## **POSTER PRESENTATION**



**Open Access** 

## Evolutionary algorithm search for connectivity patterns conducive to bursting in respiratory neural networks

Daniel T Robb<sup>1\*</sup>, Maya Shende<sup>1</sup>, Peter Griffin<sup>1</sup>, Natalia Toporikova<sup>2</sup>

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

The respiratory neural network in the pre-Botzinger complex of the ventrolateral medulla controls and flexibly maintains the breathing rhythm, coordinating networkwide bursting to signal the inspiratory phase of the breath. Interestingly, however, the connectivity of the network by which it achieves this coordination is still a subject of active research. We search for connectivity patterns which vield high performance in a measure of network bursting, using an evolutionary algorithm (EA)-based approach, in networks of leaky integrate-and-fire (LIF) and conductance-based model (CBM) neurons. In LIF networks, the connectivity patterns of bursting networks are characterized by regularities in several network statistics: closeness centrality(CC), betweenness centrality (BC) and out-degree (OD) distributions. We find additionally that intentionally selecting for these statistical regularities in CC, BC and OD leads to steady improvement in the network bursting measure. We examine the extent to which these trends in network statistics are present in well-adapted networks of CBM neurons without intrinsically bursting neurons, finding that the regularities in BC and OD are also visible. We also present initial results on the statistical regularities in networks of CBM neurons with intrinsic bursters.

## Authors' details

<sup>1</sup>Department of Mathematics, Computer Science and Physics, Roanoke College, Salem, VA 24153, USA. <sup>2</sup>Department of Biology, Washington and Lee University, Lexington, VA 24450, USA.

Published: 21 July 2014

\* Correspondence: robb@roanoke.edu

<sup>1</sup>Department of Mathematics, Computer Science and Physics, Roanoke College, Salem, VA 24153, USA

Full list of author information is available at the end of the article



doi:10.1186/1471-2202-15-S1-P25 Cite this article as: Robb *et al.*: Evolutionary algorithm search for connectivity patterns conducive to bursting in respiratory neural networks. *BMC Neuroscience* 2014 15(Suppl 1):P25.

## 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

) Bio Med Central

Submit your manuscript at www.biomedcentral.com/submit

© 2014 Robb 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.



**Figure 1** illustrates the regularities in closeness centrality (CC), betweenness centality (BC) and out-degree (OD) distributions in well-adapted networks of LIF neurons. In well-adapted networks with (a) 2, (b) 3, (c) 4 and (d) 5 tonically spiking neurons present (of 20 total neurons), these three network statistics show statistically significant differences from random networks with the same average connectivity. Note that in the figure, CC is statistic number 4, BC is statistic number 7, and OD is statistic number 14.