



2014

A dynamic model for delta rhythm fit to high-frequency cortical activity data shows discrete functional connectivity in mouse cortex

Mark A. Reimers

Virginia Commonwealth University, mreimers@vcu.edu

Majid Mohajerani

University of Lethbridge

Timothy H. Murphy

University of BC

Follow this and additional works at: http://scholarscompass.vcu.edu/psych_pubs

© 2014 Reimers 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.

Downloaded from

http://scholarscompass.vcu.edu/psych_pubs/4

This Article is brought to you for free and open access by the Dept. of Psychiatry at VCU Scholars Compass. It has been accepted for inclusion in Psychiatry Publications by an authorized administrator of VCU Scholars Compass. For more information, please contact libcompass@vcu.edu.

POSTER PRESENTATION

Open Access

A dynamic model for delta rhythm fit to high-frequency cortical activity data shows discrete functional connectivity in mouse cortex

Mark A Reimers^{1*}, Majid Mohajerani^{2,3}, Timothy H Murphy³

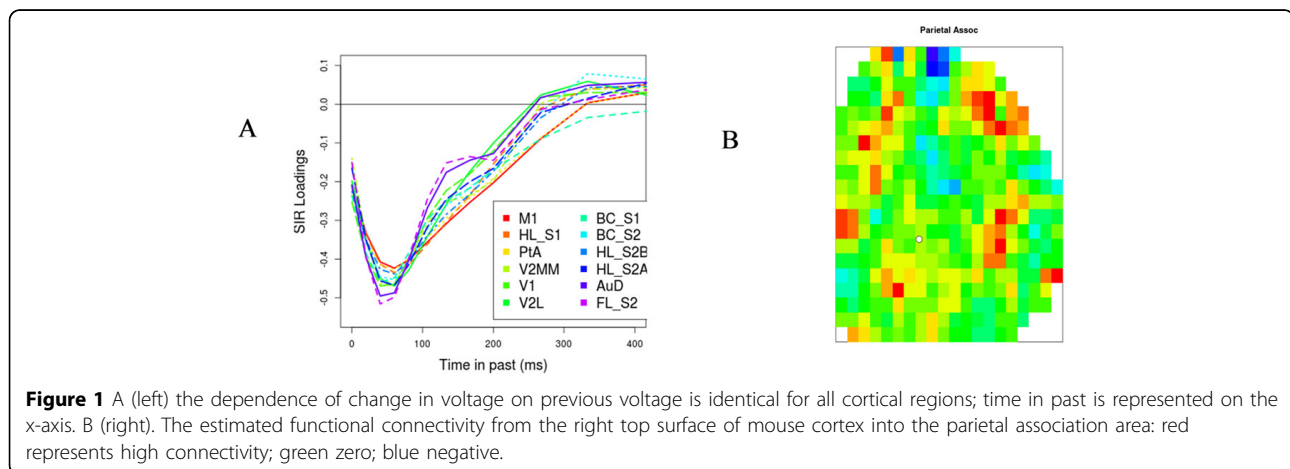
From The Twenty Third Annual Computational Neuroscience Meeting: CNS*2014
Québec City, Canada. 26-31 July 2014

Spontaneous activity as recorded by fMRI has often been used to infer active connections ('functional connectivity') in the human brain through correlations of activity measures. Some serious questions have been raised about the interpretation of these correlations, which are often apparent only on time scales of tens of seconds. Confirmation of correlations in measures of activity on shorter time-scales closer to those of neural activity would be very desirable.

Numerous mechanisms have been proposed for various rhythms but in the past half-century little consensus has been reached on the mechanism of any major rhythm. The recent development of high-throughput

imaging methods enable us for the first time to rigorously and quantitatively test ideas about the dynamics of brain rhythms.

We have generated high-resolution data on neural activity over most of one hemisphere of mouse cortex by voltage-sensitive dyes, in both anesthetized and awake animals. In previous work [1] we have analyzed relations between activity measures at different locations in terms of correlations. Here we fit these data to a predictive model, in which we attempt to predict the next change in activity at every point on cortex from the current pattern of activity over cortex. We fit both linear and non-linear models, whose parameters represent the



* Correspondence: mreimers@vcu.edu

¹Department of Psychiatry, Virginia Commonwealth University, Richmond, VA 23221, USA

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

intrinsic dynamics of local cortical regions and the inputs from distal regions. We find that all regions of mouse cortex appear to have virtually identical patterns of intrinsic dynamics (Figure 1A). We find that even a simple linear fit gives surprisingly sparse patterns of inferred connectivity. Where we have clear anatomical information, these fitted patterns appear to match known anatomy. Furthermore this fit can be used to identify the most prominent functional inputs into anatomically diffusely-connected areas such as the parietal association area (Figure 1B).

Our results suggest that similar methods can be used with data generated by the new high-throughput technologies anticipated by the BRAIN initiative, to understand communication between brain regions at time scales of neural computation.

Authors' details

¹Department of Psychiatry, Virginia Commonwealth University, Richmond, VA 23221, USA. ²Canadian Center for Behavioral Neuroscience, University of Lethbridge, Lethbridge, AB, Canada. ³Department of Psychiatry, University of BC, Vancouver, BC, Canada.

Published: 21 July 2014

Reference

1. Mohajerani MH, Chan AW, Mohsenvand M, LeDue J, Liu R, McVea DA, Boyd JD, Wang YT, Reimers M, Murphy TH: **Spontaneous cortical activity alternates between motifs defined by regional axonal projections.** *Nature neuroscience* 2013, **16**(10):1426-1435.

doi:10.1186/1471-2202-15-S1-P82

Cite this article as: Reimers *et al.*: A dynamic model for delta rhythm fit to high-frequency cortical activity data shows discrete functional connectivity in mouse cortex. *BMC Neuroscience* 2014 **15**(Suppl 1):P82.

**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

Submit your manuscript at
www.biomedcentral.com/submit

