INTERNSHIP PROPOSAL

(One page maximum)

Laboratory name: **Matière et Systèmes Complexes (MSC)**
CNRS identification code: **7057**
Internship director'surname: **Atef ASNACIOS**
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Internship location: **Bâtiment Condorcet, 10 rue Alice Domon et Léonie Duquet, 75013 Paris**

Thesis possibility after internship: **YES**
Funding: **NO** If YES, which type of funding:

Title : Towards an integrated model of tip growth

Summary (half a page maximum)

Colonizing the world is one of the great challenges of living organisms. Animals move themselves, but other organisms, such as plants and fungi, rely mainly on growth. Concentrating the elongation in the tip is a solution allowing organisms to quickly adapt growth to the properties of their environment. Therefore, tip growth is a convergent evolution observed for cells as distant in the phylogeny as fission yeast, fungal hyphae, plant pollen tube or plant root hair.

Root hairs are cylindrical extensions which grow laterally from the root epidermis. While they keep a typical cell diameter of 10 µm, root hairs can reach ~1 mm in length, thus significantly increasing the surface area of roots, enhancing their ability to uptake essential resources for plant growth and development.

In this context, we have designed original micro-mechanical techniques, combined with microfluidic devices, allowing us to measure, *in vivo*, many parameters of the growing root hair, as well as the nucleus movements, allowing us now to get an integrated quantitative description of tip growth[1-4].

We propose an internship dedicated to such mechanical measurements after hyper-osmotic shocks in order to gain insight into growth regulation. The internship could also involve image analysis (PIV) to analyse the effect of a stiffening environment on nucleus dynamics. This internship could be followed by a PhD dedicated to defining an integrated model of tip growth.

1. Pereira et al. ***The cell Surface***, Volume 9, 100104, **2023.** https://doi.org/10.1016/j.tcsw.2023.100104

2. Pereira et al. ***Scientific Reports***, 14 : 13788, **2024**. https://doi.org/10.1038/s41598-024-64423-8

3. Alline et al. ***Eur. Phys. J. E* 49**, 11, **2026**. https://doi.org/10.1140/epje/s10189-025-00546-8

4. Kulich et al. ***Science*** 392 (6795), 296-300, **2026.** https://doi.org/10.1126/science.adu8197

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics:	NO	Soft Matter and Biological Physics:	YES
Quantum Physics:	NO	Theoretical Physics:	NO