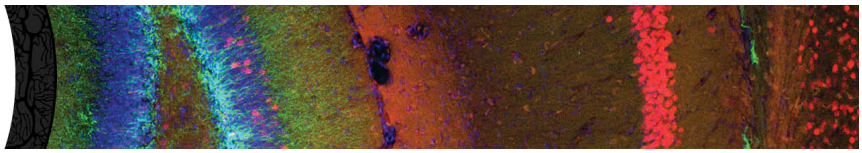

(https://www.abstractsonline.com/pp8/#!/10485)

Session P868 - Place Cells III

Add to Itinerary

P868.07 - Spatial information transfer in hippocampal place-cell models depends on biophysical heterogeneities, trial-to-trial variability, and symmetry of place-field firing

November 9, 2021, 8:45 AM - 9:45 AM | Virtual Only

Grant Support
DBT/Wellcome Trust India Alliance [Senior Fellowship No. IA/S/16/2/502727]

Grant Support
Department of Biotechnology through the DBT-IISc partnership program

Grant Support
Revati and Satya Nadham Atluri Chair Professorship

Grant Support
Kishore Vaigyanik Protsahan Yojana

Authors
***A. ROY**, R. NARAYANAN;
Indian Inst. of Sci., Bangalore, India

Disclosures
A. Roy: None. **R. Narayanan:** None.

Abstract
The relationship between the feature-tuning curve and information transfer profile of individual neurons provides vital insights about neural encoding. However, the relationship between the spatial tuning curve and spatial information transfer of hippocampal place cells remains unexplored. Here, employing a stochastic search procedure spanning 12000 morphologically realistic models, we arrived at 127 conductance-based place-cell models that matched 22 intrinsic somato-dendritic measurements with their electrophysiological counterparts, and were endowed with sharp place-field tuning profiles (high peak firing rate and low spatial width). The parametric values exhibited neither clustering nor strong pairwise correlations. We introduced trial-to-trial variability (activity-dependent and activity-independent) in responses and computed model tuning curves and information transfer profiles, using stimulus-specific (SSI) and mutual (MI) information metrics, across locations within the place field. We found spatial information transfer to be heterogeneous across models, but to reduce consistently with increasing degrees of variability. Importantly, whereas reliable low-variability responses implied that maximal information transfer occurred at high-slope regions of the tuning curve, increase in variability resulted in maximal transfer occurring at the peak-firing location in a subset of models. Moreover, experience-dependent asymmetry in place-field firing introduced asymmetries in the information transfer computed through MI, but not SSI, and the impact of activity-dependent variability on information transfer was minimal compared to activity-independent variability. Biophysically, we unveiled a many-to-one relationship between different ion channels and information transfer. We also demonstrated critical roles for *N*-methyl-d-aspartate receptors, transient potassium and dendritic sodium channels in regulating information transfer via virtual knockout models (VKMs). Our results emphasize the need to account for trial-to-trial variability, tuning-curve shape and biological heterogeneities while assessing information transfer, and demonstrate ion-channel degeneracy in the regulation of spatial information transfer.