

3 PhD positions in evolutionary biology of social insects at the Johannes Gutenberg University of Mainz, Germany

The Institute of Organismic and Molecular Evolution is seeking candidates for 3 PhD positions (starting October 1st 2019) to study the molecular regulation of ant social life within the Research Training Group GenEvo.

Position 1 – **Molecular regulation of reproduction in insect societies** (co-supervised by Romain Libbrecht and René Ketting). The main feature of social insects is the reproductive division of labor, whereby queens monopolize reproduction while sterile workers perform other tasks to maintain the colony. Investigating the molecular mechanisms regulating reproduction and division of labor in ants is necessary to understand the evolution and ecological success of insect societies. The clonal raider ant *Ooceraea biroi* has emerged as a powerful study system to investigate gene regulatory processes and the molecular regulation of reproduction (Chandra et al. 2018, Libbrecht et al. 2016, Libbrecht et al. 2018). This project will identify putative gene regulatory mechanisms associated with reproduction, and investigate the functional link between social cues (presence of larvae), regulatory mechanisms, gene expression, and reproduction. It will thus shed light on the regulation and evolution of reproductive division of labor in insect societies, as well as on how gene regulation can translate social cues into physiological changes.

Position 2 – **Gene regulation and division of labor** (co-supervised by Susanne Foitzik, Peter Baumann, Susanne Gerber). Social insect workers specialize in specific tasks and this division of labor contributes to the ecological success of insect societies. Task specialization is mostly neither genetically determined nor rigid, but changes with age and colony needs. Typically, young workers takeover brood care, whereas older workers focus on risky tasks. The expression of behavioral genes shifts with the tasks of workers and histone acetylation can regulate task-specific gene expression (Simola et al. 2016). Our preliminary work revealed division of labor, the expression and functions of task-specific genes (Feldmeyer et al. 2014; Kohlmeier et al. 2018; 2019), and the importance of histone acetylation for their expression in the ant *Temnothorax longispinosus*. This projects aims to understand how different regulatory processes respond to external cues, the expression of which genes they alter and how fast they can change gene expression. It will thus give insights into the molecular regulation of worker division of labor in social insects.

Position 3 – Parasite interference with gene regulation of a social host (co-supervised by Susanne Foitzik, Peter Baumann, Falk Butter). Parasites with complex life cycles often manipulate the behavior of their intermediate hosts to increase transmission to the definite host and we hypothesise that they do so by interfering with host gene regulation. Infection of *Temnothorax nylanderi* ant larvae with the parasitic cestode *Anomotaenia brevis* strongly alters the adult phenotype. Parasitized workers exhibit altered behaviour, morphology, chemical profile and a lifespan extension (Scharf et al. 2012, Beros et al. 2015), and these changes are linked to transcriptomic alterations (Feldmeyer et al. 2016). The cestode, residing in its cysticercoid stage in the ants' gaster is transcriptionally active and releases many proteins into the host. The aim of this project is to demonstrate that parasite-induced changes in host phenotype are actively promoted by the parasite. We therefore will study how the cestode parasite interferes with the hosts' gene regulation, which gene-regulatory mechanisms are utilized and whether these alterations are permanent or have to be actively maintained. This project will reveal genetic and epigenetic underpinnings of behavior and longevity in social insects and will uncover the mechanisms of across-species interference in gene regulation.

We are looking for highly motivated students with a Master degree (or equivalent) in biology, good English skills, and a keen interest in evolutionary biology. Previous experience with social insects, statistics and bioinformatics is advantageous, but not required. Successful applicants will join an international, interactive, dynamic and English-speaking scientific environment in a brand new building with access to state-of-the-art, newly equipped laboratories and climate-controlled rooms. The JGU of Mainz hosts many excellent scientific institutions, and Mainz is a historic city located on the Rhine River with a large student population and a rich social and cultural life.

Interested candidates should apply to the IPP summer call 2019. They will have to register before **May 22nd 2019** and complete their application before **May 27th 2019**. Informal enquiries should be sent to Dr. Romain Libbrecht (romain.libbrecht@uni-mainz.de) for position 1 and Dr. Susanne Foitzik (foitzik@uni-mainz.de) for positions 2 and 3.

The starting date for all three positions is **October 1st 2019**. The Johannes Gutenberg University of Mainz is interested in increasing the number of women in science. Applications from women are therefore strongly encouraged. Similarly, qualified candidates with disabilities will be preferred.