Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2025-2026

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

Name and status of the scientist in charge of the project: A. Antkowiak (MCF)
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: Characterization of brain-cytoplasmic actin proprieties

Objectives (up to 3 lines):

This project aims to study the dynamic properties of brain-purified actin and to characterize how various nucleators affect its behavior, providing insight into the regulation of neuronal actin and, more broadly, into the role of cytoplasmic actin in cells.

Abstract (up to 10 lines):

The cell cytoskeleton, and actin in particular, regulates major biological functions such as cell differentiation, division and migration. While actin is encoded by 6 different genes in humans, most of the data available to date on this protein comes from actin expressed in muscles. Recent unpublished data obtained in the lab suggest that cytoplasmic actin found in the brain cannot coassemble with muscle actin, even though these proteins are over 93% identical. This represents a completely new and unexplored area of research. The project of this M2 internship is therefore to explore the specific dynamic properties of brain-cytoplasmic actin and its ability to be regulated by known nucleators such as formins and the Arp2/3 complex. This work will rely on biochemical approaches to purify the relevant proteins, combined with advanced microscopy techniques, including total internal reflection fluorescence (TIRF) microscopy, to study actin dynamics.

Methods (up to 3 lines):

Protein expression (bacteria) and purification (chromatography, affinity, polymerization strategy), protein labelling, SDS-PAGE. Imaging (video-microscopy and/or TIRF). Spectrofluorimetric method to monitor actin polymerization. Analysis (ImageJ/Fiji, R).

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 (up to 5 keywords):

Protein biochemistry, Photonic microscopy, Data analysis, Ability to follow protocols, Ability to write and present results.