

**Master 2 internship project
Year 2026-2027**

Laboratory/Institute: Grenoble Institut Neurosciences - GIN

Director: E. Barbier

Team: From development to repair

Head of the team: H. Nawabi

Name and status of the scientist in charge of the project: Homaira Nawabi, DR Inserm

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: Understanding guidance cues dynamics during brain innervation

Objectives (up to 3 lines): This project aims to decipher guidance cues dynamics in the visual system during development through histology, biochemistry and imaging approaches.

Abstract (up to 10 lines): During development, thousands of axons grow simultaneously to form the nervous system. Interestingly, the topography of the nervous is highly stereotyped, meaning that a given axon will always connect the same target. How this specificity of connection is made is still an open question. To address our questions, we will be using the mouse visual system as a model. We will focus on specific brain regions that integrate visual information. We will decipher the expression of cues key for connectivity in these regions and their known reception within the retina. Understanding these processes key for proper brain wiring will be crucial not only for neurodevelopmental diseases but also in the context of regeneration to repair the injured nervous system.

Methods (up to 3 lines): Histology (immunostaining, in situ hybridization); primary culture (retina explants); biochemistry (westernblot) and imaging (epifluorescence, confocal, airscan and super resolution imaging)

Up to 3 relevant publications of the team:

1- Vilallongue N, Schaeffer J, Hesse AM, Delpech C, Paccard A, Couté Y, Belin S, Nawabi H. Axon guidance modalities in CNS regeneration revealed by quantitative proteomic analysis. **Nature Communications 2022 PMID: 36229455**

This study highlights guidance cues expression map in the mature brain using a proteomics approach. We showed that mature regenerating axons are sensitive to these factors. These data demonstrate that regenerative axons can be guided in the context of the circuit reformation.

2- Schaeffer J, Vilallongue N, Blot B, El Bakdouri N, Decourt C, Plissonnier E, Excoffier B, Paccard A, Diaz JJ, Humbert S, Catez F, Saudou F, Nawabi H*, Belin S*. Customization of translational complex regulates mRNA-specific translation to control CNS regeneration. **Neuron 2023** * co-last- **PMID: 37442131**

We demonstrate that translational regulation of a specific subset of mRNAs is at play to control axon regeneration in the injured CNS. This selective translation process is controlled by the functional association of non-canonical translation factors to ribosomes.

Prize "grandes avancées françaises en Biologie" 2024 French Academia of Science

3- Delpech C, Schaeffer S, Vilallongue N, Benadjal A, Blot B, Excoffier B, Plissonnier E, Albert F, Paccard A, Zagar Y, Castellani V, Belin S, Chédotal A, **Nawabi H**. Axon guidance during CNS regeneration is required for specific brain innervation. **Developmental Cell** 2024- PMID: 39353435

We show that mature suprachiasmatic nuclei (SCN) are repulsive for regenerating axon. Robo/slit signaling is involved in this repulsive activity. Inhibition of Robo/Slit signaling lead to SCN innervation by regenerating axons. The newly formed circuit sustains functional recovery.

- **Research highlighted in Nature Reviews Neuroscience.** *Opening the gate to regeneration.* 2024 Oct 28. doi: 10.1038/s41583-024-00875-1 Online ahead of print. PMID: 39468372

- **Selected article for Developmental Cell cover** Volume 59, Issue 24, December 16, 2024

- **Previews highlighted in Developmental Cell.** *Axon guidance in central nervous system regeneration* Volume 59, Issue 24 p3190-3192 December 16, 2024

- **Selected article for INSERM scientific advances 2024**

- **Selected as French Society of Neurosciences 2025 highlight**

Requested domains of expertise (up to 5 keywords): biochemistry, histology, molecular and cellular biology; neuroscience