

Encoding of decision making by dopamine neurons

Supervisory team:

Main supervisor: Dr Paul Dodson (University of Bristol)

Second supervisor: Dr Jiaxiang Zhang (Cardiff University)

Dr Nathan Lepora (University of Bristol)

Host institution: University of Bristol

Project description:

Understanding how we make decisions in the face of uncertainty and how we weigh risk and reward remains a central challenge for neuroscience. It is clear that signalling by dopamine plays a pivotal role in these calculations. However, the dopamine neurons responsible for these signals are diverse in terms of the anatomical connections they make, their molecular make-up, and their encoding of behaviour; it is not clear how these different populations generate the signals used for decision making. The focus of this PhD is to define how different populations of dopamine neurons encode aspects of decision-making and action. To achieve this, we will use an innovative approach, combining cutting-edge neurophysiological techniques and advanced computational models:

To record from individual dopamine neurons in behaving mice we will take advantage of a new technique we recently developed (Dodson et al. 2015, 2016). This approach not only allows one to identify the precise location and neurochemical identity of each recorded neuron, but also to interrogate which key proteins they express and which brain regions they innervate (and thus subdivide neurons into their different populations). We will then use computational models to probe how the signals we record are related to different parts of the decision-making process.

During the PhD, the student will have the opportunity to learn, and develop their skills in: in vivo recording, animal behaviour, neuroanatomy and immunohistochemistry, microscopy, data analysis and programming, and computational modelling.