Internship offer
M2 Musculo-Skeletal system, Locomotion, Exercise (MuSkLE)

Title of the Internship: 3D anatomical analysis of muscle and brain alterations in mouse models of neurodevelopmental disorders

Laboratory (name, n°, website):
Institut NeuroMyoGène
Physiopathology and Genetics of Neuron and Muscle Unit
UMR CNRS 5261 – INSERM U1315
Université Claude Bernard Lyon 1
8 Avenue Rockefeller, 69008 Lyon, France
https://pgnm.inmg.fr/en/

Research team (name, website):
Yalcin-Jacquemond Team (as of 01/01/2027)
NGMM - NeuroGenetic Mechanisms of CNS disorders and Muscle function
https://pgnm.inmg.fr/en/jacquemond/

Supervisor to contact (name, email address):
Stephan Collins (stephan.collins@univ-lyon1.fr)

Project description including a short introduction, aim/objectives and methods/approach to be used
Many genetic neurological disorders are associated with skeletal muscle dysfunction, including generalized hypotonia and muscle weakness. However, the contribution of muscle dysfunction to these disorders remains poorly understood. To investigate the link between brain and muscle alterations, we use genetically modified mouse models carrying human mutations and reproducing aspects of the neurological and muscular symptoms observed in patients.

The aim of this M2 project will be to perform a differential anatomical analysis of healthy and pathological muscles, as well as brain structures, in one or two mouse models of human genetic diseases. The project will rely on high-resolution episcopic microscopy (HREM), an innovative 3D imaging approach that allows tissue reconstruction at near-cellular resolution. HREM is already routinely used in the laboratory for brain samples and will be adapted to skeletal muscle tissue in order to identify and quantify pathological abnormalities.

The student will contribute to HREM image analysis, 3D reconstruction and segmentation of regions of interest using 3D Slicer, followed by quantitative and statistical analyses using R. The results will help establish genotype–phenotype correlations and improve our understanding of muscle comorbidities associated with neurological disorders.

References:
1. Amelan A*, Collins SC* et al. *CRISPR knockout screens reveal genes and pathways essential for neuronal differentiation and implicate PEDS1 in neurodevelopment*. Nature Neuroscience. 2026 Mar;29(3):592-603 (*co-first)
2. Schreiber et al. *Reduced voltage-activated Ca^{2+} release flux in muscle fibers from a rat model of Duchenne dystrophy.* Journal of General Physiology. 2025;157:e202413588.

Skills required:
Motivation and interest in mouse models, neurological disorders, muscle biology and 3D imaging. Previous experience in image analysis, 3D reconstruction, 3D Slicer or R would be appreciated, but is not required. The student should be rigorous, organized and interested in quantitative data analysis