



Research module project (Forschungsmodul)

Caste-specific role of transposable elements in gene regulation in termites

Background: Termites are eusocial roaches, living in colonies composed of several castes. These castes differ in terms of fertility (sterile and fertile) and tasks (workers, soldiers, queens, kings), with strong morphological, physiological and behavioural differences. Intriguingly, analogous to other eusocial insects, such as ants, some bees and wasps, different termite castes differ phenotypically, while sharing the same genome, often being full siblings. How different expression patterns are regulated that allow the differentiation and maintenance of these castes is an ongoing field of research, with many publications describing long lists of caste-specific genes. Especially in termites, transposable elements (TEs) may play an important role in the expansion of gene families involved in the evolution of termites (Harrison et al., 2018). However, the role of TEs in the modulation of expression patterns, for example, by insertion into regulatory regions of genes, is so far unknown.

Objectives: The overall aim of this project is to investigate the hypothesis that TEs play a role in gene regulation, effecting the formation and maintenance of castes in 3 termite species, *Cryptotermes secundus*, *Zootermopsis nevadensis* and *Macrotermes natalensis*. In particular, the student will investigate the position of repetitive elements in relation to gene regulatory regions, and compare their expression between castes, stages and species. Possible extensions, if time permits, can include (i) an investigation of co-expression with coding genes to make predictions regarding gene regulation, and (ii) a comparison to TE expression in the non-social cockroach, *Blattella germanica*. The project can also be restricted to one species depending on module type.

Requirements:

- Interest in genome evolution
- Experience working on the command line, basic scripting skills
- Ability to work independently
- some basic knowledge of gene expression and regulation

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References

Harrison, M. C., Jongepier, E., Robertson, H. M., et al. (2018). Hemimetabolous genomes reveal molecular basis of termite eusociality. *Nature ecology & evolution*, page 1.