

PROGRESS IN BIOMEDICAL OPTICS AND IMAGING

Vol. 13, No. 19

Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues X

**Daniel L. Farkas
Dan V. Nicolau
Robert C. Leif**
Editors

**21–23 January 2012
San Francisco, California, United States**

Sponsored and Published by
SPIE

Volume 8225

Proceedings of SPIE, 1605-7422, v. 8225

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues X, edited by Daniel L. Farkas, Dan V. Nicolau, Robert C. Leif, Proc. of SPIE Vol. 8225, 822501 · © 2012 SPIE · CCC code: 1605-7422/12/\$18 · doi: 10.1117/12.931289

Proc. of SPIE Vol. 8225 822501-1

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 *Imaging, Manipulation, and Analysis of Biomolecules, Cells, and Tissues X*, edited by Daniel L. Farkas, Dan V. Nicolau, Robert C. Leif, Proceedings of SPIE Vol. 8225 (SPIE, Bellingham, WA, 2012) Article CID Number.

ISSN 1605-7422

ISBN 9780819488688

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

Copyright © 2012, Society of Photo-Optical Instrumentation Engineers.

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 1605-7422/12/\$18.00.

Printed in the United States of America.

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

SPIE 
Digital Library

SPIDigitalLibrary.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

ix *Conference Committee*

SESSION 1 FUNCTIONAL IMAGING OF BIOMOLECULES, LIVE CELLS, AND TISSUES

- 8225 05 **Heavy metal stress detection and monitoring via LED-induced chlorophyll fluorescence analysis of *Zea mays* L. seedlings aimed at polluted soil phytoremediation** [8225-04]
A. S. Gouveia-Neto, E. A. Silva, Jr., A. J. da Silva, C. W. A. do Nascimento, Univ. Federal Rural de Pernambuco (Brazil)
- 8225 0A **Long-term measurement of spontaneous membrane fluctuations over a wide dynamic range in the living cell by low-coherent quantitative phase microscopy** [8225-11]
T. Yamauchi, Hamamatsu Photonics K.K. (Japan); T. Sakurai, Toyohashi Univ. of Technology (Japan) and Hamamatsu Univ. School of Medicine (Japan); H. Iwai, Y. Yamashita, Hamamatsu Photonics K.K. (Japan)

SESSION 2 OPTICAL MANIPULATION OF CELLS AND TISSUES

- 8225 0B **Rotation of microscopic objects in fiber optic trap** [8225-12]
B. J. Black, S. K. Mohanty, The Univ. of Texas at Arlington (United States)
- 8225 0C **Multispectral optical tweezers for molecular diagnostics of single biological cells (Invited Paper)** [8225-13]
C. Butler, S. Fardad, A. Sincore, M. Vangheluwe, M. Baudelet, M. Richardson, CREOL, The College of Optics and Photonics, Univ. of Central Florida (United States)

SESSION 3 BIOPHOTONIC TECHNIQUES FOR REGENERATIVE MEDICINE

- 8225 0G **Phase resolved and coherence gated en face reflection imaging of multilayered embryonal carcinoma cells** [8225-17]
T. Yamauchi, T. Fukami, H. Iwai, Y. Yamashita, Hamamatsu Photonics K.K. (Japan)
- 8225 0H **Label-free multiphoton fluorescence imaging monitors metabolism in living primary human cells used for tissue engineering** [8225-18]
L.-C. Chen, W. R. Lloyd, S. Kuo, C. L. Marcelo, S. E. Feinberg, M.-A. Mycek, Univ. of Michigan (United States)
- 8225 0J **Investigation for the differentiation process of mouse ES cells by Raman spectroscopy** [8225-20]
Y. Yamaguchi, M. A. El-Hagrasy, E. Shimizu, M. Saito, E. Tamiya, Osaka Univ. (Japan)

SESSION 4 ADVANCED QUANTITATION IN CELLS (CYTOMICS) AND TISSUES (HISTOMICS) I

- 8225 0L **A new diagnostic tool based on diffusion reflection measurements of gold nanoparticles** [8225-08]
R. Ankri, H. Duadi, D. Fixler, Bar-Ilan Univ. (Israel)
- 8225 0M **mb-FLIM: model-based fluorescence lifetime imaging (Invited Paper)** [8225-23]
Q. Zhao, I. T. Young, R. Schouten, S. Stallinga, Technische Univ. Delft (Netherlands); K. Jalink, Netherlands Cancer Institute (Netherlands); S. de Jong, Lambert Instruments BV (Netherlands)
- 8225 0N **MEM-FLIM: all-solid-state camera for fluorescence lifetime imaging** [8225-22]
Q. Zhao, I. T. Young, B. Schelen, R. Schouten, R. van den Oever, Technische Univ. Delft (Netherlands); R. Leenen, H. van Kujik, I. Peters, F. Polderdijk, J. Bosiers, Teledyne DALSA (Netherlands); K. Jalink, Netherlands Cancer Institute (Netherlands); S. de Jong, B. van Geest, K. Stoop, Lambert Instruments BV (Netherlands)
- 8225 0O **Quality testing of an innovative cascade separation system for multiple cell separation** [8225-24]
A. Pierzchalski, A. Moszczynska, Univ. Leipzig (Germany) and Cardiac Ctr. GmbH (Germany); B. Albrecht, Cardiac Ctr. GmbH (Germany); J.-M. Heinrich, pluriSelect GmbH (Germany); A. Tarnok, Univ. Leipzig (Germany) and Cardiac Ctr. GmbH (Germany)
- 8225 0P **In vivo cell tracking and quantification method in adult zebrafish** [8225-25]
L. Zhang, Massachusetts General Hospital, Harvard Medical School (United States) and Fudan Univ. (China); C. Alt, Massachusetts General Hospital, Harvard Medical School (United States); P. Li, R. M. White, L. I. Zon, Harvard Medical School (United States); X. Wei, Shanghai Jiaotong Univ. (China) and Fudan Univ. (China); C. P. Lin, Massachusetts General Hospital, Harvard Medical School (United States)

SESSION 5 ADVANCED QUANTITATION IN CELLS (CYTOMICS) AND TISSUES (HISTOMICS) II

- 8225 0Z **A cost-effective analog method to produce time-gated luminescence images** [8225-35]
R. C. Leif, Newport Instruments (United States); S. Yang, Newport Instruments (United States) and Phoenix Flow Systems Inc. (United States); Y. Lu, Macquarie Univ. (Australia) and Tsinghua Univ. (China); D. Jin, Macquarie Univ. (Australia); S. Chambers, Artemis CCD Ltd. (United Kingdom)
- 8225 10 **Towards a colony counting system using hyperspectral imaging** [8225-36]
B. Masschelein, IMEC (Belgium); A. Robles-Kelly, National ICT Australia (Australia); C. Blanch, N. Tack, IMEC (Belgium); B. Simpson-Young, National ICT Australia (Australia); A. Lambrechts, IMEC (Belgium)

SESSION 6 IMAGE AND DATA PROCESSING, QUANTIFICATION, STANDARDS, AND DISPLAY METHODS

- 8225 11 **The effects of different gold standards on the accuracy of optical coherence tomography** [8225-37]
C. N. Copeland, A. K. Ellerbee, Stanford Univ. (United States)

- 8225 12 **Comparison of quantitative flow cytometric data provided by panels with lower and increased color number** [8225-38]
J. Bocsi, A. Mittag, A. Pierzchalski, A. Baumgartner, I. Dähnert, A. Tárnok, Univ. Leipzig (Germany)
- 8225 13 **Diffusion properties of single F_0F_1 -ATP synthases in a living bacterium unraveled by localization microscopy** [8225-39]
M. Renz, Univ. of Stuttgart (Germany) and Jena Univ. Hospital (Germany); T. Rendler, Univ. of Stuttgart (Germany); M. Börsch, Univ. of Stuttgart (Germany) and Jena Univ. Hospital (Germany)
- 8225 14 **Sparsity reconstruction for bioluminescence tomography based on an augmented Lagrangian method** [8225-40]
W. Guo, K. Jia, Beijing Univ. of Technology (China); J. Tian, Institute of Automation (China); D. Han, Institute of Automation (China) and Northeastern Univ. (China); X. Liu, Northeastern Univ. (China); K. Liu, Institute of Automation (China); Q. Zhang, Xidian Univ. (China); J. Feng, Beijing Univ. of Technology (China); C. Qin, Institute of Automation (China)

SESSION 7 SPECTRAL IMAGING: MICROSCOPIC AND MACROSCOPIC

- 8225 15 **Raman imaging of alkyne as a small tag for biological molecules (Invited Paper)** [8225-41]
K. Fujita, Japan Science and Technology Agency (Japan) and Osaka Univ. (Japan); H. Yamakoshi, K. Dodo, Japan Science and Technology Agency (Japan) and RIKEN (Japan); A. Palonpon, Japan Science and Technology Agency (Japan); M. Okada, Osaka Univ. (Japan); J. Ando, Japan Science and Technology Agency (Japan); S. Kawata, Osaka Univ. (Japan) and RIKEN (Japan); M. Sodeoka, Japan Science and Technology Agency (Japan) and RIKEN (Japan)
- 8225 16 **Two-photon cryomicroscope** [8225-42]
H. G. Breunig, C. Köhler, JenLab GmbH (Germany); K. König, JenLab GmbH (Germany) and Saarland Univ. (Germany)
- 8225 17 **Extraction of masked fluorescence peaks through synchronous fluorescence spectroscopy** [8225-43]
S. Devi, M. Mozumder, Indian Institute of Technology Kanpur (India); N. Ghosh, Indian Institute of Science Education and Research Kolkata (India); A. Pradhan, Indian Institute of Technology Kanpur (India)
- 8225 18 **Water's contribution and enzyme's work: a KITA study** [8225-44]
B. Born, Ruhr-Univ. Bochum (Germany) and The Weizmann Institute of Science (Israel); I. Sagi, The Weizmann Institute of Science (Israel); M. Havenith, Ruhr-Univ. Bochum (Germany)
- 8225 1B **Inhomogeneous Monte Carlo simulations of dermoscopic spectroscopy** [8225-47]
D. S. Gareau, The Rockefeller Univ. (United States) and Oregon Health & Science Univ. (United States); T. Li, S. Jacques, Oregon Health & Science Univ. (United States); J. Krueger, The Rockefeller Univ. (United States)

8225 1C **Raman spectroscopic study of keratin 8 knockdown oral squamous cell carcinoma derived cells** [8225-48]
S. P. Singh, H. Alam, C. Dmello, M. M. Vaidya, C. M. Krishna, Advanced Ctr. for Treatment, Research and Education in Cancer (India)

8225 1D **Multiphoton spectroscopy of human skin in vivo** [8225-49]
H. G. Breunig, M. Weinigel, JenLab GmbH (Germany); K. König, JenLab GmbH (Germany) and Saarland Univ. (Germany)

SESSION 8 MULTIPARAMETER MEASUREMENTS

8225 1F **Multimodal in vivo MRI and NIRF imaging of bladder tumor using peptide conjugated glycol chitosan nanoparticles** [8225-51]
J. Key, D. Dhawan, D. W. Knapp, Purdue Univ. (United States); K. Kim, I. C. Kwon, K. Choi, Korean Institute of Science and Technology (Korea, Republic of); J. F. Leary, Purdue Univ. (United States)

8225 1I **Multimodal optical setup for nonlinear and fluorescence lifetime imaging microscopies: improvement on a commercial confocal inverted microscope** [8225-54]
V. B. Pelegati, Univ. Estadual de Campinas (Brazil); J. Adur, Univ. Estadual de Campinas (Brazil) and Univ. Nacional de Entre Rios (Argentina); A. A. de Thomaz, D. B. Almeida, M. O. Baratti, H. F. Carvalho, C. L. Cesar, Univ. Estadual de Campinas (Brazil)

SESSION 9 BIOMEDICAL IMAGING AND CELL MANIPULATION USING A DIGITAL MICROMIRROR DEVICE I: JOINT SESSION WITH CONFERENCE 8254

8225 1K **Realization of an endoscope equipped with microprojection system for optogenetics** [8225-56]
R. Baumgartner, R. Falk, R. Pashaie, Univ. of Wisconsin-Milwaukee (United States)

POSTER SESSION

8225 1P **LED induced chlorophyll fluorescence signatures from leaves of *Saccharum officinarum* seedlings under water deficit stress** [8225-60]
A. S. Gouveia-Neto, E. A. Silva, Jr., R. A. Oliveira, P. C. Cunha, E. B. Costa, T. J. R. Câmara, L. G. Willadino, Univ. Federal Rural de Pernambuco (Brazil)

8225 1Q **Hydrogen peroxide induces apoptosis via a mitochondrial pathway in chondrocytes** [8225-61]
C. Zhuang, Q. Liang, X. Wang, The First Affiliated Hospital of Jinan Univ. (China); T. Chen, South China Normal Univ. (China)

8225 1R **Combining nanoscale optical phenomena with atomic force microscopy for cellular studies** [8225-62]
S. Amini, Texas A&M Univ. (United States); Z. Sun, G. A. Meininger, Univ. of Missouri-Columbia (United States); K. E. Meissner, Texas A&M Univ. (United States)

- 8225 1V **Milk phospholipid's protective effects against UV damage in skin equivalent models** [8225-69]
C. Dargitz, A. Russell, M. Bingham, Z. Achay, R. Jimenez-Flores, L. H. Laiho, California Polytechnic State Univ. (United States)
- 8225 1X **Biological imaging with high dynamic range using compressive imaging technique** [8225-71]
M. Abolbashari, G. Babaie, The Univ. of North Carolina at Charlotte (United States); F. Magalhães, M. V. Correia, INESC Porto (Portugal) and Univ. do Porto (Portugal); F. M. Araújo, Univ. do Porto (Portugal); A. S. Gerges, F. Farahi, The Univ. of North Carolina at Charlotte (United States)
- 8225 1Z **Single optical fiber probe for optogenetics** [8225-73]
R. Falk, M. Habibi, R. Pashaie, Univ. of Wisconsin-Milwaukee (United States)
- 8225 22 **Dual coupled radiative transfer equation and diffusion approximation for the solution of the forward problem in fluorescence molecular imaging** [8225-76]
D. Gorpas, Technological Educational Institute of Messolonghi (Greece); S. Andersson-Engels, Lund Univ. (Sweden)
- 8225 23 **Spectrally resolved visualization of fluorescent dyes permeating into skin** [8225-77]
U. Maeder, T. Bergmann, S. Beer, J. M. Burg, T. Schmidts, F. Runkel, M. Fiebich, Technische Hochschule Mittelhessen (Germany)
- 8225 24 **Live cardiomyocyte imaging via hybrid TPEF-SHG microscopy** [8225-78]
H. Liu, W. Qin, Clemson Univ. (United States); Y. Shao, Shenzhen Univ. (China); Q. Liu, Z. Ma, Clemson Univ. (United States); T. K. Borg, Medical Univ. of South Carolina (United States); B. Z. Gao, Clemson Univ. (United States)
- 8225 26 **Classification of retinopathic injury using image cytometry and vasculature complexity** [8225-80]
K. Staniszewski, R. Sepehr, Univ. of Wisconsin, Milwaukee (United States); C. M. Sorenson, N. Sheibani, Univ. of Wisconsin School of Medicine and Public Health (United States); M. Ranji, Univ. of Wisconsin, Milwaukee (United States)
- 8225 29 **Threshold-free method for three-dimensional segmentation of organelles** [8225-83]
Y.-H. M. Chan, W. F. Marshall, Univ. of California, San Francisco (United States)
- 8225 2A **Optical cryo-imaging of kidney mitochondrial redox state in diabetic mouse models** [8225-84]
S. Maleki, R. Sepehr, K. Staniszewski, Univ. of Wisconsin, Milwaukee (United States); N. Sheibani, C. M. Sorenson, Univ. of Wisconsin School of Medicine and Public Health (United States); M. Ranji, Univ. of Wisconsin, Milwaukee (United States)
- 8225 2B **Investigation of shape memory of red blood cells using optical tweezers and quantitative phase microscopy** [8225-85]
N. Cardenas, S. K. Mohanty, The Univ. of Texas at Arlington (United States)

- 8225 2C **Multispectral angular domain imaging with a tunable pulsed laser** [8225-86]
E. Ng, Lawson Health Research Institute (Canada) and The Univ. of Western Ontario (Canada); F. Vasefi, Lawson Health Research Institute (Canada), The Univ. of Western Ontario (Canada), and Simon Fraser Univ. (Canada); J. J. L. Carson, Lawson Health Research Institute (Canada) and The Univ. of Western Ontario (Canada)
- 8225 2E **Tissue imaging with a stigmatic mass microscope using laser desorption/ionization** [8225-88]
K. Awazu, H. Hazama, Osaka Univ. (Japan) and Japan Science and Technology Agency (Japan); T. Hamanaka, Osaka Univ. (Japan); J. Aoki, M. Toyoda, Osaka Univ. (Japan) and Japan Science and Technology Agency (Japan); Y. Naito, The Graduate School for the Creation of New Photonics Industries (Japan) and Japan Science and Technology Agency (Japan)
- 8225 2J **Dynamic focus optical coherence tomography: feasibility for improved basal cell carcinoma investigation** [8225-93]
M. R. Nasiri-Avanaki, Univ. of Kent (United Kingdom) and St Bartholomew's and Royal London School of Medicine and Dentistry (United Kingdom); A. Aber, St Bartholomew's and Royal London School of Medicine and Dentistry (United Kingdom); S. A. Hajjatoleslami, Univ. of Kent (United Kingdom); M. Sira, Hermitage Lane Maidstone Hospital (United Kingdom); J. B. Schofield, Preston Hall Hospital (United Kingdom); C. Jones, St Bartholomew's and Royal London School of Medicine and Dentistry (United Kingdom); A. Gh. Podoleanu, Univ. of Kent (United Kingdom)
- 8225 2K **Kynetic resazurin assay (KRA) for bacterial quantification of foodborne pathogens** [8225-94]
Y. Arenas, A. Mandel, Theralase, Inc. (Canada); L. Lilge, Ontario Cancer Institute, Univ. of Toronto (Canada)

Author Index

Conference Committee

Symposium Chairs

James G. Fujimoto, Massachusetts Institute of Technology (United States)

R. Rox Anderson, Wellman Center for Photomedicine, Massachusetts General Hospital, Harvard School of Medicine (United States)

Program Track Chairs

Ammasi Periasamy, University of Virginia (United States)

Daniel L. Farkas, SMI (United States)

Conference Chairs

Daniel L. Farkas, SMI (United States)

Dan V. Nicolau, University of Liverpool (United Kingdom)

Robert C. Leif, Newport Instruments (United States)

Conference Cochairs

James F. Leary, Purdue University (United States)

J. Paul Robinson, Purdue University (United States)

Attila Tarnok, Universität Leipzig (Germany)

Program Committee

Vincenza Andrisano, Università degli Studi di Bologna (Italy)

Christopher H. Contag, Stanford University School of Medicine (United States)

Ewa M. Goldys, Macquarie University (Australia)

Dayong Jin, Macquarie University (Australia)

Charles P. Lin, Massachusetts General Hospital (United States)

Andreas G. Nowatzky, Cedars-Sinai Medical Center (United States)

Ramesh Raghavachari, U.S. Food and Drug Administration (United States)

Markus Sauer, Universität Bielefeld (Germany)

Takahisa Taguchi, National Institute of Advanced Industrial Science and Technology (Japan)

Robert M. Zucker, U.S. Environmental Protection Agency (United States)

Session Chairs

- 1 Functional Imaging of Biomolecules, Live Cells, and Tissues
Dan V. Nicolau, University of Liverpool (United Kingdom)
- 2 Optical Manipulation of Cells and Tissues
Dan V. Nicolau, University of Liverpool (United Kingdom)
- 3 Biophotonic Techniques for Regenerative Medicine
Dan V. Nicolau, University of Liverpool (United Kingdom)
Attila Tarnok, Universität Leipzig (Germany)
- 4 Advanced Quantitation in Cells (Cytomics) and Tissues (Histomics) I
Robert C. Leif, Newport Instruments (United States)
- 5 Advanced Quantitation in Cells (Cytomics) and Tissues (Histomics) II
Attila Tarnok, Universität Leipzig (Germany)
- 6 Image and Data Processing, Quantification, Standards, and Display Methods
Ian T. Young, Technische Universiteit Delft (Netherlands)
- 7 Spectral Imaging: Microscopic and Macroscopic
Daniel L. Farkas, SMI (United States)
- 8 Multiparameter Measurements
Daniel L. Farkas, SMI (United States)
- 9 Biomedical Imaging and Cell Manipulation Using a Digital Micromirror Device I: Joint Session with Conference 8254
Calum E. MacAulay, The BC Cancer Agency Research Centre (Canada)
Michael R. Douglass, Texas Instruments Inc. (United States)
- 10 Advanced Quantitation in Cells (Cytomics) and Tissues (Histomics) III
Robert C. Leif, Newport Instruments (United States)
- 11 Biomedical Imaging and Cell Manipulation Using a Digital Micromirror Device II: Joint Session with Conference 8254
Karel J. Zuzak, Digital Light Innovations (United States)
James F. Leary, Purdue University (United States)
- 12 Biomedical Imaging and Cell Manipulation Using a Digital Micromirror Device III: Joint Session with Conference 8254
Michael R. Douglass, Texas Instruments Inc. (United States)
James F. Leary, Purdue University (United States)