Development of dendritic signal processing in the brain: a role for GABAergic interneurons?

Supervisory team:
Main supervisor: Dr Paul Anastasiades (University of Bristol)
Second supervisor: Dr Michael Ashby (University of Bristol)
Dr Paul Anastasiades (University of Bristol), Dr Michael Ashby (University of Bristol), Dr Cezar Tigaret (Cardiff University)

Host institution: University of Bristol

Project description:
Adolescence is a fundamental period for the successful emergence of higher brain functions, such as working memory and attention. It is also a period of heightened sensitivity for many mental health disorders, including schizophrenia, anxiety, and depression. Understanding adolescent changes in brain structure and function is therefore of major significance for society if we want to ensure that as many people as possible undergo healthy transitions from adolescence to adulthood.

This project will focus on understanding the maturation of higher-order brain circuits during adolescence, helping to uncover key signalling mechanisms and cell types that contribute to normal circuit formation. Classically, it has been proposed that the brain matures in a hierarchical manner, following the path of sensory information as it is relayed from the external world through different brain structures before finally reaching the prefrontal cortex, which matures during adolescence. Much less is known about the development of projections travelling in the reverse direction, from the prefrontal cortex to lower-order sensory structures. To answer this question, the successful candidate will apply a wide range of in vitro and in vivo tools for neural circuit analysis. Using a cutting-edge combination of transgenic mice, two-photon calcium imaging and slice electrophysiology this project will map the cellular changes associated with the formation of top-down circuitry during adolescence. To directly test the causal role of key cell types and circuits in adolescent circuit refinement, we will then employ genetic tools to selectively silence different neuronal populations throughout adolescence and measure the functional effect on the network.

The successful student will join an active collaboration between Dr Paul Anastasiades, whose lab works on the development of the prefrontal cortex, and Dr Mike Ashby who works on the maturation of sensory circuits. Dr Cezar Tigaret will provide expert support for the student in learning two-photon imaging of dendritic activity and analysis of the images produced. They will benefit from being surrounded by a diverse group of PhD students, postdocs and technicians working on related topics in developmental neuroscience. In addition, they will become part of the vibrant neuroscience community at the University of Bristol.

Interested candidates are encouraged to email the supervisors to discuss the project.

Relevant References:
Matta, Ashby et al., Neuron, 2011
Ashby and Isaac, Neuron 2011
Collins, Anastasiades et al., Neuron, 2018
Anastasiades, Collins et al., Neuron, 2021
Tigaret et al., Molecular Psychiatry, 2021

Our aim as the SWBio DTP is to support students from a range of backgrounds and circumstances. Where needed, we will work with you to take into consideration reasonable project adaptations (for example to support caring responsibilities, disabilities, other significant personal circumstances) as well as flexible working and part-time study requests, to enable greater access to a PhD. All our supervisors support us with this aim, so please feel comfortable in discussing further with the listed PhD project supervisor to see what is feasible.