

STEPHEN COWEN, PH.D

The Neurosciences Institute
10640 John Jay Hopkins Drive
San Diego, CA 92121
cowen@nsi.edu

CURRENT RESEARCH

Investigating the role of the prefrontal cortex in decision making through the analysis of the spiking activity of ensembles of neurons in the behaving rat.

EXPERIENCE: NEUROPHYSIOLOGY

- Experience applying electrophysiological and analytical techniques to questions involving memory consolidation, working memory, decision making, and spatial navigation.
- Designed, built, and wrote the software for a novel 120 channel neural recording system. This system is being used to explore the interactions between neurons in the frontal cortex.
- Designed and built an automated maze for the training and testing of decision-making behaviors. The design and required software is freely available online (www.cowenscience.com).

EXPERIENCE: PROGRAMMING/COMPUTATIONAL

- Produced a software based system for the real-time and off-line identification of single unit spiking activity in the behaving rat. This system was integrated with a neuroprosthetic control device for the operant conditioning of neural population states.
- Developed a novel neural network for the time-invariant identification of temporal patterns in spike train data. Work was completed with the guidance of Dr. Richard Zemel.
- Optimized the NEURON neuronal network simulator to work on a distributed computing network.
- Designed, programmed, and implemented a database to streamline the administration of 200 small business loans and 30 construction and public works projects (APRODIB, Honduras C.A.).

EDUCATION

- 2007 *University of Arizona* *Tucson, AZ*
- Ph.D. Psychology
- Summer 2005 *Okinawa Institute of Science and Technology, Okinawa, Japan*
- Attended the Okinawa Computational Neuroscience Course. Presented current research at RIKEN (Tokyo) and developed models of working memory.

Summer 2000 Marine Biological Laboratory Woods Hole, MA

- Invited to attend Methods in Computational Neuroscience, a month long intensive course covering the theory behind and application of numerous techniques for understanding neural data.

Summer 1997 Carnegie Mellon University Pittsburgh, PA

- Attended the Pittsburgh Supercomputing Center course in Computational Modeling. The course trained participants how to implement compartmental models of neural systems on parallel processing supercomputers.

1988–1992 University of Wisconsin Madison, WI

- B.A., Business Administration, Dean's List.

PEER REVIEWED PUBLICATIONS

- McNaughton, B.L., Barnes, C.A., Battaglia, F.P., Bower, M.R., Cowen, S.L., Ekstrom, A.D., Gerrard, J.L., Hoffman, K.L., Houston, P.F., Karten, Y., Lipa, P., Pennartz, C.M.A. and Sutherland, G.R. (2003) Off-line reprocessing of recent memory and its role in memory consolidation: A progress report. In: P. Maguet, C. Smith and B. Stickgold (Eds.) Sleep and Brain Plasticity. Oxford University Press: United Kingdom, pp. 225-246.
- Battaglia, F.P., Sutherland, G.R., Cowen, S.L., McNaughton, B.L. and Harris, K.D. (2005) Firing rate modulation: A simple statistical view of memory trace reactivation. *Neural Networks*, 18:1280-1291.
- Maurer, A.P., Cowen, S.L., Burke, S.N., Barnes, C.A. and McNaughton, B.L. (2006) Organization of hippocampal cell assemblies based on theta phase precession. *Hippocampus*, 16:785-794.
- Maurer, A.P., Cowen, S.L., Burke, S.N., Barnes, C.A. and McNaughton, B.L. (2006) Phase precession in hippocampal interneurons showing strong functional coupling to individual pyramidal cells. *The Journal of Neuroscience*, 26:13485-13492.
- Cowen, S.L. and McNaughton, B.L. (2007). Selective delay activity in the medial prefrontal cortex of the rat: The contribution of sensory-motor information and contingency. *Journal of Neurophysiology*, 98(1):303-16.

ABSTRACTS/PRESENTATIONS

- Kudrimoti, H.S., McNaughton, B.L., and Cowen, S.L. Direct demonstration of hippocampal memory reactivation in sleep using population vector correlations. Society for Neuroscience Meeting, Los Angeles, California, November, 1998.
- Cowen, S., Hau, B.S., McNaughton, B.L., Barnes, C.A. Selective reactivation of hippocampal place cells associated with a single reward arm following a reference-memory task. Tenth Annual Undergraduate Biology Research Conference, Tucson, AZ January, 1999.
- Gerrard, J.L., Cowen, S.L., Kudrimoti, H.S., Rosenzweig, E.S., Redish, A.D., Barnes, C.A., and McNaughton, B.L. Equivalent reactivation of hippocampal memory traces for a novel experience in young adult and aged rats. Society for Neuroscience Meeting, New Orleans, Nov. 2000.

- Cowen, S.L., Kudrimoti, H.S., Gerrard, J.L., McNaughton, B.L., and Barnes, C.A. Three measures of neural ensemble reactivation in the hippocampus fail to reflect reward probabilities present in a familiar task. Society for Neuroscience Meeting, New Orleans, November 2000.
- Battaglia, F.P., McNaughton, B.L., Cowen, S.L., and Bower, M.R. Detecting memory trace reactivation with hidden Markov models. Society for Neuroscience Meeting, New Orleans, November 2000.
- Lindstedt, E.R., Cowen, S.L., Karten, Y.J., and McNaughton, B.L. How are dreams remembered? A neurophysiological investigation of reactivation of REM sleep activity patterns during subsequent slow wave sleep. Thirteenth Annual Undergraduate Biology Research Conference, Tucson, AZ, January 2002.
- Gerrard, J.L., Kudrimoti, H.S., Cowen, S.L., Redish, A.D., Rosenzweig, E.S., Barnes, C.A. & McNaughton, B.L. Dissociation of pattern and sequence reactivation efficiency in the aged rat hippocampus. Society for Neuroscience Meeting, Orlando, FL, November 2002.
- Karten, Y.J., Cowen, S.L., Lindstedt, E.R., Kudrimoti, H.S., Gerrard, J.L., McNaughton, B.L. & Barnes, C.A. Reactivation of activity of neural ensembles during sleep in the rat hippocampus is not affected by positive or negative events during waking. Society for Neuroscience Meeting, Orlando, FL, November 2002.
- Cowen, S.L. Delay activity in the medial prefrontal cortex of the rat. RIKEN, Tokyo, Japan, July 2005.
- Maurer, A.P., Cowen, S.L., Burke, S.N., Meltzer, J., Dees, J.A., McNaughton, B.L., and Barnes, C.A. Lack of hysteresis of place fields during radial maze rotations. Society for Neuroscience Meeting, Washington DC, November 2005.
- Cowen, S.L., Ruiz Luna, M.L., Martin, J.P., Burke, S.N., and McNaughton, B.L. Delay activity in the medial prefrontal cortex of the rat discriminates between stimulus sequences that predict future reward. Society for Neuroscience Meeting, Washington DC, November 2005.
- Maurer, A.P., Cowen, S.N., Burke, S.N., Barnes, C.A., and McNaughton, B.L. Spike timing of CA1 interneurons relative to the theta rhythm in the freely behaving rat. 5th Forum of European Neuroscience, Vienna, Austria, July 2006.
- Cowen, S.L. and McNaughton, B.L. Firing rate activity of a subset of neurons in the medial prefrontal cortex of the rat increases in response to cues that improve the prediction of future delivery of food reward. Society for Neuroscience Meeting, Atlanta, GA, October 2006.
- Maurer, A.P., Cowen, S.L., Burke, S.N., Barnes, C.A. and McNaughton, B.L. Organization of hippocampal cell assemblies based on theta phase precession. Society for Neuroscience Meeting, Atlanta, GA, October 2006.
- McNaughton, B.L., Maurer, A.P., Cowen, S.L., Burke, S.N. and Barnes, C.A. Spike timing of CA1 interneurons relative to the theta rhythm in the freely behaving rat. Society for Neuroscience Meeting, Atlanta, GA, October 2006.

- Cowen, S.L. and McNaughton, B.L. Reward Expectancy Increases the Sensitivity of mPFC Neurons to Sensory-Motor Information. Society for Neuroscience Meeting, San Diego, CA, October 2007.

AWARDS

- Awarded the 2010 Blasker-Rose-Miah technology development grant from the San Diego Foundation.
- Recipient of the 1998-1999 National Science Foundation training grant.

WORK EXPERIENCE

2009 - present	<u>Associate Fellow</u> <i>The Neurosciences Institute, San Diego</i>
2008 - 2009	<u>Research Fellow</u> <i>The Neurosciences Institute, San Diego</i>
2007 - 2008	<u>Postdoctoral Fellow</u> <i>The Neurosciences Institute, San Diego</i>
1997 - 2007	<u>Graduate Research Assistant</u> <i>University of Arizona, Tucson</i>
Summer 1997	<u>Researcher</u> <i>Carnegie Mellon University, Pittsburgh, Pennsylvania</i>
1996-1997	<u>Systems Administrator</u> <i>University of Wisconsin, Madison</i>
1995-1996	<u>Database Programmer</u> <i>Phillips Plastics, Fredonia, Wisconsin</i>
1992-1994	<u>Peace Corps Volunteer</u> <i>Bay Island Development Association, Honduras</i>