

Multiphoton Microscopy in the Biomedical Sciences XIII

Ammasi Periasamy

Karsten König

Peter T. C. So

Editors

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- 6 Technology Development-I
Peter T. C. So, Massachusetts Institute of Technology (United States)
- 7 Technology Development-II
Peter T. C. So, Massachusetts Institute of Technology (United States)
- 8 Technology Development-III
Karsten König, Universität des Saarlandes (Germany)
- 9 SHG/THG Microscopy-I
Francesco Saverio Pavone, European Laboratory for Non-linear Spectroscopy (Italy)
- 10 SHG/THG Microscopy-II
Paul J. Campagnola, University of Wisconsin-Madison (United States)

Poster Session

Aisada Uchugonova, Universität des Saarlandes (Germany)
Holly L. Aaron, University of California, Berkeley (United States)
Dusan Chorvat, International Laser Centre in Bratislava (Slovakia)
Kevin W. Eliceiri, University of Wisconsin-Madison (United States)

Introduction

Multiphoton microscopy has been established as the 3-D imaging method of choice for studying biomedical specimens from single cells to whole animals with sub-micron resolution. Two decades have passed since the realization of two-photon microscopy. The ever-expanding scope of applications and the continuing instrumental innovations require a forum where new ideas can be exchanged and presented. Our conference at the SPIE BIOS 2013 meeting continues to address this need.

This is the 13th year of this conference and we start our conference with three keynote lectures from leaders in the field: Drs. Keith Berland from Emory University, United States, Gail McConnell, University of Strathclyde, United Kingdom, and Xiaoliang Sunney Xie, Harvard University, United States.

For the second year in a row, the conference is extremely pleased to have the JenLab Young Investigator Award, in addition to our regular poster awards. This award is donated by Dr. Prof. Karsten König, President and Founder of JenLab GmbH, Germany. The award selection committee includes doctors Arnd Krueger (NewPort-Spectra Physics), Conor Evans (Harvard Univ.), Paul Campagnola (Univ. of Wisconsin) and the three conference chairs. The selection process includes the abstract, manuscript and poster presentation. Two finalists are selected for oral presentation after the poster presentation. The two finalists are (1) Mr. Murat Yildirim, The University of Texas at Austin [Paper 8588-78], and (2) Ms. Alex J. Walsh, Vanderbilt University [Paper 8588-73]. Vocal fold scarring is one of the major causes of voice disorders and may arise from overuse or post-surgical wound healing. Mr. Murat has compared a maximum imaging depth using two photon autofluorescence and second harmonic generation with third-harmonic generation imaging modalities for superior porcine vocal folds using his custom-built system. The other candidate, Ms. Alex Walsh, investigated the stability over time of two-photon auto-fluorescence imaging of NADH and FAD in live-cultured tissues. Her results demonstrated that cultured tissues remain viable for at least several days post excision. Furthermore, the optical redox ratio, NADH fluorescence lifetime, and FAD fluorescence lifetime do not significantly change in the cultured tissues over time.

Ms. Alex Walsh from Vanderbilt University was selected as the winner of the JenLab Young Investigator Award 2013. Please visit the SPIE URL to see the award winning pictures.

The four poster award winners are Ke Wang (Cornell University, United States), Martin Weinigel (JenLab GmbH), Tom Lai (The University of British Columbia, Canada), and Yuji Tanaka, (Osaka University, Japan).

This process above allows the presenters to provide a more in-depth discussion of their subject. Some of the most valuable contributions in this volume are articles written by highly experienced practitioners of multi-photon microscopy. They have enumerated the most important considerations in designing multi-photon microscopes and imaging

experiments. Further, updates on the state-of-the-art commercial multi-photon microscope systems are presented. This volume also includes articles describing some recent advances in major multi-photon microscope components and applications including laser light sources, ultra-fast optics, filters, FRET, FLIM, FCS, Raman, CARS, SRS and CRS microscopy and spectroscopy, single molecule, super-resolution imaging, endoscopy, and various scientific and clinical applications.

On a personal note, the conference chairs are grateful for the participation of all authors, and acknowledge the innovation-driven manufacturers (Becker & Hickl GmbH, Boston Electronics, Carl Zeiss, Chroma Technology, Coherent, ISS, JenLab GmbH, Newport-Spectra Physics, Princeton Instruments and Semrock) for their enthusiastic support in organizing this conference successfully for the last 13 years. We look forward to other exciting conferences in the second decade and welcome your continued participation and support.

**Ammasi Periasamy
Karsten König
Peter T. C. So**

In Memoriam



**Prof. Robert M. Clegg
(1945-2012)**

One personal note to the Fluorescence Microscopy Community... We are deeply sorry to have lost a great scientist in our field. Prof. Robert M. Clegg, University of Illinois at Urbana Champaign passed away on October 15, 2012 from complications arising from cancer. He is survived by his wife and three sons.

Prof. Clegg was born on July 18, 1945, in Providence, Rhode Island. He received his doctorate in physical chemistry in 1974 from Cornell University. Professor E. L. Elson supervised his dissertation entitled "Relaxation Kinetics Applying Repetitive Pressure Perturbations." Following graduation, Bob worked as a postdoctoral research associate in the Max Planck Institute for Biophysical Chemistry in Göttingen, Germany. He was promoted to senior staff research associate in the Department of Molecular Biology where he developed state-of-the-art instruments to investigate the structure of nucleic acids, and to apply photo-physical approaches for clinical applications using FLIM and FRET techniques. Prof. Clegg accepted a position as Professor of Physics and Bioengineering at the University of Illinois at Urbana-Champaign in 1998, where he remained for the rest of his career.

Prof. Clegg was an avid student of the history of science with a special interest in FRET and FLIM. His colleagues considered him "a walking library of FLIM and FRET." Prof. Clegg was also a dedicated and beloved teacher, always searching for simple ways to convey complex biophysical ideas to his students. He was extremely generous with his time and intellect to the ultimate benefit of his students and colleagues. Prof. Clegg presented a number of papers at SPIE conferences and he was one of the Keynote Speakers at the Multiphoton Microscopy in the Biomedical Sciences IX conference, with a title "What is behind all those lifetimes anyway, and where do we go from here?" Prof. Clegg has been teaching (2003-2012) at the international annual workshop on FRET Microscopy organized at the W.M. Keck Center for Cellular Imaging at the University of Virginia, Charlottesville. The FRET and FLIM community will surely miss his absence in future scientific meetings.

