Biomedical Optics Congress
Cancer Imaging and Therapy (Cancer)
Clinical And Translational Biophotonics (Translational)
Optics and the Brain (Brain)
Optical Tomography and Spectroscopy (OTS)

25–28 April 2016
Fort Lauderdale, Florida, USA

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CALL FOR PAPERS:
TOPICS IN BIOMEDICAL OPTICS FEATURE ISSUE

Submission Deadline: 15 June 2016

This Feature Issue will highlight the following topics presented at the 2016 OSA Biomedical Optics Congress (BIOMED):

- Cancer Imaging and Therapy
- Clinical and Translational Biophotonics
- Optical Tomography and Spectroscopy
- Optics and the Brain

*Biomedical Optics Express* (BOEx) welcomes expanded submissions from the oral and poster presentations for the conference. While meeting participants are particularly encouraged to submit their work, this feature issue is open to all contributions pertaining to the topics above. All papers need to present original, previously unpublished work, and will be subject to the standard peer-review process of the Journal.

Manuscripts must be prepared according to the style guide for BOEx and must be uploaded through OSA’s electronic submission system. Standard BOEx Article Processing Charges will apply.

**FEATURE ISSUE EDITORS**

Hamid Dehghani, *University of Birmingham*, UK
Optical Tomography and Spectroscopy

Elizabeth Hillman, *Columbia University*, USA
Optics and the Brain

David Sampson, *University of Western Australia*, Australia
Cancer Imaging and Therapy

Thomas Wang, *University of Michigan*, USA
Clinical and Translational Biophotonics

For more information, visit osapublishing.org/boe/feature.cfm
Welcome to the 2016 Biomedical Optics Congress! This OSA Congress has been thoughtfully revised – taking the best of the past and adding essential and new elements. The Congress has co-located four topical meetings (listed above) to focus on technological solutions to medical challenges and applications. We will cover a diversity of cutting-edge research and innovative new tools and techniques. The Biomedical Optics Congress will bring together an international group of leading engineers, optical and medical scientists, and physicians, as well as junior researchers and graduate students, who are engaged in optical methods to advance discovery and application of medical science to clinical practice. We believe that it is critical to create as many forums as possible for technical and applied interactions to occur in order to facilitate the next advances in medical care and research.

This Congress will feature three Plenary sessions with seven Plenary presentations. During the Monday, 25 April Plenary Session, Rebecca Richards-Kortum, Rice University, and Christopher Contag, Stanford University will open the conference. Tuesday’s Plenary session will have presentations from Maria Angela Franceschini, Massachusetts General Hospital, and Lihong Wang, Washington University in St. Louis. On Wednesday, James Fujimoto, MIT, Cynthia Toth, Duke University, and Eric Swanson will present in our final Plenary Session that will highlight the 25th Anniversary of OCT.

In addition to the technical programming, the Biomedical Optics Congress will feature comprehensive Industry Programming on Wednesday, 27 April. From 10:30–12:00, we will host an Introduction to the Regulatory Process. Panelists from the regulatory, consulting, and industry communities will inform us on the process and the do’s and don’ts of obtaining regulatory approval. From success stories, and some misadventures, we will learn from the panelists what is required for success. Bring questions and expect a highly interactive session with those who have ventured down this road. From 12:00–13:30, a Bright Ideas Pitch Panel Luncheon will be held. This is a unique opportunity to present and collaborate with entrepreneurs and venture capital panelists about your emerging company and/or new technologies that may offer solutions to the challenges faced by professionals in biomedical optics. Finally, from 17:30–19:30, there will be a Town Hall Forum on Biophotonics Commercialization. Please join us for an open town-hall meeting, where thought leaders debate and share perspectives that are critical to the rapidly expanding biophotonics market. Light snacks and beverages will be provided.

The 2016 Biomedical Optics Congress will provide several networking opportunities. A Welcome Reception, held on Monday, 25 April from 17:30–19:00 (Grand Ballroom East), is open to committee members, presenting authors, students and full conference attendees. We will also be holding and Evening Cruise Event on Tuesday, 26 April from 18:00–21:00 (Diplomat Landing, Marina Dock). Conference attendees may purchase extra tickets for their guests for either or both events. This year’s Congress will also offer the OSA Meet-the-Professional Luncheon on Monday, 25 April from 12:30–13:30 (Room 214, Second Level, RSVP only). Students and young professionals with OSA memberships are invited to meet participating professionals from academia, industry and government in the biomedical optics field. This RSVP-only lunch is a casual opportunity to network with chairs, committee members and exhibitors. In addition to these events, Poster sessions are an integral part of the technical program and offer a unique networking opportunity. This year’s Congress will feature three joint Poster sessions with over 160 presenters who can discuss their results one-to-one with interested parties.

The Cancer Imaging and Therapy (Cancer) meeting will focus on optical methods in cancer, centered on imaging and treatment of cancer. The meeting will have presentations on topics on the molecular and cellular level, such as reporters and theranostics; on the tissue and pre-clinical (animal) level, such as pathology methods and advances in imaging of tumor models; and on human tissue and living human subjects, when specifically dealing with cancer. This year’s Cancer meeting program will have 8 invited speakers, 36 contributed oral presentations and 21 poster presentations.

The Clinical and Translational Biophotonics (Translational) meeting will focus on research that has demonstrated human clinical applications, such as bioimaging or biosensing of human tissue specimens, first-to-human investigations of new optical imaging technologies for disease detection, diagnosis, or monitoring, clinical studies, and larger clinical trials. This year’s Translational meeting will have 13 invited presentations, 26 oral contributed presentations, and 26 poster presentations.
The Optics and the Brain (Brain) meeting will bring together researchers working in all aspects of optics in the brain and will serve as a forum for discussion of existing and emerging techniques as well as future directions capable of shedding new light on the healthy and diseased brain. This year’s Brain meeting will feature 19 invited presentations, 24 contributed oral presentations, and 28 poster presentations.

The Optical Tomography and Spectroscopy (OTS) meeting will focus on new developments in tomographic imaging technology in the fields of diffuse optical tomography (DOT), optical coherence tomography (OCT, including sessions highlighting its 25th anniversary), photoacoustic tomography (PAT), as well as on new developments in spectroscopic technologies. The OTS meeting program will have 18 invited speakers, 36 oral contributed presentations, and 75 poster presentations.

We all are very pleased to have you join us and we look forward to a great meeting!

**Cancer Imaging and Therapy (Cancer)**
Stefan Andersson-Engels, *Lund University*, Sweden, **Chair**
David Sampson, *University of Western Australia*, Australia, **Chair**

**Clinical and Translational Biophotonics (Translational)**
Stephen Boppart, *University of Illinois at Urbana-Champaign*, United States, **Chair**
Thomas Wang, *University of Michigan*, United States, **Chair**

**Optics and the Brain (Brain)**
Elizabeth Hillman, *Columbia University*, United States, **Chair**
Francesco Pavone, *European Lab for Non-Linear Spectroscopy*, Italy, **Chair**

**Optical Tomography and Spectroscopy (OTS)**
Hamid Dehghani, *University of Birmingham*, United Kingdom, **Chair**
Christoph Hitzenberger, *Medizinische Universität Wien*, Austria, **Chair**
Daniel Razansky, *Technical University of Munich*, Germany, **Chair**
Committees

Cancer Imaging and Therapy (Cancer)

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David Sampson, University of Western Australia, Australia

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Wei Chen, University of Central Oklahoma, United States
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Michalina Gora, CNRS, Massachusetts General Hospital, United States
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Chairs
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Thomas Wang, University of Michigan, United States

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Christine Hendon, Columbia University, United States
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Rebecca Richards-Kortum, Rice University, United States
Peter So, Massachusetts Institute of Technology, United States
Melissa Suter, Harvard Medical School, Mass General Hos, United States
Gary Tearney, Wellman Center for Photomedicine, United States
Brian Wong, University of California Irvine, United States
Victor Yang, Ryerson University, Canada

Optics and the Brain (Brain)

Chairs
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Francesco Pavone, European Lab for Non-Linear Spectroscopy, Italy

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Robert St Pierre, UltraSource, Inc., United States
Alipasha Vaziri, Forschungsinstitut für Molekulare Path, Austria

Optical Tomography and Spectroscopy (OTS)

Chairs
Hamid Dehghani, University of Birmingham, United Kingdom
Christoph Hitzenberger, Medizinische Universität Wien, Austria
Daniel Razansky, Technical University of Munich, Germany

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Audrey Bowden, Stanford University, United States
Stefan Carp, Massachusetts General Hospital, United States
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Alexander Oraevsky, TomoWave Laboratories, Inc, United States

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Michael Pircher, Medical University of Vienna, Austria
Brian Pogue, Dartmouth College, United States
Wiendelt Steenbergen, Universiteit Twente/MIRA Institute, Netherlands
Ruikang Wang, University of Washington, United States
Maciej Wojtkowski, Nicolaus Copernicus University, Poland
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Arjun Yodh, University of Pennsylvania, United States
Quing Zhu, University of Connecticut, United States
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This list is current as of 30 March. Please reference the Update Sheet and Buyers’ Guide for a complete list.
Special Events

Plenary Sessions
Monday, 25 April, 09:00–10:30
Tuesday, 26 April, 08:00–09:30
Wednesday, 27 April, 08:00–10:00
Grand Ballroom West

This year’s Biomedical Optics Congress will feature seven Plenary speakers in three Plenary sessions throughout the week. Wednesday’s Plenary session will highlight the 25th Anniversary of OCT. For more information on the plenary presentations, see the Plenary descriptions on pages 12-13 of this program.

OSA Meet-the-Professionals Luncheon
(Members only - RSVP Required)
Monday, 25 April, 12:30–13:30
Room 214, Second Level
Presider: Christine Herndon, Columbia University

Students and young professionals with memberships to OSA are invited to meet participating professionals in the biomedical optics field from academia, industry and government. This RSVP-only lunch is a casual opportunity to network with chairs, committee members and exhibitors. Lunch is complimentary for all individuals that RSVP. For a list of participating professionals and a link to RSVP in advance, please visit osa.org/biomed.

Welcome Reception
25 April, 17:30–19:00
Grand Ballroom East

Join your fellow attendees for the Welcome Reception. Enjoy delectable fare while networking. The reception is open to all full conference attendees. Conference attendees may purchase extra tickets for their guests.

Postdeadline Poster Preview Session
26 April, 13:00–13:30
Grand Ballroom East

Selected papers will present a short oral poster preview in a special Postdeadline Session leading into Tuesday’s Joint Poster session. All accepted Postdeadline presenters will be presenting a poster in addition to the poster preview. Only those papers judged to be truly excellent and compelling in their timeliness were accepted. Accepted Postdeadline Presentations will be announced on the conference Update sheet which is distributed at registration. All Postdeadline papers can be accessed by visiting www.osa.org/BIOMED and clicking the “Access Digest Papers” button.

Dinner Cruise on The Grand Floridian
26 April, 18:00–21:00
Diplomat Resort & Spa, Diplomat Landing, Marina Dock

Cruise the Intracoastal waterway and enjoy dinner on a spectacular luxury yacht that offers four decks, a covered sky lounge and a spacious top deck for ocean views. Conference attendees may purchase extra tickets for their guests at the OSA Registration desk. Advance ticket purchase is required.

Cruise Schedule:
18:00–18:30  Boarding at the Diplomat Landing, Marina Dock
18:30  Cruise Departure
18:30–20:00  Cruise and Dinner Buffet
20:00  Return to Dock
21:00  Final Disembark

Industry Panel - An Introduction to the Regulatory Process: How to Get from Technology Development into Real Life Use
27 April, 10:30–12:00
Grand Ballroom West

Panelists from the regulatory, consulting, and industry communities will inform us on the process and the do’s and don’ts of obtaining regulatory approval. From success stories, and some misadventures, we will learn from the panelists what is required for success. Bring questions and expect a highly interactive session with those who have ventured down this road. For more information, please view the Industry Programming section of the website on page 10.

Bright Ideas Pitch Panel Luncheon: An Invitation to Present Your New Technology and Innovative Ideas
27 April, 12:00–13:30
Grand Ballroom West

Do you have a startup or an idea for a new company? Present your technology, explain why it’s valuable and discuss the next steps to commercialization. For more information, please view the Industry Programming section of the website on page 10. Complimentary box lunches will be provided.
Town Hall Forum on Biophotonics Commercialization
27 April, 17:30–19:30
Grand Ballroom West

Please join us for an open town-hall meeting, where thought leaders debate and share perspectives that are critical to the rapidly expanding biophotonics market. For more information, please view the Industry Programming section of the website on page 10. Light snacks and beverages will be provided.

Joint Poster Sessions
Monday 25 April, 13:30–15:30
Tuesday, 26 April, 13:30 – 15:30
Wednesday, 27 April, 13:30 – 15:30
Grand Ballroom East

The Congress will feature three joint poster sessions and over 160 poster presentations over the course of three days. Each author is provided with a board on which to display their summary and results of his or her paper. Posters are an integral part of the technical program and offer a unique networking opportunity, where presenters can discuss their results one-to-one with interested parties.

Optics in the Life Sciences Congress
2–5 April 2017
Sheraton San Diego Hotel & Marina, San Diego, California, USA

Save the date for the Optics in the Life Sciences Congress which includes the following topical meetings:

- Bio-Optics: Design and Application
- Novel Techniques in Microscopy
- Optical Molecular Probes, Imaging and Drug Delivery
- Optical Trapping Applications
- Optics and the Brain

For more information, visit www.osa.org/Lifesciencesopc
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Industry Programming

An Introduction to the Regulatory Process: How to Get from Technology Development into Real Life Use
27 April, 10:30–12:00
Grand Ballroom West

Panelists from the regulatory, consulting, and industry communities will inform us on the process and the do’s and don’ts of obtaining regulatory approval. From success stories, and some misadventures, we will learn from the panelists what is required for success. Bring questions and expect a highly interactive session with those who have ventured down this road.

Panelists:
Richard B. Dorshow, MediBeacon, Inc., USA
Daniel Schultz, Greenleaf Health LLC, USA

Bright Ideas Pitch Panel Luncheon: An Invitation to Present Your New Technology and Innovative Ideas
27 April, 12:00–13:30
Grand Ballroom West

Do you have a startup or an idea for a new company? Present your technology, explain why it’s valuable and discuss the next steps to commercialization. This is a unique opportunity to present and collaborate with entrepreneurs and venture capital panelists about your emerging company and/or new technologies that may offer solutions to the challenges faced by professionals in biomedical optics. Complimentary box lunches will be provided.

- Share your dream and receive valuable direction from those that have experienced the excitement and trepidation of starting a photonics business.
- Get both immediate market and investor feedback during the “OSA Bright Ideas Luncheon” by presenting your idea to the Entrepreneur and VC Panel.
- Our panel of experts will give you their advice on what you need to do to launch a new company or take your startup to the next level.
- In return for your brief presentation you will get the benefit of our panel’s decades of experience in commercializing photonics.
- 5-minute presentations will be followed by comments and suggestions from our panel of experts.

Panelists:
Scott Coleridge, Morningside, USA
Richard B. Dorshow, MediBeacon, Inc., USA
Daniel Schultz, Greenleaf Health LLC, USA
Eric Swanson, Entrepreneur, USA

Town Hall Forum on Biophotonics Commercialization
27 April, 17:30–19:30
Grand Ballroom West

Please join us for an open town-hall meeting, where thought leaders debate and share perspectives that are critical to the rapidly expanding biophotonics market. Light snacks and beverages will be provided. Questions to be discussed include:

- Where is the funded research going?
- What is the enabling technology that has the most market traction?
- What are the bottlenecks or “showstoppers” in photonics commercialization today?
- What are the solutions?

Panelists:
Scott Coleridge, Morningside, USA
Christopher H. Contag, Stanford University, USA
Richard B. Dorshow, MediBeacon, Inc., USA
Eric Swanson, Entrepreneur, USA
Edmund Talley, National Inst. of Neurological Disorders and Stroke, USA
**General Information**

**Congress Wireless Internet**
OSA is pleased to offer complimentary wireless internet services throughout the meeting space at the Diplomat Resort and Spa for all attendees and exhibitors.

Network: OSA100
Passcode: Biomed2016

**Registration**
Grand Ballroom Foyer

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<tr>
<th>Date</th>
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<tr>
<td>Sunday, 24 April</td>
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<td>Monday, 25 April</td>
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<td>Thursday, 28 April</td>
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**Exhibits and Coffee Breaks**
Monday, 25 April – Wednesday, 27 April
Grand Ballroom East

Coffee Breaks Sponsored by:

![Center for Imaging Medicine at Dartmouth](image)

The 2016 Biomedical Optics exhibit is open to all registered attendees. Visit a diverse group of companies representing every facet of optics. Coffee breaks and the joint poster session will be held with exhibits from Monday–Wednesday.

**Recorded Presentations**
Many of the sessions during this year’s Biomedical Optics Congress are being digitally captured for on-demand viewing. Session content will be available within forty-eight hours of being recorded. Recorded content can be accessed by visiting www.osa.org/biomed and clicking on the “Access meeting presentations/slidecasts” under Essential Links. Presentations for authors who have indicated they do not wish to be recorded will not be available. Posting of Thursday sessions may be delayed up to a week.

**About OSA Publishing’s Digital Library**
Registrants and current subscribers can access all of the congress papers, posters and postdeadline papers on OSA Publishing’s Digital Library. The OSA Publishing’s Digital Library is a cutting-edge repository that contains OSA Publishing’s content, including 16 flagship, partnered and co-published peer-reviewed journals and 1 magazine. With more than 240,000 articles including papers from over 450 conferences, OSA Publishing’s Digital Library is the largest peer-reviewed collection of optics and photonics.

**Early Online Access to the Technical Digest and Postdeadline Papers**
Full Technical Attendees have both EARLY and FREE continuous access to the digest papers through OSA Publishing’s Digital Library. To access the papers go to www.osa.org/biomed and select the “Access digest papers” essential link on the right hand navigation. As access is limited to Full Technical Congress Attendees only, you will be asked to validate your credentials by entering the same login email address and password provided during the Congress registration process.

If you need assistance with your login information, please use the “forgot password” utility or “Contact Help” link.

**Poster Presentation PDFs**
The PDFs of select poster presentations will be available two weeks after the Congress. While accessing the papers in OSA Publishing’s Digital Library look for the multimedia symbol.

**Update Sheet and Postdeadline Papers**
All technical program changes will be communicated in the onsite Congress Program Update Sheet. All attendees receive this information with registration materials, and we encourage you to review it carefully to stay informed to changes in the program. Postdeadline papers will also be announced on the update sheet.
Plenary Speakers

Joint Plenary Session I
Monday, 25 April, 09:00–10:30
Grand Ballroom West

From Brownsville to Blantyre: How Optical Technologies Can Improve Health Care in Low-Resource Settings
Rebecca Richards-Kortum, Rice University, USA
09:00–09:45

Biography: Rebecca Richards-Kortum is the Stanley C. Moore Professor and Chair of Bioengineering at Rice University. After receiving a B.S. in Physics and Mathematics from the University of Nebraska-Lincoln in 1985, she continued her graduate work at the Massachusetts Institute of Technology, where she received an MS in Physics in 1987 and a PhD in Medical Physics in 1990. She joined the faculty in Bioengineering at Rice University in 2005. In addition to being named a Howard Hughes Medical Institute Professor in 2002 and 2006, her awards include election to the US National Academy of Engineering (2008). Dr. Richards-Kortum’s research group is developing imaging systems to enable better screening for oral, esophageal, and cervical cancer and their precursors at the point-of-care. More recently, her group has worked to integrate advances in nanotechnology and microfabrication to develop novel, low-cost sensors to detect infectious diseases at the point-of-care, including crypto-sporidium, malaria, and HIV.

Insertable, Implantable and Wearable Micro-optical Devices for the Early Detection of Cancer
Christopher Contag, Stanford University, USA
09:45–10:30

Biography: Dr. Contag is a Professor in the Departments of Pediatrics, Radiology, Bioengineering and Microbiology & Immunology at Stanford University, and a member of BioX Faculty for interdisciplinary sciences, and of the Immunology Faculty. Dr. Contag is the Associate Chief of Neonatal and Developmental Medicine, director of Stanford’s Center for Innovation in In Vivo Imaging (SCI) and co-director of the Molecular Imaging Program at Stanford (MIPS). Dr. Contag is a pioneer in the field of molecular imaging and is developing imaging approaches aimed at revealing molecular processes in living subjects, including humans, and advancing therapeutic strategies through imaging. His laboratory develops macroscopic and microscopic optical imaging tools and uses imaging to assess tissue responses to stress, reveal immune cell migration patterns, understand stem cell biology and advance biological therapies. He is a founding member and a past president of the Society for Molecular Imaging, and is a recipient of the Achievement Award from the Society for Molecular Imaging for his fundamental contributions to imaging. Dr. Contag is a Fellow of the World Molecular Imaging Society (WMIS) and currently President of WMIS. Dr. Contag was a founder of Xenogen Corp. (now part of Perkin Elmer) established to commercialize innovative imaging tools for biomedicine, and a founder of ConcentRx—a cancer therapy company.

Joint Plenary Session II
Tuesday, 26 April, 08:00–09:30
Grand Ballroom West

Advances in Measuring Cerebral Oxygen Delivery and Consumption in the Clinic with Near Infrared Spectroscopy
Maria Angela Franceschini, Massachusetts General Hospital, USA
08:00–08:45

Biography: Dr. Franceschini is an Associate Professor at Harvard Medical School with specific training and expertise in the development of near-infrared spectroscopy (NIRS) techniques and applications in neuroscience, neurology, and brain health. She has been a member of the Optics Division of the Martinos Center at Massachusetts General Hospital since 2000. As a pioneer in the field of NIRS, she has made substantial contributions to the development of NIRS instruments and to the modeling and testing of diffusion theory to describe light propagation in turbid media. She has successfully applied the technology to a large range of functional neuroimaging and clinical cerebral monitoring applications.

Photoacoustic Tomography: Ultrasonically Beating Optical Diffusion and Diffraction
Lihong Wang, Washington University in St Louis, USA
08:45–09:30

Biography: Dr. Wang’s laboratory was the first to report functional photoacoustic tomography, 3D photoacoustic microscopy (PAM), photoacoustic endoscopy, photoacoustic reporter gene imaging, the photoacoustic Doppler effect, the universal photoacoustic reconstruction algorithm, microwave-induced thermoacoustic tomography, ultrasound-modulated optical tomography, time-reversed ultrasonically encoded (TRUE) optical focusing, nonlinear photoacoustic wavefront shaping (PAWS), compressed ultrafast photography (100 billion frames/s), Mueller-matrix optical coherence tomography, and optical coherence computed tomography. In particular, PAM broke through the long-standing diffusion limit on the penetration of optical microscopy and reached super-depths for noninvasive biochemical, functional, and molecular imaging in living tissue at high resolution. Dr. Wang is a Fellow of the AIMBE, Electromagnetics Academy, IEEE, OSA, and SPIE. He is the Editor-in-Chief of the Journal of Biomedical Optics. He chairs the annual conference on Photons plus Ultrasound, and was a chartered member of an NIH Study Section. Wang serves as the founding chairs of the scientific advisory boards of two companies which have commercialized photoacoustics. He received the NIH’s FIRST, NSF’s CAREER, NIH Director’s Pioneer, and NIH Director’s Transformative Research awards.
He also received the OSA C.E.K. Mees Medal, IEEE Technical Achievement Award, IEEE Biomedical Engineering Award, and SPIE Britton Chance Biomedical Optics Award, and Senior Prize of the International Photoacoustic and Photothermal Association for “seminal contributions to photoacoustic tomography and Monte Carlo modeling of photon transport in biological tissues.” An honorary doctorate was conferred on him by Lund University, Sweden.

Joint Plenary Session III: 25th Anniversary of OCT
Wednesday, 27 April, 08:00–10:00
Grand Ballroom West

Optical Coherence Tomography: From Research to Clinical Practice
James Fujimoto, MIT, USA
08:00–08:40

Biography: James G. Fujimoto obtained his bachelors, masters, and doctorate from the Massachusetts Institute of Technology and has been on the faculty since 1985 where he is Elihu Thomson Professor of Electrical Engineering and Computer Science. His group and colleagues are responsible for the invention and development of OCT. Dr. Fujimoto is in the National Academy of Engineering, the American Academy of Arts and Sciences and the National Academy of Sciences. Working with Eric Swanson, he was co-founder of Advanced Ophthalmic Devices, the company that transferred OCT to Carl Zeiss for ophthalmic imaging and was co-founder of LightLabs Imaging, a joint venture with Carl Zeiss in cardiovascular imaging. Dr. Fujimoto received the Zeiss Research Award in 2011 and was co-recipient of the Champalimaud Vision Award in 2012.

25 Years of OCT: A Revolution in Ophthalmic Care
Cynthia Toth, Duke University, USA
08:40 - 09:20

Biography: Dr. Toth specializes in the evaluation and surgical treatment of vitreoretinal diseases in adults and children and has pioneered the development of macular translocation surgery for age-related macular degeneration (AMD). Her particular clinical interests and skills also include the surgical treatment of macular diseases (such as, macular hole, epiretinal membrane and vitreomacular traction), retinal detachment, proliferative diabetic retinopathy, proliferative vitreoretinopathy (PVR), and retinopathy of prematurity (ROP). She is a world expert in retinal imaging with optical coherence tomography (OCT) and pioneered both the first use of a research hand-held spectral domain OCT system for infant examination and a novel intraoperative real-time swept source OCT-guided ophthalmic surgical system. With the pediatric system, her multidisciplinary team has demonstrated novel eye-brain linkage during preterm development. Dr. Toth performed the world’s first intraoperative swept-source OCT imaging with heads-up display during macular surgery and is perfecting such techniques. She has been repeatedly honored among the Best Doctors in America. Dr. Toth is also professor in the Department of Biomedical Engineering in the Pratt School of Engineering. Her primary research interests are in translational research and early-application clinical trials with a focus on novel retinal imaging with spectral domain and swept source optical coherence tomography (SD and SS-OCT). Dr. Toth’s Laboratory, the Duke Advanced Research in Spectral Domain OCT Imaging (DARSI) Laboratory centers on improving early diagnostic methods, imaging biomarkers and therapies for both age-related macular degeneration (AMD) and for retinal diseases in children.

Commercialization of OCT: Some Views on the Past, Present, and Future
Eric Swanson, USA
09:20–10:00

Biography: Eric Swanson is a director, advisor, and participant in a variety of industrial, academic, entrepreneurial, government, and non-profit activities. Mr. Swanson serves as a director for Acacia Communications, Curata Incorporated, and NinePoint Medical. He is also research affiliate at the Massachusetts Institute of Technology, consultant at Draper Laboratory, catalyst at the MIT Deshpande Center for Technological Innovation, and is editor of OCT News (www.octnews.org). Mr. Swanson is a co-founder or founding board member of five companies which have evolved over time and collectively shipped far in excess of $1B in products around the world. He is a Fellow of the OSA and senior member of the IEEE, has authored ~195 technical papers and conference presentations, holds ~36 US patents, and co-authored 6 book chapters. In 2002 he was a co-recipient of the Rank Prize in Opto-Electronics for pioneering work in the field of optical coherence tomography. In 2012 he was a co-recipient of the Champalimaud Award also for pioneering work in the field of optical coherence tomography. Mr. Swanson holds a B.S. summa cum laude in Electrical Engineering from the University of Massachusetts at Amherst and an M.S. in Electrical Engineering from the Massachusetts Institute of Technology.
Awards

OSA Foundation Travel Grant

We are pleased to announce The OSA Foundation Travel Grant recipient for 2016 Biomedical Optics Congress. The OSA Foundation Student Travel Grant Program is designed to provide career development opportunities by assisting students who wish to attend conferences and meetings. The grants are given to students working or studying science in qualifying developing nations so they can attend OSA-managed technical meetings and conferences.

Qiang Guo, Tsinghua University, China

Ting-Wen Yu, Graduate Inst. of Biomedical Electronics and Bioinformatics, National Taiwan Univ., Taiwan

Best Student Presentation Awards

Five Student Presentation Award winners and 15 Student Presentation Award Leaders will be selected for awards during the 2016 Biomedical Optics meeting. Award winners will be announced during the closing remarks and will be posted on the Biomedical optics website: www.osa.org/biomed after the meeting.

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Founded in 1999, Boston Micromachines Corporation (BMC) is the leading provider of advanced microelectromechanical systems (MEMS) – based mirror products for use in commercial adaptive optics systems. The company was founded by Boston University Photonics Center Director Thomas Bifano and CEO/President Paul Bierden. The company’s suite of award-winning compact deformable mirror (DM) products is the most cost-effective, highest performance mirror technology in the market today.

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The Boston University Photonics Center will pioneer fundamental knowledge and innovative technology in the field of Photonics. We aim to work on important and basic problems, to translate enabling discoveries into useful applications, and to educate future leaders in the field. The affiliated NSF sponsored Center for Biophotonic Sensors & Systems focuses on precompetitive research and provides enabling technologies to detect/sense and identify biological properties, conditions, or changes at the molecular, cellular and subcellular level.

Center for Imaging Medicine at Dartmouth

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URL: www.cim.dartmouth.edu

The Center for Imaging Medicine at Dartmouth is one of the largest collaborative hubs for optics in medicine research in the country. Spearheaded by faculty at Dartmouth’s Thayer School of Engineering with colleagues at Geisel School of Medicine, the Center facilitates global efforts toward innovation in biomedical imaging and therapy. The Center’s mission is to advance state-of-the-art technologies through creation, testing, and deployment of new technologies, and participation in outreach at Dartmouth and beyond.

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Go!Foton is a US company that designs and manufactures a variety of optical components for the medical industry including GRIN lenses for collimators and OCT, imaging and relay lenses for endoscopy and neurobiological imaging. In addition, we develop OCT probes and can manufacture subassemblies including prisms, torque coils, and hypotubes. We also provide specialized micro-prism development and high volume manufacture in Japan.

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ISS activities include two product lines: the fluorescence analytical division manufactures and markets spectrofluorometers and FLIM/FCS confocal microscopes for time-resolved and steady-state fluorescence measurements; the medical division provides instruments for the absolute measurements of oxygen saturation in tissue (brain and muscle), metabolic rate of oxygen consumption and functional brain imaging. Applications include Fluorescence Resonance Energy Transfer (FRET), Fluorescence Lifetime Imaging (FLIM), Fluorescence Fluctuation Spectroscopy (FCS, FCCS, PCh), Superresolution tissue oxygenation, and Optical Topography (NIRS).

Micro Photon Devices
Via Stradivari 4
Bolzano 1-39100 Italy
P: +39.0471.051212
F: +39.0471.051524
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Explanation of Session Codes

The first letter of the code designates the meeting (B=Brain, C=Cancer, O=OTS, T=Translational, J=Joint Session). The second element denotes the day of the week (M=Monday, Tu-Tuesday, W=Wednesday, Th=Thursday). The third element indicates the session series in that day (for instance, 1 would denote the first parallel sessions in that day). Each day begins with the letter A in the fourth element and continues alphabetically through a series of parallel sessions. The lettering then restarts with each new series. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded BM2A.4 indicates that this paper is part of the Brain topical meeting (B) and is being presented on Monday (M) in the second series of sessions (2), and is the first parallel session (A) in that series and the fourth paper (4) presented in that session.

Invited papers are noted with Invited.
Plenaries are noted with Plenary.
Presentations selected for recording are noted with 📧.
### Agenda of Sessions — Sunday, 24 April

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<tr>
<th>Time</th>
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</thead>
<tbody>
<tr>
<td>08:00–15:00</td>
<td><strong>NirFAST Workshop</strong> <em>(pre-registration required)</em></td>
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<tr>
<td>15:00–18:00</td>
<td><strong>Registration, Grand Ballroom Foyer</strong></td>
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### Agenda of Sessions — Monday, 25 April

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
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<td><strong>Registration, Grand Ballroom Foyer</strong></td>
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<tr>
<td>08:50–09:00</td>
<td><strong>Opening Remarks, Grand Ballroom West</strong></td>
</tr>
<tr>
<td>09:00–10:30</td>
<td><strong>JM1A • Joint Plenary Session I, Grand Ballroom West</strong></td>
</tr>
<tr>
<td>10:30–11:00</td>
<td><strong>Coffee Break and Exhibits, Grand Ballroom East</strong></td>
</tr>
<tr>
<td>11:00–12:30</td>
<td><strong>JM2A • Intraoperative Cancer Surgical Guidance (Joint OTS/Cancer)</strong></td>
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<tr>
<td></td>
<td><strong>TM2B • Clinical Optical Imaging Studies I</strong></td>
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<td></td>
<td><strong>OM2C • PAT: In vivo Applications</strong></td>
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<tr>
<td></td>
<td><strong>BM2D • Modulation of Brain Activity</strong></td>
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<tr>
<td>12:30–13:00</td>
<td><strong>Lunch Break, On Your Own</strong></td>
</tr>
<tr>
<td>13:30–15:30</td>
<td><strong>JM3A • Joint Poster Session I, Coffee Break, and Exhibit, Grand Ballroom East</strong></td>
</tr>
<tr>
<td>15:30–17:30</td>
<td><strong>JM4A • In vivo Human Cancer Imaging (Joint OTS/Cancer)</strong></td>
</tr>
<tr>
<td></td>
<td><strong>TM4B • Clinical Optical Imaging Studies II</strong></td>
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<tr>
<td></td>
<td><strong>OM4C • Devices and Methods in Diffuse Tomographic Imaging: Brain</strong></td>
</tr>
<tr>
<td></td>
<td><strong>BM4D • Optical Imaging and Neurovascular Coupling</strong></td>
</tr>
<tr>
<td>17:30–19:00</td>
<td><strong>Welcome Reception and Exhibits, Grand Ballroom East</strong></td>
</tr>
</tbody>
</table>

### Key to Conference Abbreviations

- **Brain** Optics and the Brain
- **Cancer** Cancer Imaging and Therapy
- **Translational** Clinical and Translational Biophotonics
- **OTS** Optical Tomography and Spectroscopy

**Biomedical Optics • 25–28 April 2016**
<table>
<thead>
<tr>
<th>Time</th>
<th>Regency Ballroom 3</th>
<th>Atlantic Ballroom 1</th>
<th>Atlantic Ballroom 2</th>
<th>Atlantic Ballroom 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>07:30–17:30</td>
<td>Registration, Grand Ballroom Foyer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08:00–09:30</td>
<td>JTu1A • Joint Plenary Session II, Grand Ballroom West</td>
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<tr>
<td>09:30–10:00</td>
<td>Coffee Break and Exhibits, Grand Ballroom East</td>
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<tr>
<td>10:00–12:00</td>
<td>OTu2A • Novel Methods in PAT</td>
<td>TTu2B • Point-of-Care Biophotonics and Global Health</td>
<td>OTu2C • Fluorescence Imaging</td>
<td>BTu2D • Functional Brain Microscopy: Improving Depth and Speed</td>
</tr>
<tr>
<td>12:00–13:00</td>
<td>Lunch Break, On Your Own</td>
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</tr>
<tr>
<td>13:00–13:30</td>
<td>Postdeadline Poster Preview Session, Grand Ballroom East</td>
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<tr>
<td>13:30–15:30</td>
<td>JTu3A • Joint Poster Session II, Coffee Break, and Exhibit, Grand Ballroom East</td>
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</tr>
<tr>
<td>15:30–17:30</td>
<td>CTu4A • Intrinsic Contrast Microscopy and Spectroscopy of Cancer</td>
<td>TTu4B • Optical Agents and Devices</td>
<td>OTu4C • OCT: Technology and Endoscopy</td>
<td>BTu4D • Towards Whole-brain Imaging in Real-time</td>
</tr>
<tr>
<td>18:00–21:00</td>
<td>Evening Cruise Event, Diplomat Resort &amp; Spa, Diplomat Landing, Marina Dock</td>
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</tbody>
</table>

**Key to Conference Abbreviations**
- **Brain**: Optics and the Brain
- **Cancer**: Cancer Imaging and Therapy
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## Agenda of Sessions — Wednesday, 27 April

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<tr>
<th>Time</th>
<th>Location</th>
<th>Session</th>
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<tr>
<td>07:30–17:30</td>
<td>Grand Ballroom Foyer</td>
<td>Registration, Grand Ballroom Foyer</td>
</tr>
<tr>
<td>08:00–10:00</td>
<td>Grand Ballroom West</td>
<td>JW1A • Plenary Session III: 25th Anniversary of OCT, Grand Ballroom West</td>
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<tr>
<td>10:00–10:30</td>
<td>Grand Ballroom East</td>
<td>Coffee Break and Exhibits, Grand Ballroom East</td>
</tr>
<tr>
<td>10:30–12:00</td>
<td>Grand Ballroom West</td>
<td>An Introduction to the Regulatory Process: From Technology Development to Real Life Use, Grand Ballroom West</td>
</tr>
<tr>
<td>12:00–13:30</td>
<td>Grand Ballroom West</td>
<td>Bright Ideas Pitch Panel Luncheon, Grand Ballroom West</td>
</tr>
<tr>
<td>13:30–15:30</td>
<td>Grand Ballroom East</td>
<td>JW3A • Joint Poster Session III, Coffee Break, and Exhibit, Grand Ballroom East</td>
</tr>
<tr>
<td>15:30–17:30</td>
<td>Grand Ballroom West</td>
<td>JW4A • Exogenous and Endogenous Marker Diagnostics and Guidance (Joint OTS/ Cancer)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BW4B • Structure, Myelin and Spinal Cord</td>
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<td></td>
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<td>JW4C • 25th Anniversary OCT Session</td>
</tr>
<tr>
<td></td>
<td></td>
<td>OW4D • Novel Developments: Devices and Methods</td>
</tr>
<tr>
<td>17:30–19:30</td>
<td>Grand Ballroom West</td>
<td>Town Hall Forum on Biophotonics Commercialization, Grand Ballroom West</td>
</tr>
</tbody>
</table>

### Key to Conference Abbreviations

- **Brain**: Optics and the Brain
- **Cancer**: Cancer Imaging and Therapy
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- **OTS**: Optical Tomography and Spectroscopy
# Agenda of Sessions — Thursday, 28 April

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<thead>
<tr>
<th>Time</th>
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<th>Atlantic Ballroom 1</th>
<th>Atlantic Ballroom 2</th>
<th>Atlantic Ballroom 3</th>
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</thead>
<tbody>
<tr>
<td>07:30–18:00</td>
<td>Registration, Grand Ballroom Foyer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08:00–09:30</td>
<td>CTh1A • Cancer Histopathology and Cytometry</td>
<td>TTh1B • In Vivo Human Optical Imaging</td>
<td>OTh1C • Instrumentation in Photoacoustic Tomography and Microscopy</td>
<td>OTh1D • Diffuse Correlation Spectroscopy</td>
</tr>
<tr>
<td>09:30–10:00</td>
<td>Coffee Break, Grand Ballroom Foyer</td>
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</tr>
<tr>
<td>10:00–12:00</td>
<td>CTh2A • Targeted Molecular Imaging of Cancer</td>
<td>OTh2B • OCT: Functional Extensions</td>
<td>OTh2C • Novel Developments for Clinical Applications</td>
<td>BTh2D • New Contrast for Optical Brain Imaging</td>
</tr>
<tr>
<td>12:00–13:30</td>
<td>Lunch Break, On Your Own</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13:30–15:30</td>
<td>JTh3A • Cancer Surgical Monitoring and Guidance (Joint OTS/ Cancer)</td>
<td>TTh3B • Optical Biomarkers I</td>
<td>OTh3C • Devices and Methods in Diffuse Tomographic Imaging: Breast</td>
<td>BTh3D • Optical Imaging of Models of Brain Disease</td>
</tr>
<tr>
<td>15:30–16:00</td>
<td>Coffee Break, Grand Ballroom Foyer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16:00–18:00</td>
<td>CTh4A • Human in vivo Diagnostics</td>
<td>TTh4B • Optical Biomarkers II (ends at 17:30)</td>
<td>OTh4C • Blood Flow Imaging and Novel Microscopy</td>
<td>BTh4D • Optical Imaging of the Human Brain</td>
</tr>
<tr>
<td>18:05–18:30</td>
<td>Closing Remarks, Atlantic Ballroom 3</td>
<td></td>
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</tr>
</tbody>
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Key to Conference Abbreviations

- **Brain**: Optics and the Brain
- **Cancer**: Cancer Imaging and Therapy
- **Translational**: Clinical and Translational Biophotonics
- **OTS**: Optical Tomography and Spectroscopy
Normal brain during surgical resection. By surgical microscopes delineates tumor from for malignant glioma. Fluorescence imaging of protoporphyrin IX following oral delivery in Muenster, Germany. The accumulation of fluorescent protoporphyrin IX is a promising tool for the visualization of tumors in vivo. This technique could be particularly useful for the identification of early cancers and for the improvement of surgical resection margins.

The use of molecular imaging technologies, such as fluorescence imaging, can provide valuable information about the spatial and temporal distribution of molecular markers within the tumor. This can help to guide surgical resection and improve the accuracy of tumor removal. In conclusion, the combination of fluorescent imaging and surgical microscopes offers a promising approach for the identification and resection of malignant gliomas.
Monday, 25 April

Regency Ballroom 3

Joint Optical Tomography and Spectroscopy / Cancer Imaging and Therapy

JM2A • Intraoperative Cancer Surgical Guidance—Continued

JM2A • 11:30

MarginPAT: High-Speed Intraoperative Breast Tumor Margin Assessment Tool, Pu Wang1, Lu Lan1, Ru Li2, Ji-Xin Cheng3,4; Purdue Univ., USA; 3Vibronix, Inc, USA. As lumpectomy is well accepted for the breast cancer treatment, a highly sensitive tool is needed for intraoperative margin assessment. We present a multi-modal photoacoustic/ultrasound imaging system for high-speed intraoperative margin assessment.

JM2A • 11:45

Mapping the Mechanical Heterogeneity of Human Breast Tissue Using Optical Coherence elastography, Lixin Chen1, Philip Wijesinghe1, Bruce Latham2, Christobel M. Saunders3,4, David D. Sampson3,4, Brendan F. Kennedy1; 1School of Electrical, Electronic & Computer Engineering, Univ. of Western Australia, Australia; 2PathWest, Australia; 3School of Surgery, The Univ. of Western Australia, Australia; 4Breast Clinic, Royal Perth Hospital, Australia. A Centre for Microscopy, Characterisation & Analysis, The Univ. of Western Australia. Elastography images can be difficult to interpret for an untrained observer. We introduce a new method of facilitating the interpretation of optical coherence elastography, by measuring mechanical heterogeneity, and mapping it onto an image.

JM2A • 12:00

Intraoperative Optical Spectroscopy of Brain Tumors for Guiding Resection, Michael Jermy1, Frederic Leblond1; 1Polytechnique Montreal, Canada. We present a novel surgical oncology technique using Raman spectroscopy and intrinsic tissue fluorescence for highly sensitive and specific cancer detection beyond tumor margins detectable with magnetic resonance imaging technology.

Atlantic Ballroom 3

Clinical and Translational Biophotonics

TM2B • Clinical Optical Imaging Studies I—Continued

TM2B • 11:30

Predicting Chemotherapy Response in Breast Cancer using Diffuse Optical Spectroscopic Imaging (DOSI): Results from the ACRIN 6691 Multi-Center Trial, Bruce J. Tromberg1,2, Anita Mahadevan-Jansen3,4; 1Univ. of California Irvine, USA; 21School of Physical Electronics, Univ. of Electronic Science and Technology of China, China. A miniaturized 3D wearable PAT (3D-wPAT) technique is described for brain study in behaving animals. This 3D-wPAT technique has a considerable potential in neuroscience studies, such as behavior, cognition, and preclinical brain disease researches.

Atlantic Ballroom 2

Optical Tomography and Spectroscopy

OM2C • PAT: In vivo Imaging—Continued

OM2C • 11:30

Optoacoustic Imaging of Breast Cancer: Technical Challenges and Recent Accomplishments, Alexander A. Oraevsky1,2; 1TomoWave Laboratories, inc, USA. This lecture presents the design, technical parameters and results of clinical validation of the 2D and 3D laser optoacoustic ultrasonic imaging systems applied in diagnostic imaging of breast cancer.

Atlantic Ballroom 1

Optics and the Brain

BM2D • Modulation of Brain Activity—Continued

BM2D • 11:30

On Multifunctional Optoelectronic Probes for the Brain, Arto Nurmikko1; 1Brown University, USA. This presentation will involve multifunctional optoelectronic probes for the brain.

12:30–13:30 Lunch Break, On Your Own
JM3A.1 Application of spatial frequency domain imaging for characterizing wide field tissue optical heterogeneity, Sreyanki Nandy1, Atahar Mostafa2, Quang Zhu3; 1Univ. of Connecticut, USA; 2School of Electrical and Computer Engineering, Dalhousie Univ., Canada; 3Institute of Biomedical Engineering, National Taiwan Univ., Taiwan.

JM3A.2 Automated Data Selection Method for Diffuse Optical Tomography to Improve the Robustness of Breast Cancer Detection, Hamed Vandi1,2, Jong Hwan Lee1,3, Hyun Keol Kim1,3, Emerson Lim1,3; 1Univ. of South Florida, USA; 2School of Physical and Electrical Engineering, Dalhousie Univ., Canada; 3Chemistry, PSIBS, UK.

JM3A.3 Blood phantom verification of a new compact DOT system, Benjamin Hallacoglu1, Jason W. Traubbaugh2, Kate L. Bechtel2, Chandran V. Selahagin1; 1Jason W. Traubbaugh, USA; 2Department of Medical Imaging, Univ. of Connecticut, USA.

JM3A.4 Direct Soft Prior Regularization in NIR Spectral Tomography from MIR-contrast and Distance-constraints, for Segmentation-free Reconstruction, Jinchao Feng1,2,3, Zijin Cai1,2,1, Shudong Li1,2,1, Wenzhen Li1,2,1; 1School of Optics, University of Science and Technology of China, China; 2Department of Physics, Imperial College London, UK; 3Department of Chemistry, Imperial College London, UK.

JM3A.5 Development of a Rotatable Optical Probe for Trans-rectal Ultrasound Coupled Diffuse Optical Tomography Imaging of Prostate Cancer, Jong Hwan Lee1, Hyun Keol Kim1, Emerson Lim2, Andreas H. Hielscher1, Brian W. Pogue2, Keith Paulsen2; 1Inst. of Inflammation and Aging, University of Liverpool, UK; 2Inst. of Electrical Engineering, National Taiwan Univ., Taiwan.

JM3A.6 Spectral Characterization of Murine Arthritis Models, Sophie Glinton1,2, Amy Naylor1, Ela Czardak1,2; 1Chemistry, PSIBS, UK; 2Computer Science, UK; 3Inst. of inflammation and aging, UK.

JM3A.7 Non-contact scanning diffuse optical tomography for three-dimensional vascular imaging in a murine bone graft model, Jingxuan Ren1, Songfeng Han1, Ashley R. Proctor2, Danielle S. Benoit1, Regine Che3; 1Univ. of Rochester, USA. A non-contact scanning diffuse optical tomography system was developed for monitoring vascularization during bone graft healing in a murine femur model. Preliminary testing of the system using tissue phantoms is presented.

JM3A.8 Non-Scanning Holography Fluorescence Microscopy, Yamil A. Nieves1, Juan S. Gomza1, JustineDupéré1, David Clark1, Myung Kim1; 1Univ. of South Florida, USA. Current progress in fluorescence cell imaging is presented using an SDH (Self-interference Incoherent Digital Holography) module that does not employ the use of a scanning light source or scanning devices. Future work will include cellular processes.

JM3A.9 Optical Oximetry of Volume-Oscillating Vascular Compartments at any Frequency, Sergio Fantini1,2, Angela Sassaroli1, Jana M. Kainerstorfer1, Carmeille Megan6, USA; 2School of Physical and Electrical Engineering, Dalhousie Univ., Canada; 3Chemistry, PSIBS, UK.

JM3A.10 Optical Property Reconstruction of a Two-Layer Diffusive Medium from Single-Distance Time-Resolved Measurements, Lorenzo Spinnelli1,2,3, Samuele Del Bianco1, Stefano Cavallini1, Tiziano Binzoni4,5, Alexander Jelzow6, Rainer Fantini2, Sergio Fantini1,2,3, Tiziano Binzoni4,5, Alexander Jelzow6; 1Carnegie Mellon Univ., USA; 2Norris Chair of Photons Group, Department of Electrical Engineering, National Taiwan Univ., Taiwan; 3School of Chemistry, Imperial College London, UK; 4Département de Neurosciences Fondamentales, Univ. of Geneva, Switzerland; 5Inst. of Biomedical Electronics and Bioinformatics, National Taiwan Univ., Taiwan; 6Physikalisch-Technische Bundesanstalt, Germany.

JM3A.11 Optimum source-detector separators for diffuse light in non-invasive tissue constituent sensing, Jin Liu1, Tongshuai Han1, Guang Han1, Zijin Cai2, Ziyang Zhang1, Bingjie Liu1, Kexin Xu1, Tijinun , China. We present an optimum source-detector separation (SDS) for recording Near-infrared diffuse spectra. At this SDS, the diffuse light intensity may not vary with scattering variation in media but most sensitively vary with absorption variation in it.

JM3A.12 Quantification of effective absorption perturbations for Time-Resolved Diffuse Optical Tomography with totally absorbing objects, Judy Zhou1,2,4, Lionel Hervé1,2,5, Laura di Siene1, Alberto Dalla Mora1, Andrea Farina1,4, Andrea Pfennel1, Jacques Derouard4, Jean-Marc Dietz1,2,5, CEAT, Let, France; 4Instituto Bionucleares Alpes, France; 5Dipartimento di Fisica, Politecnico di Milano, Italy. We evaluate the ability of time-resolved diffuse optical tomography to quantify the absorption coefficient of deep objects in turbid media. Phantom experimental results with totally absorbing objects show good quantification up to 0.4 cm⁻¹.

JM3A.13 Quantitative Multi-plexed Fluorescence Spectroscopy in the Presence of a Strong Fluorescent Marker, Jaime Bravo1, Scott C. Darr2, David W. Roberts1, Keith Paulsen2, Stephen C. Kaniecki1,2,1; 1Yager School of Engineering, Dartmouth College, USA; 2Norris Cotton Cancer Center, Dartmouth-Hitchcock Medical Center, USA; 3Department of Neurosurgery, Dartmouth-Hitchcock Medical Center, USA. Localized reflectance spectra containing fluorescence emissions from a strong marker (fluorescein sodium) are accurately modeled. The model is used to estimate metrics of vascular physiology and correct pixel absorption and scattering-dominated distortions.

JM3A.14 Withdrawn.

JM3A.15 Remote focal scanning and sub-volume optical projection tomography, Thomas Watson1, Natalie Andreuw2, Edward Harty1, Louise Hoppe1, Florian Klämpfl1, Felix Tenner1,2, Maggie J. Dallman1, James A. McCoy1, Paul M. French1,3; 1Photonics Group, Department of Physics, Imperial College London, UK; 2Institut de Biologie, Imperial College London, UK; 3Life Sciences, Imperial College London, UK. We demonstrate an improvement in resolution over conventional OCT.

JM3A.16 Remote photoacoustic tomography using speckle sensing with a high-speed camera, Benjamin Lengenfelder1,2, Fanuel Mehari1,2, Louise Happe2, Florian Klampfl1, Felix Tenner1,2, Zev Zalevsky2,3, Michael Schmidt1,2; 1Institute of Photonic Technologies, Friedrich Alexander Universität Erlangen-Nürnberg, Germany; 2Graduate School in Advanced Optical Technologies (SAOT), Germany; 3Faculty of Engineering, Bar-Ilan Univ., Israel. In the emerging photoacoustic imaging and tomography technique, contactless imaging approaches are of great interest. In this work, a proof-of-principle for remote photoacoustic tomography using speckle sensing is shown.

JM3A.17 Simulation Study on Optimal Probe Numerical Aperture for Diffuse Reflectance Spectroscopy, Andy Liad1, King-Bin Sung2,1; 1Graduate Inst. of Biomedical Electronics and Bioinformatics, National Taiwan Univ., Taiwan; 2Department of Electrical Engineering, National Taiwan Univ., Taiwan; 3Molecular Imaging Center, National Taiwan Univ., Taiwan. Diffuse reflection changes in tissue optical parameters differ for different layers. This study investigates different fiber NAs for depth selective sampling in DRS. Results show larger NA increases sensitivity and accuracy to epithelial layer parameters.

JM3A.18 Simultaneously reconstruction of absorption and scattering coefficients with zero cross-talk and in high resolution, Le Yi2, Huabei Jiang1,1,2; 1Univ. of Florida, USA; 2School of Physical and Electrical Engineering, Dalhousie Univ., Canada; 3Department of Electrical Engineering, National Taiwan Univ., Taiwan. By employing the pseudospectral time-domain (PSTD) simulation technique, we analyze the propagation of monochromatic light through a macroscopic scattering medium. Simulation results show that, evanescent wave can propagate to the PCM without loss.

JM3A.19 2-D PSTD Simulation of wave behavior analysis via Optical Phase Conjugation Phenomenon, Min-Lun Yu1, Chia-Ta Tseng1, Show H. Tseng1,2; 1Graduate Inst. of Photonics and Optoelectronics, National Taiwan Univ., Taiwan; 2School of Biomedical Engineering, National Taiwan Univ., Taiwan. A new tomographic imaging method using concurrently measured time-resolved photoacoustic and optical data is presented. This method can provide the images of both absorption and scattering coefficients with zero cross-talk and in high resolution.

JM3A.20 Combined Mueller matrix polarimetry and polarization-sensitive optical coherence tomography for characterization of birefringent samples, Joseph Chue-Sang1, Jessica C. Ramella-Roman1, Florida International Univ., USA; 2Department of Physics, Imperial College London, UK. We present an improved resolution in volume-oscillating compartment using speckle sensing with a high-speed camera.

JM3A.21 Removal of limited dynamic range artifacts from swept-source optical coherence tomography images, Josh D. Farrell1, Dan MacDougall1, Robert Adamson1,2, School of Biomedical Engineering, Dalhousie Univ., Canada; 3Institute of Biomedical Engineering, National Taiwan Univ., Taiwan. We describe and implement a new approach to remove artifacts caused by the limited dynamic range of the point-spread function of swept-source lasers in swept-source optical coherence tomography.
Sensitivity enhancement in swept-source optical coherence tomography by parametric balanced detector and amplifier, Japing Kang1, Xiaoming Wei1, Bowen Li1, Ke Wang1, Luozin Yu1, Sisi Tian1, Kenneth K. Wong1, ‘The Univ. of Hong Kong, Hong Kong. We report a sensitivity enhancement method in interference signal detection of swept-source optical coherence tomography with full-parametric amplifier and balanced detector. 12-dB sensitivity improvement spanning over 76 nm was achieved.

Towards the Assessment of Blood Oxygenation Using Multispectral Multiple Scattering Low Coherence Interferometry, Ying Zhao1, Jason R. Maher1, Adam Wax1, ‘Duke Univ., USA. Oxygenation of hemorrhaged blood was measured with multispectral multiple-scattering low coherence interferometry revealing a high correlation (r=0.91) with gold-standard spectrophotomter measurements.

Visible Inverse Spectroscopic Optical Coherence Tomography Probe for Spatially Resolved Nanoscale Characterization, James Winkelmans1, ‘Graham Speaker1, Aly Ed1, Ji Yi1, Vadim Backman1, ‘Northwestern Univ., USA. We propose a unique radial scanning achromatic visible probe design utilizing doublet lenses capable of obtaining spatially and spectrally resolved optical properties, enabling characterization of mass density fluctuations on nanometer length scales.

Towards Geometric Modeling of the Atria using Optical Coherence Tomography, Yu Gan1, Sarah Guibaud1, Igor R. Efimov2, Christine Nelles2, Gorm Greisen2, Simon Hyttel-Sørensen2, ‘Northwestern Univ., USA. We present an optimized stitching strategy for the calculation of the light penetration depth in diffusive media, both in continuous-wave and time-domain regimes. Analytical results are validated with Monte-Carlo simulations.

Statistics of the Light Penetration Depth in a Diffusive Medium, Andrea Farina1, Mirano Bintz1, Antasou Torricelli1, ‘LETI, CNRS, France. We define a Spectroscopic Tip Optical Probe (STOP) to quantify spatial optical properties in order to differentiate dull from bright tone of panelists. We show its capability to probe the diffuse medium in depth.

Super-resolution Snapshot Chemical Imaging with Plasmonic Nanoholes, Ael P. Olson1, Nathan Lindquist1, ‘Physics, Bethel Univ., USA. We show super-resolution chemical imaging with plasmonic nanoholes, Surface Enhanced Raman Spectroscopy and Stochastic Optical Reconstruction Microscopy. Spectral and spatial content are obtained simultaneously by imaging through filters or gratings.

The BabyLux project - an optical neuro-monitor of cerebral oxygen metabolism and blood flow for neonatology, Albert Wittekind1, ‘Universität zu Berlin, Germany; 2Universitätsklinikum Charité, Berlin, Germany; 3Universitätsklinikum Schleswig-Holstein, Kiel, Germany. We report on the first results of an in-vivo endoscopic and invasive multi-spectral measurement of cerebral oxygenation and blood flow with optical coherence tomography in term and preterm neonates.

Optical Imaging of Cancer Cell Metabolism in Murine Metastatic Breast Cancer, Kinan Alhalka1, Lisa Effredo1, Narsimhan Rajaram1, ‘Univ. of Arkansas, USA. Results from imaging the optical redox ratio in murine breast cancer cells at normoxic and hypoxic conditions are presented. These data compare well with measurements of glycolysis and oxidative phosphorylation using a metabolic flux analyzer.


Fluorescence Lifetime-based Multiplexing of Near-Infrared Förster Resonance Energy Transfer Pairs, Sean-Jade Chen1, Nattawut Smuesombat1, Alena Rudkoskaya1, Margarida Barros1, Xavier Intes1, ‘Rensselaer Polytechnic Inst., USA; ‘Albany Medical College, USA. We investigated the potential to perform FRET multiplexing in the near-infrared based on lifetime imaging. We tested a set of fluorophores/dark quencher and demonstrated their utility in terms of FRET quantification and multiplexing.

Design and Characterization of a Computational Endomicroscopy Platform for Optical Biopsy, John Paul Dumas1, Mark C. Pierce2, Muhammad Lodhi1, Waleed U. Bajwa3, ‘Rutgers Univ., USA. We are using compressive sensing concepts to overcome the resolution limitation imposed by discrete fibers in cobblestone-based endomicroscopy. Resolution can be improved by integrating system-specific information into reconstruction algorithms.

Human Fresh Tissue Optical Biopsy Using Multiphoton Microscopy for PDT Control, Natalia Shakhatova1, Sergey Gamyun2, Parvada Dutdenkova1, Anna Brilina1, Sergey Kuznetsov2, ‘IAP RAS, USA; ‘Republican Clinical Oncological Dispensary, Russian Federation; ‘Nanhy Nursing State Univ., Russian Federation; ‘Nanhy Nursing State Medical Academy, Russian Federation. Capabilities of multiphoton microscopy for investigation of Photoditazin distribution in tumor cell line and in ex vivo human tumor is demonstrated. The preferential accumulation of FS in the stroma compared with cellular component is shown.
JM3A.41 Cherkenkov Radiation Portal Imaging during Photon Radiotherapy, Suize Mason1,2; Vinnis Roussakis1,2, Ranqiao Zhang1, Geoff Heyes1, Gareth Webster1, Stuart Green1, Brian W. Pogue1, Hamid Dehghani1, Univers of Birmingham, UK; 1Univ Hospital Birmingham, UK; 2Harvard Univ., USA, Dartmouth College, USA. Cherkenkov Radiation from the exit face of a radiotherapy beam was optically imaged as a novel form of portal imaging. Resolution and contrast were found to be comparable to values achieved from a commercial system.

JM3A.42 Simultaneous, non-invasive measurement of local tissue hemodynamics, oxygen metabolism and gold nanorod concentration in vivo, Jordi Morales1, Miguel Adrian Mireles Nunez1, Johannes D. Johansson1, Mar Martinez-Lozano1, Clara Vilches1, Oriol Casanovas2, Romain Quidant1,3, Turgut Durduran1,3; Institute of Photonic Sciences, Spain; 2Tumor Angiogenesis Group, IDIBELL, Spain; 3Institucio Catalana de Recerca i Estudis Avanats (ICREA), Spain. A hybrid broadband diffuse optical and diffuse correlation spectroscopy system is used to measure local tissue hemodynamics, oxygen metabolism and gold nanorod concentration. The objective is to provide real-time feed-back for photothermal therapy.

JM3A.43 Withdrawn.

JM3A.44 Hydrogen Peroxide Level Changes in Viable and Apoptotic Tumor Cells under Cisplatin Action, Anna Orlova1, Anastasya Belova1, Irina Balalaeva1, Natalia Antonova1, Anna Maslen-nikova1, Elena Zagaznova1, Vsevolod Belousov1; 1Inst. of Applied Physics RAS, USA; 2N. I. Lobachevsky State Univ. of Nizhn Novgorod, Russian Federation; 3Nizhn Novgorod State Medical Academy, Russian Federation. Clinical outcomes of PDT of 855 patients are analyzed. Application of fluorescence imaging and optical coherence tomography for non-invasive monitoring of PDT is shown, prospects of optical bioimaging to prognosis of clinical results is demonstrated.

JM3A.45 Alterations in Resting State Networks in a Mouse Model of Glialoma Growth, Inema Orukari1, Adam G. Bauer1, Grant A. Baxter1, Joshua Rubin1, Joseph P. Culver1, Washington Univ. in St Louis, USA. The relationship between brain tumor growth and alterations in resting state networks is poorly understood. Functional connectivity optical intrinsic imaging enables assessment of resting state alterations in a mouse model of glioma growth.

JM3A.46 Longitudinal Volumetric Assessment of Glioblastoma Brain Tumor in 3D Bio-Printed Environment by Mesoscopic Fluorescence Molecular Tomography, Mehmet S. Ozturk1, Xavier Intes1, Guishao dai1, Vivian K. Lee1, Renselsaer Polytechnic Inst., USA; 3D optical reconstruction of in-vivo Glioblastoma brain tumors was evaluated longitudinally with Mesoscopic Fluorescence Molecular Tomography. Tumor response to the Temozolomide, a clinical drug, was evaluated longitudinally with Mesoscopic Fluorescence Molecular Tomography. The relationship between brain tumor growth and alterations in resting state networks is poorly understood. Functional connectivity optical intrinsic imaging enables assessment of resting state alterations in a mouse model of glioma growth.

JM3A.47 Optical Bioimaging as a Tool for Prognosis of Oncologic and Functional Results of PDT of Non-Melanoma Skin Carcinoma, Maria Shakhova1, Nizhn Novgorod State Medical Academy, Russian Federation. Clinical outcomes of PDT of 855 patients are analyzed. Application of fluorescence imaging and optical coherence tomography for non-invasive monitoring of PDT is shown, prospects of optical bioimaging to prognosis of clinical results is demonstrated.

JM3A.48 Whole body lifetime FRET imaging in transmigration and reflectance for the assessment of drug delivery efficacy in small animals, Nataliya Sumsuphan1, Alena Rudkouskaia1, Margarida Barroso1, Xavier Intes1; Renselsaer Polytechnic Inst., USA; 2Albany Medical College, USA. We implemented transmission and reflectance wide-field fluorescence lifetime imaging for whole body animal imaging and applied it to assess drug delivery efficacy. Both configurations provided robust and similar in vivo quantification in all organs.

JM3A.49 Longitudinal Monitoring of Therapy Response in a Preclinical Model using Spatial Frequency Domain Imaging, Syeda Tabassum1, Ravef Isfani1, Darren Roblyer1, Boston Univ, USA. We present here a proof-of-concept longitudinal study of cytotoxic and antiangiogenic therapy response in a preclinical model using Spatial Frequency Domain Imaging. Significant changes in optical scattering and hemoglobin were observed in tumors.

JM3A.50 Optically Cleared Mouse Tongues for Three-Dimensional Investigation of Oral Neoplasia, Emily Tran1, Anne Hellebus1, Jean Wu1, Ann Gillenwater1, Nadarajah Vigneswaran1, Rebecca R. Richards-Kortum1, Rice Univ., USA; 2The Univ. of Texas School of Dentistry at Houston, USA; 3Univ. of Texas MD Anderson Cancer Center, USA. Modification and application of an optical clearing technique, CLARITY, to mouse tongue tissue to improve fluorescence imaging depth and allow investigation of oral neoplasia in three dimensions.

JM3A.51 PEI-Folic acid modified carbon nanodots for cancer cells targeted delivery and two-photon excitation imaging, Jing Wang1, State Key Laboratory of High Field Laser Physics, Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, People’s Republic of China, China. PEI-FA was coated on the fluorescent CDs into tissue to improve optical coherence imaging depth and allow investigation of oral neoplasia in three dimensions. PA was used as the targeting ligand. Ten times more particles were internalized by FR-positive KB cancer cells as compared to the FR-negative A549 cancer cells.

JM3A.52 Quantification of cell surface receptor in live tissue culture using a paired-agent stain and rinse approach, Xiao Xu1, Jialing Xiang1, Kenneth M. Tichauer1; 1Univ. of North Carolina at Chapel Hill, USA. We recently developed motility metrics for 3D breast co-culture models using spicule fluctuation spectroscopy in optical coherence tomography. Here we apply these metrics to excised mouse mammary tissue, and also demonstrate fat cell sizing.

JM3A.53 Probing nanoscopic cell surface areas for rapid and label-free plasmon enhanced Raman spectroscopy, Chii Zhang1, Soumik Sodhania1, Chao Zhang1, Istan Barman1, J. Johns Hopkins Univ., USA; 2Department of Breast Surgery, The First Hospital of Jilin Univ., China. Applying surface enhanced Raman spectroscopy with nanoparticle array to identify aggressive prostate cancer cell surface markers, we highlight the potential of probing variant cell phenotypes via such combination platforms.

JM3A.54 Imaging of Tumor Hypoxia using 4-Nitroimidazole ICG-conjugate, Feifei Zhou1, Akram Abuusen1, Christopher Dietz2, Inura Moham-mad1, Michael Smith1, Quing Zhu1, Biomedical Engineering department, USA; 2Chemistry, Univ. of Connecticut, USA; 3Electrical and Engineering, Univ. of Connecticut, USA. We compared in vivo hypoxia targeting of 4-nitroimidazole-piperazine-ICG with midazole and 2-nitroimidazole-ICG conjugate. Results showed 1:5 fold and 2:5 fold intensity ratio between each pair. This is supported by cell and IHC results.

JM3A.55 Motility Imaging and Adipocyte Sizing of Mouse Mammary Tissue by Optical Coherence Topography, Amy L. Oldenburg1, Xiao Yu1, Liza Makowski1, Melissa Troester1; 1Univ. of North Carolina at Chapel Hill, USA. We recently developed motility metrics for 3D breast co-culture models using spicule fluctuation spectroscopy in optical coherence tomography. Here we apply these metrics to excised mouse mammary tissue, and also demonstrate fat cell sizing.

JM3A.56 Tumors In Situ Cancer Diagnosis With Plasmonic Optical Fiber Sensors, Christophe Cauchetier1, Gisalde Rabat1, Ruddy Watteez1; 1Univ. of Mons, Belgium. A near-infrared plasmonic optical fiber immunosensor is demonstrated for detection of cytokeratins in serum, which are proteins of interest for the lung cancer diagnosis. Results are presented in terms of sensitivity and limit of detection.
JMA4 • 15:30
Novel Optical Contrast in Cancer: Cherenkov Radiation in Radiotherapy and in Nuclear Medicine, Brian W. Pogue 1,2, Dartmouth College, USA; 3DoseOptics LLC, USA. Cherenkov light emission occurs when high energy radiation (>220keV) travels through tissue. This optical signal is useful for molecular tracer imaging, radiation dose imaging, or molecular sensing in vivo. Human and animal studies are demonstrated.

Atlantic Ballroom 3
15:30–17:30

OCT Imaging Studies II
President: To be determined

TM4B.1 • 15:30
Field Carcinogenesis Detection for Colon Cancer Screening: A Novel Application of Photoacoustic Imaging, Harinsh Subramanian1, Andrew Radoevich1, Scott Gladstein2, Vadin B. Backman3, Adam Eshen1, Boston Univ., USA; 2Boston Medical Center, USA; 3Biomedical Engineering, Northeastern University, USA. Field carcinogenesis represents an important clinical target for biophotonic research potentially providing highly accurate risk stratification which is integral to cancer screening.

TM4B.2 • 16:00
Multimodal Optical Imaging for Early Detection of Oral Cancer, Cory Olsavsky1, Rodrigo Cuencia2, Yi-Shing Lisa Cheng3, John Wright4, Javier A. Jo5, Kristen C. Maitland1, 2Department of Biomedical Engineering, Texas A&M Univ., USA; 2Department of Diagnostic Sciences, Texas A&M Univ. Health Science Center – Baylor College of Dentistry, USA. We present results from in vivo imaging of the oral cavity using macroscopic fluorescence lifetime imaging followed by reflectance confocal microscopy.

JMA4 • 16:30
Towards biopsy guidance of oral lesions with wide-field OCT imaging, Anthony M. Lee1, Ryan Nolan 1, Sarah J. Wright 1, Samuel J. Lucas1, David Davies2, 1Inst. of Biomaterials & Biomedical Engineering, Univ. of Toronto, Canada; 2The Edward S. Rogers Sr. Department of Electrical & Computer Engineering, Univ. of Toronto, Canada. A multi-modal imaging system was used to analyze the spatiotemporal evolution of correlates to neural activity in a uniform cortical seizure model. We observed wave-like propagation during seizures and subtle spatial variation during drug interference.

Atlantic Ballroom 2
15:30–17:30

OCT Imaging Studies
President: X. Luis Dean-Ben; Helmholtz Zentrum Munchen, Germany

OM4C.1 • 15:30
Diffuse Optical Imaging Methodologies in the Neonatal Intensive Care Unit, Robert J. Cooper1; UCL, UK. We will describe the studies underway at neoLAB (UCL-Cambridge) that are developing CW- and TR-DOT approaches to investigate the haemodynamic correlates of neurological injury and abnormal electrocortical activity (seizures and discontinuous EEG) in term-age infants.

OM4C.2 • 16:00
Towards Optical Tomography of an Adult Human Head, Stanslaw Wojcieszek1, Piotr Sawosz1, Michal Kapeczak1, Anna Gerega1, Karolina Bieg1, Roman Maniewski1, Adam Liebert1; 1BBE PAS, Poland. We have developed a high-resolution diffuse optical tomography system capable of carrying out measurements on an adult human head at source-detector separations 1.5-11.8mm. We present first results obtained during a Valsalva maneuver.

OM4C.3 • 16:15
A New Multichannel Broadband Near Infrared Spectroscopy System to measure spatial distribution of Cytoschrome-oxidase and Tissue Oxygenation, Phang Phan1, David Highton2, Martin Smith2, Ilia Tsachtidis3, Clare Ellwell4; 4Medical Physics and Biomedical Engineering, Univ. College London, UK; 2Neurocritical Care, National Hospital for Neurology and Neurosurgery, UK. We report a novel broadband near-infrared spectroscopy system that has the capability of measuring changes in cerebral haemodynamics and metabolism at multiple locations simultaneously.

OM4C.4 • 16:30
Monitoring the Injured Brain – High density near infrared probes and registered atlas models improve cerebral saturation recovery, Michael Clancy1, Samuel J. Lucas1, David Davies2, Antonio Bell3, Zhanjie Su4, Stanislaw Wojciechewicz1, Piotr Sawosz1, Hamid Dehghani5; 5Univ. of Birmingham, UK; 7NIHR Surgical Reconstruction & Research Centre, UK; 4National Institute for Biomedical Imaging and Bioengineering, Poland. High density near infrared probes and registered subject specific atlas models are used to show the potential improvements to the quantitative accuracy of recovered parameters relevant to monitoring an injured brain.

Atlantic Ballroom 1
15:30–17:30

OCT Imaging and Neurovascular Coupling
President: Maria Angela Franceschini; Massachusetts General Hospital, United States

BM4D.1 • 15:30
Optical Imaging of Oxygen Delivery and Consumption: Guiding Interpretation of BOLD fMRI, David A. Ross1,2, Harvard Medical School, USA; 3Radiology, Massachusetts General Hospital, USA. I will discuss novel optical imaging methods that we developed to better understand oxygen delivery and consumption during brain activity to guide us in more quantitative interpretation of human functional brain imaging by BOLD fMRI.

BM4D.2 • 16:00
Capillary substrate of brain tissue oxygenation changes with age, Mohammad Moeini1, Maryam Tabatabaee2, Ashok Kakkar3, Frederic Lasage2, 1Ecole Polytechnique, Canada; 2Chemistry, McGill Univ., Canada. We investigate the impact of vascular changes with age on brain tissue oxygenation. We measured capillary BFC-dynamics and tissue oxygenation using two-photon lifetime imaging in young and aged mice and showed decreased oxygen delivery with age.

BM4D.3 • 16:15
Multi-modality Optical Imaging of Temporal and Spatial Dynamics During in vivo Seizure-like Activity, Drive Ringuette1, Peter Carlen1, Offer Levi1, 1Inst. of Biomaterials & Biomedical Engineering, Univ. of Toronto, Canada; 2The Edward S. Rogers Sr. Department of Electrical & Computer Engineering, Univ. of Toronto, Canada. A multi-modal imaging system was used to analyze the spatiotemporal evolution of correlates to neural activity in a uniform cortical seizure model. We observed wave-like propagation during seizures and subtle spatial variation during drug interference.

BM4D.4 • 16:30
Optical Dissection of Massacural Cerebral Hemodynamics in the Behaving Brain, Patrick Drew2; 1Pennsylvania State Univ., USA. We investigated the hemodynamic response to locomotion in the cerebral cortex of awake mice. Arterial and venous signals had distinct spatiotemporal dynamics, neural coupling, and sensitivity to cardiovascular state.
Machine-learning detection of basal cell carcinoma in human skin using polarization sensitive optical coherence tomography, Tahereh Marvashid1, Lian Duan1, Jean Tang2, Sumaira Aasi1, Audrey E. Bowden1; Stanford Univ., USA. We report results on the first automated detection of basal cell carcinoma in human skin using polarization-sensitive optical coherence tomography. Our classifier achieves a sensitivity, specificity and accuracy of 92.6%, 87% and 90%, respectively.

Multimodal Structural Priors for Spatially-Dense Diffuse Optical Tomography of Breast Cancer, Jeffrey M. Cochran1, Han Y. Ban1, David R. Busch2, Martin Schweiger1, Verkaiah C. Kavuri1, Saurav Pathak1, Simon Arridge1, Arjun G. Yod2; Univ. of Pennsylvania, USA; 2Department of Neurology, Children's Hospital of Philadelphia, USA; 3Department of Computer Science, Univ. College London, UK. We demonstrate spatially-dense diffuse optical tomographic (DOT) reconstructions of breast cancer utilizing two forms of structural priors: MR images from a concurrent DOT-MRI instrument and fringe-projection profilometry in an optical-only system.

Wide-field quantitative imaging of intrinsic scatter bio-markers using sub-diffusive structured light, David M. McClatchy III1, Elizabeth Rauz1, Wendy A. Wells1,2, Jesseong Heang1, Keith Paulsen1,2, Brian W. Pogue1,3, Stephen C. Kanick3; Thayer School of Engineering, Dartmouth College, USA; 2Pathology, Dartmouth Hitchcock Medical Center, USA; 3Quantum Electronics and Photonics Division, National Inst. of Standards and Technology, USA. Sub-diffusive structured light imaging can quantitate the density of scatterers versus their size scale distribution in a wide-field geometry. Phantoms with unique fractal distributions and n=22 fresh human breast specimens are imaged and analyzed.

Optical Mammography: Imaging breast cancer response to neoadjuvant chemotherapy, Pamela Anderson1, Angelo Sassaroli1, Srinsha Kal1, Nishanth Krishnamurthy1, Shital Mak1, Roger Graham2, Sergio Fantini1; 1Department of Biomedical Engineering, Tufts Univ., USA; 2Department of Radiation Oncology, Tufts Medical Center, USA; 3Department of Surgery, Tufts Medical Center, USA. Optical mammograms were obtained on 7 patients undergoing neoadjuvant chemotherapy. When therapy was 30% complete, patients achieving a high pathologic response had a lower oxy-hemoglobin decrease compared to those with extensive disease remaining.

Optical Tomography and Translational Biophotonics

Optical Mammography: Near-infrared fluorescence lymphatic imaging in the pediatric population, John C. Rasmus1, Melissa B. Aldrich1, Duraisamy Balaguru1, Matthew R.Greives1, Eva Sexv1,2; Univ. of Texas Health Science Center, USA. Near-infrared fluorescence lymphatic imaging using indocyanine green is used to assess the lymphatic anatomy and contractile function in pediatric patients with primary lymphedemas and postoperative chylorax without ionizing radiation or sedation.

Non-invasive functional neuroimaging in awake mice to show that ChR2-evoked maps provide patterns of functional network connectivity that are more spatially-specific than resting-state functional connectivity maps. Christopher Ha1, Divya S. Bolar1, Jeffery N. Stout2, Borjan Gagic1, Rutvi Vyas1, Christopher Ha1, Divya S. Bolar1, Henry H. Cheng1, Jane Newburger1, Maria Angel Francheschina1, Elfar Adalsteinsson1, Ellen Grant2; 2Fetal-Neonatal Neuroimaging and Developmental Science Center, Boston Children's Hospital, USA; 1Harvard-MIT Health Sciences and Technology, Massachusetts Inst. of Technology, USA; 2Marinos Center for Biomedical Imaging, MGH, Harvard Medical School, USA; 3Department of Cardiology, Boston Children's Hospital, USA. Cerebral perfusion in neonates with congenital heart disease is a clinical concern. Combined measures of MRI and NIRS can provide complementary information to improve monitoring. We compare multimodal measures of cerebral hemodynamics in this group.

Non-invasive Functional Neuroimaging in the Mouse Using Diffuse Optical Tomography, Matthew Reisman1, Adam Q. Bauer1, Zachary Markow1, Joseph P. Culver1; 1Washington Univ. in St. Louis, USA. We present a new technique expanding on previous minimally invasive optical intrinsic signal (OIS) imaging methods to perform non-invasive functional neuroimaging in mice using Structured Illumination combined with Diffuse Optical Tomography.

Biomedical Optics • 25–28 April 2016
Advances in Measuring Cerebral Oxygen Delivery and Consumption in the Clinic with Near Infrared Spectroscopy, Maria Angela Franceschini1,2, ‘Massachusetts General Hospital, USA. With the foundation of our seminal frequency-domain near infrared spectroscopy (FD-NIRS) and diffuse correlation spectroscopy (DCS) efforts with neonates established, we are now developing novel devices and approaches to better quantify cerebral blood flow and oxygen metabolism in the clinical setting. I will present the first fully integrated FD-NIRS/DCS commercial system. I will show results of this technology in measuring infants affected by hydrocephalus in Africa, and measuring pediatric and adult patients in intensive care settings in Boston. In parallel to the clinical translation of the established FD-NIRS/DCS technology, we have also advanced the field and developed totally new approaches which have the potential to be rapidly translated into a clinically viable, non-invasive, comprehensive cerebral hemodynamic monitoring method with significant advantages over existing methods. In particular, time-domain diffuse correlation spectroscopy (TD-DCS) is a novel technology which enables us for the first time to employ time-gating strategies used in TD-NIRS to DCS cerebral blood flow measurements and realize improvements which are not possible when the two techniques are performed independently. The development of DCS devices with fast acquisition rates allow us to acquire cerebral blood flow variations due to the cardiac cycle. We are the first to explore the possibility of using the pulsatile blood flow to assess intracranial pressure continuously and non-invasively.

Photoacoustics-assisted Wavefront Shaping in Multispectral Optoacoustic Tomography, Amir Rosenthal1,2, ‘Technion - Israel Inst. of Technology, Israel. In multispectral optoacoustic tomography (MSOT), sparsity is found in the measured dataset as well as in the model of the imaging system. In this talk, sparsity-based methods for image reconstruction in MSOT will be discussed.

High-speed, 3D SCAPE Microscopy of Fresh Tissues for in situ Histopathology, Kripa Patel1,2, Venkataakudi Velei1, Elizabeth M. Hillman1,2, ‘Columbia Univ, USA. Freshly excised tissues were imaged with SCAPE microscopy, allowing rapid 3D visualization. Results suggest in situ imaging using SCAPE could be used to diagnose and monitor diseased tissue, and guide targeted biopsies and surgical resection.

Development of a Multi-Modular Optical Imaging System, Shelley L. Taylor1,2, Phillip N. Newsome1,2, ‘PSIBS Centre for Doctoral Training, Univ. of Birmingham, UK. A multi-modal optical imaging system is presented which uses diffuse optical tomography to determine subject-specific, heterogeneous tissue attenuation to increase the quantitative accuracy of bioluminescence tomography.

Ultra-high Resolution Models of the Human Brain – Computational and Neuroscientific Challenges, Katrin Amunts1, ‘Forschungszentrum Julich GmbH, Germany. Whole brain models of cellular and fiber architecture will be shown, which are based on advanced ICT. They allow integrating multimodal and multilevel data, thus opening new perspectives to decode the human brain.
<table>
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<th>Session</th>
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<tr>
<td>Ttu2B.3</td>
<td>Imaging Based System for Performing a White Blood Cell Count and Partial Differential at the Point of Care</td>
<td>Steven S. Hou, Brian Backait, Anand T. Kumar, Alzheimer’s Disease Research Unit, Department of Neurology, Massachusetts General Hospital, Harvard Medical School, USA, Athinaou A. Martinos Center for Radiologic Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, USA. We present an improved FOCO microscopy design that enhances system performance and ease of use. We also show that imaging mouse brain, veins, arteries, and Drosophila larva at high temporal resolution.</td>
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<tr>
<td>Ttu2B.4</td>
<td>Calibration of a Wireless Patch SpO2 Sensor for Respiratory Disorders Applications</td>
<td>Anne Koomen, Remy Gerbelot, Jean-Christian Boire, Cheyne Desir, Matthieu Legrand, Sammarmar Chacaroun, Samuel Vergez, Bernard Wuyan, Jean-Marc Dinten, Pierre Jallon, CEA-LETI, France, Agirdrom, France, Univ Grenoble Alpes-Laboratoire HF2, France, UT042, INSERM, France. We present a clinical study conducted in order to evaluate the performance of an oximetry sensor on different body locations. This sensor is part of a configurable wireless patch that can provide real-time feedback on the distribution of respiratory disorders monitoring.</td>
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<td>Ttu2C.3</td>
<td>Fluorescence lifetime optical projection tomography and FRET applied to visualizing apoptosis in live zebrafish larvae</td>
<td>Natalie Andersen, Marie-Chistine Ramel, Sunil Kumar, Yuriy Alexandrov, Douglas Kelly, Sean Warren, Louise Kenny, Nicola Lockwood, Antonina Frolov, Paul Frankel, Laurence Bugeon, James A. Gary, Maggie J. Dallman, Paul F. French, Imperial College London, UK. We present the application of FRET-OPM to detect functional imaging of live zebrafish larvae using genetically expressed cleavable FRET biosensors.</td>
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<td>Ttu2B.5</td>
<td>Improving Penetration Depth in Biological Imaging Using Nd:Yb3+/Er3+ Doped Upconverting Nanoparticles</td>
<td>Monreeshalaad Moshayeghi, Hugo Soderlund, Haichun Liu, Stefan Andersson-Engels, Lund Univ, Sweden, Department of Biomedical Engineering, Faculty of Engineering, National Univ. of Singapore, Singapore. We have synthesized and evaluated 2D upconverting nanoparticles. We provide improved signal strengths from deep regions of the tissue phantom as compared to conventional upconverting nanoparticles.</td>
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<td>Ttu2D.3</td>
<td>SCAPE microscopy for high-speed volumetric functional imaging of the awake, behaving brain</td>
<td>Verkataukas Ali, Wenzu Li, Mate Greaney, Kay E. L. Love, Elizabeth M. Hillman, Columbia Univ., USA. We present an improved SCAPE microscopy design that enhances system performance and ease of use. We also show that imaging mouse brain, veins, arteries, and Drosophila larva at high temporal resolution.</td>
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OTu2A • Novel Methods in PAT—Continued

Quantitative Photoacoustic Tomography in Biological Tissues Assisted with Intrinsic Acoustic Measurements, Anabela Da Silva1, Charles Handschin2, Christophe Riedinger2, Serge Mensah1, Amélie Litman1, Hassan Alkhoury1; 1Aix-Marseille Université, CNRS, Centrale Marseille, Institut Fresnel UMR 7249, France; 2SATT Sud Est (SATT PACA Corse SAS), France; 3Aix-Marseille Université, CNRS, Centrale Marseille, LMA UPR 7051, France. Purely acoustic information can be extracted from photoacoustic measurements that can be used afterwards as prior knowledge in the reconstruction process. The fact is illustrated through experiments conducted on phantoms and on synthetic data.

OTu2A.5 • 11:30
Light fluence estimation by imaging photo-switchable probes with temporally unmixed multispectral optoacoustic tomography, X Luis Dean-Ben1, Andre C. Stiel1, Yuanyuan Jiang1, Vaslis Ntziachristos1, Gill G. Westmeyer1, Daniel Razansky1; 1Inst. for Biological and Medical Imaging, Technical Univ. of Munich and Helmholtz Center Munich, Germany. We report on a new method for mapping light fluence distribution deep in a scattering tissues based on real-time optoacoustic tomographic acquisition of temporal-data from reversibly switchable fluorescent proteins (RSFPs).

OTu2A.6 • 11:45
Pressure Ulcer Progression and Prediction Using Diffuse Correlation Spectroscopy, David Diaz1, Alec Lafontant1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidrauer1, Michael Neidraer
JTu3A.1 Instrument for Early Detection of Hemorrhage via Diffuse Correlation Spectroscopy, Daniel Fernandez1, Christopher Stapels1, Daniel McAdams1, James Christian1, Noah Kolodjeski1,2; Radiation Monitoring Devices, USA. We present an instrument to diagnose hemorrhage by monitoring changes in perfusion associated with early compensatory mechanisms. Detecting these early stages of hemorrhage will allow clinicians to respond sooner to ensure patient survivability.

JTu3A.2 Comparing Time-resolved and Continuous-wave Near-infrared Spectroscopy for Determining Oxygen Saturation in Human Skeletal Muscle tissue, Emilie Kratzenberg1, Alisa Sahraeen1,2, Adam Ahamed Sabahi1, Dmitry Kholtypar1, Stefan-Acmeertas2,3, Bouquet Kiel1, Division of Cardiology, Department of Internal Medicine, The Catholic Univ. of Korea, Korea (the Republic of). We compare different gradient-based methods to reconstruct chromophore and scatterer concentrations simultaneously by multispectral CW diffuse optical tomography. Adjoint theory is used to calculate the gradient in the optimization problem.

JTu3A.3 Confocal and Transient Absorption Ultrasonic Microscopy Imaging of Heme Proteins, Scott Mattison1, Brian E. Applegate1,2; Texas A&M Univ., USA. We have recently developed transient absorption for ultrahigh resolution photoacoustic microscopy. We will discuss recent progress incorporating confocal microscopy and imaging of heme proteins which play a vital role in numerous cellular processes.

JTu3A.4 Rapid Identification of Methicillin-Resistant Staphylococci by Biosensor Assay Consisting of Nanoscale Films on Optical Fiber Long-Period Grating, James1, Hefflin1,2, Akola Bandara1,2, Siddharth Ramachandran3,4, Alfred Ritter1, Thomas Inzana1, Virginia Tech., USA; Boston Univ., USA. We have recently developed transient absorption for ultrahigh resolution photoacoustic microscopy. We will discuss recent progress incorporating confocal microscopy and imaging of heme proteins which play a vital role in numerous cellular processes.

JTu3A.5 Non-invasive assessment of skin roughness through speckle pattern analysis, Armist Lotay1,2, Mariama Canval1, John Girk1, Durham Univ., UK. A novel system for the application of laser speckle analysis for in vivo skin roughness assessment is presented. Our algorithm exploits scattering statistics for roughness parameters - the height deviation (h) and correlation length (L)...

JTu3A.6 Dynamic Phantom Measurements to Validate a Novel Optical Tomographic Breast Imaging System, Bernhard Zimmermann1,2, Bin Ding1, Bhawna Singh1,2, Qingan Fang1,2, David A. Boas1,2, Stefan Carp1,2, Alphonso A. Martinsao Center for Biomedical Imaging, Harvard Medical School / Massachusetts General Hospital, USA; Department of Electrical Engineering and Computer Science, Massachusetts Inst. of Technology, USA; Department of Bioengineering, Northeastern Univ., USA. We validated the temporal imaging performance of our second generation tomographic optical breast imaging system (TBI2) by using diffuse Optical Tomography. The measurements were performed on a spherical phantom containing spherical glass-free inclusions. The rise time was less than 6 s.

JTu3A.7 Enhanced SNR in intravascular photoacoustic/ultrasound catheter, Seongho Choi1,2, Chang-hoon Cho1,2, Sungjo Park2, Jinmoo Kim1, Hyeoung Park2, Hyung-Ki Kim1, Division of Cardiology, Department of Internal Medicine, The Catholic Univ. of Korea, Korea (the Republic of). We compare different gradient-based methods to reconstruct chromophore and scatterer concentrations simultaneously by multispectral CW diffuse optical tomography. Adjoint theory is used to calculate the gradient in the optimization problem.

JTu3A.8 Full-field RBC velocity imaging and real-time concentration monitoring in optically accessible skin, Guojun Yang1, Mingyi Wang1, Vaguang Zeng1,2; Beijing Normal Univ., China; Foshan Univ., China. We propose spatiotemporal demodulation autocorrelation with a microscopy system for full-field mapping of velocity red blood cells (RBCs) in capillaries and laser speckle imaging with short-time modulation for real-time monitoring of RBC concentration.

JTu3A.9 GA-GPUMCML: A New GPU Accelerated Algorithm for Optical Tomography Reconstruction, Atakar Mostafal,1 Hamed Vavas,2 Adam A. Karssemeijer,1; Univ. of Connecticut, USA. An advanced advanced surface segmentation algorithm is presented here that extracts breast lesion information for co-registered diffusion optical tomography and inputs these parameters to improve reconstruction of lesion absorption maps.

JTu3A.10 Fiber Spectroscopy for Tumor Margin Detection – Selection of the Best Methods, Vacheslav Artyushenko1,2, Z. Zabanyo1,2, A. Bogomolov1, O. Minet1, H. Krause1, T. Salabarda1, L. Varoquaux1, F. Schulte1, H. J. Eckher2, Art photonics GmbH, Germany; Medical Physics and Optical Diagnosis, Charité Universitätsmedizin, Germany; Dept. of Radiology, Charité Universitätsmedizin Berlin, Germany; Inst. of Optics and Atomic Physics, Technical Univ. of Berlin, Germany. Relatively unique multispectral fiber system is made to detect kidney tumor margins by 4 spectroscopy methods: IR-absorption, Raman-scattering, NIR-fluorescence, FL- fluorescence – to develop the best spectral fiber sensors for intraoperative diagnostics.

JTu3A.11 GAQPUMCML: A New GPU Accelerated Algorithm for Optical Tomography Reconstruction, Atakar Mostafal,1 Hamed Vavas,2 Adam A. Karssemeijer,1; Univ. of Connecticut, USA. We present a multi-channel depth encoded swept source joint aperture Doppler optical coherence tomography system for absolute flow velocity measurements in a flow phantom featuring one active and two passive detection channels.

JTu3A.12 Improved Depolarization Imaging in Polarization-Sensitive Optical Coherence Tomography, N. Ottege-Quijano1,2, Tahereh Mardavash1, Audrey E. Bowden1, Stanford Univ., USA; Institut de Physique de Rennes, France. We demonstrate that the superior contrast of the differential depolarization index (DDI) compared to the degree of polarization uniformity makes DDI a promising candidate for characterizing depolarization with polarization-sensitive OCT images.

JTu3A.13 Real-time Three-dimensional Imaging of Laeryn Using a Swept-source Optical Coherence Tomography System, Atakar Mostafal,1 Hamed Vavas,2 Adam A. Karssemeijer,1; Univ. of Connecticut, USA. We have developed a new algorithm (GRIN lens rod-based probe and a High Speed Laser Source, Swathi Rangarajan, U. of Connecticut, USA. We have developed a new algorithm (GRIN lens rod-based probe in conjunction with a large field imaging range 200 kHz Vertical-Cavity Surface

JTu3A.14 High Speed Model-based Inversion in Cross-sectional Optical Tomography, X. Luan2, B. Watanabe3, Y. Iida4, Y. Yanagisawa5, Y. Tanaka6, R. Watanabe7,8, K. Hara9, A. Kurosawa10, H. Sajo11, M. Obi12, J. M. Arfberger13,14,15,16,17,18; A Thinoula A. Martinos Center for Biomedical Imaging, Harvard Medical School / Massachusetts General Hospital, USA; 2Depart- ment of Electrical Engineering and Computer Science, Massachusetts Inst. of Technology, USA; 3Department of Bioengineering, Northeastern Univ., USA; 4Depart- ment of Electrical Engineering and Computer Science, Massachusetts Inst. of Technology, Keio Univ., Japan; 5Human Informat- ics Research Inst., Advanced Industrial Science and Technology, Keio Univ., Japan; 6Inst. of Biomedical Sciences, Tokushima Univ. Graduate School, Japan; 7Medical Photonics Research Center, Hamamatsu Univ. School of Medicine, Japan. We describe a new inversion procedure for cross-sectional optical tomographic, which can be efficiently implemented on graphic-processing units, allowing accurate model-based image rendering at frame rates exceeding 10 Hz.

JTu3A.15 Impact of errors in optical properties and/or geometry on the recovery of cerebral blood flow changes in diffuse correlation spectroscopy, Stefan Carp1,2, David A. Boas1,2,1; Massachusetts General Hospital, USA; 2Harvard Medical School, USA. We use a layered Monte Carlo model of diffuse correlation spectroscopy measurements to assess the impact of errors in optical properties and/or geometry on the recovery of cerebral blood flow changes single and multi-distance measurements.

JTu3A.16 Construction of an Anatomical Neck Model for Diffuse Optical Imaging, Naoyoshi Wakahayashi1, Ken Nadamoto1, Kazuki Kurinahara2, Shinpei Okawa2, Koh Hashimoto3, Hiroshi Kawaguchi4, Yukari Tanaka5, Hirokayo Fujii5, Satoru Kohnoh5, Yoko Hoshi2, Eiji Okada2; Dept. of Electronics and Electrical Engineering, Keio Univ., Japan; National Defense Medical College, Japan; Leading-edge Laboratory, Science and Technology, Koei Univ., Japan; Human Informatics Research Inst., Advanced Industrial Science and Technology, Keio Univ., Japan; Division of Mechanical and Space Engineering, Faculty of Engineering, Hokkaido Univ., Japan; Inst. of Biomedical Sciences, Tokushima Univ. Graduate School, Japan; 2Medical Photonics Research Center, Hamamatsu Univ. School of Medicine, Japan. A neck model was constructed for the feasibility study of diffuse optical imaging of malignant lesions in the thyroid gland. The light propagation in the thyroid gland is affected by the presence of the trachea.
**JTu3A 22**
Improved Near-infrared Spectral Tomography Image Reconstruction Guided by Both DCE and Diffusion Images, Jinhao Feng1, Junqiang Xu2, Shudong Jiang3, Yan Zhao3, Scott C. Davis3, Brian W. Pogue3, Hong Yin1, 2,3, Shudong Jiang2, Yan Zhao2, Scottin Photoacoustic Microscopy, Jongin Park1, Improved Synthetic Aperture Focusing MRI guidance approach.

show that the depth-resolved skin parameters to obtain skin optical parameters. The results retrospective clinical study on the detection of Andreas H. Hielscher1, Antonio Pifferi3, Marco Long-lasting, liquid phantom for diffuse optical tomography, Liu Yubin1, Junq. We present here a 6-layered multispectral model, 1COLUMBIA UNIV., USA; 2School of Medicine, Interventional Pulmonary, Critical Care and Sleep Medicine, Univ. USA; 3Department of Medicine, Division of Pulmonary, Critical Care and Sleep Medicine, Univ. of Nebraska, Omaha. Peripheral lung lesions are evaluated with transbronchiar biopsies, but accurate characterization is challenging. We used diffuse optical spectroscopy and found significant differences between malignant/benign, indicating potential for clinical use.

**JTu3A 28**
Miniaturized Scanning Photoacoustic Imaging for Brain Study in Behaving Rats, Jianbo Tang1, Xianjun Dai2, Huabei Jiang3,1, Univ. of Florida, USA. A wearable-scanning photoacoustic imaging (wPAI) system is presented for noninvasive brain study in behaving rats. wPAI is able to image blood vessels at a depth of up to 5 mm with intact scalp and skull.

**JTu3A 29**
Modulation of inhalational oxygen as a translational marker to predict the efficacy of chemotherapy, Songyuan Lee1, Hyeyun Jeong1, Jay Young Bae2, Jei Gwan Kim1,1, Department of Medical System Engineering (DMSE), Gwangju Inst. of Science and Technology (GIST), Korea (the Republic of).

**JTu3A 30**
Monitoring vascular markers of joint inflammation in a rabbit model of rheumatoid arthritis with time-resolved near-infrared spectroscopy, Ajay Rajaram1,2, Laura Morrison1,2, Keith St. Lawrence1,2, Ting Yin Lee1,2, Memadodrop1,2, Arunaseelan Selvam3,4,1, University Department of Biophysics, Western Univ., Canada; 2Imaging Program, Roberts Research Inst., Canada. Joint inflammation plays a central role in rheumatoid arthritis. Vascular markers of inflammation were quantified in knee joints using time-resolved NIRS and preliminary results show decreased oxyhemoglobin in inflamed but not healthy joints.

**JTu3A 31**
Monte Carlo simulation predicts deep-seated photoacoustic effect at the different wavelengths. In this paper, we will use MC to conduct simulation tests to systematically explore the deep-seated photoacoustic effect at the different wavelengths of illumination, different depths and different sizes of absorbers.

**JTu3A 32**
In vivo Time Domain Broadband (600 -1200 nm) Diffuse Optical Characterization of Human Bone, Sananath Konagaya Venkata Sekar1, Alberto Dalla Mora1, Eduardo Martinenghi1, Paola Taron1, Antonio Pifferi1, Andrea Farina1, Jordi Puig1, Eugenia Negredo3,4, Claus Lindner1, Marco Paggiari1, Turgut Durdu1, poliitechne en Medicina, Universidad Católica San Antonio de Murcia, Spain; 2Department of Medicine, Division of Pulmonary, Critical Care and Sleep Medicine, Univ. of Nebraska, Omaha. Peripheral lung lesions are evaluated with transbronchiar biopsies, but accurate characterization is challenging. We used diffuse optical spectroscopy and found significant differences between malignant/benign, indicating potential for clinical use.

**JTu3A 33**
Towards in vivo high-resolution OCT based ducal imaging, Xinwen Yao1, Ernest Chang1, Harina Haidara, Sheldon Feldman1, Christine P. Hendon1, COLUMBIA U, USA; 2Columbia Univ. College of Physicians and Surgeons, USA. We present an atlas of OCT b-scans of human breast tissue generated by a custom- ized ultra-high-resolution spectral-domain OCT system with an axial resolution of 2.7μm and a lateral resolution of 6.2μm.

**JTu3A 34**
A Cervical Cancer Screening System and the Clinical Application, Hao Dong1, Mengyu Jia1, weiya wang1, Lihong Yang2, pengpeng qu1, Feng Gao1, Huijuan Zuo1, Tiantian Liu1,2,4,1, Beijing Univ. of Technology, China; 2School of Information and Technology, Korea (the Republic of); 3POSTECH, Korea (the Republic of). We propose an improved synthetic aperture focusing technique based on a delay-multiply-and-sum for acoustic-resolution photoacoustic microscopy. A lateral resolution in out-of-focus regions is much improved, thereby extending the imaging focal length.

**JTu3A 35**
Polarization sensitive optical biopsy with diffusely reflected polarized light, Alexander Bykov1, Alexey Popov1, Tatiana Novkova1, Alexander Dornorin1, Igor Meglinski1, Univ. of Oulu, Finland; 2Yale Univ., USA; 3École Polytechnique, France. The results of comparative non-invasive screening of cancerous and noncancerous tissue samples in vitro with two major polarization-based diagnostic modalities utilizing Jones vec- tor and Mueller matrix formalisms are presented.

**JTu3A 36**
Characterization of lung lesions using diffuse optical spectroscopy: preliminary results, Daniel J. Rohrbach1, Kashem Haris1,2, Jeremy Kress1, Ulus Sunar3, Biomedical, Industrial and Biotechnology, Kuwait. A monolithic point of care testing device consisting of a microfluidic optical system integrated with dual wavelength individually controlled LEDs emitting light in 797nm 775nm for blood plasma therapy and analysis in a single step.

**JTu3A 37**
Optical Based Diagnosis and Treatment of Onychomycosis, Ana Paula da Silva1, Marcelo Saio Nogueira1, Javier A. Jo1, Vanderlei Salva- dor Bagnato1, Natalia Mayumi Inada1, Univ. of Sao Paulo, Brazil. Onychomycosis is a common disease of the nail plate caused by fungi, yeasts and/or bacteria. In this study we present the use of fluorescence imaging for its diagnosis, and photodynamic therapy (PDT) for its treatment.

**JTu3A 38**
Integrated Near-infrared Diffuse Optical Imaging and Digital Breast Tomography for monitoring compression induced hemodynamics in breast cancer patients, Bhawana Singh1,2, Qinqian Fang1, Bing Deng3, Benhard Zimmerman1, David A. Bois1, Jayne Commer, Richard Moore1, Daniel Kopans1, Mansi Saksena1, Stefan Carp4,5,6,7, New York University, USA; 7MIT, USA; 8Harvard Medical School, USA. We report preliminary results from our second generation diffuse optical imaging system integrated with digital breast tomography. Specifically, we measure dynamic changes in breast blood volume of breast cancer patient after applying compression.

**JTu3A 39**
Optical spectroscopy facilitated characterization of RFA lesions in atrial tissue is presented based on optical spectroscopic sensing of tissue endog- enous metmyoglobin content. We validate this approach through in-vitro measurement in ex vivo swine atrial samples.

**JTu3A 40**
Withdrawn.
Biophysical markers of Sickle Cell Disease at Individual Cell Level, Yooya Hosseini1, Sabia Abidi1, Gregory Kato1, Qing Dao2, Zahid Yaqoob3, Peter So4. MIT, USA; 1Univ. of Pittsburgh, USA. Using a common-path interferometric technique, we measured biomechanics and morphology of individual erythrocytes in sickle cell patients and investigated correlation of these properties with hydroxyurea treatment and standard clinical measurements.

In-vivo diffuse reflectance spectroscopy (DRS) of oral mucosa of normal volunteers, Fan-Hua Ko1, Gen-Hao Tien1, Min-Jie Chuang1, Tsin-Hueh Huang1, Ming-Hua Hung1, Kung-Bin Sung2,3. Biomedical Optics and Bioinformatics, National Taiwan Univ., Taiwan; 1Electrical Engineering, National Taiwan Univ., Taiwan; 2Molecular Imaging Center, National Taiwan Univ., Taiwan. To non-invasively detect early epithelial cancers with DRS, we used a two-layered Monte Carlo method to quantify healthy oral mucosa. Results showed that our method is feasible to extract optical properties in vivo.

Smartphone Single-snapshot Mapping of Skin Chromophores, Janis Spigulis1, Ilze Oshina1, Zigmarus Rupenheits1. Univ. of Latvia, Latvia. Suitability of smartphone for single-snapshot mapping of skin chromophors and deoxy-hemoglobin under 3-wavelengths illumination was provided by a portable laser-based prototype.

Clinical Assessment of the Fiber-Optic Sensor for Monitoring Vital Signs of MRI Patients, Lukasz Dziuda1, Marusz Kraj2, Paulina Baran1, Franczek Skibniewski1. Military Inst. of Aviation Medicine, Poland. We developed an FBG-based sensor to monitor claudistic reactions and reduce their effects in patients undergoing MRI examinations. The sensor ability to acquire respiration curve and ballistocardiogram was assessed clinically involving 50 patients.

Cerebral Autoregulation During Pediatric Extracorporeal Membrane Oxygenation Therapy, David R. Busch1,5, Genevieve Du Pont-Thibodeau1, Constantine MAVroudis2, Ann McCarthy3, Tiffany Ko4, Madeline Winters4, John Newland2, Kobina Mensah-Brown4, Kaitlin R. Griffith4, Jennifer Lynch4, Peter J. Schwab4, Ern M. Buckley5, Arjun G. Yodh5, Daniel Licht6. Pediatrics/Neurology, Children’s Hospital of Philadelphia, USA; 1Anesthesiology and Critical Care Medicine, Children’s Hospital of Philadelphia, USA; 2Surgery, Hospital of the Univ. of Pennsylvania, USA; 3Biomedical Engineering, Georgia Inst. of Technology, USA; 4Physics, Univ. of Pennsylvania, USA; 5Biomedical Engineering, Univ. of Pennsylvania, USA. Extracorporeal membrane oxygenation therapy mechanically circulates and oxygenates blood. We assess cerebral blood flow during perturbation of ECMO flow using diffuse optical and correlation spectroscopies. We observe both regulated and passive flow.

Clinical swept-spectre optical coherence tomography of the middle ear, Dan MacDougall1, Josh D. Farrell2, Manohar L. Bance1, Nicholas Jufas1, Robert Adamson1. Dalhousie Univ., Canada. We report the first clinical results from a swept-source optical coherence tomography system designed for clinical imaging of the middle ear. We highlight imaging of middle ear muscle contraction and prosthesis imaging as promising applications.

Diffusional Laser-Induced Perturbation Spectroscopy Method for Biological Material Characterization, Erman K. Oztekin1, David W. Hahn2. Univ. of Florida, USA. Novel diffusional laser-induced perturbation spectroscopy (DILPS) Raman and fluorescence scattering probes are used to classify biologically relevant components. Its performance is shown as compared to traditional Raman and fluorescence probes.

MEMS Based Side-Viewing Confocal Endomicroscope for Vertical/Horizontal Cross-Sectional Imaging, Xiyu Duan1, Haijun Li1, Asha Part1, Gaoming Li1, Oldham R. Kenn2, Thomas D. Wang3. Univ. of Michigan, USA. We demonstrate a side-viewing confocal endomicroscope with an outer diameter of 4.2 mm that can image either the horizontal or vertical plane, by using an integrated monolithic, electrostatic 3D MEMS scanner.

Utilizing Optical Coherence Tomography and Cone Beam Computed Tomography for Oral Tissues Characterization: ex vivo Study, Hasan Salehi1, Mina Mahdian1, Hisham Alnajjar1, Aditya Tadinada2, A. Saleh Amirsadraei3, 1Univ. of Texas Health Science Cente, USA. A novel, high-speed, longitudinally large field of view OCT system, Yb-fiber laser based, handheld 2PE/SHG microscopy imaging system is introduced being suitable for in vivo imaging of murine skin at an average power level as low as 5 mW at 200 kHz sampling rate.

Non-invasive Monitoring of Oxygen in the Lungs of Newborn Infants using Diode Laser Spectroscopy, Emilie Krite Svanberg1, Patrik Lundin1, Marcus Larsson1, Jonas Åkesson2, Katarina Svanberg3,5, Sune Svanberg3,5, Vineta Fellman1,2, Stefan Andersson-Engels1, Lund Univ., Sweden; 1Center for Optical and Electromagnetic Research, South China Normal Univ., China; 2Children’s Hospital, Helsinki Univ. Hospital and Univ. of Helsinki, Finland. The main purpose of this study was to investigate a novel non-invasive optical technique for rapid bedside detection of oxygen gas in the lungs of full-term newborn infants. The results suggest that the technique will be clinically useful.

Cone Beam Computed Tomography for Oral Health Applications in Dermatology, Venereology and Dermatooncology, Semmelweis Univ., Hungary. The main purpose of this study was to investigate a novel non-invasive optical technique for rapid bedside detection of oxygen gas in the lungs of full-term newborn infants. The results suggest that the technique will be clinically useful.
Clinical and Translational Biophotonics

OTu4B • OCT: Technology and Endoscopy
President: Audrey Ellerbee-Bowden; Stanford Univ., USA

OTu4C • OCT: Technology, Clinical Applications and Beyond, Robert Huber1, Universität zu Lübeck, Germany. The recent demonstration of OCT with A-scan rates of several MHz opened the way for many future applications. The talk will discuss the technology, application and first clinical studies with the new MHz-OCT.

OTu4C.1 • 15:30
OTu4C.2 • 16:00
Label-free Optoacoustic Scanning and Prognosis, Evelyn Regar1, Wolfgang Wieser2, Marie-Christine Ramirez1, Ashley R. Proctor1, Songfeng Han1, E. Fisher1, Conor L. Evans1; Imperial College London, UK; 2University College London, UK. We report a new optoacoustic scanning technology for non-invasive visualization of pheomelanin inside the skin, which has shown great potential to aid in early detection of melanoma precursors.

OTu4C.3 • 16:15
Assessment of Airway Smooth Muscle Structure and Function with Birefringence Endomicroscopy, David Adams1, Lida Hatiri1, Alyssa Miller1, Jasmin Holz1, Margit Szabari1, Andrew Luster1, Benjamin Medoff1, Melissa Suter1; 1Massachusetts General Hospital, USA.

OTu4D • 15:30–17:30
15:30–17:30
BTu4D • Towards Whole-brain Imaging in Real-time
President: Tim E. Holy, Washington Univ. in St. Louis, USA

The Promise of Large-scale Neuro Imaging with Optoacoustics, Daniel Razansky1, 1Inst. for Biological and Medical Imaging, Technical Univ. of Munich and Helmholtz Center Munich, Germany. The talk focuses on the development of real-time volumetric optoacoustic tomography for non-invasive observation of spatiotemporal neural activity of large neural populations in scannable brains using genetically encoded calcium indicators.
CTu4A • Intrinsic Contrast Microscopy and Spectroscopy of Cancer—Continued

CTu4A.4 • 16:45
Spectroscopic Raman Analysis of Tumor Micro-environments in Human Breast and Rat Mammary Cancer, Sixian You1, HaoHua Tu2, Youbo Zhao2, Yuan Lu1, Eric Cherney1, Marina Marjanovic1, Stephen A. Boppart1, Univ. of Illinois at Urbana-Champaign, USA. The tumor micro-environment plays important roles in carcinogenesis. We report spectroscopic Raman analysis of fatty acids and increased polyunsaturated fatty acids in the wider tumor macromenvironment in both human breast and rat mammary cancer.

CTu4A.6 • 17:00
Three-Dimensional Quantification of Collagen Fibers in Cancer Metastases within the Peritoneal Cavity, Zhiy Li1, Dimitra Pouli3,4,3, Margarete Akens5,6, Mikhail Bruke4,3, Virginijus Barzda1,2, Ayelet Schwartz1,2, Sagar Soni1, Dev Patel1, Hanli Liu1, Yu W. Wang1, 1Tufts Univ., USA; 2Applikate Biomedical Optics, Sweden; 3Istituto Nazionale di Ottica (CNR), Italy; 4European Laboratory for Non-linear Spectroscopy, Italy; 5Center for Medical Physics and Biomedical Engineering, Medical Univ. of Vienna, Austria; 6Department of Medical Technologies, USA. We present a multiphoton microscopy approach with clearning optimized for pathology evaluation yielding quality comparable to traditional histology. Application to human renal tissue reveals pathologic findings not evident on single slide sections.

CTu4B • Optical Agents and Devices—Continued

CTu4B.4 • 16:45
Multiplexed Molecular Imaging of SERS Nanoparticles for Guiding Breast Tumor Resection, Sooyang Kang1, Yu W. Wang1, Jonathan T. Liu1, Mechanical Engineering, Univ. of Washington, USA. To guide breast cancer lpectomy procedures, we are developin a system for wide-area raster-scanned multiplexed molecular imaging human breast tumor excisions rapidly stained with a mix of topically applied molecularly targeted SERS nanoparticles.

CTu4B.6 • 17:15
Second Harmonic Generation Reduced Double Stokes Mueller Polarimetric Microscopy of Vertebral Bone, Ahmad Golaraei1,2,1, Ayellet Atkin1, Mikhail Bruke4,3, Margarete Akens5,6, Can Whyne1, Virginia Barza1,2,3, Physics, Univ. of Toronto, Canada; 2Chemical and Physical Sciences, Univ. of Toronto Mississauga, Canada; 3Orthopedic Biomechanics Laboratory, Sunnybrook Research Inst., Canada; 4Inst. of Biomaterial and Biomedical Engineering, Univ. of Toronto, Canada; 5Techin Inst., Univ. Health Network, Canada; 6Department of Medical Biophysics, Univ. of Toronto, Canada. Reduced double Stokes Mueller polarimetric imaging method was used to study collagen organization of bone in normal tissue and newly formed bone in metastatic vertebrae. It differentiated between old and new bone in normal and tumor samples.

CTu4C • OCT: Technology and Endoscopy—Continued

CTu4C.5 • 16:45
Lensless holographic endoscopy with a fiber bundle, Lara M. Wurster1,2, Abishhek Kumar1,2, Daniel J. Fedchik1,2, Larin Griener1,2, Rainer A. Leitgeb1,2, Christian Doppler Labor for Innovative Optical Engineering and its Translation to Medicine, Medical Univ. of Vienna, Austria; 1Center for Medical Physics and Biomedical Engineering, Medical Univ. of Vienna, Austria. Holographic lensless endoscopy with a fiber bundle was performed and a resolution target and biological sample was successfully imaged. Improvements of the resolution were achieved by sweeping the laser for specie reduction via wavelength diversity.

CTu4C.6 • 17:00
A tri-modal miniature probe for in vivo imaging, Xianan Dai1, Lei Xi1, Can Duan2, Hao Yang1, Huikai Xie1, Huabei Jiang1, J. Crayton Pruitt Family Department of Biomedical Engineering, Univ. of Florida, USA; 2Department of Electrical and Computer Engineering, Univ. of Florida, USA; 3School of Physical Electronics, Univ. of Electronic Science and Technology of China, China. We report a tri-modal miniature side-view probe, through which, optical-resolution photacoustic microscopy (OR-PAM), optical coherence tomography (OCT), pulse-echo ultrasonic (US) images can be coaxially acquired and displayed simultaneously.
Optical Coherence Tomography (OCT) uses echoes of light to generate micron resolution, cross-sectional and three-dimensional images of microstructure in materials and biological systems. Since its development 25 years ago, OCT has been applied in multiple clinical specialties as well as in fundamental science, with an extensive international research community. In ophthalmology, OCT has become a standard of care for the diagnosis and monitoring of retinal and optic nerve diseases. Evolution of the technology has included spectral domain OCT and swept source OCT which alone provided new possibilities in imaging due to an increase in speed of image acquisition and depth of penetration in ocular tissues. Image processing and segmentation are just a few of the visualization and analytic methods which have enabled the precise assessment of tissues of interest. Together, these have been critical for staging of disease and monitoring response to therapy. This ophthalmic technology continues to evolve with OCT angiography as just one of the new non-invasive applications which has displaced conventional intravenous dye injection for retinal evaluation. Furthermore, the technology is shifting from the photography suite to applications for intraocular visualization and more importantly for micorsurgical guidance. Ophthalmology is the perfect field for the application of OCT-guided surgery as will be demonstrated in this presentation. OCT imaging of the retina (part of the central nervous system) is also a cornerstone of emerging modality for intravascular and endoscopcic imaging. Next generation swept source OCT enables high speeds with gigapixel data sets as well as meter ranges with micron level precision. The development of OCT required multidisciplinary teams spanning science, engineering, medicine and business. This presentation will review the history OCT as an example of translation from research to clinical practices, as well as comment on current advances and future prospects.

Antonio Pifferi, Lorenzo Spinelli
JW3A.8  A Combined Diffuse Correlation and Time-Resolved Spectroscopy Instrument for Continuous monitoring of Absolute Cerebral Blood Flow, Veronika C. Kanar1, Wesley Baker1, Ashwin B. Parthasarathy1, Ramani Balu1, Anuj G. Yodh1, Andrew Kelk2,1, University of Pennsylvania, USA.

We investigate the feasibility of constructing an instrument, which can help to corelate physicians by real-time monitoring absolute cerebral blood flow (CBF) to facilitate fast diagnosis of ischemia.

JW3A.9  Acousto-optic imaging and reconstruction in highly scattering media: towards quantitative imaging, Clement Dupuy1, Samuel Powell1, Terence Leung1, Francois Ramaz2, Institute Langevin, France. Medical Physics and Biomedical Engineering, Univer. College London, UK.

Using a reconstruction algorithm on acousto-optic images acquired using photo refractive crystal detection, we recover the relative absorption coefficient of millimeter sized absorbers embedded within several centimeters of tissue mimicking phantom.

JW3A.13  A new model using novel single photon avalanche diode arrays for multi-exposure laser speckle flowmetry, Tanja Dragovic1, Danilo Bronzi2, hari varma1, Claudia P. Vales3, Clara Castelli1, Federica Villa1, Alberto Tos1, Carlies Justice1, Franco Zappa2, Turgut Durdu1,2, ICF0 - The Institute of Photonic Sciences, Spain. Department of Electronics, Information and Bioengineering, Politecnico di Milano, Italy; Department of Brain Ischemia and Neurodegeneration, Institute for Biomedical Research (IRB), Spain; Sapienza University of Rome, Italy. We present a new method to quantify dynamic absorption and scattering changes in neural tissues.

JW3A.14  A new water-immersible two-axis MEMS scanning mirror for photoacoustic microscopy, Song Xu1, Zou Jun2, Chih-Hsen Huang1, Electrical and Computer Engineering, Texas A&M Univ., USA. A new water-immersible two-axis MEMS scanning mirror has been designed, fabricated, and tested for both laser and ultrasound beam steering. The two scans can have different resonant frequencies, which are suitable for raster scanning.

JW3A.15  A Non-Contact Fiber-Less Diffuse Optical Tomographic System for Dynamic Imaging of the Feet with Peripheral Artery Disease, Jennifer W. Ho1, Hyun Kim2, Andreas H. Hei3, Silber1, Columbia University, USA. We present a new design of a non-contact fiber-less diffuse optical tomography system capable of simultaneously capturing multiple views of feet for dynamic imaging of foot vasculature.

JW3A.16  An analytical model of photothermal optical coherence tomography to predict signal intensities with a preset 45° tilted angle scan, Jason Tucker-Schwartz1, Melissa Skala2, Vanderbilt University, USA. We present the first analytical model of photothermal optical coherence tomography to replicate an experimental A-scan. We also present the PT-CLEAN algorithm to remove two imaging artefacts: phase accumulation and shadowing.

JW3A.17  An Optical Coherence Tomography Endoscopic Probe Based on a Tilted MEMS Mirror, Can Duan1, Quentin Tangy2,1, Antonio Pozzi3, Huike Xie1, Electrical and Computer Engineering, University of Florida, USA; Small Animal Surgery Clinic, University of Zurich, Switzerland; Micro Nano Science and Systems, FEMTO-ST, France. This paper reports a compact microendoscopic OCT probe enabled by a novel 2-axis scanning MEMS mirror integrated on a silicon optical bench with a tilted angle. Its OCT imaging performance is presented.

JW3A.18  Improving the calibrated fMRI estimation of CMRO2, with oxygen-sensitive Two-Photon Microscopy, Louis Gagnon1, Sava Sakadzic2, Frederic Lesage2, Philippe Roulois3, Anders M. Dale1, Ana Devor2, Richard Buxton1, David A. Boas2, Department of Medicine, Laval University, Canada; Athinoula A. Martinos Center for Biomedical Imaging, USA; Ecole Polytechnique, Canada; Radiology, UCSD, USA. We improved the accuracy of calibrated fMRI by using Two-Photon microscopic measurements of cortical hemoglobin in rats, together with first principle Monte Carlo simulations of proton diffusion across the two-photon volumes.

JW3A.19  Measuring the thermodynamic effects of neuronal coupling in the awake, behaving mouse brain, Andrew Tsao1, Rubudo Thilanka Gamage2, Sharon Kim1, Mohamed A. Shair3, Elizabeth M. Hillman1, Columbia University, USA. We explore the use of heat as a contrast mechanism for in vivo brain-imaging, using thermal imaging to understand the role of dynamic blood flow changes in temperature regulation of the living brain.

JW3A.20  High-speed Functional Photacoustic Microscopy of the Mouse Brain, Tianxiong Wang1, Nadi Sun2, Rui Cao3, Bo Ning1, Song Hu1, University of Virginia, USA. We have developed high-speed functional photacoustic microscopy based on a single laser source. This technique is capable of imaging the oxygen saturation of hemoglobin in the mouse brain with an A-line rate of 100 kHz.

JW3A.21  Realistic Modeling of Optogenetic Neuronal Excitation in Light-Scattering Brain Tissue, Guy Yona1, Antonian Weissler2, Nazan Meitav1, Eliran Guti2, Dalia Roldin3, itamar Kain4, Shay Shoham1, Technion - Israel Institute of Technology, Israel. We investigated a realistic simulation of optogenetic modulation, which includes an analytical model for the light distribution in brain tissue and a neuronal biophysical model, highlighting the importance of indirect excitation in optogenetics.

JW3A.22  Contribution of Extra-cerebral and Cerebral Hemodynamic Signals During Exercise Quantified with Time-domain Near Infrared Spectroscopy, Hélèse Auger1, Louis Bherer2, Etienne Boucher1, Richard Hoge2,3, Frederic Lesage1, Mathieu Dehaes1, Centre Hospitalier Universitaire Sainte-Justine, Canada; Institut Universitaire de Génétique de Montréal, Canada; Department of Neurology and Neurosurgery, McGill University, Canada; Centre Hospitalier Universitaire Sainte-Justine, Canada; Department of Radiology, Université de Montréal, Canada. Time-domain near infrared spectroscopy was used to quantify hemodynamic signals during physical exercise and rest. Changes in extra-cerebral hemodynamics relative to rest are significant and their quantification may prevent data interpretation bias.

JW3A.23  Combination of two-photon fluorescence microscopy and label-free near-infrared reflectance: a new complementary approach for brain imaging, Irene Costanzo1, Anna Letizia Allegra Mascaro1, Emilia Margoni1, Giulio Iannello1, Alessandro Bria1, Leonardo Sacconi1, Francesca S. Pavone1,2, European Laboratory for Non-Linear Spectroscopy, Univ. of Florence, Italy; National Inst. of Optics, National Research Council, Italy; Department of Engineering, Università Campus Bio-Medico di Roma, Italy; Department of Electrical and Information Engineering, Univer. of Cassino, Italy; Department of Physics and Astronomy, Univ. of Florence, Italy. This work describes a complimentary approach for brain imaging. We present an additional tool, the two-photon fluorescence microscopy, to a Thyl-GFP mouse model.

JW3A.24  The inflammatory response following a laser-induced cortical microhemorrhage in a rodent model is dominated by brain endothelial microvilli and not blood-borne macrophages, Sung Ji Ahn1, Josef Anrather1, Nazo3, Katsuki Saeki1, Weil Cornell Medical College, USA. Brain microhemorrhages are linked to cognitive decline, but the pathophysiological mechanisms remain unclear. We used in vivo noninvasive microscopy to characterize the inflammatory response after a laser-induced cortical microhemorrhage.

JW3A.25  Imaging Brain Function in Children with Autism Spectrum Disorder with Diffuse Optical Tomography, Adam Eggby1, Joseph P. Culver1, Washington Univer. of School of Medicine, USA. We present a feasibility study on applying diffuse optical tomography on school-aged children with autism. Feasibility is tested via assessments of raw data quality and functional activations to language processing and social-perception paradigms.

JW3A.26  Fiber Bundle in-vivo Epifluorescence Microscopy with Intra-Reconstruction, Simon Mekhail1, Omar Jäder2, Gordon Arbuthnott1, Sile Nic Chormaic1, Light Matter Interactions Unit, Okinawa Inst. of Science and Technology, Japan; Department of Medicine, Laval University, Canada. We present a method for recording calcium fluorescence in live mice using a fiber bundle. To overcome the low spatial resolution of the fiber we suggest a method for upsampling images by compressive sensing.

JW3A.27  Real-Time Movies of Neuronal Activity by Imaging Intrinsic Changes in Optical Birefringence, Al Badreddine1,2,6, Tomas Jordan1, Irving J. Bigio1,2,6, Department of Medicine, Laval University, Canada; 2Photonics Center, Boston Univ., USA. Changes in birefringence are intrinsic in axons, providing a noninvasive, fast method for detecting neuronal activity without phototoxic agents. We demonstrate for the first time a ‘real-time’ imaging of nerve impulse propagation using these signals.
**JW3A.30**

Testing Robustness of Prefrontal Hemodynamic Responses during Noxious Thermal Stimulation over Three Different Body Sites using fNIRS, Amarnath Yennu1, Fenghua Tian1, Harri Lu1; Univ. of Texas at Arlington, USA. Hemodynamic activities in the prefrontal cortex are investigated during noxious thermal stimulation over the right Forearm, right TM, and left Forearm. Robustness of prefrontal hemodynamic responses during noxious thermal stimulation is reported.

**JW3A.38**

Dynamic Monitoring of Absolute Cerebral Blood Flow with Near-Infrared Spectroscopy, Kristen Tugavekolo1, Angelo Sassaroli1, Sergio Fantini1, Tufis Univ, USA. The temporal dynamics of absolute cerebral blood flow are obtained from near-infrared spectroscopy measurements in conjunction with a hemodynamic model that relates oxygen and deoxyhemoglobin concentration changes to physiological perturbations.

**JW3A.39**

Assessing Optimal Electrode/Optode Arrangement in EEG-fNIRS Multi-Modal Imaging, Li Zhu1, Ali E. Haddad1, Tianjiao Zeng1, Yunqi Li1, Laleh Najafizadeh1; Rutgers Univ, USA. The accuracy of signals recorded from different electrode/optode arrangements in EEG-fNIRS experiments are examined. Results are particularly important for studies investigating spatio-temporal relation between neuronal activity and vascular response.

**JW3A.40**

Application of a Three-Layer Model to Multi-Distance Diffuse Correlation Spectroscopy: Validation of the Methodology and Initial Data Analysis, Lin Li1,2, Ning Zhang1, Lin Lin1,2, Rachel L. Hanson3, Lin Li1,2,4, Lin Li1,2,3, George M. Balanos1, Samuel J. Lucas1, Hamid Dehghani1,2; 1So-Phy-4-Health Centre for Doctoral Training, Univ. of Birmingham, UK; 2PSIBS Centre for Doctoral Training, Univ. of Birmingham, UK; 3Department of Neurosurgery Research, Univ. of Birmingham, UK; 4School of Sport, Exercise, and Rehabilitation Sciences, Univ. of Birmingham, UK. Two NIRS systems (NIRO and ISS) were evaluated during induced hypoxia in healthy participants to demonstrate their limits in classifying normal and hypoxic brains for absolute oxygenation measurements.

**JW3A.45**

Effect of anesthetics on cerebral oxygenation and blood flow in neonates with critical congenital heart disease, Jennifer Lynch1,2,9, Tiffany Ko1,3,9, John Newland1, Madeline Winters1, David R. Buss1, Arman Rahmim1,2,1; 1Univ of Pennsylvania, USA; 2School of Medicine, New York Univ, USA, 3Neurology, Children’s Hospital of Philadelphia, USA. We quantified the effect of anesthesia on cerebral oxygen saturation and blood flow in infants with congenital heart disease. We find that both ScO2 and CBF decrease after induction of anesthesia independent of cardiac diagnosis.

**JW3A.46**

Assessment of resting-state brain networks in young and older adults by automatic voxel classification with atlas-guided diffuse optical tomography, Lin Li1, Ojajei Babawale1, Michael Roache1, Harri Lu1, ‘Univ. of Texas at Arlington, USA; 2Univ. of California at Los Angeles, USA; 3Cook Children’s Medical Center, USA. We implemented an automatic voxel classification algorithm so that atlas-guided DOTT and graph analysis could be confidently used to assess hemodynamic resting-state brain networks in young and older adults.

**JW3A.47**

Incorporating Boundary Conditions in the Integral Form of the Radiative Transfer Equation for Transcranial Imaging, Abhinav Kumar Jha1,2,3, Yanyong Zhu1, Jakob Dreier1, Jing Kang1, Albert Gudieh1, Deepti Arain1; 1Radiology and Radiological Sciences, Johns Hopkins Univ, USA; 2Johns Hopkins Univ, USA; 3Univ of Copenhagen, Denmark. An integral Neumann boundary condition is incorporated into the radiative transfer equation that accounts for boundary conditions is proposed to simulate photon transport through tissue for transcranial optical imaging.
JW3A.48 Theoretical Analysis of the Signal-to-Noise Ratio of Two-Photon Oxygen Imaging Probes, Aamir A. Khan1, Genevieve D. Vigil1, Alexandre Kudlinski2, Alexandre Talon1, James R Goodwin1,2, Andrew J. Berger1,2, The Inst. of Optics, Univ. of Rochester, USA, 1Physics and Mechanical Engineering, Queensland Univ. of Technology, Australia, 2Department of Biomedical Engineering, Univ. of Rochester, USA; 3Facultad de Ciencias Físico Matemáticas, Universidad Autónoma de Nuevo León, Mexico. We propose modified laser Doppler imaging and the use of a nonlinear endomicroscope. The imaging works based on the moving red blood cell concentration obtained with undersampled method.

JW3A.49 Full-field blood flow monitoring with a modified laser Doppler method, Zeng Yoguang1, Mingyi Wang1, nannan dong1; Foshan Univ., China. We propose modified laser Doppler imaging for real-time monitoring anomalous changes of blood flow. The imaging works based on the moving red blood cell concentration obtained with undersampled method.

JW3A.50 fNIRS Software Development for Basic and Simple Research, Aldo Di Costanzo Mata1, James R Goodwin1,2, Andrew J. Berger1,2, The Inst. of Optics, Univ. of Rochester, USA, 1Physics and Mechanical Engineering, Queensland Univ. of Technology, Australia, 2Department of Biomedical Engineering, Univ. of Rochester, USA; 3Facultad de Ciencias Físico Matemáticas, Universidad Autónoma de Nuevo León, Mexico. A Matlab based fNIRS visualization and processing GUI developed in order to increase the researcher’s ability to analyze the patient’s signals. Developed tools: multiple window visualization, regressions, motion artifact detection and database engine.

JW3A.51 Characterization of a customized double-clad photonic crystal fiber and gradient index lens for non-linear excitation, Ali Ibrahim1, Fanny Poulon1, Marc Zanello2, Remi Habert3, Alexandre Kudlinski1, Damien ABI HAIDAR4; IMNC, France, 1Univ. of Paris 1-Paris Diderot, France, 2Univ. Lille, CNRS, UMR 8523 - PhLAM - Physique des Lasers Atomes et Molécules, France. In this work, we present a new homemade double-clad optical fiber (DCF) dedicated to in-vivo imaging, in the context of developing a nonlinear endomicroscope.

JW3A.52 Brain connectivity in joint attention skills and an intensified CCD camera based fNIRS and imaging system, Banghe Zhu1, Manish Shah1, Anuradha Godavarty1, Eva Senick1, 1UT Health Science Center at Houston, USA, 2Florida International Univ., USA. The brain connectivity in joint attention skills using NIRS and imaging was studied, indicating differences in the neuronal pathways. To further improve the spatial resolution, an intensified CCD based fNIRS and imaging system was developed.

JW3A.53 Temporal Dynamics of fNIRS-Recorded Signals Revealed Via Visibility Graph, Li Zhi1, Lihe Najafizadeh2, Rutgers Univ., USA. Temporal dynamics of fNIRS signals recorded at resting-state and during task are examined using visibility graph (VG). Results show the power of scale-freeness of the VG can be used to differentiate the brain states.

JW3A.54 Withdrawn.

JW3A.55 Hemodynamic evoked responses of the human prefrontal cortex in patients with gambling addiction: Pilot clinical results, Zhen Yuan1,2, Facultad de Ciencias Físico Matemáticas, Universidad Autónoma de Nuevo León, Mexico. We utilized fNIRS to explore the hemodynamic changes in the prefrontal cortex and our imaging results suggested that there were notable differences for the hemodynamic responses between patients with gambling addiction and healthy subjects.

JW3A.56 Photoacoustic imaging of biopotentials: a feasibility study, Naseem Rasheed1, John R. Cressman2, Pang V. Chitra1,1Boeing Engineering Department, George Mason Univ., USA, 2Dept. of Physics and Astronomy, George Mason University, USA. Photoacoustic imaging of biopotentials relies on transient absorption of light by voltage sensitive probes. PAI is less susceptible to optical scattering, which makes it an attractive noninvasive alternative to fluorescence-based voltage sensing.

NOTES
JW4A.1 • 15:30
Invited
Imaging Cellular Metabolic Heterogeneity in Cancer, Melissa Skala1, Vanderbilt Univ., USA. Optical metabolic imaging (OMI) quantifies the fluorescence intensities and lifetimes of NADH and FAD using two-photon microscopy. OMI monitors single cells in tumors, thus aiding in the development and implementation of effective cancer treatments.

JW4A.2 • 16:00
Fluorescence Lifetime Imaging Microscopy to study Metabolism in a Microfluidic Device based Tumor Microenvironment, Rupsa Datta1, Agua Sobrino2, Christopher Hughes2, Enrico Gratton1; Biomedical Engineering, Univ. of California Irvine, USA; 2Departments of Molecular Biology & Biochemistry, Univ. of California, Irvine, USA. Here we present 2-photon fluorescence lifetime imaging microscopy of nicotinamide adenine dinucleotide to study metabolism of vascularized "tumor-on-a-chip" consisting of tumor cells, fibroblast and vascular network in an optically clear PDMS device.

JW4A.3 • 16:15
Light-triggered doxorubicin release quantified by spatial frequency domain imaging and diffuse optical spectroscopy, Ulas Sunar1,2, Jeremy Kress, Daniel J. Rohrbach, Kevin Carter, Dandan Luo, Shua Shao, Shashikant Lele, Jonathan F. Love1; BIE, Wright State Univ., USA; 2Biomedical Engineering, Univ. at Buffalo, USA. Here we present the use of spectral confocal reflectance microscopy (SCoRe) for imaging individual myelinated axons and the use of 2-photon microscopy for structural and functional imaging of the brain microvasculature and mural cells in living mice.

JW4A.4 • 16:30
Nano-CaCO3 as a novel pH sensitive theranostic platform for solid tumors, Avik Som1, Ramesh Raliya1, Limei Tian1, Kvar Black1, Walter Akers1, Joseph Ipollito1, Srikant Singamaneni1, Pratim Biswas1, Samuel Achilefu1; 1Washington Univ. in St. Louis, USA. Nano-CaCO3 is a novel theranostic nanoparticle that has high pH sensitivity and selectivity and is capable of modulating the extracellular pH of cancer for therapeutic purposes.

BW4B.1 • 15:30
Imaging Deeper with with Single-photon Illumination, Timothy E. Holy1; 1Washington Univ in St. Louis, USA. A major constraint on brain imaging is the limited penetration of light through tissue. Two approaches, scattered-light infrared light sheet microscopy and a novel optical clearing, reach depths formerly inaccessible to high speed imaging.

BW4B.2 • 16:00
Label-free Confocal Reflectance and 2-photon Microscopy of Myelinated Axons and Microvasculature in Live Mice, Jaime Grutzendler1,2; 1Yale Univ., USA. We will discuss the use of spectral confocal reflectance microscopy (SCoRe) for imaging individual myelinated axons and the use of 2 photon microscopy for structural and functional imaging of the brain microvasculature and mural cells in living mice.

BW4B.3 • 16:30
Label-free Imaging of Schwann Cell Myelination by Third Harmonic Generation Microscopy, Hyunguk Lim1, Dena Sharokhkhooi, Yanqing Zhang, James L. Salzer2, Carmen Melendez-Vasquez2; 1City Univ. of New York, USA, 2New York Univ School of Medicine, USA. We describe third-harmonic generation microscopy for label-free imaging of myelinating Schwann cells in live culture and ex vivo and in vivo tissue. The estimation of g-ratio is demonstrated for mouse models of hypomyelination.

JW4C.1 • 15:30
25 Years of Translational Research in OCT, Joseph A. Izatt1; 1Illumination, Univ of Illinois at Urbana-Champaign, USA and Christoph K. Hitzenberger; Medizinische Universitat Wien, Austria

JW4C.2 • 16:00
A Historical Journey through the Discovery of Spectral/Fourier Domain OCT, Johannes F. de Boer,1,2; 1Vrije Universiteit, Amsterdam, Netherlands. In 2003, the breakthrough papers on Spectral Domain and Fourier Domain were published. In this presentation I will take you on a personal journey through these exciting beginning years between 1997 and 2003.

JW4C.3 • 16:30
Intravascular OCT, Brett E. Bouma1; 1Harvard Medical School, USA. This presentation will discuss Intravascular OCT.

OW4D.1 • 15:30
Toward Rare Cell In Vivo Flow Cytometry, Mark Niedre1; 1Northwestern Univ., USA. In this talk, I will discuss our development of new technology for non-invasive detection, enumeration and tracking of very rare circulating cells in the bloodstream, and prospects for this technology in enabling new biomedical research.

OW4D.2 • 16:00
Time-resolved Diffuse Optical Tomography with Silicon Photomultipliers, Judy Zouaou1,2, Lionel Herve1,2, Laura di Sieno1, Alber-ta Dalla Mora1, Edoardo Martinengo1, Antonio Pifferi1,3; 1Johannes Gutenberg-Universität Mainz, Germany, 2Milano, Italy; 3CREATIS, CNRS, France. Time-resolved diffuse optical tomography on phantoms using Silicon photomultipliers (SiPMs) as detectors was carried out. We infer that SiPMs are promising new detectors to probe and accurately quantify biological tissues.

OW4D.3 • 16:15
Time-resolved Diffuse Optical Tomography based on Single pixel camera, Andrea Farina1, Marta Bertke1, Nicola Duccio1, Laura di Sieno1, Andrea Bassi1, Antonio Pifferi1,3; 1Johannes Gutenberg-Universität Mainz, Germany, 2Milano, Italy, 3CREATIS, CNRS, France. In this work a time-resolved DOT system based on rotating view acquisition and data sampling in compressed illumination/detection space is proposed and implemented. Reconstruction on tissue mimicking phantoms with absorbing inclusions are presented.

OW4D.4 • 16:30
Contrast enhancement for diffuse reflectance imaging by microbubbles, Homa Asadi1,2, Aditya Pandya1,2, Irina Schekanova1,2, Raffi Kar-shafian1,2, Alexandre Doupil1,2; 1University of Toronto, Canada, 2BEST, St. Michael Hospital, Canada. Microbubble contrast agents can potential improve optical imaging diagnostics based on increasing light scattering. Detection and quantification of microcirculation have been improved in diffuse reflectance imaging by administrating microbubbles.
Optical Tomography and photoacoustic imaging have been demonstrated in vivo and non-invasively using photoacoustic imaging agent, has been demonstrated in vivo and non-invasively using photoacoustic imaging.

The assessment of the longitudinal and dose dependent response of mouse models of two vascular disrupting agents, has been demonstrated in vivo and non-invasively using photoacoustic imaging.

The use of the longitudinal and dose dependent response of mouse models of two human colorectal tumours, to vascular disrupting therapy, has been demonstrated in vivo and non-invasively using photoacoustic imaging.

Raman spectroscopy was developed to diagnose early cancers in vivo. We have developed a novel system for in vivo three-photon imaging of the spinal cord of awake, running mice that enables correlation of neural activity patterns with gait and speed.

We have developed a novel system for imaging in a mouse brain in vivo. Cerebral vasculature is imaged in a mouse brain in vivo.

A spectroscopic fiber-based system with white light and coherent Raman contrast is demonstrated. Both modalities are used to identify the tissue types in different species (mice, rats, pigs and monkeys, humans). Results showing the differences between tissue types will be presented.

A novel approach is presented for enhancing the detection of “early” photons in time-domain optical tomography utilizing the dead time effect of the detector to shift the dynamic range of it towards the first arrival photons.

Enhanced detection of early photons in time-domain optical tomography using time-domain optical tomography using dead-time characteristics of SPADs, Lagnojita Sinha, Wei Zhou, Rajendra Mehta, Jovan G. Brankov, Kenneth M. Tichauer, Illinois Inst. of Technology, USA. A novel approach is presented for enhancing the detection of “early” photons in time-domain optical tomography utilizing the dead time effect of the detector to shift the dynamic range of it towards the first arrival photons.
We present a novel fiber optic based singlet oxygen luminescence probe coupled to a Luminescence Sensor. Patterned time gating limited dark slides, a process that can take days. MUSE, a non-destructive technique, exploits shallow-penetrating UV light to create diffraction-limited images directly from thick tissues.

Total retinal blood flow in healthy and glaucomatous human eyes measured with three beam Doppler optical coherence tomography. We developed a three beam Doppler optical coherence tomography technique to evaluate total retinal blood flow and absolute velocity in healthy and glaucomatous eyes without the need of any a-priori knowledge on the vessel geometry.

A Compact Fiber Optic Based Singlet Oxygen Luminescence Sensor, Nathan R. Gemmell, Aongus McCarthy, Michele Kim, Israel Velleux, Timothy Zhu, Gerald Buller, Brian Wilson, Robert Hadfield, Division of Electronic and Nanoscale Engineering, Univ. of Glasgow, UK, Inst. of Photonics and Quantum Sciences, Heriot-Watt Univ., UK, Department of Oncology, Univ. of Pennsylvania, USA, Univ. Health Network, Canada. We present a novel fiber optic based singlet oxygen luminescence probe coupled to an InGaAs/InP single photon avalanche diode detector. Patterned time gating limited dark counts and eliminated the strong photosensitizer detector. Patterned time gating limited dark.

CTh1B.1 • 08:30
Spectroscopic Imaging of Dysplasia and Early Cancer with Scattered Light, Lev T. Perelman; Harvard Univ., USA. Light scattering in biological tissue originates from tissue inhomogeneities such as extracellular matrix, cells and cellular organelles. This translates into unique spectroscopic features of scattered light emerging from tissue. In this talk we will discuss how light scattering signatures could be used to detect dysplasia and early cancer in epithelial tissue.

OTh1C.1 • 08:00
Optical Ultrasonar Detection in Photoacoustic Microscopy, Hao F. Zhang; Northwestern Univ., USA. Comparing with piezoelectric ultrasound detectors, optical ultrasound detection provides several benefits including improved detection sensitivity, extended bandwidth, device miniaturization, optical transparency, and potential mechanical flexibility. These features may bring photoacoustic microscopy to broader biomedical applications.

OTh1D.2 • 08:30
Diffuse correlation tomography for longitudinal monitoring of murine femoral graft healing, Songfeng Han, Joseph B. Vella, Ashley R. PROCUREMENT, University of Rochester, USA. We developed spatially dense diffuse correlation tomography instrument and reconstruction algorithm to monitor 3D blood flow changes in murine femoral grafts. Our preliminary results show spatially resolved blood flow changes in a mouse allograft.

OTh1D.3 • 08:45
Withdrawn.
CTh1A • Cancer Histopathology and Cytometry—Continued

CTh1A.4 • 09:00 A light sheet microscopy system for rapid, volumetric imaging and pathology of large tissue specimens, Adam Glaser1, Jonathan T. Liu2, Univ. of Washington, USA. We employ Monte Carlo simulations to assess the performance of light sheet microscopy (LSM) in large, highly scattering tissues, and present a novel system design which addresses logistical challenges in using LSM for non-transparent samples.

CTh1A.5 • 09:15 Evaluation of Lung and Prostate Biospecimens at the Point-of-Acquisition with a Dual-Color Fluorescent H&E Analog, Katherine N. Elfer1, Andrew Sholl1, J. Quincy Brown1; Tulane Univ., USA. We report a novel topical fluorescent H&E, which combined with rapid ex vivo micros-

TTh1B • In Vivo Human Optical Imaging—Continued

TTh1B.4 • 09:00 Internal Fingerprint imaging with Visible Light Full-field Optical Coherence Tomography, Egidijus Auksova1; A. Claude Boccara2; Institut Langevin, France. We report on a compact full-field optical coherence tomography system operating in the visible region of spectrum that is able to produce en face images of the internal fingerprints.

TTh1B.5 • 09:15 Multiple wavelength probing of skin structures in depth with elliptically polarized light, Susmita Sridhar1,2, Anabela Da Silva1, Institut Fresnel, France; Medical Optics, ICFO, Spain. A polarization gating protocol combining co- & counter-elliptical measurements of in vivo samples (skin abnormalities of volunteers) illuminated at different wavelengths to selectively access subsurface tissue layers & spectral information is proposed.

OTh1C • Instrumentation in Photothermal Imaging and Spectroscopy—Continued

OTh1C.3 • 09:00 Micromachined Silicon Acoustic Delay Lines with 3D Printed Micro Linker Structures for Real-Time Photothermal Tomography, Young Cho1, Akhil Kumar1, Song Xu1, Jun Zou1, Texas A&M Univ., USA. Micromachined silicon acoustic delay lines with 3D printed micro linker structures have been developed. They can provide an effective solution to achieve the multichannel time-delayed ultrasound receiver system for real-time photothermal tomography.

OTh1C.4 • 09:15 Triple-Modality Imaging of Optoacoustic Pressure, Ultrasonic Scattering, and Optical Diffuse Reflectance with Improved Resolution and Speed, Pavel Subochev1, Anna Orlova1, Ilya Turchin1; Institute of Applied Physics, Russian Federation. The system allowing simultaneous imaging of diffuse reflectance, optoacoustic pressure and ultrasonic scattering will be reported, the results of phantom and in vivo experiments will be demonstrated.

OTh1D • Diffuse Correlation Spectroscopy—Continued

OTh1D.4 • 09:00 A non-contact, small animal scanner based on diffuse optical spectroscopy and diffuse correlation spectroscopy, Miguel Adrian Mireles Nunes1, Johannes D. Johansson1, Parisa Farzam2, Mar Martinez-Lozano1, Orial Casanova2, Turgut Durduran1, ICFO-The Inst. of Photonic Sciences, Spain; Tumour Angiogenesis Group, Catalan Inst. of Oncology-IDIBELL, Spain. A scanning system that combines broadband diffuse optical spectroscopy and diffuse correlation spectroscopy for non-contact, large field-of-view imaging of small animal models and humans is presented and demonstrated in vivo.

OTh1D.5 • 09:15 Pressure Modulation Algorithm to Separate Cerebral Hemodynamic Signals from Extracerebral Artifacts, Wesley Baker1, Tiffany Ko1, Wei Xiao1, Ashwin B. Parthasarathy1, David R. Bush1,2, Daniel Licht2, Arjun G. Yodh1; Physics and Astronomy, Univ. of Pennsylvania, USA; Neurology, Children’s Hospital of Philadelphia, USA. We applied a novel pressure modulation algorithm to isolate cerebral blood flow signals from extracerebral artifacts during optical monitoring of scalp hyperemia in a healthy adult. This was achieved without a priori anatomical information.

09:30–10:00 Coffee Break, Grand Ballroom Foyer

Presentations selected for recording are designated with a 🎧.
To view recorded presentations, go to www.osa.org/biomed and click on Access meeting presentations slidecasts under Essential Links.
Optical Tomography and Tumor contrast peaked at 3 hours post-injection specific peptide probe in nude mice xenograft. Hepatocellular carcinoma, the en1, Thomas D. Wang1; Sinsuebphon1, Xavier Intes1, Margarida Barroso2; Gaoming Li1, Xiyu Duan1, Rork Kuick1, Scott Ow-2Hepatobiliary Surgery, Peking Univ. People’s Hospital, China. We employ FLIM-FRET to quantify the internalization of transferrin in vivo. We report that in vivo FLIM-FRET data correlate with the tumor size, heterogeneity of transferrin receptor expression as validated ex vivo.

We developed visible-light optical coherence tomography to image cerebral blood flow in rodents, Joseph L. Hollmann1, Tanja Dragovic2, Hari Vaman1, Carles Justicia1, Claudia P. Valdes1, Joseph P. Culver4, Turgut Durduran1,2; 1CFD - Institut de Ciències Fotoniques, The Barcelona Inst. of Science and Technology, Spain; 2Department of Brain Ischemia and Neurodegeneration, Institute for Biomedical Research (IIBB), Spanish Research Council (CSIC); 3Department of Radiology, Washington Univ. School of Medicine, USA; 4Department of Phys- ics, Washington Univ., USA; 1Instituto Catalana de Recerca i Estudis Avancats (ICREA), Spain. High-density speckle contrast optical tomography (SCOT) has been developed to image cerebral blood flow through intact skull in mice during ischemic stroke. The results are quantified and compared to magnetic resonance imaging.

Label Free All Optical Cellular Activity Detection Using PS-SDOCT, Sarmsihtha Satpathy1; 1Univ. of Texas at Arlington, USA. Here Phase Sensitive Spectral Domain Optical Coherence Tomography is used to detect cellular activity in HEK and primary neurons in an all optical, label free manner in sub-millisecond timescale and micrometer resolution without using invasive means.
Intraoperative OCT for Soft Tissue Sarcoma Margin Identification, Kelly Mesa1, Laura E. Selmi2, Marina Marjanovic1, Eric Cheney3, Stephen A. Boppart1; 1Univ. of Washington, USA; 2Rice Univ., USA; 3Biomedical Engineering, Northeastern Univ., USA. Analysis of breast DCE-MR and NIR tomography imaging of 17 NAC patients showed combined pre-TX contrast intensity and HbT were statistically significant in differentiating the patients with versus without complete pathological response (AUC=0.94).

Optical measurements of low-frequency hemodynamic oscillations in human breast tissue, Nahannah Krishnamurthy, Kristen Tzagkaio1, Pamela Anderson1, Angelo Sassaroli1, Sergio Fantini1; 1Biomedical Engineering, Tufts Univ., USA. Induced hemodynamic perturbations in two healthy subjects featured in-phase oscillations, which will be used to monitor treatment response early during chemotherapy to guide treatment.

Characterization of Breast Lesions Using Structural Prior Guided Optical Tomography on the Realistic Breast Model – DigiBreast, Bin Deng1,2, Dana Brooks1, David A. Boas2, Mats Lundqvist1, Qianqian Fang1,5; 1Boston Univ., USA; 2Massachusetts General Hospital, USA; 3Cornell Univ., USA. Multiple cell types contribute to neurodegeneration. Multiphoton microscopy and femtosecond laser ablation enable imaging and lesioning at the cellular scale in vivo. Using more fluorophores enables the dynamics of complex cell-cell interactions to be investigated.
**CTh4A • Human in vivo Diagnostics**

**Presider:** Calum E. MacAulay; BC Cancer Agency Research Centre, Canada

**CTh4A.1 • 16:00**

**Invited**

Targeted Detection of Flat Colorectal Neoplasia with Wide-field Multi-modal Endoscopy, Thomas D. Wang1,2, Department of Internal Medicine, Division of Gastroenterology, Univ. of Michigan, USA; Department of Biomedical Engineering, Univ. of Michigan, USA. We demonstrate a multi-modal video endoscope that collects wide-field fluorescence images in real time to detect pre-malignant lesions in colon that are flat and difficult to visualize with white light using targeted contrast agents.

**CTh4A.2 • 16:30**

**Clinical Detection of Cervical Dysplasia Using Angle-resolved Low Coherence Interferometry, Derek S. Ho1, Tyler Drake2, Karen K. Smith-MacGurn3, Teresa M. Darragh4, Lori Y. Huang5, Adam Wax6, Duke Univ., USA, “Univ. of California, San Francisco, USA. We assess the diagnostic capability of aLCI in vivo for cervical detection. The nuclear diameter was determined from the aLCI scans using a Mic theory and a wavelet based hybrid analysis, and the results were compared to histopathology.

**CTh4A.3 • 16:45**

**In Vivo Detection of Oral Epithelial Pre-Cancer and Cancer by Endogenous Fluorescence Lifetime Imaging (FLIM) Endoscopy, Shuna Cheng1, Dae Yon Huang2, Rodrigo Cuenc3, Bilal Malik2, Kristen C. Maitland1, John Wright1, Y. S. Lisa Cheng2, Javier A. Jo1, Texas A&M Univ., USA. Endogenous FLIM images are being acquired in vivo from patients undergoing biopsy of oral lesions. Preliminary results (20 patients) strongly suggest the potential of endogenous FLIM for detecting oral pre-cancer/cancer from benign conditions.

**CTh4A.4 • 17:00**

**Is Collagen an Independent Risk Factor for Breast Cancer?**, Paola Taroni1, Anna Maria Paganoni2, Francesca Isav3, Francesca Abbate4, Enrico Cassano1, Rinaldo Cubeddu1, Marco Augustin1, Tiago Martinho2,3, Edward Wegman1,2, Ramon Diaz-Arrastia3,4,5,6,7, National Inst. of Health, USA; 2USUS, CNRM, USA; 3Department of Statistics, George Mason Univ., USA. Using fNIRS in the prefrontal cortex, multivariate machine learning approach has been used to analyze hemodynamic responses from a group of 31 healthy and 30 TBI subjects performing complexity task. High accurate classification has been obtained.

**CTh4A.5 • 17:15**

**Clinical Detection of Cervical Dysplasia Using Angle-resolved Low Coherence Interferometry, Derek S. Ho1, Tyler Drake2, Karen K. Smith-MacGurn3, Teresa M. Darragh4, Lori Y. Huang5, Adam Wax6, Duke Univ., USA, “Univ. of California, San Francisco, USA. We assess the diagnostic capability of aLCI in vivo for cervical detection. The nuclear diameter was determined from the aLCI scans using a Mic theory and a wavelet based hybrid analysis, and the results were compared to histopathology.

**CTh4A.6 • 17:30**

**Is Collagen an Independent Risk Factor for Breast Cancer?**, Paola Taroni1, Anna Maria Paganoni2, Francesca Isav3, Francesca Abbate4, Enrico Cassano1, Rinaldo Cubeddu1, Marco Augustin1, Tiago Martinho2,3, Edward Wegman1,2, Ramon Diaz-Arrastia3,4,5,6,7, National Inst. of Health, USA; 2USUS, CNRM, USA; 3Department of Statistics, George Mason Univ., USA. Using fNIRS in the prefrontal cortex, multivariate machine learning approach has been used to analyze hemodynamic responses from a group of 31 healthy and 30 TBI subjects performing complexity task. High accurate classification has been obtained.

**CTh4A.7 • 17:45**

**A Machine Learning Approach to Identify Functional Biomarkers for Traumatic Brain Injury (TBI) Using Functional Near-Infrared Spectroscopy (fNIRS), Nader Karamzadeh1, Frank Amyot2, Kimba Kenney1, Fatima Chowdry2,4,5, Afrouz Anderson1, Victor Chernomordik1, Edward Wegman1,2, Eric Wassermann1, Ramon Diaz-Arrastia3,4,5,6,7, National Inst.s of Health, USA; 2USUS, CNRM, USA; 3Department of Statistics, George Mason Univ., USA. Using fNIRS in the prefrontal cortex, multivariate machine learning approach has been used to analyze hemodynamic responses from a group of 31 healthy and 30 TBI subjects performing complexity task. High accurate classification has been obtained.
CTh4A • Human in vivo Diagnostics—Continued

CTh4A.4 • 17:00
Automatically finding tumors using structural-prior guided optical tomography, Dora C. Inácio1, Bin Deng2, Daniel Kopans2, David A. Boas1, Qianqian Fang1. 1Physics, Univ. of Liege, Belgium; 2Radiation Oncology, Duke Univ., USA. We report a computer aided detection (CAD) method to automatically identify the location and type of an unknown breast lesion using structural-prior guided optical image reconstructions.

CTh4A.5 • 17:15
Diffuse optical characterization of the human thyroid, Claus Lindner1, Mireia Morà2,3, Paria Farzami1, Mattia Squarcia4,3, Johannes Johansson4, Udo M. Weigel1,5, Irene Halperin2,3, Felicia Haar2,3, Turgut Durduran1,6; 1Physics, Univ. of Pennsylvania, USA; 2Pediatrics/Neurology, Children’s Hospital of Philadelphia, USA; 3ICFO-The Inst. of Photonic Sciences, Spain; 4Neurology, Hospital of the Univ. of Pennsylvania, USA; 5Inst. of Physics, Univ. of Campinas, Brazil; 6Institución Catalana de Recerca i Estudis Avançats (ICREA), Spain. The human thyroid was measured by ultrasound-guided near-infrared time-resolved spectroscopy and diffuse correlation spectroscopy characterizing the healthy thyroid and nodules allowing us to envision applications in thyroid cancer screening.

CTh4A.6 • 17:30
Hyperspectral Imaging of Glucose Uptake, Mitochondrial Membrane Potential, and Vascular Oxygenation Differentiates Breast Cancers with Distinct Metastatic Potential In Vivo, Amy E. Fress1, Samuel S. McCachen1, Marianne Lee1, Helen A. Murphy1, Narasimhan Rajaram2, Mark W. Dewhirst2, Nimala Ramanujam3; 1Biomedical Engineering, Duke Univ., USA; 2Biomedical Engineering, Univ. of Arkansas, USA; 3Radiation Oncology, Duke Univ., USA. We performed in vivo hyperspectral imaging in a preclinical cancer model to capture key metabolic endpoints (glucose uptake, mitochondrial membrane potential, and vascular oxygenation) to successfully distinguish metastatic and non-metastatic tumors.

TTh4B • Optical Biomarkers II—Continued

TTh4B.5 • 17:00
Blood Flow Response to Orthostatic Challenges in Health and Diseased Populations, David R. Busch1,2, Clara Gregori-Pisa1,2, Igor Blančar1, Martin Fleischhauer3,4, Christopher Faviola1,2, Jennifer Lynch1,2, Madeline Winters1,2, Kohna Mensah-Brown1,2, Tiffany Ko1,2, Ann McCarthy1,2, John A. Detet1, Arjun G. Yodh1; 1Physics, Univ. of Pennsylvania, USA; 2Pediatrics/Neurology, Children’s Hospital of Philadelphia, USA; 3ICFO—the Inst. of Photonic Sciences, Spain; 4Neurology, Hospital of the Univ. of Pennsylvania, USA, 1st Inst. of Physics, Univ. of Campinas, Brazil; 2Institución Catalana de Recerca i Estudis Avanzats (ICREA), Spain; 3Medical School, New York Univ., USA; 4Department of Biomedical Engineering, Univ. of Pennsylvania, USA. Supine postures are utilized to increase cerebral blood flow following ischemic stroke. We find supine cerebral blood flow is lower than sitting flow in 25% of subjects and that postural changes increase supine blood flow.

TTh4B.6 • 17:15
Intraventricular hemorrhage consequences on cerebral neurovascular coupling in pre-mature infants, A multimodal neuroimaging EEG-NIRS approach, Mahal Mahmoudzadeh1, Ghislaine Dehaene-Lambertz1, Fabricio wallace1, INSERM U1105, France; 2INSERM U992, France. Multimodal coregistration (NIRS-EEG) offer unique opportunities for studying cerebral responses of preemies. In Intraventricular Hemorrhage, it revealed weaker hemodynamic response which can provide early diagnosis of neurovascular coupling impairment.

OTh4C • Blood Flow Imaging and Novel Microscopy—Continued

OTh4C.5 • 17:00
Multimodal Nonlinear Optical Imaging of Subcellular Lipid and Vascular Structures, Xuesong Liu1, W. Jien Lam2, Zhe Cao3, Yan Hao1, Qiqi Sun1, Sicang He1, Ho Yi Mak2, Jian Y. Ou1; 1Department of Electronic and Computer Engineering, Hong Kong Univ. of Science and Technology, Hong Kong, 2Division of Life Science, Hong Kong Univ. of Science and Technology, Hong Kong, 3Center of Systems Biology and Human Health, School of Science and Inst. for Advanced Study, Hong Kong Univ. of Science and Technology, Hong Kong. A unique cross-filtering technique was developed to eliminate the false lipid signal in fs SRS and THG. This enabled integration of SRS, THG and two-photon fluorescence microscopy for imaging lipid droplets and associated vesicular structures.

OTh4C.6 • 17:15
Spectroscopic Microscopy Explicitly Measures the Subdiffractional Structure of Biomaterials, Lukas Cherkezyan1, Di Zhang2, Hanharan Subramanian3, Allen Taflove1, Vadim Backman1; 1Northwestern Univ., USA, 2Pediatrics/Neurology, Children’s Hospital of Philadelphia, USA; 3Division of Biology and Human Health, School of Science and Inst. for Advanced Study, Hong Kong Univ. of Science and Technology, Hong Kong. Cytochrome-C-Oxidase Exhibits Higher Brain-Specificity than Haemoglobin in Functional Activation, Isabel de Roever1, Gemma Bale2, Robert J. Cooper1; 1Division of Medical Physics and Bioengineering, UCL, UK, 2Broadband NIRS measured changes in haemoglobin and cytochrome-c-oxidase (aCCO) at different source-detector spacings during functional activation. aCCO displayed higher brain specificity, with haemoglobin response influenced by extracerebral layers.

OTh4C.7 • 17:30
Visualizing Cellular Metabolic Processes With Combined Nonlinear Optical Microscopy, Alba Alfonso García1, Tim Smith1, Rupsa Datta1, Enrico Gratton1, Eric O. Potma1, Wendy Liu1; 1University of California Irvine, USA. Macrophages are key players in inflammation. We combine label-free nonlinear optical microscopy techniques (coherent Raman scattering and fluorescent lifetime imaging) to link lipid and energy metabolism with macrophage phenotype in living cells.

BTh4D • Optical Imaging of the Human Brain—Continued

BTh4D.4 • 17:00
Cytochrome-C-Oxidase Exhibits Higher Brain-Specificity than Haemoglobin in Functional Activation, Isabel de Roever1, Gemma Bale2, Robert J. Cooper1; 1Division of Medical Physics and Bioengineering, UCL, UK, 2Broadband NIRS measured changes in haemoglobin and cytochrome-c-oxidase (aCCO) at different source-detector spacings during functional activation. aCCO displayed higher brain specificity, with haemoglobin response influenced by extracerebral layers.
**NOTES**

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**Biomedical Optics • 25–28 April 2016**

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**OTh4C • Blood Flow Imaging and Novel Microscopy—Continued**

**OTh4C.8 • 17:45**
Adaptive Field Microscopy: Shaping Field for 3D Laser Scanning Microscopy, Hyungsik Lim¹, Jorge Colon¹; ¹City Univ. of New York, USA. We describe adaptive field microscopy to improve the efficiency of 3D imaging by controlling the image plane. The practicality is demonstrated for imaging a large area of the corneal epithelium of intact mouse eye.

**BTh4D • Optical Imaging of the Human Brain—Continued**

**BTh4D.7 • 17:45**
Cerebral Autoregulation Dynamics with High-Speed Diffuse Correlation Spectroscopy, Ashwin B. Parthasarathy¹, Kimberly Gannon², Wesley Baker¹, Venki Kavuri¹, Michael Muller², John A Detre², Arjun G. Yodh¹; ¹Dept. of Physics and Astronomy, Univ. of Pennsylvania, USA; ²Div. of Stroke and Neurocritical Care, Hospital of Univ. of Pennsylvania, USA. We demonstrate the bedside measurement & characterization of cerebrovascular autoregulation (CWAR) dynamics from 10 healthy volunteers, using a new diffuse correlation spectroscopy (DCS) instrument for high-speed measurement of cerebral blood flow.

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**18:05–18:30  Closing Remarks, Atlantic Ballroom 3**

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