


## Michael Lin

Associate 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

Lori Bates - Administrative Assistant

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**Tel** (650) 736-9356##

### Bio

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### BIO

Our lab applies biochemical and engineering principles to the development of protein-based tools for imaging and control of biochemical processes. Topics of investigation include fluorescent proteins structure and biophysics, fluorescent protein-based biosensors, neuronal activity sensors, spatiotemporal analysis of protein translation pathways, chemical control of protein translation, and light-responsive proteins.

### ACADEMIC APPOINTMENTS

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

### PROFESSIONAL EDUCATION

- BA, Harvard University , Biochemistry (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: <http://www.stanford.edu/~mzlin/>

## Research & Scholarship

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### 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

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### COURSES

#### 2018-19

- Protein Engineering: BIOE 231 (Win)

#### 2016-17

- Molecular and Cellular Engineering Lab: BIOE 301A (Aut)

#### 2015-16

- Molecular and Cellular Engineering Lab: BIOE 301A (Aut)

### STANFORD ADVISEES

#### Doctoral Dissertation Reader (AC)

Jen Hope, Ruben Land, Aaron Mayer

#### Postdoctoral Faculty Sponsor

Dongyun Jiang, Lin Ning, Yichi Su, Yufeng Zhao

#### Master's Program Advisor

Christian Choe, Chris Hughes

#### Doctoral (Program)

Derek Croote, Hannah Kempton, Nathan Kipniss

### GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Neurosciences (Phd Program)

## Publications

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### PUBLICATIONS

- **A Suite of Transgenic Driver and Reporter Mouse Lines with Enhanced Brain-Cell-Type Targeting and Functionality** *CELL*  
Daigle, T. L., Madisen, L., Hage, T. A., Valley, M. T., Knoblich, U., Larsen, R. S., Takeno, M. M., Huang, L., Gu, H., Larsen, R., Mills, M., Bosma-Moody, A., Siverts, et al  
2018; 174 (2): 465+
- **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

- **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
- **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
- **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
- **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.  
2017: 443-48
- **Fast two-photon imaging of subcellular voltage dynamics in neuronal tissue with genetically encoded indicators.** *eLife*  
Chamberland, S., Yang, H. H., Pan, M. M., Evans, S. W., Guan, S., Chavarha, M., Yang, Y., Salesse, C., Wu, H., Wu, J. C., Clandinin, T. R., Toth, K., Lin, et al  
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*  
Rodriguez, E. A., Campbell, R. E., Lin, J. Y., Lin, M. Z., Miyawaki, A., Palmer, A. E., Shu, X., Zhang, J., Tsien, R. Y.  
2016
- **Fluorescent indicators for simultaneous reporting of all four cell cycle phases.** *Nature methods*  
Bajar, B. T., Lam, A. J., Badiie, 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
- **Simultaneous dual-color fluorescence lifetime imaging with novel red-shifted fluorescent proteins.** *Nature methods*  
Laviv, T., Kim, B. B., Chu, J., Lam, A. J., Lin, M. Z., Yasuda, R.  
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.  
2016; 19 (9): 1142-1153
- **Structure-guided wavelength tuning in far-red fluorescent proteins.** *Current opinion in structural biology*  
Ng, H., Lin, M. Z.  
2016; 39: 124-133
- **A bright cyan-excitable orange fluorescent protein facilitates dual-emission microscopy and enhances bioluminescence imaging in vivo.** *Nature biotechnology*  
Chu, J., Oh, Y., Sens, A., Ataie, N., Dana, H., Macklin, J. J., Laviv, T., Welf, E. S., Dean, K. M., Zhang, F., Kim, B. B., Tang, C. T., Hu, et al  
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.

2016; 166 (1): 245-257

- **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.  
2016; 36 (4): 462-475
- **Improving brightness and photostability of green and red fluorescent proteins for live cell imaging and FRET reporting** *SCIENTIFIC REPORTS*  
Bajar, B. T., Wang, E. S., Lam, A. J., Kim, B. B., Jacobs, C. L., Howe, E. S., Davidson, M. W., Lin, M. Z., Chu, J.  
2016; 6
- **Replication-Competent Influenza Virus and Respiratory Syncytial Virus Luciferase Reporter Strains Engineered for Co-Infections Identify Antiviral Compounds in Combination Screens.** *Biochemistry*  
Yan, D., Weisshaar, M., Lamb, K., Chung, H. K., Lin, M. Z., Plemper, R. K.  
2015; 54 (36): 5589-5604
- **Optical control of biological processes by light-switchable proteins** *WILEY INTERDISCIPLINARY REVIEWS-DEVELOPMENTAL BIOLOGY*  
Fan, L. Z., Lin, M. Z.  
2015; 4 (5): 545-554
- **Tunable and reversible drug control of protein production via a self-excising degron.** *Nature chemical biology*  
Chung, H. K., Jacobs, C. L., Huo, Y., Yang, J., Krumm, S. A., Plemper, R. K., Tsien, R. Y., Lin, M. Z.  
2015; 11 (9): 713-720
- **Tunable and reversible drug control of protein production via a self-excising degron** *NATURE CHEMICAL BIOLOGY*  
Chung, H. K., Jacobs, C. L., Huo, Y., Yang, J., Krumm, S. A., Plemper, R. K., Tsien, R. Y., Lin, M. Z.  
2015; 11 (9): 713-?
- **Optical control of biological processes by light-switchable proteins.** *Wiley interdisciplinary reviews. Developmental biology*  
Fan, L. Z., Lin, M. Z.  
2015; 4 (5): 545-554
- **Designs and sensing mechanisms of genetically encoded fluorescent voltage indicators.** *Current opinion in chemical biology*  
St-Pierre, F., Chavarha, M., Lin, M. Z.  
2015; 27: 31-38
- **Experimental systems for optogenetic control of protein activity with photodissociable fluorescent proteins** *Conference on Optical Techniques in Neurosurgery, Neurophotonics, and Optogenetics II*  
Zhou, X. X., Lin, M. Z.  
SPIE-INT SOC OPTICAL ENGINEERING.2015
- **Investigating neuronal function with optically controllable proteins.** *Frontiers in molecular neuroscience*  
Zhou, X. X., Pan, M., Lin, M. Z.  
2015; 8: 37-?
- **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
- **Optobiology: optical control of biological processes via protein engineering** *BIOCHEMICAL SOCIETY TRANSACTIONS*  
Kim, B., Lin, M. Z.  
2013; 41: 1183-1188
- **Photoswitchable fluorescent proteins: ten years of colorful chemistry and exciting applications.** *Current opinion in chemical biology*  
Zhou, X. X., Lin, M. Z.  
2013; 17 (4): 682-690

- **Fluorescent and photo-oxidizing TimeSTAMP tags track protein fates in light and electron microscopy** *NATURE NEUROSCIENCE*  
Butko, M. T., Yang, J., Geng, Y., Kim, H. J., Jeon, N. L., Shu, X., Mackey, M. R., Ellisman, M. H., Tsien, R. Y., Lin, M. Z.  
2012; 15 (12): 1742-?
- **New Alternately Colored FRET Sensors for Simultaneous Monitoring of Zn<sup>2+</sup> in Multiple Cellular Locations** *PLOS ONE*  
Miranda, J. G., Weaver, A. L., Qin, Y., Park, J. G., Stoddard, C. I., Lin, M. Z., Palmer, A. E.  
2012; 7 (11)
- **Optical Control of Protein Activity by Fluorescent Protein Domains** *SCIENCE*  
Zhou, X. X., Chung, H. K., Lam, A. J., Lin, M. Z.  
2012; 338 (6108): 810-814
- **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-?
- **Beyond the rainbow: new fluorescent proteins brighten the infrared scene** *NATURE METHODS*  
Lin, M. Z.  
2011; 8 (9): 726-728
- **Toward the Second Generation of Optogenetic Tools** *JOURNAL OF NEUROSCIENCE*  
Knoepfel, T., Lin, M. Z., Levsikaya, A., Tian, L., Lin, J. Y., Boyden, E. S.  
2010; 30 (45): 14998-15004
- **TimeSTAMP tagging of newly synthesized proteins.** *Current protocols in protein science / editorial board, John E. Coligan ... [et al.]*  
Lin, M. Z., Tsien, R. Y.  
2010; Chapter 26: Unit 26 5-?
- **Autofluorescent Proteins with Excitation in the Optical Window for Intravital Imaging in Mammals** *CHEMISTRY & BIOLOGY*  
Lin, M. Z., McKeown, M. R., Ng, H., Aguilera, T. A., Shaner, N. C., Campbell, R. E., Adams, S. R., Gross, L. A., Ma, W., Alber, T., Tsien, R. Y.  
2009; 16 (11): 1169-1179
- **Mammalian Expression of Infrared Fluorescent Proteins Engineered from a Bacterial Phytochrome** *SCIENCE*  
Shu, X., Royant, A., Lin, M. Z., Aguilera, T. A., Lev-Ram, V., Steinbach, P. A., Tsien, R. Y.  
2009; 324 (5928): 804-807
- **Characterization of Engineered Channel rhodopsin Variants with Improved Properties and Kinetics** *BIOPHYSICAL JOURNAL*  
Lin, J. Y., Lin, M. Z., Steinbach, P., Tsien, R. Y.  
2009; 96 (5): 1803-1814
- **A drug-controllable tag for visualizing newly synthesized proteins in cells and whole animals** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*  
Lin, M. Z., Glenn, J. S., Tsien, R. Y.  
2008; 105 (22): 7744-7749
- **Selective labeling of proteins with chemical probes in living cells** *PHYSIOLOGY*  
Lin, M. Z., Wang, L.  
2008; 23 (3): 131-141
- **Improving the photostability of bright monomeric orange and red fluorescent proteins** *NATURE METHODS*  
Shaner, N. C., Lin, M. Z., McKeown, M. R., Steinbach, P. A., Hazelwood, K. L., Davidson, M. W., Tsien, R. Y.  
2008; 5 (6): 545-551
- **Eph-dependent tyrosine phosphorylation of ephexin1 modulates growth cone collapse** *NEURON*  
Sahin, M., Greer, P. L., Lin, M. Z., Poucher, H., Eberhart, J., Schmidt, S., Wright, T. M., Shamah, S. M., O'Connell, S., Cowan, C. W., Hu, L., Goldberg, J. L., Debant, et al  
2005; 46 (2): 191-204
- **Survival factor-mediated BAD phosphorylation raises the mitochondrial threshold for apoptosis** *DEVELOPMENTAL CELL*

Datta, S. R., Ranger, A. M., Lin, M. Z., Sturgill, J. F., Ma, Y. C., Cowan, C. W., Dikkes, P., Korsmeyer, S. J., Greenberg, M. E.  
2002; 3 (5): 631-643

● **Neurotrophins use the Erk5 pathway to mediate a retrograde survival response** *NATURE NEUROSCIENCE*

Watson, F. L., Heerssen, H. M., BHATTACHARYYA, A., Klesse, L., Lin, M. Z., Segal, R. A.  
2001; 4 (10): 981-988

● **EphA receptors regulate growth cone dynamics through the novel guanine nucleotide exchange factor ephexin** *CELL*

Shamah, S. M., Lin, M. Z., Goldberg, J. L., Estrach, S., Sahin, M., Hu, L., Bazalakova, M., NEVE, R. L., Corfas, G., Debant, A., Greenberg, M. E.  
2001; 105 (2): 233-244

● **Neurogenin promotes neurogenesis and inhibits glial differentiation by independent mechanisms** *CELL*

Sun, Y., Nadal-Vicens, M., Misono, S., Lin, M. Z., Zubiaga, A., Hua, X. X., Fan, G. P., Greenberg, M. E.  
2001; 104 (3): 365-376

● **EphB receptors interact with NMDA receptors and regulate excitatory synapse formation** *CELL*

Dalva, M. B., Takasu, M. A., Lin, M. Z., Shamah, S. M., Hu, L., Gale, N. W., Greenberg, M. E.  
2000; 103 (6): 945-956

● **Rapid nuclear responses to target-derived neurotrophins require retrograde transport of ligand-receptor complex** *JOURNAL OF NEUROSCIENCE*

Watson, F. L., Heerssen, H. M., Moheban, D. B., Lin, M. Z., Sauvageot, C. M., BHATTACHARYYA, A., Pomeroy, S. L., Segal, R. A.  
1999; 19 (18): 7889-7900

● **Akt promotes cell survival by phosphorylating and inhibiting a forkhead transcription factor** *CELL*

Brunet, A., Bonni, A., Zigmond, M. J., Lin, M. Z., Juo, P., Hu, L. S., ANDERSON, M. J., Arden, K. C., Blenis, J., Greenberg, M. E.  
1999; 96 (6): 857-868