Program#/Poster#: 587.12/S9

Title: Intraneuronal resonance and frequency response properties of CA1 pyramidal neuron models

Location: San Diego Convention Center: Halls B-H

Presentation Start/End Time: Tuesday, Nov 06, 2007, 11:00 AM -12:00 PM

Authors: ***C. C. RUMSEY**, R. NARAYANAN, D. JOHNSTON;
Cntr for Learning and Memory, Univ. of Texas Austin, Austin, TX

Abstract: Information arriving at a dendritic location undergoes a two-step filtering process before integration occurs at the soma. The first is governed by the local frequency response of the dendritic branch, and the second depends on the propagation of this signal along the dendritic tree. In intrinsically resonating neurons, these filters are band-pass in nature and are optimally tuned to respond to frequencies centered at their respective resonance frequency. Consistent with terminology used with respect to impedance, we term the former as input resonance and the latter as transfer resonance. CA1 pyramidal neurons exhibit an intrinsic resonance at subthreshold membrane potentials that depends on the hyperpolarization-activated h-conductance. While it is known that the input resonance frequency is directly related to the local density of the h-conductance, the dependence of transfer resonance on the distribution and parameters of the h-conductance has not been investigated. Using computer simulations of neurons, including morphologically realistic models, we show that the transfer resonance frequency increases for signals propagating into regions of higher h-conductance and decreases in the opposite direction. Interestingly, the total resonance frequency is commutative, as its value for a signal propagating from location A to B is identical to that traveling from location B to A, regardless of the particular morphology and conductance profile between A and B. Additionally, although resonance properties can be calculated by measuring voltage responses to sinusoidal current injections of varying frequency, the frequency response of a neuron to synaptic input of varying rates and its dependence on Ih is less well understood. We show that the input and transfer frequency responses to synaptic stimulation depend on the accumulation of experimentally observed Ih deactivation. Finally, it is known that plasticity of Ih and, thus, input resonance occur in combination with the induction of synaptic potentiation and depression. We show that such plasticity alters the transfer resonance and frequency response properties of CA1 pyramidal neuron models.

Disclosures: **C.C. Rumsey** , None; **R. Narayanan**, None; **D. Johnston**, None.

Support: Supported by NIH

[Authors]. [Abstract Title]. Program No. XXX.XX. 2007 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2007. Online.

Click here to return to the Home Page.

Leave OASIS Feedback