Neuronal Basis of multisensory integration for spatial navigation

- **Supervisors:** Dr Guifen Chen
- **Studentship Funding:**
  - **Name:** SBBS Studentship
  - **Funder:** School of Biological and Behavioural Sciences (SBBS) at QMUL
- **Application Deadline:** 23.59PM, 23rd June 2024
- **Expected Start Date:** Sept 2024

Project Overview

Applications are open for a 3-Year funded PhD Studentship in the School of Biological and Behavioural Sciences (SBBS) at Queen Mary University of London.

Our physical environment possesses many different cues that are perceived by our sensory systems. As we move through the environment, we observe a corresponding change in the sensory cues. In mammals, the hippocampus and its adjacent areas in the medial temporal lobe, have long been implicated in spatial navigation and learning. Several types of spatial neurons have been discovered in this area, including place cells and grid cells.

The activity of these neurons represents an animal's current location. Despite this discovery of an internal representation (or "map") of space, it remains unclear how the brain combines environmental sensory cues (e.g. visual landmarks) with self-motion information (e.g. locomotor or optic flow cues) in order to form these maps. Hence, the focus of this project is to disentangle the effects of visual and self- motion cues on place cells and grid cells during spatial mapping.

Virtual reality (VR) offers a powerful tool for investigating spatial cognition, allowing environmental manipulations that are impossible in the real world. We have recently developed a two-dimensional VR (2D VR) system for mice with mainly visual and motor/proprioceptive inputs, allowing a close approximation of spatial representation in the real world.

The project will study the distinct roles of place cells and grid cells in building spatial representations, by taking advantage of the new 2D VR system. The aim is to understand how place and grid cells interact and combine sensory cues to represent space in health and aging models such as Alzheimer's disease. The project offers a new angle for understanding the interaction between spatial cells and their functions in spatial learning, providing the foundation for the applications in the fields of artificial intelligence and robotic navigation. The primary techniques that will be used include in vivo electrophysiological single-unit recording using tetrodes and Neuropixel probes.

Find out more about the School of Biological and Behavioural Sciences on our website.

Keywords:

Spatial navigation, virtual reality, sensory integration

Research Environment

The School of Biological and Behavioural Sciences at Queen Mary is one of the UK's elite research centres, according to the 2021 Research Excellence Framework (REF). We offer a multi-disciplinary research environment and have approximately 180 PhD students working on projects in the biological and psychological sciences. Our students have access to a variety of research facilities supported by experienced staff, as well as a range of student support services.

Dr Guifen Chen's lab focuses on studying how sensory inputs are integrated at the neural network level to form spatial representation in the brain. Using the state-of-the-art two-dimensional virtual reality system, combined with in vivo electrophysiological recording, her group can investigate the separate effects of sensory inputs on spatial learning in awake animals. Her long-term research interests lie in the network mechanisms of spatial cognition and episodic memory in healthy and diseased brains including Alzheimer's and Autism. Further details about Dr Guifen Chen's group are available here: https://www.qmul.ac.uk/sbbs/staff/guifen-chen.html

The project will be in close collaboration with Prof Francesca Caccuci's lab at UCL. Caccuci's lab studies how these spatial maps support memories, with a special interest in how they emerge during post-natal development. Using cutting-edge technologies such as 2-photon microscopy and opto- and chemo-genetics, her group can both visualise and manipulate neural circuits during behaviour. Further details is available here: https://www.cacuccilab.net/

Find out more about the School of Biological and Behavioural Sciences on our website.

Entry Requirements & Criteria

We are looking for candidates to have or expecting to receive a first or upper-second class honours degree and a Master's degree in an area relevant to the project such Neuroscience, Life Sciences, Medicine, Psychology, Physics, Maths or Computer Science. Candidates must also have experience conducting research in a laboratory environment.

Programming skills such as Matlab, a good understanding of math, and experience of rodent experiments would be highly advantageous but are not required.

Find out more about our entry requirements here.

Applicants from outside of the UK are required to provide evidence of their English language ability. Details can be found on our English Language requirements page.

Funding

The studentship is funded by QMUL**.** It will cover home tuition fees, and provide an annual tax-free maintenance allowance for **3 years** at the UKRI rate (£20,622 in 2023/24).

To classify for Home Fees, this typically means the candidate will have unrestricted access on how long they can remain in the UK (i.e. are a British National, have settled, or pre-settled status, have indefinite leave to remain etc.)

International students will need to cover the difference in fees between the home and overseas basic rate from external sources. Further details can be found on our PhD Tuition Fees page.

Funding and eligibility queries can be sent to the sbbs-pgadmissions@qmul.ac.uk

How to Apply

Formal applications must be submitted through our online form by the **stated deadline** for consideration.

Applicants are required to submit the following documents:

- Your CV
- Personal Statement
- References
- Copies of academic transcripts and degree certificates

Find out more about our application process on our SBBS website.

Informal enquiries about the project can be sent to **Guifen Chen** AT **guifen.chen@qmul.ac.uk**

Admissions-related queries can be sent to sbbs-pgadmissions@qmul.ac.uk.

Apply Online

The School of Biological and Behavioural Sciences is committed to promoting diversity in science; we have been awarded an Athena Swan Silver Award. We positively welcome applications from underrepresented groups.

http://hr.qmul.ac.uk/equality/
https://www.qmul.ac.uk/sbbs/about-us/athenaswan/

References

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