1. Introduction

Microelectrode arrays allow recording and stimulation of in vivo neurons. However, the small number of electrodes typically used (<100) limits the amount of information and control they can provide. In contrast, computer models have no such limitations. Here, we validate a thalamocortical model by comparison with in vivo data, and use it to predict how microstimulation (MiSt) will affect stimulus field properties.

2. Methods

- **Experiment:** Microelectrode arrays were implanted in the somatosensory cortex of two macaques. Natural touch stimuli were applied to the hand both before and after MiSt.
- **Simulation:** The model consisted of event-driven, rule-based single-compartment thalamocortical neurons (Figs. 1 and 2). Connection probabilities are distance-dependent, while weights change via spike-timing-dependent-plasticity (STDP).

3. Results

4. Discussion

- We have demonstrated that a large-scale computer model of the thalamocortical system can replicate multiple aspects of in vivo dynamics, including firing rates, stimulus-induced modulations, and higher-order properties.
- The model predicts that microstimulation will reduce the size and amplitude of the stimulus field associated with natural touch.
- Future work will focus on the development of a combined somatosensory-motor cortex model to control a virtual arm during grasping movements.

Reference


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Further information

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