

What makes a social parasite? Analysis of genes specific to parasites and genes specific to their hosts

Background: Socially parasitic ants avoid nursing, housekeeping and foraging by exploiting the care behaviour of other ant species. Through destructive raids, parasites capture brood from colonies of their host species that will act as their worker force. Though parasitic are phylogenetically very closely related to their hosts (10-30 million years since divergence from their most recent ancestor), parasites and hosts differ drastically in their behaviour, and to some extent in their morphology. Comparative genomics can allow us to uncover genes which are specific to a certain lifestyle, and which may have evolved over short evolutionary periods.

Objectives: In this project, you will use bioinformatic tools to identify genes which are species-specific, or lifestyle-specific (*i.e.* specific to hosts or parasites). The aim is to identify and functionally characterise genes which are representative of the parasitic versus the host lifestyle.



Figure 1: Trophallaxis between the slavemaker ant, *Temnothorax americanus* (left) and its slave *T. longispinosus* (right). Credit: Susanne Foitzik.

Requirements:

- Interest in social evolution and the evolution of social parasitism
- Interest in learning how to use bioinformatic tools for comparative genomics

Methods:

- Use a genomic dataset from 8 ant species to identify genes which are present in only one species or lifestyle
- Verify that these genes are not present in other genomes by performing a reciprocal BLASTp
- Functionally analyse the resulting species-specific or lifestyle-specific genes

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Selected literature:

- B. Feldmeyer, D. Elsner, A. Alleman, and S. Foitzik. Species-specific genes under selection characterize the co-evolution of slavemaker and host lifestyles. *BMC evolutionary biology*, 17(1):1–11, 2017.
- R. Libbrecht, P. R. Oxley, D. J. Kronauer, and L. Keller. Ant genomics sheds light on the molecular regulation of social organization. *Genome biology*, 14(7):1–9, 2013.
- L. Schrader, H. Pan, M. Bollazzi, M. Schiøtt, F. J. Larabee, X. Bi, Y. Deng, G. Zhang, J. J. Boomsma, and C. Rabeling. Relaxed selection underlies genome erosion in socially parasitic ant species. *Nature communications*, 12(1):1–13, 2021.