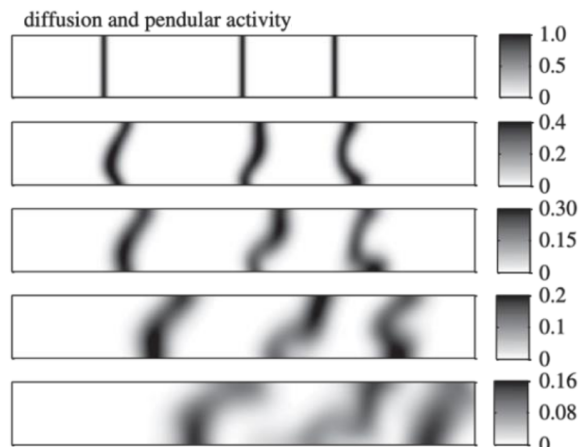


## **MASTER 2 INTERNSHIP PROPOSAL**

Laboratory name: Laboratoire Jean Perrin  
CNRS identification code: UMR 8237  
Internship director's surname: Claude Loverdo  
e-mail: [claudeloverdo@upmc.fr](mailto:claudeloverdo@upmc.fr) Phone number: 01 44 27 28 23  
Web page: <http://www.normalesup.org/~loverdo/>  
Internship location: Sorbonne Université, Jussieu, Paris.  
Thesis possibility after internship: YES  
Funding: YES If YES, which type of funding: ANR

### **Multi-scale modeling of transport in the gastrointestinal tract**

Transport in the digestive tract is important for nutrient absorption, as well as for bacterial dynamics [1] and their interaction with the immune system. However, transport in the digestive tract is poorly characterized. The master internship is part of an integrated and interdisciplinary project that draws on the complementary expertise of three teams in biorheology, theoretical biophysics and physiology. Based on experiments at the interface of physiology and fluid mechanics and numerical simulations of flows, this project proposes



to develop an analytical model of transport connecting different scales. The other project partners, Clément de Loubens and Stéphane Tanguy, will develop experiments on animal models to study the transport of particles along the digestive system and in the vicinity of microstructures of the intestinal mucosa [2]. These experiments will be used to simulate numerically the coupling between flows at microscopic and macroscopic scales in order to understand the role of active and microstructured interfaces on the transport and mixing of microparticles. All of these data from experiments and numerical simulations will make it possible to build analytical and simplified models of the transport and mixture of particles at different spatial and temporal scales.

The master internship will consist in analyzing trajectory data from already existing preliminary fluid dynamics numerical simulations based on physiological realistic features [3], in computing different observables and in comparing them to several analytical approximations. The internship will be based in LJP in Paris, and will be in close collaboration with the team of Clément de Loubens at the Laboratoire Rhéologie et Procédés (LRP) in Grenoble. Ideally, the intern would stay for a funded PhD on the project.

- [1] Hydrodynamic flow and concentration gradients in the gut enhance neutral bacterial diversity, D Labavić, C Loverdo, AF Bitbol (2021) arXiv:2105.06733  
[2] A review of mixing and propulsion of chyme in the small intestine: fresh insights from new methods, RG Lentle, C De Loubens (2015) Journal of Comparative Physiology B 185 (4), 369-387  
[3] Fluid mechanical consequences of pendular activity, segmentation and pyloric outflow in the proximal duodenum of the rat and the guinea pig, C De Loubens, RG Lentle, RJ Love, C Hulls, PWM Janssen (2013) Journal of the Royal Society Interface 10 (83), 20130027

