BP 30: Posters - Neurosciences

Time: Tuesday 14:00–16:00 Location: P2-OG1

BP 30.1 Tue 14:00 P2-OG1

Self-organized criticality in a binary neural network model with local rules — •Stefan Landmann and Stefan Bornholdt — Institute for Theoretical Physics, University of Bremen, D-28359 Bremen, Germany

Since the seminal work of Beggs and Plenz [1] which gave strong evidence for criticality in neural systems there is a growing interest in how criticality may emerge in neural networks.
Extending previous work of our group [2,3] we present and investigate a simple but biologically plausible neural network model which exhibits self-organized criticality (SOC). Based on local rules only the network evolves towards criticality, showing typical power-law distributed avalanche statistics. This behavior is independent of initial conditions and robust under noise. Due to its biological plausibility the model could help to understand mechanisms leading to criticality in neural systems.

[1] J. M. Beggs and D. Plenz, Journal of Neuroscience 23(35): 11167 (2003)
[2] S. Bornholdt and T. Rohlf, Phys. Rev. E 67: 066118 (2003)
[3] M. Rybarsch and S. Bornholdt, PLoS ONE 9(4): e93090 (2014)

BP 30.2 Tue 14:00 P2-OG1

Mechanotransduction in the pentamere chordotonal organ of the Drosophila larva — •Achintya Prahlad[1], Christian Spalthoff[2], Ben Warren[2], Deqing Kong[3], Jörg Grosshans[3], Martin Göpfert[2], and Christoph Schmidt[1] — [1]Third Institute of Physics, Georg August University, Göttingen — [2]Schwann-Schleiden Research Centre, Georg August University, Göttingen — [3]Institute of Biochemistry and Molecular Cell Biology, University Medical Centre, Göttingen

Chordotonal organs perform mechanosensory functions across diverse insect species. How these organs transduce mechanical stimuli is so far unknown. Our organ of interest is the lch5 organ, which plays a key role in coordinating locomotion in the Drosophila larva. This organ consists of neurons and accessory cells. We applied tension to the whole organ in situ by transverse deflection. Upon release, the organ displays overdamped relaxation with two widely separated time constants, a rapid snap-back followed by a slow relaxation. When the muscles covering the lch5 organ were excised, the slow relaxation was absent and the fast time constant was faster. Most of the strain in the stretched organ is localized in the cap cells, which account for 66% of the length of the entire organ, and could be stretched to increase the length by ~10% without apparent damage. In laser ablation experiments we found that cap cells severed from the neurons retracted over 100 microns indicating considerable stress and strain in these cells. Given that myosins are abundant in the cap cells, the results point to a mechanical regulatory role of the cap cells in the lch5 organ.