BMC Neuroscience

Poster presentation

Open Access

Trial-to-trial variability of phase precession in the hippocampus

Robert Schmidt*[1,2], Kamran Diba[3], Christian Leibold[4], Dietmar Schmitz[2,5], György Buzsáki[3] and Richard Kempter[1,2,5]

Address: [1]Institute for Theoretical Biology, Department of Biology, Humboldt-Universität zu Berlin, Invalidenstr. 43, 10115 Berlin, Germany, [2]Bernstein Center for Computational Neuroscience Berlin, Philippstr. 13, 10115 Berlin, Germany, [3]Center for Molecular and Behavioral Neurobiology, Rutgers University, 197 University Ave, Newark, New Jersey 07102, USA, [4]Department of Biology II, University of Munich, Großhaderner Str. 2, 82152 Planegg-Martinsried, Germany and [5]Neuroscience Research Center, Charité, Universitätsmedizin Berlin, Charitéplatz 1, 10117 Berlin, Germany

Email: Robert Schmidt* - r.schmidt@biologie.hu-berlin.de

* Corresponding author

from Eighteenth Annual Computational Neuroscience Meeting: CNS*2009
Berlin, Germany. 18–23 July 2009

Published: 13 July 2009

BMC Neuroscience 2009, **10**(Suppl 1):P339 doi:10.1186/1471-2202-10-S1-P339

This abstract is available from: http://www.biomedcentral.com/1471-2202/10/S1/P339

During the crossing of the place field of a pyramidal cell in the rat hippocampus, the firing phase of the cell decreases with respect to the local theta rhythm. This phase precession is usually studied on the basis of data in which many place field traversals are pooled together (Figure 1A). Here, we study the properties of phase precession in single trials (Figure 1B) and compare them to the properties of pooled-trial phase precession. We find that single-trial and pooled-trial phase precession are different with respect to three fundamental properties: phase-position correlation, phase-time correlation, and phase range. While pooled-trial phase precession may span 360°, the most frequent single-trial phase range is only around 180°. Further, an important source of variability of phase precession pooled over trials is the large trial-to-trial variability. Only a part of this trial-to-trial variability may be explained by running speed and firing rate differences across trials, but the larger part of the variability remains to be explained. Finally, comparison with surrogate trials indicates that single trials are not randomly drawn samples from the pooled data and that pooling over trials changes basic measures of phase precession.

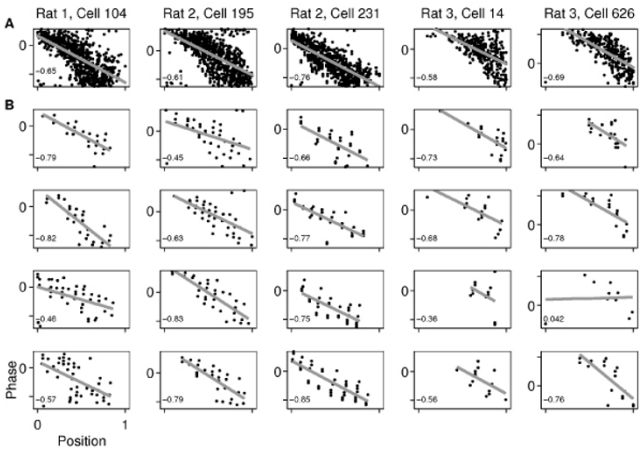

Figure 1
(A) Pooled-trial and (B) single-trial phase precession.

Acknowledgements

This work has been supported by the Deutsche Forschungsgemeinschaft (DFG) through SFB 618 "Theoretical Biology" and GRK 1123 "Memory Consolidation" as well as Emmy Noether grants (Schm 1381/1-2,3 and Ke 788/1-4) to DS and RK and Exc 257 to DS, and the Bundesministerium für Bildung und Forschung (Bernstein Centers for Computational Neuroscience Berlin and Munich, 01GQ0410 and 01GQ0440, respectively), and by the NIH (NS034994) and the J. S. McDonnell Foundation.