

CURRICULUM VITAE

Michale Sean Fee

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Research interests

- 1) Neuroscience - Neural mechanisms underlying the generation and learning of complex sequences.
- 2) Advanced optical and electrical techniques for measurement of brain activity in behaving animals.

Education and training

1994 Neurobiology Course, Marine Biological Laboratory, Woods Hole, MA
1992 Ph.D. in Applied Physics, Stanford University, Advisor: Steven Chu
1985 Bachelor of Engineering Physics, University of Michigan, Ann Arbor, MI

Professional experience

May 2003- present **Associate Professor of Computational and Systems Neuroscience**,
Department of Brain and Cognitive Sciences, Massachusetts Institute of
Technology, Cambridge, MA
May 2003- present **Investigator**, McGovern Institute for Brain Research, Cambridge, MA
Jan 2000-Jun 2003 **Adjunct Faculty**, Molecular Biology Department, Princeton University
Jun 1996-May 2003 **Member of Technical Staff (Principal Investigator)**, Biological
Computation Research Dept, Bell Laboratories, Lucent Technologies
Oct 1992- May 1996 **Postdoctoral Member of Technical Staff**, Biological Computation
Research Department, AT&T Bell Laboratories.
Oct 1990-Oct 1992 **Consultant**, Optical Physics Research Department, AT&T Bell
Laboratories
Sep 1986-Sep 1992 **Research Assistant**, Applied Physics Department, Stanford University
Jan 1986-Aug 1996 **Research Scientist**, Infra-red and Optics Division, Environmental
Research Institute of Michigan, Ann Arbor, MI

Research grants

2001-2004 National Science Foundation, Principal Investigator – Award #0112258
1996-1998 Whitehall Foundation, Principal Investigator

Publications

Encoding Pheromonal Signals in the Accessory Olfactory Bulb of Behaving Mice, M. Luo, M.S. Fee, L.C. Katz, *Science* 299: 1196-1201 (2003).

The speed of learning premotor representations in songbirds may depend on the temporal sparseness of premotor activity, I. Fiete, R.H.R. Hahnloser, A.A. Kozhevnikov, M.S. Fee, H.S.

Seung, *Proc Natl Acad Sci USA* (2003) to be submitted.

The structure and origin of sleep burst sequences in the songbird, R.H.R. Hahnloser, A.A. Kozhevnikov, M.S. Fee, *J Neuroscience* (2003), to be submitted.

An ultra-sparse code underlies the generation of neural sequences in a songbird, R.H.R. Hahnloser, A.A. Kozhevnikov, M.S. Fee, *Nature*, 419: 65-70 (2002).

Measurement of the Linear and Nonlinear Mechanical Properties of the Oscine Syrinx: Implications for Function, M.S. Fee, *J Comp Physiol A* 188: 829-839 (2002), Invited Paper

Population coding without single-neuron coding in a premotor nucleus of the songbird, A. Leonardo and M.S. Fee, *Neuron* (2002) under review.

A Miniature Head-Mounted Two-Photon Microscope: High Resolution Brain Imaging in Freely Moving Animals, F. Helmchen, M.S. Fee, D.W. Tank, W. Denk, *Neuron*, 31(6): 903-912 (2001).

Miniature motorized microdrive and commutator system for chronic neural recording in small animals, M.S. Fee and A. Leonardo, *J Neurosci Meth*, 112: 83-94 (2001).

Active stabilization of electrodes for intracellular recording in awake behaving animals, M. S. Fee, *Neuron*, 27:461-468 (2000).

Miniature headstage with 6-channel drive and vacuum-assisted microwire implantation for chronic recording from neocortex, S. Venkatachalam, M.S. Fee, and D. Kleinfeld, *J Neurosci Meth*, 90(1):37-46 (1999).

The role of nonlinear dynamics of the syrinx in the vocalizations of a songbird, M.S. Fee, B. Shraiman, B. Pesaran, P.P. Mitra, *Nature*, 395:67-71 (1998).

Motor modulation of sensory input: Exploratory whisking by rat as a model system. D. Kleinfeld, P. P. Mitra and M. S. Fee. Proceedings of Barrels IX. In *Somatosensory and Motor Research* 14:63 (1997).

Central Versus Peripheral Determinants of Patterned Spike Activity in Rat Vibrissa Cortex During Whisking, M.S. Fee, P.P. Mitra, D. Kleinfeld, *J Neurophysiol*, 78: 1144-1149 (1997).

Variability of Extracellular Spike Waveforms of Cortical Neurons, M.S. Fee, P.P. Mitra, D. Kleinfeld, *J Neurophysiol*, 76(6): 3823-3833 (1996).

Automatic sorting of multiple unit neuronal signals in the presence of anisotropic and non-Gaussian variability, M.S. Fee, P.P. Mitra, D. Kleinfeld, *J Neurosci Meth*, 69: 175-188 (1996).

Dynamics of Propagating Waves in the Olfactory Network of a Terrestrial Mollusk: An Electrical and Optical Study, D. Kleinfeld, K.R. Delaney, M.S. Fee, J.A. Flores, D.W. Tank, and A. Gelperin, *J Neurophysiol*, 72(3): 1402 (1994).

Waves and stimulus modulated dynamics in an oscillating olfactory network, K.R. Delaney, A. Gelperin, M.S. Fee, J.A. Flores, R. Gervais, D.W. Tank, and D. Kleinfeld, *Proc Natl Acad Sci*

USA, 91: 669 (1994).

Measurement of the Positronium 1S-2S Interval by Continuous-Wave Two-Photon Excitation, M.S. Fee, A.P. Mills, Jr., S. Chu, E.D. Shaw, K. Danzmann, R.J. Chichester, and D.M. Zuckerman, *Physical Review Letters*, 70(10): 1397 (1993).

Precision measurement of the positronium 1S-2S interval by continuous-wave two-photon excitation, M.S. Fee, A.P. Mills, Jr., S. Chu, E.D. Shaw, R.J. Chichester, D.M. Zuckerman, and K. Danzmann, *Physical Review A*, 4: 192 (1993).

Optical heterodyne measurements of pulsed lasers: Toward high precision pulsed spectroscopy, M.S. Fee, K. Danzmann, and S. Chu, *Physical Review A*, 45(7): 4911 (1992).

Sensitive detection of Doppler-free two-photon excited 2S positronium by spatially separated photoionization, M.S. Fee, A.P. Mills, Jr., E.D. Shaw, R.J. Chichester, D.M. Zuckerman, S. Chu, and K. Danzmann, *Physical Review A*, 44: R5 (1991)

Scanning electromagnetic transmission line microscope with sub-wavelength resolution, M.S. Fee, S. Chu, and T.W. Hansch, *Optics Communications*, 69: 219 (1989).

Doppler-free laser spectroscopy of positronium and muonium: Reanalysis of the 1S-2S measurements, K. Danzmann, M.S. Fee, and Steven Chu, *Physical Review A*, 39: 6072 (1989).

Patents

- Acousto-optic Monitoring and Imaging in a Depth Sensitive Manner, M.S. Fee and M.J. Schnitzer (2001), *pending*
- System and Method for Optical Scanning, M.S. Fee, F. Helmchen, D. Tank, W. Denk (2001), *pending*
- Predictive Probe Stabilization Relative to Subject Movement, M.S. Fee (2000), *pending*
- Interferometric Probe Stabilization Relative to Subject Movement, M.S. Fee (2000), *pending*
- Speech Processing Technique for Use In Speech Recognition and Speech Coding, M.S. Fee, P.P. Mitra (1999)

Teaching experience

2002	<i>Faculty</i> , Neuroinformatics Course, Marine Biological Laboratory, Woods Hole, MA
2002	<i>Invited Lecturer</i> , Neural Systems and Behavior Course, Marine Biological Laboratory
2002	<i>Invited Lecturer</i> , Methods in Computational Neuroscience Course, Marine Biological Laboratory
1997-2001	<i>Invited Lecturer</i> , Workshop on the Analysis of Neural Data, Marine Biological Laboratory
2001	<i>Invited Lecturer</i> , Graduate Level Neurobiology, Molecular Biology Department, Princeton University
2000	<i>Invited Lecturer</i> , Graduate Level Neurobiology, Molecular Biology Department, Princeton University

Invited talks (Research departments)

Center for Systems Neuroscience, Harvard University, Cambridge MA (2003)
Division of Engineering and Applied Sciences, Harvard University, Cambridge MA (2003)
Department of Physiology and Biophysics, Univ. Washington Med School, Seattle WA (2003)
Division of Biology, University of California, San Diego (2003)
Beckman Institute, University of Illinois at Urbana-Champaign, Urbana IL (2003)
Department of Neurobiology, Harvard Medical School, Cambridge MA (2003)
Department of Brain and Cognitive Sciences, MIT, Cambridge MA (2003)
Department of Physics, Duke University, Durham NC (2003)
Neuroscience Seminar Program, Cold Spring Harbor Laboratory, Cold Spring Harbor NY (2002)
Psychology Department, Princeton University, Princeton NJ (2002)
Series on Biology of Vocal Learning and Brain Repair, Rockefeller University, New York NY (2002)
Department of Physics, Princeton University, Princeton NJ (2002)
Neuroscience Research Seminar, Columbia University (2002)
Department of Physics, Penn State University, State College PA (2002)
Seventh Annual Birdsong Workshop, Rockefeller University Field Station, Millbrook, NY (July 2002)
Department of Neurobiology, Duke University, Durham NC (2002)
Max-Planck-Institute for Medical Research, Heidelberg, Germany (2002)
Max-Planck-Institute for Biochemistry, Munich, Germany (2002)
Max-Planck-Institute for Biological Cybernetics, Tübingen, Germany (2002)
Institute of Neuroinformatics, ETH, Zurich, Switzerland (2002)
Program in Neuroscience, Columbia University, New York NY (2002)
Department of Molecular Biology, Princeton University, Princeton NJ (2002)
Sixth Annual Birdsong Workshop, Rockefeller University Field Station, Millbrook, NY (July 2001)
Graduate Seminar in Neurobiology, University of Washington, Seattle WA (2000)
Sloan Center for Theoretical Neurobiology, Caltech, Pasadena CA (2000)
Fourth Annual Birdsong Workshop, Rockefeller University Field Station, Millbrook, NY (June 1999)

Invited talks (Meetings)

Plenary Address: Time and Sequence in the Brain: Insights From a Songbird. Annual Conference on Neural Information Processing Systems, Vancouver BC (to be given December 2003)
Ladislav Tauc Conference in Neurosciences, Gif-sur-Yvette, France (to be given December 2003)
Neural Mechanisms of Sequence Generation and Learning in the Songbird, Computational Neuroscience/Neuromorphic Engineering Workshop, Telluride CO (July 2003)
Simple But Interesting: The physicists search for a model neural system, John Hopfield 70th Birthday Symposium, Princeton, NJ (June 2003)

Signaling In the Brain: Insights From the Songbird, Keck Center Symposium, Keck Center of the National Academies, Washington DC (May 2003)

Time and Sequence in the Brain: Insights From a Songbird. Banbury Center Conference on Neural Circuits: Principles of Design and Operation, Cold Spring Harbor, NY (April 2003)

Learning and Representation of Sequences, Panel on Robust Computation – NSF Conference on Advanced Computation Inspired by Biological Processes, Arlington, VA (April 2003)

Neural Mechanisms of Sequence Generation in the Brain. Neural Information and Coding Workshop, Snowbird, Utah (March 2003)

Miniature Two-Photon Microscope for Brain Imaging in Freely Moving Animals, Photonics West, The International Society for Optical Engineering, San Jose, CA (January 2003)

Techniques for Recording Single Identified Neurons in Small Behaving Animals, Behavioral Neurobiology of Bird Song Meeting, New York, NY (December 2002)

Songs, Sequences and Time: A look at the neural mechanisms of sequence generation. Behavioral Neurobiology of Bird Song Meeting, New York, NY (December 2002)

Keynote Speaker: Songs, Sequences and Time: Neural mechanisms of vocal control in the songbird, Integrated Neuroscience Symposium, Center for Molecular and Behavioral Neuroscience, Newark NJ (October 2002)

Vocal Control in the Songbird: Neural Mechanisms of Complex Sequence Generation, ITP Program on Dynamics of Neural Networks: From Biophysics to Behavior, Santa Barbara, CA (October 2001)

Physical and Neural Dynamics Underlying Vocal Sequences In the Songbird, Animal Behavior Society Meeting, Corvallis, OR (July 2001)

Bird Songs: The Machine Behind the Music, World of Science Seminar Series, Bell Laboratories, Lucent Technologies, Murray Hill, NJ (March 2001) Public lecture for high school students

Neural Dynamics Underlying Vocal Control In the Songbird, Winter Conference on Brain Research, Steamboat Springs CO (January 2001)

The role of nonlinear dynamics of the syrinx in the vocalizations of a songbird, Fifth Experimental Chaos Conference, Orlando FL (June 1999)

Peer review

Scientific Advisory Board, National Alliance for Autism Research, April 2002.

Scientific Review Panel, Collaborative Research in Computational Neuroscience, NSF/NIH, May 2002

Honors and awards

2003 Dart Scholar – Marine Biological Laboratory, Woods Hole, MA

1994 Society of General Physiologists Scholarship

1986 Sigma Xi Award – for outstanding undergraduate research

1986 Engineering Physics Outstanding Achievement Award

Activities and certifications

Private Pilot – Single-Engine Land and Glider Ratings

Amateur Radio Operator, Extra-class

Classical and Ragtime Piano