PROGRESS IN BIOMEDICAL OPTICS AND IMAGING
Vol. 16 No. 55

# *Clinical and Biomedical Spectroscopy and Imaging IV*

**J. Quincy Brown**
**Volker Deckert**
*Editors*

**22–24 June 2015**
**Munich, Germany**

*Sponsored by*
SPIE (United States)
The Optical Society (United States)

*With Support from*
ThorLabs (United Kingdom)
Topcon (Japan)
Toptica Photonics AG (Germany)
Zeiss (United States)

*Published by*
SPIE (United States)

**Volume 9537**

Proc. of SPIE-OSA Biomedical Optics, 1605-7422, V.9537



Clinical and Biomedical Spectroscopy and Imaging IV, edited by J. Quincy Brown, Volker Deckert, Proc. of SPIE-OSA Vol. 9537, 953701 · © 2015 SPIE-OSA
CCC code: 1605-7422/15/$18 · doi: 10.1117/12.2206138

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 *Clinical and Biomedical Spectroscopy and Imaging IV*, edited by J. Quincy Brown, Volker Deckert, Proc. of SPIE-OSA Biomedical Optics Vol. 9537 (SPIE, Bellingham, WA, 2015) Article CID Number.

ISSN: 1605-7422
ISBN: 9781628417029

Copublished 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

and

**The Optical Society**
2010 Massachusetts Ave., N.W., Washington, D.C., 20036 USA
Telephone 1 202/223-8130 (Eastern Time) · Fax 1 202/223-1096
http://www.osa.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. Papers are published as they are submitted and meet publication criteria. A unique 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.

# Contents

# Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

# Conference Committee

*General Chairs*

**Andreas Hielscher**, Columbia University (United States)
**Jürgen Popp**, Friedrich-Schiller Universität Jena (Germany)

*Programme Chairs*

**Rainer Leitgeb**, Medizinische Universität Wien (Austria)
**Nirmala Ramanujam**, Duke University (United States)

*Conference Chairs*

**J. Quincy Brown**, Tulane University (United States)
**Volker Deckert**, Institut für Photonische Technologien e.V. (Germany)

*Conference Programme Committee*

**Yu Chen**, University of Maryland, College Park (United States)
**Darren M. Roblyer**, Boston University (United States)
**Kristen C. Maitland**, Texas A&M University (United States)
**Melissa C. Skala**, Vanderbilt University (United States)
**Jonathan T. C. Liu**, University of Washington (United States)
**Quan Liu**, Nanyang Technological University (Singapore)
**Niels Bendsoe**, Lund University Hospital (Sweden)
**Thomas G. Mayerhöfer**, Institut für Photonische Technologien e.V. (Germany)
**Lise Lyngsnes Randeberg**, Norwegian University of Science and Technology (Norway)
**Kishan Dholakia**, University of St. Andrews (United Kingdom)
**Alastair J. M. Watson**, Royal Liverpool and Broadgreen University Hospitals NHS Trust (United Kingdom)
**Francesco Pavone**, European Laboratory for Non-linear Spectroscopy (Italy)
**James W. Tunnell**, The University of Texas at Austin (United States)

*Session Chairs*

1 Biospectroscopy and POC Diagnostics
**J. Quincy Brown**, Tulane University (United States)

2 Clinical and Preclinical Diagnostics I
**J. Quincy Brown**, Tulane University (United States)

3 Clinical and Preclinical Diagnostics II
**Lise Lyngsnes Randeberg**, Norwegian University of Science and Technology (Norway)

4 Clinical and Preclinical Tissue Characterization I
**Pilar Beatriz García-Allende**, Technische Universität München (Germany)

5 Clinical and Preclinical Tissue Characterization II
**Riccardo Cicchi**, Istituto Nazionale di Ottica (Italy)

6 Minimally Invasive Diagnostics / Laboratory Medicine I
**J. Quincy Brown**, Tulane University (United States)

7 Minimally Invasive Diagnostics / Laboratory Medicine II
**Quan Liu**, Nanyang Technological University (Singapore)

8 Novel Techniques in Diagnosis, Therapy, and Monitoring
**Herbert Schneckenburger**, Hochschule Aalen (Germany)

ECBO Post-Deadline Session
**Rainer Leitgeb**, Medizinische Universität Wien (Austria)

# Introduction

These proceedings are from Clinical and Biomedical Spectroscopy and Imaging IV, held June 22-24, 2015 at the European Conferences on Biomedical Optics in Munich, Germany. This year's conference comprised 45 oral and 42 poster presentations from leading international research groups.

The conference was organized into five tracks and ten sessions including: Biospectroscopy and POC Diagnostics; Clinical and Preclinical Diagnostics I and II; Clinical and Preclinical Tissue Characterization I and II; Minimally Invasive Diagnostics / Laboratory Medicine I and II; and Novel Techniques in Diagnosis, Therapy, and Monitoring. A poster session and corresponding poster preview session were also held.

The Biospectroscopy and POC Diagnostics session contained six oral presentations, on topics ranging from label-free Raman analysis of microorganisms to fluorescence-based rapid porphyria diagnostic tests and multi-spectral surface plasmon resonance sensing.

The Clinical and Preclinical Diagnostics track covered two sessions containing 10 oral presentations. Reports included a number of *ex vivo* and *in vivo* clinical applications, including the use of targeted fluorescence guidance in gastrointestinal endoscopy, fluorescence lifetime imaging of corneal metabolism, rapid near-patient fluorescence microscopy of prostate biopsies, tracking of lipids and invasomes in stratum corneum using TERS, noninvasive detection of hypercholesterolemia using hyperspectral skin imaging, comprehensive analysis of *in vivo* skin optical properties and vascular parameters using diffuse reflectance spectroscopy, deep skin optical property extraction using diffuse reflectance spectroscopy, improved precancer diagnosis using fusion of autofluorescence and diffuse reflectance spectroscopy, the use of diffuse optics to probe the bone marrow for oncological management, and characterization of the thyroid using diffuse optics.

The Clinical and Preclinical Tissue Characterization track also covered two sessions with 11 oral presentations, and included reports on tissue diagnostics using a combined Raman and fluorescence fiber probe, early diagnosis of tongue malignancies using fluorescence spectroscopy, a fluorescent replacement for traditional H&E histopathology, characterization of colitis using autofluorescence spectroscopy, analysis of length-scale variations on light scattering patterns of cells, the use of NIRS to monitor tumor microwave ablation, clinical results on the use of Raman spectroscopy to discriminate inflammatory bowel diseases, the use of structured illumination microscopy to image entire prostate surgical margins, an analysis of the effect of realistic fiber probe interfaces on Monte-Carlo simulated diffuse reflectance, fiber optic thermotherapy for liver tumors, and the effects of

pressure on tissue optical properties measured by single-fiber reflectance spectroscopy.

The Minimally Invasive Diagnostics/Laboratory Medicine track covered two sessions with 12 oral presentations. Topics included lab-on-a-chip SERS for levofloxacin detection in body fluid, SERS for detection of harmful environmental substances, Raman spectroscopy of biogenic gases in hollow-core fibers, Raman spectroscopic temporal monitoring of the quality of stored whole donated blood, a novel method to create a universal calibration data set for Raman reconstruction based on Wiener estimation, detection of propofol in blood by Raman spectroscopy, intracellular pH sensing in cells using genetically encoded ratiometric sensors, measurement of aqueous glucose using differential absorption frequency domain OCT, real time medical diagnostics using hyperspectral imaging, spectroscopic characterization of an ultra-broadband tunable quantum cascade laser, spectroscopic imaging of blood glucose in superficial skin vessels, and a battery operated ATR Fourier spectrometer for *in situ* glucose monitoring.

The Novel Techniques in Diagnosis, Therapy, and Monitoring contained six oral presentations on 3D imaging of apoptosis using light sheet microscopy, reflectance property analysis of RF-fused bowel tissues, analysis of yeast cells using light scattering microscopy, the use of light scattering microscopy for probing apoptosis and tumor cell recognition, the use of 5-ALA for see-and-treat in Barrett's esophagus cellular models, and the use of gold nanorods to track cell death during plasmonic photothermal therapy.

The conference chairs very gratefully acknowledge the members of the programme committee for their work in peer reviewing and scoring the three-page summaries submitted to the conference. In addition, we are grateful to SPIE staff for their help and support during the organization of the conference. Finally, we would like to thank all of the conference attendees and authors for contributing to this year's successful conference.

**J. Quincy Brown**
**Volker Deckert**