Closed loop deep brain stimulation for Parkinsons disease

https://www.neurodegenerationresearch.eu/survey/closed-loop-deep-brain-stimulation-for-parkinsons-disease/

Principal Investigators

STARR, PHILIP ANDREW

Institution

UNIVERSITY OF CALIFORNIA, SAN FRANCISCO

Contact information of lead PI
Country

USA

Title of project or programme

Closed loop deep brain stimulation for Parkinsons disease

Source of funding information

NIH (NINDS)

Total sum awarded (Euro)

€ 3,190,739.45

Start date of award

30/09/2016

Total duration of award in years

5

The project/programme is most relevant to:

Parkinson's disease and PD-related disorders

Keywords
Research Abstract
Abstract Deep brain stimulation (DBS) has a major role in the management of movement disorders, and is under investigation for the treatment of disorders of mood and memory. In Parkinson’s disease (PD), DBS of basal ganglia nuclei can improve motor signs and reduce medication-induced motor fluctuations and dyskinesia, characterized by frequent transitions between a hypokinetic state (too little movement) and a hyperkinetic state (too much

movement). However, since the introduction of DBS for PD 25 years ago, there have been no major improvements in this therapy. Existing DBS devices deliver “open loop” stimulation, continuously stimulating their target structures regardless of changes in the brain circuits related to disease expression. Device programming is a labor-intensive process based on “trial and error” requiring significant clinical expertise, which is a barrier to widespread application. In PD, continuous open-loop stimulation may result in suboptimal control of fluctuating motor signs, stimulation-induced adverse effects, and short battery life. DBS could be significantly improved by delivering “closed-loop” stimulation, in which stimulation parameters are automatically adjusted based on brain signals that reflect the patient’s clinical state. Using both intraoperative and chronic invasive recording techniques, we and others have identified abnormal patterns of oscillatory activity that may provide physiological signatures or “biomarkers” of hypokinetic and hyperkinetic states in PD. Here, we plan to develop closed-loop DBS algorithms based on these brain signals, using an investigational neural interface (Medtronic Activa RC+S) that can sense and store brain activity as well as delivering DBS. We will determine which brain signals are the most appropriate to optimize DBS therapy and answer critical questions including the site of control signal detection (cortical versus subcortical) and the required complexity of control signals (single frequency power versus cross frequency interactions). Ten PD patients with motor fluctuations and dyskinesia will be implanted bilaterally with Activa RC+S attached to a subthalamic nucleus (STN) DBS lead and an electrocorticography (ECoG) lead placed over motor cortex. We will collect ECoG and subcortical local field potential (LFP) recordings to characterize “personalized” physiological signatures for each subject and prototype stimulation paradigms by data streaming through an external computer in a clinical setting (Aims 1 and 2). We will then embed algorithms in the pulse generator to implement chronic and fully closed-loop DBS in a small double-blinded clinical trial (Aim 3). Motor function will be assessed by wearable automated detectors as well as rating scales from videotapes and self-report instruments. The study will define the technical characteristics required for the design of future DBS devices. “Self programming” DBS devices offer the potential to simplify the therapy and allow many more patients to receive DBS. As electrophysiological signatures of abnormal circuit function in other disorders are identified, this new generation of closed-loop devices will facilitate the introduction of novel DBS therapies in other brain diseases. .

Lay Summary

Project narrative Deep brain stimulation (DBS) is a promising treatment for many brain disorders, but DBS technology has not improved in the 25 years since its introduction. The next advance in DBS therapy is to identify brain signals directly related to disease signs and symptoms, and utilize them to automatically adjust stimulation settings according to changing brain needs (closed-loop control). Here, in patients with Parkinson’s disease, we will leverage recent advances in the understanding of how brain networks produce abnormal movement, to develop and test closed-loop strategies using a novel implantable brain device that can sense and store brain activity, as well as deliver therapeutic stimulation.

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

Database Tags:
N/A