Sekulić et al. BMC Neuroscience 2014, 15(Suppl 1):P43
http://www.biomedcentral.com/1471-2202/15/S1/P43

BMC Neuroscience

POSTER PRESENTATION Open Access

Non-uniform dendritic distributions of I_h channels in experimentally-derived multi-compartment models of oriens-lacunosum/moleculare hippocampal interneurons

Vladislav Sekulić[1,2*], Tse-Chiang Chen[4,1], John J Lawrence[5,6], Frances K Skinner[1,3,2]

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

Inhibitory interneurons are crucial for generating prominent network rhythms and coordinating information flow in hippocampal microcircuits. The oriens-lacunosum/moleculare (O-LM) cell is an interneuron type in the hippocampal CA1 region that synapses onto distal dendrites of pyramidal cells [1]. O-LM cells mediate feedback inhibition onto pyramidal cells and gate information flow between sensory input from entorhinal cortex and previously stored associations from the CA3 area. Despite the distal location of inhibitory synapses from O-LM cells onto the excitatory populations, their control of pyramidal cell output has been clearly shown [2]. Thus, how the dynamic firing properties of O-LM cells in its network circuit environment is generated needs to be understood. Furthermore, it is clear that the presence and distribution of voltage-gated channels on the dendrites of O-LM cells would affect its integrative properties in response to synaptic input. However, given the highly challenging aspects to experimentally determine whether and what sort of distributions of voltage-gated channels are present on dendrites, we take advantage of computational modeling studies to consider different possibilities.

In this work, we focus on I_h channels. While the existence of I_h channels in O-LM cells has long been known [3], it is at present unknown whether these channels are present on O-LM cell dendrites. In previous work, we used ensemble modeling techniques in conjunction with experimental data to show that physiologically realistic multi-compartment O-LM cell models may possess dendritic I_h, but only uniform distributions across the dendritic tree were examined. In the work here, we turned our focus to how the kinetics of I_h and non-uniform distributions would affect our models' output. In tuning our models, we found that different I_h kinetics as well as non-uniform distributions were better able to reproduce experimental O-LM cell responses. Interestingly, this occurred only when there were decreasing conductance densities away from the soma. This is in contrast to pyramidal cells which have higher I_h conductance densities in more distal dendrites [4]. Non-uniform distributions of I_h would indicate that there are particular synaptic input distributions that affect the firing properties of O-LM cells and thus their ability to affect information flow.

Acknowledgements
Supported by NIH, NSERC, a Dept. of Physiology, University of Toronto Fellowship, and the SciNet HPC Consortium.

Authors' details
[1]Toronto Western Research Institute, University Health Network, Toronto, Ontario, M5T 2S8, Canada. [2]Department of Physiology, University of Toronto, Ontario, M5S 2J7, Canada. [3]Department of Medicine (Neurology), University of Toronto, Ontario, M5S 2J7, Canada. [4]Department of Medical Biophysics, University of Toronto, Ontario, M5S 2J7, Canada. [5]Department of Biomedical and Pharmaceutical Sciences, University of Montana, Missoula, Montana, 59812, USA. [6]NIH COBRE Center for Structural and Functional Neuroscience, University of Montana, Missoula, Montana, 59812, USA.

Published: 21 July 2014

References

1. Freund T, Buzsáki G: **Interneurons of the hippocampus.** *Hippocampus* 1996, **6**:347-470.
2. Leão RNR, Mikulovic SS, Leão KEK, Munguba HH, Gezelius HH, Enjin AA, Patra KK, Eriksson AA, Loew LML, Tort ABLA, *et al*: **OLM interneurons**

* Correspondence: vlad.sekulic@utoronto.ca
[1]Toronto Western Research Institute, University Health Network, Toronto, Ontario, M5T 2S8, Canada
Full list of author information is available at the end of the article

differentially modulate CA3 and entorhinal inputs to hippocampal CA1 neurons. *Nat Neurosci* 2012, **15**:1524-1530.
3. Maccaferri G, McBain CJ: **The hyperpolarization-activated current (Ih) and its contribution to pacemaker activity in rat CA1 hippocampal stratum oriens-alveus interneurones.** *J Physiol* 1996, **497**:119-130.
4. Magee JC: **Dendritic Hyperpolarization-Activated Currents Modify the Integrative Properties of Hippocampal CA1 Pyramidal Neurons.** *J Neurosci* 1998, **18**:7613-7624.

doi:10.1186/1471-2202-15-S1-P43
Cite this article as: Sekulić *et al.*: Non-uniform dendritic distributions of I_h channels in experimentally-derived multi-compartment models of oriens-lacunosum/moleculare hippocampal interneurons. *BMC Neuroscience* 2014 **15**(Suppl 1):P43.