**Title of the PhD project:** Aerobic performance and skeletal muscle bioenergetics adjustments during endurance exercise in hypoxia

**Disciplines:** Physiology  
**Laboratory:** LEHNA laboratory, UMR5023 CNRS/University of Lyon, Villeurbanne, FRANCE (http://umr5023.univ-lyon1.fr/equipes-de-recherche/e2c); Director: Pr. Christophe Douady

**Doctoral school:** Interdisciplinary Doctoral program in health-sciences (EDISS) - ED 205

**Description:**  
**Scientific background and rationale:** Fish are excellent models for characterizing different pathways of energy metabolism at different levels. Indeed, in fish, the glycolytic/white muscle is well separated anatomically from the aerobic/red muscle and swimming performances easily identifiable according to the metabolic pathways involved. These two characteristics are particularly interesting for studying the potential relationships between in vivo performances (locomotor capacity, cost of transport, muscle efficiency), cellular bioenergetics, and the characterization of the use of different energy substrates (Teulier et al., 2013; Salin et al., 2015, Weber, 2016). **Aim:** We want to determine, from the whole animal to subcellular levels, which biochemical characteristics allow organisms to adjust their exercise performances and skeletal muscle bioenergetics in a low oxygen environment. **Biological models:** We will study three species of fish: the rainbow trout (Oncorhynchus mykiss); crucian carp (Carassius auratus) and zebrafish (Danio rerio). The first two fishes have very contrasting characteristics in terms of swimming performance but also in terms of resistance to hypoxia. The trout is an enduring fish, living in well-oxygenated waters that poorly supports the lack of oxygen. On the contrary, the crucian carp is a weak active fish that tolerates hypoxic waters more easily. The third fish is a model of choice for exploring the molecular aspects of muscle adaptations. **Description of the project methodology:** Fishes will be chronically exposed to hypoxia (an environment favoring carbohydrate metabolism) and endurance training (a physiological constraint promoting lipid metabolism). We will assess the evolution of metabolic parameters in vivo by measuring resting and exercise oxygen consumption, swimming performance (critical swimming speed associated with aerobic metabolism, rate of change of pace related to the use of anaerobic metabolism), the costs transport. and in vitro, by measuring the metabolic activities and bioenergetics of "white", "red" and cardiac muscles with different energy substrates. Special attention will be given to the study of lipid metabolism. **Expected results:** Results from this work will give strong clues on the link between exercise performances in vivo and skeletal muscle metabolic energy pathways in vitro. We will also determine how hypoxia can modulate this relationship. **Perspectives:** Pinpoint some bioenergetics mechanisms which can be modulated to allow aerobic performance of skeletal muscle to withstand with severe hypoxic environment.

**Skills required:** permeabilized fibers and characterization, mitochondrial bioenergetics assessment, exercise performance quantification in vivo, metabolism and physiology.


**Key-words:** skeletal muscle, energy efficiency, lipid oxidation, hypoxia, exercise performance.

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**Application should include:** CV, application letter, Names and addresses of two references. The application file should be sent before May 14, 2017 to: (email of the supervisor). The open competitive recruitment process is in two steps: 1. Internal laboratory procedure. 2. Interdisciplinary jury of EDISS.