Åkerberg and Chacron *BMC Neuroscience* 2010, **11**(Suppl 1):F3
http://www.biomedcentral.com/1471-2202/11/S1/F3

BMC Neuroscience

FEATURED TALK PRESENTATION

Coding signal strength by correlated activity in bursting neurons

Oscar Ávila Åkerberg[1*], Maurice J Chacron[1,2]

From Nineteenth Annual Computational Neuroscience Meeting: CNS*2010
San Antonio, TX, USA. 24-30 July 2010

Understanding how populations of neurons encode sensory information is of critical importance [1]. Correlations between the activities of neurons are ubiquitous in the central nervous system and, although their implications for encoding and decoding of sensory information has been the subject of arduous debates, there is a general consensus that their effects can be significant [2]. As such, there is great interest in understanding how correlated activity can be regulated. Recent experimental evidence has shown that correlated activity amongst pyramidal cells within the electrosensory lateral line lobe (ELL) of weakly electric fish can be regulated based on the behavioral context: these cells modulate their correlated activity depending on whether the fish is performing electrolocation or communication tasks without changing the mean firing rate of their response [3]. Moreover, it was shown in the same study that the changes in correlated activity were correlated with changes in bursting dynamics.

In this work we explore the role of intrinsic bursting dynamics on the correlated activity of ELL pyramidal neurons. We use a combination of mathematical modeling as well as *in vivo* and *in vitro* electrophysiology to show that bursting dynamics can significantly alter the

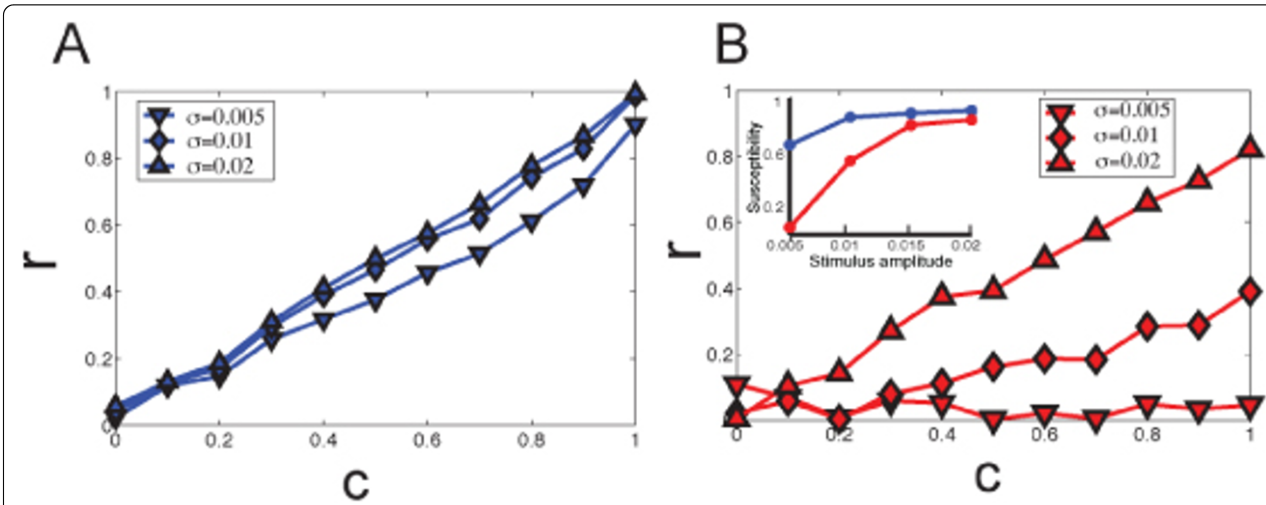

Figure 1 Modeling results Output correlation coefficient, r, as a function of input correlation, c, for three different stimulus amplitudes in tonic firing neurons A and bursting neurons B. As shown in the inset the correlation susceptibility (i.e. the ratio of output correlation r to input correlation c) is roughly independent of stimulus amplitude σ when the neurons are in the tonic firing mode but increases with stimulus amplitude when the neurons are in the bursting firing mode.

* Correspondence: oscar@cnd.mcgill.ca
[1]Department of Physics, McGill University, Montreal, Quebec, Canada, H3A2T8

ability of neuronal populations to be correlated by common input. In particular, our model predicts that the ratio of output to input correlations (i.e. the correlation susceptibility [4]) is largely independent of stimulus amplitude when neurons are in the tonic firing model. In contrast, we find that the correlation susceptibility increases with stimulus amplitude when the neurons are in the bursting mode (Fig. 1). We then performed *in vivo* and *in vitro* experiments to verify this prediction. Our results show that intrinsic dynamics have important consequences on correlated activity and have further revealed a potential coding mechanism for stimulus amplitude through correlated activity.

Author details
[1]Department of Physics, McGill University, Montreal, Quebec, Canada, H3A2T8. [2]Department of Physiology, McGill University, Montreal, Quebec, Canada, H3G1Y6.

Published: 20 July 2010

References

1. Averbeck BB, Latham PE, Pouget A: **Neural correlations, population coding and computation.** *Nat. Rev. Neurosci* 2006, **7**:358-366.
2. Salinas E, Sejnowski TJ: **Correlated neuronal activity and the flow of neural information.** *Nat. Rev. Neurosci* 2001, **2(8)**:539-550.
3. Chacron MJ, Bastian J: **Population coding by electrosensory neurons.** *J Neurophysiol* 2008, **99(4)**:1825-1835.
4. Shea-Brown E, Josic K, de la Rocha J, Doiron B: **Correlation and synchrony transfer in integrate-and-fire neurons: basic properties and consequences for coding.** *Phys Rev Lett* **100(10)**:108102.

doi:10.1186/1471-2202-11-S1-F3
Cite this article as: Åkerberg and Chacron: **Coding signal strength by correlated activity in bursting neurons.** *BMC Neuroscience* 2010 **11**(Suppl 1):F3.