Offre de stage de Master / Master Internship offer

- **Tuteur du stage et laboratoire d'accueil / Internship supervisor and Host laboratory :**

Team : Functional genomics of host/intestinal bacteria interactions (PI : François Leulier)
Institut de Génomique Fonctionnelle de Lyon (IGFL)

Supervisor : Cathy Ramos
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Additional info :
http://igfl.ens-lyon.fr/equipes/f.-leulier-functional-genomics-of-host-intestinal-bacteria-interactions

- **Titre du projet de recherche / Research project title :**

Impact of the intestinal microbiota on *Drosophila* locomotor activity: a focus on the Neuromuscular junction.

- **Description du projet / Project description :**

In animals, nutrition during the juvenile growth period is particularly crucial since undernutrition leads to severe wasting, stunting and in extreme cases, childhood mortality. Importantly, it has been shown that children suffering from malnutrition have a persistent gut immaturity altering their future life. In this context, the Leulier team has recently revealed using gnotobiotic animal models (*Drosophila* and mice) the **evolutionarily conserved impact of the intestinal microbiota** on the promotion of linear growth upon chronic undernutrition. Specifically, the lab demonstrated that **a single natural fly gut commensal bacteria, *Lactobacillus plantarum*, fully recapitulates the beneficial effect of an intact microbiota by accelerating growth and maturation rate of undernourished juveniles.**

Given the pleiotropic effects of chronic undernutrition on juvenile traits these results pave the way for additional macroscopic and behavioral studies beyond the linear growth promotion. Notably chronic undernutrition triggers an increased food-foraging behavior. This locomotor activity occurs through body wall muscles contraction under the control of neuromuscular junctions activities. These synapses are very plastic structures and adapt to environmental changes, such as nutrition, by modifying their morphology and physiology. Therefore this training project will integrate into a more global project on going in the lab that aims to determine **the effect of the microbiota on the *Drosophila* larval locomotor activity on both muscles and neurons sides**. Specifically, the **master trainee will focus on characterizing the morphometrics of the larval neuromuscular junctions upon under-nutrition in germ-free and gnotobiotic animals by exploiting the well-established *Drosophila/Lactobacillus plantarum* association model**.

Methods used in the laboratory :
Drosophila genetics, immunohistochemistry, confocal imaging, RNA-Seq, RT-qPCR.

Trainee profile : The candidate has to show a great interest for Science in general and be highly motivated by cellular biology, microbiology and/or genetics.

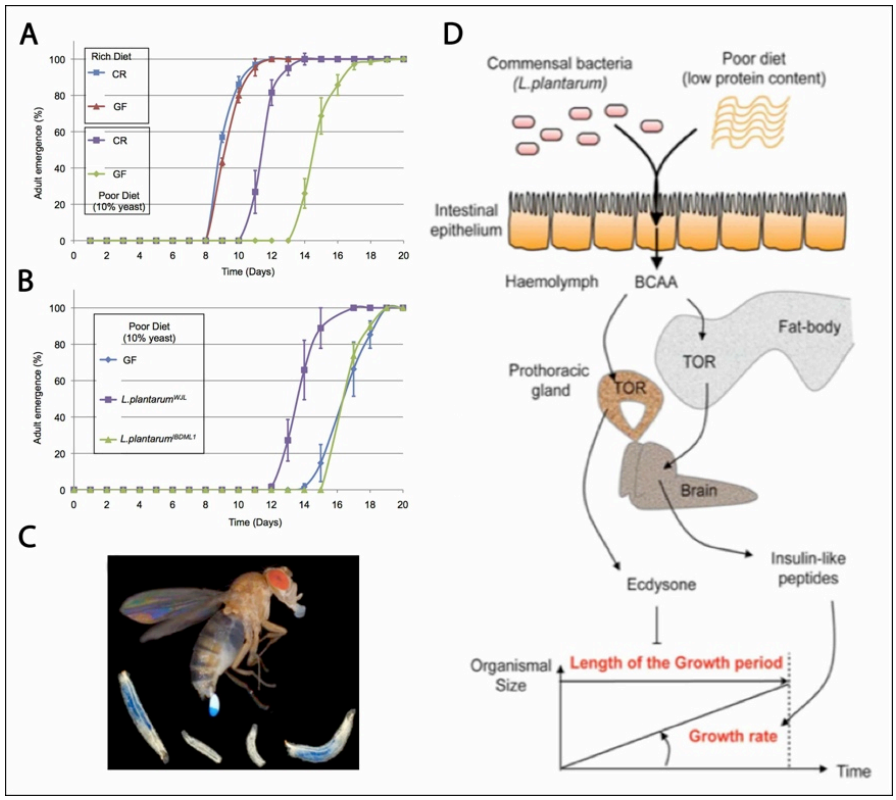
***Lactobacillus plantarum* / *Drosophila melanogaster* mutualistic interaction.**

A) *Drosophila* microbiota accelerates developmental timing upon nutrient scarcity. No change is observed on animals grown on rich diet, while upon nutrient scarcity the GF larvae metamorphosis is delayed. CR: conventionally raised (commensal microbiota); GF: germ free.

B) *L.plantarum (Lp)* re-association of GF individual accelerates *Drosophila* development timing in a strain specific manner (Lp^{WJL} *vs* Lp^{IBDML1}).

C) *L.plantarum* (associated with blue food and faeces) colonizes the host intestine (in both adults and larvae) and is transmitted vertically to progenies and promotes larval growth *vs* non-colonized larvae (no blue in the intestinal) when grown for six days on a low nutrient diet.

D) Our current model of the integrated action of *L.plantarum* association on its host hormonal system controlling systemic growth. BCAA: branched chain amino acids; TOR: target of rapamycin kinase. From (Storelli et al. 2011).



Publications du laboratoire (5 max) / Lab publications (5 max) :

- ***Storelli, G. et al***., Drosophila Perpetuates Nutritional Mutualism by Promoting the Fitness of Its Intestinal Symbiont Lactobacillus plantarum. Cell Metabolism 27(2), 362–377 (2018).

- ***Matos, R. et al.*** , D-alanine esterification of teichoic acids contributes to Lactobacillus plantarum mediated Drosophila growth promotion upon chronic undernutrition. Nature Microbiology 2(12), 1635–1647. (2017)

- ***Schwarzer, M. et al***. Lactobacillus plantarum strain maintains growth of infant mice during chronic undernutrition. Science 351, 854–857 (2016).

- ***Erkosar, B. et al***. Pathogen Virulence Impedes Mutualist-Mediated Enhancement of Host Juvenile Growth via Inhibition of Protein Digestion. Cell Host Microbe 18, 445–455 (2015).

- ***Storelli, G. et al.*** Lactobacillus plantarum promotes Drosophila systemic growth by modulating hormonal signals through TOR-dependent nutrient sensing. Cell Metabolism 14, 403–414 (2011).