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Ammasi Periasamy
Karsten König
Peter T. C. So
Editors

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Introduction

We started this conference in 2001 and for a few years the total number of abstracts on the average was about 45. As we enter into the 11th year of the conference, the abstract total numbers grown to 120. This is possible because of various factors including great interest in the multi-photon excitation fluorescence microscopy, technology advances in lasers, optics and support and encouragement from various sponsors (vendors) of the conference, and more importantly transformation of the multiphoton technology from bench to bed.

The 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 past since the realization of two-photon microscopy, and the ever-expanding scope of applications and the continuing instrumental innovations require a forum where new ideas can be exchanged and presented. Our conference in the SPIE BIOS2011 meeting continues to address this need. In this year, the conference enjoys the participation of four keynote presentations from leaders of our field including Professors Paras Prasad, Watt Webb, Colin Sheppard, and Karsten König. It is a particular pleasure to have Professor Webb returning to the conference who has given one of the first keynote talks of this conference.

These proceedings 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 the 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 such as the laser light source and the ultra-fast optics.

While the basic physical principles underlying multi-photon microscopy are well understood, the application of this method to biological systems has its unique challenges in biomedical optics and photophysics. Work in this area includes the characterization of the two-photon point spread function in turbid medium and development of new methods to quantify two-photon cross sections in chromophores. Realizing that the incorporation of spectroscopy techniques is critical for extracting quantitative information from specimens, a number of novel spectroscopy techniques based on multi-photon microscopy have been developed. New multi-photon methods have incorporated novel contrast mechanisms such as SRS and CARS, quantitative emission spectroscopy, fluorescence resonance energy transfer, fluorescence correlation spectroscopy and second and third harmonic generation microscopy for acquisition of dynamic information in biological systems.

A number of presentations in this conference have demonstrated that multi-photon imaging is a promising method for single molecular spectroscopy investigations. Single molecular studies using multi-photon fluorescence correlation spectroscopy techniques were presented. Multi-photon imaging methods based on second and third harmonic generation were described. In addition to the development in instrumentation and optics, this volume also contains a number of exciting articles on the use of two-photon microscopy in cell biological studies. Particularly important areas including FRET and FLIM imaging. Many papers were presented are on the use of multi-photon microscopy for the study of tissue physiology and pathology utilizing the long tissue penetration depth of this technique with major impact on many subfields of medicine. Finally, the impact of multiphoton imaging on biotechnology also cannot be underestimated.

A series of excellent papers in this proceeding over the past decade is a sign of the vitality in the multi-photon microscopy field. We have deliberately avoided mentioning any author by name because we believe that it would be inappropriate for us to direct the readers to any particular paper(s). As the field progress, controversies and conflicts among researchers in this field are unavoidable. We believe that this series of proceeding papers should serve as a forum where the authors can voice controversial opinions. Unlike archival journal papers, the editors of this proceeding series intentionally leave in controversial papers. It should be noted that the publication of these papers in this proceeding do not imply the scientific approval of the editors or SPIE as an organization. Further, we believe that this series should serve as a forum for civilized scientific idea of exchange in various technology development and applications. The editors reserve the right to reject any paper without a primary goal of disseminating scientific or engineering knowledge or that is deem to bleach the necessary civility.

On a personal note, the conference chairs are grateful for the participation of all authors, and acknowledge the vendors (Becker & Hickl GmbH, Boston Electronics, Chroma Technology, Coherent, Jen Lab GmbH, Leica Microsystems, MultiPhoton Laser Technologies, Newport-Spectra Physics, Omega Optical, and Semrock) for their enthusiastic support in organizing this conference successfully for the last 11 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

Acknowledgments

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