M2 Internship:
Role of mechanotransduction in morphodynamics of microglia

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Microglia are the immune cells of the central nervous system. As such they are the main players involved in responses to pathological events, ranging from brain injuries, pathogen invasions up to neurodegenerative diseases. Their immune function seems highly associated with change of morphology as resting microglia present in the healthy brain are highly ramified with very motile processes probing their immediate surrounding, while larger cell bodies, fewer ramifications and still processes characterize activated microglia [1](Fig. 1). The close relationship between morphology and function calls for a better understanding of how microglia morphodynamic is regulated.

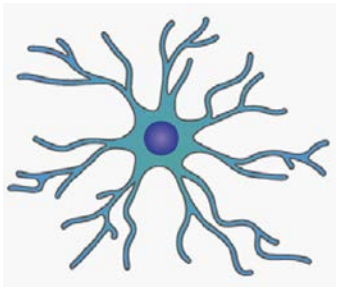
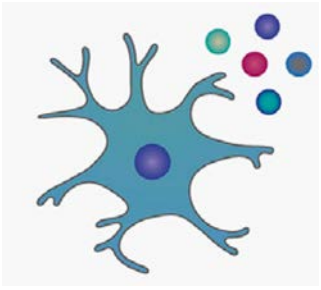


Figure 1 Homeostatic microglia



Pro-inflamatorry microglia (adapted from [1])

The overall goal of this Master 2 project is to evaluate the contribution of the cellular adhesion mechanisms and of the rigidity of its environment in the change of morphology and dynamics of microglia in healthy and neuroinflammatory contexts. The project will consist in two aims:
1) Developing tools to quantify and describe morphodynamics changes in microglia in an automated/semi-automated manner, in order to get high throughput data.
2) Evaluate how changes in the rigidity of the support, and composition of the coating affects microglia morphodynamics and propensity to activate upon inflammatory trigger.
To do so we will use primary cultures of microglial cells and various coatings to assess the effect of rigidity, composition and potentially stretching of the support on microglia morphodynamics. The image analysis will rely on Fourier transform and segmentation. This project standing on strong biology and physics backgrounds will be conducted in a collaborative manner with H. Delanoë-Ayari (ILM, phyisics lab) and O. Pascual (INMG, biology lab).

[1] Lee, Jeesan, Oscar David Villarreal, Xiaoru Chen, Stéphanie Zandee, Yoon Kow Young, Cynthia Torok, and others, 'QUAKING Regulates Microexon Alternative Splicing of the Rho GTPase Pathway and Controls Microglia Homeostasis', Cell Reports, 33.13 (2020), 108560