Deciphering the molecular dialogue between the mutualistic symbiosis between the cereal weevil *Sitophilus oryzae* and the endosymbiotic bacteria *Sodalis pierantonius*

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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. During the first week of adulthood, the midgut bacteriome shows an exponential increase in endosymbiont load, concomitant with cuticle synthesis. Indeed, the endosymbionts provide aromatic amino acids and vitamins that lack in the weevil's diet. Once the cuticle is built, the endosymbionts, along with the bacteriocytes/bacteriomes go through an apoptotic/autophagy process until no bacteria is found in the adult midgut (around two-week-old weevils). In order to understand the regulation of endosymbiont growth and elimination, we have recently obtained transcriptomic data from both symbiotic and artificially obtained aposymbiotic *S. oryzae* animals, through five time points of adult bacteriome development.

Host team. 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 aim of the master student will be to pinpoint key genes and pathways associated with endosymbiont presence and control. The project will include three main approaches:

Comparison between dual RNAseq and RNAseq datasets. We currently hold dual RNAseq datasets along with RNAseq datasets for the same tissues and development time, providing the opportunity to assess if both methods are equivalent and could be used in differential expression analysis. The student will make broad comparative analysis of differentially expressed genes and clusterization between the methods.

Comparative transcriptomics between symbiotic and aposymbiotic animals. Preliminary analysis of this large dataset has shown specific transcriptomic regulations dependent on the presence of the endosymbiont. The student will specifically identify host genes and pathways that are differentially regulated in the presence of endosymbionts.
Take advantage of a transposon-rich genome to pinpoint potential links between repeats and endosymbiont control. The cereal weevil genome shows some of the largest repeat content, especially regarding transposable elements (TEs). TEs are DNA sequences capable of moving throughout their host genome. Around 72% of *S. oryzae*'s genome is composed of TE sequences, and we have previously demonstrated that symbiotic and aposymbiotic ovaries show different TE expression. The PhD student will take advantage of the large aposymbiotic-symbiotic dataset to characterize the TE transcriptional landscape during bacteriome adult development, and to demonstrate the potential role of TE transcriptional activity in insect-endosymbiont control.

Master student: We are looking for a highly motivated student, who has experience dealing with transcriptomic datasets. 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.

Lab: The BF2i laboratory is affiliated to both 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.

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