UFR de Chimie et de Biologie
UNIVERSITÉ Grenoble Alpes

**Master's degree in Biology – Chemistry-Biology Department**

# Master 2 internship project
# Year 2023-2024

**Laboratory/Institute:** Grenoble Institut Neurosciences - GIN **Director:** E. Barbier
**Team:** Neuropathologies and Synaptic Dysfunctions **Head of the team:** A. Buisson

**Name and status of the scientist in charge of the project:** Yves Goldberg **HDR: yes x no** □
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**Program of the Master's degree in Biology:**

□ Microbiology, Infectious Diseases and Immunology □ Structural Biology of Pathogens
□ Physiology, Epigenetics, Differentiation, Cancer **x** Neurosciences and Neurobiology

**Title of the project:**

**Regulation of post synaptic protein recruitment by optical manipulation of the post synaptic actin cytoskeleton**

**Objectives (up to 3 lines):**

Dendritic spines are the seat of excitatory synapses in the brain, and their size correlates with synaptic strength and memory formation. This project aims at testing the hypothesis that expansion of the spine actin cytoskeleton directly controls scaffold protein recruitment at synapses.

Abstract (up to 10 lines):

The dendritic spines of hippocampal and other neurons are tiny bulbous protrusions that harbour a pancake-like structure called the post synaptic density (PSD), a supramolecular assembly that serves as housing for post-synaptic receptors responsible for excitatory neurotransmission. The size of spines and that of their resident PSD appear to be regulated by each other as a function of plasticity and memory signals, in a way that is not clearly understood. Since the size of spines depends on expansion of their internal actin cytoskeleton, one possibility is that spine actin filaments physically control the recruitment of PSD proteins. Our results suggest that actin actually constrains the expansion of the PSD. To pursue this hypothesis, we are using pharmacological and optogenetic tools in cultured hippocampal neurons. In particular, optogenetic constructs will be built and used to track the dynamics of PSD proteins as a response to light-induced actin assembly in single spines.

Methods (up to 3 lines):

Cloning of optogenetic constructs, primary culture and transfection of hippocampal neurons, fluorescent reporters, confocal microscopy of live neurons, image analysis

Up to 3 relevant publications of the team:

Peris, L., et al., 2022. Brain 145, 2486–2506.
Peris, L., et al., 2018. Nature Communications 9, 3775.
Chassefeyre, R., et al., 2015. J. Neurosci. 35, 3155–3173.

Requested domains of expertise (up to 5 keywords):

Cell culture, microscopy, molecular cloning, if possible some knowledge of statistical analysis of experimental data.