

# **Doctoral grant (funded by I-SITE ULNE) :**

## **Synchronization of the mammalian circadian clock with metabolism: biophotonic approaches coupled with mathematical modeling**

### **CONTEXT**

The team of Marc Lefranc at PhLAM develops data-driven mathematical models to describe the dynamics of the circadian clock, which synchronizes to the day/night cycle and orchestrates many biological functions. The team of Laurent Héliot at PhLAM has leading expertise in tracking the dynamics of molecules and their interactions using real-time biophotonic approaches in living cells. This project is in collaboration with Bart Staels and Hélène Duez (U1011, Institut Pasteur de Lille).

### **SUBJECT**

There is increasing evidence that disruption of the circadian clock in metabolic organs plays a key role in pathologies such as obesity or diabetes. To clarify the mechanisms involved, we have designed a mathematical model of the mammalian liver clock synchronized to feeding/fasting cycles via the intracellular factors NAD<sup>+</sup> and AMP (Woller et al, Cell Rep 17, 1087, 2016). We seek a PhD student to develop biophotonic experiments with cell cultures to obtain data for validating and extending this model. Using reporters and biosensors for key metabolic actors such as SIRT1 or AMPK, as well as for core clock genes, we will quantify how various factors reset the circadian clock of hepatocytes and compare measurements with model predictions, but also validate molecular interactions playing a central role in the model. There will be a strong interaction with the modeling part of the project, to which the candidate is also welcome to contribute.

### **PROFILE**

Candidates should have a good biological background and experience with cell cultures and transfection, as well as a motivation for quantitative approaches to biological systems, combining cell cultures and imaging with mathematical modeling. Since the student will interact closely with researchers of different disciplines, excellent communication skills and a capacity to work in an interdisciplinary environment are required.

### **APPLICATION**

The contract is for 3 years. Funding is already secured from the University of Lille Nord Europe ISITE project. Candidates should send as soon as possible a cover letter stating their motivations and curriculum vitae to Marc Lefranc (marc.lefranc@univ-lille1.fr).

### **WHERE**

On the Science and Technology campus of the University of Lille, in northern France. Lille is the core of the 4<sup>th</sup> French urban area (1.2 M people) and is connected by high-speed trains to Brussels (40 min), Roissy airport (50 min.), Paris (60 min), and London (80 min). With a lively atmosphere and a reasonable cost of living, Lille is an attractive place to stay.