

## Tatyana O. Sharpee, PhD

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Computational Neurobiology Laboratory

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### EDUCATION

<i>Michigan State University</i> , East Lansing, MI Ph.D. in Theoretical Physics	1996 – 2001
<i>Ukraine National University</i> , Kiev, Ukraine M.S. in Theoretical Physics (diploma with honors)	1992 – 1997
Summer school: <i>Methods in Computational Neuroscience</i> Marine Biological Laboratory, Woods Hole, MA	2001

### RESEARCH EXPERIENCE

<i>The Salk Institute for Biological Studies</i> , La Jolla, CA Assistant Professor	2007 – present
<i>University of California, San Francisco</i> , CA Assistant Research Scientist	2004 – 2007
<i>University of California, San Francisco</i> , CA Sloan-Swartz Postdoctoral Fellow in Theoretical Neurobiology	2001 – 2004

### RESEARCH INTERESTS

Statistical physics and information theory approach to understanding sensory processing. Statistical properties of natural auditory and visual environments. Neural adaptation as an optimization problem. Formation of selective, yet invariant neural responses with respect to continuous transformations, such as translation or scaling.

### GRANTS and AWARDS

W. M. Keck Foundation Research Excellence Award	2009
McKnight Scholar Award	2009 – 2012
Ray Thomas Edwards Foundation Career Development Award	2009 – 2011
Alfred P. Sloan Research Fellowship	2008 – 2010
Searle Scholar	2008 – 2011
NSF grant “Signal transformation in the early visual system”, PI: Dr. Lawrence Sincich. Role: Co-PI. NSF Robust Intelligence.	2007 – 2009
K25 Mentored Quantitative Research Career Development Award, National Institute of Mental Health	2004 – 2009
Research grant from the Swartz Foundation	2003 – 2004

### PROFESSIONAL SOCIETY MEMBERSHIP

American Physical Society	1996 – present
Society for Neuroscience	2001 – present
American Physiological Society	2008 – present

## SERVICE

Ad hoc reviewer for *Advances in Neural Information Processing Systems*, *Biological Cybernetics*, *Frontiers in Computational Neuroscience*, *Journal of Biological Engineering*, *Journal of Cognitive Neuroscience*, *Journal of Computational Neuroscience*, *Journal of Neuroscience*, *Journal of Neuroscience Methods*, *Journal of Neurophysiology*, *Journal of the Optical Society of America A*, *Journal of Vision*, *Metallurgical and Materials Transactions A.*, *Network: Computation in Neural Systems*, *Neural Computation*, *Neuron*, *Proceedings of National Academy of Science*, *Science*, *Statistics in Medicine*, *Vision Research*.

Reviewing Editor for “*Frontiers in Computational Neuroscience*.”

Presentation for “Women Scientists in Action”, Reuben H Fleet Science Museum	2009
Academic Planning Forum	2009
Organizer for mini-symposium at the Society for Neuroscience Annual Meeting, Chicago, IL	2009
“Common Principles of Adaptation to the Natural Environment”	
UCSD Graduate Neuroscience Admission Committee	2008 – 2009

## TEACHING

### Courses

UCSD “Phys Lab-Electricity, Magnetism, Waves, Optics”	2010
UCSD “Advanced Sensory Systems”	2009

### Lectures in Courses

Okinawa Computational Neuroscience course	2010
Supervising Summer Research Undergraduates	2008
Salk High School Science Day	2008
Neuroscience bootcamp course	2007-2008
“Statistical and Computational Methods in Neurosciences”,	2007-2009
“Biophysics of Neurons and Networks”	2007/2009

## INVITED TALKS

Cosyne workshop “Linearity and it’s discontents: Is there life in a post-STRF world?”	2010
Science at the Edge seminar series, Michigan State University	2010
NIPS workshop “Normative electrophysiology: explaining cellular properties of neurons from first principles”	2009
Annual March Meeting of the American Physical Society, Pittsburgh	2009
Bernstein Center for Computational Neuroscience, Göttingen, Germany	2009
Gordon Research Conference: “Sensory Coding and the Natural Environment”, Italy	2008
Winter School in Mathematical and Computational Biology, Univ. of Queensland, Australia	2007
Advances in Neural Information Processing workshop “Decoding the neural code”	2006
Center for Theoretical Neuroscience, Columbia University	2006
3rd workshop on “Statistical Analysis of Neural Data”, Carnegie Mellon University	2006
Rockefeller University	2006
Department of Physics, Northwestern University	2006
Sloan-Swartz meeting on Computational Neuroscience, California Institute of Technology	2006

Helen Wills Neuroscience Institute, Berkeley	2006
Center for Brain Science, Harvard University	2005
Sloan-Swartz meeting on Computational Neuroscience, Cold Spring Harbor Laboratory	2004
Department of Physics, Massachusetts Institute of Technology	2004
Department of Physics, The Pennsylvania State University	2004
Department of Physics, Florida Atlantic University	2004
Department of Physics, Arizona State University	2004
Neural Coding workshop, Mathematical Biosciences Institute, Ohio State University	2002
NASA Ames Research Center	2002
Condensed Matter Seminar, Bell Laboratories	2001

## LIST OF PUBLICATIONS

All published papers are available in PDF format at <http://cnl-t.salk.edu/Publications>

### Papers: Neuroscience and Information-Theory

1. B.W. Gallarda, **T.O. Sharpee**, S.L. Pfaff, W.A. Alaynick, “Defining rhythmic locomotor burst patterns using a continuous wavelet transform”, *Annals of the New York Academy of Sciences*, in press.
2. C.A. Atencio, **T.O. Sharpee**, C.E. Schreiner, “Hierarchical computation in the canonical auditory cortical circuit”, *PNAS*, **106**(51), pp. 21894-21899 (2009).
3. J.D. Fitzgerald, **T.O. Sharpee**, “Maximally informative pairwise interactions in networks”, *Phys. Rev. E*, **80**, 031914 (2009).
4. Y. Liu, C.F. Stevens, **T.O. Sharpee**, “Predictable irregularities in retinal receptive fields”, *PNAS*, **106**(38), pp. 16499-16504 (2009).
5. M. Kouh and **T.O. Sharpee**, “Estimating linear-nonlinear neural models using Renyi divergences”, *Network: Computation in Neural Systems*, **20**(2), pp. 49-68 (2009).
6. L.C. Sincich, J.C. Horton, **T.O. Sharpee**, “Preserving information in neural transmission”, *Journal of Neuroscience*, **29**(19), pp. 6207-6216 (2009).
7. **T.O. Sharpee** and J.D. Victor, “Contextual modulation of V1 receptive fields depends on their spatial symmetry”, *Journal of Computational Neuroscience*, **26**(2), pp. 203-218 (2009).
8. C.A. Atencio<sup>†</sup>, **T.O. Sharpee**<sup>†</sup>, and C.E. Schreiner, “Cooperative nonlinearities in auditory cortical neurons”, *Neuron* **58**(6), pp. 829-831 (2008).  
<sup>†</sup> These authors contributed equally to this work.
9. **T.O. Sharpee**, K.D. Miller, and M.P. Stryker, “On the importance of the static nonlinearity in estimating spatiotemporal neural filters with natural stimuli”, *Journal of Neurophysiology*, **99**(5), pp. 2496-2509 (2008).
10. C.W. Clifford, M.A. Webster, G.B. Stanley, A.A. Stocker, A. Kohn, **T.O. Sharpee**, and O. Schwartz, “Visual adaptation: neural, psychological and computational aspects”, *Vision Research* **47**, pp. 3125-3131, (2007).
11. **T. Sharpee** and William Bialek, “Optimal neural decision boundaries for maximal information transmission”, *PLoS One* 2(7): e646 (2007). See also <http://arxiv.org/abs/q-bio.NC/0703046>

12. **T. Sharpee**, “Comparison of information and variance maximization strategies for characterizing neural feature selectivity”, *Statistics in Medicine* **26**(21), pp. 4009-4031 (2007).
13. **T.O. Sharpee**, H. Sugihara, S. Rebrik, A. Kurgansky, M.P. Stryker, and K.D. Miller, “Adaptive filtering enhances information transmission in visual cortex”, *Nature* **439**, pp. 936-942 (2006). See also <http://arxiv.org/abs/q-bio.NC/0611037>.
14. J. D. Victor, F. Mechler, M. Repucci, K. Purpura, **T. Sharpee**, “Responses of V1 neurons to two-dimensional Hermite Functions”, *Journal of Neurophysiology*, **95**, pp. 379-400 (2006).
15. **T. Sharpee**, Nicole C. Rust, and William Bialek, “Analyzing Neural Responses to Natural Signals: Maximally Informative Dimensions”, *Neural Computation* **16** (2), pp. 223-250 (2004).  
See also <http://arxiv.gov/abs/physics/0212110>.

### Papers: Condensed Matter Theory and Mathematical Physics

(maiden name: Barabash)

16. **T. Sharpee**, M.I. Dykman, and P.M. Platzman, “Tunneling decay in a magnetic field”, *Phys. Rev. A* **65**, 032122 (2002). See also <http://arxiv.gov/abs/cond-mat/0106566>.
17. **T. Sharpee**, M.I. Dykman, and P.M. Platzman, “Tunneling from a correlated 2D electron system transverse to a magnetic field”, *Phys. Rev. B* **64**, 245309 (2001). See also <http://arxiv.gov/abs/cond-mat/0103151>.
18. M.I. Dykman, **T. Sharpee**, and P.M. Platzman, “Enhancement of tunneling from a correlated 2D electron system by a many-electron Mössbauer-type recoil in a magnetic field”, *Phys. Rev. Lett.* **86**, pp. 2408-11 (2001). See also <http://arxiv.gov/abs/cond-mat/000642>.
19. **T. Barabash-Sharpee**, M.I. Dykman, and P.M. Platzman, “Tunneling transverse to a magnetic field, and its occurrence in correlated 2D electron systems”, *Phys. Rev. Lett.* **84**, pp. 2227-30 (2000).
20. **T. Barabash**, M.I. Dykman, P.M. Platzman, and V.N. Smelyanskiy, “Ripplon-induced tunneling transverse to the magnetic field”, *Phys. Rev. B* **58**, pp. R10214-7 (1998).
21. M.A. Ivanov, B.A. Greenberg, and **T.O. Barabash**, “Description of the behavior of a dislocation ensemble with allowance for dislocation multiplication reproduction”, *Phys. Met. Metallogr.* **86**, 3, pp. 240-9 (1998)
22. B.A. Greenberg, M.A. Ivanov, **T.O. Barabash**, and A.G. Blokhin, “Comparative analysis of stress jumps in metals and intermetallic compounds: I. Description of two-stage straining”, *Phys. Met. Metallogr.* **81**, 4, pp. 374-80 (1996).
23. B.A. Greenberg, M.A. Ivanov, **T.O. Barabash**, and A.G. Blokhin, “Comparative analysis of stress jumps in metals and intermetallic compounds: II. Stress Macrojumps”, *Phys. Met. Metallogr.* **81**, 4, pp. 381-6 (1996).
24. **T.O. Barabash** and S.D. Eidelman, “Necessary and sufficient conditions on boundary regime that guarantee the stabilization of the solutions of a model third-order equation”, *Dopov. Nats. Akad. Nauk Ukraini*, 10, pp. 5-7 (1995).
25. **T. Barabash**, “Why does an aspen leaf tremble?”, *Quantum* **1**, pp. 16-8, (1992).

### Conference Proceedings (Refereed)

26. **Tatyana Sharpee**, “Comparison of methods for characterizing neural feature selectivity”, *Advances in Neural Information Processing 20* edited by J.C. Platt, D. Koller, Y. Singer, and S. Roweis, pp. 1305-1312 (MIT Press, Cambridge, MA), 2008. See also <http://arxiv.org/abs/0801.0311>.
27. **T. Sharpee**, A.V. Kurgansky, H. Sugihara, S. Rebrik, M.P. Stryker, and K.D. Miller, “Probing neural feature selectivity of neurons in primary visual cortex with natural stimuli”, *Fluctuations and Noise in Biological, Biophysical and Biomedical Systems II*, edited by D. Abbott, S. M. Bezrukov, A. Der, and A. Sánchez, pp. 212-222, Proceedings of SPIE **5467** (2004).
28. **Tatyana Sharpee**, Nicole C. Rust, and William Bialek, “Maximally informative dimensions: Analyzing neural responses to natural signals”, *Advances in Neural Information Processing 15* edited by S. Becker, S. Thrun and K. Obermayer, pp. 261-268 (MIT Press, Cambridge 2003). See also <http://arxiv.gov/abs/physics/0208057>.
29. **T.O. Barabash** and S.D. Eidelman, “Asymptotic behavior of solutions of boundary value problems for linearized KdV equation”, in *Nonlinear boundary value problems*, Kiev, pp. 13-9 (1997).