Master's degree in Biology – Chemistry-Biology Department

Master 2 internship project
Year 2025-2026

Laboratory/Institute: Grenoble Institut Neurosciences **Director:** E. Barbier
Team: Central Nervous system: from development to repair **Head of the team:** H. Nawabi

Name and status of the scientist in charge of the project: Monia Barnat, Inserm researcher
HDR: yes ☐ no x
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Program of the Master's degree in Biology:

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

Title of the project: Understanding the developmental mechanisms regulating the formation of the cerebral cortex

Objectives (up to 3 lines):

The project aims to characterize the molecular and cellular mechanisms regulating the brain development during mammalian and human embryogenesis. More specifically, we focus on the development of the cerebral cortex to shed light on the etiology of neurodevelopmental disorders.

Abstract (up to 10 lines):

The cerebral cortex is a six-layered brain structure that ensures higher motor, sensory and cognitive functions. Its laminar organization reflects the fine regulation of developmental processes which, if altered, can lead to malformations of cortical development. These malformations are associated with clinical manifestations combining intellectual and/or motor deficits. Therefore, understanding how the cortex develops *in utero* is a sine qua non condition for deciphering neurodevelopmental disorders and their associated pathophysiological mechanisms. The cortical layers, holding a well-defined number and subtype of excitatory neurons, arise the sequential differentiation of progenitors into neurons that subsequently migrate to reach their final location. Using a combination of multi-scale approaches, we aim to study the developmental mechanisms that regulate the acquisition of neuronal identity and the orderly build-up of cortex.

Methods (up to 3 lines):

Murine lines (genotyping), histology (embryonic and post-natal brain sectioning), in utero electroporation, primary culture (embryonic brain slices, cortical neuroprogenitor cells), immunohisto- and cytochemistry, confocal microscopy, image analyses and molecular biology techniques.

Up to 3 relevant publications of the team:

Wennagel D, *et al*. Huntingtin coordinates dendritic spine morphology and function through cofilin-mediated control of the actin cytoskeleton. Cell Rep. (2022). 40(9):111261.
Barnat M, *et al*. Huntington's disease alters human neurodevelopment. Science (2020). 369(6505):787-793.
Barnat M, *et al*. Huntingtin-mediated multipolar-bipolar transition of newborn cortical neurons is critical for their postnatal neuronal morphology. Neuron (2017). 93(1):99-114.

Requested domains of expertise (up to 5 keywords): Neurobiology, Cortical development, Cellular biology, Cell adhesion and dynamics, Molecular biology