



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

FIELD: Biology
(eg: Mathematics, Physics, Sociology,)

Thesis subject title:

Impact of polylysogeny on *Lactiplantibacillus plantarum* fitness and probiotic traits

Name of the French doctoral school : 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/index_html?set_language=en&cl=en

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Lab Language : English/French

Research Proposal Abstract :

Metazoans establish complex interactions with their resident microorganisms, which contributes for different aspects of host physiology. One such important aspect is juvenile growth especially upon chronic undernutrition. Despite the renewed interest in understanding the functional impact of gut microbiota on host physiology, a clear view of the molecular dialog engaged upon host/microbiota interaction remains elusive. Therefore, the use of simple animal models, such as *Drosophila*, will help to unravel the evolutionarily conserved mechanisms underlying the impact of intestinal bacteria on their host's physiology. *Lactiplantibacillus plantarum* (*Lp*) is a prevalent member of *Drosophila* microbiota and upon chronic undernutrition, certain strains fully recapitulate the beneficial effect of a more complex microbiota, by promoting *Drosophila* growth and maturation. This effect is partly dependent on increased proteases expression in the enterocytes driven by bacterial cell envelope components via a peptidoglycan-responsible NF- κ B- dependent signaling pathway (the PGRP-LE/Imd/Relish cascade) and an additional signal dependent on esterification of teichoic acids with D-Alanine.

With this project, we would like to go beyond cell envelope factors and uncover novel bacterial factors involved in this symbiotic relationship. Precisely, we will use controlled experiments with genetically modified strains to elucidate the nature of the interaction between prophages and their bacterial gut symbiont, and of those with their animal host. Specifically (i) we will broaden our knowledge on *Lp* prophages by studying their biology, activity and contribution to bacterial fitness in the gut niche, and (ii) determine prophage contribution to *Lp*-mediated animal juvenile growth promotion.

This research program will shed light on the molecular mechanisms underlying the beneficial symbiosis at play between commensal bacteria and the physiology of their host in the context of chronic undernutrition.

References :

Ma, D., Storelli, G., Mitchell, M. & Leulier, F. Studying host-microbiota mutualism in *Drosophila*: Harnessing the power of gnotobiotic flies. *Biomed J* 38, 285–293 (2015).

Storelli, G. *et al.* *Lactobacillus plantarum* Promotes *Drosophila* Systemic Growth by Modulating Hormonal Signals through TOR-Dependent Nutrient Sensing. *Cell Metab* 14, 403–414 (2011).

Matos, R. C. *et al.* d-Alanylation of teichoic acids contributes to *Lactobacillus plantarum*-mediated *Drosophila* growth during chronic undernutrition. *Nat Microbiol* 2, 1–15 (2017).

Nanda, A. M., Thormann, K. & Frunzke, J. Impact of Spontaneous Prophage Induction on the Fitness of Bacterial Populations and Host-Microbe Interactions. *J Bacteriol* 197, 410–419 (2015).

Oh, J.-H. *et al.* Dietary Fructose and Microbiota-Derived Short-Chain Fatty Acids Promote Bacteriophage Production in the Gut Symbiont *Lactobacillus reuteri*. *Cell Host Microbe* 25, 273-284.e6 (2019).

Type of PhD :

1.Full PhD

- Joint PhD/cotutelle (leading to a double diploma) : NO
- Regular PhD (leading to a single French diploma) : YES

2. Visiting PhD (for students enrolled at a Chinese institution who will be invited to a French institution to carry out a mobility period) : NO