Windels et al. BMC Neuroscience 2014, **15**(Suppl 1):P52 http://www.biomedcentral.com/1471-2202/15/S1/P52



BMC Neuroscience



Auditory stimulation modulates amygdala network dynamics

François Windels^{*}, Peter Stratton, Pankaj Sah

From The Twenty Third Annual Computational Neuroscience Meeting: CNS*2014 Québec City, Canada. 26-31 July 2014

Auditory fear conditioning is a widely used paradigm to study the physiology of associative memory. Based on this model the co-activation of aversive and sensory inputs converging onto neurons of the lateral amygdala is proposed to induce synaptic plasticity that supports fear learning. However, amygdala neurons' activity entrained by auditory stimulation and the potential ensuing network dynamics remain unexplored. In this study, male Sprague-Dawley rats (n=4) were implanted with 8 tetrodes targeting the lateral amygdala. A screening period started a week after surgery and consisted of repeated presentation of tones at different frequencies (3 to 12 KHz). Z-scored peristimulus-time-histograms were used to analyze the responses of single units to the tones (bins: 20ms; 500ms baseline; p<0.01). We found that half of the tone-responsive cells (n=50) responded to only one frequency whereas the remaining cells responded to up to 8 frequencies. Despite the use of a broad range of frequencies, overlapping the peak sensitivity of the rat audiogram, we did not find a preferential response to one frequency based on the number of responsive cells or the response amplitude. Only 30% of frequency responses, per unit, were observed consistently between recording sessions. We used gravitational clustering [1] to study network dynamics in groups of units recorded concurrently in lateral amygdala (Figure 1). Significant interactions were identified using Monte Carlo simulation. This analysis of small networks showed that response coupling between neurons increased transiently during tone presentation independent of frequency

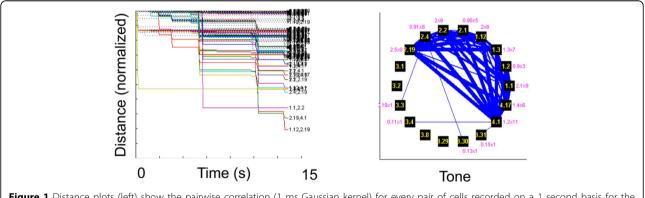


Figure 1 Distance plots (left) show the pairwise correlation (1 ms Gaussian kernel) for every pair of cells recorded on a 1 second basis for the duration of the tone presentation, each colored line shows the dynamic of the interaction between each pair; these results were then used to build the network topology (right) with each unit represented as a node (black square) and the edge strength (blue line thickness) representing the connection strength.

* Correspondence: f.windels@uq.edu.au

Queensland Brain Institute, The University of Queensland, Brisbane, Queensland, Australia



© 2014 Windels et al; licensee BioMed Central Ltd. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The Creative Commons Public Domain Dedication waiver (http:// creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise stated. (one-way ANOVA, p<0.01). These results indicate that networks of neurons rather than any single unit represent frequency responses in the amygdala.

Published: 21 July 2014

Reference

 Lindsey BG, Gerstein GL: Two enhancements of the gravity algorithm for multiple spike train analysis. *Journal of Neuroscience Methods* 2006, 150(1):116-127.

doi:10.1186/1471-2202-15-S1-P52 Cite this article as: Windels *et al.*: Auditory stimulation modulates amygdala network dynamics. *BMC Neuroscience* 2014 **15**(Suppl 1):P52.

Submit your next manuscript to BioMed Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

BioMed Central

Submit your manuscript at www.biomedcentral.com/submit