



PhD Research Proposal Form China Scholarship Council (CSC) - ENS Group

FIELD: BIOLOGY

(eg: Mathematics, Physics, Sociology,)

Thesis subject title:

Impact of commensal bacteria on *Drosophila* gut growth and maturation upon undernutrition

Name of the French doctoral school : Biologie Moléculaire Intégrative et Cellulaire (BMIC)

Name of the Research team : Integrative Physiology of Host-Microbes Interactions

Website : <http://igfl.ens-lyon.fr/equipes/f.-leulier-functional-genomics-of-host-intestinal-bacteria-interactions>

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Lab Language : English

Research Proposal Abstract :

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. In this context, our team has recently revealed using gnotobiotic models (mice and *Drosophila*) the evolutionarily conserved impact of the intestinal microbiota on the promotion of linear growth. Specifically, the lab demonstrated that a single natural fly gut commensal bacteria, *Lactiplantibacillus plantarum*, fully recapitulates the beneficial effect of an intact microbiota by accelerating juvenile growth and maturation rate. Also, through transcriptomics, metabolomics and functional studies using *Drosophila*, our lab showed that *Lactiplantibacillus plantarum* influences juvenile growth at least partly through the increased expression of a set of specific intestinal digestive enzymes. These results strongly suggest a causative link between microbiome activities, enhanced digestion capabilities and growth promotion.

In this context, we want to determine whether the linear growth promoting effect of *Lactiplantibacillus plantarum* impacts differently specific organs. Our preliminary data show a differential bacteria effect on the gut growth. Indeed, for a same larvae longitudinal size, the guts of monoassociated larvae are longer than those of germ-free animals. We have now identified several interesting candidate genes to explain this local growth benefit. In this light, the project will require to develop and optimize techniques such as *Drosophila* genetics, RNA-Seq, RT-qPCR, FACS, immunostaining, epifluorescence and confocal imaging...

The *Ph.D.* student will focus on deciphering the molecular mechanisms that sustain the coordination of gut growth and maturation upon undernutrition and how *Lactiplantibacillus plantarum* affects them by exploiting the well-established *Drosophila/Lactiplantibacillus plantarum* partnership model.

References :

Selected publications :

- **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).

Type of PhD :

Full PhD :

Regular PhD (leading to a single French diploma)