Computational and neural mechanisms of statistical learning and endogenous pain control in the human brainstem and spinal cord

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Department/Institute: Engineering

Research area: Interdisciplinary: Computational neuroscience, neuroimaging

Project outline:

According to a recent NHS survey, the prevalence of chronic pain in the UK ranges from 16% among people aged 16–24 years to 53% among those aged 75 years and over. Many chronic pain conditions don't have known causes. Even when there is a known cause, the level of injury/inflammation is not linearly associated with the level of pain. Pain is strongly modulated by how the brain interprets pain signals and controls them through the engagement of descending control pathways, which regulate pain based on prior knowledge and other factors.

The project takes an innovative information engineering approach to understand the neural processing and regulation of pain. We see the pain system as a unique biological learning and control system, whose functions are to signal potential harm, learn from noxious inputs to control its responses and maximise wellbeing or survival. We will focus on understanding the neural correlates of statistical learning for pain, which underpins the ability of the human brain to predict and control the temporal evolution of pain. The project is based on two recent papers from our group, accepted for publication in Nature Comms and PNAS. It will investigate whether statistical learning engages endogenous pain control pathways in the brainstem and modulates dorsal horn spinal cord activity. This involves use of high-resolution 7T neuroimaging in Cambridge, in collaboration with Dr Falk Eippert (MPI Leipzig) and Dr Enrico Schulz (Munich) research group. We will also collaborate with the MRI physics teams in Cambridge and Hamburg, to develop new scanning sequences. Research costs are fully funded by a MRC Career Development Award.

BBSRC DTP main strategic theme: Bioscience for an integrated understanding of health

BBSRC DTP secondary strategic theme: Understanding the rules of life