ÉCOLE NORMALE SUPÉRIEURE DE LYON

Offre de stage de Master / Master Internship offer

Date of the offer: Early 2022

Tuteur du stage et Laboratoire d'accueil / Internship supervisor and Host laboratory:

Abderrahman Khila/ Dvelopmental Genomics and Evolution

Laboratoire / Lab :

Institut de Genomique Fonctionnelle de Lyon

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Site internet de l'équipe / Team Website : http://igfl.ens-lyon.fr/equipes/a.-khila-developmental-genomics-and-evolution

Langues parlées dans l'équipe / Languages spoken in the lab:

Français/Anglais

UNIVERSITÉ DE LYON

ENS DE LYON

Titre du projet de recherche / Research project title:

Screening genes involved in a male-specific sexually antagonistic trait

Mots clés / Keywords : Sexual conflict, Development, Evolution, gene function, water triders

Description du projet / Project description (subject and technics):

Background: Selection in males and females is often antagonistic in that traits favoured in one sex often impose fitness costs to the other, thus creating a conflict between the sexes (Arnqvist and Rowe, 2005). In waters striders, there is a conflict over mating frequency such that high mating frequency favours males but imposes fitness costs on the females (Arnqvist and Rowe, 2005). This opposing selection often results in escalation and arms race between the sexes where males evolve traits that increase and females evolve traits that decrease mating frequency (Arnqvist and Rowe, 2005; Crumiere et al., 2018; Crumiere and Khila, 2019). These sex-specific phenotypes are often called sexually antagonistic traits. While we have a good understanding of antagonistic co-evolution of the sexes at the phenotypic level, our understanding of how this co-evolution operates at the genomic level remains poor. This is primarily due to the dichotomy between models where we understand genetics and those where we understand sexual conflict.

Study model: This project will take advantage of water striders as powerful models for the study of sexual conflict, combined with the genetics and genomics tools we established recently, to identify loci underlying a male sexually antagonistic trait (Khila et al. 2012). We focus on a species pair called *Gerris buenoi* and *Gerris odontogaster* that can hybridize and whose hybrids are fertile.

Males of *Gerris odontogaster* possess abdominal spines used to grasp females (Arnqvist, 1989), whereas these spines are absent from *Gerris buenoi*. The hybrids possess antagonistic traits with intermediate size. The ability to generate hybrids and introgression crosses represents a powerful tool to study the genomic basis of sexually antagonistic traits and, therefore, the genomics of sexual conflict.

Aims of the project: We crossed these two species for over 10 generations and we conducted a pool-sequencing of extreme phenotypes based on the presence or absence of the spines in males. This allowed us to identify multiple single nucleotide polymorphisms associated with male spines and we were able to experimentally confirm some of them through RNA interference.

The Masters student will be able to continue screening through RNA interference other important genes in our candidate list. This experiment involves the cloning of multiple coding sequences of important developmental regulators, producing double stranded RNA in vitro and injecting nymphs with this double stranded RNA. The resulting adults will be imaged using a VHX-7000 digital scope for phenotyping. If time allows, the student will also be able

to conduct behavioural experiments to understand the impact of the spine on male and female interaction. The student will have the opportunity to learn molecular biology and manipulation of gene function techniques, microscopy, phenotyping and morphometrics.

Publications du laboratoire ou revue recommandée sur le sujet / Lab publications or recommended review on the subject (5 max):

Arnqvist, G., 1989. Sexual Selection in a Water Strider - the Function, Mechanism of Selection and Heritability of a Male Grasping Apparatus. Oikos 56, 344-350.

Arnqvist, G., Rowe, L., 2005. Sexual conflict. Princeton University Press, Princeton, N.J.

Crumiere, A.J.J., Armisen, D., Vargas, A., Kubarakos, M., Moreira, F.F.F., Khila, A., 2018. Escalation and constraints of antagonistic armaments in water striders. biorxiv.

Crumiere, A.J.J., Khila, A., 2019. Hox genes mediate the escalation of sexually antagonistic traits in water striders. Biol Lett 15, 20180720.

Khila, A., Abouheif, E., Rowe, L., 2012. Function, developmental genetics, and fitness consequences of a sexually antagonistic trait. Science 336, 585-589.