

Thomas A. Zangle, Ph.D.

Assistant Professor
Department of Chemical Engineering
University of Utah
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Education and Training

University of California, Los Angeles
Los Angeles, CA, 2010-2014

Postdoctoral fellowship

Laboratory of Dr. Michael Teitell
Department of Pathology and Laboratory Medicine

Stanford University

Stanford, CA, 2007-2010

Ph.D. in Mechanical Engineering

Thesis: "Concentration Polarization at Microfluidic-Nanofluidic Interfaces."

Stanford University

Stanford, CA, 2005-2007

Master of Science in Mechanical Engineering

Dartmouth College

Hanover, NH, 2001-2005

Bachelor of Engineering

Bachelor of Arts, summa cum laude

Research and Professional Experience

Department of Chemical Engineering, University of Utah

Assistant Professor, 2016-present

Development of novel technologies based on or complementary to optical measurement of cell mass by quantitative phase microscopy. Ongoing work includes development of microfluidic devices which complement measurement of cell mass and application of dynamic mass redistribution measurements to quantify altered cancer cell mechanical properties and to study intracellular transport.

Department of Bioengineering, UCLA

Assistant Researcher and Adjunct Assistant Professor, 2014-2016

Application of quantitative phase microscopy to development of approaches to study cancer biology. Collaborations with colleagues in the Schools of Medicine and Engineering in B cell biology, stem cell biology, and cancer.

Department of Pathology and Laboratory Medicine, UCLA

Postdoctoral fellow in laboratory of Michael Teitell, M.D., Ph.D., 2010-2014

Development and application of high-throughput live cell interferometry (LCI) to quantify cancer cell response to chemotherapy based on single-cell measurement of cell mass and growth. LCI study of stem cell differentiation and daughter cell mass partitioning during cytokinesis.

Stanford University Microfluidics Laboratory

Graduate Research Assistant in laboratory of Juan Santiago, Ph.D., 2005-2010

Combined experimental, computational, and analytical study of microchannel-nanochannel electrokinetic transport physics. Optical study of electrically gated nanopore translocation. Development of novel microchannel-nanopore protein detection device.

Journal Articles

- Kim, D.N.H.**, Teitell, M.A., Reed, J., and **Zangle, T.A.**, “Hybrid random walk-linear discriminant analysis method for unwrapping quantitative phase microscopy images of biological samples,” *Journal of Biomedical Optics* 2015, 20. 111211.
- Zangle, T.A.*** and Teitell, M.A.*, “Live cell mass profiling: An emerging approach in quantitative biophysics,” *Nature Methods* 2014, 11. 1221-1228. *co-contributing author
- Zangle, T.A.**, Reed, J.C., and Teitell, M.A., “Live cell interferometry quantifies dynamics of biomass partitioning during cytokinesis,” *PLOS ONE*. 2014, 9. e115726.
- Silvia, S., Lo, Y.-C., Huang, D., **Zangle, T.A.**, Gholkar, A.A., Robert, L., Homet Moreno, B., Ribas, A., Summers, M.K., Teitell, M.A., Damoiseaux, R., and Torres, J.Z., "Chemical dissection of the cell cycle: probes for cell biology and anticancer drug development," *Cell Death and Disease* 2014, 5. e1462.
- Zangle, T.A.**, Chun, J., Zhang, J., Reed, J., and Teitell, M.A., “Quantification of biomass and cell motion in human pluripotent stem cell colonies,” *Biophysical Journal* 2013, 105. 593-601.
- Zangle, T.A.**, Burnes, D., Mathis, C., Witte, O.N., and Teitell, M.A., “Quantifying biomass changes of single CD8+ T cells during antigen specific cytotoxicity,” *PLOS ONE* 2013, 8. e68916.
- Chun, J., **Zangle, T.A.**, Kolarova, T., Finn, R.A., Teitell, M.A., and Reed, J., “Rapidly quantifying drug sensitivity of dispersed and clumped breast cancer cells by mass profiling,” *Analyst* 2012, 137. 5495-5498.
- Reed, J., Chun, J., **Zangle, T.A.**, Kalim, S., Hong, J.S., Pefley, S.E., Zheng, X., Gimzewski, J.K., and Teitell, M.A., “Rapid, massively parallel single-cell drug response measurements via live cell interferometry,” *Biophysical Journal* 2011, 101. 1025-1031.
- Suss, M.E., Mani, A., **Zangle, T.A.**, and Santiago, J.G., “Electroosmotic pump performance is affected by concentration polarizations of both electrodes and pump,” *Sensors and Actuators A: Physical* 2011, 165. 310-315.
- Zangle, T.A.**, Mani, A., and Santiago, J.G., “Effects of constant voltage on time evolution of propagating concentration polarization,” *Analytical Chemistry* 2010, 82. 3114-3117.
- Zangle, T.A.**, Mani, A., and Santiago, J.G., “Theory and experiments of concentration polarization and ion focusing at microchannel and nanochannel interfaces,” *Chemical Society Reviews* 2010, 39. 1014-1035.
- Strickland, D.G., Suss, M.E., **Zangle, T.A.**, and Santiago, J.G., “Evidence shows concentration polarization and its propagation can be key factors determining electroosmotic pump performance,” *Sensors and Actuators B* 2010, 143. 795-798.

Zangle, T.A., Mani, A. and Santiago, J.G., “On the propagation of concentration polarization from microchannel-nanochannel interfaces. Part II. Numerical and experimental study,” *Langmuir* 2009, 25. 3909-3916.

Mani, A., **Zangle, T.A.**, and Santiago, J.G., “On the propagation of concentration polarization from microchannel-nanochannel interfaces. Part I. Analytical model and characteristic analysis,” *Langmuir* 2009, 25. 3898-3908.

Conferences and Presentations

Zangle, T.A., “Low refractive index microfluidics for high precision monitoring of cell response to therapy,” *invited oral presentation* to be given at IEEE International Conference on Micro/Nano Engineered and Molecular Systems (IEEE-NEMS) 2017, Los Angeles, CA, April 9-12, 2017.

Huang, D., Kim, D.N.H., Teitell, M.A., and **Zangle, T.A.**, “Quantification of cancer cell response to therapy with quantitative phase microscopy,” Biomedical Engineering Society (BMES) 2016 Annual Meeting, Minneapolis, MN, October 5-8, 2016.

Nguyen, T.L., Teitell, M.A., and **Zangle, T.A.**, “Quantifying the effects of cell division on mass redistribution dynamics in multicellular clusters using live cell interferometry,” Biophysical Society 60th Annual Meeting, Los Angeles, CA, February 27–March 2, 2016.

Kim, D.N.H., Teitell, M.A., Reed, J., and **Zangle, T.A.**, “Hybrid random walk-linear discriminant analysis method for unwrapping quantitative phase images of biological samples,” Biophysical Society 60th Annual Meeting, Los Angeles, CA, February 27–March 2, 2016.

Polanco, E.R., **Nguyen, T.L.**, Teitell, M.A., and **Zangle, T.A.**, “Quantifying cellular elasticity using quantitative phase microscopy measurements of electromagnetically actuated magnetic microsphere indentation,” Biophysical Society 60th Annual Meeting, Los Angeles, CA, February 27–March 2, 2016.

Huang, D., **Zangle, T.A.**, and Teitell, M.A., “Quantification of cancer cell fate in response to small molecule mitotic inhibitors using live cell interferometry,” Biophysical Society 60th Annual Meeting, Los Angeles, CA, February 27–March 2, 2016.

Zangle, T.A., “Quantitative phase microscopy to quantify cancer cell response to therapy,” *presentation* at the University of California, Santa Barbara, November 10, 2015.

Kim, D.N.H., Teitell, M.A., and **Zangle, T.A.**, “Quantification of Tumor and T Cell Mass during T Cell Mediated Cytotoxicity for Cancer Immunotherapy,” *oral presentation* at Biomedical Engineering Society (BMES) 2015 Annual Meeting, Tampa, FL, October 7–10, 2015.

Kim, N.H. Diane, Teitell, M.A., Reed, J., and **Zangle, T.A.**, “Hybrid random walk-linear discriminant analysis phase unwrapping method for accurate biological quantitative phase imaging,” University of California Systemwide Bioengineering Symposium, Santa Cruz, CA, June 22–24, 2015.

- Huang, D., **Zangle, T.A.**, Lo, R.S., and Teitell, M.A., “Dissection of melanoma drug resistance and heterogeneity using live cell interferometry,” University of California Systemwide Bioengineering Symposium, Santa Cruz, CA, June 22–24, 2015.
- Zangle, T.A.**, Burnes, D., Mathis, C., Witte, O.N., and Teitell, M.A., “High-throughput screening of T cell cytotoxic events by biomass profiling,” Biophysical Society 58th Annual Meeting, San Francisco, CA, February 15–19, 2014. *Biophysical Journal* 2014, 106, 811a.
- Zangle, T.A.** “Live cell mass dynamics in cancer and stem cell biology,” *oral presentation* at UCLA Bioengineering Department seminar. Los Angeles, CA, February 19, 2013.
- Zangle, T.A.**, Chun, J., Zhang, J., Reed, J., and Teitell, M.A., “Biophysical characterization of pluripotent stem cell mass accumulation rate and intracolony motion,” Biophysical Society 57th Annual Meeting, Philadelphia, PA, February 2–6, 2013. *Biophysical Journal* 2013, 104, 669a.
- Zangle, T.A.**, “T cell identification and profiling via live cell mass measurement,” *oral presentation* at Nanosystems Biology Cancer Center meeting, California Institute of Technology, Pasadena, CA, May 29, 2013.
- Zangle, T.A.** “Interferometry to study TCR engineered cytotoxicity,” *oral presentation* at the Engineered Immunity Consortium Meeting, Caltech University, January 12, 2013.
- Zangle, T.A.**, Chun, J., Zhang, J., Reed, J., and Teitell, M.A., “hPSC differentiation occurs at a nearly constant mass accumulation rate,” *oral presentation* at 7th Nagoya University-UCLA International Symposium, Sapporo, Japan, September 21–22, 2012.
- Zangle, T.A.**, Reed, J., and Teitell, M.A., “Measurements of cell mass distribution during cell division with quantitative phase microscopy,” Biophysical Society 56th Annual Meeting, San Diego, CA, February 25–29, 2012. *Biophysical Journal* 2012, 102, 202a.
- Chun, J., **Zangle, T.A.**, Hong, J., Gimzewski, J.K., Teitell, M.A., and Reed, J., “Instantaneous mass profiling of live cells via live cell interferometry,” Biophysical Society 56th Annual Meeting, San Diego, CA, February 25–29, 2012. *Biophysical Journal* 2012, 102, 563a.
- Zangle, T.A.**, Mani, A., and Santiago, J.G. “Experimental and theoretical studies of microchannel-nanochannel interface effects,” *invited oral presentation* at Pittcon 2011, Atlanta, GA, March 13–17, 2011.
- Zangle, T.A.**, Kant, R., Howe, R.T., and Santiago, J.G., “Microfluidic device with integrated nanopores for protein detection,” *oral presentation* at Thirteenth International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS2009), ICC Jeju, Korea, November 1-5, 2009.
- Zangle, T.A.**, Mani, A., and Santiago, J.G., “The effects of concentration polarization on the concentration inside a nanochannel,” Gordon Research Conference on Microfluidics, Physics & Chemistry Of, Lucca (Barga), Italy, June 28–July 3, 2009.

- Kant, R., **Zangle, T.A.**, Santiago, J.G., and Howe, R.T., "Batch fabrication compatible integration of 3D nanopores with microfluidic devices using silicon migration," 15th International Conference on Solid-State Sensors, Actuators, and Microsystems 2009, Denver, CO, June 21-25, 2009.
- Strickland, D.G., **Zangle, T.A.**, and Santiago, J.G., "Visualization of concentration polarization generated by electroosmotic pumps," 215th Meeting of the Electrochemical Society, San Francisco, CA, May 24–29, 2009.
- Suss, M.E., Lewis, M.A., **Zangle, T.A.**, and Santiago, J.G., "Concentration polarization in electroosmotic pumps," 215th Meeting of the Electrochemical Society, San Francisco, CA, May 24–29, 2009. *ECS Transactions* 2009, 19. 25-35.
- Mani, A., **Zangle, T.A.**, and Santiago, J.G., "Identification of concentration polarization regimes in microchannel-nanochannel interfaces using method of characteristics," Meeting of the American Physical Society Division of Fluid Dynamics. San Antonio, TX, Nov. 23-25 2008.
- Zangle, T.A.**, Talasaz, A.H., and Santiago, J.G., "Nanopore Concentration Polarization," *oral presentation* at ASME International Mechanical Engineering Congress and Exposition (IMECE) 2008, Boston, MA, October 31–November 6, 2008.
- Zangle, T.A.**, Talasaz, A.H., Davis, R.W., and Santiago, J.G., "The Effects of Concentration Polarization on Molecule Translocation in a Nanopore Device," Proceedings of the Twelfth International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS2008), San Diego, CA, p. 212-214, October 12–16, 2008.
- Zangle, T.A.**, Mani, A., and Santiago, J.G., "Concentration Polarization at a Microchannel-Nanochannel Interface," *oral presentation* at the Thermal & Fluid Sciences Affiliates Conference 2008, Stanford University, Stanford, CA, February 7, 2008.
- Zangle, T.A.**, A. Mani and J.G. Santiago, "Concentration Polarization and Focusing at a Microchannel-Nanochannel Interface," Gordon Research Conference on Microfluidics, Physics & Chemistry Of, Waterville Valley, NH, July 15–20, 2007.
- Zangle, T.A.**, Mani, A., and Santiago, J.G., "Experimental Study of Microchannel-Nanochannel Interface Effects," *oral presentation* at ASME International Mechanical Engineering Congress and Exposition 2007, Seattle, WA, November 11–15, 2007.
- Zangle, T.A.**, Mani, A., and Santiago, J.G., "Novel Device for Electrophoretic Focusing and Separation at a Microchannel-Nanochannel Interface," *presented* at the Eleventh International Conference on Miniaturized Systems for Chemistry and Life Sciences (μ TAS2007), Paris, France, October 7–11, 2007. Proceedings p. 1204-1206.
- Talasaz, A.H., **Zangle, T.A.**, Tropini, C., Pease, F., Davis, R.W., and Santiago, J.G., "Real-Time Control of Nanopore Wall Potential for Single-Molecule Analysis," Proceedings of the Eleventh International Conference on Miniaturized Systems for Chemistry and Life Sciences, Paris, France, p. 1592-1594. October 7–11, 2007.

Zangle, T.A., Pennathur, S., and Santiago, J.G., “Micro-Nano Channel Interface Sample Stacking,” *oral presentation* at Sandia National Laboratory, Livermore, CA, August 24, 2006.

Zangle, T.A., Padilla, L.E., and Shao, X., “Micro Air Vehicle Design and Stability Investigation,” *oral presentation* at the 2005 American Institute of Aeronautics and Astronautics Northeast Region I Student Paper Conference, Princeton, NJ, April 22–23, 2005. *Awarded first place in the design team category.*

Patent Applications

“Identifying Desirable T Lymphocytes by Change in Mass Responses,” Michael A. Teitell, Thomas A. Zangle, Owen N. Witte, and Daina Burnes Linton, Provisional patent application number 61/827,378, International publication number WO 2014/190303 A1, May 23, 2014.

Teaching Experience

Course Instructor

Introduction to Bioengineering (UCLA BE10) Fall 2014, Fall 2015: Introduction to basic concepts in bioengineering, summary of how current department research in bioengineering relates to the broader field and graduate school or job opportunities after graduation.

Project Mentorship

Mentored Undergraduate Research (UCLA BE99 and BE199) 2015 Winter, Spring, Fall: Supervisor for undergraduate research projects in my lab.

Senior Capstone Design (UCLA BE177) 2015-2016 Academic year: Project mentor for a year-long project to design and build a low-cost quantitative phase microscope to monitor cell growth.

Guest Lectures

Ribet Academy Guest Speaker Series January 2015: 1 lecture titled “Weighing cells with light” presenting current research topics to 9th-12th grade students.

Introductory Fluids Engineering (Stanford ME70) Spring 2009: 3 lectures covering internal flows, pipe network analysis, external flows, boundary layers, and course summary/wrap-up.

Fluid Flow in Microdevices (Stanford ME457) Winter 2009: 1 lecture covering introduction to electrostatics, Poisson equation, Gauss’ law, capacitor problems.

Introductory Fluids Engineering (Stanford ME70) Spring 2007: 1 lecture on the momentum equation in moving and accelerating control volumes.

Introduction to Experimentation (Stanford ME22N) Fall 2006: 2 lectures and accompanying lab exercises measuring Doppler shift and speed of sound using soundcard oscilloscope software.

Laboratory Work

Introductory Fluids Engineering (Stanford ME70) 2009: Year-long project to refresh laboratory demonstrations and rewrite lab materials. Designed two new lab exercises covering non-dimensional analysis (viscous liquid in a rotating tank) and particle image velocimetry (PIV).

Experimental Methods in Fluid Mechanics (Stanford ME354) Fall 2007: course assistant, held office hours, graded, set up lab exercises, ran final lab demonstration (microchannel PIV).

Teaching Interests

Fluid mechanics, heat and mass transfer, biological transport, flow in microdevices, thermodynamics, experimental methods, fluid mechanics laboratory, microscopy and optics, image processing, introductory bioengineering.

Awards, Honors, and Funding

2015-2016	Jonsson Comprehensive Cancer Center (JCCC) seed grant “ <i>Live cell interferometry based identification and isolation of cytotoxic T cells for cancer immunotherapy</i> ”
2014-2017	UCLA Broad Stem Cell Research Center recruitment funding
2012-2015	NIH K25 Mentored Quantitative Research Development Award “ <i>Live Cell Interferometry for Quantifying Mass Transport in Cancer</i> ”
2012	UCLA T32 Tumor Immunology training program
2012	Biophysical Society Educational Committee travel award
2010-2011	UCLA T32 Tumor Cell Biology training program
2005-2009	Regina Casper Stanford Graduate Fellowship
2008	Stanford Bio-X Travel Subsidy Award
2005	Thayer School Faculty Award for Academic Excellence
2005	Richard W. Olmsted 1932 (Thayer 1933) Prize
2005	First place design team category presentation, AIAA Student Conference
2005	AIAA northeast region college achievement award
2004	Phi Beta Kappa and Tau Beta Pi honor societies
2003-2005	Rufus Choate Scholar (awarded to top 5% of class)

Peer Review and Service

Peer reviewer for *Physical Review Letters*, *Physical Review E*, *Physical Review Applied*, *PLOS ONE*, *Optics Express*, *Analytical Chemistry*, *Lab on a Chip*, *Langmuir*, *Micromachines*, and *AIChE Journal*.

Session chair, Cancer Technologies: Engineered Models of Cancer Metastasis and Treatment Response, at Biomedical Engineering Society (BMES) 2016 Annual Meeting, Minneapolis, MN, October 5-8, 2016.

Invited session organizer and chair, Biomedical NEMS/MEMS Devices, at IEEE International Conference on Micro/Nano Engineered and Molecular Systems (IEEE-NEMS) 2017, Los Angeles, CA, April 9-12, 2017.

External Grant Review

NIH National Cancer Institute Small grants program for cancer research (R03) and Exploratory/Development Research Program (R03 and R21) drug delivery and cancer therapeutics Special Emphasis Panel – Spring 2016.

US-Israel Binational Science Foundation (BSF) Biomedical Engineering program review – Spring 2016.

Ph.D. Advising/Review

Department of Bioengineering, University of California, Los Angeles

Dian Huang, Ph.D. candidate, 5th year. Doctoral committee-co-chair, co-advisor.

N.H. Diane Kim, Ph.D. student (pre-candidacy), 3rd year, NSF Graduate Research Fellowships Program (GRFP) fellow. Primary advisor.

Thang Nguyen, Ph.D. student (pre-candidacy), 3rd year. Co-advisor.

David Pereira, Ph.D. candidate, 5th year. Doctoral committee member.

Department of Chemical and Biomolecular Engineering, University of Melbourne

Christian Biscombe, Ph.D.: External committee member for Ph.D. thesis awarded August 2015.

Undergraduate Advising

Former students, University of California, Los Angeles

Kevin Kim, Biochemistry major, expected graduation in June 2017.

Edward Polanco, Physics major, NIH Maximizing Access to Research Careers (MARC) fellow, expected graduation in June 2017.

Carolyn Kim, Bioengineering major, expected graduation in June 2018.

Michael Mellody, Bioengineering major, UCLA Undergraduate Research Fellows Program (URFP) fellow, expected graduation in June 2018.

Alex Lim, Bioengineering major, expected graduation in June 2019

Omar Qattan, Bioengineering major, expected graduation in June 2016.

Eva Chen, Bioengineering major, expected graduation in June 2018.