



Master 2 Internship (PhD funding available)
Starting date : February 2022

Image analysis and modelling of soft particles deformation during phagocytosis

Institut Pierre-Gilles de Gennes pour la Microfluidique
École Normale Supérieure, Chemistry Department

We are recruiting a **Master intern (Master 2)** to work on the **mechanobiology of the phagocytosis of IgG-functionalized emulsion droplets**.

Aim of the project. Phagocytosis by macrophages represents a fundamental process essential for both immunity and tissue homeostasis. Most of our current quantitative knowledge on phagocytosis is based on the use of solid polymer microparticles as model targets that are well adapted to the study of phagocytosis mechanisms that do not involve any lateral mobility of the ligands, despite the relevance of this parameter in the immunological context.

Recently, we designed monodisperse, deformable IgG-coated lipid droplets that are efficiently and specifically internalized by macrophages through in-vitro FcγR-mediated phagocytosis. We have shown that, contrary to solid polymeric beads, droplet uptake is efficient even for low IgG densities, and is accompanied by the clustering of the opsonins in the zone of contact with the macrophage during the adhesion step.

In this collaborative project, we wish to extend the biological analysis to other types of receptors, and to initiate a mechanobiological study of the forces acting on the lipid droplets during the engulfment process.

The recruitment takes place in the context of a funding from the French *Agence Nationale pour la Recherche* (ANR) for a collaborative project involving our team (Jacques FATTACCIOLI, IPGG ENS) the group of Florence NIEDERGANG (Institut Cochin) and the group of Jean-Maurice MALLET (Department of Chemistry, ENS). In parallel to additional recruitments that have taken, or will take place in other labs of the consortium, we are looking for a skilled researcher to :

- Develop, or adapt/extend from the literature, image analysis methods to map in real time the lipid droplet deformation during their uptake by cells
- Quantify the deformation of the lipid droplets during their uptake by macrophages, in a statistic manner, to precisely map the mechanical forces acting on it for various ligands and biological conditions

Applicants should have a background in image analysis, cell biology, biophysics, soft matter science and related fields, with a strong interest for quantitative experimental work/analysis, including the development of biophysical image analysis procedures.

An interest/expertise in open-source softwares/programming languages (e.g. Python, ImageJ), the usage of public repositories (e.g. Github) will be a plus.

In addition, a basic knowledge or interest in cell culture and related procedures (staining, transfection, etc.) would be beneficial for this part of the project.

Applicants are expected to be self-driven, have a strong work-capacity and enthusiasm for science, and have good communication/writing skills.



Location. J. Fattaccioli's team is part to the *Microfluidics group* of the Chemistry Department of the ENS. The team is located at the Institut Pierre-Gilles de Gennes, in the Latin Quarter, in Paris (France). We are particularly interested in application of advanced microfabrication techniques, microfluidic tools as well as emerging concepts and biophysics.

Funding and salary. Internship gratification will follow national regulations. A funding is available for a possible PhD extension.

Application procedure. Potential candidates are asked to send a research statement, a CV, and names and contact information of three references to jacques.fattaccioli@ens.psl.eu While applications will be accepted until the post is filled, first interviews will take place as soon as possible. Therefore, it is advised to send applications before 26 September, 2021.

Relevant links :

[\[link\]](#) Institut Pierre-Gilles de Gennes :

[\[link\]](#) Department of Chemistry, École Normale Supérieure :

[\[link\]](#) Team « Biology of Phagocytes », Institut Cochin

[\[link\]](#) Team Jean-Maurice Mallet, Laboratoire des Biomolécules, Department of Chemistry, ENS

Relevant reference for the project :

[1] B. Dumat[‡], L. Montel[‡], P. Matton, L. Pinon, L. Cattiaux, J. Fattaccioli*, J.M. Mallet*. **ACS Applied Bio Materials.**, 2, 11, 5118-5126 (2019)

[2] L. Montel, L. Pinon, J. Fattaccioli*. **Biophys. J.**, 117 (3) pp. 408-419 (2019)

[3] K. Ben M'Barek, D. Molino, S. Quignard, M. Plamont, Y. Chen, P. Chavrier and J. Fattaccioli, **Biomaterials**, 51, 270–277 (2015).