1st of February 2023

Interdisciplinary Doctoral project in the **RAUZI lab** (University Côte d'Azur, IBV, Nice) and in the **ETIENNE lab** (Univ Grenoble Alpes, LIPHY, Grenoble) at the interface between **computational physics and biology**

Studying the mechanisms and mechanics driving tissue folding

Mophogenesis builds living shapes. A key morphogenetic transformation that shapes tissues and organs is epithelial invagination: a tissue bends and it is eventually internalized transforming the physiological topology of the system. The invagination of epithelial tissues is a vital transformation during embryo development since it is pivotal during embryo gastrulaion and neurulation. While much is known of the mechanisms and mechanics driving epithelial flattening (first phase) and bending (second phase), how a tissue is eventually internalized (third phase) is still poorly understood. To tackle this, we propose to use the *Drosophila* embryo that provides the most advanced genetic tools and study the process of mesoderm internalization. On the computational physics side, we will develop a formal physical framework that can theoretically reproduce morphogenetic processes and predict features of the system that are then back tested experimentally. More specifically, we will design a mechanical model based on active viscoelastic shells and use numerical simulations based on existing tools (e.g., Surface Evolver in 3D) to calculate shell deformations. On the biology side, we will implement multi-view light sheet microscopy coupled to optogenetics and plasma-based laser ablation and image data analysis to characterize and syntheticlly modulate tissue shape changes to test numerical predictions. The student will be trained on these multiple approaches and techniques to develop an interdiscplinary project focused on uncovering the fundamental principles governing epithelial folding. This knowledge could be used in the future to synthetically build and shape functional organs.The project will be developped in both the Rauzi lab (http://ibv.unice.fr/research-team/rauzi/) and the Etienne lab (http://www-liphy.univ-grenoble-alpes.fr/pagesperso/etienne).

We are seeking a highly motivated and talented candidate to develop this interdisciplinary PhD project. Send a CV, a motivation letter, master scores/ranking and reference letters to matteo.rauzi@univ-cotedazur.fr and jocelyn.etienne@univ-grenoble-alpes.fr