

Title: Tracking of neural tau proteins on microtubules with fluorescence imaging of unique molecules.

Mention: Research MSc

Thesis advisors: STOPPIN-MELLET Virginie + virginie.stoppin-mellet@univ-grenoble-alpes.fr + 33(0)4 56 52 06 89 DENARIER Eric + eric.denarier@univ-grenoble-alpes.fr + 33(0)4 56 52 05 38 CHATELAIN Florent + florent.chapotot@gipsa-lab.fr + 33(0)4 76 57 43 71 BECQ Guillaume + guillaume.becq@gipsa-lab.fr, 33(0)4 76 82 62 70

Laboratory: Grenoble Institute of Neurosciences (GIN), Bâtiment Edmond J. Safra, Chemin Fortuné Ferrini, Site Santé, 38706 La Tronche Cedex, <https://neurosciences.univ-grenoble-alpes.fr>

Working place: Grenoble image parole signal and automatic laboratory (Gipsa-lab), UMR 5216 CNRS - Grenoble INP - Université Grenoble Alpes, 11 rue des Mathématiques, Grenoble Campus, BP46, F - 38402 SAINT MARTIN D'HERES Cedex, <http://www.gipsa-lab.fr>

If a PhD is foreseen: unknown

Context: The GIN is specialized in biological imaging of neurons and the Gipsa-lab is specialized in signal and image processing. They are starting a collaboration to study the interactions between Tau proteins and microtubules (Neurocog - project Taunique). Tau is a neuronal protein whose dysfunctions are involved in neurodegenerative diseases such as Alzheimer disease and dementia.

Objectives: The student will process movies of sfGFP-tau protein in interaction with microtubules observed in TIRF microscopy. The objective will be to detect and track moving fluorescent proteins and study the dynamical effects and locations sites of interactions with microtubules. Detection and tracking algorithms, generally used in the biologist community with imageJ, will be studied and adapted. The analysis of the movement of unique molecules will be analyzed to put in evidence the interactions with microtubules and compared, if possible, to theoretical models based on point processes described in the literature.

Competences required: Signal or image processing fundamentals - Probability and statistics fundamentals - Programming skills in Java or Python

Master tracks: Data Science (DS), Modeling, Scientific Computing and Image analysis (MSCI), and Statistics (STAT)

A short bibliography: At GIN, V. Stoppin-Mellet, associate professor at UGA, and E. Denarier, research engineer at CEA, are specialists of unique molecule recordings with microscopy. At Gipsa-lab, F. Chatelain, associate professor at Grenoble INP, and G. Becq, research engineer at CNRS, have experiences in detection and tracking of objects in natural, random or simulated recordings. Specific scientific articles are available upon request.