BMC Neuroscience

Poster presentation

Open Access

Sparse network models reproduce experimentally observed spike timing jitter during inspiratory population rhythms in the pre-Bötzinger complex

Michael S Carroll*[1] and Jan-Marino Ramirez[2]

Address: [1]Committee on Computational Neuroscience, The University of Chicago, Chicago, IL 60637, USA and [2]Department of Organismal Biology and Anatomy, The University of Chicago, Chicago, IL 60637, USA

Email: Michael S Carroll* - msc@uchicago.edu

* Corresponding author

from Seventeenth Annual Computational Neuroscience Meeting: CNS*2008
Portland, OR, USA. 19–24 July 2008

Published: 11 July 2008

BMC Neuroscience 2008, **9**(Suppl 1):P14 doi:10.1186/1471-2202-9-S1-P14

This abstract is available from: http://www.biomedcentral.com/1471-2202/9/S1/P14

Neurons within the pre-Bötzinger complex of the ventral respiratory group (VRG) in the medulla generate rhythmic network activity which has been shown to be essential for normal breathing *in vivo*. Furthermore, many physiological responses of this network are preserved in transverse medullary brain slice preparations, where bursts of population discharge are typically recorded with large, low-impedance electrodes [1]. Recent analysis of multiunit extracellular recordings from this *in vitro* preparation has shown that the onset timing of spikes from the individual neurons that make up this rhythm is quite variable on a burst-by-burst basis. A conductance-based model [2] of this network with all-to-all connectivity fails to reproduce this variability, while a model with sparse (but proportionally stronger) synaptic coupling generates firing patterns with a higher fidelity to the experimental results (see Figure 1). Specifically, the mean variance of burst-triggered spike timing was 0.0218 ± 0.0184 (SD) for *in vitro* recordings, 0.0347 ± 0.0267 for sparsely connected network models, and 0.0004 ± 0.0023 for fully connected models. Continuing simulations will explore further relationships between parameters of network topology and spike timing variability.

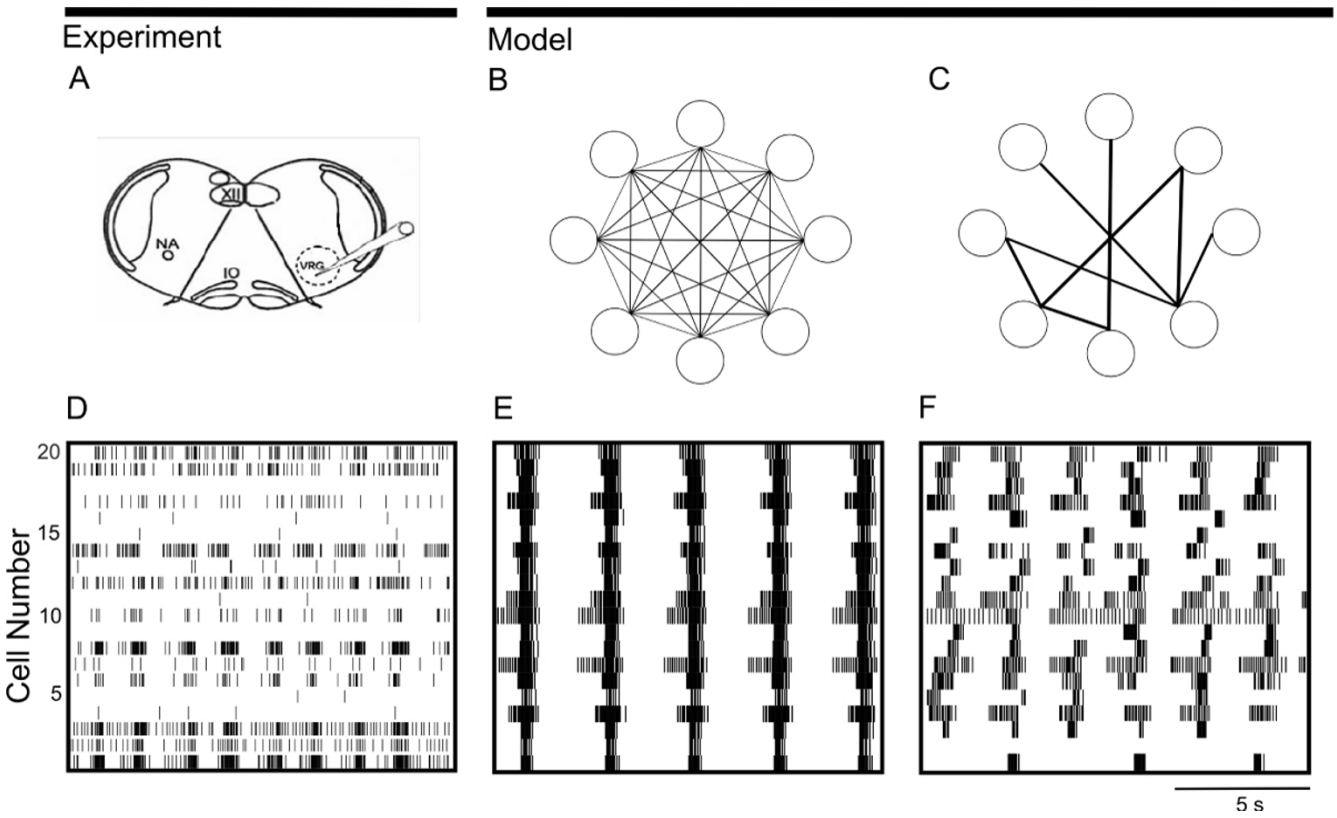

Figure 1
In vitro and modeling results for networks with varying connectivity. Schematic of transverse slice preparation of the ventral lateral medulla (**A**) and connectivity profiles for fully (**B**) and sparsely connected (**C**) network models. Example spike time raster of individually identified neurons during normal population rhythms (**D**) show noticeable variability in burst onset timing. This variability is reproduced in sparsely connected network models (**F**) but not in fully connected networks (**E**). For simulation rasters a random selection of 20 of 300 simulated cells is shown.

References

1. Ramirez J-M, Tryba AK, Peña F: **Respiratory rhythm generation: converging concepts from in vitro and in vivo approaches?** *Respir Physiol Neurobiol* 2002, **131(1–2):**43-56.
2. Rybak IA, Shevtsova NA, Ptak K, McCrimmon DR: **Intrinsic bursting activity in the pre-Botzinger complex: role of persistent sodium and potassium currents.** *Biol Cybern* 2004, **90(1):**59-74.