

# ***Bioinspired, Biointegrated, Bioengineered Photonic Devices II***

**Luke P. Lee  
John A. Rogers  
Seok Hyun Andy Yun**  
*Editors*

**1–2 February 2014  
San Francisco, California, United States**

*Sponsored by*  
SPIE

*Cosponsored by*  
SAMSUNG

*Published by*  
SPIE

**Volume 8958**

Proceedings of SPIE, 1605-7422, V. 8958

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

Bioinspired, Biointegrated, Bioengineered Photonic Devices II, edited by Luke P. Lee,  
John A. Rogers, Seok Hyun Andy Yun, Proc. of SPIE Vol. 8958, 895801 · © 2014  
SPIE · CCC code: 1605-7422/14/\$18 · doi: 10.1117/12.2062791

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 *Bioinspired, Biointegrated, Bioengineered Photonic Devices II*, edited by Luke P. Lee, John A. Rogers, Seok Hyun Andy Yun, Proceedings of SPIE Vol. 8958 (SPIE, Bellingham, WA, 2014) Article CID Number.

ISSN: 1605-7422

ISBN: 9780819498717

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 © 2014, 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](http://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 1605-7422/14/\$18.00.

Printed in the United States of America.

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



[SPIDigitalLibrary.org](http://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

v *Conference Committee*

---

## SESSION 1 BIOMIMETIC PHOTONICS

---

- 8958 04 **Self-formed ultraefficient resonators in mollusk shells** [8958-3]  
S. H. Choi, Y. L. Kim, Weldon School of Biomedical Engineering, Purdue Univ. (United States)

---

## SESSION 2 PHOTONICS OF THE EYE

---

- 8958 0A **Bio-inspired hemispherical compound eye camera (Invited Paper)** [8958-9]  
J. Xiao, Univ. of Colorado Boulder (United States); Y. M. Song, Y. Xie, V. Malyarchuk, Beckman Institute for Advanced Science and Technology (United States) and Frederick Seitz Materials Research Lab., Univ. of Illinois at Urbana-Champaign (United States); I. Jung, Kyung Hee Univ. (Korea, Republic of); K.-J. Choi, Univ. of Illinois at Urbana-Champaign (United States); Z. Liu, A\*STAR Institute of High Performance Computing (Singapore); H. Park, Harvard Univ. (United States); C. Lu, Zhejiang Univ. (China) and Northwestern Univ. (United States); R.-H. Kim, Beckman Institute for Advanced Science and Technology (United States) and Frederick Seitz Materials Research Lab., Univ. of Illinois at Urbana-Champaign (United States); R. Li, Northwestern Univ. (United States) and Dalian Univ. of Technology (China); K. B. Crozier, Harvard Univ. (United States); Y. Huang, Northwestern Univ. (United States); J. A. Rogers, Beckman Institute for Advanced Science and Technology (United States) and Frederick Seitz Materials Research Lab., Univ. of Illinois at Urbana-Champaign (United States)

---

## SESSION 3 BIOMATERIALS AND PHOTONICS

---

- 8958 0B **Micovascular integration into porous polyHEMA scaffold** [8958-10]  
E. H. Cho, A. Boico, Duke Univ. (United States); N. A. Wisniewski, R. Gant, K. L. Helton, PROFUSA, Inc. (United States); N. L. Brown, J. K. Register, T. Vo-Dinh, T. Schroeder, B. Klitzman, Duke Univ. (United States)

---

## SESSION 4 ENERGY HARVESTING DEVICE

---

- 8958 0I **Understanding the nanophotonic light-trapping structure of diatom frustule for enhanced solar energy conversion: a theoretical and experimental study** [8958-17]  
X. Chen, C. Wang, E. Baker, J. Wang, C. Sun, Northwestern Univ. (United States)

*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 (United States) and Harvard School of Medicine  
(United States)

## *Program Track Chair*

**Paras N. Prasad**, University at Buffalo (United States)

**Dan V. Nicolau**, McGill University (Canada)

## *Conference Chairs*

**Luke P. Lee**, University of California, Berkeley (United States)

**John A. Rogers**, University of Illinois at Urbana-Champaign  
(United States)

**Seok Hyun Andy Yun**, Wellman Center for Photomedicine  
(United States)

## *Conference Program Committee*

**David Erickson**, Cornell University (United States)

**Malte C. Gather**, Technische Universität Dresden (Germany)

**Viktoria Greanya**, Defense Threat Reduction Agency (United States)

**Hongrui Jiang**, University of Wisconsin-Madison (United States)

## *Session Chairs*

Keynote Session

**Seok Hyun Andy Yun**, Wellman Center for Photomedicine  
(United States)

1 Biomimetic Photonics

**Luke P. Lee**, University of California, Berkeley (United States)

2 Photonics of the Eye

**Hongrui Jiang**, University of Wisconsin-Madison (United States)

3 Biomaterials and Photonics

**Malte C. Gather**, Technische Universität Dresden (Germany)

- 4 Energy Harvesting Device  
**Viktor Greanya**, Defense Threat Reduction Agency (United States)
- 5 Biosensors  
**Wooyoung Jang**, Samsung (Korea, Republic of)