

Jared Toettcher

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EDUCATION

Massachusetts Institute of Technology

Ph.D., Biological Engineering

Cambridge, MA
2004 – 2009

University of California, Berkeley

B.Sc. with High Honors, Bioengineering
Minor: Mathematics

Berkeley, CA
2000 – 2004

PROFESSIONAL EXPERIENCE

Princeton University

Assistant Professor of Molecular Biology
Associated Faculty, Chemical and Biological Engineering
Member, Cancer Institute of New Jersey

Princeton, NJ
2015-present

RESEARCH POSITIONS AND TRAINING

University of California, San Francisco

Cancer Research Institute Postdoctoral Fellow

Mentors: Prof. Wendell Lim and Prof. Orion Weiner

Topic: Optogenetic approaches for interrogating intracellular signaling

San Francisco, CA
2009-2014

Massachusetts Institute of Technology

Graduate Student, Biological Engineering

Thesis advisors: Prof. Bruce Tidor and Prof. Galit Lahav (Harvard Medical School)

Thesis: Relating topology and dynamics in cell signaling networks

Cambridge, MA
2004 – 2009

University of California, Berkeley

Undergraduate Student

Advisors: Prof. Adam Arkin and Prof. David Schaffer

Topic: Stochastic gene expression in an HIV-1 transcriptional positive feedback loop

Berkeley, CA
2002 – 2004

AWARDS AND FELLOWSHIPS

NIH Director's New Innovator Award

2016-2021

Cancer Research Institute Postdoctoral Fellowship	2010-2013
NIH Kirschstein Postdoctoral Fellowship	(declined)
MIT Presidential Graduate Fellowship	2004
Phi Beta Kappa	2004
UC Berkeley Regents' Scholarship	2000
National Merit Scholarship	2000

PUBLICATIONS

1. Wilson MZ, Ravindran PT, Lim WA, **Toettcher JE**. Tracing information flow from Erk to target gene induction reveals mechanisms of dynamic and combinatorial control. *Molecular Cell* **67**:1-13 (2017).
2. Johnson HE, Goyal Y, Pannucci N, Schupbach G, Shvartsman SY, **Toettcher JE**. The spatiotemporal limits of developmental Erk signaling. *Developmental Cell* **40**:185-192 (2017).
 - *Commentary*: Shilo BZ, Barkai N. Lighting up ERK activity. *Developmental Cell* **40**:115-116 (2017).
3. Shin Y, Berry J, Pannucci N, Haataja M, **Toettcher JE**^{**}, Brangwynne CP^{**}. Spatiotemporal control of intracellular phase transitions using light-activated optoDroplets. *Cell* **168**: 159-171 (2017). (** Co-corresponding authors)
 - *Commentary*: Paci G, Lemke EA. Shining a light on phase separation in the cell. *Cell* **168**:11-13 (2017).
4. Diner BA, Lum KK, **Toettcher JE**, Cristea IM. Viral DNA sensors IFI16 and cyclic GMP-AMP synthase possess distinct functions in regulating viral gene expression, immune defenses, and apoptotic responses during herpesvirus infection. *mBio* **7**: e01553-16 (2016).
5. Gordley RM, Williams RE, Bashor CJ, **Toettcher JE**, Yan S, Lim WA. Engineering dynamic control of cell fate switching using synthetic phospho-regulons. *Proc Natl Acad Sci* **113**:13528-13533 (2016).
6. Johnson HE, **Toettcher JE**. The duty of an intracellular signal: illuminating calcium's role in transcriptional control. *Cell Systems* **2**:223-224 (2016).
7. Hoeller O^{*}, **Toettcher JE**^{*}, Cai H, Sun Y, Freyre M, Zhau M, Devreotes PN, Weiner OD. G β regulates coupling between actin oscillators for cell polarity and directional migration. *PLoS Biology* **14**, e1002381 (2016). (* Co-first authors)
8. **Toettcher JE**, Weiner OD, Lim WA. Using optogenetics to interrogate the dynamic control of signal transmission by the Ras/Erk module. *Cell* **155**:1422-1434 (2013).
 - *Commentary*: Featured as "Editor's Choice" in Berndt JD. The lights on Ras avenue. *Science Signaling* **10**:ec298 (2013).
9. **Toettcher JE**, Gong D, Lim WA, Weiner OD. Light-based feedback for controlling intracellular signaling dynamics. *Nature Methods* **8**:837-839 (2011).
 - *Commentary*: Haugh, J. Cells see the light to bring signaling under control. *Nature Methods* **8**:808-809 (2011).
10. **Toettcher JE**, Castillo A, Tidor B, White JK. Oscillator sensitivity analysis in the presence of hidden conservation constraints. In *Proceedings of the 48th IEEE Design Automation Conference*, p. 806-811, June 2011.

11. **Toettcher JE**, Gong D, Lim WA, Weiner OD. Light control of plasma membrane recruitment using the Phy-PIF system. *Methods in Enzymology* **497**, 409-423 (2011).
12. **Toettcher JE**, Apgar JF, Castillo AR, Tidor B, White J. Recycling circuit simulation techniques for mass-action biochemical kinetics. In: Li P, Silveira LM, Feldman P (Eds.), *Advanced Simulation and Verification of Electronic and Biological Systems*. Springer, p. 115-136 (2011).
13. **Toettcher JE**, Voigt CA, Weiner OD, Lim WA. The promise of optogenetics in cell biology: interrogating molecular circuits in space and time. *Nature Methods* **8**, 35-38 (2011).
14. **Toettcher JE**, Mock C, Batchelor E, Loewer A, Lahav G. A synthetic-natural hybrid oscillator in human cells. *Proc Natl Acad Sci* **107**:17047-17052 (2010).
 - *Commentary: Featured as "Editor's Choice" in Ray LB. Oscillator fine-tuning. Science Signal.* **3**:ec315 (2010).
15. **Toettcher JE***, Loewer A*, Ostheimer GJ, Yaffe MB, Tidor B, Lahav G. Distinct mechanisms act in concert to mediate cell cycle arrest. *Proc Natl Acad Sci* **16**:785-790 (2009). (* Co-first authors)
16. Apgar JF, **Toettcher JE**, Endy D, White FM, Tidor B. Stimulus design for model selection and validation in cell signaling. *PLoS Comput Biol* **4**: e30 (2008).
17. Weinberger LS, Burnett JC, **Toettcher JE**, Arkin AP, Schaffer DV. Stochastic gene expression in a lentiviral positive-feedback loop: HIV-1 Tat fluctuations drive phenotypic diversity. *Cell* **122**:169-82 (2005).

INVITED TALKS AND SEMINARS

World Economic Forum Meeting of the New Champions, Dalian, China	June 2017
SignGene Winter School, Eilat, Israel (<i>seminar and workshop</i>)	March 2017
Caltech Chemical Physics Seminar, Pasadena CA	February 2017
ASCB 2016, San Francisco CA (<i>mini-symposium co-chair</i>)	December 2016
Janelia Farm Workshop on Imaging Mouse Development, Ashburn VA	June 2016
EMBO Practical Course: Optogenetics and Cell Signalling (<i>co-organizer</i>)	May 2016
Middle Tennessee State University Seminar Series, Nashville TN	April 2016
UPenn NIH/NIDDK Center for Molecular Studies, Philadelphia PA	April 2016
Lorentz Workshop on Optogenetics, Leiden, Netherlands	March 2016
Keystone Symposium on Optogenetics, Denver CO	March 2015
Western Association of Core Directors meeting, Davis CA	September 2014
FASEB Meeting on Protein Phosphorylation and Signal Rewiring, Aspen CO	July 2014
iCEMS International Symposium on Light Control in Cell Biology, Kyoto, Japan	June 2014
CSHL Meeting on Computational Cell Biology, Cold Spring Harbor NY	March 2013
INSERM Workshop on Optogenetics, Bordeaux, France	September 2012
LAMPP Seminar, UC Irvine, Irvine CA	May 2012
NASA Ames Research Center Synthetic Biology Seminar, Mountain View CA	February 2012
Gordon Research Symposium on Photoreceptor Signaling, Galveston TX	January 2012
1st Engineering in Medicine and Biology Conference, Boston MA	August 2011
48th Design and Automation Conference, San Diego CA	June 2011
Society of Toxicology, Washington DC	March 2011
CSHL Meeting on Computational Cell Biology, Cold Spring Harbor NY	March 2009
Merck-MIT Symposium, Boston MA	November 2008

TEACHING EXPERIENCE

MOL 518 (co-taught with Coleen Murphy, Mohamed Donia) Quantitative Methods in Molecular Biology Graduate course to gain an understanding of modern, quantitative experimental and computational methods in molecular biology. The course places a special emphasis on practical, hands-on training in scientific programming for genomics, data mining, biochemical modeling and image analysis.	Princeton University Spring 2017-present
MOL 215 (co-taught with Alexei Korennykh) Quantitative Principles in Cell & Molecular Biology Undergraduate course tailored to freshman/sophomore life science and engineering majors. Covers central concepts and experiments in cellular, molecular, and developmental biology with an emphasis on underlying physical and engineering principles.	Princeton University Fall 2016-present
EMBO Workshop: Non-Neuronal Optogenetics Co-organizer; instructor Co-organizer; instructor	Heidelberg, Germany June 2016 September 2017
MBL Physiology Course Co-instructor	Woods Hole, MA Summer 2015
UCSF/PKU Team Challenge Workshop Workshop Instructor	Beijing, China Summer 2012
UCSF/Lincoln High School iGEM Team Instructor / Mentor	University of California, San Francisco Summer 2010
SMA5301: Computation and Systems Biology Teaching Assistant	National University of Singapore Summer 2008
CME5238: Computational Linear Algebra Teaching Assistant	National University of Singapore Summer 2008
20.482: Foundations of Algorithms and Computational Techniques in Systems Biology Teaching Assistant	MIT Spring 2005
20.420: Biomolecular Kinetics and Cellular Dynamics Teaching Assistant	MIT Fall 2005

MENTORSHIP

Graduate students

Alex Goglia (NIH F30 recipient)	2015-present
Elliot Dine	2016-present
Evan Zhao	2016-present
Siddhartha Jena	2017-present
Ping Wu	2017-present

Sarah McFann (Hertz fellowship recipient) 2017-present

Postdoctoral fellows

Heath Johnson, PhD (NIH F32 recipient) 2015-present

Max Wilson, PhD 2015-present

Agnieszka Gil, PhD 2016-present

Undergraduate thesis students

Daniel DiGiorno '15 2014-2016

Jennifer Lee '16 2015-2017

Pavithran Ravindran '18 2015-present

Joshua Kim '17 2017-present

Giselle Uribe '21 2017-present