



Internship proposal (starting Sep 2020, 4 months)

## **Effects of drugs on the collective behaviour of molecular motors**

**Context:** Molecular motor designates a large family of proteins, which convert chemical energy provided by ATP hydrolysis into mechanical work. This property is used for instance in muscle contraction and for the transport of organelles inside the cell.

**Goal:** The goal of the project is to predict the impact of a drug (being currently in clinical tests for cardiomyopathies) on the collective properties of molecular motors. The effects of this drug on the molecular structure and biochemical properties of a single motor are rather well understood, but how the drug, and its concentration in affects the mechanical output of a large number of motors *in vivo* is still unknown. We will work on a theoretical model of an ensemble of motors to identify these effects as a guidance to adjust future clinical treatments.

**Scientific tools:** The model is based on the stochastic simulation of an ensemble of molecular motors connected through confining elastically scaffolds. It will take into account the tight coupling between the mechanical output of the motors and the biochemistry of the ATPase activity of myosin in the presence of a perturbing drug. This theoretical project will be in direct interaction with two other groups: the PhysioLab in the University of Florence (Italy) specialized in mechanical experimentation on molecular motors and the group of Anne Houdusse at Institut Curie (Paris), for its expertise in the structural properties of muscle myosin.

**Team:** The Internship will take place at the Laboratoire Modélisation et Simulation Multi-Echelle in Paris-Est University, 15 min from downtown Paris by metro.

**Profile:** Basic training in Mechanics or Physics or Chemistry. Some experience with Matlab and/or a molecular dynamics software is a plus. Above all, the candidate should be interested in biological questions and willing to work on a highly interdisciplinary project.

**Contact:**

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