UFR CHIMIE & BIOLOGIE Université Grenoble Alpes

Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2026-2027

Laboratory/Institute: Grenoble Institut Neurosciences - GIN **Director:** E. Barbier
Team: Neurocytoskeleton Dynamics and Structure **Head of the team:** I. Arnal

Name and status of the scientist in charge of the project: Adrien Antkowiak, MCF UGA
HDR: yes ☐ no ☒
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Program of the Master's degree in Biology:

☐ Microbiology, Infectious Diseases and Immunology ☐ Biochemistry & Structure
☒ Physiology, Epigenetics, Differentiation, Cancer ☒ Neurosciences and Neurobiology

Title of the project:
Brain actin: understanding a fundamental building block of neuronal function and disease

Objectives:

This project aims to characterize the unique molecular and dynamic properties of brain actin and determine how its assembly is regulated. This fundamental knowledge will provide new insights into cytoskeletal regulation in neuronal function and disease.

Abstract:

The actin cytoskeleton is a key regulator of cell architecture, differentiation and function. In neurons, actin dynamics are essential for synaptic organization and plasticity, and their dysregulation is associated with neurological disorders. Despite the existence of multiple actin isoforms, most knowledge of actin dynamics comes from studies of muscle actin. Recent unpublished findings from our lab reveal that brain-purified actin displays distinct assembly properties and cannot coassemble with muscle actin despite sharing more than 90% sequence identity. This suggests that brain actin represents a specialized molecular component with unexplored properties. This project will define the biochemical characteristics of brain actin and determine how its assembly is regulated by actin nucleators, including formins and the Arp2/3 complex. Revealing the molecular properties of brain actin will uncover new principles of cytoskeletal regulation and provide insight into how alterations of cytoskeletal networks involving factors such as Tau contribute to neuronal dysfunction.

Methods:

Protein expression and purification (chromatography, affinity, polymerization strategy), protein labeling, SDS-PAGE and biomimetic assays. Actin dynamics and organization will be monitored by spectrofluorimetry and video/TIRF microscopy. Quantitative analysis will be performed using Fiji/ImageJ, R and/or Python.

Up to 3 relevant publications of the team:

* Elie E et al. (2015) Tau co-organizes dynamic microtubule and actin networks. Sci Rep 5:9964
* Antkowiak et al. (2019) Sizes of actin networks sharing a common environment are determined by the relative rates of assembly PLoS Biol 17(6): e3000317.
* Bagdadi et al. (2024) Stable GDP-tubulin islands rescue dynamic microtubules. J Cell Biol (2024) 223 (8): e202307074.

Requested domains of expertise:

Protein biochemistry, Cytoskeletal regulation, Advanced microscopy, Quantitative imaging, Research collaboration