Smart Biomedical and Physiological Sensor Technology X

Brian M. Cullum
Eric S. McLamore
Editors

1–2 May 2013
Baltimore, Maryland, United States

Sponsored and Published by
SPIE

Volume 8719
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:


ISSN: 1605-7422
ISBN: 9780819495105

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 © 2013, 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 1605-7422/13/$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the 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

vii Conference Committee

SMART BIOSENSING STRATEGIES AT THE CELLULAR AND BACTERIAL LEVEL

8719 03 Developing a cell-based sensor for the detection of Autoinducer-2 [8719-2]
M. D. Servinsky, K. Germane, E. S. Gerlach, C.-Y. Tsao, U.S. Army Research Lab. (United States); C. M. Byrd, Univ. of Maryland (United States); C. J. Sund, U.S. Army Research Lab. (United States); W. E. Bentley, Univ. of Maryland (United States)

SMART MATERIALS FOR BIORECOGNITION AND BIOSENSING

8719 09 Biodiscovery of aluminum binding peptides [8719-9]
B. L. Adams, D. A. Sarkes, A. S. Finch, M. M. Hurley, D. Stratis-Cullum, U.S. Army Research Lab. (United States)

8719 0A Prediction of protein-peptide interactions: application of the XPairIt API to anthrax lethal factor and substrates [8719-10]
M. M. Hurley, M. S. Sellers, U.S. Army Research Lab. (United States)

LAB-ON-A-CHIP TECHNOLOGIES FOR BIOLOGICAL SENSING

8719 0C From microfluidic modules to an integrated Lab-on-a-chip system for the detection of Francisella tularensis [8719-12]
N. Hlawatsch, M. Krumbholz, A. Prüfer, C. Moche, H. Becker, C. Gärtner, microfluidic ChipShop GmbH (Germany)

8719 0D Effect of surface structuring onto the efficiency of the in- and out-coupling of light from a chip in Lab-on-a-chip approaches with optical detection [8719-13]
I. Frese, R. Gransee, Institut für Mikrotechnik Mainz GmbH (Germany)

8719 0E Purification of Bacillus thuringiensis DNA with polymer-based, microfluidic lab-on-a-chip systems [8719-14]
S. Julich, Friedrich-Loeffler-Institute (Germany); N. Hlawatsch, microfluidic ChipShop GmbH (Germany); R. Kopinc, A. Lapanje, Institute of Physical Biology (Slovenia); H. Tomaso, Friedrich-Loeffler-Institute (Germany)

8719 0F Microchannel impedance for quasi Newtonian fluids with spatial modulated viscosity [8719-15]
T. Tabares Medina, Univ. EAFIT (Colombia)

8719 0G Cylindrical matrix device with a circular release area with inhomogeneous diffusivity (Invited Paper) [8719-16]
C. A. Cuartas Velez, Univ. EAFIT (Colombia)
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
<th>Institution(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8719 0H</td>
<td>Lignin and silicate based hydrogels for biosensor applications [8719-17]</td>
<td>S. L. Burrs, S. Jairam, Univ. of Florida (United States); D. C. Vanegas, Univ. of Florida (United States) and Ciudad Univ. Meléndez (Colombia); Z. Tong, E. S. McLamore, Univ. of Florida (United States)</td>
<td></td>
</tr>
<tr>
<td>8719 0I</td>
<td>Biocompatible hydrogel membranes for the protection of RNA aptamer-based electrochemical sensors [8719-18]</td>
<td>L. R. Schoukroun-Barnes, S. Wagan, J. Liu, J. B. Leach, R. J. White, Univ. of Maryland, Baltimore County (United States)</td>
<td></td>
</tr>
<tr>
<td>8719 0J</td>
<td>Utilizing metalized fabrics for liquid and rip detection and localization [8719-19]</td>
<td>S. A. Holland, The Univ. of Tennessee Knoxville (United States); C. A. Mahan, Western Kentucky Univ. (United States); M. J. Kuhn, N. C. Rowe, Oak Ridge National Lab. (United States)</td>
<td></td>
</tr>
<tr>
<td>8719 0K</td>
<td>Non-invasive mechanical properties estimation of embedded objects using tactile imaging sensor [8719-20]</td>
<td>F. Saleheen, V. Oleksyuk, A. Sahu, C.-H. Won, Temple Univ. (United States)</td>
<td></td>
</tr>
<tr>
<td>8719 0L</td>
<td>Ambulatory EEG NeuroMonitor platform for engagement studies of children with development delays [8719-21]</td>
<td>R. Mahajan, S. Consul-Pacareu, M. Abusaud, M. N. Sahadat, B. I. Morshed, The Univ. of Memphis (United States)</td>
<td></td>
</tr>
<tr>
<td>8719 0M</td>
<td>Remote sensing of heart rate using millimeter-wave interferometry and probabilistic interpolation [8719-22]</td>
<td>I. V. Mikhelson, Northwestern Univ. (United States); S. Bakhtiari, T. W. Elmer II, S. Liao, Argonne National Lab. (United States); A. V. Sahakian, Northwestern Univ. (United States)</td>
<td></td>
</tr>
</tbody>
</table>

### SMART SENSING PLATFORMS AND TECHNOLOGIES

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
<th>Institution(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8719 0N</td>
<td>Non-invasive microsensors for studying cell/tissue physiology [8719-23]</td>
<td>D. C. Vanegas, Univ. of Florida (United States) and Ciudad Univ. Meléndez (Colombia); M. Taguchi, P. Chaturvedi, S. Burrs, E. S. McLamore, Univ. of Florida (United States)</td>
<td></td>
</tr>
<tr>
<td>8719 0O</td>
<td>A multiplexing fiber optic microsensor system for monitoring oxygen concentration in plants [8719-24]</td>
<td>P. Chaturvedi, B. A. Hauser, Univ. of Florida (United States); L. H. Allen, USDA - Agricultural Research Service (United States); K. J. Boote, Univ. of Florida (United States); E. Karplus, Science Wares, Inc. (United States); E. S. McLamore, Univ. of Florida (United States)</td>
<td></td>
</tr>
<tr>
<td>8719 0P</td>
<td>Towards a modular, robust, and portable sensing platform for biological and point of care diagnostics [8719-25]</td>
<td>A. S. Finch, J. R. Bickford, M. A. Conn, M. B. Coppock, D. A. Sarkes, D. N. Stratis-Cullum, U.S. Army Research Lab. (United States)</td>
<td></td>
</tr>
</tbody>
</table>

E. Simsek, The George Washington Univ. (United States)
MULTISPECTRAL IMAGING AGENTS AND SYSTEMS FOR TISSUE DIAGNOSTICS

8719 0T Development and characterization of two-photon fluorescent mini-emulsion nanoparticles for targeted cancer drug delivery [8719-29]
S. K. Sarkar, Conestoga High School (United States) and Univ. of Massachusetts Lowell (United States); L. Li, Univ. of Massachusetts Lowell (United States); M. V. Backer, J. M. Backer, SibTech, Inc. (United States); J. Kumar, Univ. of Massachusetts Lowell (United States)

8719 0U Bifunctional gold nanoparticles for targeted dual imaging of angiotensin converting enzyme (Invited Paper) [8719-30]
W. E. Ghann, Univ. of Maryland, Baltimore County (United States); Y.-S. Kim, National Cancer Institute (United States); S. Xu, X. Lu, M. F. Smith, R. Gullapalli, T. Fleiter, Univ. of Maryland School of Medicine (United States); M. W. Brechbiel, National Cancer Institute (United States); M.-C. Daniel, Univ. of Maryland, Baltimore County (United States)

8719 0V Acousto-optical imagers for chemical and biological detection: growth and characterization of Hg2Cl2-xBrx crystals [8719-32]
N. B. Singh, Univ. of Maryland, Baltimore County (United States); M. Gottlieb, D. Suhre, Univ. of Maryland, Baltimore County (United States) and DRS Scientific Inc. (United States); T. Raja, B. Arnold, Univ. of Maryland, Baltimore County (United States); M. Singh, VBS Purvanchal Univ. (India); D. Machuga, Potomac Institute for Policy Studies (United States)

8719 0W Hyperspectral imaging system to discern malignant and benign canine mammary tumors [8719-33]
A. Sahu, C. McGoverin, N. Pleshko, Temple Univ. (United States); K. Sorenmo, Univ. of Pennsylvania (United States); C.-H. Won, Temple Univ. (United States)

BIOPHOTONIC IMAGING OF TISSUE AND TISSUE PHANTOMS

8719 0X Near-infrared photoacoustic diagnostics in biomedicine: analysis of thermal safety and light-tissue interactions [8719-34]
T. Gould, Q. Wang, D.-H. Kim, J. Pfefer, U.S. Food and Drug Administration (United States)

8719 0Y Characterization and application of 3D-printed phantoms for biophotonic imaging [8719-35]
J. Wang, Univ. of Maryland (United States) and U.S. Food and Drug Administration (United States); J. Coburn, U.S. Food and Drug Administration (United States); C.-P. Liang, Univ. of Maryland (United States); N. Woolsey, Univ. of Maryland (United States) and U.S. Food and Drug Administration (United States); D. Le, J. Ramella-Roman, U.S. Food and Drug Administration (United States) and The Catholic Univ. of America (United States); Y. Chen, Univ. of Maryland (United States) and U.S. Food and Drug Administration (United States); J. Pfefer, U.S. Food and Drug Administration (United States)

8719 10 Evaluation of endogenous species involved in brain tumors using multiphoton photoacoustic spectroscopy [8719-37]
S. Dahal, B. M. Cullum, Univ. of Maryland, Baltimore County (United States)

Author Index
Conference Committee

Symposium Chair

Kenneth R. Israel, Major General (USAF Retired) (United States)

Symposium Cochair

David A. Whelan, Boeing, Defense, Space, and Security (United States)

Conference Chairs

Brian M. Cullum, University of Maryland, Baltimore County (United States)
Eric S. McLamore, University of Florida (United States)

Conference Program Committee

Troy A. Alexander, U.S. Army Research Laboratory (United States)
Christopher Anton, Episensors, Inc. (United States)
Karl S. Booksh, University of Delaware (United States)
Amethist S. Finch, U.S. Army Research Laboratory (United States)
Claudia Gärtner, microfluidic ChipShop GmbH (Germany)
Christopher D. Geddes, University of Maryland, Baltimore (United States)
Ilko K. Ilev, U.S. Food and Drug Administration (United States)
Lori Kamemoto, University of Hawai‘i at Manoa (United States)
Chang-Soo Kim, Missouri University of Science and Technology (United States)
Nicole Y. Morgan, NIBIB/National Institutes of Health (United States)
Joshua Pfefer, U.S. Food and Drug Administration (United States)
Marcin Ptaszek, University of Maryland, Baltimore County (United States)
Adam M. Rawlett, U.S. Army Research Laboratory (United States)
Shiv K. Sharma, University of Hawai‘i at Manoa (United States)
Narsingh B. Singh, University of Maryland, Baltimore County (United States)
Ryan J. White, University of Maryland, Baltimore County (United States)
Session Chairs

1  Smart Biosensing Strategies at the Cellular and Bacterial Level
   Christopher Anton, Episensors, Inc. (United States)
   Brian M. Cullum, University of Maryland, Baltimore County
   (United States)

2  Micro- and Nanotechnology for Health Care: Joint Session
   with Conference 8725 and 8719
   Brian M. Cullum, University of Maryland, Baltimore County
   (United States)
   Eric S. McLamore, University of Florida (United States)
   Noriko Satake, UC Davis Medical Center (United States)
   Scott D. Collins, University of Maine (United States)
   Thomas George, Zyomed Corporation (United States)

3  Smart Materials for Biorecognition and Biosensing
   Amethyst S. Finch, U.S. Army Research Laboratory (United States)
   Ryan J. White, University of Maryland, Baltimore County
   (United States)

4  Lab-on-a-Chip Technologies for Biological Sensing
   Claudia Gärtner, microfluidic ChipShop GmbH (Germany)
   Brian M. Cullum, University of Maryland, Baltimore County
   (United States)

5  Electrochemical and Noninvasive Sensing for Rapid Patient
   Monitoring
   Ryan J. White, University of Maryland, Baltimore County
   (United States)
   Eric S. McLamore, University of Florida (United States)

6  Smart Sensing Platforms and Technologies
   Bryn L. Adams, U.S. Army Research Laboratory (United States)
   Christopher Anton, Episensors, Inc. (United States)

7  Multispectral Imaging Agents and Systems for Tissue Diagnostics
   Mohan Singh, Purvanchal University (India)
   Marie-Christine F. Daniel, University of Maryland, Baltimore County
   (United States)

8  Biophotonic Imaging of Tissue and Tissue Phantoms
   Joshua Pfefer, U.S. Food and Drug Administration (United States)
   Narsingh B. Singh, University of Maryland, Baltimore County
   (United States)