

Using computer simulations for predicting interventions restoring healthy patterns of neural activity

<https://www.neurodegenerationresearch.eu/survey/using-computer-simulations-for-predicting-interventions-restoring-healthy-patterns-of-neural-activity/>

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Contact information of lead PI Country

United Kingdom

Title of project or programme

Using computer simulations for predicting interventions restoring healthy patterns of neural activity

Source of funding information

MRC

Total sum awarded (Euro)

€ 1,746,189

Start date of award

01/04/2015

Total duration of award in years

5.0

The project/programme is most relevant to:

Parkinson's disease & PD-related disorders

Keywords

Research Abstract

Many neurological disorders are characterized by abnormal patterns of oscillations in neural activity. However, due to the complexity of the circuits these oscillations originate from, it is

often unclear how they are generated, and how to best control them. To understand dynamics of complex systems, mathematical and computational methods are routinely employed in more established areas of science and engineering, and they have been proved critical for developing effective mechanisms for control of oscillations. This programme will develop methodology for using computer simulations of neural circuits affected by neurological disorders to predict interventions optimally restoring healthy patterns of activity. It will initially focus on Parkinson's disease, because the basal ganglia circuits producing abnormal activity in this disorder are relatively well understood. Computational models of the basal ganglia will be developed that will describe how it generates the pathological dynamics and how it responds to deep brain stimulation (DBS) and optogenetic stimulation. The unique aspect of these models is that they will be constrained by a wide range of the high quality experimental data directly available in the MRC Unit, and optimized to maximize their ability to predict responses to novel stimulation protocols. The models will be used to rapidly test candidate versions of closed-loop DBS in silico, and to identify how and when with respect to ongoing activity the stimulation should be provided to optimally restore neural activity normally present in healthy basal ganglia. The suggested closed-loop intervention protocols will be tested within the MRC Unit, and results will be iteratively used to further refine the procedure. Moreover, the programme will investigate how the developed methodology and theory can be generalized to other neurological disorders (e.g. essential tremor) and to other neural systems (e.g. hippocampus).

Lay Summary

Further information available at:

Types:

Investments > €500k

Member States:

United Kingdom

Diseases:

Parkinson's disease & PD-related disorders

Years:

2016

Database Categories:

N/A

Database Tags:

N/A