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Poster presentation

Intermittent patterns of synchronous activity in human basal ganglia

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Introduction

Basal ganglia (BG) are involved in control of movement and are impacted in Parkinson's disease (PD). This impact is believed to be responsible for the symptoms. Recent studies provided evidence for the significance of oscillatory activity in beta and gamma bands for BG physiology in both health and disease, such as PD and dystonia [1,2]. The dynamics of the oscillations and their mechanisms are the subjects of this study.

Methods

We record intraoperatively from subthalamic nucleus (STN) of patients undergoing stereotactic surgery in PD. We use the network of conductance based models of excitatory subthalamic and inhibitory pallidal cells (following [3]) to study intermittent activity in the model of BG circuits. We rely on the approach of detection of statistically significant episodes of phase-locking activity developed by us and colleagues [4] to characterize intermittent
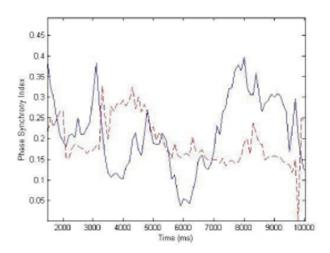

Figure 1
The evolution of a phase synchrony index (solid line) computed over 1s window in the real data (left) and model (right). The dashed line represents the 95% confidence level for the index (obtained with surrogate data).

patterns of synchronous activity between spiking units and local field potentials (LFP) in the data and the model.

Results

The synchronous episodes are short-lived and intermittent. We explored the model to find the activity similar to the real one according to qualitative (similarity of first return maps) and quantitative criteria. An example of dynamics in the model and data is at the Figure 1. We explore the conditions under which intermittent synchronization arises.

Discussion

The properties and mechanisms of the intermittent activity as well as its functional significance are discussed.

References

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