

Multiscale mechanics of disordered cellular materials

Postdoc (1+2 years)

Location : IRPHE / CPT (Marseille)

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Starting date: April 2026 (flexible)

Context - There is growing evidence that collective cellular motion - or tissue flows - are crucial for many stages of embryonic development [1]. Yet, the constitutive laws of early embryonic tissues - relating stresses and deformations at the tissue scale - remain elusive [2]. Tissue mechanical properties emerge from a combination of intertwined cellular processes, including **elastic cell deformation, topological rearrangements and active fluctuations**. In this project, we combine experiments, simulations, machine learning and theory to **understand how these local processes give rise to non-linear tissue mechanics as viscoelasticity and viscoplasticity**.

As a crucial step toward living tissues, we focus on adhesive emulsions, which share key mechanical features with tissues while providing a highly controlled, reproducible framework [3]. The recruited postdoc will join the theoretical/computational efforts of this project, primarily focusing on **vertex model simulations, analysis of microfluidic imaging data [3], and mesoscopic modeling of emulsion/tissue dynamics** at the cellular level. He/she will closely interact with other parts of the project to connect this mesoscopic dynamics with the **coarse-grained constitutive laws** characterized through shear rheometry and data-driven rheology inference.

[1] Gsell, Tlili, Merkel & Lenne, Nat. Phys., 2025. doi:[10.1038/s41567-025-02802-2](https://doi.org/10.1038/s41567-025-02802-2)

[2] Lenne & Trivedi, Nat. Comm., 2022. doi:[10.1038/s41467-022-28151-9](https://doi.org/10.1038/s41467-022-28151-9)

[3] Guigue et al., arXiv. doi:[10.48550/arXiv.2503.18782](https://doi.org/10.48550/arXiv.2503.18782)

Candidate profile - We seek candidates with a background in **physics, mechanics** or **applied mathematics**, and with experience in programming and numerical modeling. Experience on developing or using vertex models is an asset. Biological background is not required, but applicants should be interested in studying living systems and engaging in interdisciplinary research.

Host environment - The research will take place in Marseille, France, at the [IRPHE](#) and [CPT](#) institutes. Both labs are part of a vibrant research environment in soft matter physics, fluid mechanics and engineering. Marseille also provides a stimulating setting for interdisciplinary research on living systems, particularly through the [CENTURI institute](#).

