The role of DNA methylation in the symbiosis between a cereal weevil and its endosymbiotic bacteria

Host laboratory : UMR INRAE/INSA Lyon 203 BF2I (Biologie Fonctionnelle, Insectes et Interactions) ; INSA Bâtiment Louis Pasteur, 20 avenue Albert Einstein, 69621 Villeurbanne cedex. http://bf2i.insa-lyon.fr/

Supervisors :
Rita Rebollo - rita.rebollo@inrae.fr - @rita_rebollo
Marie Fablet – marie.fablet@univ-lyon1.fr

Scientific context: Cereal weevils are common insect crop pests causing an estimated worldwide loss of hundreds of millions of dollars and hence their study is crucial for ecological and economical reasons. *Sitophilus oryzae*, the rice weevil, has partnered along evolution with the Gram-negative bacterium *Sodalis pierantonius*, allowing the insect to thrive exclusively on cereals despite their low amount in amino acids and vitamins. The bacteria are present within specialized insect cells called bacteriocytes, which are organized into organs, the gut and ovarian bacteriomes. In the last decade, our team has used this association to untangle the molecular interactions between host and bacteria and to understand how the insect immune system has co-evolved with the endosymbionts. Recently, we have shown that weevils associated with endosymbiotic bacteria show a higher proportion of methylated cytosines than animals devoid of such bacteria. DNA methylation is an epigenetic mark, usually associated with gene silencing in most animals and plants with the exception of arthropods, where its role remains elusive. The link between DNA methylation and pathogen-host interaction has been recurrently studied, but few studies have focused on long-term associations between animals and symbiotic bacteria.

The aim of the master student will be to elucidate the role of DNA methylation in insect-bacteria symbiosis. Since the function of DNA methylation in insects remains obscure, we have performed RNA interference against major enzymes responsible for DNA methylation in *Sitophilus oryzae.* Methylome and transcriptome datasets are available for animals lacking DNA methylation enzymes. Thanks to this dataset the PhD student will pinpoint the effect of the presence of DNA methylation in gene transcription, splicing, along with gene ontology analysis of DNA-methylated target genes. This will be the first functional analysis of DNA methylation in insects.

Master student: We are looking for a highly motivated student, who will learn how to manipulate weevils and perform molecular and cellular biology. The student will be closely working with the core management (two supervisors) and other members of the BF2i laboratory, and will benefit from a very supportive team. We expect a proactive person who enjoys being part of a team and is passionate about science.

Host teams: The BF2i laboratory is affiliated with the National Research Institute for Agriculture, Food and the Environment (INRAE) and the 'Institut National des Sciences Appliquées de Lyon' (INSA Lyon). The lab research work focuses on the biology of different types of interactions involving insects, plants and insect symbiotic bacteria. It also aims at investigating emerging technologies required for insect pest control. The successful applicant will benefit from fully equipped laboratories for genomics, molecular biology, biochemistry and histology research.

The GEI (Génétique et Evolution des Interactions) group in LBBE has a long-term expertise in the epigenetics of the interactions between hosts and molecular parasites such as transposable elements. In addition, the lab benefits from a powerful computing center, which allows the analysis of high-throughput sequencing from transcriptomic and epigenomic data.

Environment: Lyon is built around the Rhône and Saône rivers. It is the second economic French city and its rich history and architecture made it part of the Unesco World Heritage. The city is also culturally very dynamic. Within France, Lyon has a strategic geographical position, close to the Alps and the Mediterranean coast, Switzerland and Italy. Paris is only two hours away by TGV. Last but not the least, Lyon is considered the French capital of gastronomy, offering a wide variety of food and wine from the surrounding areas.

Keywords: Bacteriocyte, symbiosis, insects, coleoptera, epigenetics, methylation