**University of Leicester**

**BBSRC MIBTP Studentship Project 2024-5 entry.**

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| **Project Reference** |  |

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| **First Supervisor** | Dr Ben Warren |
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| **Additional Supervisor** |  |

**Section 2 – *Project Information***

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| **Project Title** | Short and long-term genetic and behavioural consequences of traumatic brain injury in fruit flies.   |
| **Project Summary**  |
| **General background** How many fingers am I holding up? What day of the week is it? Follow my finger? These three questions are designed to test your sensory, memory and motor neural abilities following an accident; all three systems are affected by a severe deceleration of your brain. Traumatic brain injury (TBI) is the leading form of death and long-term injury in young people, and now, even sub-concussive impacts (such as heading a football) disputedly lead to cognitive impairments in later life. The mechanical incapacitation of a nervous system (concussion) is not unique to humans and appears to be a shared feature of any animal with a nervous system (Buhlman et al., 2021; Delventhal et al., 2013). You will derive a comprehensive understanding of the short and long-term consequences of TBI in an experimentally trackable animal, the fruit fly *Drosophila melanogaster*. Specifically, you will track and analyse the locomotion, circadian rhythms and gene transcription changes of fruit flies directly after TBI and over their life span. Behaviour and gene transcription changes will be complemented with confocal and electron microscopy imaging of the fly brain. You will use the mechanical “Thor” device to deliver known decelerations (ranging from 10 to 1000G) to cohorts of flies.  **Objectives** 1. Quantify the threshold G-force required to induce changes in locomotion, circadian rhythm and gene expression changes.
2. Quantify long-term changes in locomotion, circadian rhythm and gene expression due to repetitive sub-concussive impacts.
3. Identify and track gene expression changes across a life span.
4. Characterise and track morphological changes in the fly’s brain with confocal and electron microscopy.

**Training and international meetings** You will receive extensive hands-on training in mechanics, fly genetics, molecular biology, state-of-the-art imaging approaches and bioinformatics from Dr Warren, Prof. Rosato and Dr Feuda. You will be part of the thriving Neurogenetics community that spans the School of Biological Sciences and the Department of Genetics and Genome Biology with access to state-of-the-art facilities and tailored career development programmes run by MIBTP and the Doctoral College.  You will attend international meetings to present your work such as the 28th European *Drosophila* Research Conference in 2027 and the 18th Traumatic Brain Injury Conference (USA) 2028 and well as domestic meetings such as the UK “Clock Club” (every six months) and an annual Neurogenetics Group retreats. **Methodology** * Mechanics and calibration of accelerometers including use of Doppler laser Vibrometer.
* Fly locomotion, circadian behaviour and limb tracking using computer learning (AI) approaches.
* General molecular biology methodology including RNA extraction, PCR, gel electrophoresis.
* Bioinformatics to analyse changes in RNA (gene expression)

**Techniques that will be undertaken during the project*** Mechanics/laser Doppler vibrometry
* Behaviour (locomotion and circadian), including computer learning (AI) approaches to track limb movements
* Molecular biology (RNA extraction, PCR, gel electrophoresis).
* Bioinformatics (to analyse transcriptomes)

The methodology, skills and training is well sought after in academia and industry and will make the student competitive for roles post their PhD studies.  |
| **References** |
| Buhlman LM, Krishna G, Jones TB (2021) Drosophila as a model to explore secondary injury cascades after traumatic brain injury. doi: 10.1016/j.biopha.2021.112079  Delventhat R, Wooder ER, Basturk M, Sattar M, Lai J, Bolton D, Muthukumar G, Ulgherait M, Shirasu-Hiza MM (2022) Dietary restriction ameliorates TBI-induced phenotypes in *Drosophila melanogaster* doi: 10.1038/s41598-022-13128-x  |

**To apply please refer to**

[**https://le.ac.uk/study/research-degrees/funded-opportunities/bbsrc-mibtp**](https://le.ac.uk/study/research-degrees/funded-opportunities/bbsrc-mibtp)