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POSTER PRESENTATION

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Homeostasis in large networks of neurons through the Ising model - do higher order interactions matter?

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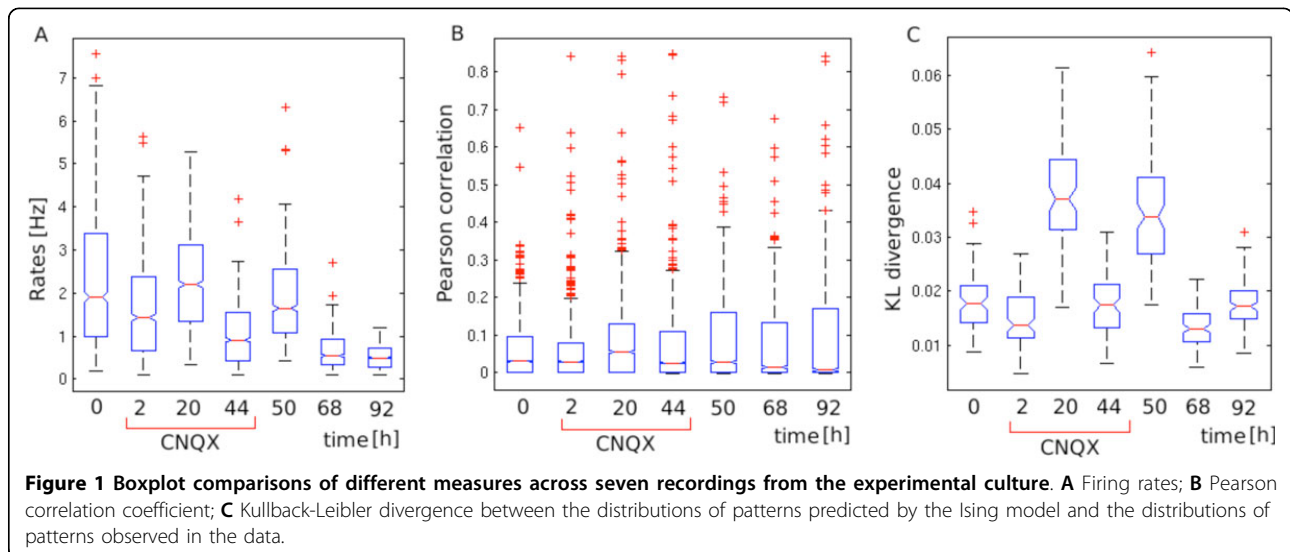
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Homeostatic activity in large networks of neurons is a relatively scantily explored area of neuroscience, both on experimental and computational level [1]. With recent advance in recording techniques, the lack of experimental data is gradually ceasing to be the limitation. New multi-electrode arrays (MEA) allow for monitoring cultures of thousands of neurons over many days with high spatial resolution [2]. However, the interpretation of multi-neuron recordings is not straightforward and requires methods going beyond the simplest descriptive statistics.

Here we explore a novel approach to analyzing multi-unit neuronal activity recorded over a five day homeostatic

experiment by employing the Ising model [3,4]. This statistical model explains the probability of multi-neuron spike patterns solely on the basis of firing rates and correlations, assuming an otherwise minimally structured distribution. Its application to a variety of recordings has helped re-evaluate the importance of neural interactions in shaping the global activity [3,4]. In addition, due to the models minimal structure, the quality of the fits can be treated as an indicator of higher-order interactions in the activity [4].

We compare the Ising model fits in the same preparation over several recordings: before, during and after CNQX application. We find that, in addition to the changes in



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firing rates and correlations, also the quality of the fits changes significantly across recordings (Figure 1). However, while firing rates and correlations do not appear to stabilize to a baseline level, the quality of the model fit does (Figure 1). Altogether this indicates that changes to first and second order statistics cannot explain the homeostatic changes in activity; and that higher order interactions might be a significant component of homeostatic compensation. Whether homeostatic maintenance of a complex higher-order dynamics is an effect of interplay of simple mechanisms or a global homeostatic set-point remains to be investigated.

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