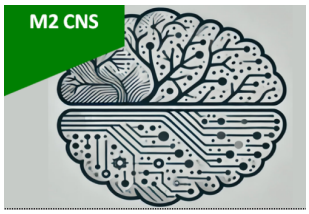


MASTER 2 Computational Neurosciences

Internship proposal 2025-2026

(internship from January to June 2026)

Host laboratory: *Camille Jordan Institute, Université Claude Bernard Lyon 1, Bâtiment Braconnier, 43 boulevard du 11 novembre 1918*
The candidate may be required to work at the premises of INSA and INRIA (Doua campus) alongside co-supervisors and collaborators.

Host team : *the candidate will be hosted by the Applied Mathematics for Biology and Medicine group, which is part of the Mathematical Modeling and Scientific Computing (MMCS) team (https://math.univ-lyon1.fr/icj/modelisation-mathematique-calcul-scientifique/) at the Camille Jordan Institute (https://math.univ-lyon1.fr/icj/).*

Internship supervisors : *the supervisors will be **Laurent Pujo-Menjouet** (Professor of Applied Mathematics, Claude Bernard University Lyon 1 – pujo@math.univ-lyon1.fr), **Amanda Lo Van** (Associate Professor in Biosciences, INSA – amanda.lo-van@insa-lyon.fr), and **Sergio Peignier** (Associate Professor in Biosciences, INSA – sergio.peignier@insa-lyon.fr).*

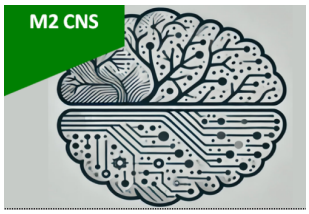
Project title : *Contribution to the study of a multiscale model describing the impact of Alzheimer's disease on neurons and their environment.*

*Project summary : **Alzheimer's disease affects nearly 50 million people worldwide.** Despite being studied for over a century, it remains poorly understood. In particular, the mechanisms regulating the proteins involved in neuronal death are highly complex, necessitating, for the past two decades, the use of mathematical modeling approaches.*
The objective of this internship is to connect the work of our teams across different scales:

- ***Macroscopic scale**: tissue destruction and plaque formation,*
- ***Mesoscopic scale**: activation of microglial cells and inflammation phenomena affecting neurons,*
- ***Microscopic scale**: interactions of proteins in the extracellular environment near neurons, within the cytoplasm, and around and inside the nucleus.*

Each scale is currently represented by one or more mathematical models. The aim will be to integrate these scales to better understand their interactions. Once the model is validated, we will simulate therapeutic strategies (in silico) to propose them for in vitro or even clinical trials. The mathematical tools employed will include, among others: numerical simulations of differential equations and partial differential equations, statistical data analysis, and sensitivity analysis of parameters. The candidate will be supported by one or more members of the supervising team, as well as by other members of the teams involved in this project.

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



Related publications :

1- « A qualitative analysis of a Aβ-monomer model with inflammation processes for Alzheimer's disease», *I. Ciuperca, **L. Pujo-Menjouet**, L. Matar-Tine, N. Torres, V. Volpert,* **Royal Society, Open Science, 11: 231536, https://doi.org/10.1098/rsos.231536**

2- « Toward an Early Diagnosis for Alzheimer's Disease Based on the Perinuclear Localization of the ATM Protein », *E. Berthel, **L. Pujo-Menjouet**, E. Le Reun, L. Sonzogni, J. Al-Choboq, A. Chekroun, A. Granzotto, C. Devic, M. L. Ferlazzo, S. Pereira, M. Bourguignon, N. Foray*, Cells, 2023, **https://doi.org/10.3390/cells12131747**

3- « Neuron Scale Modeling of Prion Production with the Unfolded Protein Response », *M. Adimy, L. Babin, **L. Pujo-Menjouet**, **SIAM J. APPLIED DYNAMICAL SYSTEMS, 2022***

4- « A reaction–diffusion model of spatial propagation of Aβ oligomers in early stage Alzheimer's disease », *M. Andrade-Restrepo, I. Sorin Ciuperca, P. Lemarre, **L. Pujo-Menjouet**, Léon Matar Tine*, **Journal of Mathematical Biology *volume 82, Article number: 39 (2021)***

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