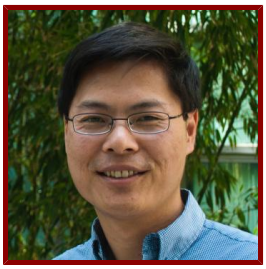
Stanford



Michael Lin

Professor of Neurobiology, of Bioengineering and, by courtesy, of Chemical and Systems Biology

NIH Biosketch available Online Curriculum Vitae available Online

CONTACT INFORMATION

- **Administrative Contact**

  Alissa Ceja - Administrative Assistant

  Email alceja@stanford.edu

  Tel (650) 498-1780

Bio

BIO

Michael Lin, MD PhD, is Professor of Neurobiology and Bioengineering, and by courtesy, Chemical and Systems Biology. Dr. Lin received his BA summa cum laude from Harvard University in biochemistry, then obtained a PhD at Harvard Medical School with Michael Greenberg studying signal transduction pathways controlling cell shape. After completing his MD training at UCLA, Dr. Lin performed postdoctoral research in engineering protein sensors and controllers with Roger Tsien at UCSD.

Dr. Lin is a translational synthetic biologist developing novel technologies to investigate in vivo biology and improve molecular medicines. Among his contributions have been the introduction of viral proteases and protease inhibitors to control protein function in vivo, the invention of cofactor-independent photoswitchable proteins for investigating signaling dynamics and controlling gene editing in vivo, the development of fluorescent voltage-sensing proteins for understanding neuronal circuit signaling in vivo, the discovery of luciferase-based reporters and substrates for non-invasive imaging of biochemical events in vivo, and the engineering of synthetic signaling pathways to rewire cancer signals to therapeutic outputs for tumor eradication in vivo.

ACADEMIC APPOINTMENTS

- Professor, Neurobiology
- Professor, Bioengineering
- Professor (By courtesy), Chemical and Systems Biology
- Member, Bio-X
- Member, Cardiovascular Institute
- Member, Maternal & Child Health Research Institute (MCHRI)
- Faculty Fellow, Sarafan ChEM-H
- Member, Stanford Cancer Institute
- Member, Wu Tsai Neurosciences Institute

HONORS AND AWARDS

- Burroughs Wellcome Career Award for Medical Scientists, Burroughs Wellcome Foundation (2007-2013)
- Damon Runyon-Rachleff Cancer Innovation Award, Damon Runyon Foundation (2012-2014)
- Pioneer Award, NIH (2013-2018)
- Roger Tsien Award for Excellence in Chemical Biology, World Molecular Imaging Society (2019)

PROFESSIONAL EDUCATION

- BA, Harvard University , Biochemical Sciences (1994)
- PhD, Harvard Medical School , Biological & Biomedical Sciences, Lab of Michael E. Greenberg (2002)
- MD, UCLA , Medicine (2004)
- Postdoctoral Fellowship, UCSD , Lab of Roger Y. Tsien (2009)

LINKS

- Lin Lab Web Site: https://linlab.stanford.edu

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Our lab applies biochemical and engineering principles to the development of protein-based tools for investigating biology in living animals. Topics of investigation include fluorescent protein-based voltage indicators, synthetic light-controllable proteins, bioluminescent reporters, and applications to studying animal models of disease.

Teaching

COURSES

2025-26

- Protein Engineering: BIOE 231, BIOE 331 (Spr)

2024-25

- Protein Engineering: BIOE 231, BIOE 331 (Spr)

2023-24

- Protein Engineering: BIOE 231, BIOE 331 (Spr)

2022-23

- Protein Engineering: BIOE 231, BIOE 331 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Yuxi Ke, Lexy Strom, Xiaowei Zhang

Postdoctoral Faculty Sponsor

Daesun Song, Yiting Wang, Xinzhi Zou

Doctoral Dissertation Advisor (AC)

Julisia Chau, Pengli Wang

Master's Program Advisor

Wen-Chieh Chao, Hunter Hendrix, Alexander Shih, Clara Yi, Xucheng Zhang

Undergraduate Major Advisor

Spencer Cha

Doctoral (Program)

Sijbren Kramer, Zixuan Liu, Shuyu Shi, Yinglin Situ

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Neurosciences (Phd Program)

Publications

PUBLICATIONS

- **A fast and responsive voltage indicator with enhanced sensitivity for unitary synaptic events.** *Neuron*
  Hao, Y. A., Lee, S., Roth, R. H., Natale, S., Gomez, L., Taxidis, J., O'Neill, P. S., Villette, V., Bradley, J., Wang, Z., Jiang, D., Zhang, G., Sheng, et al
  2024
- **A positively tuned voltage indicator for extended electrical recordings in the brain.** *Nature methods*
  Evans, S. W., Shi, D., Chavarha, M., Plitt, M. H., Taxidis, J., Madruga, B., Fan, J. L., Hwang, F., van Keulen, S. C., Suomivuori, C., Pang, M. M., Su, S., Lee, et al
  2023; 20 (7): 1104-1113
- **Kinase-Modulated Bioluminescent Indicators Enable Noninvasive Imaging of Drug Activity in the Brain.** *ACS central science*
  Wu, Y., Walker, J. R., Westberg, M., Ning, L., Monje, M., Kirkland, T. A., Lin, M. Z., Su, Y.
  2023; 9 (4): 719-732
- **Optobiochemistry: Genetically Encoded Control of Protein Activity by Light.** *Annual review of biochemistry*
  Seong, J., Lin, M. Z.
  2021
- **A compact synthetic pathway rewires cancer signaling to therapeutic effector release.** *Science (New York, N.Y.)*
  Chung, H. K., Zou, X. n., Bajar, B. T., Brand, V. R., Huo, Y. n., Alcudia, J. F., Ferrell, J. E., Lin, M. Z.
  2019; 364 (6439)
- **StaPLs: versatile genetically encoded modules for engineering drug-inducible proteins.** *Nature methods*
  Jacobs, C. L., Badiee, R. K., Lin, M. Z.
  2018; 15 (7): 523–26
- **Optical control of cell signaling by single-chain photoswitchable kinases.** *Science*
  Zhou, X. X., Fan, L. Z., Li, P., Shen, K., Lin, M. Z.
  2017; 355 (6327): 836-842
- **Fluorescent indicators for simultaneous reporting of all four cell cycle phases.** *Nature methods*
  Bajar, B. T., Lam, A. J., Badiee, R. K., Oh, Y., Chu, J., Zhou, X. X., Kim, N., Kim, B. B., Chung, M., Yablonovitch, A. L., Cruz, B. F., Kulalert, K., Tao, et al
  2016
- **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
- **Non-invasive intravital imaging of cellular differentiation with a bright red-excitable fluorescent protein** *NATURE METHODS*
  Chu, J., Haynes, R. D., Corbel, S. Y., Li, P., Gonzalez-Gonzalez, E., Burg, J. S., Ataie, N. J., Lam, A. J., Cranfill, P. J., Baird, M. A., Davidson, M. W., Ng, H., Garcia, et al
  2014; 11 (5): 572-578

- **Bright calcium-modulated bioluminescent indicators for activity imaging and red photon-assisted synaptic transmission.** *bioRxiv : the preprint server for biology*
  Zhao, Y., Porta-de-la-Riva, M., Lee, S., Wu, Y., Klein, M., Hall, M. P., Su, Y., Encell, L. P., Kirkland, T. A., Krieg, M., Lin, M. Z.
  2026
- **Steric disruption of EGFR oligomerization overcomes therapy resistance in non-small cell lung cancer.** *Science advances*
  Song, D., Jang, J., Lin, M. Z., Jung, Y.
  2025; 11 (49): eady7032
- **Novel Near-Infrared Fluorescent Protein for Biliverdin Biosensing with a Hydrogel Scaffold.** *ACS sensors*
  Zhao, Y., Kim, B. B., Sit, V. M., Malic, L., Veres, T., Lin, M. Z.
  2025
- **Kilohertz volumetric imaging of in vivo dynamics using squeezed light field microscopy.** *Nature methods*
  Wang, Z., Zhao, R., Wagenaar, D. A., Espino, D., Sheintuch, L., Benshlomo, O., Kang, W., Zhu, E., Lee, C. K., Schmidt, W. C., Pammar, A., Wang, J., Wong, et al
  2025; 22 (10): 2194-2204
- **Voltage imaging reveals hippocampal inhibitory dynamics shaping pyramidal memory-encoding sequences.** *Nature neuroscience*
  Taxidis, J., Madruga, B., Safaryan, K., Dorian, C. C., Melin, M. D., Day, Z., Lin, M. Z., Golshani, P.
  2025
- **Imaging high-frequency voltage dynamics in multiple neuron classes of behaving mammals.** *Cell*
  Haziza, S., Chrapkiewicz, R., Zhang, Y., Kruzhilin, V., Li, J., Li, J., Delamare, G., Swanson, R., Buzsaki, G., Kannan, M., Vasan, G., Lin, M. Z., Zeng, et al
  2025
- **Imaging sensory transmission and neuronal plasticity in primary sensory neurons with a positively tuned voltage indicator.** *Nature communications*
  Zhang, Y., Shannonhouse, J., Gomez, R., Son, H., Ishida, H., Evans, S., Chavarha, M., Shi, D., Zhang, G., Lin, M. Z., Kim, Y. S.
  2025; 16 (1): 6396
- **An optimized luciferin formulation for NanoLuc-based in vivo bioluminescence imaging.** *Scientific reports*
  Gao, C., Wu, Y., Fitzgerald, C., Wang, H., Ugo, T., Uyeda, T., Zhou, W., Su, Y., Kirkland, T. A., Lin, M. Z.
  2025; 15 (1): 12884
- **An axonal brake on striatal dopamine output by cholinergic interneurons.** *Nature neuroscience*
  Zhang, Y., Luan, P., Qiao, Q., He, Y., Zatka-Haas, P., Zhang, G., Lin, M. Z., Lak, A., Jing, M., Mann, E. O., Cragg, S. J.
  2025
- **A deep learning framework for automated and generalized synaptic event analysis.** *eLife*
  O'Neill, P. S., Baccino-Calace, M., Rupprecht, P., Lee, S., Hao, Y. A., Lin, M. Z., Friedrich, R. W., Mueller, M., Delvendahl, I.
  2025; 13
- **A robust fluorogenic substrate for chikungunya virus protease (nsP2) activity.** *Protein science : a publication of the Protein Society*
  Makhaik, S., Rut, W., Choudhary, S., Upadhyay, T., Hao, C., Westberg, M., Bobst, C., Yoo, E., Fejzo, J., Lin, M. Z., Bogyo, M., Thompson, P., Drag, et al
  2025; 34 (3): e70069
- **Visualizing drug effects over time in live animals using optical pharmacodynamics** *NATURE CHEMICAL BIOLOGY*
  Wu, Y., Su, Y., Lin, M.
  2025
- **Pharmacodynamics of Akt drugs revealed by a kinase-modulated bioluminescent indicator.** *Nature chemical biology*
  Wu, Y., Hao, C., Gao, C., Hageman, M., Lee, S., Kirkland, T. A., Gray, N. S., Su, Y., Lin, M. Z.
  2025
- **Synaptic basis of feature selectivity in hippocampal neurons.** *Nature*
  Gonzalez, K. C., Negrean, A., Liao, Z., Terada, S., Zhang, G., Lee, S., Ócsai, K., Rózsa, B. J., Lin, M. Z., Polleux, F., Losonczy, A.
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- **Deep two-photon voltage imaging with adaptive excitation.** *Research square*
  Zhao, S., Hebert, E., Gruzdeva, A., Mahishi, D., Takahashi, H., Lee, S., Hao, Y. A., Lin, M. Z., Yapici, N., Xu, C.
  2024
- **Replication Capacity and Susceptibility of Nirmatrelvir-Resistant Mutants to Next-Generation Mpro Inhibitors in a SARS-CoV-2 Replicon System.** *Antiviral research*
  Lo, C., Kariv, O., Hao, C., Gammeltoft, K. A., Bukh, J., Gottwein, J., Westberg, M., Lin, M. Z., Einav, S.
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- **Imaging high-frequency voltage dynamics in multiple neuron classes of behaving mammals.** *bioRxiv : the preprint server for biology*
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  2024; 15 (1): 6295
- **An orally bioavailable SARS-CoV-2 main protease inhibitor exhibits improved affinity and reduced sensitivity to mutations.** *Science translational medicine*
  Westberg, M., Su, Y., Zou, X., Huang, P., Rustagi, A., Garhyan, J., Patel, P. B., Fernandez, D., Wu, Y., Hao, C., Lo, C. W., Karim, M., Ning, et al
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- **Dendritic mGluR2 and perisomatic Kv3 signaling regulate dendritic computation of mouse starburst amacrine cells.** *Nature communications*
  Acarón Ledesma, H., Ding, J., Oosterboer, S., Huang, X., Chen, Q., Wang, S., Lin, M. Z., Wei, W.
  2024; 15 (1): 1819
- **Functional architecture of intracellular oscillations in hippocampal dendrites.** *bioRxiv : the preprint server for biology*
  Liao, Z., Gonzalez, K. C., Li, D. M., Yang, C. M., Holder, D., McClain, N. E., Zhang, G., Evans, S. W., Chavarha, M., Yi, J., Makinson, C. D., Lin, M. Z., Losonczy, et al
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- **Imaging of Evoked Cortical Depolarizations Using Either ASAP2s, or chi-VSFP, or Di-4-Anepps, or Autofluorescence Optical Signals.** *Journal of integrative neuroscience*
  Milicevic, K. D., Zhu, M. H., Barbeau, B. L., Baser, O., Erol, Z. Y., Liu, L. X., Lin, M. Z., Antic, S. D.
  2023; 22 (6): 160
- **Machine learning identifies experimental brain metastasis subtypes based on their influence on neural circuits.** *Cancer cell*
  Sanchez-Aguilera, A., Masmudi-Martín, M., Navas-Olive, A., Baena, P., Hernández-Oliver, C., Priego, N., Cordón-Barris, L., Alvaro-Espinosa, L., García, S., Martínez, S., Lafarga, M., Lin, M. Z., Al-Shahrour, et al
  2023
- **Kinase-Modulated Bioluminescent Indicators Enable Noninvasive Imaging of Drug Activity in the Brain** *ACS CENTRAL SCIENCE*
  Wu, Y., Walker, J. R., Westberg, M., Ning, L., Monje, M., Kirkland, T. A., Lin, M. Z., Su, Y.
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- **An optimized bioluminescent substrate for non-invasive imaging in the brain.** *Nature chemical biology*
  Su, Y., Walker, J. R., Hall, M. P., Klein, M. A., Wu, X., Encell, L. P., Casey, K. M., Liu, L. X., Hong, G., Lin, M. Z., Kirkland, T. A.
  2023
- **Non-invasive bioluminescent imaging of kinase inhibition in mouse brain**
  Su, Y., Wu, Y., Lin, M.
  WILEY.2023
- **Rational Design of Improved and Novel Photodissociable GFPs and RFPs**
  Westberg, M., Trigo, M. L., Devenish, S., Huang, P., Lin, M. Z.
  WILEY.2023
- **Track: Protein Phase Separation in Biomolecular Condensates Using Phase Separation as Mechanism to Enhance Inducibility of a Synthetic Therapeutic Pathway**

Chau, J., Westberg, M., Song, D., Lin, M.
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- **Combinatorial effects of RhoA and Cdc42 on the actin cytoskeleton revealed by photoswitchable GEFs** *SENSORS AND ACTUATORS B-CHEMICAL*
  Ryu, H., Lee, H., Ju, J., Park, J., Oh, E., Lin, M. Z., Seong, J.
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  Ju, J., Lee, H. N., Ning, L., Ryu, H., Zhou, X. X., Chun, H., Lee, Y. W., Lee-Richerson, A. I., Jeong, C., Lin, M. Z., Seong, J.
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- **Enhanced safety and efficacy of protease-regulated CAR-T cell receptors.** *Cell*
  Labanieh, L., Majzner, R. G., Klysz, D., Sotillo, E., Fisher, C. J., Vilches-Moure, J. G., Pacheco, K. Z., Malipatlolla, M., Xu, P., Hui, J. H., Murty, T., Theruvath, J., Mehta, et al
  2022

- **A red fluorescent protein with improved monomericity enables ratiometric voltage imaging with ASAP3.** *Scientific reports*
  Kim, B. B., Wu, H., Hao, Y. A., Pan, M., Chavarha, M., Zhao, Y., Westberg, M., St-Pierre, F., Wu, J. C., Lin, M. Z.
  2022; 12 (1): 3678

- **FRET Imaging of Rho GTPase Activity with Red Fluorescent Protein-Based FRET Pairs.** *Methods in molecular biology (Clifton, N.J.)*
  Bajar, B. T., Guan, X., Lam, A., Lin, M. Z., Yasuda, R., Laviv, T., Chu, J.
  2022; 2438: 31-43

- **A Bright, Nontoxic, and Non-aggregating red Fluorescent Protein for Long-Term Labeling of Fine Structures in Neurons.** *Frontiers in cell and developmental biology*
  Ning, L., Geng, Y., Lovett-Barron, M., Niu, X., Deng, M., Wang, L., Ataie, N., Sens, A., Ng, H., Chen, S., Deisseroth, K., Lin, M. Z., Chu, et al
  2022; 10: 893468

- **Optical control of fast and processive engineered myosins in vitro and in living cells.** *Nature chemical biology*
  Ruijgrok, P. V., Ghosh, R. P., Zemsky, S. n., Nakamura, M. n., Gong, R. n., Ning, L. n., Chen, R. n., Vachharajani, V. T., Chu, A. E., Anand, N. n., Eguchi, R. R., Huang, P. S., Lin, et al
  2021

- **Brightening up Biology: Advances in Luciferase Systems for in Vivo Imaging.** *ACS chemical biology*
  Liu, S., Su, Y., Lin, M. Z., Ronald, J. A.
  2021

- **Simultaneous Detection of Four Cell Cycle Phases with Live Fluorescence Imaging.** *Methods in molecular biology (Clifton, N.J.)*
  Bajar, B. T., Lin, M. Z.
  2021; 2274: 25-35

- **Integrated Neurophotonics: Toward Dense Volumetric Interrogation of Brain Circuit Activity-at Depth and in Real Time.** *Neuron*
  Moreaux, L. C., Yatsenko, D., Sacher, W. D., Choi, J., Lee, C., Kubat, N. J., Cotton, R. J., Boyden, E. S., Lin, M. Z., Tian, L., Tolias, A. S., Poon, J. K., Shepard, et al
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  Su, Y., Walker, J. R., Park, Y., Smith, T. P., Liu, L. X., Hall, M. P., Labanieh, L., Hurst, R., Wang, D. C., Encell, L. P., Kim, N., Zhang, F., Kay, et al
  2020

- **On the cutting edge: protease-based methods for sensing and controlling cell biology.** *Nature methods*
  Chung, H. K., Lin, M. Z.
  2020

- **Kilohertz two-photon fluorescence microscopy imaging of neural activity in vivo.** *Nature methods*
  Wu, J., Liang, Y., Chen, S., Hsu, C., Chavarha, M., Evans, S. W., Shi, D., Lin, M. Z., Tsia, K. K., Ji, N.
  2020

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Li, B. n., Chavarha, M. n., Kobayashi, Y. n., Yoshinaga, S. n., Nakajima, K. n., Lin, M. Z., Inoue, T. n.
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- **An Axonal Blueprint: Generating Neuronal Polarity with Light-Inducible Proteins.** *Cell chemical biology*
  Lin, M. Z.
  2019; 26 (12): 1634-1636
- **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
- **Novel NanoLuc substrates enable bright and sustained bioluminescence imaging in animals**
  Walker, J., Park, Y., Smith, T., Wang, D., Hall, M., Liu, L., Hurst, R., Su, Y., Encell, L., Kim, N., Casey, K., Kirkland, T., Lin, et al
  AMER CHEMICAL SOC.2019
- **Novel substrates for NanoLuc luciferase with improved brightness and signal duration for bioluminescence imaging in vivo**
  Walker, J. R., Park, Y., Lin, M., Kirkland, T. A., Hall, M. P., Encell, L. P., Oh, Y., Liu, L.
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- **SYNTHETIC BIOLOGY A compact synthetic pathway rewires cancer signaling to therapeutic effector release** *SCIENCE*
  Chung, H. K., Zou, X., Bajar, B. T., Brand, V. R., Huo, Y., Alcudia, J. F., Ferrell, J. E., Lin, M. Z.
  2019; 364 (6439): 451-+
- **An orange calcium-modulated bioluminescent indicator for non-invasive activity imaging** *NATURE CHEMICAL BIOLOGY*
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  Yang, Y. n., Geng, Y. n., Jiang, D. n., Ning, L. n., Kim, H. J., Jeon, N. L., Lau, A. n., Chen, L. n., Lin, M. Z.
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  2018; 174 (2): 465-+
- **Excitation wavelength optimization improves photostability of ASAP-family GEVIs** *MOLECULAR BRAIN*
  Xu, F., Shi, D., Lau, P., Lin, M. Z., Bi, G.
  2018; 11: 32
- **A Single-Chain Photoswitchable CRISPR-Cas9 Architecture for Light-Inducible Gene Editing and Transcription.** *ACS chemical biology*
  Zhou, X. X., Zou, X., Chung, H. K., Gao, Y., Liu, Y., Qi, L. S., Lin, M. Z.
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- **Understanding CRY2 interactions for optical control of intracellular signaling** *NATURE COMMUNICATIONS*
  Duan, L., Hope, J., Ong, Q., Lou, H., Kim, N., McCarthy, C., Acero, V., Lin, M. Z., Cui, B.
  2017; 8: 547
- **The Growing and Glowing Toolbox of Fluorescent and Photoactive Proteins** *TRENDS IN BIOCHEMICAL SCIENCES*
  Rodriguez, E. A., Campbell, R. E., Lin, J. Y., Lin, M. Z., Miyawaki, A., Palmer, A. E., Shu, X., Zhang, J., Tsien, R. Y.
  2017; 42 (2): 111-129

- **A Single-Chain Photoswitchable CRISPR-Cas9 Architecture for Light-Inducible Gene Editing and Transcription** *A Single-Chain Photoswitchable CRISPR-Cas9 Architecture for Light-Inducible Gene Editing and Transcription*
  Zhou, X. X., Zou, X., Chung, H. K., Gao, Y., Liu, Y., QI, L. S., Lin, M. Z.
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  2017; 6
- **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-?
- **The Growing and Glowing Toolbox of Fluorescent and Photoactive Proteins.** *Trends in biochemical sciences*
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  2016
- **Simultaneous dual-color fluorescence lifetime imaging with novel red-shifted fluorescent proteins.** *Nature methods*
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  2016
- **A Guide to Fluorescent Protein FRET Pairs** *SENSORS*
  Bajar, B. T., Wang, E. S., Zhang, S., Lin, M. Z., Chu, J.
  2016; 16 (9)
- **Genetically encoded indicators of neuronal activity.** *Nature neuroscience*
  Lin, M. Z., Schnitzer, M. J.
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  Ng, H., Lin, M. Z.
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  2016; 34 (7): 760-767
- **Subcellular Imaging of Voltage and Calcium Signals Reveals Neural Processing In Vivo** *CELL*
  Yang, H. H., St-Pierre, F., Sun, X., Ding, X., Lin, M. Z., Clandinin, T. R.
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- **Quantitative Multiscale Cell Imaging in Controlled 3D Microenvironments.** *Developmental cell*
  Welf, E. S., Driscoll, M. K., Dean, K. M., Schäfer, C., Chu, J., Davidson, M. W., Lin, M. Z., Danuser, G., Fiolka, R.
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- **Improving brightness and photostability of green and red fluorescent proteins for live cell imaging and FRET reporting** *SCIENTIFIC REPORTS*
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