Adaptive neuroprosthetic control at the synaptic level: restoring dynamic dopamine signaling in Parkinson's disease

Initiative: Freigeist-Fellowships

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Laufzeit: 5 Jahre

Projekt-Website: https://expneuro.charite.de/en/research/translational_neuromodulation_group/

The continuous exchange of information in neural networks is critical to help us make decisions, generate movements and learn in response to reward. Today, it has remained an unmet challenge to integrate the fundamental principles of dynamic network communication in the treatment of neurological disorders. This project envisions the design of an adaptive neural prosthesis that will, for the first time, extend concepts from automatic control to the molecular level of synaptic signaling pathways to restore dynamic dopamine signaling in Parkinson's disease. Using machine-learning algorithms, the prosthesis will monitor brain activity to predict intended movements in real-time and derive required amounts of dopamine release. Concurrently, the project aims to develop a library of optogenetic tools and stimulation functions that mimic dopamine signaling at millisecond resolution. Using this hybrid computational and molecular approach, the project will ask the perplexing question: can the brain learn to self-regulate its own activity, when specific network elements go missing in a disease context? Ultimately, this project aims to understand how we should implement the dimension of time in the design of future therapies for neurological disorders.

Projektbeteiligte

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Open Access-Publikationen

Supporting front crawl swimming in paraplegics using electrical stimulation: a feasibility study
Circuits for State-Dependent Modulation of Locomotion
Real-Time Detection of Freezing Motions in Parkinson's Patients for Adaptive Gait Phase Synchronous Cueing.
Algorithms for Automated Calibration of Transcutaneous Spinal Cord Stimulation to Facilitate Clinical Applications.
Rodent models for gait network disorders in Parkinson's disease - a translational perspective.