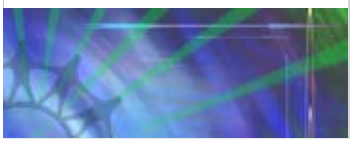
Awards



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Award Abstract #0848469

SGER: Collaborative Research: Cognitive Rhythms Collaborative, A Discovery Network

NSF Org:	DMS Division of Mathematical Sciences
Initial Amendment Date:	September 18, 2008
Latest Amendment Date:	September 18, 2008
Award Number:	0848469
Award Instrument:	Standard Grant
Program Manager:	Mary Ann Horn DMS Division of Mathematical Sciences MPS Directorate for Mathematical & Physical Sciences
Start Date:	October 1, 2008
Expires:	September 30, 2010 (Estimated)
Awarded Amount to Date:	$51391
Investigator(s):	Nancy Kopell nk@bu.edu (Principal Investigator)
Sponsor:	Trustees of Boston University 881 COMMONWEALTH AVE BOSTON, MA 02215 617/353-4365
NSF Program(s):	MATHEMATICAL BIOLOGY
Field Application(s):	0000099 Other Applications NEC
Program Reference Code(s):	OTHR, 9237, 0000
Program Element Code(s):	7334

ABSTRACT

This project focuses on the functional implications of low-frequency rhythms in the basal ganglia and neocortex. The collaborative effort involves four groups: Kopell, (Boston University), Moore (Massachusetts Institute of Technology), Graybiel (Massachusetts Institute of Technology) and Boyden (Massachusetts Institute of Technology). The project is the first collaborative research effort of the newly formed Cognitive Rhythms Collaborative (CRC), a group of Boston Area faculty members from Boston University, Massachusetts Institute of Technology, Massachusetts General Hospital Martinos Center for Biomedical Imaging, Brandeis University and Tufts University. The aims of the CRC, which fosters research and training, are to map the spatio-temporal structure of brain dynamics and connect these dynamics to brain function. This is the first project to try to understand from basic electrophysiology the

growing literature suggesting that the low frequency brain rhythms are critical for both attention and learning, and that interactions among brain structures such as the basal ganglia and neocortex are central for such functions. The project makes use of the electrophysiology skills of the Graybiel lab, which is focused on the dynamics of the basal ganglia, and those of the Moore lab, focused on the neocortex, to understand the flow of information between the cortex and the basal ganglia during learning and attention. This collaboration is enriched by new molecular biology technology developed by the Boyden group. This technology, in which cells can be activated and inactivated by light, provides powerful new techniques for figuring out circuits by looking at effects of perturbations, even in behaving animals. The experimental work is guided by modeling ideas from the Kopell and Moore labs, and the output of the modeling can be tested almost immediately by the labs for quick feedback and changes. This CRC project exemplifies a new and transformational way of doing science, bridging the boundaries of disciplines and institutes to facilitate cutting edge research at the forefront of interdisciplinary endeavors.

PUBLICATIONS PRODUCED AS A RESULT OF THIS RESEARCH

E Boyden, GT Franzesi, X Qian, M Li, X Han, C Borgers, NJ Kopell, F Le Beau, and MA Whittington. "Probing mechanisms of gamma rhythmogenesis with cell type-specific optical neural control.," *Frontiers in Systems Neuroscience Conference Abstract: Computational and systems neuroscience.*, 2009.

J Cardin, M CarlÃ©n, K Meletis, U Knoblich, F Zhang, K Deisseroth, L-H Tsai, and CI Moore. "Activation of Fast Spiking Interneurons Induces Gamma Oscillations and Shapes Sensory Transmission.," *Nature*, v.459, 2009, p. 663.

X Han, X Qian, JG Bernstein, H Zhou, GT Franzesi, P Stern, RT Bronson, AM Graybiel, R Desimone, and ES Boyden. "Millisecond-Timescale Optical Control of Neural Dynamics in the Nonhuman Primate Brain.," *Neuron*, v.62, 2009, p. 191.

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