

## MICHAEL LIN, PH.D. M.D.

*Curriculum Vitae*

### CONTACT INFORMATION

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### EDUCATIONAL HISTORY

1994-2004        ***M.D.*, University of California Los Angeles School of Medicine, Los Angeles, CA**  
1996-2002        ***Ph.D.*, Harvard Medical School, Boston, MA, Biological and Biomedical Sciences**  
1990-1994        ***B.A., summa cum laude*, Harvard University, Cambridge, MA, Biochemistry**  
1989-1990        ***Early Action Honors Program*, University of California San Diego, San Diego, CA (concurrent with high school)**

### PROFESSIONAL POSITIONS

5/2017-present ***Associate Professor, Stanford University, Departments of Neurobiology and Bioengineering*** Also Assistant Professor by Courtesy in the Department of Chemical and Systems Biology, and Member of Bio-X, Chem-H, and the Stanford Neuroscience Institute. Developing new technologies for optical and chemical sensing and control of biology, including genetically encoded membrane voltage sensors, far-red calcium sensors, fluorescent proteins for FRET reporting, and photodissociable fluorescent proteins for optical control of protein activity. Also developed new methods for control of protein production and viral replication, including self-removable tags for rapid control of protein expression

9/2015-4/2017 ***Assistant Professor, Stanford University, Departments of Neurobiology and Bioengineering***

6/2010-8/2015 ***Assistant Professor, Stanford University, Departments of Pediatrics and Bioengineering***

5/2009-5/2010 ***Acting Assistant Professor, Stanford University, Departments of Pediatrics and Bioengineering***

6/2004-4/2009 ***Postdoctoral Fellow, Laboratory of Prof. Roger Y. Tsien, HHMI and UCSD School of Medicine, Department of Pharmacology***  
Developed tools for imaging and controlling signaling in living neurons, including a drug-controllable tag for sensitive and selective visualization and purification of newly synthesized proteins of interest, new green and red fluorescent proteins for in vivo imaging and biosensing, and improved channelrhodopsins for controlling neuronal excitability.

7/1996-6/2002 ***PhD Student, Laboratory of Prof. Michael E. Greenberg, Harvard Medical School, Departments of Microbiology and Neurobiology***  
Investigated mechanisms of signaling from extracellular stimuli to local morphological responses in neurons, specifically discovering mechanism of Eph receptor signaling to Rho GTPases via Src-mediated activation of ephexin. Developed novel knock-in and knock-out strategies for engineering mutant ephexin and BAD alleles in transgenic mice.

7/1994-6/1996 ***MD-PhD student, Laboratory of Prof. S. Larry Zipursky, UCLA School of Medicine, Department of Biological Chemistry and HHMI***  
Mapped and identified cell cycle control genes in *Drosophila*.

- 9/1991-6/1994 *Undergraduate thesis student, Laboratory of Prof. Fotis C. Kafatos, Harvard University, Department of Biology*  
Identified P-element mutations in a screen for embryogenesis genes in *Drosophila*.
- 6/1990-9/1990 *Research assistant, Protein engineering group of Dr. Margaret Moore, Hybritech Inc.*  
Designed system for reporting protein interactions using beta-galactosidase fragment complementation.

## TEACHING EXPERIENCE

- 2018 *Course chair, BioE331, protein engineering, Stanford Department of Bioengineering*
- 2010,2015-16 *Co-instructor, Stanford Neuroscience Graduate Program boot camp*
- 2016 *Co-instructor, CSB260, graduate quantitative cell biology, Stanford Department of Bioengineering*
- 2012-16 *Guest lecturer, CSB210, graduate cell signaling, Stanford Department of Chemical and Systems Biology*
- 2011-12,2015-16 *Course chair, BioE301A, graduate molecular bioengineering laboratory, Stanford Department of Bioengineering*
- 2012-15 *Guest lecturer, CSB260, graduate quantitative cell biology, Stanford Department of Chemical and Systems Biology*
- 2013-14 *Course chair, BioE141AB, undergraduate senior design course, Stanford Department of Bioengineering*
- 2013-14 *Guest lecturer, MCP222, graduate microscopy and imaging, Stanford Department of Bioengineering*
- 2012-13 *Guest lecturer, BioE331, graduate protein engineering, 2012, 2013, Stanford Department of Bioengineering*
- 2013 *Guest lecturer, BioE 80, undergraduate introduction to bioengineering, Stanford Department of Bioengineering*
- 2012 *Guest lecturer, BioE222, graduate molecular imaging, Stanford Department of Bioengineering*
- 2010-11 *Course chair, BioE393, graduate bioengineering topics seminar, Stanford Department of Bioengineering*
- 2011 *Guest lecturer, MI215, graduate biological technologies, Stanford Department of Bioengineering*
- 2010 *Guest lecturer, BioE390, graduate introduction to bioengineering research, Stanford Department of Bioengineering*
- 1999 *Teaching assistant, graduate developmental neurobiology with Profs. Christopher A. Walsh, David van Vactor, and Rosalind Segal, Harvard Medical School Department of Neurobiology*
- 1995 *Teaching assistant, undergraduate nucleic acid chemistry with Prof. Al Courey, UCLA Department of Chemistry*
- 1996 *Teaching assistant, undergraduate cell biology with Prof. Michael Grunstein, UCLA Department of Biological Chemistry*
- 1993-94 *Teaching fellow, genetics with Profs. William Gelbart and Matthew Meselson, Harvard University Department of Biochemistry*
- 1991-94 *Tutor, undergraduate biology, chemistry, and physics, Harvard University Bureau of Study Counsel*

## OTHER PROFESSIONAL ACTIVITIES

- Program Director, Master of Science in Medicine program, Stanford School of Medicine, 2018-present.
- Admissions Committee, Stanford Bioengineering PhD program, 2010-present.
- Admissions Committee, Stanford Medical Scientist Training Program, 2012-present.
- Reviewer, NIH/NIMH Special Emphasis Panel for the BRAIN Initiative, ZMH1 ERB-L (04), 5/2016.
- Reviewer, NIH/NIMH Special Emphasis Panel for the BRAIN Initiative, ZMH1 ERB-L (06), 6/2015.
- Reviewer, Cancer Prevention Institute of Texas, 2009-2013
- Reviewer, Stanford Grant Writing Academy Faculty Review Workshops, 2016
- Guest Editor, Journal of Biomedical Optics, 2013.
- Review Editorial Board Member, Frontiers in Cellular Neuroscience, 2014-present.
- Ad hoc reviewer for *Science, eLife, Neuron, Nature Biotechnology, Nature Methods, Nature Chemical Biology, Nature Neuroscience, Nature Communications, PNAS, Science Signaling, Scientific Reports, Cell Chemical Biology,*

*Journal of Neuroscience, Journal of Neurophysiology, Journal of Biomedical Optics, Brain Cell Biology, Cellular and Molecular Bioengineering, Sensors, PLoS One, Trends in Neuroscience, and Trends in Biotechnology.*

Co-organizer, Annual Meeting of the Cellular and Molecular Bioengineering Special Interest Group of the Biomedical Engineering Society, 1/2017.

Organizer, Pacificchem Symposium on Fluorescent and Bioluminescent Proteins, 12/2015.

Member, Biomedical Engineering Society, 2012-present.

Member, Society for Neuroscience, 2005-present.

Member, American Society for Cell Biology, 2006-present.

Member, Biophysical Society, 2008-present.

Member, American Society of Gene and Cell Therapy, 2010-present.

Member, American Society for Biochemistry and Molecular Biology, 2011-present.

Member, American Chemical Society, 2013-present.

Member, Protein Society, 2013-present.

Advisor, Stanford Neuroscience Institute Microscopy Core, 2014-present.

Assistant Director, Stanford Masters of Medicine Program, 2014-present.

Member, Stanford Medical Scientist Training Program Admissions Committee, 2014-present.

Co-Director, Stanford Medical School Bioengineering Scholarly Concentration, 2014-2015.

Thesis advisory committee member, Program in Neuroscience, 2010-present.

Thesis advisory committee member, Department of Bioengineering, 2010-present.

Thesis advisory committee member, Department of Chemistry, 2012-present.

Thesis advisory committee member, Department of Chemical Engineering, 2012-present.

## AWARDS AND HONORS

2013 NIH Pioneer Award, 2013.

2013 Rising Star Award, Biomedical Engineering Society, Cellular and Molecular Bioengineering Special Interest Group.

2012 Damon Runyon-Rachleff Innovation Award.

2011 Rita Allen Foundation Scholar.

2007 Burroughs Wellcome Career Award for Medical Scientists.

2005 Jane Coffin Childs Memorial Research Fellowship.

2004 Western Student Medical Research Forum Prize.

1997 U.S. Department of Defense Graduate Fellowship.

1994 NIH Medical Scientist Training Program Fellowship.

1994 Harvard University Phi Beta Kappa Honors Society.

1993 Harvard Public Service Abroad Fellowship.

1992,1993 Ford Undergraduate Research Fellowship.

1992,1993,1994 John Harvard Scholarship for academic achievement.

## PATENTS

1. Jacobs C, Lin MZ. 2018. Compositions and methods for inducing protein function. US Patent Application 62/536307.

2. Chung H, Lin MZ. 2017. Rewiring aberrant cancer signaling to a therapeutic effector response with a synthetic two-component system. US Patent Application 16/044131.

3. Chung H, Jacobs C, Lin MZ. 2016. Degron fusion constructs and methods for controlling protein production. Applications US15/737712, EP20160818587, WO2017004022A3.

4. Chu J, Oh Y, Lin MZ. 2016. Cyan-excitable orange-red fluorescent proteins and bioluminescent resonance energy transfer systems. US Patent 9908918B2.

5. St-Pierre F, Lin MZ. 2017. Fluorescent protein voltage sensor for measuring membrane potential and imaging high-frequency neuronal electrical activity. US Patent 9606100.

6. Zhou X, Lin MZ. 2014. Optical control of protein activity and localization by fusion to photochromic fluorescent protein domains. US Patent 8735096.

7. Lin MZ, Tsien RY. 2015. Fusion proteins and polynucleotide constructs to measure protein turn-over. US Patent 8993256.

## PUBLICATIONS

1. Ju J, Ning L, Chun H, Zhou XX, Ryu H, Lee-Richerson AI, Jeong C, Lin MZ\*, Seong J\*. Optical control of cellular morphology with photoswitchable activators of Cdc42, Rac1, and RhoA. *In review*. \*co-corresponding authors.
2. Yang Y, Geng Y, Ning N, Kim HJ, Jeon NL, Lau A, Chen L, Lin MZ. mTOR pathway inhibition restores PSD95 induction in neurons lacking Fragile X mental retardation protein. *In revision*.
3. Wu J, Liang Y, Hsu C-L, Chavarha M, Evans SW, Shi D, Lin MZ, Tsia KK, Ji N. Kilohertz *in vivo* imaging of neural activity. *In revision*. <http://doi.org/10.1101/543058>.
4. Chavarha C\*, Villette V\*, Dimov IK, Pradhan L, Evans SW, Shi DQ, Yang R, Chamberland S, Bradley J, Mathieu B, St-Pierre F, Schnitzer MJ, Bi GQ, Toth K, Ding J, Dieudonné S\*\*, Lin MZ\*\*. Fast two-photon volumetric imaging of an improved voltage indicator reveals electrical activity in deeply located neurons in the awake brain. *In revision*. <http://doi.org/10.1101/445064>. \*equal contribution. \*\*co-corresponding authors.
5. Chung HK, Zou X, Bajar BT, Brand BR, Huo Y, Alcurdia JF, Ferrell JE, Lin MZ. Rewiring aberrant cancer signaling to therapeutic effector release with a synthetic two-component system. *Science* **2019**, in press.
6. Oh Y, Park Y, Cho, JH, Wu H, Paulk NK, Liu LX, Kim N, Kay MA, Wu JC, Lin MZ. An orange calcium-modulated bioluminescent indicator for non-invasive activity imaging. *Nature Chemical Biology* **2019**, <https://doi.org/10.1038/s41589-019-0256-z>.
7. Daigle TL, Madisen L, Hage TA, Valley MT, Knoblich U, Larsen RS, Takeno MM, Huang L, Gu H, Larsen R, Mills M, Bosma-Moody A, Siverts LA, Walker M, Graybuck LT, Yao Z, Fong O, Nguyen TN, Garren E, Lenz GH, Chavarha M, Pendergraft J, Harrington J, Hirokawa KE, Harris JA, Nicovich PR, McGraw MJ, Ollerenshaw DR, Smith KA, Baker CA, Ting JT, Sunkin SM, Lecoq J, Lin MZ, Boyden ES, Murphy GJ, da Costa NM, Waters J, Li L, Tasic B, Zeng H. A suite of transgenic driver and reporter mouse lines with enhanced brain-cell-type targeting and functionality. *Cell* **2018**, 174:465. <http://doi.org/10.1016/j.cell.2018.06/035>. PMID 30007418.
8. Jacobs CL, Badiee RK, Lin MZ. StaPLs: versatile genetically encoded modules for engineering drug-inducible proteins. *Nature Methods* **2018**, 15:523. <http://doi.org/10.1038/s41592-018-0041-z>. PMID 29967496.
9. Xu F, Shi DQ, Lau PM, Lin MZ, Bi GQ. Excitation wavelength optimization improves photostability of ASAP-family GEVIs. *Molecular Brain* **2018**, 11:32. <http://doi.org/10.1186/s13041-018-0374-7>. PMID 29866136.
10. Zhou XX, Zou X, Chung HK, Gao Y, Liu Y, Qi LS, Lin MZ. A single-chain photoswitchable CRISPR-Cas9 architecture for inducible gene editing and transcription. *ACS Chemical Biology* **2017**, 13:443. <http://doi.org/10.1021/acscchembio.7b00603>. PMID 28938067.
11. Ting D, Hope J, Ong Q, Lou H, Kim N, McCarthy C, Acero V, Lin MZ\*, Cui B\*. Understanding CRY2 interactions for optical control of intracellular signaling. *Nature Communications* **2017**, 8:547. <http://doi.org/10.1038/s41467-017-00648-8>. PMID 28916751. \*corresponding authors.
12. Chamberland S, Yang HH, Pan M, Evans SW, Chavarha M, Yang Y, Salesse C, Wu H, Wu JC, Clandinin TR, Toth K, Lin MZ, St-Pierre F. Fast two-photon imaging of subcellular voltage dynamics in neuronal tissue with genetically encoded indicators. *eLife* **2017**, 6:e25690. <http://doi.org/10.7554/eLife.25690>. PMID 28749338. PMCID PMC5584994.
13. Zhou XX, Fan L, Zhou P, Shen K, Lin MZ. Optical control of cell signaling by single-chain photoswitchable kinases. *Science* **2017**, 355:836. <http://doi.org/10.1126/science.aah3604>. PMID 28232577. PMCID PMC5589340.
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15. Laviv T\*, Kim BB\*, Chu J, Lin MZ\*\*, Yasuda R\*\*. Simultaneous dual-color fluorescence lifetime imaging with novel red-shifted fluorophores. *Nature Methods* **2016**, 13:989. <http://doi.org/10.1038/nmeth.4046>. PMID 27798609. PMCID PMC5322478. \*equal contributions. \*\*corresponding authors.
16. Bajar BT\*, Lam AJ\*, Badiee R, Oh YH, Chu J, Zhou XX, Kim N, Kim BB, Chung M, Yabonovitch AL, Cruz BF, Kulalert K, Tao JJ, Meyer T, Su XD, Lin MZ. Fluorescent indicators for simultaneous reporting of all four cell cycle phases. *Nature Methods* **2016**, 13:993. <http://doi.org/10.1038/nmeth.4045>. PMID 27798610. PMCID PMC5548384. \*co-first authors.
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18. Bajar BT, Wang ES, Zhang S, Lin MZ, Chu J. A guide to fluorescent protein FRET pairs. *Sensors* **2016**, 16:1488. <http://doi.org/10.3390/s16091488>. PMID 27649177. PMCID PMC5038762.

19. Lin MZ\*, Schnitzer MJ\*. Genetically encoded indicators of neuronal activity. *Nature Neuroscience* **2016**, 19:1142. <http://doi.org/10.1038/nn.4359>. PMID 27571193. PMCID PMC5557009. \*corresponding authors.
20. Ng H-L, Lin MZ. Wavelength tuning in far-red fluorescent proteins: insights from structural biology. *Current Opinion in Structural Biology* **2016**, 39:124. <http://doi.org/10.1016/j.sbi.2016.07.010>. PMID 27468111. PMCID PMC5548387.
21. Yang HH\*, St-Pierre F\*, Sun X, Ding X, Lin MZ, Clandinin TR. Subcellular imaging of voltage and calcium signals reveals neural processing *in vivo*. *Cell* **2016**, 166:1. <http://doi.org/10.1016/j.cell.2016.05.031>. PMID 27264607. \*equal contribution.
22. Chu J, Oh YH, Sens A, Ataie N, Dana H, Macklin J, Laviv T, Welf ES, Dean KM, Zhang F, Kim BB, Tang CT, Hu M, Baird MA, Davidson MW, Fioka F, Kay M, Fiolka R, Yasuda R, Kim DS, Ng H-L, Lin MZ. A bright cyan-excitable orange fluorescent protein facilitates dual-emission microscopy and enhances bioluminescence imaging *in vivo*. *Nature Biotechnology* **2016**, 34:760. <http://doi.org/10.1038/nbt.3550>. PMID 27240196. PMCID PMC4942401.
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24. Bajar BT, Wang ES, Lam AJ, Kim BB, Jacobs CL, Howe ES, Davidson MW, Lin MZ\*, Chu J\*. Improving brightness and photostability of green and red fluorescent proteins for live cell imaging and FRET reporting. *Scientific Reports* **2016**, 6:20889. <http://doi.org/10.1038/srep20889>. PMID 26879144. PMCID PMC4754705. \*corresponding authors. (Featured in Research Highlights, *Nature Methods* 13:290.)
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27. Zhou XX, Pan M, Lin MZ. Investigating neuronal development and function with engineered light-controllable proteins. *Frontiers in Molecular Neuroscience* **2015**, 8:37. <http://doi.org/10.3389/fnmol.2015.00037>. PMID 26257603. PMCID PMC4543534.
28. St-Pierre F, Chavarha M, Lin MZ. Designs and sensing mechanisms of genetically encoded fluorescent voltage indicators. *Current Opinion in Chemical Biology* **2015**, 27:31. <http://doi.org/10.1016/j.cbpa.2015.05.003>. PMID 26079047. PMCID PMC4553077.
29. Fan LZ, Lin MZ. Optical control of biological processes by light-switchable proteins. *WIREs Developmental Biology* **2015**, 4:545. <http://doi.org/10.1002/wdev.188>. PMID 25858669. PMCID PMC4529752.
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31. Chu J, Haynes RD, Corbel SY, Li P, Gonzalez-Gonzalez E, Burg JS, Ataie NJ, Lam AJ, Cranfill PJ, Baird MA, Davidson MW, Ng H-L, Garcia, KC, Contag CH, Shen K, Blau HM, Lin MZ. Non-invasive intravital imaging of cellular differentiation with a bright red-excitable fluorescent protein. *Nature Methods* **2014**, 11:572. <http://doi.org/10.1038/nmeth.2888>. PMID 24633408. PMCID PMC4008650.
32. Seong J, Tajik A, Sun J, Guan JL, Humphries MJ, Craig SE, Shekaran A, García AJ, Lu S, Lin MZ, Wang N, Wang Y. Distinct biophysical mechanisms of focal adhesion kinase mechanoactivation by different extracellular matrix proteins. *PNAS* **2013**, 110:19372. PMID 24222685. PMCID PMC3845171.
33. Kim B, Lin MZ. Optobiology: optical control of biological processes via protein engineering. *Biochemical Society Transactions* **2013**, 41:1183. PMID 24059506. PMCID PMC4076147.
34. Zhou XX, Lin MZ. Photoswitchable fluorescent proteins: Ten years of colorful chemistry and exciting applications. *Current Opinion in Chemical Biology* **2013**, 17:682. PMID 23876529. PMCID PMC3771498.
35. Miranda JG, Weaver AL, Qin Y, Park JG, Stoddard CI, Lin MZ, Palmer AE. New alternately colored FRET sensors for simultaneous monitoring of Zn<sup>2+</sup> in multiple cellular locations. *PLoS One* **2012**, 7:e49371. PMID 23173058. PMCID PMC3500285.

36. Zhou XX, Chung HK, Lam AJ, Lin MZ. Optical control of protein activity by fluorescent protein domains. *Science* **2012**, 338:810. PMID 23139335. PMCID PMC3702057.
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43. Lin MZ, McKeown MR, Ng HL, Aguilera TA, Shaner NC, Campbell RE, Adams SR, Gross LA, Ma W, Alber T, Tsien RY. Autofluorescent proteins with excitation in the optical window for intravital imaging in mammals. *Chemistry and Biology* **2009**, 16:1169. PMID19942140.
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