**Call for Excellence Doctoral Scholarship – MuSkLE**

# Role of estrogenic activity in skeletal muscle regeneration

**Host Laboratory**: Institut NeuroMyoGene (CNRS 5261, INSERM U1315, UCBL, Lyon), Stem cell environment and skeletal muscle homeostasis (Team Chazaud/Gondin)

**PhD supervisor**: Julien GONDIN (DR CNRS; julien.gondin@univ-lyon1.fr)

## Project description

Background:

Skeletal muscle is a plastic tissue that regenerates *ad integrum* after injury thanks to the key role of satellite cells (SCs) and their dynamic interactions with their niche (*e.g.*, macrophages and fibro-adipogenic progenitors (FAP))[1]. Skeletal muscle regeneration is improved in females as compared with males and is impaired in the absence of estrogens[2]. One cause of sexual dimorphism in skeletal muscle regeneration may be therefore the natural fluctuations of estrogens during the ovarian cycle. So far, animal studies have used supraphysiological and constant estrogen doses in ovarian-hormone depleted females[3,4], thereby limiting our understanding on how the natural fluctuations of estrogens affect muscle regeneration.

Aims: The PhD project aims i) at investing the impact of estrogenic activity on skeletal muscle regeneration in mice, ii) at deciphering the underlying cellular and molecular mechanisms.

Description of the project methodology: Experiments will be performed in a mouse model of exercise-induced muscle damage previously developed by the host laboratory[5]. By combining histological analyses with cell culture experiments, we will determine how estrogenic cycling influences the regulation of the distinct cell types that constitute the SC regenerative niche and how their interactions contribute to proper skeletal muscle regeneration[6]. Molecular analyses will be performed to elucidate the role of estrogen receptors in both uninjured and regenerating muscles. Finally, the functional impact of cyclic estrogenic activity on muscle regeneration will be assessed using gain- and/or loss-of-function approaches.

Expected results**:** The implementation of highly standardized *in vitro*, *ex vivo* and *in vivo* techniques, with specific mouse models of muscle injury, puts us in a unique position to address the influence of ovarian cycle on estrogen signaling in mouse muscle regeneration.

Techniques: Immunostaining, histology, microscopy, cell culture, animal experiments, force measurements.

Host laboratory: Our team investigates the role of the interactions myogenic cells develop with their environment in the regulation of skeletal muscle regeneration and their impact in both physiological and pathological contexts. **J. Gondin** is an expert in the field of skeletal muscle physiology. The unifying theme of his research concerns the skeletal muscle plasticity associated with physiological (hypertrophy[7], regeneration[5,8–10]) or pathophysiological conditions (e.g., cachexia associated with cancer or sepsis).

Application: Applicants should have a MSc diploma in an area of biological sciences, with a solid background in physiology and cell biology. Interested candidates should apply to Dr. Julien Gondin (julien.gondin@univ-lyon1.fr) with their CV, the contact information for at least 2 references, and a brief statement of their research interests and career goals.

## References (Publications from the host lab are in red font)

1. Bernard, C. *et al. Physiol Rep* **10**, e15480 (2022).
2. Jomard, C. & Gondin, J. *Physiol Rep* **11**, e15798 (2023).
3. Velders, M. *et al. FASEB J* **26**, 1909–1920 (2012).
4. Enns, D. L. & Tiidus, P. M. *J. Appl. Physiol.* **104**, 347–353 (2008).
5. Bernard, C. *et al. FASEB J* **37**, e23107 (2023).
6. Juban, G. *et al. Cell Rep* **25**, 2163-2176.e6 (2018).
7. Fessard, A. *et al. Skelet Muscle* **15**, 3 (2025).
8. Ancel, S. *et al. J Clin Invest* **134**, e163648 (2024).
9. Fouré, A. *et al. PLoS ONE* **9**, e107298 (2014).
10. Fouré, A. & Gondin, J. *Exerc Sport Sci Rev* **49**, 59–65 (2021).