

Master Physics – Internship offer – 2026/2027

Phase transitions in immune cell migration mediated by molecular clues

Laboratory : Adhésion et Inflammation, Inserm U1067 / CNRS UMR7333 / Aix Marseille Univ.

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Immune cells explore their environment to look for specific molecular clues which are bound to target cells. To decipher mechanisms by which a cell decides to stop when encountering the appropriate ligand, we have engineered soluble engagers molecules which mediate the interaction between immune receptors and target ligands. Combining live interferential microscopy and systematic titration experiments with engager of different lengths, we have disclosed a strong dependence of arrest control on these parameters [1]. Our data suggest some sharp phase transition controlling arrest/departure dynamics, which remains to be better described and investigated.

The experimental part of the project entails microscopy acquisition and image analysis using custom designed protocols and AI-based image analysis software [2,3] to collect hundreds of single cell dynamic events on large populations. The project can have an experimental, a theoretical aspect or combining both (M2).

The laboratory offers a dynamic and interdisciplinary environment gathering physicists, biologists and medical doctors around questions dealing with the function of immune systems, from molecule to cell-cell interaction, with cutting edge biophysical methods.

The internship could lead to a PhD project, presented within the Centuri consortium (<https://centuri-livingsystems.org/>)

References:

[1] Tuning T-cell immunological synapse by modular DNA-Nanobody engagers for precision immunotherapy (2026) Prothon J, Verma G, Diaz-Bello B, Biarnes-Pelicot M, Dupuy F, Gosse C, Bellot G, Sengupta K, Limozin L*, Chames P* [BioRxiv](#)

[2] Celldetective: an AI-enhanced image analysis tool for unraveling dynamic cell interactions (2026) Torro R*, Diaz-Bello B, El Arawi D, Dervanova K, Ammer L, Dupuy F, Chames P, Sengupta K, Limozin L*. [ELIFE](#). 105302

[3] Quantitative microscopy for cell-surface and cell-cell interactions in immunology (2025) Diaz-Bello B, El Arawi D, Torro R, Chames P, Sengupta K, Limozin L* [bio-protocol](#). 15: e5427 (2025).