

PROJECT TITLE: Alarm behaviour in ants: how do ants react to different stressors?

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Project description:

The global ecological success of ants can be credited to the evolution of sociality [1]. However, group-living in high density also incurs an increased risk of disease epidemics. Ants have evolved a series of cooperative disease defence mechanisms providing a social immunity [1-3]. While this is well studied, the mechanisms of spreading disease-related information are still unknown. A novel, body shake behaviour has been observed in the black garden ant, *Lasius niger*, when exposed to the pathogenic spores of *Metarhizium brunneum* fungi. Preliminary results indicate that this could be generic alarm behaviour which increases in frequency after contact with a pathogen-exposed ant.



Figure 1 - tracking ants using DeepLabCut software [4]

In this project, you will experimentally test how ants react to different environmental stressors, such as an infectious pathogen, intruders, physical disturbance or light exposure, and observe the body shaking alarm signal. The project aim is to investigate which stimuli cause shakes, and track the alarm spread through a group of workers. The project will involve caring for ant colonies, designing and running experiments, making behavioural observations and subsequent trajectory analysis using an automatic tracking software, DeepLabCut (figure 1) [4]. The findings will aid in understanding the alarm behaviour and how ant colonies can communicate efficiently for collective responses. No bioinformatics background is required. Candidates should be motivated and willing to work independently as well as part of a team.

The project will approximately involve 3 weeks of lab work, 3 weeks of desk work and 2 weeks of report writing.

Background reading and references:

1. Meunier J. Social immunity and the evolution of group living in insects. *Philosophical Transactions of the Royal Society B: Biological Sciences*. 2015 May 26;370(1669):20140102.
2. Cremer S, Armitage SA, Schmid-Hempel P. Social immunity. *Current biology*. 2007 Aug 21;17(16):R693-702.
3. Stroeymeyt N, Casillas-Pérez B, Cremer S. Organisational immunity in social insects. *Current Opinion in Insect Science*. 2014 Nov 1;5:1-5.
4. Mathis A, Mamidanna P, Cury KM, Abe T, Murthy VN, Mathis MW, Bethge M. DeepLabCut: markerless pose estimation of user-defined body parts with deep learning. *Nature neuroscience*. 2018 Sep;21(9):1281-9.