PhD studentship in Computational Visual Neuroscience – How Specific Classes of Retinal Cells Contribute to Vision: a Computational Model

Background

The process of vision begins in the retina. This thin neural tissue, located at the back of the eye, is able to convert light from different parts of the visual scene into a «code » sent to the brain. This code is composed of electrical impulses, or spikes, generated by retinal ganglion cells (RGCs), the cells that connect the eye to the brain via the optic nerve. A human retina contains ~1 million RGCs (45,000 in mouse) and each of these cells sends information (shape, motion, colour etc.) from its immediate surrounding about the visual scene. Amazingly, the brain can recreate images from interpreting these highly compressed barcodes" or trains of spikes. This ability is partly due to the astonishing functional diversity of RGCs, each interpreting a different feature of the visual scene. It is all these parallel streams of information that impart the complexity of visual scenes to our brain visual areas. How precisely this complexity is encoded in the spike trains produced by the population of RGCs is, however, largely unknown. Adding to the complexity even further, RGCs interact with each other during the encoding of complex visual scenes.

At present, over 30 RGC sub-types have been identified, typically on the basis of common anatomical features or basic functions (e.g. sensitivity to motion, orientation, motion direction etc.). More recently, evidence has started accumulating, showing that RGCs belonging to the same type also share gene expression.

Project

The studentship is part of a new interdisciplinary project funded by the Leverhulme Trust to investigate how different groups of RGCs contribute to the encoding of visual scenes. The project is using a pharmacogenetics approach (combined with high density multielectrode array physiology, anatomy, computational modelling and behaviour) to reversibly silence subgroups of RGCs sharing gene expression through DREADD (Designer Receptors Exclusively Activated by Designer Drugs) activation. Removing an entire functional RGC group from the population response will not only help us characterise the receptive field properties of these cells, but it will also shed light about the role these same cells play in population encoding of complex visual scenes.

All the experimental work is done at the Institute of Neuroscience in Newcastle University, UK (E. Sernagor's lab; http://www.ncl.ac.uk/ion/).

The studentship will focus on the computational aspect of the project which will be undertaken by the Biovision team (B. Cessac's lab, INRIA, Sophia Antipolis, France; https://team.inria.fr/biovision/). The goal of the PhD is to analyse and model the effects of silencing subpopulations of RGCs on the population response of the retina to visual stimuli. A simulation platform will be developed, allowing to reproduce the experimental findings and to anticipate new effects.

Due to funder regulations, the student will be registered in Newcastle, but is expected to spend most of her/his time in France, on the French Riviera, with regular visits to Newcastle (funding is available for these visits).

The studentship is for three years, starting in October 2017. It covers student fees and maintenance as well as funds for travelling between the two teams and conference expenses.

Eligibility Criteria

You must have a theoretical profile (physics, computer science) and have achieved at least a 2:1 honours degree or international equivalent. You must have an MSc or MRes in a subject relating to computational neuroscience with good skills in C or C++ coding and be ready to work with experimentalists.

The award is available to UK/EU applicants only.

How to apply

You must apply through the Newcastle University's online postgraduate application system. To do this please 'Create a new account (http://www.ncl.ac.uk/postgraduate/apply/)'.
Only mandatory fields need to be completed. However, you will need to include the following information:
-Insert the programme code 8300F in the programme of study section.
-Select 'PhD in the Faculty of Medical Sciences – Neuroscience as the programme of study.
-Insert the studentship code IN090 in the studentship/partnership reference field.
-Attach a covering letter and CV. The covering letter must state the title of the studentship, quote the studentship reference code IN090 and state how your interests and experience relate to the project.
-Attach degree transcripts and certificates and, if English is not your first language, a copy of your English language qualifications.
The deadline for application is 15 June 2017.

Contact

For informal enquiries and further details, please contact:
Dr Bruno Cessac
INRIA Sophia Antipolis, France
Email:
bruno.cessac@inria.fr
Telephone: +3349238503
And/or
Dr Evelyne Sernagor
Institute of Neuroscience, Newcastle University
Email:
evelyne.sernagor@ncl.ac.uk
Telephone: +44 (0) 191 208 8541