**Master 2 Internship**

**Title: Impact of nutrition on metabolism, cardiac function, locomotor performance, and behavior in honeybees**

Location: INRAE UR 406 Bees & Environment, Avignon

Supervisors: Claude Collet (INRAE UR 406 AE) & Cyril Reboul (LAPEC)

Application procedure: Please send a CV and a cover letter with the subject line "Bee Nutrition Internship AE" to claude.collet@inrae.f and cyril.reboul@univ-avignon.fr

The *Bees & Environment* (AE) research unit, in collaboration with LAPEC, IMBE, and C2VN, is developing an innovative research program aimed at studying the impact of food resource quality on honeybee metabolism, locomotor performance, and cardiac function. In the alarming context of the decline in insect abundance and species richness (Jactel et al., 2020), managed honeybee colonies suffer from an average annual mortality rate of nearly 30%. Multiple stressors appear to contribute to this phenomenon, in particular nutritional deficiencies.

The objective of the Master's internship (M2) will be to evaluate the deleterious effects of nutritional deficiencies on survival, behavior, skeletal and cardiac muscle function, and to identify potential metabolic disorders that could weaken colonies. From a nutritional perspective, the internship may help identify a diet and specific micronutrients capable of mitigating the detrimental effects of chronic deficiencies to which bees are exposed.

The AE laboratory has developed original tissue- and cell-based approaches to study the functioning of the honeybee heart and its constituent cardiomyocytes. In addition, a recent, innovative, and non-invasive method now makes it possible to measure, at high throughput, locomotor performance, which reflects the physiology of both skeletal and cardiac muscles in bees. These physiological and behavioral approaches will complement the biochemical and metabolic analyses carried out by LAPEC, IMBE, and C2VN.

The student will be jointly supervised by C. Collet (INRAE PACA Center, UR 406 AE, Avignon) and C. Reboul (LAPEC, University of Avignon). The 6-month internship will take place within the AE unit, which specializes in skeletal and cardiac muscle physiology, behavior, pathology, and nutrition in honeybees, as well as in the biotic (predators, pathogens) and abiotic (insecticides) pressures exerted on them. The LAPEC unit specializes in cardiac stress in vertebrates in relation to exercise and nutrition.

**Student missions will include:**

- Measuring the survival of bees subjected to different diets
- Assessing and analyzing the behavior and locomotor performance of these bees
- Characterizing the cardiac function of bees exposed to the chosen diets

**Internship allowance:** ~600 €/month