**JOINT PhD Program**

**University Côte d'Azur (Nice, France) – University of Utah (Salt Lake City, USA)**

**Limitation of fatigue and performance during exercise: the brain–muscle interaction**

The University Côte d'Azur (Nice, France) and the University of Utah (Salt Lake City, USA) are offering a **3-year, fully funded PhD position in the field of Exercise Physiology** (see project summary below). During completion of the PhD program, the student will conduct her/his work in the **Laboratory of "Motricité Humaine, Expertise, Sport, Santé"** in Nice, France and in the **Utah Vascular Research Laboratory** in Salt Lake City, UT, USA under the supervision of Prof. Dr. Grégory Blain and Prof. Dr. Markus Amann. At completion of the project, the student will receive a **PhD degree from both the University Côte d'Azur and the University of Utah**.

The **University Côte d'Azur** is a recently created cluster of higher education establishments on the French Riviera. Université Côte d'Azur aims to develop a new University model based on interactions between disciplines, coordination between research, teaching, and innovation, and strong partnerships with the private sector and local authorities. Université Côte d'Azur won the prestigious "IDEX" award from the French government, placing it among the **top 10 world-class, comprehensive universities** in France.

The **University of Utah** has been committed to developing cutting-edge research and to cultivating a leading research institution through excellence, innovation, and interdisciplinary collaborations. Recognized as a **Top-Tier 1 research university** (Carnegie Classification of Institutions in Higher Education) – the University of Utah continues to develop groundbreaking research on a local, national, and international level.

**Outstanding applicants** should have a background in one or several of the following research fields: neuromuscular physiology, cardiovascular or pulmonary physiology, exercise physiology. Data analysis and treatment skills (e.g. Matlab), although not mandatory, will be valued. Essential requirements for this PhD position are: excellent grades, the ability to learn, understand and apply new physiological concepts and experimental methodologies from different disciplines, a strong motivation, and the willingness to work in a team.

**Fluency in French is not mandatory. An intermediate level in English (or higher) is expected**.

**The starting date is Fall 2020**. **Applications are accepted until May 31, 2020**. Short-listed candidates will be asked to prepare for an interview with the hiring committee, composed of members from the doctoral school in Human Movement Sciences. Interviews will take place early July 2020 in Marseille (France). Net salary is approximately 1500€ (not including possible extra income from teaching assistance) and includes a health insurance package. Professional expenses (e.g. experiments, hardware, software, travel, publications) will be covered by the hosting laboratories / universities.

Applicants should contact Prof. Dr. Grégory Blain (gregory.blain@univ-cotedazur.fr) or Prof. Dr. Markus Amann (markus.amann@utah.edu) to prepare their application as soon as possible (**deadline May 31st**). The application should include a cover letter, a statement of research interests (1 page limit), CV, list of publications (if any), relevant certificates (degrees and grades), and the name and contact information of at least two references. The documents have to be written in English. The application should be merged into one PDF and emailed to Prof. Blain.

**Project summary**
**Limitation of fatigue and performance during exercise: the brain–muscle interaction**

Understanding the link between the mechanisms controlling the development of fatigue and exercise performance is of critical importance in terms of exercise tolerance and the functional capacity of athletes and patients as well as for chronic adaptations/maladaptations to exercise.

Fatigue development during exercise progressively limits the power producing capabilities of the neuromuscular system. In order to prevent excessive fatigue, the working muscle inhibit the CNS motor output during fatiguing exercise. Findings from our group suggest a pivotal role of group III–IV muscle afferents in monitoring and limiting exercise-induced fatigue or, more accurately, associated intramuscular metabolic perturbation. The purpose of this 'brain–muscle' interaction might be to prevent a severe deviation from muscle homeostasis and, ultimately, a potentially harmful impairment of the muscle contractile function.

It remains, however, unclear whether the inhibitory effect of this 'brain-muscle' interaction on exercise performance is modulated by exercise intensity / duration and by interventions such as acute ischemic pre-conditioning of the locomotor muscles or chronic exercise training with partial ischemia.

Therefore, this project will attempt to:

1) determine the interrelation between intramuscular metabolite accumulation, group III-IV muscle afferent feedback, muscle activation, neuromuscular fatigue, and performance during exercise within the severe intensity domain.

2) determine the influence of acute and chronic muscle ischemia on this 'brain-muscle' interaction.

The mechanistic bases of exercise-induced fatigue and exercise performance / tolerance will be investigated within the framework provided by the power output - time to exhaustion relationship.

At completion of the project, it is expected that the candidate will master:

- Theoretical concepts related to the metabo- / pressor-reflex and the critical power.
- Experimental techniques including motor nerve stimulation, electromyography, microdialysis, cardiovascular and pulmonary measurements and analysis, ergometry, and data analysis.

**Relevant literature (not exhaustive):**


Amann M, Blain GM, Proctor LT, Sebranek JJ, Pegelow DF & Dempsey JA (2011). Implications of group III and IV muscle afferents for high-intensity endurance exercise performance in humans. J Physiol (Lond) 589, 5299–5309.

Blain GM & Hureau TJ (2017). Limitation of fatigue and performance during exercise: the brain–muscle interaction. Exp Physiol 102, 3–4.

Blain GM, Mangum TS, Sidhu SK, Weavil JC, Hureau TJ, Jessop JE, Bledsoe AD, Richardson RS & Amann M (2016). Group III/IV muscle afferents limit the intramuscular metabolic perturbation during whole body exercise in humans. J Physiol (Lond) 594, 5303–5315.

Cruz RS de O, de Aguiar RA, Turnes T, Pereira KL & Caputo F (2015). Effects of ischemic preconditioning on maximal constant-load cycling performance. Journal of Applied Physiology 119, 961–967.

Poole DC, Burnley M, Vanhatalo A, Rossiter HB & Jones AM (2016). Critical Power: An Important Fatigue Threshold in Exercise Physiology. Medicine & Science in Sports & Exercise 48, 2320–2334.

Thomas K, Elmeua M, Howatson G & Goodall S (2016). Intensity-Dependent Contribution of Neuromuscular Fatigue after Constant-Load Cycling: Medicine & Science in Sports & Exercise 48, 1751–1760.


**More information:**

Laboratory of "Motricité Humaine, Expertise, Sport, Santé": http://unice.fr/laboratoires/lamhess
Utah Vascular Research Laboratory: https://medicine.utah.edu/internalmedicine/geriatrics/research/vrl/
Université Côte d'Azur : http://univ-cotedazur.fr/en
University of Utah: https://www.utah.edu/
Doctoral School in Human Movement Sciences: https://ecole-doctorale-463.univ-amu.fr/fr