**/NO
Funding: YES/**NO**

## Symmetry breaking instabilities during axial patterning of vertebrate embryos

The life of an embryo starts from a simple aggregate of cells, which gradually turns into distinct tissues from which specific structures emerge. Recent studies have put in evidence that throughout morphogenesis, biochemical signals function in concert with mechanical cues, in order to pattern and organize embryonic tissues, and eventually give rise to organs. Therefore, understanding the mechanisms by which mechanical cues act to pattern and shape tissues, stays one of the central questions in the field.



Mesodermal explant spreading

We are interested in somite generation process, which is an essential patterning event in vertebrate embryos, leading to the formation of our muscles and skeleton. During this process, under the action of morphogen gradients, as the cells of the posterior mesodermal tissue reach the anterior end, they condense, and pinch off periodically into multi-cellular segments, reminiscent of droplets formed from a water jet. We will investigate the mechanisms leading to the mechanical instability of the mesodermal tissue and hence the generation of somites, as well as the feedback mechanisms between mechanics and biochemical signaling involved in this process.

In this M2 project with the possibility to continue as a PhD thesis, we will develop approaches inspired by soft matter physics to assess the mechanical responses of the chicken embryonic mesodermal tissue during axial maturation. We will study the wetting dynamics of mesoderm segments and evaluate whether there is a wetting transition as the tissue matures into epithelial phenotype during somite formation. The role of substrate rigidity and morphogen concentration in wetting transition will be evaluated. During the axial maturation, it is known that cells modify their adhesiveness and motility, which implies that the mechanical properties of the mesoderm should accordingly change. We will evaluate *in vivo* and *ex-vivo* the visco-elastic properties of the paraxial mesoderm in order to decipher the origins of the mechanical instability responsible in somitogenesis.

The M2 internship will be supervised by Karine Guevorkian at Physico-Chimie Curie with close collaboration with Isabelle Bonnet (SU, PCC) and Clement Campillo (Paris Saclay).

**Keywords:** tissue stress; morphogenesis; actomyosin; mesenchymal to epithelial transition; visco-elasticity; AFM; micropipette aspiration; micromanipulation.