Neuroscience

Name of PI | Varun Sreenivasan
Project: Circuit mechanisms underlying emergent behaviours in early postnatal development
Description: Active exploration is essential for survival, but it doesn't emerge at birth because many brain circuits are still developing. In mice, whisking behaviour—where whiskers are moved to gather tactile information—only emerges at around two weeks of age. This project will investigate how whisking sensorimotor circuits are assembled after birth and how disruptions in their development affect the emergence of whisking. Techniques used include in-vivo whole-cell and extracellular recordings, optogenetics, chemogenetics, and viral tracing in gene-targeted mice.
Contact: Dr. Varun Sreenivasan (V.Sreenivasan@sussex.ac.uk)
Lab Website

Name of PI | Kevin Staras
Project: Neural circuits for risky decision-making
Description: Using Lymnaea.stagnalis as a model organism, this project investigates neural circuit mechanisms underlying decision-making, particularly when an animal faces conflicting threats, such as hunger versus predation. The student will gain expertise in AI-driven behavioural tracking, voltage-sensitive dyes, multi-electrode arrays, and intracellular recordings to elucidate the key mechanisms controlling action selection in response to changing inputs.
Skills: AI tracking, electrophysiology, decision-making circuits.

Name of PI | Claudio R. Alonso
Project: The molecular biology of neurons as they move from differentiation into adult neural circuits
Description: This project explores how the transition from neuronal differentiation to maturity is controlled by Hox genes in Drosophila. The goal is to understand the molecular mechanisms that regulate this transition and its impact on neural physiology. Students will use genetics, genomics, transcriptomics, advanced microscopy, and neurophysiology.
Skills: Genetics, transcriptomics, microscopy, neurophysiology.

Name of PI | Claudio R. Alonso
Project: The molecular basis of behaviour: mapping the roles of non-coding RNAs in the

brain
Description: This project focuses on understanding the role of microRNAs in regulating behaviour in Drosophila. The student will investigate how mutations in microRNA genes affect neural function and behaviour by using genetics, optogenetics, neurophysiology, and transcriptomics to study the role of microRNAs in specific neurons.
Skills: Genetics, optogenetics, neurophysiology, microRNA research.

Name of PI | Andrew Penn
Project: Developmental changes and mechanisms of aberrant neuronal signalling resulting from mutations in GRIN2B
Description: This project investigates how mutations in NMDA glutamate receptors affect neuronal signalling and lead to disorders such as epilepsy, intellectual disabilities, and Autism Spectrum Disorder. The student will study how these mutations impact neuronal function and development using techniques like patch clamping, CRISPR technology, fluorescence imaging, and tissue culture.
Skills: Electrophysiology, CRISPR, molecular biology, fluorescence imaging.

Name of PI | Miguel Maravall
Project: Neuroethology of sensory exploration in mice
Description: This project uses AI-driven motion tracking technologies to study how mice explore their environment and how sensory information is processed during active exploration. The goal is to understand how engaging with the environment affects sensory processing and learning. This project has implications for understanding the neuronal basis of learning and sensory processing.
Skills: AI tracking, sensory behaviour, mouse ethology.

Name of PI | Miguel Maravall
Project: Revealing the logic of complex neuronal activity in the sensory cortex of mice
Description: This project focuses on understanding how the sensory cortex processes sensory evidence and influences behaviour. Using tools like two-photon microscopy, Neuropixels electrophysiology, and optogenetics, the student will explore how neuronal activity in the sensory cortex contributes to decision-making and behaviour.
Skills: Electrophysiology, two-photon microscopy, optogenetics.

Name of PI | Sylvia Schroeder
Project: The impact of reward and learning on visual processing in mice
Description: This project investigates how reward and learning influence visual

processing in the superior colliculus (SC), a brain region important for orienting behaviours. The student will use two-photon calcium imaging, behavioural training, and advanced data analysis techniques to examine how reward-based learning affects visual processing in the SC.

Name of PI | Tom Baden
Project: Evolution of function in the vertebrate retina
Description: This project explores how synapses, neurons, and networks in the vertebrate retina have evolved to meet new sensory and behavioural demands. The student will use systems neuroscience, behavioural ecology, and genetic manipulation to study these processes in model organisms such as zebrafish, mice, and other vertebrates, contributing to a deeper understanding of evolutionary changes in brain function.