Three-year PhD position

**Developmental genetic basis of an evolutionary innovation**

**Where:**
- **The Khila lab** at the Institute of Functional Genomics (IGFL), École Normale Supérieure de Lyon, UMR CNRS 5242, Lyon, France
  
  

The student will also have access to the expertise in systems biology of the **Francesconi lab** at the Laboratoire de Biologie et Modelisation de la Cellule (LBMC), Ecole Normale Supérieure de Lyon, UMR CNRS 5242, Lyon, France


**Salary:** 1800 Euros/month

**Starting date:** January 2022

**Deadline for applications:** October 30\(^{th}\), 2021 or till the position is filled

**Project title:** Understanding the origin of evolutionary innovation using water strider propelling fan as a model

**Keywords:** EvoDevo, developmental genetics, RNAi, Single cell-sequencing

**Background:** Evolutionary innovations are qualitatively new and beneficial phenotypes that allow the bearing lineages to access previously unexploited ecological opportunities. Studying these traits offers a unique opportunity to understand how novelty arises and evolves. Although many iconic examples have been documented, it is still difficult to study the origin of evolutionary innovations for various reasons. For example, systems bearing striking evolutionary innovations may be intractable for experimentation, or the innovation itself may be too complex for manipulation.

**Model system:** The Khila lab has established the propelling fan of the water strider *Rhagovelia* (Figure 1A) as a model to study the origin of evolutionary innovations. The propelling fan in *Rhagovelia* is composed of ~20 plum-like structures that can be deployed or retracted as the animal rows on the water (Santos et al., 2017) (Figure 1B). The fan allows the water strider to sustain permanent movement on fast flowing streams – a previously unexploited ecological opportunity that is not accessible to fanless species. This innovation may have contributed to the burst of speciation of the genus *Rhagovelia*, which alone accounts for almost half of the species count in the family (over 400 species). We investigate the origin of this evolutionary innovation through a comparative study of the cellular and developmental genetic mechanisms underlying fan development in species with one pair, two pairs or no fans (Figure 1).

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**Figure 1:** *Rhagovelia* possess a pair of plumy fans in the mid-legs (A, B) while *Tetraripis* possess two pairs of bushy fans in the mid-legs (C) and hind-legs (D).
**PhD project:** The Phd student will study the function of a selection of genes expressed in fan cells, and test their interactions with Hox genes during development, using RNAi and immunohistochemistry. The student will also collaborate with other lab members to generate single cell sequencing data from the cell populations expressing fan markers (see Santos et al. Science 2017). Finally, the student will conduct experiments to test the gene network composition underlying fan development and evolution.

**Requirement:** Master’s degree (or equivalent).

**Skills sought or to be acquired:** Good communication skills in English (written and spoken), motivation, creativity, curiosity, critical thinking and a good awareness of the literature of the topic, good work ethics, teamwork, and good inter-personal relationship with colleagues. Knowledge in evolutionary developmental biology or bioinformatics would be a plus.

**How to apply:** By email to abderrahman.khila@ens-lyon.fr with a motivation letter explaining why you are interested by this position and how you think you are a good fit, your CV and names and e-mail addresses of two or three referees who can write letters of reference on your behalf.

**Lab publication on the Rhagovelia fan:**