



MASTER 2 Fundamental and Clinical Neurosciences

Internship proposal 2024-2025

(internship from January to June 2025)

Host laboratory: Lyon Neuroscience Research Center CRNL. Inserm U1028 - CNRS UMR5292 - UCBL. Centre Hospitalier Le Vinatier - Bâtiment 462 - Neurocampus. 95 boulevard Pinel. 69675 Bron Cedex

Host team: WAKING. <https://www.crnل.fr/fr/equipe/waking>

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Project title: Consequences of midline thalamus chemogenetic silencing on memory consolidation

Project summary: *approx 10 lines*

A general model of memory consolidation assumes that labile memory traces are transferred from hippocampus to the neocortex for long term storage. This process occurs primarily at night during slow wave sleep. Electrophysiologically, hippocampal sharp wave ripples (SWR) and thalamocortical spindles constitute a signature of information transfer when the two oscillations occur synchronously.

However, the mechanism allowing for the coordination of SWR and spindle is unknown. We hypothesise that midline thalamic neurons could orchestrate the synchronisation. These neurons show bi-directional connections with the neocortex and the hippocampus. In the neocortex, midline thalamic neurons target the inhibited cortical interneurons.

Project: During the M2 project, we will silence the midline thalamus using chemogenetic and we will record sleep oscillations in baseline condition and after a learning task. We will compare the behavioural performance at the task in control and thalamus off mice. These results will be the basis of a PhD project aiming at determining, using optogenetic tools and electrophysiology in naturally sleeping mice, if the thalamus signals the neocortex to get ready for the arrival of a SWR and therefore could promote memory consolidation.

3-5 recent publications:

- 1- Hay YA, Deperrois N, Fuchsberger T, Quarrell T, Koerling AL, Paulsen O. Thalamus mediates neocortical Down state transition via GABAB receptor-targeting interneurons. *Neuron*. 2021 Sep 1;109(17):2682-2690.e5. doi: 10.1016/j.neuron.2021.06.030. Epub 2021 Jul 26. PMID: 34314698.
- 2- Jarzebowski P, Tang CS, Paulsen O, Hay YA. Impaired spatial learning and suppression of sharp wave ripples by cholinergic activation at the goal location. *Elife*. 2021 Apr 6;10:e65998. doi: 10.7554/eLife.65998. PMID: 33821790; PMCID: PMC8064750.
- 3- Hay YA, Naudé J, Faure P, Lambolez B. Target Interneuron Preference in Thalamocortical Pathways Determines the Temporal Structure of Cortical Responses. *Cereb Cortex*. 2019 Jul 5;29(7):2815-2831. doi: 10.1093/cercor/bhy148. PMID: 30059985.