CHING-WEI CHANG

Department of Bioengineering

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EDUCATION

Ph.D.   **UNIVERSITY OF MICHIGAN**   **Biomedical Engineering   Sep. 2005 - Apr. 2009**

Dissertation: Improving Accuracy and Precision in Biological Applications of Fluorescence Lifetime Imaging Microscopy

FLIM (Fluorescence Lifetime Imaging Microscopy) is an approach that produces fluorescence lifetime maps and indicates molecular micro-environments. In this study,

- FLIM was used to resolve statistically significant differences, implying molecular interactions, in live-cell imaging with FRET (Förster or Fluorescence Resonance Energy Transfer) technique.

- Optimal gating schemes were determined, with computer simulations, to significantly improve the precision of FLIM.

- Novel TV (Total-Variation) denoising models were applied to FLIM and further improved the precision of FLIM.

M.S.   **UNIVERSITY OF MICHIGAN**   **Biomedical Engineering   Sep. 2003 - Dec. 2004**

Thesis: A Novel Technique to Identify Gene Regulation Profile by Using Nascent RNA Quantification and Microarray Analysis

This novel technique involves DNA microarray techniques and their data analysis, nascent RNA isolation and amplification, DNA recombination, and PCR / PCR primers design.

B.S.   **NATIONAL TAIWAN UNIVERSITY**   **Chemical Engineering   Sep. 1997 - June 2001**

Thesis: Analysis on the Permeation Characteristics of Chitosan Films

Techniques for manufacturing, crosslinking, and testing biomedical materials were applied to Chitosan films, including freeze drying, SEM, microbe passage test, bubble point test, water uptake test, and mechanical strength test. The significance of this study was the potential applications of this material as tissue regeneration scaffolds.

RESEARCH INTERESTS

- Digital image processing and image informatics

- Enhancement of fluorescence detection in tissues and cells

- Optical diagnosis of disease

- Mathematical modeling of complex biological systems

- Disease treatments and drug developments using molecular biology techniques

RESEARCH / TRAINING EXPERIENCE

POSTDOCTORAL SCHOLAR - CELL IMAGING, MICROSCOPY, IMAGE ANALYSIS, AND MOLECULAR BIOLOGY SCIENTIST   June 2010 - Present

Department of Bioengineering, University of California, Berkeley

Study of cellular mechanotransduction using optical methods, with Dr. Sanjay Kumar

- Use of FRET probes to detect protein activation after live-cell force stimulation and redistribution

- Use of laser ablation and FRET probes to measure pico-scale force events in live cells

- Co-management of a confocal / multi-photon laser scanning microscopy system

RESEARCH ASSOCIATE - DATA ANALYSIS, IMAGE DENOISING, AND CANCER CELL BIOLOGY SCIENTIST   May 2010

Department of Biomedical Engineering, University of Michigan, Ann Arbor

Technical consulting and training provided to graduate students on FLIM instrumentation, FLIM data analysis, image denoising, and cell culturing, with Dr. Mary-Ann Mycek

RESEARCH FELLOW - FLIM, FRET, AND IMAGE PROCESSING ALGORITHMS SCIENTIST   May 2009 - April 2010

Department of Biomedical Engineering, University of Michigan, Ann Arbor

Advanced studies based on my Ph.D. work on the improvements of the accuracy and precision of FLIM and FRET, and additional projects, with Dr. Mary-Ann Mycek

- Broader applications of the previously used techniques to other biomedical imaging systems such as CT, PET, and confocal / multi-photon microscopy

- Further investigation of wavelet-based denoising methods for FLIM use

- Research on novel clinical technology for rapid detection of tissue fluorescence wavelength-time matrices from articular cartilage

GRADUATE STUDENT RESEARCH ASSISTANT   Sep. 2005 - Apr. 2009

Department of Biomedical Engineering, University of Michigan, Ann Arbor

Ph.D. degree studies with Dr. Mary-Ann Mycek.

RESEARCH ASSISTANT - BIOINFORMATICS, GENOMICS, TRANSCRIPTOMICS
                                                        Jan. 2005 - Aug. 2005

Department of Radiation Oncology, University of Michigan, Ann Arbor

Characterization of the regulation of glucose transporters by tumor suppressor p53, with Dr. Mats Ljungman

- Application of the novel gene expression profiling technique developed in my M.S. studies

- Significant enhancement of the expression / repression profiling by multi-fold

GRADUATE STUDENT RESEARCH ASSISTANT   Sep. 2003 - Dec. 2004

Department of Radiation Oncology, University of Michigan, Ann Arbor

M.S. degree studies with Dr. Mats Ljungman

RESEARCH ASSISTANT - COMPUTATIONAL / SYSTEMS BIOLOGY, MATHEMATICAL MODELING   May 2002 - July 2003

Institute of Chemistry, Academia Sinica, Taipei, Taiwan

Theoretical analysis and computer simulation for genetic and biochemical regulatory networks using C, Java, and Matlab, with Dr. Chao-Ping Hsu

- Development of my skills on bioinformatics and systems biology

- Initiation of two novel projects

    o Construction of quantitative models from qualitative mutant phenotypes for selecting sensory organ precursors in *Drosophila*

    o Analysis of dynamics in apoptosis and caspase (*cysteine-asp*artic prote*ase*s) regulations

- Significant improvement of the quantitative understanding of biological regulatory systems for further pre-clinical and clinical studies

ADVANCED LINGUISTIC COURSES   Nov. 2001 - Apr. 2002

Luxin Linguistic Studies, Taipei, Taiwan

Advanced English courses including scientific and analytical reading, writing, listening comprehension, and vocabulary

BASIC MILITARY TRAINING AND SPECIALIZED TRAINING   July 2001 - Oct. 2001

Army Chemical School, Taiwan

Techniques for detecting bio-chemicals and for antidoting neuro-destructive reagents / English-to-Chinese translation of users' manuals for innovative chemical military facilities

SUMMER STUDENT TRAINING   Summer 1999

Division of Molecular and Genomic Medicine, National Health Research Institutes, Taipei, Taiwan

Genetic experiments of microorganism transformation in an anti-cancer project, with Dr. Hsiu-Ming Shih

TRANSLATOR   Summer 1999

U-Chanter Enterprise Co., LTD, Taipei, Taiwan

English to Chinese translation of users' manuals for novel medical instruments

TEACHING EXPERIENCE

GUEST LECTURER - BIOMEDICAL OPTICS   Oct. 2009

Biomed. Eng. 552 Biomedical Optics, instructed by Dr. Mary-Ann Mycek in Fall, 2009, at the University of Michigan, Ann Arbor

- Overview and principles of light microscopy
- Theory on resolution in light microscopy

TEACHING ASSISTANT - ANALYTICAL & QUANTITATIVE LIGHT MICROSCOPY
May 2007, May 2009

Analytical & Quantitative Light Microscopy Program, Marine Biological Laboratory, Woods Hole, Massachusetts

- Courses / laboratories on FLIM and FRET
  - Two-photon TCSPC (Time-Correlated Single Photon Counting) FLIM
  - Frequency-domain FLIM
  - Intensity-based FRET detection methods such as sensitized emission of FRET acceptor
- Preparation of live-cell samples
- Explanation of how the hardware worked and how the software / algorithm processed the data, and answered the questions from scientists, researchers, and advanced graduate students.

TEACHING ASSISTANT
Feb. 1998 - Apr. 1998

Nobel Education Center, Taipei, Taiwan

Basic and creative courses for youngsters in physics, chemistry, and biology

HONORS AND AWARDS

BME BLOCK GRANT
Spring and summer, 2004

Provided to students with great academic performance, by the Department of Biomedical Engineering, University of Michigan, Ann Arbor

PRESIDENTIAL AWARDS
Four times during 1997 - 2001

Given each semester to students ranking within the top 5% of the class, by National Taiwan University

CHIANG KAI-SHEK SCHOLARSHIPS
Four years during 1997 - 2001

Awarded to those who are excellent both in academic and campus student activities, by the Taipei Chiang Kai-Shek Scholarship Foundation

LABORATORY TECHNIQUES

IMAGING / IMAGE PROCESSING / MICROSCOPY
- Image segmentation and morphometric analysis
  - Segmentation and orientation / anisotropy analysis of cells and subcellular structures in

live-cell time-series confocal and two-photon images

- TV (Total Variation) and wavelet-based image denoising / image deconvolution

    o Development of novel TV denoising models and their comparison with other currently existing TV models in the improvement of the precision of FLIM

    o Discrete wavelet transform, stationary wavelet transform, and a Poisson-adapted wavelet-based method used and compared in the applications to FLIM

    o Monte Carlo simulations used to evaluate the performance of the image denoising models applied to FLIM images

    o Application of image deconvolution to FLIM images to improve the spatial resolution

- Confocal / multi-photon microscopy and TCSPC FLIM

    o As a super user: Swept field confocal (SFC) / multi-photon laser scanning microscopy system developed by Prairie Technologies, equipped with an Olympus BX51WIF microscope, solid state lasers (405, 488, 561, 643 nm), and a Coherent Chameleon Ultra II Ti:Sapphire laser (680 - 1080 nm) at the Stem Cell Center of the University of California, Berkeley.

    o Confocal laser scanning Zeiss microscope (LSM 510-META), equipped with Coherent Enterprise laser for UV (351, 364 nm), Argon laser for FITC/GFP (458, 488, 514 nm), Helium Neon 1 laser for Rhodamine, Texas Red, Cy3 (543 nm), and Helium Neon 2 laser for Cy5 (633 nm), at the University of Michigan Microscopy and Image Analysis Laboratory

    o Confocal / multi-photon laser scanning Leica microscope (TCS SP5X), equipped with white light laser (470-670 nm), MP laser (710-990 nm), and Argon laser (458, 476, 488, 496, 514 nm), at the University of Michigan Microscopy and Image Analysis Laboratory

    o Two-photon TCSPC FLIM system, composed of a Chameleon^{TM} Vision laser (690-1040 nm) from Coherent Inc., a Zeiss microscope (LSM-510), and a Becker & Hickl TCSPC module, at Marine Biological Laboratory, Woods Hole, Massachusetts

- Time-gated FLIM

    o Novel wide-field time-domain FLIM system for picosecond time-resolved biological imaging, equipped with a nitrogen laser pumping a dye laser for UV-visible-NIR excitation for sub-nanosecond FLIM imaging, with a large temporal dynamic range (750 ps – 1 μs), the 50 ps lifetime discrimination, and the spatial resolution of 1.4 μm

- Super resolution microscopy

    o PALM (Photoactivated Localization Microscopy) and STORM (Stochastic Optical Reconstruction Microscopy) used to visualize detailed localization of molecular motors in cytoskeleton structures

- Atomic force microscopy

    o Development of novel approaches to studying live-cell mechanotransduction, combined with optical methods

- Traction force microscopy

    o Studies of the relationship between cellular traction, tension in focal adhesion proteins, and cytoskeleton viscoelasticity

- FRET (Förster or Fluorescence Resonance Energy Transfer)

    o FRET employed with ECFP and EYFP to detect the interaction of RhoC GTPase and its inhibitor RhoGDIγ in living cells, looking for hints for the treatments of inflammatory breast cancer (IBC). Interaction successfully detected with a difference in ECFP lifetime in our model cells (CV1 cells, SUM149 cells) with a statistically very significant p-value ($<10^{-10}$), confirming this interaction in real time in live-cell cytoplasm

- o FRET employed to detect protein activation after live-cell force stimulation and redistribution

- o FRET employed to measure pico-scale force events in live cells

- FRAP (Fluorescence Recovery After Photobleaching)

  - o FRAP utilized to investigate the assembly stability of molecular motors in cytoskeleton structures

- Optimal gating and fitting methods for fluorescence lifetime mapping

  - o Monte Carlo simulations used to estimate accuracy and precision of each combination of the gating parameters in a time-gated FLIM system to find the optimal sets

  - o Evaluation of model fitting methods

    - Nonlinear least squares (NLLS)

    - Weighted nonlinear least squares (WNLLS)

    - Maximum likelihood estimation (MLE)

- Ultrasound, CT, and MRI

  - o A course "EECS 516 Medical imaging systems" taken (Instructor: Dr. Jeffrey Fessler). Ultrasound, CT, and MRI covered and grade "A" received

CELLULAR / MOLECULAR BIOLOGY

- Cell culture

  - o Two years of working experience in culturing HCT116 and HeLa cells.

  - o Four years of working experience in culturing CV1 and SUM149 cells.

  - o More than four years of working experience in culturing U373 and NIH/3T3 cells.

  - o Four years of responsibility for managing and maintaining laboratory cell culture facilities including an incubator, a laminar flow cabinet, other equipments / chemicals needed for cell culture and assays, and their safety / training.

- Flow cytometry

- Fluorescence-activated cell sorting (FACS)

- DNA microarray techniques / data analysis

- Total / nascent RNA isolation / amplification

  - o Application of the above two techniques to the construction of accurate large-scale genetic profiling of p53-related responses under irradiation stress that caused DNA repair

- Viral transduction

- Transient transfection

- RNA interference (RNAi)

- DNA recombination

- Real-time PCR (Polymerase Chain Reaction) including the design of primers

- PCR-based site-directed mutagenesis for RNAi-resistant construct production

- Immunocytofluorescence

- Western blot

NUMERICAL METHODS / ANALYSIS

- Complex biological system modeling
  - Topics
    - Construction of quantitative models from qualitative mutant phenotypes for selecting sensory organ precursors in Drosophila
    - Analysis of dynamics in apoptosis and caspase (*c*ysteine-*asp*artic prote*ase*s) regulations
  - Methods
    - Modeling with differential equations described by chemical kinetics
    - Development of an algorithm for chemical kinetic parameter estimation, using genetic phenotypes to do multiple large-scale screening with random number generation
    - Analysis of nonlinear dynamics of the complex systems
- Statistical and multivariate analysis
  - Statistical comparisons of fluorescence lifetimes in FRET-FLIM live-cell experiments
  - Analysis of noise and CCD (Charge-Coupled Device) performance
    - Different forms of noises distinguished, explained, and modeled
    - Incorporation of overall noise effects into the novel TV denoising models
  - Analysis of variance (ANOVA) and Tukey-Kramer tests
  - Principal component analysis (PCA)

TISSUE ENGINEERING / BIOMATERIALS

- Polyacrylamide gel synthesis with various stiffness
- Collagen-based biomaterial manufacturing and crosslinking for articular cartilage phantom production
- Freeze drying
- SEM (Scanning Electron Microscopy)
- Microbe passage test
- Bubble point test
- Water uptake test
- Mechanical strength test

CHEMICAL SEPARATION

- Membrane separation
- High performance liquid chromatography (HPLC)
- Gas chromatography (GC)
- Thin layer chromatography (TLC)

COMPUTER PROFICIENCIES

LANGUAGES / PROGRAMMING: Matlab, LabView, C, C++, Java, Fortran

- Language programming was extensively applied in the computational sections of my Ph.D. dissertation, mainly with Matlab.

- Controls of electronics were implemented with LabView.

- C was used for developing a code to simulate stochastic molecular interactions described by chemical kinetics.

OPERATION SYSTEMS: Windows 95/98/2000/XP/Vista/7/8, Linux, Unix, Macintosh

PUBLICATIONS

INVITED BOOK CHAPTERS

De Los Santos, C., **Chang, C. W.**, Mycek, M. A., Cardullo, R., "FRAP, FLIM, and FRET: Detection and analysis of cellular dynamics on a molecule scale using fluorescence microscopy", manuscript in preparation for *Molecular Reproduction and Development*.

Chen, L. C., Lloyd, W. R., **Chang, C. W.**, Sud, D., and Mycek, M. A., "Fluorescence lifetime imaging microscopy for quantitative biological imaging", *Methods Cell Biol.*, 2013, 114, 457-488

Chang, C. W., Mycek, M. A., "Quantitative molecular imaging in living cells via FLIM", *Reviews in Fluorescence 2010*, 2012, 173-198

Chang, C. W., Sud, D., Mycek, M. A., "Fluorescence lifetime imaging microscopy", *Methods Cell Biol.*, 2007, 81, 495-524

PEER-REVEWED JOURNAL ARTICLES

Chang, C. W., Mycek, M. A., "Optimal schemes for retrieving luminescence lifetime from double-exponential decay with gated integration", manuscript in preparation for *Analytical Chemistry*

Chang, C. W., Kumar, S., "Differential contributions of nonmuscle myosin II isoforms and functional domains to stress fiber mechanics", manuscript submitted to *Molecular Biology of the Cell*

Chang, C. W., Kumar, S., "Vinculin tension distributions of individual stress fibers within cell-matrix adhesions", *Journal of Cell Science*, 2013, 126(14), 3021-3030

Paulsen, M. T., Veloso, A., Prasad, J., Bedi, K., Ljungman, E. A., Tsan, Y. C., **Chang, C. W.**, Tarrier, B., Washburn, J. G., Lyons, R., Robinson, D. R., Kumar-Sinha, C., Wilson, T. E., Ljungman, M., "Coordinated regulation of synthesis and stability of RNA during the acute TNF-induced proinflammatory response", *Proceedings of the National Academy of Sciences*, 2013, 110(6),

2240-2245

Chang, C. W., Mycek, M. A., "Total variation versus wavelet-based methods for image denoising in fluorescence lifetime imaging microscopy", *Journal of Biophotonics*, 2012, 5(5-6), 449-57

Chang, C. W., Mycek, M. A., "Enhancing precision in time-domain fluorescence lifetime imaging", *Journal of Biomedical Optics*, 2010, 15(5), 056013

Lloyd, W. R., Wilson, R. H., **Chang, C. W.**, Gillispie, G. D., Mycek, M. A., "Instrumentation to rapidly acquire fluorescence wavelength-time matrices of biological tissues", *Biomedical Optics Express*, 2010, 1(2), 574–586

Chang, C. W., Mycek, M. A., "Precise fluorophore lifetime mapping in live-cell, multi-photon excitation microscopy", *Optics Express*, 2010, 18(8), 8688-8696

Chang, C. W., Wu, M., Merajver, S. D., and Mycek, M. A., "Physiological FLIM improves FRET detection in living cells", *Journal of Biomedical Optics*, 2009, 14(6), 060502

Zhong, W., Wu, M., **Chang, C. W.**, Merrick, K. A., Merajver, S. D., Mycek, M. A., "Picosecond-resolution fluorescence lifetime imaging microscopy: a useful tool for sensing molecular interactions in vivo via FRET", *Optics Express*, 2007, 15(26),18220-18235

Xu, Z., Raghavan, M., Hall, T. L., **Chang, C. W.**, Mycek, M. A., Fowlkes, J. B., Cain, C. A., "High speed imaging of bubble clouds generated in pulsed ultrasound cavitational therapy-histotripsy", *IEEE Trans. Ultrasonics Ferroelectrics Freq. Control*, 2007, 54(10), 2091-2101

Hsu, C. P., Lee, P. H., **Chang, C. W.**, Lee, C. T., "Constructing quantitative models from qualitative mutant phenotypes: preferences in selecting sensory organ precursors", *Bioinformatics*, 2006, 22, 1375-1382

Derheimer, F. A., **Chang, C. W.**, Ljungman, M., "Transcription inhibition: a potential strategy for cancer therapeutics", *Eur. J. Cancer*, 2005, 41(16), 2569-2576

Chang, C. W., Pi, H., Chien, C. T., Hsu, C.P., "Network modeling of Drosophila external sensory organ precursor formation: the role of recently studied genes", *J. Genet. Mol. Biol.*, 2003, 14(4), 243-251

PEER-REVIEWED CONFERENCE PROCEEDINGS

Lloyd, W., **Chang, C. W.**, Wilson, R., Gillispie, G., Mycek, M. A., "Novel clinical technology for rapid detection of tissue fluorescence wavelength-time matrices", *Optical Society of America Biomedical Optics Technical Digest*, 2010, JMA96 (3 pages)

Chang, C. W. and Mycek, M. A., "Increasing precision of lifetime determination in fluorescence lifetime imaging", *Proceedings of SPIE Photonics West, Biomedical Optics Symposium*, 2010, Vol. 7570, 757007 (6 pages)

Chang, C. W., Lloyd, W., Wilson, R., Gillispie, G., Mycek, M. A., "Clinically compatible instrumentation for accurate detection of fluorescence intensity and lifetime in turbid media", *Proceedings of SPIE Photonics West, Biomedical Optics Symposium*, 2010, Vol. 7555, 755503 (6 pages)

Chang, C. W., Wu, M., Merajver, S. D., and Mycek, M. A., "Improving FRET detection in living cells", *Proceedings of SPIE European Conferences on Biomedical Optics*, 2009, Vol. 7370, 737007 (7 pages)

Chang, C. W. and Mycek, M. A., "Improving precision in time-gated FLIM for low-light live-cell imaging", *Proceedings of SPIE European Conferences on Biomedical Optics*, 2009, Vol. 7370, 737009 (6 pages)

Chang, C. W. and Mycek, M. A., "Applying image restoration to fluorescence lifetime imaging microscopy (FLIM)", *Proceedings of SPIE European Conferences on Biomedical Optics*, 2009, Vol. 7367, 73671E (6 pages)

Xu, Z., Raghavan, M., Hall, T. L., **Chang, C. W.**, Mycek, M. A., Fowlkes, J. B., Cain, C. A., "High speed imaging of bubble clouds in pulsed cavitational ultrasound therapy-histotripsy", *Proc. IEEE International Ultrasonics Symposium*, 2006, 293 (4 pages)

PRESENTATIONS

INVITED PRESENTATIONS

Chang, C. W., "Quantitative analysis of cell biology using image processing and biophotonics", *Invited by Dr. Weilan Ye, Molecular Oncology Division, Genentech Inc*, South San Francisco, California, May 1, 2014

Chang, C. W., "Biophotonic dissection of tensile signaling by single stress fibers at the cell-matrix interface", *Invited by Stanford Photonics Research Center Annual Symposium*, Stanford, California, September 17-19, 2012

Chang, C. W., "Fluorescence lifetime imaging microscopy for quantitative live-cell imaging", *Invited by High Content Analysis Conference*, San Francisco, California, January 12, 2011

Chang, C. W., "Study of cellular mechanotransduction using Förster resonance energy transfer (FRET)", *Invited by Dr. David Schaffer, Department of Bioengineering, University of California, Berkeley*, Berkeley, California, October 4, 2010

Chang, C. W., "Fluorescence lifetime imaging microscopy for live-cell analysis", *Invited by Michigan Microscopy & Microanalysis Society Meeting*, East Lansing, Michigan, April 30, 2010

Chang, C. W., "FRET-FLIM analysis in live cells", *Invited by Dr. Kevin Eliceiri, Department of Molecular Biology and Department of Biomedical Engineering, University of Wisconsin-Madison*, Madison, Wisconsin, April 22, 2010

Chang, C. W., "Studying RhoGTPase signaling and mechanotransduction by using FRET-FLIM" *Invited by Dr. Sanjay Kumar, Department of Bioengineering, University of California, Berkeley*, Berkeley, California, April 19, 2010

Chang, C. W., "Molecular imaging in live cells: physiological FLIM for FRET detection and FLIM precision improvement", *Invited by Dr. Irene Georgakoudi, Department of Biomedical Engineering, Tufts University*, Medford, Massachusetts, April 6, 2010

Chang, C. W., "Molecular imaging in live cells: physiological FLIM for FRET detection and FLIM precision improvement", *Invited by Dr. Anna Greka, Division of Nephrology, Massachusetts General Hospital and Harvard Medical School*, Charlestown, Massachusetts, April 6, 2010

Chang, C. W., "Molecular imaging in live cells: physiological FLIM for FRET detection and FLIM precision improvement", *Invited by Dr. Claudio Vinegoni and Dr. Ralph Weissleder, Center for Molecular Imaging Research and Center for Systems Biology, Massachusetts General Hospital and Harvard Medical School*, Boston, Massachusetts, April 5, 2010

CONTRIBUTED PRESENTATIONS AND POSTERS

Chang, C. W. and Kumar, S., "Using FRET and laser nanosurgery to measure the tension distribution of individual stress fibers at the cell-matrix interface", *Cell Biology Across the Bay/ASCB Local Meeting*, Santa Clara, California, May 3, 2014

Chang, C. W. and Kumar, S., "Spatiotemporal tension distribution of individual stress fibers at the cell-matrix interface", *Biophysical Society 58th Annual Meeting*, San Francisco, California, February 15-19, 2014

Chang, C. W. and Kumar, S., "Differential contributions of nonmuscle myosin II isoforms and functional domains to stress fiber mechanics", *Biophysical Society 58th Annual Meeting*, San Francisco, California, February 15-19, 2014

Ananthanarayanan, B., MacKay, J., Singh, G., **Chang, C. W.**, Kumar, S., "Mechanisms of three-dimensional tumor cell motility in dense extracellular matrices", *Biophysical Society 58th Annual Meeting*, San Francisco, California, February 15-19, 2014

Chang, C. W. and Kumar, S., "Combining laser nanosurgery and FRET to measure the tension distribution of single stress fibers at the cell-matrix interface", *Second USACM Thematic Conference on Multiscale Methods and Validation in Medicine and Biology*, Berkeley, California**,** February 13-14, 2014

Chang, C. W. and Kumar, S., "Spatiotemporal distribution of tensile forces by single stress fibers at the cell-matrix interface", *American Society for Cell Biology Annual Meeting*, San Francisco, California, December 15-19, 2012

Chang, C. W. and Kumar, S., "Differential contributions of nonmuscle myosin II isoforms to stress fiber mechanics", *American Society for Cell Biology Annual Meeting*, San Francisco, California, December 15-19, 2012

Ananthanarayanan, B., Singh, G., MacKay, J., **Chang, C. W.**, Kim, Y., Kumar, S., "Mechanisms of three-dimensional glioma cell motility in non-fibrillar matrices", *American Society for Cell Biology Annual Meeting*, San Francisco, California, December 15-19, 2012

Chang, C. W. and Kumar, S., "Mapping single stress fiber contributions to tensional homeostasis with laser nanosurgery and FRET", *BMES 2012 Annual Fall Meeting*, Atlanta, Georgia, October 24-27, 2012

Ananthanarayanan, B., Kim, Y., **Chang, C. W.,** Singh, G.., and Kumar, S., "Mechanisms of glioma invasion in brain-mimetic hyaluronic acid matrices", *BMES 2012 Annual Fall Meeting*, Atlanta, Georgia, October 24-27, 2012

Chang, C. W. and Kumar, S., "Combining laser ablation and FRET to measure the tension distribution of individual stress fibers on focal adhesions", *Annual UC Systemwide Bioengineering Symposium*, Berkeley, California, June 21-23, 2012

Chang, C. W. and Kumar, S., "Isoform-specific contributions of non-muscle myosin II to viscoelastic properties of stress fibers", *Annual UC Systemwide Bioengineering Symposium*, Berkeley, California, June 21-23, 2012

Chang, C. W. and Kumar, S., "Combining laser ablation and FRET to measure the tension distribution of individual stress fibers on focal adhesions", *American Society for Cell Biology Annual Meeting*, Denver, Colorado, December 3-7, 2011

Chang, C. W. and Kumar, S., "Isoform-specific contributions of non-muscle myosin II to viscoelastic properties of stress fibers", *American Society for Cell Biology Annual Meeting*, Denver, Colorado, December 3-7, 2011

Lloyd, W., **Chang, C. W.**, Wilson, R., Gillispie, G., Mycek, M. A., "Novel clinical technology for rapid detection of tissue fluorescence wavelength-time matrices", *OSA Biomedical Optics*, Miami, Florida, April 11-14, 2010

Chang, C. W. and Mycek, M. A., "Increasing precision of lifetime determination in fluorescence lifetime imaging", *Photonics West*, San Francisco, California, January 23-28, 2010

Chang, C. W., Lloyd, W., Wilson, R., Gillispie, G., Mycek, M. A., "Clinically compatible instrumentation for accurate detection of fluorescence intensity and lifetime in turbid media", *Photonics West*, San Francisco, California, January 23-28, 2010

Lloyd, W., **Chang, C. W.**, Wilson, R., Gillispie, G., Mycek, M. A., "Fluorescence intensity and lifetime detection in turbid biological media using clinically compatible instrumentation", *University*

of Michigan Engineering Graduate Symposium, Ann Arbor, Michigan, November 13, 2009

Chang, C. W., Wu, M., Merajver, S. D., and Mycek, M. A., "Improving FRET detection in living cells", *European Conferences on Biomedical Optics*, Munich, Germany, June 14–18, 2009

Chang, C. W. and Mycek, M. A., "Improving precision in time-gated FLIM for low-light live-cell imaging", *European Conferences on Biomedical Optics*, Munich, Germany, June 14–18, 2009

Chang, C. W. and Mycek, M. A., "Applying image restoration to fluorescence lifetime imaging microscopy (FLIM)", *European Conferences on Biomedical Optics*, Munich, Germany, June 14–18, 2009

Chang, C. W., Rosenthal, D., Wu, M., Merajver, S., Mycek, M. A., "Detecting molecular interactions in live cells: environmental controls for FLIM-based FRET detection", *BMES 2008 Annual Fall Meeting*, St. Louis, Missouri, October 2-4, 2008

Chang, C. W., Mycek, M. A., "Improving precision in fluorescence lifetime imaging microscopy for low-light live-cell imaging", *BMES 2008 Annual Fall Meeting*, St. Louis, Missouri, October 2-4, 2008

Xu, Z., Raghavan, M., Hall, T. L., **Chang, C. W.**, Mycek, M. A., Fowlkes, J. B., Cain, C. A., "High speed imaging of bubble clouds in pulsed cavitational ultrasound therapy-histotripsy", *IEEE International Ultrasonics Symposium, 1D-4,* Vancouver, Canada, October 3-6, 2006

Chang, C. W., Rhee, E., Wu, M., Merajver, S., Mycek, M. A., "Imaging molecular interactions of oncogene RhoC in living cells using FLIM/FRET", *Optical Imaging 2006 Fifth Inter-Institute Workshop on Optical Diagnostic Imaging from Bench to Bedside at the National Institutes of Health,* Bethesda, Maryland, September 25-27, 2006

Chang, C. W., Paulsen, M. T., Tsan, Y. C., Beer, D., Ljungman, M., "A novel DNA microarray approach to study inducible gene expression in breast cancer cells", *Department of Defense Breast Cancer Research Program Meeting*, Philadelphia, Pennsylvania, June 8-11, 2005

Chang, C. W., Ljungman, M., "The regulation of glucose transporter 3 by tumor suppressor p53", *Seventh Annual Midwest DNA Repair Symposium*, Detroit, Michigan, May 21-22, 2005

Chang, C. W., Hsu, C. P., "Analysis of robustness in the neurogenic network of Drosophila through theoretical modeling", *16ᵗʰ Federation of Asian and Oceanian Biochemists and Molecular Biologists*, Taipei, Taiwan, September 21- 22, 2002

Lin, M. C., **Chang, C. W.**, Hsieh, H. J., "Symmetric and asymmetric porous chitosan matrices", *ROC-Japan Joint Symposium on Biomaterials and Controlled Release*, Taipei, Taiwan, February 23-24, 2001

LABORATORY PRESENTATIONS AND TOURS

Open House for the CIRM/QB3 Stem Cell Center Shared Facility, University of California, Berkeley, Oct. 5, 2010

Graduate Student Recruitment, Biomedical Engineering, University of Michigan, Mar. 12, 2010

Biomedical Engineering Society (BMES) Lab Open House, University of Michigan, Feb. 25, 2010

Engineering Graduate Symposium, University of Michigan, Nov. 13, 2009

University of Michigan Biomedical Engineering Department Retreat, Sep. 26, 2009

Graduate Programs Information Day and Preview Visits, University of Michigan, Nov. 17, 2006

Society of Women Engineer's Summer Engineering Exploration Camp, University of Michigan, July 19, 2006

Undergraduate Student Recruitment, College of Engineering, University of Michigan, Nov. 5, 2005

Graduate Information Day and Preview Visits, University of Michigan, Nov. 4, 2005

ADDITIONAL PROFESSIONAL ACTIVITIES

TECHNOLOGY TRANSFER DISCLOSURE

Novel Total Variation Models for Denoising (Department of Biomedical Engineering, University of Michigan, Ann Arbor)

GRADUATE- LEVEL COURSE PROJECTS

Diagnosis of Potential Thrombosis Associated with Atherosclerosis Lesions by Using Optical Coherence Tomography, *Biomed. Eng. 552 Biomedical Optics*, instructed by Dr. Mary-Ann Mycek in Fall, 2008, at the University of Michigan, Ann Arbor

Applying Total-Variation (TV) Denoising Models to Images Acquired from Fluorescence Lifetime Imaging Microscopy (FLIM), *MATH 651 Topics in Applied Mathematics I (Applied Mathematics in Image Processing)*, instructed by Dr. Selim Esedoglu in Fall, 2007, at the University of Michigan, Ann Arbor

Introduction to Microarrays, *BIOLCHEM 516 Introduction to Biochemical Laboratory*, instructed by Dr. David Ballou, in Fall, 2004, at the University of Michigan, Ann Arbor

Chaotic Carcinogenesis!? - Theoretical Modeling of Bystander Effects, *Env. Health & Safety 583 Radiation Biology*, instructed by Dr. Mats Ljungman, in Fall, 2003, at the University of Michigan, Ann Arbor

STUDENT / POSTDOC TRAINING AND SUPERVISION

Trainee: Mekhala Raghavan (Graduate Student, Biomedical Engineering, University of Michigan)

Laboratory safety training, laboratory instrument / software training

Trainee: Wei-Zong Chang (Graduate Student, Electrical Engineering, University of Michigan)

Laboratory safety training, laboratory instrument / software training

Trainee: Viola Schweller (Graduate Student, Biomedical Engineering, University of Michigan)

Laboratory safety training, laboratory instrument / software training

Trainee: William Lloyd (Graduate Student, Biomedical Engineering, University of Michigan)

Laboratory safety training, laboratory instrument / software training, research project supervision

Trainee: Leng-Chun Chen (Graduate Student, Biomedical Engineering, University of Michigan)

Laboratory safety training, laboratory instrument / software training, research project supervision

Trainee: Yushan Kim (Graduate Student, Bioengineering, University of California, Berkeley)

Confocal and multi-photon microscopy instrument / software training

Trainee: Sophie Wong (Graduate Student, Bioengineering, University of California, Berkeley)

Confocal microscopy instrument / software training

Trainee: Amit Pathak (Postdoctoral Scholar, Bioengineering, University of California, Berkeley)

Confocal microscopy instrument / software training

Trainee: Albert Keung (Graduate Student, Chemical Engineering, University of California, Berkeley)

Multi-photon microscopy instrument / software training

Trainee: Sebastian Rammensee (Postdoctoral Scholar, Bioengineering, University of California, Berkeley)

Multi-photon microscopy instrument / software training

Trainee: Elena Kassianidou (Graduate Student, Bioengineering, University of California, Berkeley)

Confocal and multi-photon microscopy instrument / software training, laboratory instrument / software training, research project supervision

LANGUAGE PROFICIENCIES

ENGLISH	Fluent
CHINESE (MANDARIN)	Native
CHINESE (TAIWANESE)	Fair
JAPANESE	Beginner

EXTRACURRICULAR ACTIVITIES

VICE PRESIDENT   Aug. 1999 - Feb. 2000

MMB Youngsters' Service Club, NTU (National Taiwan University)

TEACHING ADVISER   Aug. 1998 - Aug. 1999

Cocktail and Cold Beverage Club, NTU

DOCUMENTS AND JOURNAL EDITOR   Aug. 1998 - Feb. 1999

Cocktail and Cold Beverage Club, NTU

JOURNAL EDITOR IN CHIEF   Feb. 1998 - Aug. 1998

Cocktail and Cold Beverage Club, NTU