Summary of the PhD project:

Role of inter-tissue mechanical coupling in the early morphogenesis of the olfactory placode in teleost fish

How organs acquire their shape is a central question in biology. Numerous studies demonstrated that morphogenesis results from the integration of molecular signals with mechanical cues such as forces and tissue stiffness. So far most mechanobiology research has conceptualised tissues as autonomous entities. *In vivo*, however, developing tissues are embedded in a crowded embryonic environment where neighbouring tissues constantly pull/push on one another through shared interfaces. Yet, whether such inter-tissue mechanical interactions represent a general developmental mechanism, and how their modulation contribute to organ shape diversification across species, remains underexplored.

To investigate these questions, we will develop an interdisciplinary strategy at the interface between biology (group of Marie Breau, PhD director) and physics (group of Léa-Laetitia Pontani, PhD co-director). We will study the development of the zebrafish olfactory placode, a well-defined 3D organ whose morphogenesis depends on inter-tissue forces generated by the neighbouring eye. We will combine quantitative live imaging of cell/tissue movements with measurements of tissue shape, mechanical stresses at the tissue interface (using laser ablation), and tissue material properties (through the implementation of a micro-rheology method based on injection of magnetic ferrofluid droplets). We will start by studying zebrafish embryos, ideally suited for live imaging and targeted perturbations of tissue dynamics. We will then compare zebrafish to *Astyanax Mexicanus,* a non-model teleost species with naturally distinct olfactory placode–eye configurations, to test if variations in mechanical parameters correlates with differences in the shape of the olfactory placode. Finally, we will use zebrafish to perform targeted perturbations that reproduce the mechanical configurations observed across species.

Altogether, this PhD project will integrate concepts and methods from developmental biology, biophysics and evolutionary biology to shed a light on how inter-tissue mechanical coupling influences organ shape and its diversification.