

Stanford



Mark J. Schnitzer

Professor of Biology and of Applied Physics

 Curriculum Vitae available Online

CONTACT INFORMATION

- **Alternate Contact**

Annette Lewis

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Bio

ACADEMIC APPOINTMENTS

- Professor, Biology
- Professor, Applied Physics
- Member, Bio-X
- Member, Wu Tsai Neurosciences Institute

HONORS AND AWARDS

- National Academy of Sciences, Committee on Biological Physics, A Decadal Survey, National Academy of Sciences (2019-present)
- Scientific Advisory Council, Allen Institute for Brain Science, MindScope Project, Allen Institute for Brain Science (2019-2020)
- 2019 Method of the Year, Nature Methods, awarded to the miniature fluorescence microscope, Cell Press (2019)
- Course Lecturer, “Functional, Structural, & Molecular Imaging”, Soc. for Neuroscience Annual Meeting, Society for Neuroscience (2018)
- Course Lecturer, FENS Cajal Neuroscience Training Course, “Interacting with Neural Circuits”, Federation of European Neuroscience Societies (2017)
- Editorial Board, Neuron, Cell Press, Cell Press (2016-present)
- Scientific Advisory Board, NSF National Center for Brain Mapping, National Science Foundation (2016-present)
- Co-Organizer, DECODE Summit, Neural Circuits and Brain Disease, Inscopix, Inc. (2016)
- Caltech, Wiersma Visiting Professor, California Institute of Technology (2015)
- Co-Organizer, Cell Press Symposium, “Engineering the Brain”, Cell Press (2015)
- Invited Speaker, White House Office of Science & Technology, BRAIN Initiative Meeting, United States BRAIN Initiative (2015)
- Issue Editor, Current Opinion in Neurobiology, Current Opinion in Neurobiology (2015)
- NIH BRAIN Initiative Multi-Council Working Group, which oversees the BRAIN Initiative, National Institutes of Health (2014-17)
- NIH National Institute on Drug Abuse (NIDA), National Advisory Council, Ad hoc member, National Institutes of Health (2014-17)
- Milken Institute Global Conference, Invited Panelist, Milken Institute (2014)
- NIMH Director’s Innovation Speaker, National Institutes of Health (2014)
- White House BRAIN Conference, Invited Panelist, United States BRAIN Initiative (2014)
- NIH, Parkinson Disease Basic Science Working Group, National Institutes of Health (2013-14)

- United States BRAIN Initiative NIH Director's Advisory Committee, which authored "BRAIN 2025", National Institutes of Health (2013-14)
- 14th Distinguished Kavli Lecture, Kavli Institute for Systems Neuroscience, NTNU, Trondheim, Norway (2013)
- Finalist (on behalf of Inscopix, for our lab's miniature microscope), Israel Brain Prize, Tel Aviv (2013)
- Top Innovation of 2013 (miniature fluorescence microscope), The Scientist (2013)
- Ellison Senior Scholar Award, Ellison Foundation (2012)
- National Academy Keck Futures Initiative Award, W.M. Keck Foundation (2011)
- Allen Distinguished Investigator Award, Paul G. Allen Family Foundation (2010)
- Michael & Kate Bárány Young Investigator Award, Biophysical Society (2010)
- HHMI Investigator, Howard Hughes Medical Institute (2008)
- Best Techniques Paper, Co-Author, American Society of Biomechanics (2007)
- NIH Director's Pioneer Award, National Institutes of Health (2007)
- The Brilliant 10, Top ten brilliant scientists under age 40, Popular Science Magazine (2007)
- W.M. Keck Foundation, Medical Research Program grant, W.M. Keck Foundation (2007)
- Terman Fellow, Stanford University (2006)
- Alfred P. Sloan Foundation Research Fellow, Alfred P. Sloan Foundation (2005)
- Beckman Interdisciplinary Translational Research Program Award, Stanford University (2005)
- Fellowship in Science & Engineering, David & Lucille Packard Foundation (2005)
- Klingenstein Fellowship in the Neurosciences, Klingenstein Foundation (2004)
- Presidential Early Career Award in Science and Engineering 2004, Presented at the White House on June 13, 2005 (2004)
- Young Investigator Award, Office of Naval Research, Cognitive & Neural Division (2004)
- Young Investigator Award, Beckman Foundation (2004)
- Cutting Edge Basic Research Award (CEBRA) Science, National Institutes of Health (2003)
- Member of TR100, World's Top 100 Innovators under age 35, Technology Review Magazine (2003)
- Young Investigator Award (with #1 world ranking), Human Frontiers in Science Program (2002)
- McKnight Technological Innovations in Neuroscience Award, McKnight Foundation (2000)
- Burroughs Wellcome Fellowship, Program in Mathematics and Molecular Biology (1998-1999)
- Charlotte Elizabeth Procter Honorary Fellowship, Princeton University (1997-1998)
- Predoctoral Fellowship, American Heart Association (1996-1998)
- Predoctoral Fellowship, NSF (1993-1996)
- Winston Churchill Fellowship, Winston Churchill Foundation of the United States (1992-1993)
- Junior Phi Beta Kappa for top 12 Junior men, Harvard University (1991)
- Barry Goldwater Fellowship for Excellence in Science, United States, Barry Goldwater Fellowship for Excellence in Science, United States (1990)
- John Harvard Scholarships, John Harvard Scholarships (1989-1991)
- Detur Scholar, Harvard University (1989)
- United States Physics Team, International Physics Olympiad, Bad Ischl, Austria (1988)

LINKS

- Schnitzer Lab Web Site: <http://pyramidal.stanford.edu/>

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The long-term goal of our research is to advance experimental paradigms for understanding normal cognitive and disease processes at the level of neural circuits, with emphasis on learning and memory processes. By contrast, much current research on learning and memory concentrates on levels of organization in the nervous system that are either more macroscopic (e.g. in cognitive psychology) or more microscopic (e.g. in synaptic physiology).

Our approach combines behavioral, electrophysiological, and computational methodologies with high-resolution fluorescence optical imaging that is capable of resolving individual neurons and dendrites. By necessity, we aim to advance imaging methods so that we can examine dynamics of neuronal populations or of dendritic compartments in behaving animals. En route, we are also performing experiments on circuit properties in anesthetized animals, such as the studies that use our newly invented fluorescence endoscopes for examining hippocampal cells and dendrites in vivo.

We seek explanations that span different levels of organization, from cells to entire circuits. We work with both genetic model organisms, mice and fruit flies, and human subjects. Our research emphasizes understanding the control and learning of motor behaviors, as well as the potential application of our newly developed imaging techniques to clinical use in humans.

Teaching

COURSES

2021-22

- Advanced Imaging Lab in Biophysics: APPPHYS 232, BIO 132, BIO 232, GENE 232 (Spr)
- Introduction to Biophysics: APPPHYS 205 (Win)

2020-21

- Introduction to Biophysics: APPPHYS 205, BIO 126, BIO 226 (Spr)

2019-20

- Introduction to Biophysics: APPPHYS 205, BIO 126, BIO 226 (Win)

2018-19

- Advanced Imaging Lab in Biophysics: APPPHYS 232, BIO 132, BIO 232, BIOPHYS 232, GENE 232 (Spr)
- Introduction to Biophysics: APPPHYS 205, BIO 126, BIO 226 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Adam Bowman

Postdoctoral Faculty Sponsor

Behnam Abaie, Daniel Berg, Radek Chrapkiewicz, Jordi Fernandez Albert, Simon Haziza, Oscar Hernandez, Xiqian Jiang, Itamar Landau, Monique Mendes, Nicole Mercer Lindsay, Christopher Miranda, Adam Shai, Xiaochen Sun, Michael White

Doctoral Dissertation Advisor (AC)

Omer Hazon, Yuxi Ke, Vasily Kruzhilin, Yang Li, Jessica Maxey, James Thomson, Seung Je Woo

Doctoral Dissertation Co-Advisor (AC)

Stephan Eismann, Kevin Feigelis, Nick Rommelfanger

Doctoral (Program)

Yijun Jiang, Yang Li, Zhiru Liu, Jessica Maxey, Yixiu Zhao

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biology (School of Humanities and Sciences) (Phd Program)
- Biophysics (Phd Program)
- Neurosciences (Phd Program)

Publications

PUBLICATIONS

- **RecV recombinase system for in vivo targeted optogenomic modifications of single cells or cell populations.** *Nature methods*
Yao, S., Yuan, P., Ouellette, B., Zhou, T., Mortrud, M., Balam, P., Chatterjee, S., Wang, Y., Daigle, T. L., Tasic, B., Kuang, X., Gong, H., Luo, et al
2020
- **Fundamental bounds on the fidelity of sensory cortical coding** *NATURE*
Rumyantsev, O. I., Lecoq, J. A., Hernandez, O., Zhang, Y., Savall, J., Chrapkiewicz, R., Li, J., Zeng, H., Ganguli, S., Schnitzer, M. J.
2020
- **Microendoscopy detects altered muscular contractile dynamics in a mouse model of amyotrophic lateral sclerosis.** *Scientific reports*
Chen, X., Sanchez, G. N., Schnitzer, M. J., Delp, S. L.
2020; 10 (1): 457
- **Skilled reaching tasks for head-fixed mice using a robotic manipulandum.** *Nature protocols*
Wagner, M. J., Savall, J. n., Kim, T. H., Schnitzer, M. J., Luo, L. n.
2020
- **Ultrafast Two-Photon Imaging of a High-Gain Voltage Indicator in Awake Behaving Mice.** *Cell*
Villette, V., Chavarha, M., Dimov, I. K., Bradley, J., Pradhan, L., Mathieu, B., Evans, S. W., Chamberland, S., Shi, D., Yang, R., Kim, B. B., Ayon, A., Jalil, et al
2019; 179 (7): 1590
- **Amygdala ensembles encode behavioral states** *SCIENCE*
Grundemann, J., Bitterman, Y., Lu, T., Krabbe, S., Grewe, B. F., Schnitzer, M. J., Luthi, A.
2019; 364 (6437): 254+
- **Amygdala ensembles encode behavioral states.** *Science (New York, N.Y.)*
Grundemann, J., Bitterman, Y., Lu, T., Krabbe, S., Grewe, B. F., Schnitzer, M. J., Luthi, A.
2019; 364 (6437)
- **Shared Cortex-Cerebellum Dynamics in the Execution and Learning of a Motor Task** *CELL*
Wagner, M. J., Kim, T., Kadmon, J., Nguyen, N. D., Ganguli, S., Schnitzer, M. J., Luo, L.
2019; 177 (3): 669+
- **Shared Cortex-Cerebellum Dynamics in the Execution and Learning of a Motor Task.** *Cell*
Wagner, M. J., Kim, T. H., Kadmon, J., Nguyen, N. D., Ganguli, S., Schnitzer, M. J., Luo, L.
2019
- **An amygdalar neural ensemble that encodes the unpleasantness of pain.** *Science (New York, N.Y.)*
Corder, G., Ahanonu, B., Grewe, B. F., Wang, D., Schnitzer, M. J., Scherrer, G.
2019; 363 (6424): 276-81
- **Kilohertz two-photon brain imaging in awake mice.** *Nature methods*
Zhang, T. n., Hernandez, O. n., Chrapkiewicz, R. n., Shai, A. n., Wagner, M. J., Zhang, Y. n., Wu, C. H., Li, J. Z., Inoue, M. n., Gong, Y. n., Ahanonu, B. n., Zeng, H. n., Bito, et al
2019

- **Fast, in vivo voltage imaging using a red fluorescent indicator.** *Nature methods*
Kannan, M., Vasan, G., Huang, C., Haziza, S., Li, J. Z., Inan, H., Schnitzer, M. J., Pieribone, V. A.
2018
- **Long-Term Consolidation of Ensemble Neural Plasticity Patterns in Hippocampal Area CA1.** *Cell reports*
Attardo, A., Lu, J., Kawashima, T., Okuno, H., Fitzgerald, J. E., Bito, H., Schnitzer, M. J.
2018; 25 (3): 640
- **Three-photon imaging of mouse brain structure and function through the intact skull** *NATURE METHODS*
Wang, T., Ouzounov, D. G., Wu, C., Horton, N. G., Zhang, B., Wu, C., Zhang, Y., Schnitzer, M. J., Xu, C.
2018; 15 (10): 789+
- **Calcium Transient Dynamics of Neural Ensembles in the Primary Motor Cortex of Naturally Behaving Monkeys** *CELL REPORTS*
Kondo, T., Saito, R., Otaka, M., Yoshino-Saito, K., Yamanaka, A., Yamamori, T., Watakabe, A., Mizukami, H., Schnitzer, M. J., Tanaka, K. F., Ushiba, J., Okano, H.
2018; 24 (8): 2191+
- **Long-term optical brain imaging in live adult fruit flies** *NATURE COMMUNICATIONS*
Huang, C., Maxey, J. R., Sinha, S., Savall, J., Gong, Y., Schnitzer, M. J.
2018; 9: 872
- **Unsupervised Discovery of Demixed, Low-Dimensional Neural Dynamics across Multiple Timescales through Tensor Component Analysis.** *Neuron*
Williams, A. H., Kim, T. H., Wang, F. n., Vyas, S. n., Ryu, S. I., Shenoy, K. V., Schnitzer, M. n., Kolda, T. G., Ganguli, S. n.
2018
- **Diametric neural ensemble dynamics in parkinsonian and dyskinetic states.** *Nature*
Parker, J. G., Marshall, J. D., Ahanonu, B. n., Wu, Y. W., Kim, T. H., Grewe, B. F., Zhang, Y. n., Li, J. Z., Ding, J. B., Ehlers, M. D., Schnitzer, M. J.
2018
- **Neuronal Representation of Social Information in the Medial Amygdala of Awake Behaving Mice** *CELL*
Li, Y., Mathis, A., Grewe, B. F., Osterhout, J. A., Ahanonu, B., Schnitzer, M. J., Murthy, V. N., Dulac, C.
2017; 171 (5): 1176+
- **Social behaviour shapes hypothalamic neural ensemble representations of conspecific sex** *NATURE*
Remedios, R., Kennedy, A., Zelikowsky, M., Grewe, B. F., Schnitzer, M. J., Anderson, D. J.
2017; 550 (7676): 388+
- **Cerebellar granule cells encode the expectation of reward** *NATURE*
Wagner, M. J., Kim, T. H., Savall, J., Schnitzer, M. J., Luo, L.
2017; 544 (7648): 96-?
- **Neural ensemble dynamics underlying a long-term associative memory** *NATURE*
Grewe, B. F., Grundemann, J., Kitch, L. J., Lecoq, J. A., Parker, J. G., Marshall, J. D., Larkin, M. C., Jercog, P. E., Grenier, F., Li, J. Z., Luthi, A., Schnitzer, M. J.
2017; 543 (7647): 670-?
- **Robust Estimation of Neural Signals in Calcium Imaging**
Inan, H., Erdogdu, M. A., Schnitzer, M. J., Guyon, Luxburg, U. V., Bengio, S., Wallach, H., Fergus, R., Vishwanathan, S., Garnett, R.
NEURAL INFORMATION PROCESSING SYSTEMS (NIPS).2017
- **Long-Term Optical Access to an Estimated One Million Neurons in the Live Mouse Cortex** *CELL REPORTS*
Kim, T. H., Zhang, Y., Lecoq, J., Jung, J. C., Li, J., Zeng, H., Niell, C. M., Schnitzer, M. J.
2016; 17 (12): 3385-3394
- **Cell-Type-Specific Optical Recording of Membrane Voltage Dynamics in Freely Moving Mice** *CELL*
Marshall, J. D., Li, J. Z., Zhang, Y., Gong, Y., St-Pierre, F., Lin, M. Z., Schnitzer, M. J.
2016; 167 (6): 1650-?
- **Distinct Hippocampal Pathways Mediate Dissociable Roles of Context in Memory Retrieval.** *Cell*
Xu, C., Krabbe, S., Gründemann, J., Botta, P., Fadok, J. P., Osakada, F., Saur, D., Grewe, B. F., Schnitzer, M. J., Callaway, E. M., Lüthi, A.
2016; 167 (4): 961-972 e16

- **Changes in sarcomere lengths of the human vastus lateralis muscle with knee flexion measured using in vivo microendoscopy** *JOURNAL OF BIOMECHANICS*
Chen, X., Sanchez, G. N., Schnitzer, M. J., Delp, S. L.
2016; 49 (13): 2989-2994
- **Genetically encoded indicators of neuronal activity.** *Nature neuroscience*
Lin, M. Z., Schnitzer, M. J.
2016; 19 (9): 1142-1153
- **Large-Scale Fluorescence Calcium-Imaging Methods for Studies of Long-Term Memory in Behaving Mammals** *COLD SPRING HARBOR PERSPECTIVES IN BIOLOGY*
Jercog, P., Rogerson, T., Schnitzer, M. J.
2016; 8 (5)
- **High-speed recording of neural spikes in awake mice and flies with a fluorescent voltage sensor** *SCIENCE*
Gong, Y., Huang, C., Li, J. Z., Grewe, B. F., Zhang, Y., Eismann, S., Schnitzer, M. J.
2015; 350 (6266): 1361-1366
- **In Vivo Imaging of Human Sarcomere Twitch Dynamics in Individual Motor Units** *NEURON*
Sanchez, G. N., Sinha, S., Liske, H., Chen, X., Viet Nguyen, V., Delp, S. L., Schnitzer, M. J.
2015; 88 (6): 1109-1120
- **Entorhinal Cortical Ocean Cells Encode Specific Contexts and Drive Context-Specific Fear Memory.** *Neuron*
Kitamura, T., Sun, C., Martin, J., Kitch, L. J., Schnitzer, M. J., Tonegawa, S.
2015; 87 (6): 1317-1331
- **Optogenetics: 10 years after ChR2 in neurons-views from the community** *NATURE NEUROSCIENCE*
Adamantidis, A., Arber, S., Bains, J. S., Bamberg, E., Bonci, A., Buzsaki, G., Cardin, J. A., Costa, R. M., Dan, Y., Goda, Y., Graybiel, A. M., Haeusser, M., Hegemann, et al
2015; 18 (9): 1202-12
- **Impermanence of dendritic spines in live adult CA1 hippocampus.** *Nature*
Attardo, A., Fitzgerald, J. E., Schnitzer, M. J.
2015; 523 (7562): 592-596
- **Impermanence of dendritic spines in live adult CA1 hippocampus** *NATURE*
Attardo, A., Fitzgerald, J. E., Schnitzer, M. J.
2015; 523 (7562): 592-?
- **Distinct speed dependence of entorhinal island and ocean cells, including respective grid cells** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Sun, C., Kitamura, T., Yamamoto, J., Martin, J., Pignatelli, M., Kitch, L. J., Schnitzer, M. J., Tonegawa, S.
2015; 112 (30): 9466-9471
- **Dexterous robotic manipulation of alert adult Drosophila for high-content experimentation.** *Nature methods*
Savall, J., Ho, E. T., Huang, C., Maxey, J. R., Schnitzer, M. J.
2015; 12 (7): 657-660
- **Dexterous robotic manipulation of alert adult Drosophila for high-content experimentation.** *Nature methods*
Savall, J., Ho, E. T., Huang, C., Maxey, J. R., Schnitzer, M. J.
2015; 12 (7): 657-660
- **The BRAIN Initiative: developing technology to catalyse neuroscience discovery** *PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B-BIOLOGICAL SCIENCES*
Jorgenson, L. A., Newsome, W. T., Anderson, D. J., Bargmann, C. I., Brown, E. N., Deisseroth, K., Donoghue, J. P., Hudson, K. L., Ling, G. S., MacLeish, P. R., Marder, E., Normann, R. A., Sanes, et al
2015; 370 (1668): 8-19
- **Cellular Level Brain Imaging in Behaving Mammals: An Engineering Approach** *NEURON*
Hamel, E. J., Grewe, B. F., Parker, J. G., Schnitzer, M. J.

2015; 86 (1): 140-159

- **The neural representation of taste quality at the periphery** *NATURE*
Barretto, R. P., Gillis-Smith, S., Chandrashekar, J., Yarmolinsky, D. A., Schnitzer, M. J., Ryba, N. J., Zuker, C. S.
2015; 517 (7534): 373-U511
- **Distinct speed dependence of entorhinal island and ocean cells, including respective grid cells.** *Proceedings of the National Academy of Sciences of the United States of America*
Sun, C. n., Kitamura, T. n., Yamamoto, J. n., Martin, J. n., Pignatelli, M. n., Kitch, L. J., Schnitzer, M. J., Tonegawa, S. n.
2015; 112 (30): 9466-71
- **In Vivo Imaging of Human Sarcomere Twitch Dynamics in Individual Motor Units.** *Neuron*
Sanchez, G. N., Sinha, S. n., Liske, H. n., Chen, X. n., Nguyen, V. n., Delp, S. L., Schnitzer, M. J.
2015; 88 (6): 1109-20
- **Editorial overview: Large-scale recording technology: Scaling up neuroscience.** *Current opinion in neurobiology*
Battaglia, F. P., Schnitzer, M. J.
2015; 32: iv-vi
- **Visualizing mammalian brain area interactions by dual-axis two-photon calcium imaging** *NATURE NEUROSCIENCE*
Lecoq, J., Savall, J., Vucinic, D., Grewe, B. F., Kim, H., Li, T. Z., Kitch, L. J., Schnitzer, M. J.
2014; 17 (12): 1825-1829
- **Visualizing mammalian brain area interactions by dual-axis two-photon calcium imaging.** *Nature neuroscience*
Lecoq, J., Savall, J., Vucinic, D., Grewe, B. F., Kim, H., Li, J. Z., Kitch, L. J., Schnitzer, M. J.
2014; 17 (12): 1825-1829
- **High-fidelity optical reporting of neuronal electrical activity with an ultrafast fluorescent voltage sensor.** *Nature neuroscience*
St-Pierre, F., Marshall, J. D., Yang, Y., Gong, Y., Schnitzer, M. J., Lin, M. Z.
2014; 17 (6): 884-889
- **Imaging neural spiking in brain tissue using FRET-opsin protein voltage sensors** *NATURE COMMUNICATIONS*
Gong, Y., Wagner, M. J., Li, J. Z., Schnitzer, M. J.
2014; 5
- **Bidirectional plasticity of purkinje cells matches temporal features of learning.** *journal of neuroscience*
Wetmore, D. Z., Jirenhed, D., Rasmussen, A., Johansson, F., Schnitzer, M. J., Hesslow, G.
2014; 34 (5): 1731-1737
- **Imaging neural spiking in brain tissue using FRET-opsin protein voltage sensors.** *Nature communications*
Gong, Y., Wagner, M. J., Zhong Li, J., Schnitzer, M. J.
2014; 5: 3674-?
- **High-speed laser microsurgery of alert fruit flies for fluorescence imaging of neural activity** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Sinha, S., Liang, L., Ho, E. T., Urbanek, K. E., Luo, L., Baer, T. M., Schnitzer, M. J.
2013; 110 (46): 18374-18379
- **Engineering Approaches to Illuminating Brain Structure and Dynamics** *NEURON*
Deisseroth, K., Schnitzer, M. J.
2013; 80 (3): 568-577
- **Sarcomere lengths in human extensor carpi radialis brevis measured by microendoscopy** *MUSCLE & NERVE*
Cromie, M. J., Sanchez, G. N., Schnitzer, M. J., Delp, S. L.
2013; 48 (2): 286-292
- **GABAergic Lateral Interactions Tune the Early Stages of Visual Processing in Drosophila** *NEURON*
Freifeld, L., Clark, D. A., Schnitzer, M. J., Horowitz, M. A., Clandinin, T. R.
2013; 78 (6): 1075-1089
- **Enhanced Archaelrhodopsin Fluorescent Protein Voltage Indicators** *PLOS ONE*

- Gong, Y., Li, J. Z., Schnitzer, M. J.
2013; 8 (6)
- **Optical Strategies for Sensing Neuronal Voltage Using Quantum Dots and Other Semiconductor Nanocrystals** *ACS NANO*
Marshall, J. D., Schnitzer, M. J.
2013; 7 (5): 4601-4609
 - **Long-term dynamics of CA1 hippocampal place codes** *NATURE NEUROSCIENCE*
Ziv, Y., Burns, L. D., Cocker, E. D., Hamel, E. O., Ghosh, K. K., Kitch, L. J., El Gamal, A., Schnitzer, M. J.
2013; 16 (3): 264-266
 - **Nanotools for Neuroscience and Brain Activity Mapping** *ACS NANO*
Alivisatos, A. P., Andrews, A. M., Boyden, E. S., Chun, M., Church, G. M., Deisseroth, K., Donoghue, J. P., Fraser, S. E., Lippincott-Schwartz, J., Looger, L. L., Masmanidis, S., McEuen, P. L., Nurmikko, et al
2013; 7 (3): 1850-1866
 - **Improving FRET Dynamic Range with Bright Green and Red Fluorescent Proteins** *57th Annual Meeting of the Biophysical-Society*
Lam, A. J., St-Pierre, F., Gong, Y., Marshall, J. D., McKeown, M. R., Schnitzer, M. J., Tsien, R. Y., Lin, M. Z.
CELL PRESS.2013: 683A-683A
 - **Photon Shot Noise Limits on Optical Detection of Neuronal Spikes and Estimation of Spike Timing** *BIOPHYSICAL JOURNAL*
Wilt, B. A., Fitzgerald, J. E., Schnitzer, M. J.
2013; 104 (1): 51-62
 - **Enhanced Archaelhodopsin Fluorescent Protein Voltage Indicators.** *PloS one*
Gong, Y. n., Li, J. Z., Schnitzer, M. J.
2013; 8 (6): e66959
 - **Towards a Photonic Crystal Mode-Locked Laser** *Conference on Novel In-Plane Semiconductor Lasers XII*
Leedle, K., Janjua, A., Paik, S., Schnitzer, M. J., Harris, J. S.
SPIE-INT SOC OPTICAL ENGINEERING.2013
 - **Two-photon optogenetic toolbox for fast inhibition, excitation and bistable modulation** *NATURE METHODS*
Prakash, R., Yizhar, O., Grewe, B., Ramakrishnan, C., Wang, N., Goshen, I., Packer, A. M., Peterka, D. S., Yuste, R., Schnitzer, M. J., Deisseroth, K.
2012; 9 (12): 1171-U132
 - **Unified Resolution Bounds for Conventional and Stochastic Localization Fluorescence Microscopy** *PHYSICAL REVIEW LETTERS*
Mukamel, E. A., Schnitzer, M. J.
2012; 109 (16)
 - **Improving FRET dynamic range with bright green and red fluorescent proteins** *NATURE METHODS*
Lam, A. J., St-Pierre, F., Gong, Y., Marshall, J. D., Cranfill, P. J., Baird, M. A., McKeown, M. R., Wiedenmann, J., Davidson, M. W., Schnitzer, M. J., Tsien, R. Y., Lin, M. Z.
2012; 9 (10): 1005-?
 - **In vivo optical microendoscopy for imaging cells lying deep within live tissue.** *Cold Spring Harbor protocols*
Barretto, R. P., Schnitzer, M. J.
2012; 2012 (10): 1029-1034
 - **In vivo microendoscopy of the hippocampus.** *Cold Spring Harbor protocols*
Barretto, R. P., Schnitzer, M. J.
2012; 2012 (10): 1092-1099
 - **Estimation Theoretic Measure of Resolution for Stochastic Localization Microscopy** *PHYSICAL REVIEW LETTERS*
Fitzgerald, J. E., Lu, J., Schnitzer, M. J.
2012; 109 (4)
 - **Miniaturized integration of a fluorescence microscope** *NATURE METHODS*
Ghosh, K. K., Burns, L. D., Cocker, E. D., Nimmerjahn, A., Ziv, Y., El Gamal, A., Schnitzer, M. J.
2011; 8 (10): 871-U147

- **Symmetries in stimulus statistics shape the form of visual motion estimators** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
Fitzgerald, J. E., Katsov, A. Y., Clandinin, T. R., Schnitzer, M. J.
2011; 108 (31): 12909-12914
- **An infrared fluorescent protein for deeper imaging** *NATURE BIOTECHNOLOGY*
Lecoq, J., Schnitzer, M. J.
2011; 29 (8): 715-716
- **Defining the Computational Structure of the Motion Detector in Drosophila** *NEURON*
Clark, D. A., Bursztyn, L., Horowitz, M. A., Schnitzer, M. J., Clandinin, T. R.
2011; 70 (6): 1165-1177
- **Time-lapse imaging of disease progression in deep brain areas using fluorescence microendoscopy** *NATURE MEDICINE*
Barretto, R. P., Ko, T. H., Jung, J. C., Wang, T. J., Capps, G., Waters, A. C., Ziv, Y., Attardo, A., Recht, L., Schnitzer, M. J.
2011; 17 (2): 223-U120
- **Journal club. A neuroscientist learns about algorithms for motor learning.** *Nature*
Schnitzer, M. J.
2010; 463 (7279): 273-?
- **Automated Analysis of Cellular Signals from Large-Scale Calcium Imaging Data** *NEURON*
Mukamel, E. A., Nimmerjahn, A., Schnitzer, M. J.
2009; 63 (6): 747-760
- **In vivo brain imaging using a portable 2.9 g two-photon microscope based on a microelectromechanical systems scanning mirror** *OPTICS LETTERS*
Piyawattanametha, W., Cocker, E. D., Burns, L. D., Barretto, R. P., Jung, J. C., Ra, H., Solgaard, O., Schnitzer, M. J.
2009; 34 (15): 2309-2311
- **In vivo fluorescence imaging with high-resolution microlenses** *NATURE METHODS*
Barretto, R. P., Messerschmidt, B., Schnitzer, M. J.
2009; 6 (7): 511-U61
- **Motor Behavior Activates Bergmann Glial Networks** *NEURON*
Nimmerjahn, A., Mukamel, E. A., Schnitzer, M. J.
2009; 62 (3): 400-412
- **Advances in Light Microscopy for Neuroscience** *ANNUAL REVIEW OF NEUROSCIENCE*
Wilt, B. A., Burns, L. D., Ho, E. T., Ghosh, K. K., Mukamel, E. A., Schnitzer, M. J.
2009; 32: 435-506
- **IMAGING SARCOMERES OF EXTENSOR CARPI RADIALIS BREVIS IN HUMANS USING MINIMALLY INVASIVE MICROENDOSCOPY** *ASME Summer Bioengineering Conference*
Cromie, M. J., Sanchez, G. N., Schnitzer, M. J., Delp, S. L.
AMER SOC MECHANICAL ENGINEERS.2009: 1009-1010
- **High-speed, miniaturized fluorescence microscopy in freely moving mice** *NATURE METHODS*
Flusberg, B. A., Nimmerjahn, A., Cocker, E. D., Mukamel, E. A., Barretto, R. P., Ko, T. H., Burns, L. D., Jung, J. C., Schnitzer, M. J.
2008; 5 (11): 935-938
- **Lock-and-key mechanisms of cerebellar memory recall based on rebound currents** *JOURNAL OF NEUROPHYSIOLOGY*
Wetmore, D. Z., Mukamel, E. A., Schnitzer, M. J.
2008; 100 (4): 2328-2347
- **Minimally invasive high-speed imaging of sarcomere contractile dynamics in mice and humans** *NATURE*
Llewellyn, M. E., Barretto, R. P., Delp, S. L., Schnitzer, M. J.
2008; 454 (7205): 784-788
- **A portable two-photon fluorescence microendoscope based on a two-dimensional scanning mirror** *IEEE/LEOS International Conference on Optical MEMS and Nanophotonics*

Piyawattanametha, W., Cocker, E. D., Barretto, R. P., Jung, J. C., Flusberg, B. A., Ra, H., Solgaard, O., Schnitzer, M. J.
IEEE.2007: 6-7

- **Long-term cellular level imaging of deep brain areas using one- and two-photon fluorescence microendoscopy** *51st Annual Meeting of the Biophysical Society*
Ko, T. H., Jung, J. C., Barretto, R. P., Wang, T. J., Capps, G., Recht, L., Schnitzer, M. J.
CELL PRESS.2007: 155A-155A
- **Next-generation optical technologies for illuminating genetically targeted brain circuits** *JOURNAL OF NEUROSCIENCE*
Deisseroth, K., Feng, G., Majewska, A. K., Miesenbock, G., Ting, A., Schnitzer, M. J.
2006; 26 (41): 10380-10386
- **Fast-scanning two-photon fluorescence imaging based on a microelectromechanical systems two-dimensional scanning mirror** *OPTICS LETTERS*
Piyawattanametha, W., Barretto, R. P., Ko, T. H., Flusberg, B. A., Cocker, E. D., Ra, H., Lee, D., Solgaard, O., Schnitzer, M. J.
2006; 31 (13): 2018-2020
- **In vivo Imaging of mammalian cochlear blood flow using fluorescence microendoscopy** *Annual Meeting of the American-Neurotology-Society*
Monfared, A., Blevins, N. H., Cheung, E. L., Jung, J. C., Popelka, G., Schnitzer, M. J.
LIPPINCOTT WILLIAMS & WILKINS.2006: 144-52
- **Fiber-optic fluorescence imaging** *NATURE METHODS*
Flusberg, B. A., Cocker, E. D., Piyawattanametha, W., Jung, J. C., Cheung, E. L., Schnitzer, M. J.
2005; 2 (12): 941-950
- **Statistical kinetics of macromolecular dynamics** *BIOPHYSICAL JOURNAL*
Shaevitz, J. W., Block, S. M., Schnitzer, M. J.
2005; 89 (4): 2277-2285
- **In vivo brain imaging using a portable 3.9 gram two-photon fluorescence microendoscope** *OPTICS LETTERS*
Flusberg, B. A., Lung, J. C., Cocker, E. D., Anderson, E. P., Schnitzer, M. J.
2005; 30 (17): 2272-2274
- **Retinal coding of visual scenes - Repetitive and redundant too?** *NEURON*
Mukamel, E. A., Schnitzer, M. J.
2005; 46 (3): 357-359
- **Fiber optic two-photon fluorescence microendoscopy: Towards brain imaging in freely moving mice** *Conference on Lasers and Electro-Optics (CLEO)*
Flusberg, B. A., Jung, J. C., Cocker, E. D., Anderson, E. P., Schnitzer, M. J.
OPTICAL SOC AMERICA.2005: 2233-2235
- **In vivo mammalian brain Imaging using one- and two-photon fluorescence microendoscopy** *JOURNAL OF NEUROPHYSIOLOGY*
Jung, J. C., Mehta, A. D., Aksay, E., Stepnoski, R., Schnitzer, M. J.
2004; 92 (5): 3121-3133
- **Fiber optic in vivo imaging in the mammalian nervous system** *CURRENT OPINION IN NEUROBIOLOGY*
Mehta, A. D., Jung, J. C., Flusberg, B. A., Schnitzer, M. J.
2004; 14 (5): 617-628
- **Multiphoton endoscopy** *OPTICS LETTERS*
Jung, J. C., Schnitzer, M. J.
2003; 28 (11): 902-904
- **Multineuronal firing patterns in the signal from eye to brain** *NEURON*
Schnitzer, M. J., Meister, M.
2003; 37 (3): 499-511
- **Biological computation: Amazing algorithms** *NATURE*
Schnitzer, M. J.
2002; 416 (6882): 683-683

- **Molecular motors - Doing a rotary two-step** *NATURE*
Schnitzer, M. J.
2001; 410 (6831): 878-?
- **Force production by single kinesin motors** *NATURE CELL BIOLOGY*
Schnitzer, M. J., Visscher, K., Block, S. M.
2000; 2 (10): 718-723
- **Single kinesin molecules studied with a molecular force clamp** *NATURE*
Visscher, K., Schnitzer, M. J., Block, S. M.
1999; 400 (6740): 184-189
- **Force and velocity measured for single molecules of RNA polymerase** *SCIENCE*
Wang, M. D., Schnitzer, M. J., Yin, H., Landick, R., Gelles, J., Block, S. M.
1998; 282 (5390): 902-907
- **Kinesin hydrolyses one ATP per 8-nm step** *NATURE*
Schnitzer, M. J., Block, S. M.
1997; 388 (6640): 386-390
- **Statistical kinetics of processive enzymes** *Cold Spring Harbor Symposia on Quantitative Biology - Protein Kinesis: The Dynamics of Protein Trafficking and Stability*
Schnitzer, M. J., Block, S. M.
COLD SPRING HARBOR LAB PRESS, PUBLICATIONS DEPT.1995: 793-802
- **Theory of continuum random walks and application to chemotaxis.** *Physical review. E, Statistical physics, plasmas, fluids, and related interdisciplinary topics*
Schnitzer, M. J.
1993; 48 (4): 2553-68