Structural and Functional Connectivity of the Human Basal Ganglia in Health and Disease using High Resolution MRI at 7T

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Name of Fellow

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Institution
Funder

MRC

Contact information of fellow
Country

United Kingdom

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Structural and Functional Connectivity of the Human Basal Ganglia in Health and Disease using High Resolution MRI at 7T

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MRC

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5.0

The project/programme is most relevant to:

Parkinson's disease & PD-related disorders

Keywords

Connectivity | High resolution | Human Basal Ganglia | Huntington's disease | MRI | Parkinson's

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Research Abstract

The circuits of the basal ganglia are a massive centre of convergence for cortical information. To date however, only invasive animal studies have been able to look at the basal ganglia at the scale required to investigate their connections, challenging most recently the classic model of the organisation of these circuits. Our goal is to characterise in vivo the connectivity of the human basal ganglia. This should ultimately allow us to better understand the mechanisms of two devastating movement disorders caused by degeneration in the basal ganglia: Parkinson’s and Huntington’s disease. Unfortunately, conventional MRI, which allows the in vivo study of the human brain anatomy and function and the follow-up of degenerative processes, lacks the necessary resolution to investigate the connections of these very small structures composing the basal ganglia. In this proposed project, I will combine cutting-edge imaging techniques and behavioural measures in 30 healthy, 30 Parkinson’s and 30 Huntington’s participants to study the structural and functional connectivity of the basal ganglia at a high resolution only achievable with our MRC-funded 7T scanner available at the Oxford FMRIB Centre. I will carry out both a cross-sectional and a longitudinal study testing the latest hypothetical models of the basal ganglia connectivity using (i) diffusion imaging to infer the structural connections of the basal ganglia, (ii) functional imaging at rest to determine the connectivity of all functionally-distinct basal ganglia networks and (iii) functional imaging during a finger tapping task to examine the effective motor connectivity of the basal ganglia. These three complementary approaches will allow me to elucidate the human basal ganglia circuits based on predictions drawn from the most recent animal literature, to test the role of each pathway in the execution of movement and to uncover the impact of Parkinson’s and Huntington’s disease on these connections.

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