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Synchronous transitions of up and down states in a network model based on stimulations

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Abstract

The phenomenon of spontaneous periodic up and down transitions is considered to be a significant characteristic of slow oscillations. Our previous theoretical studies have shown that the single neuron and network model can both exhibit spontaneous up and down transitions. Another characteristic of up and down dynamics is the synchronicity. So in this paper, we focused on the synchronized characteristic of up and down transitions in the network based on stimulations. Spontaneous activities showed no synchronous transitions between neurons. However, the external stimulation, mainly the stimulation frequency and the number of neurons stimulated on, were related to the synchronous transitions of up and down states. The simulation results suggested that simultaneous high frequency excitation or firing of neurons in the network was responsible for the generation of synchronous transitions of up and down states. Through the observation and analysis of the findings, we have tried to explain the reason for synchronous up and down transitions and to lay the foundation for further work on the role of these synchronized transitions in cortex activity.

Keywords: up and down states, synchronicity, stimulation frequency, resonance

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