

MASTER 2 Fundamental and Clinical Neurosciences

Internship proposal 2022-2023

(internship from January to June 2023)

Host laboratory: MeLis 8 avenue Rockefeller 69008 LYON

Host team : *Synaptopathie et autoanticorps* <https://www.inmg.fr/honnorat/>

Internship supervisors : *Olivier Pascual CRCN* olivier.pascual@inserm.fr

Project title : Deciphering neuron/microglia signaling involved in synaptic plasticity

Project summary : *approx 10 lines*

Brain plasticity that underlies memory function likely results from a balance between synapse formation, potentiation and removal. The synapse formation and potentiation occur mostly during wakefulness, while synaptic downscaling and removal occur mostly during sleep. Recent studies have revealed key tasks for microglial interactions with neurons during normal physiological conditions, especially in regulating the maturation of neural circuits and shaping their connectivity in an activity- and experience-dependent manner. However, their role in learning and memory remains elusive. Specifying the role of microglia in synaptic consolidation according to the sleep/wake cycle is undoubtedly a particular challenge to research.

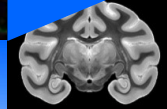
Our initial results *in vivo*, on head restrained mice, indicate that change of neuronal activity linked to sleep/wake cycles affects the motility of microglia processes. We are now investigating the signaling pathways involved in microglia/neuron communication. This project will consist to train and perform *in vivo* imaging of synaptic activity and microglial motility in presence of agonists and antagonists of adenosine a well-known neuromodulator involved in learning and memory. A significant part of the project will also consist in data treatment and image analysis using Matlab software.

Overall the present project should allow us to better understand the signaling between microglia and neuron involved in learning and memory.

3-5 recent publications :

1: Hubert V, Hristovska I, Karpati S, Benkeder S, Dey A, Dumot C, Amaz C, Chounlamountri N, Watrin C, Comte JC, Chauveau F, Brun E, Marche P, Lerouge F, Parola S, Berthezène Y, Vorup-Jensen T, Pascual O, Wiart M, Multimodal Imaging with NanoGd Reveals Spatiotemporal Features of Neuroinflammation after Experimental Stroke. Adv Sci (Weinh). 2021 Sep;8(17):e2101433. doi: 10.1002/advs.202101433. Epub 2021 Jul 1

Please send your proposal to marion.richard@univ-lyon1.fr for publication on the Master of Neuroscience website.



- 2: Garofalo S, Picard K, Limatola C, Nadjar A, Pascual O, Tremblay MÈ. Role of Glia in the Regulation of Sleep in Health and Disease. *Compr Physiol*. 2020 Mar 12;10(2):687-712. doi: 10.1002/cphy.c190022. PMID: 32163207.
- 3: Zakaria M, Ferent J, Hristovska I, Laouarem Y, Zahaf A, Kassoussi A, Mayeur ME, Pascual O, Charron F, Traiffort E. The Shh receptor Boc is important for myelin formation and repair. *Development*. 2019 May 2;146(9):dev172502. doi: 10.1242/dev.172502. PMID: 31048318.
- 4: Takata-Tsuji F, Chounlamountri N, Do LD, Philippot C, Novion Ducassou J, Couté Y, Ben Achour S, Honnorat J, Place C, Pascual O. Microglia modulate gliotransmission through the regulation of VAMP2 proteins in astrocytes. *Glia*. 2021 Jan;69(1):61-72. doi: 10.1002/glia.23884. Epub 2020 Jul 7. PMID: 32633839.
- 5: Karpati S, Hubert V, Hristovska I, Lerouge F, Chaput F, Bretonnière Y, Andraud C, Banyasz A, Micouin G, Monteil M, Lecouvey M, Mercey-Ressejac M, Dey AK, Marche PN, Lindgren M, Pascual O, Wiart M, Parola S. Hybrid multimodal contrast agent for multiscale in vivo investigation of neuroinflammation. *Nanoscale*. 2021 Feb 18;13(6):3767-3781. doi: 10.1039/d0nr07026b. PMID: 33555278.