

Nicole Rust, PhD

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Current position:

Postdoctoral Associate (02/06 – present)
Laboratory of Dr. James DiCarlo, McGovern Institute for Brain Research & Department of Brain and Cognitive Science, Massachusetts Institute of Technology

Education:

Postdoctoral. HHMI and Center for Neural Science, New York University (7/04-01/06)
Advisor: Dr. Eero P. Simoncelli

Graduate: New York University, New York, NY (9/99 – 6/04)
Ph.D. Neural Science
Advisor: Dr. J. Anthony Movshon
Thesis topic: Signal transmission, feature representation and computation in areas V1 and MT of the macaque monkey

Undergraduate: University of Idaho, Moscow, ID
B.S. Molecular Biology and Biochemistry; Minor: Chemistry
Graduation Date: December, 1997, Magna Cum Laude

Publications (for reprints, visit my web site: <http://www.mit.edu/~rust>)

Rust NC, Mante V, Simoncelli EP, Movshon JA (2006) How MT cells analyze the motion of visual patterns. *Nature Neuroscience*, 11:1421-1431.

Schwartz O, Pillow JP, Rust NC, Simoncelli EP (2006) Spike-triggered neural characterization. *Journal of Vision* 6, 484-507.

Rust NC, Movshon JA (2005) In praise of artifice. *Nature Neuroscience* 8:1647-1649.

Carandini M, Demb JB, Mante V, Tolhurst DJ, Dan Y, Olshausen BA, Gallant JL, Rust NC (2005) Do we know what the early visual system does? *Journal of Neuroscience* 25, 10577-10597.

Rust NC, Schwartz O, Movshon JA, Simoncelli EP (2005) Spatiotemporal elements of macaque V1 receptive fields. *Neuron* 46: 945-956.

Rust NC, Schwartz O, Movshon JA, Simoncelli EP (2004) Spike-triggered characterization of excitatory and suppressive stimulus dimensions in monkey directionally selective neurons. *NeuroComputing*: 58-60: 793-799. (CNS conference proceedings).

Sharpee T, Rust NC, Bialek W (2003) Analyzing neural responses to natural signals: Maximally informative dimensions. *Neural Computation* 16(2) 223-250.

Sharpee T, Rust NC, Bialek W (2003) Maximally informative dimensions: analyzing neural responses to natural signals. *Advances in Neural Information Processing Systems 16*, eds Thrun, Saul, and Schoelkopf (NIPS proceedings).

Rust NC, Schultz SR, Movshon JA (2002) A reciprocal relationship between reliability and responsiveness in developing cortical neurons. *Journal of Neuroscience* 15:10519-10523.

Weinshenker D, Szot P, Miller NS, Rust NC, Hohmann JG, Pyaati U, White SS, Palmiter RD (2001) Genetic comparison of seizure control by norepinephrine and neuropeptide Y. *Journal of Neuroscience* 21: 7764-7769.

Munger SD, Gleeson RA, Aldrich HC, Rust NC, Ache BW, Greenberg RM (2000) Characterization of a Phosphoinositide-mediated odor transduction pathway reveals plasma membrane localization of an IP3 receptor in lobster olfactory receptor neurons. *Journal of Biological Chemistry* 275(27):20450-7.

Weinshenker D, Rust NC, Miller NS, Palmiter RD (2000) Ethanol-associated behaviors of mice lacking norepinephrine. *Journal of Neuroscience* 20:3157-3164.

Szot P, Weinshenker D, White SS, Robbins CA, Rust NC, Schwartzkroin PA, Palmiter RD (1999) Norepinephrine-deficient mice have increased susceptibility to seizure-inducing stimuli. *Journal of Neuroscience* 19:10985 – 10992.

Meeting presentations:

Rust NC, DiCarlo JJ (2008) Increases in selectivity are offset by increases in tolerance ("invariance") to maintain sparseness across the ventral visual pathway. To be presented at: Society for Neuroscience.

Rust NC, DiCarlo JJ (2008) Concurrent increases in selectivity and tolerance produce constant sparseness across the ventral visual stream. *Computational and Systems Neuroscience (Cosyne)*. Poster.

Rust NC (2006) Can understanding the analysis of motion illuminate the analysis of form? *Cosyne Workshop: Understanding shape coding in higher visual areas*. Talk.

Movshon JA, Rust NC, Mante V, Simoncelli EP (2006) How MT cells analyze the motion of visual patterns. *European Conference on Visual Perception (ECVP)*, St. Petersburg, Russia.

Rust NC, Movshon JA (2006) In praise of artifice. *Cosyne Workshop: The role of natural images in guiding our understanding of visual function*. Talk.

Rust NC, Simoncelli EP, Movshon JA (2005) How macaque MT cells compute pattern motion. Program No. 591.11. *Abstract Viewer/Itinerary Planner*, Washington DC: Society for Neuroscience. Talk.

Rust NC, Movshon JA, Simoncelli EP (2005) Neurons in MT Compute Pattern Direction by Pooling Excitatory and Suppressive Inputs. *Vision Sciences Society (VSS) Conference: Journal of Vision* 5(8), 83a. Talk.

Rust NC, Movshon JA, Simoncelli EP (2005) Subspace reverse correlation reveals a role for suppression in the computation of pattern direction motion in MT. Computational and Systems Neuroscience (Cosyne) workshop: New techniques in neural characterization. Talk.

Rust NC, Sharpee T, Movshon JA, Simoncelli EP (2004) Comparison of two spike-triggered techniques for neural characterization based on covariance and information measures. Gordon conference: Sensory Coding and the Natural Environment, Oxford, UK. Poster.

Rust NC, Schwartz O, Simoncelli EP, Movshon JA (2004) Unexpected spatiotemporal structure in V1 simple and complex cell revealed by spike-triggered covariance. Computational and Systems Neuroscience (COSYNE) meeting, Cold Spring Harbor Laboratory. Talk.

Rust NC, Schwartz O, Simoncelli EP, Movshon JA (2003) An analysis of spike-triggered covariance reveals suppressive mechanisms of directional selectivity in macaque V1 neurons. Society for Neuroscience Abstracts. Talk.

Movshon JA, Rust NC, Kohn A, Kiorpes L, Hawken MJ (2003) Receptive field properties of MT neurons in infant macaques. Society for Neuroscience Abstracts.

Rust NC, Schwartz O, Movshon JA, Simoncelli EP (2003) Spike-triggered characterization of excitatory and suppressive stimulus dimensions in monkey directionally selective neurons. Computational Neuroscience Meeting, Alicante, Spain. Talk.

Sharpee T, Rust NC, Bialek W (2002) Maximally informative dimensions: analyzing neural responses to natural signals. Neural Information Processing Systems (NIPS).

Rust NC, Majaj NJ, Simoncelli EP, Movshon JA (2002) Gain control in macaque area MT is directionally selective. Society for Neuroscience Abstracts. Poster.

Rust NC, Simoncelli EP, Movshon JA (2002) Inhibitory interactions in MT receptive fields [Abstract]. Journal of Vision, 2(7), 413a, <http://journalofvision.org/2/7/413/>. Talk.

Sharpee T, Rust NC, Bialek W (2002) Neural response to natural stimuli: maximizing information to find the receptive fields. American Physical Society March Meeting Abstracts.

Rust NC, Schultz SR, Panzeri S, Movshon JA (2000) Information about contrast in the responses of neurons in macaque striate cortex during development. Society for Neuroscience Abstracts. Talk.

Awards:

2005 Dean's Outstanding Dissertation Award in the Natural Sciences, New York University

Research support:

National Research Service Award (NRSA), National Eye Institute, NIH 3/07-present

Teaching:

Teaching Assistant, Computational Vision, Cold Spring Harbor, June 2004 & 2006

Teaching Assistant, Brain and Behavior, Professor Michael Hawken, Spring 2002

Teaching Assistant, Developmental Neurobiology, Professor Dan Sanes, Fall 2000

Workshop and Symposium Organization:

Workshop: The role of natural images in guiding our understanding of visual function. Computational and Systems Neuroscience (Cosyne) 2006. Organizers: Jonathan Pillow, Nicole Rust, Eero Simoncelli.

Minisymposia: Do we know what the early visual system does? Society for Neuroscience 2005 meeting. Co-chairs: Matteo Carandini, Nicole Rust.

Workshop: New Techniques in Neural Characterization. Computational and Systems Neuroscience (Cosyne) 2005 meeting. Organizers: Jonathan Pillow, Nicole Rust, Eero Simoncelli.

Journal review:

Journal of Neuroscience
Journal of Neurophysiology
Journal of Vision
Visual Neuroscience
Nature Protocols

Additional Graduate Research:

Rotation, Dr. Mal Semple, Center for Neural Science, New York University
Auditory cortical physiology in awake macaque monkeys.

Research Experience, Pre-graduate:

Laboratory Assistant. Dr. Richard Palmiter, University of Washington, June 1998 - June 1999
Phenotypic characterization of mice lacking adrenaline and noradrenaline.

Research Project. Dr. Eberhard Fetz, University of Washington, Jan. - March 1997.
Investigation of learning rules within an oscillatory neural network model.

Summer Intern. Dr. John Byrne, University of Texas Medical School, Houston, June – Aug. 1996.
Exploration of transitions between chaotic solutions in a model of quadrupedal locomotion.

Undergraduate Senior Thesis. Dr. Catherine Ulibarri, Washington State University, Jan. - Nov. 1996.
Measurement of CGRP and Galanin levels in the gerbil hypothalamus to investigate sexual dimorphisms.

NSF-REU Intern. Dr. Barry Ache, University of Florida, June – Aug. 1995.
Cloning and sequencing of a $G\alpha_q$ protein involved in olfactory transduction in the lobster.