Post-doc position offer

Topic: computational modeling of multisite stimulation for disrupting epileptic activity

(NIH Support: R01 NS092760-01A1)

Background

Epilepsy affects about 1% of the general population (World Health Organization, Fact Sheet on Epilepsy, Oct. 2012). When seizures are refractory to drugs, surgery is the treatment of choice, consisting in the surgical removal of the epileptogenic zone (EZ). Numerous studies have shown that the EZ is characterized by an imbalance between excitatory and inhibitory processes in underlying affected neural networks involved in seizure generation. In some patients, surgery is contraindicated. Consequently, there is a strong demand for alternative therapeutic procedures capable of reducing EZ excitability while preserving brain tissue. Among these procedures, local electrical stimulation (i.e. « *in situ* » using intracerebral electrodes) is a promising approach as it could be used to modulate, or even control, epileptic activity.

Rationale. Previous studies based on local stimulation have been largely empirical, and a rational definition of stimulation protocols remains to be established. Numerous biophysical (intensity, frequency) and neurophysiological parameters (inhibitory/excitatory effects on neurons, neurotransmitter release, synaptic plasticity) are critical to modulate activity in the stimulated brain tissue. In this context, computational models have proven to be efficient tools to investigate the mechanisms underlying the impact of electrical fields on the brain. ***Objective.*** The general objective is to develop a large-scale multi-structure computational model for temporal lobe epilepsy, allowing further theoretical investigation of spontaneous seizure initiation and termination as well as research of stimulation-based perturbations leading to synchrony disruptions and ultimately to seizure abortion.
Data. Model parameters will be identified from in vivo data (rat) suggesting that seizures can be aborted by local multisite stimulation at specific frequencies. ***Methods.*** Neural mass modeling, signal processing, optimization techniques, analysis of nonlinear system dynamics in response to exogenous perturbations will be used to develop and investigate stimulation mechanisms in the model (that will start from models already available in the lab).

Candidate profile

The research project is at the interface between bioengineering (signal processing, computational modeling) and neurology (epilepsy). Therefore, the Post-doc fellow will preferably have a background in biomedical engineering, in computational neuroscience or in EE with experience in biosignals (PhD in signal processing, neuroscience or system biology). Knowledge in electrophysiology and/or EEG analysis would be an asset. The post-doc fellow will join a multidisciplinary team including research scientists in biomedical engineering, signal processing, modeling and electrophysiology.

Contract

The position will be opened May 1st, 2016. The contract is for 2 years with possible renewal (total of 4 years max). The competitive salary will be according to experience. The candidate will also have access to the French system benefits.

Location in the city of Rennes, France. LTSI laboratory, University of Rennes. In addition, the post-doc fellow will have the opportunity to perform visits and to actively collaborate with the Department of Biomedical Engineering of the Illinois Institute of Technology (Prof. D. Mogul).

Contact (please provide resume, cover letter and email of 2 references)

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