
A Spiking Model of Hippocampus for Guiding Behavior
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Michael E. Hasselmo
Boston University, Charles River Campus

This grant has supported development of models of neural firing patterns in the hippocampus, entorhinal cortex and prefrontal cortex which guide goal directed behavior of virtual animals performing tasks in virtual environments. These models simulate existing data and guide design of new experiments. Collaboration between the Hasselmo laboratory and Robert Cannon at Edinburgh has developed the graphics based simulation package CATACOMB. In the Hasselmo laboratory, CATACOMB and MATLAB simulations have replicated features of single unit spiking activity and field potentials in the hippocampus and prefrontal cortex (Hasselmo, 2005; Hasselmo and Eichenbaum, in review, Koene and Hasselmo, 2005; Koene et al., 2003). Models of the hippocampus (Hasselmo and Eichenbaum, in review) simulate the phenomenon of splitter cells observed in the Eichenbaum laboratory (Wood et al., 2000), the phenomenon of theta phase precession (O'Keefe and Recce, 1993; Skaggs et al., 1996) and the context-dependent onset of phase precession on each day (Mehta et al., 2002). Models of the prefrontal cortex (Hasselmo, 2005; Koene and Hasselmo, 2005) address spiking activity during performance of operant tasks in monkeys (Schultz et al., 2000) and spatial tasks in rats (Jung et al., 1998). Model predictions about the unit firing properties during acquisition and performance of a spatial alternation task have been analyzed in recordings of over 200 single units using tetrode recording techniques by Inah Lee with Amy Griffin and Prateek Aggarwal. Some units show the predicted difference in theta phase between unit responses in the arms and stem of the maze, but other units show a novel forward shift in context-selective responses.

Project and PI Website

http://people.bu.edu/hasselmo

http://askja.bu.edu

Publications

Kunec S, Hasselmo M, Kopell N. (2005) Encoding and retrieval in the CA3 region of the hippocampus: a model of theta phase separation. *J Neurophysiol*., in press.

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Conference papers and abstracts:

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