PROGRESS IN BIOMEDICAL OPTICS AND IMAGING
Vol. 15 No. 10

Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XII

Tuan Vo-Dinh
Anita Mahadevan-Jansen
Warren S. Grundfest
Editors

2–4 February 2014
San Francisco, California, United States

Sponsored and Published by
SPIE

Volume 8935

Proceedings of SPIE, 1605-7422, V. 8935

Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XII, edited by
Tuan Vo-Dinh, Anita Mahadevan-Jansen, Warren S. Grundfest, Proc. of SPIE Vol. 8935,
893501 © 2014 SPIE · CCC code: 1605-7422/14/$18 · doi: 10.1117/12.2053619

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:
Author(s), "Title of Paper," in *Advanced Biomedical and Clinical Diagnostic and Surgical Guidance Systems XII*, edited by Tuan Vo-Dinh, Anita Mahadevan-Jansen, Warren S. Grundfest M.D., Proceedings of SPIE Vol. 8935 (SPIE, Bellingham, WA, 2014) Article CID Number.

ISSN: 1605-7422
ISBN: 9780819498489

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE Digital Library
SPIEDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B … 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID Number.

Contents

BIOSENSING AND IMAGING I

BIOSENSING AND IMAGING II

POSTER SESSION

Conference Committee

Symposium Chairs

James G. Fujimoto, Massachusetts Institute of Technology (United States)
R. Rox Anderson, Wellman Center for Photomedicine, Massachusetts General Hospital (United States) and Harvard School of Medicine (United States)

Program Track Chairs

Tuan Vo-Dinh, Fitzpatrick Institute for Photonics, Duke University (United States)
Anita Mahadevan-Jansen, Vanderbilt University (United States)

Conference Chairs

Tuan Vo-Dinh, Fitzpatrick Institute for Photonics, Duke University (United States)
Anita Mahadevan-Jansen, Vanderbilt University (United States)
Warren S. Grundfest, University of California, Los Angeles (United States)

Conference Program Committee

Maurice C. Aalders, Forensic Technical Solutions (Netherlands)
Francesco Baldini, Istituto di Fisica Applicata Nello Carrara (Italy)
Jennifer K. Barton, The University of Arizona (United States)
Stephen A. Boppart M.D., University of Illinois at Urbana-Champaign (United States)
Gerald Grant, Duke University (United States)
Hong Liu, The University of Oklahoma (United States)
Laura Marcu, University of California, Davis (United States)
Mary-Ann Mycek, University of Michigan (United States)
Jianan Y. Qu, Hong Kong University of Science and Technology (Hong Kong, China)
Urs Utzinger, The University of Arizona (United States)
Georges A. Wagnières, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
Christopher W. Woods M.D., Duke University (United States)
Pixuan 'Joe' Zhou, DMetrix, Inc. (United States)

Session Chairs

1 Fluorescence Systems
Tuan Vo-Dinh, Duke University (United States)

2 Global Health Technologies I
Tuan Vo-Dinh, Duke University (United States)
Pixuan 'Joe' Zhou, DMetrix, Inc. (United States)

3 Global Health Technologies II
Tuan Vo-Dinh, Duke University (United States)
Pixuan 'Joe' Zhou, DMetrix, Inc. (United States)

4 Treatment Modalities and Image-Guided Surgery
Warren S. Grundfest, University of California, Los Angeles (United States)

5 Raman Devices and Methods
Anita Mahadevan-Jansen, Vanderbilt University (United States)

6 Scattering, Reflectance, and Polarimetric Techniques
Kristen Maitland, Texas A&M University (United States)

7 Biosensing and Imaging I
Francesco Baldini, Istituto di Fisica Applicata Nello Carrara (Italy)

8 Biosensing and Imaging II
Urs Utzinger, The University of Arizona (United States)

9 Coherence Techniques I
A. Claude Boccara, Institut Langevin (France)

10 Coherence Techniques II
Stephen A. Boppart M.D., University of Illinois at Urbana-Champaign (United States)

11 Endoscopic Devices and Methods
Urs Utzinger, The University of Arizona (United States)

12 Advanced Medical Devices and Techniques
Paul M. W. French, Imperial College London (United Kingdom)

Introduction

This year's conference continues to explore diagnostic and surgical applications of a broad range of optical techniques, including fluorescent imaging methods, reflectance spectroscopy, diffuse optical spectroscopy, optical coherence tomography, Raman spectroscopy, and other advanced photonic methods. These investigations represent the state-of-the-art in their respective fields, and provide the reader with a snapshot of the most recent developments in optical imaging sciences for diagnostics and surgical guidance. This volume is not meant to be comprehensive. Rather, it presents focused research studies that are necessary for technology development and translation to clinical application. The studies in this volume range from basic science and engineering and modeling efforts to clinical investigations using recently created novel devices. It is important for the reader to place these achievements in context. The goal of many of these studies is to establish the feasibility of a particular approach or device. Demonstration of success does not guarantee clinical adoption of the technology. However, this volume demonstrates the dramatic progress that has been made over the last several years in using optical methods to extract information from tissue, and provide intraoperative guidance for surgical procedures. This progress has been possible through collaborative efforts involving biomedical engineers, optical scientists from a range of disciplines, physicians, electrical and mechanical engineers, molecular biologists, and pharmacologists, among others. Government support, primarily through the NIH and the DOD, has been critical to the development and growth of these interdisciplinary teams. At the same time, several companies have been successful in developing optical-based technologies for diagnostic systems and surgical guidance. This has encouraged additional investment in this growing area of research, which facilitates translation to clinical practice. As noted in last year's Foreword, "These papers illustrate the need for increased support of translational activities and development of academic, industry, and government partnerships to facilitate translation from proof of principle into clinical practice."

At the same time, continued support of basic science and preliminary investigations is critical to continue the growth and development of optical sciences and engineering. These studies provide the foundation for device development and new methods of surgical guidance. Before any new technology can be adapted for clinical use, it is essential to determine both the safety and efficacy of the technology, and demonstrate its operation in models and in animal models (where appropriate). Productive capacity is necessary for the conduct of clinical trials, since clinical trials cannot occur with one device. Therefore, collaboration and technology transfer to industry is an essential part of the technology development process.

We hope that readers of this volume use the papers presented here to assess the state-of-the-art in biomedical optics for advanced biomedical and clinical diagnostic systems and surgical guidance systems. Further, we hope that these papers promote future investigations and serve as a guidepost to future studies.

Tuan Vo-Dinh
Anita Mahadevan-Jansen
Warren S. Grundfest