**BBSRC MIBTP Studentship Project**

**September 2023**

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| **Project Title** | Mating in a disease-vector mosquito and global warming |
| **Project Summary**  |
| **Background** Mosquitoes are the deadliest animals in the world due to their ability to harbour and transmit multiple disease vectors. Their geographic range is determined by environmental conditions but with global warming they are exploiting ever expanding niches and new mosquito species are predicted to become established in ever more northern latitudes. A pivotal moment in the life-cycle of mosquitoes is swarming. During the swarm male mosquitoes use their exquisitely sensitive antennal ears to locate the flight tone of females before mating. Both the flight tone of mosquitoes and the operation of the mosquito’s antennal hearing organ are significantly altered with temperature. This PhD will work towards understanding the ability of mosquitoes to mate in different temperatures. This PhD will use state-of-the-art single cell RNA Sequencing technology and bioinformatic analyses combined with electrophysiological recordings of the superbly exquisite antennal hearing organ of *Anopheles gambiae*.   You will be part of the very social and successful Neurogenetics Group, at the University of Leicester, and be expected to attend yearly international conferences and perform field-work to collect mosquito samples. **Objectives** 1. Measure the effect of temperature on the wing beat frequency and proportion of successful mating attempts in artificial laboratory swarms at different temperatures.
2. Measure the sound-evoked electrophysiological response of the auditory Johnston’s organ of male mosquitoes at different temperatures.
3. Extract RNA from the head and Johnston’s organ of mosquitoes that are able to swarm and mate at extreme cold temperatures.
4. Use single-cell/single nuclei RNA Sequencing to understand the genetic expression changes that lead to mosquitoes particularly apt at mating in cold temperatures.

**Methods** You will be trained in behaviour, electrophysiology, molecular biology and bioinformatics.  1. You will measure wing beat frequencies and the time of swarming using a mosquito swarming arena with in built microphones. You will video-track mosquitoes as they leave the swarm in copula and assess genetic fitness by counting offspring. You will do this at different temperatures to assess the effect of temperature on wing beat frequencies and genetic fitness.
2. You will insert tungsten electrodes into the male’s auditory Johnston’s organ and play sounds to measure its tuning at different temperatures.
3. You will be trained how to dissect the Johnston’s organ and head of mosquitoes and to dissociate nuclei for single nuclei RNA sequencing.
4. You will be trained in bioinformatic analysis to understand gene changes at a single cell resolution.

**Outcome** At the end of your PhD you will have a strong background in electrophysiology and state-of-the-art single cell RNA sequencing protocols and bioinformatic analyses. You will answer a profound scientific question: What are the consequences of global warming for the spread of mosquito-borne disease?  Techniques that will be undertaken during the project:* Single nuclei/single cell RNA Sequencing (Parse Biosciences workflow)
* Electrophysiology
* Swarming behaviour
* Acoustics

BBSRC Strategic Research Priority: Understanding the Rules of Life - Neuroscience and behaviour, Systems Biology |
| **References** |
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