Spatiotemporal optimization of deep brain stimulation for Parkinsons Disease

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USA

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Spatiotemporal optimization of deep brain stimulation for Parkinsons Disease

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01/07/2016

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5

The project/programme is most relevant to:

Parkinson's disease & PD-related disorders

Keywords

Deep Brain Stimulation, spatiotemporal, Parkinson Disease, Structure of subthalamic nucleus, Globus Pallidus

Research Abstract

PROJECT SUMMARY AND ABSTRACT The basal ganglia have a rich, functional topography

composed of motor subcircuits and oscillatory networks that are thought to be critically important to the pathophysiology of Parkinson’s disease (PD) and the successful application of deep brain stimulation therapy (DBS) in managing each cardinal motor sign of PD. There is a strong clinical need to better understand these processes and in turn harness them to deliver therapy that is tailored to an individual patient and a patient’s own symptomatology. In this project, we seek to develop a novel spatiotemporally optimized DBS therapy and evaluate its efficacy in a non-human primate model of PD. The optimization approach leverages the unique capabilities of (1) high-field MR imaging (7T and 10.5T), (2) subject-specific computational models of DBS, (3) a high-density DBS lead with electrodes arranged along and around the lead shank, and (4) a real-time signal processing interface that can readily adapt stimulation parameters on the DBS array based on analysis of ongoing oscillatory activity at and downstream of the site of stimulation. High-density DBS arrays spanning the subthalamic nucleus (STN) and thalamic fasciculus (Array A) and the external and internal globus pallidus (GP) (Array B) will be implanted in each subject. Aim 1 will characterize the magnitude and time course of therapeutic effects on each parkinsonian motor sign when targeting electrical stimulation within and around the STN and GP. Aim 2 will investigate how targeted stimulation differentially affects oscillatory activity at and downstream of the site of stimulation and relates to improvement in each parkinsonian motor sign. Aim 3 will develop and apply a novel set of optimization algorithms, including chaotic desynchronization and real-time closed-loop phasic stimulation, to test the hypothesis that optimizing suppression of exaggerated phase amplitude coupling in the STN and GP will further increase the overall magnitude of DBS therapy. Together, this project will enhance our understanding of the pathophysiology of PD and provide critical data towards translating a patient-optimized DBS therapy that integrates high-density DBS leads with novel closed-loop stimulation.

Lay Summary
NARRATIVE While dopamine replacement therapy can mitigate many of the symptoms of Parkinson’s disease, over time many patients develop severe drug-induced dyskinesias, motor fluctuations, and significantly less time in the “on” state. Deep brain stimulation (DBS) is a complementary therapy to medication aimed at providing more consistent motor control for patients with these fluctuations; yet, several challenges remain with coordinating the optimization of stimulation parameters to each parkinsonian motor sign. This project will develop a novel spatiotemporally optimized DBS therapy using a combination of high-field (7/10.5T) MR imaging, subject- specific computational models, a DBS lead technology with electrodes arranged along and around the lead, and a real-time signal processing interface that can readily adapt stimulation parameters across a DBS array based on analysis of ongoing oscillatory-coupled activity within the brain.

Further information available at:

Types:
Investments > €500k

Member States:
United States of America

Diseases:
Parkinson's disease & PD-related disorders

Years:

2016

Database Categories:
N/A

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