

Liang Chen

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EDUCATION & RESEARCH EXPERIENCE

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| 2014-present | Project Scientist, Molecular Biophysics and Integrated Bioimaging Division, Lawrence Berkeley National Lab, Berkeley, CA |
| 2009-2014 | Postdoctoral research fellow, Earth Science Division, Lawrence Berkeley National Laboratory, Berkeley, CA |
| 2003-2009 | Ph.D. in Applied Physics, Department of Applied Physics, Stanford University, Stanford, CA |
| 1998-2003 | B.S. in Physics, Special Class for Gifted Young, University of Science and Technology of China, Hefei, Anhui, China |

PROFESSIONAL EXPERIENCE

September 2014 - Present, *Project Scientist*

Climate & Ecosystem Sciences Division (CESD) at Lawrence Berkeley National Lab

Principal Investigator: Dr. Hoi-Ying Holman, Senior Staff Scientist, CESD

- Developed a GUI in Matlab to automate high dimensional infrared spectral data visualization and univariate/multivariate statistical analysis. The U.S. patent application for the software was filed in 2016.
- Implemented a wide-field super-resolution microscopy technique using structured illumination, fast fourier transform and maximum likelihood estimation methods, achieving a 2X improvement in spatial resolution.
- Designed and built the Multiplex Chemotyping Microarray, a system for high-throughput spectral sample screening, increasing the throughput by 64X. This invention won the 2014 R&D 100 Award and the U.S. patent was approved in 2016.
- Applied the Synchrotron infrared spectroscopy analytical techniques to the study of HCE cell electrotaxis behavior and characterized HCE cell's initial signaling response events at molecular level.
- Co-authored 10 journal publications with a total of 700+ citations.

September 2009 - September 2014, *Postdoctoral Research Fellow*

Earth Science Division (ESD) at Lawrence Berkeley National Lab

Principal Investigator: Dr. Hoi-Ying Holman, Staff Scientist, ESD

- Developed combined fluorescence and infrared spectroscopy imaging technique to track protein phosphorylation in live PC12 cells in real time.

- Applied the Synchrotron infrared spectroscopy analytical techniques to study the low dose radiation bystander effects and discovered that the effects could span one millimeters away from the center of target and the effects of low dose radiation are qualitatively different from that of a high dose exposure.
- Designed, constructed and performed critical performance test on a general purpose microfluidic cell culture platform for micro-spectroscopy measurements.
- Contributed to the programming of an automation software to coordinate the operations of the microfluidic device and the infrared spectroscopy microscope.
- Applied the Synchrotron infrared spectroscopy analytical techniques to the study of cell wall structure of *Brachypodium* and discovered that different natural accession lines have distinct distribution of structure material in cell wall which may be exploited to fingerprint the strain identity.
- Trained non-expert research staff to prepare live cell samples for infrared spectroscopy and perform the synchrotron radiation Fourier transform infrared spectroscopy (SR-FTIR) measurements and data analysis.

September 2003 - August 2009, *Ph.D. Candidate*

Department of Applied Physics, Stanford University

Thesis Advisor: Professor Steven Chu, Secretary of Energy; Professor of Physics and Molecular & Cell Biology at UC-Berkeley; Emeritus Professor of Physics at Stanford University; Nobel Laureate of Physics in 1997

Co-advisor: Professor William Mobley and Professor Yanmin Yang, Department of Neurology and Neurological Sciences, Stanford University

Collaborator: Dr. Hoi-Ying Holman (ESD), Dr. Michael Martin, Dr. Hans Bechtel (Advanced Light Source, Lawrence Berkeley National Laboratory)

- Developed single molecule fluorescence imaging and image analysis technique to track the retrograde transport of nerve growth factor (NGF) in live dorsal root ganglion (DRG) neurons in real time.
- Designed and fabricated the microfluidic devices to culture compartmentalized primary neurons for isolated chemical treatment on distal axons from cell bodies.
- Constructed a dual-view single molecule imaging microscope for simultaneous tracking of retrograde transport of NGF and TrkA in DRG neurons.
- Applied the dual-view single molecule imaging and image analysis technique to study the pathogenesis of the Giant Axonal Neuropathy (GAN) disease.
- Developed a novel infrared imaging technique for detection of protein phosphorylation in live PC12 cells
- Constructed the nano-imaging devices for a proof-of-concept testing of near-field super-resolution infrared spectral imaging

August 2007 - December 2007, *Technical Consultant to Amaxa, Inc.*

Collaborator: Amaxa, Inc., Gaithersburg, MD

- Optimized large-volume electroporation protocols for transfection of primary neurons
- Principle investigator of field testing the prototype micro-volume electroporation device for transfection of low-cell-count primary cells

July 2007- August 2009, *Student Research Mentor*

Department of Neurology and Neurological Sciences, Stanford University School of Medicine

Student: Lisa He, Miridu Kapur, Jessica Gall

- Trained students of essential laboratory techniques, including preparation of primary neurons and cell lines, culture and transfection of primary neurons, fabrication of microfluidic device, fluorescence imaging and analysis technique
- Supervised students on summarizing and presenting experimental results and helped trouble shooting technical problems

TECHNICAL SKILLS**Programming Language Skills**

Python, Matlab, R, Java

Data analysis and Computational Skills

Infrared spectra data analysis, Univariate and multivariate statistical analysis, Signal processing, Digital image processing, Computational imaging, Chemometrics, Machine learning, Deep learning, Bayesian statistics methods

Optical Imaging & Microscopy Techniques

Synchrotron radiation Fourier transform infrared (SR-FTIR) spectro-microscopy, Super-resolution structured illumination microscopy, Fourier ptychography and computational imaging, Fourier optics, Total-internal-reflection fluorescence microscopy (TIR-FM), Fluorescence confocal imaging

Biochemistry and Cell Biology Techniques

Primary and cell line tissue culture techniques, protein enzymatic assays, protein fractionation, protein immunoprecipitation, protein purification, western blot, 2-D gel protein electrophoresis analysis, cellular ligand uptake and internalization studies, cytotoxicity assays, viral infection system construction, viral particle packaging and infection of primary neurons and cells, Transient cell transfection and stable cell transformation

Molecular Biology Techniques

Recombinant DNA synthesis, molecular cloning, sequencing, site-directed mutagenesis quantitative PCR

HONORS & AWARDS

- 2014 R&D 100 Award Winner for the invention of Multiplex Chemotyping Microarray (MCM) technology, 2014
- Research Assistant Fellowship, Department of Neurology and Neurological Sciences, Stanford University, 2008-2009

- Research Assistant Fellowship, Department of Applied Physics, Stanford University , 2003-2008
- Outstanding Student Scholarship, University of Science and technology of China, 1999-2003
- Chen Xiangmei Scholarship, the Chen Xiangmei Foundation, 1995

RESEARCH PUBLICATIONS AND PATENTS

- Kamennaya NA, Zemla M, Mahoney L, **Chen L**, Holman E, Holman HY, Auer M, Ajo-Franklin CM, Jansson C. High pCO₂-induced exopolysaccharide-rich ballasted aggregates of planktonic cyanobacteria could explain Paleoproterozoic carbon burial. *Nat Commun*. 2018 May 29; 9(1):2116
- Loutherbach K, Giovanni B, **Chen L**, Holman HY. Microfluidic approaches to synchrotron radiation-based Fourier transform infrared (SR-FTIR) spectral microscopy of living biosystems. *Protein Pept Lett*. 2016; 23(3):273-82.
- Loutherbach K, **Chen L**, Holman HY. Open-Channel Microfluidic Membrane Device for Long-Term FT-IR Spectromicroscopy of Live Adherent Cells. *Anal Chem*. 2015 May 5; 87(9):4601-6.
- Holman HY, **Chen L**. Nondestructive Molecular Mapping and Imaging: Synchrotron FTIR Spectral Microscopy. In G. C. Howard, W. E. Brown & M. Auer (Eds). *Imaging Life: Biological Systems from Atoms to Tissues* (pp. 302-338). New York, USA: Oxford University Press
- “Multiplex Chemotyping Microarray (MCM) system and methods” Holman HY, Sun C, Birarda, G, **Chen L**, 2016, US Patent No. 20160129415
- Zhang K, Fishel Ben Kenan R, Osakada Y, Xu W, Sinit RS, **Chen L**, Zhao X, Chen JY, Cui B, Wu C. Defective axonal transport of Rab7 GTPase results in dysregulated trophic signaling. *J Neurosci*. 2013 Apr 24; 33(17):7451-62.
- Hu P, Borglin S, Kamennaya N, **Chen L**, Park H, Mahoney L, Kijac A, Shan G, Chavarría K, Zhang C, Quinn N, Wemmer D, Holman HY, Jansson C. Metabolic phenotyping of the cyanobacterium *Synechocystis* 6803 engineered for production of alkanes and free fatty acids. *Applied Energy*. 2013 Feb;102:850-859
- **Chen L**, Holman HY, Hao Z, Hans B, Wu C, Michael M, Chu S. Synchrotron infrared measurements of protein phosphorylation in living single PC12 cells during neuronal differentiation. *Anal Chem*. 2012 May 1;84(9):4118-25
- Lacayo CI, Malkin AJ, Holman HY, **Chen L**, Ding SY, Hwang MS, Thelen MP. Imaging cell wall architecture in single *Zinnia elegans* tracheary elements. *Plant Physiol*. 2010 Sep; 154(1):121-33.

- Zhang K, Osakada Y, Vrljic M, **Chen L**, Mudrakola H, Cui B, Single-molecule imaging of NGF axonal transport in microfluidic devices. *Lab on a Chip*, DOI: 10.1039/c003385e (2010).
- Wu C, Cui B., He L, **Chen L**, Mobley WC. The Coming of Age of Axonal Neurotrophin Signaling Endosomes. *Journal of Proteomics*, 2009 Feb 15;72(1):46-55
- Cui B, Wu C, **Chen L**, Ramirez A, Mobley WC, Chu S. One at a time: tracking NGF retrograde transport in live neurons. *Proc. Natl. Acad. Sci. USA*, 2007 Aug 21;104(34):13666-71

INVITED TALKS & CONFERENCES

- “Enhancing resolution of wide-field FTIR imaging using structured illumination” 2017 ALS User meeting, Lawrence Berkeley National Laboratory, Berkeley, CA, October 2017
- “Super-resolution wide-field FTIR microscopy using structured illumination” FACSS SciX 2016 meeting, Minneapolis, MN, September 2016
- “Synchrotron Infrared Measurements of Protein Phosphorylation Dynamics during HCE Cell Electrotaxis”, 8th International Workshop on Infrared Microscopy and Spectroscopy using Accelerator Based Sources, Long Island, NY, October 2015
- “Imaging the Chemistry of living cells” 2013 ALS User meeting, Lawrence Berkeley National Laboratory, Berkeley, CA, October 2013
- “Comparative molecular imaging analysis of *Brachypodium distachyon* and its mutants” the 2011 USDA-DOE Plant Feedstock Genomics for Bioenergy Awardee Meeting, Arlington, VA, April 2011
- “Role of Rab5- and Rab7-Endocytic Vesicles in Regulating Trafficking and Signaling of NGF”, “Single molecule imaging of NGF transport in a microfluidic device” Gordon research conference on Molecular & Cellular Neurobiology, Hong Kong University of Science and Technology, Hong Kong, China, June 2008
- “One at a time: live tracking of NGF retrograde transport using quantum dots”, “A High-Resolution Analysis of Axonal Trafficking of NGF Using Quantum Dots”, Gordon research conference on Neurotrophic Factors, Salve Regina University, Newport, RI, June 2007
- “Simultaneous Tracking of NGF and TrkA Retrograde Transport at the Single Molecule Level”, Biophysical Society 51th Annual Meeting, Baltimore, MD, March 2007
- “Direct observation of NGF retrograde transport in live neurons at single molecular level”, Biophysical Society 50th Annual Meeting, Salt Lake City, UT, February 2006