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Poster presentation

Irregularity of emergent network activity in the local circuit

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In recent years, there has been in easing interest in determining the statistics of firing in local networks that generate self-sustained activity, and its mechanistics bstrate. Two phenomena thought to be generated by reverberation in the local recurrent circuitry are persistent activity underlying working memory and slow oscillatory activity during slow-wave sleep or anaesthesia. Neurophysiological experiments on awake monkeys have reported highly irregular persistent activity during the performance of an oculomotor delayed response ask [1]. In these experiments, the coefficient of variation (CV) for interspike intervals of prefrontal neurons during the delay period is above 1, reflecting highly irregular firing. Recent modeling studies [2,3] have proposed different mechanisms that can reproduce this irregularity of the persistent state.

On the other hand, a biophysical network model of slow oscillations that reproduces both single neuron as well as collective network firing patterns observed *in vitro* has been proposed [4]. As persistent activity in the working memory model, in this network the up state is maintained by strong recurrent excitation balanced with inhibition, but here an intrinsic slow adaptation current produces spontaneous transitions between up and down states. In the framework of bistable networks, while it is now evident that working memory activity generated in the local circuit can be quite irregular [2,3], an experimental and theoretical analysis of the statistics of firing during the up state of slow oscillations is still pending.

In order to address this issue, we analyzed data from the following studies, (1) *in vitro* recordings that show slow oscillatory activity [5]. These recordings allow evaluation of the irregularity of reverberant activity in the local circuit in the absence of sources of noise from outside the microcircuit; (2) *in vivo* recordings from anaesthetized animals showing slow oscillations. The comparison with (1) allows the evaluation of the influence of external inputs on the irregularity of reverberant activity in the microcircuit. We compare and interpret the experimental results based on biophysical simulations of three different networks, (i) Ring model with selective excitatory neurons and inhibition, which displays highly regular persistent activity [6]; (ii) Ring model endowed with short-term depression mechanism and high reset potential, which displays irregular persistent activity [2]; (iii) Biophysical model of slow oscillations [4].

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