Biomedical Optics (BIOMED)
Topical Meeting and Tabletop Exhibit

Technical Conference: April 11-14, 2010
Exhibition: April 11-14, 2010
The Deauville Beach Resort Hotel
Miami, FL, USA

Postdeadline Submission Deadline: March 16, 2010 12:00 p.m. noon, EDT (16.00 GMT)
NEW!! Housing Deadline: Extended through March 19, 2010
Pre-Registration Deadline: March 19, 2010

Part of Biomedical Optics and 3-D Imaging:
OSA Optics & Photonics Congress

Featuring Two Collocated Topical Meetings and a Special Workshop:

Biomedical Optics (BIOMED)
Digital Holography and Three-Dimensional Imaging (DH)
Workshop on Diffuse Optical Tomography NIRFAST software using MATLAB
About BIOMED

There are few basic biological science studies that are not touched by biomedical optics. Optical methods play a critical role in biotechnologies ranging from genomics to cell-based assays to in vivo imaging and therapies. In light of this, the importance of biomedical optics has never been greater. The upcoming Biomedical Optics meeting covers the diversity of cutting edge biomedical research and brings together leading scientists, engineers and physicians engaged in biological and medical research using optical methods. With over 400 attendees, this must-attend meeting affords attendees the opportunity to interact one-on-one with oral presenters, along with multiple poster sessions allowing for lively discussions of the latest research.

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Program Committee

General Chairs

Vasilis Ntziachristos, Technische Univ. Munchen, Germany
Lihong V. Wang, Washington Univ., USA

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3. Photonic Nanotechnology and Probes
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Adah Almutairi, University of California at San Diego, USA
Xiaoyuan (Shawn) Chen, School of Medicine, Stanford Univ., USA
Tayyaba Hasan, Harvard Medical School, USA
Ella F. Jones, Univ. of California at San Francisco, USA
Hisataka Kobayashi, Preclinical Development Section, Molecular Imaging Program, NCI/NIH, USA
Eva M. Sevick-Muraca, Brown Foundation Inst. of Molecular Medicine, Univ. of Texas Health Center Science-Houston, USA
Takashi Murakami, Jichi Medical Univ., Japan
Ching Tung, Massachusetts General Hospital, Harvard Medical School, USA
4. Microscopy
Irene Georgakoudi, Tufts Univ., USA, Co-chair
Jerome Mertz, Boston Univ., USA, Co-Chair
Emmanuel Beaurepaire, Ctr. Natl. de Res. Scientifique, France
Caroline Boudoux, École Polytechnique Montréal, Canada
Min Gu, Swinburne Univ. of Technology, Australia
Charles Lin, Massachusetts General Hospital Wellman Ctr. for Photomed, Harvard Med School, USA
Gabi Popescu, Beckman Inst., USA
Peter So, MIT, USA
Volker Westphal, Max-Planck-Inst. for Biophysical Chemistry, Germany

5. Optical Coherence Tomography and Sensing
Xingde Li, Johns Hopkins Univ., USA, Chair
Zhongping Chen, Univ. of California at Irvine, USA
Wolfgang Drexler, Cardiff Univ., UK
James Fujimoto, MIT, USA
Joseph A. Izatt, Duke Univ., USA
Rainer A. Leitgeb, Medical Univ. Vienna, Austria
Guillermo J. Tearney, Massachusetts General Hospital, Harvard Medical School, USA
Alex Vitkin, Univ. of Toronto, Canada
Ruikang Wang, Oregon Health and Science Univ., USA
Yoshiaki Yasuno, Univ. of Tsukuba, Japan

6. Photoacoustic Imaging and Spectroscopy
Paul Beard, Univ. College London, UK, Chair
Mark Anastasio, Illinois Inst. of Technology, USA
Stanislav Emelianov, Univ. of Texas at Austin, USA
Robert Kruger, Optosonics Inc., USA
Pai-Chi Li, National Taiwan Univ., Taiwan
Alexander Oraevsky, Fairway Medical Technologies, USA
Guenther Paltauf, Graz, Univ., Austria
Wiendelt Steenbergen, Univ. of Twente, Netherlands
Roger Zemp, Univ. Alberta, Canada

7. Optical Imaging and Spectroscopy
Arjun Yodh, Univ. of Pennsylvania, USA, Chair
Simon Arridge, Univ. College London, UK
David Boas, NMR Center, Massachusetts General Hospital, Harvard Medical School, USA
Turgut Durduran, ICFO- Inst. of Photonic Sciences, Spain
Jeremy C. Hebden, Univ. College London, UK
Andreas H. Hielscher, Columbia Univ., USA
Steven L. Jacques, Oregon Health and Science Univ., USA
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Lev T. Perelman, Harvard Medical School, USA
Brian W. Pogue, Thayer School of Engineering at Dartmouth, USA
Gabriel Popescu, Univ. of Illinois at Urbana-Champaign, USA
John C. Schotland, *Univ. of Pennsylvania, USA*
Bruce J. Tromberg, *Univ. of California at Irvine, USA*
Tuan Vo-Dinh, *Duke Univ., USA*
Topics to be Considered

- Bio-optics in clinical application
- Biological and drug discovery imaging
- Photonic nanotechnology and probes
- Microscopy
- Optical coherence tomography and sensing
- Photoacoustic imaging & spectroscopy
- Optical imaging & spectroscopy
Special Events

Joint Welcome Reception

Monday, April 12, 2010
6:30 p.m.–8:00 p.m.

Start the Congress excitement early by joining us on Monday, April 12th, for the Welcome Reception. This reception is the perfect kick-off to this year’s congress. Free to all Technical Conference Attendees. Meet with colleagues from around the world. Light hors d’oeuvres will be served.

Meet the Editors of OSA’s new journal, Biomedical Optics Express!

Editor in Chief Dr. Joseph Izatt of Duke University and Deputy Editor Dr. Gregory Faris of SRI International will be available at the end of the Welcome Reception to answer your questions and discuss their plans for OSA’s new journal home for biomedical optics. Look for the Biomedical Optics Express table in the reception area.

Poster Sessions

Sunday, April 11, Monday, April 12 and Tuesday, April 13
1:30 p.m.–3:30 p.m.

Poster presentations offer an effective way to communicate new research findings and provide an opportunity for lively and detailed discussion between presenters and interested viewers. During these poster sessions, the Biomedical Topical Meeting Program committee will select best student poster presenters who demonstrate outstanding research and scientific presentation skills in the Biomedical Optics field.

Keynote Speakers

Sam Gambhir; Stanford Univ., USA

Molecular Imaging of Living Subjects
Sunday, April 11, 2010
8:00 a.m.–9:00 a.m.

Biography: Dr. Gambhir is the Virginia and D. K. Ludwig Professor of Radiology & Bioengineering at Stanford University. He obtained his B.S. in Physics and his M.D. and Ph.D. in the Medical Scientist Training Program at UCLA. He currently has a lab of 35 post-doctoral fellows, graduate students, and staff and directs over 200 scientists in the Molecular Imaging Program at Stanford (MIPS). His laboratory is focused on translation of novel molecular imaging strategies for cancer detection and
management. He is also the head of Nuclear Medicine at Stanford Hospital and Director of the Canary Center at Stanford for Cancer Early Detection. He has received the Tesla Medal, Hounsfield Medal, Holst Medal, Aebersold award, and was elected in 2009 to the Institute of Medicine of the US National Academies.

Abstract: Molecular Imaging is a growing field in which molecular spies are introduced into subjects. Optical molecular imaging is rapidly growing and with the use of novel imaging agents has great potential to accelerate medical care.

Roger Tsien; Univ. of California at San Diego, USA  
Breeding and Building Molecules to Spy on Cells and Tumors  
Tuesday, April 13, 2010  
8:00 a.m. - 9:00 a.m.

Biography: Roger Y. Tsien received his AB in Chemistry and Physics from Harvard College in 1972. He received his PhD in Physiology in 1977 from the University of Cambridge and remained as a Research Fellow until 1981. In 1989 he moved to the University of California at San Diego, where he is an Investigator of the Howard Hughes Medical Institute and Professor in the Departments of Pharmacology and of Chemistry and Biochemistry. He was a scientific co-founder of Aurora Biosciences Corporation and Senomyx Inc. His honors include First Prize in the Westinghouse Science Talent Search (1968), Searle Scholar Award (1983), Artois-Baillet-Latour Health Prize (1995), Gairdner Foundation International Award (1995), Award for Creative Invention from the American Chemical Society (2002), Heineken Prize in Biochemistry and Biophysics (2002), Wolf Prize in Medicine (shared with Robert Weinberg, 2004), Rosenstiel Award (2006), E.B. Wilson Medal of the American Society for Cell Biology (shared with M. Chalfie, 2008), and Nobel Prize in Chemistry (shared with O. Shimomura and M. Chalfie, 2008). He is a member of the National Academy of Sciences and the Royal Society.

Abstract: New flavoproteins photogenerate singlet oxygen, enabling genetically encoded correlative light and electron microscopy. Synthetic peptides provide an amplifying mechanism for targeting fluorophores, MRI contrast agents, and drugs to sites of protease activity (e.g. tumors) in vivo.
Invited Speakers

Keynote Speakers

BSuA1, Molecular Imaging of Living Subjects, Sam Gambhir; Stanford Univ., USA

BTuA1, Breeding and Building Molecules to Spy on Cells and Tumors, Roger Tsien; Univ. of California at San Diego, USA

Plenary Speakers

BSuA2, Biomedical Imaging and Optical Biopsy Using Optical Coherence Tomography, James Fujimoto; MIT, USA

BMA1, Nanotechnology for Molecular Imaging and Image-Guided Surgery, Shuming Nie; Emory Univ. and Georgia Tech, USA

BMA2, Development of Optical Imaging Biomarkers and Applications in Drug Discovery and Development, Bohumil Bednar; Merck & Co., USA

BMA3, Technology Development for Deep Tissue Multiphoton Imaging, Chris Xu; Cornell Univ., USA

BTuA2, Clinical Translation of Optical Imaging: Global Prospects to Improve Early Cancer Detection, Rebecca R. Richards-Kortum; Rice Univ., USA

Invited Speakers

BSuC1, Multimegahertz Optical Coherence Tomography: High Quality Biomedical Imaging beyond 1 Million A-Scans per Second, Wolfgang Wieser, Benjamin R. Biedermann, Thomas Klein, Christoph M. Eigenwillig, Robert Huber; Ludwig-Maximilians-Univ. München, Germany

BSuF1, OCT Imaging of the Developing Heart, Andrew Rollins; Case Western Reserve Univ., USA

BMC1, Two-Photon Microscopy of Biological Organisms with Shaped Broadband Pulses, Guillaume Labroille¹, Rajesh S. Pillai¹, Caroline Boudoux¹,², Nicolas Olivier¹, Xavier Solinas¹, Manuel Joffre¹, Emmanuel Beaurepaire¹; ‘École Polytechnique-CNRS-INSERM, France, ²École Polytechnique, Canada

BMD1, Developments in Fluorescence Nanoscopy, Alexander Egner; Max Planck Inst. for Biophysical Chemistry, Germany
BWB1, Can Scattering Spectroscopy Detect Disease Earlier than Histopathology? Irving Bigio; Boston Univ., USA

BWD1, Near-Infrared Fluorescence Imaging and Tomography to Assess Lymphovascular Disorders, Eva M, Sevick-Muraca; Univ. of Texas, USA

BWF1, Clinical Metabolic Imaging Using Diffuse Optics, Bruce Tromberg; Beckman Laser Inst., Univ. of California at Irvine, USA

BWH1, Deep-Tissue Imaging of Morphology and Molecular Function with Multispectral Optoacoustic Tomography, Daniel Razansky; Technical Univ. of Munich, Germany
Students

Student members are an important and active part of the OSA community. Student benefits are built around the unique needs of those preparing to enter the professional world of optics. As an OSA Student Member, you join a worldwide community of optics and photonics scientists, engineers and business leaders. Join us today.

Student Members attend OSA conferences, exhibits and educational sessions at reduced rates. Frontiers in Optics (OSA's Annual Meeting), the Optical Fiber Communication Conference & Exposition and National Fiber Optic Engineers Conference (OFC/NFOEC), the Conference on Lasers and Electro-Optics (CLEO) and more than 20 topical meetings are among the many annual events hosted by OSA.

Best Student Poster Presentation Awards

Congratulations to the 2010 Student Poster Award Winners!

Biological and Drug Discovery Imaging

Metasebya Solomon: Handheld Video Rate Fluorescence Diffuse Optical Tomography, Metasebya Solomon¹, Brian R. White², Adam Q. Bauer², Gavin Perry², Joseph P. Culver², ¹Dept. of Biomedical Engineering, Washington Univ. in Saint Louis, USA, ²Dept. of Radiology, Washington Univ., USA

Bio-Optics in Clinical Application

Erin M. Buckley: Post-Surgical Cerebral Autoregulation in Neonates with Congenital Heart Defects Monitored with Diffuse Correlation Spectroscopy, Erin M. Buckley¹, Donna A. Goff², Turgut Durduran¹,², Meeri N. Kim¹, Grady Hedstrom², Rickson C. Mesquita¹, Daniel J. Licht³, Arjun G. Yodh¹; ¹Univ. of Pennsylvania, USA, ²Children's Hospital of Philadelphia, USA, ³Inst. de Ciències Fotòniques, Spain

Nikhil N. Mutyal: Design and Implementation of Fiber Optic Probe for measuring Field Effect of Carcinogenesis with Low- Coherence Enhanced Backscattering Spectroscopy (LEBS), Nikhil N. Mutyal¹, Vladimir Turzhitsky¹, Jeremy D. Rogers¹, Andrew Radosevich¹, Hemant Roy², Micheal J. Goldberg², Mohammed Jameel², Andrej Bogojevich², Vadim Backman¹; ¹Northwestern Univ., USA, ²Northshore Univ. HealthSystems, USA.

Ashwin B. Parthasarathy: Cerebral Blood Flow Imaging during Neurosurgery with Laser Speckle Contrast Imaging, Ashwin B. Parthasarathy¹, Erica L. Weber¹, Lisa M. Richards¹,
Mark G. Burnett², Douglas J. Fox², Andrew K. Dunn¹; ¹Univ. of Texas at Austin, USA, ²NeuroTexas Inst., USA.


Pablo A. Valdes: Intraoperative δ-aminolevulinic Acid-Induced Protoporphyrin IX Spectroscopic Quantification Improves Clinical Margin Delineation of Intracranial Tumors, Pablo A. Valdes¹,², Frederic Leblond³, Anthony Kim¹, Xiaoyao Fan¹, Brian C. Wilson³, Brent T. Harris⁴, Keith D. Paulsen¹, David W. Roberts⁵,²; ¹Thayer School of Engineering, Dartmouth College, USA, ²Dartmouth Medical School, Dartmouth College, USA, ³Dept. of Medical Biophysics, Univ. of Toronto, Canada, ⁴Dept. of Pathology, Dartmouth-Hitchcock Medical Ctr., USA, ⁵Section of Neurosurgery, Dartmouth-Hitchcock Medical Ctr., USA.

Microscopy

Flor A. Cianchetti: Stimulus-Evoked Calcium Transients in Somatosensory Cortex are Inhibited After a Nearby Microhemorrhage, Flor A. Cianchetti, Nozomi Nishimura, Chris B. Schaffer; Cornell Univ., USA.

Lauren Grosberg: 3-D Visualization of Intrinsic Contrast in Neoplastic Colon Tissue Using Hyperspectral Two-Photon Microscopy, Lauren Grosberg, Andrew J. Radosevich, Samuel Asfaha, Xiangdong Yang, Timothy C. Wang, Elizabeth M. C. Hillman; Columbia Univ., USA.

Optical Coherence Tomography and Sensing

Golnaz Farhat: Speckle Decorrelation as a Method for Assessing Cell Death, Golnaz Farhat¹,²,³, Adrian Mariampillai⁴,⁵, Victor X. D. Yang⁶,⁷, Gregory J. Czarnota¹,⁶,³,², Michael C. Kolios⁵,¹; ¹Dept. of Medical Biophysics, Univ. of Toronto, Canada, ²Imaging Res., Sunnybrook Health Sciences Ctr., Canada, ³Dept. of Radiation Oncology, Sunnybrook Health Sciences Ctr., Canada, ⁴Ontario Cancer Inst., Canada, ⁵Dept. of Physics, Ryerson Univ., Canada, ⁶Dept. of Radiation Oncology, Univ. of Toronto, Canada.

Jiefeng Xi: Real-Time Calibration for High-Speed Swept-Source OCT, Jiefeng Xi, Li Huo, Jiasong Li, Xingde Li; John Hopkins, Dept. of Biomedical Engineering, USA.

Optical Imaging & Spectroscopy

Jin Chen: Time Resolved Optical Imaging with Patterned Light for Pre-Clinical Studies, Jin Chen, Xavier Intes; Rensselaer Polytechnic Inst., USA.

Alexander Jelzow: Combined EEG and Time-Resolved NIRS to Study Neuro-Vascular Coupling in the Adult Brain, Alexander Jelzow¹, Stefan Paul Koch², Heidrun Wabnitz¹, Jens Steinbrink³, Hellmut Obrig⁴, Rainer Macdonald¹; ¹Physikalisch-Technische Bundesanstalt, Germany, ²Berlin NeuroImaging Ctr., Charité-Univ.smedizin Berlin, Germany, ³Ctr. for Stroke
Haichun Liu: Dual-Beam Fluorescence Diffuse Optical Tomography Using Nonlinear Upconverting Nanoparticles, Haichun Liu, Can T. Xu, Stefan Andersson-Engels; Dept. of Physics, Lund Univ., Sweden.

Benjamin T. Schmidt: Near-Infrared Functional Brain Imaging of Prefrontal and Motor Regions During a Step-Reaction Stroop Test, Benjamin T. Schmidt, Nancy H. Beluk, Patrick Sparto, Theodore J. Huppert; Univ. of Pittsburgh, USA Jeffrey M. Shainline, Gustavo Fernandes, Zhijun Liu, Jimmy Xu; Brown Univ., USA

Brian R. White: A Quantitative Evaluation of High-Density Diffuse Optical Tomography: In vivo Resolution and Mapping Performance, Brian R. White, Joseph P. Culver; Washington Univ. at St. Louis, USA.

Yan Xu: Imaging Heterogeneous Absorption Distribution of Advanced Breast Cancers using Optical Tomography Guided by Ultrasound, Yan Xu, Quing Zhu; Univ. of Connecticut, USA.

Photoacoustic Imaging & Spectroscopy

Sibylle Gratt: Photoacoustic Imaging & Spectroscopy Direct, Sibylle Gratt, Klaus Passler, Robert Nuster, Guenther Paltauf; Inst. of Physics, Karl-Franzens-Univ. Graz, Austria.

Jithin Jose: Simultaneous Imaging of Speed-of-Sound, Acoustic Attenuation and Optical Absorption Using a Computed Tomography Photoacoustic Imager, Jithin Jose¹, Rene Willemink¹, Steffen Resink¹, Daniele Piras¹, Johan C. G. Van Hespen¹, Ton G. Van Leeuwen¹,², Srirang Manohar¹; ¹Univ. of Twente, Netherlands, ²Academic Medical Ctr., Univ. of Amsterdam, Netherlands.
OSA Foundation Student Travel Grants

The OSA Foundation is pleased to offer travel grants to students working or studying in a qualifying developing nation who plan to attend Biomedical Optics (BIOMED).

Congratulations to these grant recipients:
# Molecular Imaging of Living Subjects, Sanjiv Sam Gambhir; Stanford Univ., USA.

Molecular imaging is a growing field in which molecular spies are introduced into subjects. Optical molecular imaging is rapidly growing and with the use of novel imaging agents has great potential to accelerate medical care.

# Biomedical Imaging and Optical Biopsy Using Optical Coherence Tomography, Jim Fujimoto; MIT, USA.

OCT performs micron scale three dimensional imaging of tissue structure, enabling *in situ* and real time visualization of pathology. We describe the development of OCT technology and its applications in research, ophthalmology and cardiology.
BSuB1 • 10:30 a.m. 
Imaging Benign and Malignant Breast Lesions with Combined Optical Imaging and Tomosynthesis, 
Qianqian Fang, Stefan A. Carp, Richard H. Moore, Daniel B. Kopans, David A. Boas; Massachusetts General Hospital, USA. We have imaged over 170 patients over the past 3 years with a combined optical and tomosynthesis imaging system. The region-of-interest analysis of 23 malignant lesions, 15 benign solid lesions and 8 cysts is reported.

BSuB2 • 11:00 a.m. 
Breast Cancer Therapy Monitoring with Diffuse Optical Tomography and Diffuse Correlation Spectroscopy, Regine Chae1, Turgut Durduran1,2, So Hyun Chung1, Seren D. Konecky2, Saurav Pathak1, Han Y. Ban1, David R. Busch1, Erin M. Buckley1, Meeri N. Kim1, Angela DeMichele1, Carolyn Mies1, Mark A. Rosen1, Mitchell D. Schnall1, Artun G. Yodh1; 1Univ. of Pennsylvania, USA, 2ICFO, Spain, *Hospital of the Univ. of Pennsylvania, USA. Preliminary results on breast cancer suggest early changes in optically accessible parameters (e.g. blood flow, total hemoglobin concentration) by diffuse optical tomography and diffuse correlation spectroscopy may be related to pathological outcome of chemotherapy.

BSuB3 • 11:15 a.m. 
Fluorescence Imaging of Breast Cancer with ICG, Dirk Grosentick1, Axel Hagen1, Herbert Rinneberg2, Rainer Macdonald1, Alexander Pöllinger3, Susen Barock1, Peter M. Schlager1; 1Phys.-Techn. Bundesanstalt, Germany, 2Dept. of Radiology, Germany, 3Comprehensive Cancer Ctr., Charité - Univ. Medicine, Germany. We have investigated twenty patients with suspicious breast lesions by fluorescence mammography using ICG as contrast agent. Differences in early and late fluorescence mammograms offer the chance to distinguish malignant from benign lesions.

BSuC1 • 10:30 a.m. 
Multimegahertz Optical Coherence Tomography: High Quality Biomedical Imaging beyond 1 Million A-Scans per Second, Wolfgang Wieser, Benjamin R. Biedermann, Thomas Klein, Christoph M. Eigenthaler, Robert Huber; Ludwig-Maximilians-Univ. München, Germany. We demonstrate optical coherence tomography with line rates in excess of 1MHz and effective voxel rates >5GHz. Different setups to achieve these super fast line rates are presented and the image quality is compared.

BSuC2 • 11:00 a.m. 
Ultrasapid Full-Field Optical Coherence Tomography for Visualizing Human Photoreceptor Cells in vivo, Masahiro Akiha1, John Yan1, Charles Reisman1, Zhenguo Wang1, Yasuomi Fakuma2, Masanori Hangai2, Nagahisa Yoshimura2, Kinpui Chae1; *TOPCON Advanced Biomedical Imaging Lab, USA, 1Kyoto Univ. Hospital, Japan. We present in vivo human retinal imaging by full-field (FF) OCT. A phase-locked dual-channel detection scheme was incorporated with a short duration illumination technique. Human retinal cone mosaic was clearly observed by FF-OCT.

BSuC3 • 11:15 a.m. 
Interferometric Spectrally ECODEd Confocal Scanning Laser Ophthalmoscopy, Yuankai K. Tao, Joseph A. Izatt; Duke Univ., USA. We present in vivo human fundus imaging using interferometric spectrally encoded confocal scanning laser ophthalmoscopy (iSECSLO). iSECSLO allows for video-rate fully confocal imaging with the interferometric advantage of optical coherence tomography though single-mode optical fiber.
BSuB  •  Breast Cancer Imaging and Monitoring — Continued

BSuB4  •  11:30 a.m.
Optical Mammography at 635-1060 nm for Breast Density Assessment and Lesion Characterization,
Paola Taroni1, Antonio Piffieri2, Lorenzo Spinelli2, Alessandra Torricelli3, Rinaldo Cabezzetta1, Francesca Abbiate1, Anna Villa1, Nicola Balestrieri1, Giuseppe Bonfitto3, Enrico Cassano4; 1Dept. of Physics, Politecnico di Milano, Italy; 2Dept. of Radiology, European Inst. of Oncology, Italy. A clinical study is ongoing for breast density assessment and lesion characterization using our upgraded time-resolved 7-wavelength (635-1060 nm) optical mammogram. Correlation between mammographic density and optical parameters was observed over the first 34 subjects.

BSuB5  •  11:45 a.m.
A Dual-Mode Simultaneous Bilateral Optical Imaging System for Breast Cancer Detection, Rabiah M. Al Abdi1, Christoph Schmitz1, Rehman Ansari1, Randall Andronica1, Yaling Pei2, Yong Xu2, Harry Graber1, Begum Noor1, Menna Akhlavsia2, Randall L. Barbour3; 1SUNY Downstate Medical Ctr., USA, 2NIRx Medizintechnik GmbH, Germany, 3NIRx Medical Technologies LLC, USA, 4Brooklyn Hospital Ctr., USA. A dual-mode dynamic optical tomographic imaging system fitted with a programmable articulating sensing head that also performs pressure and displacement measurements is described. Measures of system performance and initial clinical findings are presented.

BSuB6  •  12:00 p.m.
Near-Infrared Spectral Tomography System for Measuring Dynamic Vascular Changes in Breast, Shulong Jiang1, Brian W. Pogue1, Colin M. Carpenter1, Peter A. Kaufman1, Keith D. Paulsen2; 1Thayer School of Engineering, Dartmouth College, USA, 2Dartmouth Medical School, USA. The dynamic vascular change in the breast due to the pressure-displacement kinetics and inspired gas dynamics are imaged by a frequency domain tomographic system with 20 second temporal resolution.

BSuB7  •  12:15 p.m.
Optical Tomography Using US Localization to Assess Response to Neoadjuvant Chemotherapy, Quing Zhu1, Patricia DeFusco1, Susan Tannenbaum2, Behrouz Tavakoli1, Yan Xu1, Yasamun Ardeshirpour1, Andrew Picci Jr1, Poornima Hegde1, Edward Cronin1, Mark Kane1; 1Univ. of Connecticut, USA, 2Harford Hospital, USA. In this report, we demonstrate that optical tomography guided by ultrasound (Optical Tomography/US) can be used during neoadjuvant chemotherapy to repeatedly monitor tumor vascular changes. Optical tomography/US may also assess early pathological response during treatment.

BSuC  •  Optical Coherence Tomography I — Continued

BSuC4  •  11:30 a.m.
Enhancing Diagnosis of Bladder Cancer by 2-D and 3-D Optical Coherence Tomography (OCT), Hangang Ren, Zhihua Yuan, Wayne C. Watzler, Jingswan Liu, Ruth A. Miles, Yingjian Pan; SUNY Stony Brook, USA. We present the results on clinical diagnosis of bladder cancer in vivo with MEMS-based endoscopic OCT and the methods to enhance the detection of carcinoma in situ by 3-D OCT using SV40T transgenic mouse model.

BSuC5  •  11:45 a.m.
High Speed Polarization Sensitive Spectral Domain OCT by Spatial Heterodyning, Rainer A. Leitgeb; Medical Univ. Vienna, Austria. Polarization sensitive spectral domain optical coherence tomography is introduced, capable to retrieve with a single camera retardation and axis orientation at 100,000 A-scans/second. Orthogonal polarization channels are distinguished through spatial modulation by an electro-optic modulator.

BSuC6  •  12:00 p.m.
OCT Imaging with Discrete-Frequency Fourier Domain Mode-Locked Laser, Li Huo1, Jiefeng Xi2, Kevin Hsu2, Xingde Li3; 1Johns Hopkins Univ., USA, 2Micron Optics Inc., USA. A uniform-k, discrete frequency FDML was demonstrated with much larger coherence length than conventional FDML. High quality OCT images with the discrete frequency FDML were presented.

BSuC7  •  12:15 p.m.
A Miniature Prototype Hybrid Intra-Operative Probe for Ovarian Cancer Detection, Yi Yang1, Nrsinghit Biswal1, Patrick Kamarov1, Tianheng Wang2, Moazaferaddin Karimeddini2, Melinda Sanders1, Molly Breuer1, Qining Zhu1; 1Univ. of Connecticut, USA, 2Univ. of Connecticut Health Ctr., USA. We demonstrate a novel prototype intraoperative probe combining Optical Coherence Tomography and positron detection in investigating normal and abnormal ovarian tissues in vivo. Also a miniature probe has been made and its performance has been demonstrated.

12:30 p.m.—1:30 p.m. Lunch Break (on your own)
BSuD1
Random-Illuminating Compressed-Sensing Photoacoustic Imaging, Dong Liang, Hao F. Zhang, Leslie Ying, Dept. of Electrical Engineering and Computer Science, Univ. of Wisconsin at Milwaukee, USA. This paper reports a new method to address the artifacts in existing limited-view photoacoustic imaging techniques. The method employs random optical illuminations and compressed sensing to obtain artifacts-free images from only two view angles.

BSuD2
Photoacoustic Imaging Using a Multiple Piezoelectric Ring Detection System, Klaus Passler1, Robert Nuster1, Sibylle Gratt1, Peter Burgholzer2, Günther Paltan1; Karl Franzens Univ. Graz, Inst. of Physics, Austria, 1Dept. of Sensor Technology, Recanati, Austria. Photoacoustic and acoustic imaging using ring shaped piezoelectric detectors leads to strong imaging artifacts. Using several ring detectors of different size image resolution is improved and image artifacts are reduced.

BSuD3
Quantitative Recovery of Absorption Coefficient Using DOT-assisted Photoacoustic Tomography for Breast Imaging, Chen Xu, Patrick Kummar1, Andres Aguirre, Quing Zhu; Electrical and Computer Engineering Dept., Univ. of Connecticut, USA. We introduce a fitting procedure which can quantitatively recover the absorption coefficient using DOT-assisted photoacoustic tomography. The background optical properties provided by DOT can significantly improve the accuracy of the fitting.

BSuD4
Withdrawn

BSuD5
Simultaneous Imaging of Speed-of-Sound, Acoustic Attenuation and Optical Absorption Using a Computed Tomography Photoacoustic Imager, Jithin Jose1, Rene Willemin1, Steffen Rois1, Daniele Pira1, Johan C. G. Van Hest1, Ton G. Van Leeuwen1, Srinang Manohar1; Univ. of Twente, Netherlands, 1Academic Medical Ctr., Univ. of Amsterdam, Netherlands. We present latest results on phantoms and biological specimens using an intrinsically ‘hybrid’ photoacoustic imaging system. This instrument permits the tomographic imaging of both optical absorption properties and acoustic transmission properties of object.

BSuD6
Enhanced Time-Domain Photoacoustic Tomography through Total-Variation Minimization, Lei Yao, Huabei Jiang; Dept. of Biomedical Engineering, Univ. of Florida, USA. A total variation minimization based iterative algorithm is described in this paper that enhances the quality of reconstructed images with time domain data over that obtained previously with a regularized least squares approach.

BSuD7
Reduction of Secondary Echoes Generated from Ultrasound Transducer Face in Photoacoustic Imaging Implemented in Reflection Geometry, Patrick D. Kummar1, Andres Aguirre, Quing Zhu; Univ. of Connecticut, USA. A method to reduce image artifacts arising from secondary ultrasound echoes during photoacoustic imaging is presented. Experimental results presented indicate a significant improvement in the image quality by the use this technique.

BSuD8
Spectroscopic Image Analysis with Pattern Recognition in Frequency Domain Optical Coherence Tomography, Volker Jaedicke1,2, Christoph Kesseck1, Nikol Gerhardt1, Hubert Welp1, Martin Hofmann1; Ruhr-Univ. Bochum, Germany. We present a concept for analyzing spectroscopic information in multilayer samples using a frequency domain optical coherence tomography system. We apply a windowed Fourier transform in the spatial regime and analyze the data by pattern recognition.

BSuD9
Integrated Optical Coherence Tomography (OCT) and Fluorescence Luminescent Optical Tomography (FLOT) for Depth-Resolved Subsurface Cancer Imaging, Yu Chen1, Shuai Yuan1, Jerry Wieriant2, Chao-Wei Chen1, Tiffany Blackwell1, Paul Winzard2, Venu Ramare2, Kristine Glaude1; 1Univ. of Maryland, USA, 2Johns Hopkins Medical School, USA. We developed a combined optical coherence tomography (OCT) and fluorescence luminescent optical tomography (FLOT) system for co-registered depth-resolved structural and molecular imaging. Experimental results using a mouse model with human breast cancer xenograft are presented.

BSuD10
Gold Nanocages for Spectroscopic OCT Imaging with a Swept Source at 1060 nm, Li Hua1, Yongqing Chen1, Jiefeng Xi1, Kevin Hsu2, Xingle Li2; 1Johns Hopkins Univ., USA, 2Micron Optics Inc., USA. Gold nanocages were synthesized to shift the surface plasmon resonance peak to ~900 nm. We demonstrate these nanocages can be used as contrast agents for conventional and spectroscopic OCT at 1060 nm.

BSuD11
Concentration Dependent Scattering Coefficients of Intralipid Measured with OCT, Vitali Kodach, Nienke Bosgraart, Jeroen Kalkman, Ton G. van Leeuwen, Dirk J. Faber; Dept. of Biomedical Engineering and Physics, Univ. of Amsterdam, Netherlands. The contribution of dependent and multiple scattering effects to the OCT-measured scattering coefficient was investigated at 800, 1300 and 1600 nm. The former plays a thus far overlooked role in quantitative mus measurements by OCT.

BSuD12
Speckle Decorrelation as a Method for Assessing Cell Death, Golnaz Farhat1,2,3, Adrian Mariampillai1, Victor X. D. Yang1,2, Gregory J. Czarnota1,2,3, Michael C. Koloski1,2,3; 1Dept. of Medical Biophysics, Univ. of Toronto, Canada, 2Imaging Res., Sunnybrook Health Sciences Ctr., Canada, 3Dept. of Radiation Oncology, Sunnybrook Health Sciences Ctr., Canada, 4Ontario Cancer Inst., Canada, 5Dept. of Physics, Ryerson Univ., Canada. A speckle decorrelation rate was measured in OCT images of cell spheroids at various stages of growth. The decorrelation rate was related to the extent of cell death observed in histological sections of spheroids.

BSuD13
Real-Time Resampling in FD-OCT Using a Graphics Processing Unit, Sam Van der Jeugt, Adrian Brada1, Adrian Gr. Podoleanu; Univ. of Kent, Canterbury, UK. We demonstrated the implementation of the wavelength re-sampling process, required in FD-OCT, on a GPU and achieved a speed-up of more than 4X over the CPU in the calibration of high resolution images.

BSuD14
Doppler Optical Coherence Tomography for Flow Imaging with Optimized Digital Frequency Ramping Method, Zhifua Yuan, Zhongchi Luo, Hugang Ren, Yingtian Pan, Conghua Duan, SUNY Stony Brook, USA. We optimized the DFRM for Doppler optical coherence tomography to effectively improve flow image quality and minimize computation loads. Both 2-D and 3-D flow images were performed to demonstrate the efficacy of new algorithm.

BSuD15
Thermally Generated Second Order Correlations in OCT, Noise or Diagnostic Approach? Mark E. Brezinski, Brigham and Women’s Hospital, USA. We have recently demonstrated that second order correlations (SOC) in-conventional OCT demonstrate quantum mechanical properties. This paper examines OCT SOC for diagnostic purposes, such as local refractive index measurements, rather than a noise source.

BSuD16
Using Image-Space Singular Mode Vectors to Assess the Spatial Resolution of Fluorescence Tomography Instruments, Frederic Leblond, Brian W. Pogue; Thayer School of Engineering, Dartmouth College, USA. Detailed singular mode analysis is used to define the spatial resolution of whole-body fluorescence tomography instruments. This proposed methodology provides image-space information that is complementary to singular values.
BSuD17
Image Reconstruction in Optical Tomography Using the Finite Element Solution of the Radiative Transfer Equation, Tanja Tarvainen2,3, Marko Vauhkonen1, Simon R. Arridge1; 1Univ. of Eastern Finland, Finland, 2Univ. of London College, UK. Optical tomography image reconstruction problem is solved using regularized least-squares method. Light transport is modelled with the frequency domain radiative transfer equation which is solved with the finite element method.

BSuD18
FPGA-Assisted Strategy toward Efficient Reconstruction (FASTER) in Diffuse Optical Tomography, Yuanyuan Jiang, Sounail Makhjerje, James E. Stine, Charles F. Bunting, Daqing Piao; Oklahoma State Univ., USA. The finite element computation of photon fluence and adjoint photon fluence necessary to image reconstruction in steady state DOT has been implemented on field programmable gate array (FPGA). Preliminary results encourage further exploration toward efficient DOT image reconstruction using FPGA.

BSuD19
“Reverse-Uptake” of Zinc-Specific Fluorophore in the Prostate by Trans-Rectal Florescence Diffuse Optical Tomography, Guan Xu, Daqing Piao, Chris J. Frederickson, Hamid Dehghani3; School of Electrical and Computer Engineering, Oklahoma State Univ., USA, 1Andro Diagnostics Inc., USA, 2School of Computer Science, Univ. of Birmingham, UK. Using fluorophore specific to zinc, a well-established prostate cancer marker, to detect prostate cancer will be challenged by the “reverse-uptake” of the fluorophore. A sensitivity-adapted reconstruction method may improve the target recovery in axial-imaging geometry.

BSuD20
3-D Noncontact Time-Resolved Fluorescent Diffuse Optical Tomography Data Processing for Improving Image’s Quality, Farouk Nouitzi1, Murielle Torregrossa2, Renée Chabrier1, Patrick Poulet; 1Lab d’Imagerie et de Neurosciences Cognitives, Univ. de Strasbourg, France, 2Lab des Sciences de l’Image, de l’Informatique et de la Teledetection, Univ. de Strasbourg, France. A method improving the quality of 3-D images acquired with a noncontact time-resolved FDOT preclinical setup is presented. Special attention concerned the optimization step using simulated data convoluted with the impulse response of the scanner.

BSuD21
Optimization of 2-D Spatial Resolution for Diffuse Optical Imaging of Brain Function, Fenghua Tian, Hailing Niu, Hanli Liu; University of Texas at Arlington, USA. The 2-D spatial resolution of diffusive optical imaging is studied using a computational analyzing approach. Influences of geometrical structure, optode density, dynamic range and noise level on spatial resolution are investigated in details.

BSuD22
The Spread Matrix: A Method to Predict the Effect of a Non Time-Invariant Measurement System, Antonio Pifferi1, Davide Contini2, Lorenzo Spinelli2, Alessandro Torricelli2, Rinaldo Cabeddu1, Fabrizio Martelli1, Giovanni Zaccanti1, Alberto Dalla Mora2, Alberto Tosi2, Franco Zappi2; 1IIT, Dept. di Fisica, ULTRAS and IFN-CNR Politecnico di Milano, Italy, 2IIT, Dept. di Fisica, Univ. degli Studi di Firenze, Italy. 3IIT, Dept. di Elettronica e Informazione, Politecnico di Milano, Italy. Time-gated systems are described using a non time-invariant operator, permitting to quantify the time-spread of collected photons and the photon rejection efficiency. Application to a fast-gated Single Photon Avalanche system is presented.

BSuD23
Reconstruction in Diffuse Optical Tomography Using Genetic Algorithm, Qing Zhao1, Lorenzo Spinelli2, Alessandro Torricelli2, Rinaldo Cabeddu1, Antonio Pifferi1,2; 1 Dept. of Robotics Brain and Cognitive Sciences, Inst. Italiano di Tecnologia, Italy, 2Inst. of Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche, Italy, 3IIT, Dept. di Fisica, Politecnico di Milano, Italy, 4Res. Unit Politecnico di Milano, Inst. Italiano di Tecnologia, Italy, 5Nat. Lab for Ultrafast and Ultraintense Optical Science, Consiglio Nazionale delle Ricerche, Italy. Diffuse optical tomography can be solved by global optimization method (genetic algorithm). For noise-free data, GA can find exact solutions with a probability of 80%. For noisy data, GA has better performance than Tikhonov regularization.

BSuD24
A Finite Volume Method for Fluorescence Diffuse Optical Tomography: Influence on Forward Model and Reconstruction, Ludovic Lecordier1,2, Lionel Herve1, Jean-Marc Doutren, Françoise Peyron3; 1CEA-LETI, MINATEC, France, 2CREATE, INSERM U 630, CNRS UMR 5220, France. This paper presents a finite volume method to compute the forward model in fluorescence diffuse optical tomography. The method is compared to the finite element method in regards of both forward model and reconstruction accuracy.

BSuD25
Photon Diffusion Associated with a Cylindrical Applicator Boundary for Axial Trans-Lumenal Optical Tomography: Experimental Examination of the Steady-State Theory, Anqi Zhang1, Daqing Piao1, Gang Yao2, Brian W. Pogue1; Oklahoma State Univ., USA, 1Univ. of Missouri, USA, 2Dartmouth College, USA. A new approach for steady-state photon diffusion modeling associated with a cylindrical applicator boundary for trans-lumenal optical tomography was evaluated numerically and experimentally. In the diffusion regime the theoretical predictions agree well with experimental findings.

BSuD26
Estimating Signal Detectability in a Model Diffuse Optical Imaging System, Stefano Young, Matthew A. Kupinski, Abhinav K. Jha; Univ. of Arizona, USA. Diffuse optical imaging (DOI) researchers need metrics for quantifying signal detectability to assess different hardware configurations. Using Monte Carlo and statistical model observers, we estimated DOI signal detectability to compare source, signal, and detector parameters.

BSuD27
An Online Modeling and Image Reconstruction Tool for Optical Imaging Based on NIRFAST, Milan Malinsky1, Michael Jermyn1, Brian W. Pogue2, Hamid Dehghani3; 1School of Computer Science, Univ. of Birmingham, UK, 2Thayer School of Engineering, Dartmouth College, USA. An online imaging and Finite Element modeling tool for optical imaging has been developed which allows the user to run problem specific cases, as well as providing an online tutorial for light propagation in tissue.

BSuD28
Empirical Bayesian Regularization of the Inverse Problem for Diffuse Optical Tomography with Multiple Priors, Farras Abdelnour, Theodore J. Huppert; Univ. of Pittsburgh, USA. Image reconstruction of diffuse optical data is underdetermined inverse problem requiring regularization to obtain accurate images. We describe the application of empirical Bayesian methods to obtain optimal regularization levels based on maximizing the log-likelihood function.

BSuD29
Radiative Transfer Equation (RTE) Based Fluorescence Molecular Tomography (FMT) of Drosophila Pupae, Yipong Tan1, Can Zhang2, Lei Zhou2, Huabei Jiang3; 1J. Crayton Pruitt Family Dept. of Biomedical Engineering, Univ. of Florida, USA, 2Dept. of Molecular Genetics and Microbiology, Univ. of Florida, USA. RTE based FMT is implemented for in vivo imaging of drosophila pupae with DiSRed reporter. In vivo DiSRed images obtained are consistent with the in vitro images obtained using confocal microscope.

BSuD30
Robust Algorithm for Automated Source Placement in Near-Infrared Diffuse Imaging, Michael Jermyn1, Brian Pogue1, Subhadra Srinivasan1, Scott Davis2, Hamid Dehghani2; 1Dartmouth College, USA, 2Univ. of Birmingham, UK. A surface-shrinking algorithm is demonstrated for automated source position localization one scattering depth into discretized simulation domains, in near-infrared imaging. The algorithm allows users to accurately place source fiber locations with minimal guidance.
BSuD31 Large Dataset DOT Breast Image Reconstruction, Saurav Pathak, Regine Choe, Han Y. Ban, So H. Chung, Arjun G. Yodh, Univ. of Pennsylvania, USA. We present a computational framework to simulate and analyze a large dataset DOT breast imaging instrument.

BSuD32 Hybrid Level-Set Segmentation of MRI on Optical Properties, Chunxiao Chen1, Jianzi Wu1, Adam T. Eggesbrecht1, Brian R. White2, Budong Chen1, Samuel Achilefu3, Joseph P. Culver4, Nanjiang Univ. of Aeronautics and Astronautics, China, 1Washington Univ. in St. Louis, USA, 2Beijing Friendship Hospital, China. A hybrid level-set segmentation approach based on T1W, T2W and PDW head MR scans is developed to segment scalp-skull, CSF, and brain. Similarity index successfully demonstrated its segmentation with acceptable accuracy for DOT reconstruction requirements.

BSuD33 Time-Domain Diffuse Fluorescence Tomography: A Featured-Data Scheme and Experimental Validation, Feng Gao, Limin Zhang, Jian Li, Huijuan Zhao, Tianjin Univ., China. This paper presents a featured data methodology for time-domain diffuse fluorescent tomography, including both the multi-channel TCSPC-based experimental setup and the image reconstruction algorithm. The feasibility of the proposed techniques is demonstrated using phantom experiments.

BSuD34 Diffuse Optical Tomography of Large Joints: A Phantom Study, Qizhi Zhang, Zhen Yuan, Eric S. Sobel, Huabei Jiang, Univ. of Florida, USA. We present a phantom study to show the ability of diffuse optical tomography for imaging the optical properties of the 'articulate cartilage' in large 'joints'.

BSuD35 Transport-Based Three-Dimensional Image Reconstruction in Optical Tomography, Lei Yao, Huabei Jiang, Dept. of Biomedical Engineering, Univ. of Florida, USA. We implemented a reconstruction algorithm based on the three-dimensional radiative transfer equation (RTE). Reconstruction results obtained indicate that the algorithm can indeed accurately handle the problems with small tissue volumes.

BSuD36 Correction of Artifacts in Angular Domain Imaging, Farhash Vasefi1, Alirea Abkhardehi1, Mohamadreza Najiminia1, Bezaa Kaminski1, Glenn H. Chapman1, Jeffrey J.L. Carson1, Simon Fraser Univ., Canada, 1Lawson Health Res. Inst., Canada, 1School of Medicine, Johns Hopkins Univ., USA. Angular domain imaging (ADI) is defined by the use of an angular filter array as a collimator to restrict detection of multiply-scattered photons. The ADI artifact correction following with image enhancement analysis has been presented.

BSuD37 Artificial Neural Networks-Based Diffuse Optical Tomography, Min-Chan Pan1, Hsian-An Hong1, Liang-Yu Chen1, Min-Cheng Parn1, Natl. Central Univ., Taiwan, 1I-Tung-Nan Univ. of Technology, Taiwan. A scheme is developed by applying the artificial neural networks techniques for the reconstruction of optical-property images instead of using forward and inverse procedures. The proposed scheme is verified by both numerical and experimental data.

BSuD38 Modeling Fluorescence Light Propagation in Arbitrarily Shaped Domains with the Equation of Radiative Transfer on Block-Structured Grids, Ludwiger D. Montejano1, Alexander D. Klöse1, Andreas H. Hirschler1, 1Dept. of Biomedical Engineering, Columbia Univ., USA, 2Dept. of Radiology, Columbia Univ., USA. We solve the frequency domain equation of radiative transfer on block-structured grids (BSG) that are adaptively refined only near boundaries. We compare solutions on BSG to solutions on single finely discretized grids.

BSuD39 Non-Negative Matrix Factorization to Unmix Several Fluorescence Spectra and Remove Autofluorescence from in vivo Spectrally Resolved Acquisitions, Anne-Sophie Montcuquet1, Lionel Herve2, Fabrice P. Navarro1, Jean-Marc Dinten1, Jerome I. Mars1, 1CEA LETI Mines, France, 2Capua-lab, DIS, France. Plurality of specific fluorescent markers in multiplexing, and autofluorescence of biological tissues limit specific fluorescence detection. A spectroscopic approach and a blind source separation method are proposed to unmix multiple fluorescence spectra and remove autofluorescence.

BSuD40 Monte Carlo Analysis of Single Fiber Reflectance Path Length and Sampling Depth, Stephen C. Kanick, Dominic J. Robinson, H.J.C.M. Sterenborg, Arjen Aneelink; Erasmus Medical Ctr., Netherlands. We utilize a Monte Carlo model to simulate single fiber reflectance measurement of a homogeneous turbid medium and describe the dependence of photon path length and sampling depth on fiber diameter and optical properties.

BSuD41 Light Diffusion in Turbid Media of Different Geometries in the Steady-State, Frequency, and Time Domains, Alvin Kienle, Andre Liemert; Inst. für Laserotechnik in der Medizin and Meßtechnik, Germany. Analytical solutions of the diffusion equation were derived for N-layered turbid media in the steady-state, frequency, and time domains having cylindrical, cuboidal and semi-in finite geometries. As source a pencil and a flat beam were considered.

BSuD42 Fast Monte Carlo Simulations for Quantifying Optical Properties from Short Source-Detector Separation Geometries, Jonathan T. Elliott1, Mamadou Diop2, Ting-Yin Lee3, Keith St. Lawrence3, Kenneth M. Tschauer1, 1Lawson Health Res. Inst., Canada, 2Dept. of Medical Biophysics, Univ. of Western Ontario, Canada, 3Imaging Labs, Robarts Res. Inst., Canada. Quantitative fluorescence lifetime imaging requires an accurate knowledge of imaging medium optical properties. The efficacy of a fast Monte Carlo to determine optical properties at short source-detector distances, required for depth-resolved epi-illumination FLI, is presented.

BSuD43 Optical Diffuse Reflectance in Anisotropic Media, Ali Shuaib, Gang Yao, Univ. of Missouri at Columbia, USA. We simulated optical diffuse reflectance in fibrous scattering media. We found the equi-intensity distribution of surface reflectance obtained using anisotropic diffuse equation is similar to Monte Carlo simulation results when fiber diameter is small.

BSuD44 Laplace-Domain Diffuse Optical Tomography System, Nanguang Chen; Natl. Univ. of Singapore, Singapore. We propose a novel design of Laplace-domain diffuse optical tomography. Laplace-domain measurement of diffuse photons can be obtained directly and data acquisition speed can be significantly improved.

BSuD45 Time-Resolved Broadband Diffuse Spectroscopy Using a Differential Absorption Approach, Antonio Pifferi, Andrea Bassi, Lorenzo Spinelli, Rinaldo Cubeddu, Paola Taroni; Politecnico di Milano, Italy. The ratio of time-resolved diffuse measurements at different wavelengths, interpreted with the Beer-Lambert law, provides the spectral changes in the absorption spectrum. The applicability of this approach is discussed with models, simulations and phantom measurements.

BSuD46 Monte Carlo Simulations of Time-Resolved Fluorescence in Two-Layered Model of Human Head, Daniel Milej, Anna Gerega, Piotr Szarek, Norbert Želek, Michał Kacprzak, Roman Maryniak, Adam Liebert; Inst. of Biocybernetics and Biomedical Engineering, Polish Acad. of Sciences, Poland. Monte Carlo simulations were applied for analysis of time-resolved fluorescence signals excited in dye distributed in two-layered tissue model mimicking human head. Obtained results allow for optimization of the time-resolved fluorescence detection setup.
A Real-Time Artifact Reduction Algorithm of Short-Separation Optical Probe Based on Precision Threshold, Weitao Li, Zhiqiu Qian, Di Xiao; Nanjing Univ. of Aeronautics and Astronautics, China. Short-separation optical probe has “look-ahead distance”, which makes boundary of different tissues blurred. A real-time algorithm based on instrument precision was proposed to reduce the artifact. The algorithm was validated by the multi-layer phantom models.

Approximation Error Approach for Compensating Modelling Errors in Optical Tomography, Tanja Tarvainen1, Ville Koivikko2, Aki Pulkkinen2, Marko Vauhkonen1, Martin Schweiger3, Simon R. Arridge1, Jari P. Kaipio4; 1Univ. of Eastern Finland, Finland, 2Univ. College London, UK, 3SUNYbrook Res. Inst., Canada, 4Univ. of Auckland, New Zealand. The applicability of the Bayesian approximation error approach to compensate for the discrepancy of the diffusion approximation in optical tomography close to the light sources and in weakly scattering sub-domains is investigated.

Optimized Wavelength Selection and Normalization in Spectral Near Infrared Tomography, Hamid Dehghan1, Ian B. Styles1, Mattea E. Eames2, Brian W. Pogue3; 1School of Computer Science, Univ. of Birmingham, UK, 2School of Physics, Univ. of Exeter, UK, 3Thayer School of Engineering, Dartmouth College, USA. Optimized bands of wavelengths in spectral optical imaging is presented showing improvement in cross talk between parameters. A normalization technique is presented which creates a more uniform update within a spectral image reconstruction model.

Diffuse Optical Tomography of Heterogeneous Fluorophore Lifetimes, Ralph E. Notbohm; Mikhail Y. Berezin, Samuel Achilefu, Joseph P. Culver; Washington Univ. School of Medicine, USA. We examine the fractional contributions of individual fluorophore in heterogeneous samples, previously demonstrated in cuvette and FLM, with diffuse optical tomography. Experimental results from phantoms are compared with simulations at multiple frequencies.

Hyperspectral Excitation-Resolved Fluorescence Tomography with the SP3 Equations, Alexander D. Klose; Columbia Univ., USA. The proposed image reconstruction method exploits the spectrally dependent optical properties of biological tissue for the purpose of three-dimensional fluorescent source reconstruction. Its light propagation model is based on the SPN equations with order N=3.

Time Resolved Diffuse Optical Tomography Using a Digital Light Processor, Vivek Venugopala, Jin Chen, Frederic Lesage1, Xavier Intos1; 1Renneslaer Polytechnic Inst., USA, 2École Polytechnique de Montréal, Canada. We report on the development of a time-resolved diffuse optical imager based on patterned light illumination. The system allows for fast multi-spectral acquisition of spatially dense time domain data sets for high-fidelity tomography.

Modeling Spectral Dependence of Reduced Scattering Coefficient for Continuous Random Media with the Born Approximation, Jeremy D. Rogers, Iker R. Capoglu, Valentiya Stepanova, Vladimir M. Turzhitsky, Vadim Backman; Northwestern Univ., USA. The power law dependence of reduced scattering coefficient on wavelength is derived for continuous random media using a three parameter model of index correlation function by applying the Born approximation.

The Pain and Gain of DC-Based Diffuse Optical Tomography Reconstruction—New Insights into an Old-Like Problem, Guan Xu1, Daqing Piao1, Charles F. Botttg, Hamid Dehghan2; 1School of Electrical and Computer Engineering, Oklahoma State Univ., USA, 2School of Computer Science, Univ. of Birmingham, UK. For diffuse optical tomography reconstruction, DC-based method outperforms frequency-domain method in background artifacts, at the known cost of increased coupling between absorption and scattering. The differences of these methods diminish when spatial priors are available.

Solutions to the Radiative Transport Equation for Non-Uniform Media, Ahtimas K. Jha, Matthew A. Kapinski, Dongzal Kang, Eric Clarkson; College of Optical Sciences, Univ. of Arizona, USA. A method for modeling the 3-D propagation of photons in non-uniform media based on the radiative transport equation is presented and demonstrated to work on homogeneous and heterogeneous tissue-like phantoms.

Quantitative Cerebral Blood Flow and Angiography with Optical Coherence Tomography, Vivek J. Sririvasana, Dmitriy N. Atosch1, James Y. Jiang, Harsha Radhakrishnan1, Mohammad A. Yaseen1, Steliana Kruvinzkaia1, WeiCheng Wu1, Scott Barry1, Alex E. Cable1, Paul L. Huang1, David A. Boa1; 1Athinoula A. Martins Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA, 2Cardiology Div. and Cardiovascular Res. Ctr., Massachusetts General Hospital, USA, 3Thorlabs, Inc., USA. We perform regional cerebral blood flow measurements using Doppler OCT in the rat cortex and validate our results with hydrogen clearance. 3-D angiography of cortical microvasculature is demonstrated, enabling rapid assessment of perfusion and tone.

Development of a Microfluidic Method for Analysis of Circulating Tumor Cells, Hangoup Kim, Sinheii Vishniakou, Sanhita Dixit, Gregory W. Faris, SRI Intl., USA. Circulating tumor cells can provide important diagnostic information using blood samples instead of direct biopsy of a solid tumor. We report development of an optical microfluidics method for molecular analysis of circulating tumor cells.

Spectrally Encoded Fluorescence Imaging Based on a Wavelength-Swept Source, Mathias Stumpfer, Etienne De Montigny, Dominic Mernoine, Caroline Boudoux; École Polytechnique de Montréal, Canada. A novel spectrally encoded fluorescence imaging system based on a wavelength-swept laser is presented. High resolution (115x1160 pixels) images of a microfluidic system filled with quantum dots were acquired at 7fps.

Mueller Matrix Microscopy, Mircea Mijat, Nicueru Iftimia, Robert D. Ferguson, Daniel X. Hammer; Physical Sciences Inc., USA. We describe here a new imaging technique, Mueller matrix microscopy, for investigating the anisotropic properties of the refractive index in biological samples. The system’s capabilities are demonstrated first on mica, quartz and biological samples.

Vertical Cross-Sectional Imaging by a Miniature Dual-Axes Confocal Microscope, Zhen Qiu, Zhongqiao Liu, Katsuo Karasuyaoshi, Kenn Oldham, Thomas D. Wang; Univ. of Michigan, USA. We present a miniature dual-axes confocal microscope with vertical cross-sectional (X-Z) imaging which is based on a 1-D MEMS scanner and a piezoelectric micro-motor. Images are acquired at 2 Hz (fps) with a large field-of-view.

Localized Surface Plasmon Microscope for Simultaneous Imaging of Reflective Index and Fluorescence Distributions: Fluorescence Enhancement by Annular Pupil Illumination, Goro Terakado, Hiroshi Kana; Muroran Inst. of Technology, Japan. We report on fluorescence enhancement in the localized surface plasmon microscopy for a simultaneous measurement of reflective index and fluorescence images. A theoretical calculation and an experiment reveal the efficacy of annular pupil illumination.
BSuD63
Fourier Transform-Second-Harmonic Generation Imaging of Collagen Fibers in Biological Tissues, Raghu Ambekar

Ramachandra Rao, Monal R. Mehta, Scott Leitheim, Kinmani C. Toussaint Jr; Univ. of Illinois at Urbana Champaign, USA. Fourier transform-second-harmonic generation imaging is presented to quantitatively describe the collagen fiber organization in biological tissues. Further, we use this technique to compare the information content in forward and backward SHG images.

BSuD64
Analytic Modeling of 3-D Structure of Biologic Cells Using a Gaussian Random Sphere Method, Marina Morave, R. S. Broek, Xia-Hua Hui, Jun Q. Lu; 1East Carolina Univ., USA; Virginia Commonwealth Univ., USA.
The 3-D structure of biologic a cell is modeled using Gaussian random sphere method with the shape statistical parameters extracted from processed z-stack confocal microscopic images of the cell in form of fitted ellipsoid.

BSuD65
Accuracy of Hemoglobin Recovery Using 3-D Image Guided Near Infrared Spectroscopy, Hamid R. Ghadyni, Sabahara Sriniavan, Michael M. Mastanduno, Brian W. Pogue, Keith D. Paulsen; Dartmouth College, USA. Accuracy and resolution of image guided near-infrared spectroscopy for breast imaging is characterized through simulations of varying contrasts and sizes. Results show errors of 4% for sizes greater than 20mm, but higher for smaller sizes.

BSuD66
In vivo Characterization of Myocardial Infarct Using Optical Spectroscopy, Po-Ching Chen, Yulin Te, Wei-Chiang Lin; Florida Int'l Univ., USA.
An animal study was carried out to validate the feasibility of developing an optical tissue characterization system, based on combined diffuse reflectance and fluorescence spectroscopy, to delineate and grade a myocardial infarct in vivo.

BSuD67
A Clinical Investigation on X-Ray Guided Three-Dimensional Diffuse Optical Imaging of Osteoarthritis in the Finger Joints, Zhen Yuan, QiZhi Zhang, E. Sobel, Huabei Jiang; 1Dept. of Biomedical Engineering, Univ. of Florida, USA, 2School of Medicine, Univ. of Florida, USA. X-ray guided diffuse optical imaging is used to investigate the typical findings that can detect osteoarthritis in the finger joints. The reconstruction results showed these functional imaging parameters can diagnose OA and monitor its progression.

BSuD68
Diffusion Approximation and Higher-Order Diffusion Equations for Optical Tomography of Osteoarthritis: A Comparable Study, Zhen Yuan, Huabei Jiang; Dept. of Biomedical Engineering, Univ. of Florida, USA. A higher-order diffusion model is employed for optical tomography of osteoarthritis. The use of higher order model in a stand-alone framework provides significant improvement in reconstruction accuracy. However, this is not the case in the image-guided setting.

BSuD69
X-Ray Guided Three-Dimensional Diffuse Optical Tomography of Osteoarthritis and Psoriatic Arthritis in Finger Joints: A Comparable Study, Zhen Yuan, QiZhi Zhang, E. Sobel, Huabei Jiang; 1Dept. of Biomedical Engineering, Univ. of Florida, USA; 2School of Medicine, Univ. of Florida, USA. X-ray guided optical tomography is used to investigate the quantitative and typical optical findings that can distinguish between osteoarthritis, psoriatic arthritis and healthy joints. Reconstruction results show the optical properties between them are clearly different.

BSuD70
We use near-infrared diffusing-wave spectroscopy to non-invasively measure the contraction of skeletal muscle in humans with a temporal resolution of 6 ms. Muscle strain is determined by using the analytical solution of the correlation-diffusion equation.

BSuD71
Post-Surgical Cerebral Autoregulation in Neonates with Congenital Heart Defects Monitored with Diffuse Correlation Spectroscopy, Erin M. Buckley, Donna A. Goff, Turgut Durduran; 1Univ. of California, Davis, USA; 2Univ. of California, San Francisco, USA. Following cardiac surgery, diffuse correlation spectroscopy measures cerebral blood flow changes in neonates with congenital heart defects. Using statistical correlations with mean arterial pressures, we explore an "autoregulation index" to define periods of impaired autoregulation.

BSuD72
EEG and Time-Domain fNIRS Co-Registration during a Divided Attention Task, Davide Contini, Erika Moltberi, Rebecca Re, Matteo Caffini, Anna Maria Bianchi, Lorenzo Spinelli, Giuseppe Baselli, Sergio Cerutti, Rinaldo Cadeddu, Alessandro Torricelli; Politecnico di Milano, Italy; 1IFN-CNRS, Inst. di Fotonica e Nanotecnologie, Sezione di Milano, Italy. We present preliminary results on 17 subjects regarding simultaneous acquisition of electroencephalography (EEG) and time-domain fNIRS during a divided attention task.

BSuD73
In vivo Micron Scale Arthroscopic Imaging of Human Knee Osteoarthritis with Optical Coherence Tomography: Comparison with MRI and Arthroscopy, Kathy Zheng, Scott D. Martin, Chris H. Rashidifard, Bin Liu, Cara Stabile, Mark E. Brezinski; Brigham and Women's Hospital, USA. A clinical need exists for a technology to identify early osteoarthritis. This study performs in vivo human arthroscopic OCT imaging with MRI and arthroscopic comparisons, demonstrating OCT as a promising method for identifying early OA.

BSuD74
The Effects of Acetic Acid on Mammalian Cells, Oana Marina, Antoine Trujillo, Claire Sanders, Kassidy Barnett, James P. Freyer, Judith R. Mournat; Los Alamos Natl. Lab, USA. Effects of the contrast agent, acetic acid, on mammalian cells are studied using light scattering measurements, viability and fluorescence pH assays. Results depend on whether cells are in PBS or are live and metabolizing.

BSuD75
Spatiotemporal Analysis Developed for Functional Diffuse Optical Imaging and Its Clinical Applications, Fenghua Tian, Sameer Dhamne, George Alexandrakis, Frank A. Kozel, Mauricio R. Delgado, Hamli Liu; 1Univ. of Texas at Arlington, USA; 2Univ. of Texas Southwestern Medical Ctr. at Dallas, USA. A spatiotemporal analysis method is developed for diffuse optical Imaging of brain functions. The approach is applied to the data measured from children with cerebral palsy and from normal adults during repetitive transcranial magnetic stimulation.

BSuD76
Optical Imaging of Transformed Breast Epithelial Cells and Breast Tumor Microenvironment, Veronica Leaudt; Vivian Mack, John N. Wright, Jing Liu, Dihua Yu, Rebecca R. Richards-Kortum; 1Rice Univ., USA, 2U.T. M.D. Anderson Cancer Ctr., USA. Optical imaging of endogenous fluorophores and exogenous contrast agents can be used to assess changes in cellular metabolism and tumor microenvironment that relate to breast cancer progression.

BSuD77
Multi-Modality Microendoscope, Houssine Makhlouf, Andrew R. Roue, Arthur F. Gmitro; 1Dept. of Radiology and College of Optical Sciences, USA; 2Dept. of Radiology, USA. An innovative multi-modality microendoscope is described that combines a parallelized point scanning multi-spectral confocal microendoscope with optical coherence tomography imaging. The system is intended for in vivo diagnosis of early stage diseases. Preliminary results are provided.
BSuD78
Diffuse Optical Detection of Cerebral Ischemia During Carotid Endarterectomy
Yu Shang1, Ran Cheng2, Lixin Dong3, Shu P. Sahat4, Guoqiang Yu5; 1Ctri. for Biomedical Engineering, Univ. of Kentucky, USA; 2Dept. of Cardiovascular Surgery, Univ. of Kentucky, USA. Cerebral blood flow and oxygenation were measured by diffuse optical tomography during carotid endarterectomy (CEA). The results demonstrate high sensitivity of diffuse optical tomography in detecting cerebral ischemia due to arterial clamping during CEA.

BSuD79
Time-Resolved Near-Infrared Technique for Quantitative Measurements of Cerebral Blood Flow
Mamadou Diop1,2, Kenneth Tichauer1,2, Mark Miquiss, Ting Yim Lee3, Keith St. Lawrence3,4, Lowner Health Res. Inst., Canada, 1Dept. of Medical Biophysics, Univ. of Western Ontario, Canada. A time-resolved near-infrared method for absolute cerebral blood flow measurements was developed. To validate the time-resolved technique, we compare it to our established continuous-wave method for quantitative brain perfusion measurements in new born piglets.

BSuD80
Diffuse Optical Spectroscopies for Evaluation of Muscle Hemodynamic Enhancements by Electrical Stimulation
Yu Shang1, Youquan Zhao1, Ran Cheng2, Lixin Dong3, Daniel Irwin4, Karin R. Suarez5, Sara S. Salles6, Guoqiang Yu7; 1Ctri. for Biomedical Engineering, Univ. of Kentucky, USA; 2Dept. of Neurosurgery, Univ. of Kentucky, USA; 3Dept. of Physical Medicine and Rehabilitation, Univ. of Kentucky, USA. Muscle blood flow and oxygenation were continuously monitored by diffuse optical spectroscopies during electrical stimulation (ES). Muscle blood flow increased significantly during 5-minute ES and remained high for more than 15 minutes after ES.

BSuD81
Laser-Induced Breakdown (LIB) of Optically Trapped Nanoparticles for Gene Transfection
Yoshihiko Arita1, Maria Leilani Torres-Mapa, Woei Ming Lee2, Tomáš Čizmár, Frank J. Guinn-Moor3, Kishan Dholakia4; Univ. of St. Andrews, UK. A novel approach to gene transfection is demonstrated. It uses laser-induced breakdown of an optically trapped single nanoparticle to achieve a high transfection efficiency in a quasi-targeted manner, without cell lysis, using a nanosecond laser.

BSuD82
Fluorescence Bioimaging with Integrin-Targeting Block Copolymer Probes
Sanchita Biswas1, Xiahua Wang1, Alma R. Morales1, Kevin D. Belfield1; Univ. of Central Florida, USA. The synthesis of water soluble block copolymers conjugated with a hydrophobic 2PA fluorescent probe and RGD for bioimaging and toxicity studies for specifically target the αvβ3 integrin over-expressing human epithelial U87MG cell lines was demonstrated.

BSuD83
Double Negative Optical Trapping, Leonardo A. Ambrosio1, Hugo E. Hernandez-Figueroa1, Unicamp - Univ. of Campinas, Brazil. Gradient forces in optical trapping for double-negative (DNG) particles are analyzed using full electromagnetic theory for both ordinary Bessel and focused Gaussian beams. Unusual and interesting behaviors reveal new potentialities for research in biomedical optics.

BSuD84
Correlation of Blood Flow and Systemic Physiology in Mice Tumor Models in Photodynamic Therapy
Hong-Wen Wang1,2, Steven Schenk2, Richard C. Mesquita3, Arjan G. Yobi4, Theresa M. Buschi5; 1Dept. of Physics and Astronomy, Univ. of Pennsylvania, USA; 2Inst. of Biophotonics, Natl. Yang-Ming Univ., Taiwan; 3Dept. of Radiation Oncology, Univ. of Pennsylvania, USA. Blood flow in mice tumor models was measured with Diffuse Correlation Spectroscopy and compared to concurrent physiology monitoring. Positive correlations were (not) found between flow and heart (breath) rate during anesthesia periods.

BSuD85
Depth Resolved Size and Shape Measurements of Aspherical Scatterers Using Two Dimensional Angle Resolved Low Coherence Interferometry
Michael G. Giacomelli1, Yizeng Zhu1, John Lee1, Adam Wax1; Duke Univ., USA. We investigate the use of two dimensional angle resolved scanning fiber light scattering, interferometry combined with T-matrix-based inverse analysis for measuring the size and shape of aspherical scatterers as a means of detecting dysplastic tissue.

BSuD86
Transport-Based Quantitative Photoacoustic Tomography
Lei Yao1, Yuan Sun2, Huabei Jiang3; Dept. of Biomedical Engineering, Univ. of Florida, USA. A method based on the radiative transfer equation (RTE) coupled with the photoacoustic equation is presented. It provides quantitatively and significantly improved image reconstruction for the cases where the photon diffusion approximation may fail.

BSuD87
Frequency-Domain Optical Tomography of Arthritic Joints
Andreas H. Hielscher1, Hyun K. Kim1, Ulve Netz1, Ludgero Montejo1, Christian D. Klose1, Sabine Blaschke2, P. A. Zsak1, Gerhard A. Müller1, Jürgen Beuthan1, 1Columbia Univ., USA, 2Laser- und Medizin-Technologie GmbH, Germany, 3Georgia-August-Univ., Germany, 4Charite-Medical Univ., Germany. Presenting data from the largest clinical trial on optical tomographic imaging of finger joints to date, we show that sensitivities and specificities better than 0.89 can be achieved, using frequency-domain techniques and advanced classification methods.

BSuD88
Exploiting the Potential of Hybrid FMT/XCT Imaging by Means of Segmentation
Marcus Freger1, Angelique Ale1, Ralf B. Schulz1, Vanilis Ntzachiastri1, Karl-Hans Engmeier1, Helmholtz Zentrum München, Inst. of Biological and Medical Imaging, Germany. Hybrid FMT/XCT systems enable us to improve optical tomography image quality by using image priors in the reconstruction algorithm. We propose segmentation techniques to extract those priors and demonstrate their utilization in FMT image reconstruction.

BSuD89
Time-Correlation Data Analysis of Fluorescence Imaging Based Diagnosis of Rheumatoid Arthritis
Daniel Biswas1,2, Carmen Weißbach1, Jan Voigt1, Alfred Walter1, Birgit Ebert1, Rainer Maclonald1, Michael Berliner1, Birgit Berliner1, Daniel Bauer1, Jens Oest1, Ilka Oest1, Thomas Hirsch1; Physikalisch-Technische Bundesanstalt, Germany, Helios Klinikum Berlin-Buch, Germany, Helios Res. Ctr., Germany, Helios Klinikum Bad Saarow, Germany. The dye ICG was investigated in a clinical study for evaluation of rheumatoid arthritis using fluorescence imaging. Two moments of correlated time series of fluorescence intensities were analysed to differentiate healthy subjects from diseased.

BSuD90
The Confounding Effect of Systemic Physiology on the Hemodynamic Response in Newborns
Benedict H. Zimmerman1, Nadge Roche-Labarbe1, Andrea Sauv01, David A. Bos1, Ellen Grant1, Maria Angela Franceschini1,2; Massachusetts General Hospital, USA, 1Children’s Hospital Boston, USA. In preterm newborns evoked hemoglobin responses to auditory stimulation are strongly affected by baseline hemodynamic physiology.

BSuD91
Simultaneous Optical Coherence Tomography and Electrophysiology Measurements to Investigate Neurovascular Coupling in Rats
Harsha Radhakrishnan, Vivek J. Srinivasan1, James Y. Jiang1, Mohammad A. Yaseen1, Weicheng Wu2, Scott Barry3, Alex Cable3, David A. Bous4, Maria Angela Franceschini1,2; Athinoula A. Martinos Ctr. for Biomedical Imaging, USA, 1Thor Labs, USA. Simultaneous measurements with microelectrodes and frequency domain optical coherence tomography were done on rats to investigate neurovascular coupling. Neuronal and vascular responses to parametric forepaw stimulation were found to be in agreement under different anesthetics.
BSuD92 Imaging Heterogeneous Absorption Distribution of Advanced Breast Cancers Using Optical Tomography Guided by Ultrasound, Yan Xu, Quing Zhu, Univ. of Connecticut, USA. The distribution of tumor vasculature in advanced cancers is complex. In this paper, we characterize the heterogeneous absorption distribution of large targets. A clinical example is given to demonstrate the complexity of tumor vasculature.

BSuD93 Photoacoustic Microscopy and Spectroscopy of Individual Red Blood Cells, Min Rui, Wolfgang Besl, Eike Weiss, Robert Lemor, Michael C. Kolios; 1 Ryerson Univ., Canada, 2 Fraunhofer Inst. for Biomedical Technology, Germany, 3 Heidelberg GmbH, Germany. Opticalacoustic imaging relies on the ultrasonic detection of pressure waves created after optical absorption. In this work we demonstrate imaging single red blood cells using an ultrasonic detection system at 200 and 400 MHz.

BSuD94 Instrumentation and Methodology for Bedside Monitoring of Cerebral Perfusion by Optical Bolus Tracking, Olivier Steinkeleiner, Heidrun Wehrnitz, Alexander Jelzwa, Clemens Gruber, Jens Steinbrink, Hellmut Obrig, Rainer Macdonald, 1 Physikalisch-Technische Bundesanstalt, Germany, 2 Klinik für Neurologie und Ctr. for Stroke Res. Berlin, Charité-Univ. Medizin Berlin, Germany. We present a time-domain near-infrared reflectometry device applied in a clinical study. Instrumentation was optimized pertaining to reliability and rapid applicability. Using signal analysis based on statistical moments, suppression of motion artifacts can be achieved.

BSuD95 Time Resolved Optical Imaging with Patterned Light for Pre-Clinical Studies, Jin Chen, Xavier Intes; Knesseler Politechnic Inst., USA. We investigated the performance of the time-gated Diffuse Optical Tomography based on Monte Carlo model with patterned wide-field illumination on a mouse model. The reconstructions outperform classical punctual excitation schemes for similar data sizes.

BSuD96 A Compact, Cost-Effective Spectral Imaging Device for Quantitative Tissue Absorption and Scattering, Justin Y. Lau, Bing Yu, Henry L. Fa, Thomas F. Kuech, Nirmala Ramanujam; 1 Duke Univ., USA, 2 Univ. of Wisconsin, USA. A compact, cost-effective spectral imaging for breast tumor margin assessment is designed. The performance of a single-pixel version of the device is validated with phantom studies. Absorption and scattering coefficients are extracted with high accuracy.

BSuD97 Quantitative Imaging of Molecular Order in Lipid Membranes Using Two-Photon Fluorescence Polarimetry, Alicia Gasecka, Tsai-Jung Han, Cyriel Favard, Sophie Brasslett, Inst. Fresnels - MOSAIC group, France. Complex molecular orders in heterogeneous Giant Unilamellar Vesicle as well as cell membranes are investigated using polarization resolved two-photon fluorescence microscopy. This method provides local structural information that cannot be achievable using traditional anisotropy measurements.

BSuD98 Fiber Delivered Probe for Efficient CARS Imaging of Tissues, Mihaela Balu, Gangqun Liu, Zhongying Chen, Eric Potma, Bruce Tromberg, Beckman Laser Inst., Univ. of California, Irvine, USA. We present a fiber-based probe for maximum collection of the Coherent anti-Stokes Raman Scattering (CARS) signal of tissues. Design challenges are discussed and images of a variety of tissues using the hand-held probe are presented.

BSuD99 3-D Visualization of Intrinsic Contrast in Neoplastic Colon Tissue Using Hyperspectral Two-Photon Microscopy, Lauren Grosberg, Andrew J. Radesveich, Samuel Asfaha, Xiandong Yang, Timothy C. Wang, Elizabeth M. C. Hillman; Columbia Univ., USA. Hyperspectral two-photon imaging of endogenous fluorescence and SHG allows 3-D visualization of gastrointestinal tissue without slicing or staining. A study of the morphological changes that occur in two mouse models of cancer is presented.

BSuD100 Multi-color Excitation Nonlinear Microscopy of Biological Tissue, Dong Li, Wei Zheng, Jianan Y. Qu; Hong Kong Univ. of Science and Technology, Hong Kong. A two-photon microscope of excitation sources from femtosecond laser and supercontinuum generation from a photonic crystal fiber was developed for the imaging of biological tissue. Its potentials for the diagnosis of tissue pathology are demonstrated.

BSuD101 Fiber Laser and Handheld Probe Based Multiphoton Microscope, Gangqun Liu, Khanh Kia, Frank W. Wise, Zhongying Chen; 1 Beckman Laser Inst., USA, 2 School of Applied and Engineering Physics, Cornell Univ., USA. A compact multiphoton microscopy (MPM) system with a femtosecond fiber laser and double clad photonic crystal fiber based handheld probe is designed and demonstrated. Multiphoton images of biological tissue were demonstrated.

BSuD102 Multicontrast Nonlinear Microscopy for Cancer Diagnostics Using H&E Stained Thick Histological Sections, Adam Tuier, Richard Cisek, Jennifer Alamii, John Rowlands, Virginijus Barzdzi; 1 Dept. of Chemical and Physical Sciences, Univ. of Toronto, Canada, 2 Sunnybrook Health Sciences Ctr., 3 Dept. of Medical Biophysics, Univ. of Toronto, Canada. Hematoxylin and eosin (H&E) stained histological sections were investigated with multicontrast second- and third-harmonic generation and multiphoton excitation fluorescence microscope. Three dimensional visualization of 50 microns thick histological sections may aid in early cancer diagnostics.

BSuD103 Digital Staining of Confocal Mosaics for Clinical Pathology, Nathaniel Chen, Jordan Sessingham, Kevin White, Todd Takiguchi, Steve Jacques, Anna Bar, Daniel S. Garcea; Dept. of Surgery and Biomedical Engineering, Oregon Health and Science Univ., USA. Digital staining of multimodal confocal mosaics may be necessary for clinical acceptance. We determined the appropriate color and weight for transformation from grayscale to resemble hematoxylin and eosin-stained fixed sections.

BSuD104 Determination of Burn Depth Based on Depth-Resolved Second-Harmonic-Generation Imaging of Dermal Collagen, Takeshi Yasui, Kamihiko Sisaki, Kyoko Tanaka, Shu-ichiro Fukushima, Tsutomu Araki, Osaka Univ., Japan. We applied depth-resolved second-harmonic-generation imaging of dermal collagen fiber for estimating burn in fresh chicken skin. Depth and area of the burn was visualized by difference of image contrast between burned and sound area.

BSuD105 Identafit®3800 ultra A Multispectral Tool For Improved Oral Lesion Evaluation, Andreas J. Zhuang, R. N. Vigneswaran, R. K. Bradley, J. M. Gillenwater, C. M. Nichols, C. Poli; Remiscale LLC, USA, 1 Univ. of Texas Dental Branch at Houston, USA, 2 Univ. of Texas M. D. Anderson Cancer Ctr., USA, 3 Berin Omega Dental Clinic, USA, British Columbia Cancer Agency, USA. A novel multispectral, autofluorescence and reflectance tool has been developed to improve differentiation of lesions from normal tissues. We report excellent results on a multi-center referral cohort of 120 patients, and the screening implications.

BSuD106 Assessment of Wound Healing with DPDW Methodology in Obese Rats, Michael Neisseruer, Leonid Zakharov, Michael S. Weinigarten, Kambiz Pourrezai, Elisabeth S. Papazoglou; Drexel Univ., USA. Wound healing was monitored in obese rats using Diffuse Photo Density Wave (DPDW) methodology of Near Infrared optical spectroscopy. Changes in the measured optical absorption coefficients reflected the various stages of wound healing.
BSuD107
Sentinel Lymph Node Detection by an Optical Method Using Scattered Photons, Franklin Tellier1, Herve Simon1, Renee Chatrier1, Rasata Ravelo1, Patrick Poulet1; 1Lab d’Imagerie et de Neurosciences Cognitives, Universite de Strasbourg/CNRS, France, 2Eurorad, France. A near infrared optical method of sentinel lymph node detection, based on the recording of scattered photons is presented. Different wavelengths are used, to improve the detection threshold of injected Patent Blue Violet dye.

BSuD108
Feasibility Study of Volumetric Diffuse Optical Tomography in Small Animal Using CCD-Camera-Based Imaging System, Zi-Jing Lin, Haijing Niu, Hanli Liu; Univ. of Texas at Arlington, USA. We report the feasibility of 3-D volumetric diffuse optical tomography for small animals using a CCD-camera-based imaging system with the novel depth compensation algorithm. It allows 3-D localization of anomaly tissue non-invasively in small animals.

BSuD109
Multi-Channel, Light Reflectance Spectroscopy for Fast Detection of Hemodynamic Changes on the Spinal Cord and the Brain Induced by Electrical Stimulations in Rats, Vikrant Sharma, Jiwei He, Sweta Narvenkar, Yuan Bo Peng, Hanli Liu; Univ. of Texas at Arlington, USA. Multi-channel, light reflectance spectroscopy with thin needle probes is developed for fast detection of neuro-hemodynamic changes induced by electrical stimulations in rats, revealing hemo-nuero pathways and information processing between the spinal cord and the brain.
BSuE • Imaging Theory
Sunday, April 11
4:00 p.m.–6:00 p.m.
Andreas H. Hielscher; Columbia Univ., USA, Presider

BSuE1 • 4:00 p.m.
Finite Element Solution of the Fokker-Planck Equation for Optical Tomography, Ossi Lehtikangas1, Tanja Tarvainen1, Ville Koilomäinen1, Aki Pulkkinen1, Simon Arridge1, Jari P. Kaipio2; 1Dept. of Physics, Univ. of Kuopio, Finland, 2Dept. of Computer Science, Univ. College London, UK. Light propagation is modeled with the Fokker-Planck equation which approximates the radiative transport equation when scattering is forward-peaked. The Fokker-Planck equation is solved with the finite element method.

BSuE2 • 4:15 p.m.
Fast 3-D Reconstruction in Highly Scattering Media Using Structured Light, Cosimo D’Andrea1, Andrea Bassi1, Gianluca Valentin1, Rinaldo Cubeddu1, Simon Arridge2; Politecnico di Milano, Italy, 1Univ. College London, UK. Fast 3-D reconstruction method, based on structured light, has been demonstrated and experimentally validated. Spatial information, resolution and selection of the optimal spatial frequencies are discussed.

BSuE3 • 4:30 p.m.
Fluorescence Tomography with a PDE-Constrained Algorithm Based on the Equation of Radiative Transfer, Hyun Keol Kim1, Jong Hwan Lee1, Andreas H. Hielscher1; Columbia Univ., USA. We introduce the PDE-constrained fluorescence tomography algorithm with a sequential quadratic programming method based on the frequency-domain radiative transfer equation. We show that the PDE-constrained approach leads to 15-fold speedup compared to the unconstrained approach.

BSuE4 • 4:45 p.m.
In vivo Fluorescence Resonance Energy Transfer and Optical Diffusion Tomography Imaging of Targeted Drug Delivery to Tumors, Vathivas Gaind1, Kevin J. Webb1, Sumith A. Kadurugamu2, Philip S. Low2; Purdue Univ., USA. Fluorescence resonance energy transfer (FRET) and optical diffusion tomography (ODT) are used for imaging a model for targeted anti-cancer drug delivery to a tumor in a mouse. Experimental and simulation results are presented.

Biomedical Optics and 3-D Imaging Congress and Exhibition • April 11–14, 2010
**BSuE • Imaging Theory – Continued**

**BSuE5 • 5:00 p.m.**
A Hybrid Finite Element-Boundary Element Method for Modeling Light Propagation in Tissue in 3-D, Subhada Srinivasan, Brian W. Pogue, Keith D. Paulsen; Tuhey School of Engineering, Dartmouth College, USA. A novel hybrid method combining 3-D FE and BE techniques has been implemented for modeling light diffusion combining homogeneous and heterogeneous regions. Results show less than 1% difference in boundary data between the different models.

**BSuE6 • 5:15 p.m.**
Sparse Image Reconstruction in Diffuse Optical Tomography: An Application of Compressed Sensing, Mehmet Süzen, Alexia Giannoula, Peyman Zirak, Nestor Oliverio, Udo Weigel, Parsa Farzam, Turgut Durduran; ICFO-Inst. of Photonic Sciences, Spain. We study Compressed Sensing (CS) framework for optical tomography. Simulations are performed in linear inverse diffuse optical image reconstructions. Potential benefits and shortcomings of CS is discussed.

**BSuE7 • 5:30 p.m.**
A Hadamard Transform Approach towards Robust Fluorescence Molecular Tomography, Ali Behrooz, Ali A. Eftekhar, Pouyan Mohajerani, Ali Adibi; Georgia Tech, USA. Inspired by Hadamard multiplexing technique, a method is proposed to improve noise robustness and minimize estimation error in fluorescence molecular tomography (FMT). Theoretical results are validated by numerical studies of 2-D simulated FMT data.

**BSuE8 • 5:45 p.m.**
Diffuse Optical Tomography Based on Simplified Spherical Harmonics Approximation, Michael Chi, Hamid Dehghan; School of Physics, Univ. of Exeter, UK, School of Computer Science, Univ. of Birmingham, UK. Higher order equations to the diffusion approximation are presented. Reconstruction of diffuse optical parameters where only the forward model is based on these equations is shown to be more accurate reducing image artifacts.

**BSuF • Optical Coherence Tomography – Continued**

**BSuF4 • 5:00 p.m.**
Simultaneous Anatomical and Biochemical Imaging of Biological Tissue Using a Multimodal Optical Coherence Tomography and Fluorescence Lifetime Imaging System, Sehna Sreretha, Jesang Park, Paritosh Pandu, Fred Clabb, Brian Applegate, Javier A. Jo; Texas A&M Univ., USA. We have developed a multimodal optical system for simultaneous optical coherence tomography (OCT) and fluorescence lifetime imaging microscopy (FLIM) imaging, and demonstrate its capability for high-speed co-registered micro-anatomical and biochemical tissue imaging.

**BSuF5 • 5:15 p.m.**
Contrast to Labeled Rehydrated, Lyophilized Platelets Using Magnetomotive OCT, Amy L. Oldenburg, Thomas H. Fischer, Timothy C. Nichols, Caterina M. Gallippi, Raghaav Chhetri, Frank Tsui; Univ. of North Carolina at Chapel Hill, USA. Rehydrated, lyophilized platelets for hemostatic therapy are incorporated with commercial MRI iron oxide contrast agents. We demonstrate that magnetomotive OCT contrasts the platelets and propose this system for monitoring hemorhagic sites targeted by platelets.

**BSuF6 • 5:30 p.m.**
Multimodal Full-Field Optical Coherence Microscopy, C. Moneron, K. Grieve, E. Guiot, J. Morea, C. Boccara, D. Sacchet, P. Georges, Arnaud Dubois; Lab. Charles Fabry de l’Inst. d’Optique, Univ. Paris-Sud, France. We present a full-field OCT system that measures the intensity, the spectrum, and the phase-retardation simultaneously. Imaging is also possible at two wavelengths. By producing multi-contrasted images with high resolution, this technology could replace histology.

**BSuF7 • 5:45 p.m.**
Multimodal Retinal Imager, Mirece Mujat, Robert D. Ferguson, Nicusor Iftimia, Daniel X. Hammer; Physical Sciences Inc., USA. We present a multimodal retinal imaging system that combines AO-corrected scanning laser ophthalmoscopy, swept source Fourier domain optical coherence tomography, wide field line scanning ophthalmoscopy, and retinal tracking in a single compact clinical prototype platform.

**BSuF8 • 6:00 p.m.**
Skin Surgery and Light-CT, B. de Polv, S. Nadolny, D. Saloman, O. de Witte, C. Brassollet, A. C. Boccara; 1LLTech, France, 2Hôpitaux Univ. de Genève, Switzerland, 3Inst. Langevin, Lab d’Optique ESPCI, France. Light-CT offers valuable diagnostics of skin pathologies. We show sections down to sub-nuclei sizes and images of patients’ skins exhibiting Werner syndrome. Light-CT merits are compared to other OCT approaches, confocal and optical coherence microscopy.
### Opening Remarks 7:30 a.m.–8:00 a.m.

**DMA • Fundamental Advances in Holography I**
- Monday, April 12
- 8:00 a.m.–10:00 a.m.
- Ting-Chung Poon; Virginia Tech, USA, Presider

**DMA1 • 8:00 a.m.**
- **Keynote**
  - The Principle of Good Enough (POGE) and the Use of Digital Holography in Sensors, John Caulfield
  - Fisk Univ., USA. POGE (Principle of Good Enough) is shown to yield dramatic new capabilities in optical pattern recognition, optical linear algebra, point source location, and Fourier pattern recognition. POGE has become a powerful template for invention.

**DMA2 • 8:45 a.m.**
- Speckle Correlation in Phase-Shifting Digital Holography, Ichirou Yamaguchi
- Toyo-Seiki Seisakusho, RIKEN, Japan. Digital holography provides 3-dimensional distributions of complex amplitude whereas speckle patterns are highly contrasted everywhere. Cross-correlations of complex amplitude and intensity are derived from phase-shifting digital holography to merge holographic interferometry and speckle metrology.

**DMA3 • 9:00 a.m.**
- One-Shot Digital Holography for Recording Wideband Complex-Amplitude Hologram, Kunihito Sato, Kohei Maejima; Hyogo Univ., Japan. One-shot digital holography is developed for instantaneous recording of wideband complex-amplitude in-line hologram by using the spatial heterodyne modulation. It is possible to enlarge bandwidth of the hologram up to the theoretical upper limit.

**DMA4 • 9:15 a.m.**
- Some Opportunities for Digital Color Holography Using a Stack of Photodiodes, Patrice Tankam
- Pascal PICART, Denis Moulin, Jean Michel Desse, Jean–chang Li; LAUM CNRS, Univ. du Maine, France, \~\textmu;{\textsuperscript{2}}École Nationale Supérieure d’Ingénieurs du Mans, France, \~\textsuperscript{3}IPEC CNRS, Univ. du Maine, France, \~\textsuperscript{4}ONERA, France, \~\textsuperscript{5}Kunming Univ. of Science and Technology, China. A simple set-up for digital color holography in which the reference beam has a unique shaping and recording uses a stacked color sensor is described. A dedicated algorithm allows color object to be fully reconstructed.

### Opening Remarks 7:50 a.m.–8:00 a.m.

**BMA • BIOMED Monday Plenary**
- Monday, April 12
- 8:00 a.m.–10:00 a.m.
- Vasilo Ntziaichristos; Technische Univ. Munchen, Germany, Presider

**BMA1 • 8:00 a.m.**
- Nanotechnology for Molecular Imaging and Image-Guided Surgery, Shuming Nie
- Emory Univ., USA, Georgia Tech, USA. Recent development in bioconjugated nanoparticles opens new opportunities for in vivo molecular imaging and image-guided cancer surgery.

**BMA2 • 8:40 a.m.**
- Development of Optical Imaging Biomarkers and Applications in Drug Discovery and Development, Bohumil Bednar
- Merck Res. Labs, USA. Molecular imaging biomarkers play a critical role in efforts to increase the probability of success of drug candidates, supporting validation of novel drug targets early in the drug discovery and development process.
### DMA • Fundamental Advances in Holography I—Continued

#### DMA5 • 9:30 a.m.

**One-Shot Color Digital Holography Based on the Fractional Talbot Effect, Lluís Martínez-León⁠¹, María A. Aracil-Esquivel⁠¹, Bahram Javidi⁠¹, Pedro Andrés⁠¹, Jesús Lancis⁠¹, Vicent Climent⁠¹, Raúl Martínez-Cuenca⁠¹, Enrique Tajahuerce⁠¹;¹Univ. Jaume I, Spain, ⁠²Univ. Autónoma de Zacatecas, Mexico, ⁠³Univ. of Connecticut, USA, ⁠⁴Univ. de València, Spain.**

We present a method for recording on-axis color digital holograms in a single shot. Our system performs parallel phase-shifting interferometry by using the fractional Talbot effect for every chromatic channel simultaneously. Experimental results are shown.

#### DMA6 • 9:45 a.m.

**20000-Frames-per-Second Phase-Shifting Digital Holography, Yasuhiro Awatsuji⁠¹, Kenichi Ito⁠¹, Yuki Shimozato⁠¹, Takashi Kakue⁠¹, Motofumi Fujiie⁠¹, Tatsuki Tahara⁠¹, Kenzo Nishio⁠¹, Shogo Ura⁠¹, Toshihiro Kabota⁠¹, Osamu Matoba⁠¹;¹Kyoto Inst. of Technology, Japan, ⁠²Kabota Holography Lab Corp., Japan, ⁠³Kobe Univ., Japan.**

The authors demonstrated a phase-shifting digital holography at the rate of 20000 frames/second, for the first time. Thanks to parallel phase-shifting digital holography, the digital holography system succeeded in three-dimensional imaging for dynamically moving objects.
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<td>Joseph Rosen; Ben Gurion Univ., Israel, Presider</td>
<td>Regine Choe; Univ. of Pennsylvania, USA, Presider</td>
<td>Jerome Mertz; Boston Univ., USA, Presider</td>
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**DMB1 • 10:30 a.m.**

*Invited*

Holography and Photopolymer Recording Materials, John Sheridan; Univ. College Dublin, Ireland. Photopolymers act as drivers and enabler of fabrication technologies for applications including refractive/diffractive optical elements, hybrid 3-D optoelectronic circuitry, data storage recording media and self-trapping. The need for and development of modeling tools is discussed.

**DMB2 • 11:00 a.m.**

*Invited*

Nonlinear Digital Holography, Christopher Barsi; Jason Fleischer, Princeton Univ., USA. We extend digital holography, and the techniques of computational imaging in general, to beam propagation in nonlinear media. Nonlinearity mixes high-frequency spatial modes with low-frequency ones, so that reconstruction results in super-resolution of the object.

**BMB1 • 10:30 a.m.**

Computer-Aided Detection of Tumors in 3-D Tomograms from Diffuse Optical Mammography, David R. Busch1, Wenhseng Guo1, Regine Choe1, Turqit Durdur2,3, Mark A. Rosen4, Mitchell D. Schnall5, Mary E. Pilt6, Arijun G. Yodli7,11, Univ. of Pennsylvania, USA, 1IFCO, Spain, 2Hospital de Un. de Pennsylvania, USA. Diffuse optical Tomography provides multi-parameter 3-D images of breast cancer. We introduce a multi-parameter, position, subject analysis to identify signatures of cancer and utilize these signatures to locate cancers in additional subjects.

**BMB2 • 10:45 a.m.**

Multi-Modality Imaging of the Compressed Breast, Stefan A. Carp1, Naige Roche-Labarbe1, Qianqian Fang1, Juliette J. Selb1, David A. Boas1; Massachusetts General Hospital, USA. We use dynamic optical and MR imaging to characterize the hemodynamic behavior of breast tissue under external compression. Preliminary data shows spatial contrast in both optical blood volume time-courses and MR oxygenation dependent (BOLD) images.

**BMB3 • 11:00 a.m.**

Quantitative and Depth-Resolved Fluorescence Techniques for Intraoperative Guidance of Brain Tumor Resection Surgery, Anthony Kim1, Mathieu Roy2, Brian C. Wilson3, Ontario Cancer Inst., Univ. of Toronto, Canada. We have developed a handheld fiberoptic probe for tissue fluorescence quantification and a technique to produce depth-resolved maps of subsurface tumor fluorescence, to elaborate upon intraoperative fluorescence guided resection of brain tumor.

**BMC1 • 10:30 a.m.**

Two-Photon Microscopy of Biological Organisms with Shaped Broadband Pulses, Guillaume Labraillé1, Rajesh S. Pillai1, Caroline Boullon1, Nicolas Olivier1, Xavier Solinas1, Manuel Joffre1, Emmanuel Beaufrepare1, CNRS, École Polytechnique, France. 2École Polytechnique, Canada. We report multiplexed two-photon imaging in vivo with fast pixel rates and micrometer resolution. Using coherent control of the two-photon excited fluorescence, we performed selective microscopy of GFP and endogenous fluorescence in developing Drosophila embryos.

**BMC2 • 11:00 a.m.**

Third Harmonic Generation as a Novel Technique for Imaging Myelin in the Central Nervous System, Matthew J. Farrar1, William Renninger1, Joseph R. Fetcho1, Frank W. Wise1, Chris B. Schaffer1, Cornell Univ., USA. We demonstrate that third harmonic generation provides a suitable modality for imaging myelination on axons in the mouse brain and spinal cord with micrometer resolution both in vivo and ex vivo.

**BMC3 • 11:15 a.m.**

Fiber-Optic Nonlinear Endomicroscopy for Intrinsic Imaging of Biological Tissues, Yicong Wu1, Jiefang Xi1, Xingde Li2, Johns Hopkins Univ., USA. We report on a fiber-optic scanning endomicroscopy system based on a customized double-clad fiber (DCF) and a miniature compound lens that enables two-photon autofluorescence imaging of biological tissues for the first time.
<table>
<thead>
<tr>
<th>Time</th>
<th>Session Title</th>
<th>Details</th>
</tr>
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<tbody>
<tr>
<td>11:30 a.m.</td>
<td>Multidimensional Optical Fractionation with Holographic Verification</td>
<td>Ke Xiao, David G. Grier; Ctr. for Soft Matter Res., USA. Using holographic microscopy to track colloidal particles’ trajectories through designed optical trapping arrays and measure their radii and refractive indexes, we demonstrate the optical fractionation with exceptionally fine resolution in either size or refractive index.</td>
</tr>
<tr>
<td>11:45 a.m.</td>
<td>Second-Harmonic Optimization Method of a Hologram</td>
<td>Youhei Takahashi, Akihiro Takita, Yoshio Hayasumi; Utsunomiya Univ., Japan. We propose a new optimization method of a hologram to improve a uniformity of the diffraction peaks in holographic femtosecond laser processing. The hologram is optimized on the basis of a second-harmonic pattern.</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td>Direct Filtering in Phase Contrast Off-Axis Digital Holography</td>
<td>Daesuk Kim; Chonbuk Natl. Univ., Republic of Korea. We describe a novel direct filtering method which can provide a much faster solution than the conventional spatial filtering approach while maintaining a moderate reconstructed phase quality.</td>
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<tr>
<td>12:15 p.m.</td>
<td>Speckle-Free Holographic Microscopy</td>
<td>Paul Petrucc; Rainer Riesenberg, Mario Kanka, Richard Kowarschik; Inst. of Photonic Technology, Germany, Inst. of Applied Optics, Univ. Jena, Germany. Holographic micro-imaging setups commonly use high coherent laser light sources, which cause coherent noise. It is shown how a partially coherent illumination suppresses the coherent noise and optimizes the imaging quality.</td>
</tr>
<tr>
<td>11:30 a.m.</td>
<td>High-Frequency Ultrasound-Guided Fluorescence Tomography of Protoporphyrin IX in Subcutaneous Tumors</td>
<td>Josiah D. Gruber, Aksiat Paliwal, Hamid Ghadimi, Edward Mayrini, Teqyba Hashan; Tufts University, USA. An automated ultrasound-guided fluorescence tomography system was created to image the Protoporphyrin IX production of subcutaneous tumors in vivo. Negative production and positive production tumors were compared to validate the system capability.</td>
</tr>
<tr>
<td>11:45 a.m.</td>
<td>Simultaneous PET and 3-D Fluorescence Optical Tomography for Small Animal Imaging</td>
<td>Julien Bic, Simon R. Cherry; Biomedical Engineering Dept., Univ. of California Davis, USA. We have built a simultaneous positron emission tomography and three-dimensional fluorescence optical tomography system for small animal imaging, and performed in vivo experiments. System improvements and a new fluorescence scanning method are proposed.</td>
</tr>
<tr>
<td>12:00 p.m.</td>
<td>Automated Confocal Detection of Malignant Melanoma</td>
<td>Ricky Hennery, Steve Jacques, Giovanni Pelligani, Daniel S. Garraway; Dept. of Surgery and Biomedical Engineering, Oregon Health and Science Univ., Univ. of Modena and Reggio Emilia, Italy. Melanoma arises in the basal layer of the skin located within the penetration limits of confocal microscopy. From confocal pathological traits, we created a computer algorithm to render a diagnosis.</td>
</tr>
<tr>
<td>12:15 p.m.</td>
<td>Multispectral Bioluminescence Tomography: Simulations and Phantom Studies with a Priori X-Ray CT Spatial Priors</td>
<td>Julius Pekar, Michael S. Patterson, Juravinski Cancer Ctr. and McMaster Univ., Canada. We describe the development of an integrated X-ray CT and bioluminescence tomography imaging system. Reconstructions of optical properties using CT spatial priors are presented with simulated multispectral bioluminescence reconstructions. Experiments to confirm the simulations are underway.</td>
</tr>
</tbody>
</table>

12:30 p.m.—1:30 p.m. Lunch Break (on your own)
Monday, April 12
Richelleau Room
1:30 p.m.-3:30 p.m.
JMA16
Reconstruction Simulations from Large-Scale and Color Holograms Using a Computer-aided Design Tool for Electroholography, Tomoyoshi Shimobaba, Neubuaki Masuda, Tomoyoshi Shimobaba, Chiba Univ., Japan. In this paper, we report on a computer-aided design (CAD) system to optimize the development of an electro-holography system. Our CAD system can evaluate a reconstructed image without having to develop an actual optical system.

JMA17
3-D/2-D Convertible Projection-type Integral Imaging System by use of Half Convex Mirror Array, Jisoo Hong1, Youngmin Kim1, Soon-gi Park1, Sung-Wook Min2, Byungho Lee1; 1School of Electrical Engineering, Seoul Natl. Univ., Republic of Korea, 2Dept. of Information Display, Kyunghee Univ., Republic of Korea. We propose a novel structure that is composed of transparent material with half convex mirror array inside it. With the proposed structure, projection-type integral imaging can provide 3-D/2-D convertible feature.

JMA18
Optical Fibre Characterization through Digital Holographic Microscopy, Freddy Alberto Morroy Ramirez, Jorge Garcia-Sucunya, Unniv. Nacional de Colombia, Colombia. Refractive index and dimensions of a partially stripped optical fibre are measured via digital holographic microscopy (DHM). These parameters are unscrambled from phase information retrieved by DHM. Results are alike to the specifications from the manufacturer.

JMA19
Binary Depth Detection Based on Cross-Spectral Density, Se Baek Oh1, George Barbabastassis2; 1MIT, USA, 2Singapore-MIT Alliance for Res. and Technology (SMART) Ctr., Singapore. We have developed an optical system for discriminating depth between two uniformly illuminated featureless objects based on cross-spectral density. With volume holograms, we encode the lateral and axial dimensions in wavelength and spatial coherence, respectively.

JMA20
Accurate Lens Lattice Extraction in Distorted Elemental Image Set, Keehoon Hong, Jae-Hyun Jung, Je-Hyung Park, Byungho Lee1; 1Seoul Natl. Univ., Republic of Korea, 2Chungbuk Natl. Univ., Republic of Korea. We propose an accurate lens lattice extraction in distorted elemental image set. Geometrical distortion in the elemental image set is recovered by using projective information. Experimental results show the lattice structures are extracted accurately.

JMA21
Using Phase Retrieval to Obtain the Complete Spatiotemporal Electric Field of Ultrashort Pulses, Pamela R. Boulan1,2, Rick Trebino1; 1School of Physics, Georgia Tech, USA, 2Swamp Optics LLC, USA. Using a phase-retrieval algorithm, we recover the only undetermined quantities—the phase vs. transverse position in spectral-interferometric ultrashort-laser-pulse measurements, to yield complete spatiotemporal measurements of the electric field of focusing ultrashort pulses.

JMA22
Single-Shot Optical-Path-Length-Shifting Color Digital Holography, Takashi Kaku1, Mitsuo Kawanoura1, Yuko Shimozato1, Tatsuki Tahara1, Yasuhito Aoyama1, Shogo Ura1, Kenzo Nishio1, Toshio Kubota1, Osamu Matobab2; 1Graduate School of Science and Technology, Kyoto Inst. of Technology, Japan, 2Dept. of Computer and Systems Engineering, Kobe Univ., Japan. We propose an optical-path-length-shifting digital holography with single-shot exposure for capturing three-dimensional images of color object. The proposed technique was numerically simulated and its validity was confirmed by evaluating root mean square errors.

JMA23
Quantitative Analysis by Digital Holography of the Effect of Optical Pressure on a Biological Cell, David C. Clark, Leo Kozzewa, Myung K. Kim; Univ. of South Florida, USA. Digital Holographic Microscopy produces quantitative phase analysis of a specimen with nanometric (sub-wavelength) precision. The deformation caused by optical pressure can be observed and used to calculate physical properties of a biological cell.

JMA24
Single Beam Dynamic Holographic Interferometry, Nickolai V. Kakh耙ri, Tatiana Kakh耙ri, Alabama A&M Univ., USA. Single beam dynamic holographic recording is realized in the photorefractive crystals. Different photorefractive mechanisms of holographic recording are discussed. Feasibility of single beam holographic interferometry with opaque (reflective) and transparent objects is demonstrated.

JMA25
Profilerometry and Reflectometry Using Low-Coherent Digital Holography, Takanori Nomura, Kohhei Yoshino, Takahisa Numata, Eiji Nitaniac, Wakayama Univ., Japan. The both profilometry and reflectometry of a 3-D object by use of digital holography with low coherent light source is proposed. For noise reduction, integration of digital holograms is introduced.

JMA26
Study of Intracellular Ion Dynamics with a Multimodality Approach Combining Epifluorescence and Digital Holographic Microscopy, Nicolas Parellan1, Alexander Benke2, Daniel Bosc1, Corinne Martot1, Pascal Jourdain1, Yves Emeri1, Christian Depueysinge1, Pierre J. Magistretti2, Pierre Marquet1; 1Ecole Polytechnique Federale de Lausanne, Switzerland, 2Lynce Tec SA, Switzerland. We present combined measurements of quantitative phase through digital holographic microscopy (DHM) and epifluorescence for cells dynamics study. We concentrate our investigation on intracellular ion concentration monitoring with both techniques for comparison.

JMA27
Reliable Data Search in a Holographic Search Engine with Defocused Recording, Bhargob Das, Joby Joseph, Kehar Singh; Indian Inst. of Technology Delhi, India. The holographic search engine based on defocused recording is investigated under rational conditions. New data page modulation coding schemes are introduced for removing the ambiguous correlation characteristics and performing a reliable data search.

JMA28
Low Complexity Compression of Hologram Sub-Lines, Peter Tsang1, Ting Chung Poon1, Jung Ping Lin1, Wei Kuang Cheung2, Wuchao Situ2; 1City Univ. of Hong Kong, Hong Kong, 2Bradley Dept. of Electrical and Computer Engineering, Virginia Tech, USA, 3Feng Chia Univ., Taiwan. In this paper we propose a low complexity scheme for compressing hologram sub-lines based on Predictive coding. Our method can attain a compression ratio of 16 times with only slight artifacts on the reconstructed images.

JMA29
Hologram Synthesis from Defocused Images Captured under Incoherent Illumination, Jae-Hyung Park, Seung-Woo Sen, Ni Chen, Nam Kim; Chungbuk Natl. Univ., Republic of Korea. An incoherent method to synthesize holography of the three-dimensional objects is proposed. The objects are captured at a fixed camera position with varying focal planes under incoherent illumination and processed to generate its Fourier holography.

JMA30
Burch Computer-Generated Hologram Watermarking Resilient to Strong Cropping Attack, Ke Deng, Guanglin Yang, Chao Zhang; Peking Univ., China. A watermarking scheme is proposed. A Burch CGH is generated to record the amplitude and phase information of original watermark and embedded into DFT domain of a cover image to effectively resist strong cropping attack.
JMA31
Modelling High-NA In-Line Holograms, John F Restrepo, Jorge García-Sucueña; Unicr Nacional de Colombia, Colombia. A diffraction-based approach is presented for modelling high-NA in-line holograms. This approach circumvents the limitations on size and shape of the modelled samples. The computation load is reduced by using Bluestein approach to DFTs.

JMA32
Real Time Digital Holographic Interferometry of Reflective Objects, Georges Nehmetallah, Partho P. Banerjee, Nicolai V. Kukhtarev, Sarat C. Praharaj; 1Univ. of Dayton, USA, 2Alabama A&M Univ., USA, 3DMS Technologies Inc., USA. We illustrate the application of digital holographic interferometry to determine the surface deformation of sample reflective objects. The recording can be performed in real time, limited by the speed of the CCD camera.

JMA33
Diffraactive Pulse-Front Tilt for Low-Coherence Digital Holography, Raul Martinez-Cuenca, Lluís Martinez-León, Jesús Lancia, Gladys Monge-Vega, Omel Mendaza-Yero, Enrique Tajahuerce, Pedro Andrés; 1Univ. Jaume I, Spain, 2Inst. de Nones Tecnologias de la Imatge, Spain, 3Servei Central d’Instrumentació Científica, Spain, 4Univ. de Valencia, Spain. We use a diffraactive lens to generate the proper pulse-front-tilt to record full-field off-axis holograms with a 10fs laser source. We experimentally demonstrate optical sectioning of three-dimensional samples with a resolution of about 5 microns.

JMA34
Accuracy Enhancement of Fringe-Projection Based 3-D Imaging, Thang Haong, Zhaoyang Wang, Dung Nguyen; Catholic Univ. of America, USA. In this paper, we present a simple yet robust scheme to enhance the accuracy of fringe-projection-based 3-D imaging. With the proposed scheme, the relative 3-D imaging accuracy can reach 1/20,000.

JMA35
Three-Dimensional Tracking of Optically Trapped Particles by Digital Gabor Holography, Marianna Potozina, Leo Krzewina, Jiankun Liu, Myung K. Kim; Univ. of South Florida, USA. A new technique for 3-D position detection of optically trapped particle by digital Gabor holography is demonstrated with a particle complex optical field is reconstructed via the angular spectrum method.

JMA36
Comparison of Laplacian Differential Reconstruction of In-Line Holograms Recorded at Two Different Wavelengths and Planes, James P. Ryle, Daayan Li, John T. Sheridan; Univ. College Dublin, Ireland. We record two holograms using two different illuminating wavelengths. Subtracting these holograms, the resulting reconstruction is an approximation to the second order Laplacian differentiation of the object wave.

JMA37
Real-Time Interferometric Microscopy in Liquids, Marc Jobin, Raphael Fochs; Univ. of Applied Sciences, Switzerland. We have made a Phase Shift Interferometric Optical Microscope operating in liquid and in real time. As a proof of concept, we show the nano-evolution of a surface profile of Cu in sulphuric acid.

JMA38
A Simple, Inexpensive Holographic Microscope, Thomas G. Dimiduk, Ekaterina A. Kocheleva, David Kaz, Ryan McGerty, Emily J. Gardel, Vinohith N. Manoharan; Harvard Univ., USA. We have built a simple holographic microscope completely out of consumer components. We obtain at least 2.8 μm resolution and depth of field greater than 200 μm from an instrument costing less than $1000.

JMA39
Low-Resolution Motion Analysis in a 3-D Model, Diego Pava, William T. Rhodes; Florida Atlantic Univ., USA. Motion analysis combined with a 3-D scene model allows the identification of humans as moving objects at extremely low resolution. Basic concepts and results of analyses are presented.

JMA40
Improved Holographic Beam Coupling through Selective Harvesting of Single Domain Ferroelectric Nanoparticles, Gary Cook, Victor Reshetnyak, Arturo Ponser, Ron F. Zielo, Sergey A. Basun; 1AFRL, USA, 2Universal Technology Corp., USA, 3Natl. Taras Shevchenko Univ. of Kyiv, Ukraine, 4Cir. de Investigacion en Quimica Aplicada, Mexico. We describe methods for significantly improving the holographic beam coupling efficiency of liquid crystal based hybrid photorefractive media through the selective harvesting and incorporation of single ferroelectric domain nanoparticles.

BIOMED Posters

JMA41
Imaging of Rapid Flows Using Zero-Crossing DOCT, Richard Villey, Lionel Carrion, Dominic Mornieux, Caroline Boudoux, Roman Maciejko; École Polytechnique de Montréal, Canada. This paper presents a novel Doppler OCT system capable of imaging flow velocities of up to 3.1 m/s in real-time without phase-aliasing artifacts well above current systems limited to a few cm/s.

JMA42
Real-Time Calibration for High-Speed Swept-Surface OCT, Jiefeng Xi, Li Hua, Jianong Li, Xingde Li; Dept. of Biomedical Engineering, Johns Hopkins Univ., USA. We demonstrated a real-time calibration method for high-speed SS-OCT.

An external clock was generated to trigger the high-speed data acquisition system point by point and enable uniform data sampling in frequency domain (K-space).

JMA43
Detecting Hemoglobin Concentration Using the Dual Window Method for Processing Spectroscopic Optical Coherence Tomography Signals, Shreetaulip Chowdury, Francisco E. Roberes, Adam Waw; Duke Univ., USA. We present a technique utilizing parallel frequency-domain OCT with the dual window method for processing SOCT signals to determine hemoglobin concentration. Preliminary data show our system’s ability to quantitatively determine hemoglobin concentration from a phantom.

JMA44
Analysis of Soft-Tissue Contrast in Optical Coherence Tomography Images by Using Box-Counting and Signal Attenuation, Dan P. Popescu; Costel Flueraru; Michael G. Soum; Inst. for Biodynamics, Natl. Res. Council Canada, Canada, 1Inst. for Microstructural Sciences, Natl. Res. Council Canada, Canada. Optical coherence tomography images are analysed using the attenuation of the OCT signal and its fractal dimensions. Two classes of samples are investigated: Arterial samples from WHHL-MI rabbits and pieces of porcine coronaries.

JMA45
Novel Calibration Method for Swept Source OCT with Improved Resolution and Dynamic Range, Ehsan Asimi, Bin Liu, Mark E. Brezinski; Brigham and Women’s Hospital, USA. For a swept source OCT, a real-time calibration process is necessary. Using Genetic Algorithm and precise interpolation, a novel calibration process is developed. When compared with existing approaches, axial resolution and dynamic range are increased.

JMA46
Quantitative Analysis of the Human Cornea Using High-Speed Swept Source OCT, Karol M. Karnowski, Michalina Gera, Bartosz J. Kaluszny, Daniel Ruminski, Slawomir Orloowski, Andrzej Kozulczak, Maciej Wojtkowski; Nicolaus Copernicus Univ., Poland. We present applicability of the high speed swept-source optical coherence tomography for quantitative corneal analysis. The detailed analysis of the influence of eye misalignment, optical distortions or raster density on the corneal topography is presented.
JMA47  Quantitative Optical Coherence Tomography Imaging of Cell Death, Goltaz Farhat1,2, Victor X. D. Ying3,4, Michael C. Kolios1,4, Gregory J. Czarnota1,2,3; 1Dept. of Medical Biophysics, Univ. of Toronto, Canada; 2Imaging Res., Sunnybrook Health Sciences Ctr., Canada; 3Dept. of Radiation Oncology, Sunnybrook Health Sciences Ctr., Canada; 4Dept. of Physics, Ryerson Univ., Canada, 0Ontario Cancer Inst., 0Canada, 0Dept. of Radiation Oncology, Univ. of Toronto, Canada. A quantitative technique measuring OCT backscatter power is used to detect three modes of cell death in acute myeloid leukemia cells. Changes in backscatter are correlated with structural differences observed in histological staining of cells.

JMA48  Comparison of Sensitivity for High Speed Fourier Domain OCT Systems, Daniel Szlag1, Maciej Szkulmowski1, Andrzej Kowalczyk1, Maciej Wojtkowski1, Nicolaus Cepernicus Univ., Poland. We discuss an impact of noise sources and technological limitations of swept source OCT and spectral OCT and estimate the optimal conditions of operation for ultrahigh speed OCT imaging.

JMA49  Simultaneous Recovery of Tissue Physiological and Acoustic Properties and Uniqueness in Multi-Spectral Photoacoustic Tomography, Zhen Yuan2, Huabei Jiang2; Dept. of Biomedical Engineering, Univ. of Florida, USA. We present an algorithm to directly reconstruct chromophore concentrations and acoustic velocity by multi-spectral photoacoustic tomography. We derive conditions for the unique and simultaneous recovery of chromophore concentrations and acoustic velocity using multi-spectral photoacoustic data.

JMA50  Three-Dimensional Quantitative Photoacoustic Tomography of Osteoarthritis: Initial Clinical Results in the Finger Joints, Yao Sun1, Eric Sobel1, Huabei Jiang2, Univ. of Florida, USA. We report the first application of three-dimensional quantitative photoacoustic tomography for detecting osteoarthritis. Apparent differences, in both the reconstructed size and optical absorption coefficient of the joint cavity, are observed between osteoarthritic and normal joints.

JMA51  Photoacoustic Imaging with a Large, Cylindrical Detector, Sibille Gratt1, Klaus Passler1, Robert Nuster1, Guenter Paltan1; Inst. of Physics, Karl-Franzens-Univ. Graz, Austria. This work is engaged in the investigation of a cylindrical shaped piezoelectric detector for photoacoustic imaging. This detector gives a plane detection area. Simulations and experiments with such a detector are shown and discussed.

JMA52  Quantified Reconstruction Methods in Optoacoustic Tomography, Daniel Razansky1, Amir Rosenblath1, Thomas Jezzeltiner1, Vasilets Ntziachristos2, Technical Univ. of Munich and Helmholtz Ctr. Munich, Germany. Quantification of optoacoustic images is a long-standing yet important challenge. To improve tomographic reconstruction accuracy under heterogeneous realistic tissue conditions, we suggest and experimentally test correction algorithms based on iterative modeling and sparse image representation.

JMA53  Ophthalmic Photoacoustic Spectroscopy in the Aqueous Humor, Adi Sheinfeld1, Sharon Gilead1, Arieh S. Solomon1, Assi Hay Eu2; School of Electrical Engineering, Faculty of Engineering, Tel Aviv Univ., Israel, 0Goldschleger Eye Res. Inst., Tel Aviv Univ., 0Sheba Medical Ctr., Israel. The use of photoacoustic spectroscopy for detection of disease related proteins in the aqueous humor is proposed. Experimental results demonstrating detection of absorbing particles in isolated ovine eyes along with eye-safety considerations are presented.

JMA54  A Quantitative Evaluation of High-Density Diffuse Optical Tomography: In vitro Resolution and Mapping Performance, Brian R. White1, Joseph P. Culver1, Washington Univ. in St. Louis, USA. Despite the unique brain imaging advantages of fNIRS, widespread neuroimaging acceptance has been hampered by low spatial resolution and image localization. We present a quantitative and in vitro compari-sohn of HD-DOT and two fNIRS geometries.

JMA55  Transcranial Time-Resolved Measurements of Fluorescence of an Exogenous Dye Circulating in Human Brain, Michal Kapczak1, Daniel Milej1, Piotr Szewcz2, Anna Gerga3, Adam Liebert4, Roman Marianowski5, Joanna Maczewska6, Katarzyna Frunczewska7, Leszek Królicki8, Wojciech Weigl1, Ewa Magzner-Zaulucka1, Tomasz Lazowski1, IBIB PAN, Poland, 0Dept. of Nuclear Medicine, Medical Univ. of Warsaw, Poland, 0Dept. of Anesthesiology and Intensive Care, Medical Univ. of Warsaw, Poland. Time-resolved imager was used for monitoring of inflow of exogenous dye into the brain. We observed variation of fluorescence signals caused by changes of dose of the dye and position of optode on the head.

JMA56  Multi-wavelength Time-resolved Detection of Fluorescence of Indocyanine Green Circulating in the Human Head, Anna Gerga1, Daniel Milej1, Michal Kapczak1, Piotr Szewcz2, Norbert Zolek1, Wojciech Weigl1, Ewa Magzner-Zaulucka1, Roman Marianowski5, Adam Liebert4; Inst. of Biocarbonises and Biomedical Engineering, Polish Acad. of Sciences, Poland, 0Dept. of Anesthesiology and Intensive Care, Medical Univ. of Warsaw, Poland. Multi-wavelength detection of time-resolved fluorescence signal on the surface of the human head was carried out. Pattern of inflow and washout of indocyanine green in the head after intravenous injection of the dye was analyzed.

JMA57  Application of Correlation Analysis Tools for the Classification of Mental Workloads in Functional Near-infrared Spectroscopy, Angelo Sassaori1, Feng Zheng2, Audrey Girouard2, Erin Treacy Solovey1, Krysta Chanskey2, Leanne H. Hirofeld1, Evan Peck1, Robert J. K. Jacob1, Sergio Fantini2; Tufts Univ., USA. We discuss some ideas for improving the discrimination of mental workloads by using correlation analysis tools and machine learning algorithms that eventually can be used with real time acquisition and processing.

JMA58  A Head Phantom for Use in near Infrared Topography for Brain Function Measurements, Hirokazu Kakuta1,2, Hiroshi Kawaiuchi1, Eiji Okada1,2; Keio Univ., Japan, 0Nat. Inst. of Radiological Sciences, Japan. A design of a head phantom for near infrared topography is proposed. In the phantom, multiple absorption changes which mimic brain activation can be occurred to evaluate spatial resolution and contrast of near infrared topography.

JMA59  High-Density Optical Mapping of the Human Somatosensory Cortex, Christoph H. Schmitz1,2, Stefan P. Koch1, Jan Mehret1,3, Susanne Holz1, Christina Habernh1, Arno Villinger1,4, Helmut Obirg1,5; Charite, Dept. of Neurology, Germany, 0NIRx Medizintechnik GmbH, Germany, 0Max-Planck-Inst. for Cognitive and Brain Sciences, Germany, 0Univ. Hospital, Day Care Clinic for Cognitive Neurology, Germany, 0Berlin School of Mind and Brain, Germany. We use a high-density diffuse-optical sensing array in conjuction with optical tomographic reconstruction to map the moto-sensory organisation of the human cortex at high resolution. Optical results are co-registered to individual anatomical brain anatomy.
JMA60
Two Approaches for Using Anatomical Atlas Information for Image Reconstruction in Optical Tomography of Neonates, Jula K. P. Heiskala1, Maria Metsäranta, P. Ellen Grant1, Mika Pollari, Jikka T. Niissilä1; 1Dept. of Computer Science, Univ. College London, UK; 2Dept. of Pediatrics, Helsinki Univ. Central Hospital, Finland, 3Div. of Neonewborn Medicine and Dept. of Radiology, Children’s Hospital Boston, USA; 4Dept. of Biomedical Engineering and Computational Science, Helsinki Univ. of Technology, Finland. Using atlas-based prior anatomical information for image reconstruction in optical tomography of neonates was studied using simulations. Results from two different atlas approaches are compared with results obtained using individual anatomical information and simpler models.

JMA61
NIRS-Specific Adaptation of the General Linear Model for Statistical Mapping of Brain Activity, Farras Abdelnour, Theodore J. Huppert; Univ. of Pittsburgh, USA. Analysis methods such as Statistical Parametric Mapping were developed for functional MRI and require subtle but important modifications for proper application to optical NIRS data. We describe the NIRS formulation of the general linear model.

JMA62
Application of Subject Specific Models for Mapping Brain Function with Diffuse Optical Tomography, Yuxuan Zhan1, Hamid Dehghani1, Brian R. White1, Joseph P. Culver1; 1School of Computer Science, Univ. of Birmingham, UK, 3Washington Univ. in St. Louis, USA. This work demonstrates the benefits of using subject specific models for image reconstruction in neuro-imaging of humans. It also investigates depth related information available from the increased number of tomographic measurements.

JMA63
Combined EEG and Time-Resolved NIRS to Study Neuro-Vascular Coupling in the Adult Brain, Alexander Jelzow1, Stefan Paul Koch1, Heidrun Wainitz1, Jens Steinbrink2, Hellmut Obrig4, Rainer Macdonald5; 1Physikalisch-Technische Bundesanstalt, Germany, 2Berlin Neuroimaging Ctr., Charité-Universitätsmedizin Berlin, Germany, 3Ctr. for Stroke Res., Charité-Universitätsmedizin Berlin, Germany, 4Dept. of Cognitive Neurology, Max-Planck-Instit. for Human Cognitive and Brain Sciences, Germany. Concurrent electroencephalography (EEG) and time-resolved near-infrared spectroscopy (tNIRS) was applied non-invasively to healthy adult subjects during motor task and visual stimulation. The temporal relationship between neuronal and vascular responses was investigated.

JMA64
Quantitative Effects of the Sagittal Sinus Vein on Occipital Cortex Measurements in Diffuse Optical Imaging, Mathieu Debale1,2, Louis Cagnon1, Alexandre Vignaud1, Romain Valabrègue3, Mélanie Pelegrim-Issa1, Frédéric Lejacq1, Reinhard Grehi1, Fabrice Wallot4, Habib Benali2,1; 1Univ Paris 06, France, 2Univ. de Montréal, Canada, 3Unio. de Picardie Jules Verne, France. We have developed a Multi-Diffuse Optical Imaging (MDO) method, which allows to measure optical properties of the brain tissue with an accuracy of ± few percentage points. We have been able to show that the首富 动脉对皮质光学测量的影响（MDO）方法，允许测量光学性质的脑组织的精度为±几个百分点。我们已经能够显示，首富动脉对皮质光学测量的影响，

JMA65
Group Analysis for Functional Optical Brain Imaging Using a Random Effects Model, Farras Abdelnour, Theodore J. Huppert; Univ. of Pittsburgh, USA. To date, group analysis methods in diffuse optical imaging have been largely restricted to analysis of region-of-interest information. We describe a random-effects imaging (inverse) model for calculating group statistics.

JMA66
3-D DOT Brain Imaging: An Anatomical Atlas-Based Method, Yong Xu1,2, Yaling Pei, Randall L. Barbour2; 1SUNY Downstate Medical Ctr., USA, 2NIRx Medical Technologies LLC, USA. An anatomical atlas-based method for 3-D DOT brain imaging is presented. Numerical simulations and phantom experiments show that the method is computation-efficient in generation, registration and anatomical labeling of 3-D image findings with high fidelity.

JMA67
Neurovascular Coupling Observed at Upper Alpha and Lower Gamma Bands, Moge Ocker1, Zabetých Basrahtarogu1, Danz Naveh1, Basri Erdogan2, Itir Kasikci, Ahmet Ademoglu1, Tamer Demiralp1, Ate Akin4, Bogazici Univ., Turkey, 1Istanbul Univ. Medical Faculty, Turkey. Steady state human visual evoked potentials that are generated in response to visual stimulation and its corresponding hemodynamic response are investigated for the frontal cortex via electroencephalography (EEG) and functional near infrared spectroscopy (fNIRS).

JMA68
Cellular Diffuse Optical Tomography of Breast Cancer, Xiaoping Liang1, QiZhi Zhang1, Stephen R. Groomber1, Huabei Jiang1; 1Dept. of Biomedical Engineering, Univ. of Florida, USA, 2Dept. of Surgery, Univ. of Florida, USA. We found that malignant tumor can be separated from benign lesion using cellular diffuse optical tomography since the difference in mean diameter and volume fraction between tumors/lesions and their normal surrounding tissues is significant.

JMA69
DOT Guided Fluorescence Molecular Tomography of Tumor Cell Quantification in Mice, Yiqiong Tan1, Lily Yang2, Huabei Jiang1, Jing Cheng3; 1Cranford Pruitt Family Dept. of Biomedical Engineering, Univ. of Florida, USA, 2Dept. of Surgery, Emory Univ., USA. DOT guided fluorescence molecular tomography (FMT) is used to image tumor cells in mouse. FMT reconstruction results with and without DOT guided are presented. Cell quantification and tumor localization are improved with DOT guidance.

JMA70
Monitoring Therapy Response with Fluorescence Imaging, Ulras Sunar, Anurag Gupta, Dan Rohrbach, Weirong Mo, Scott Gallas, Marat Targui, Intae Lee, Raviendra K. Pandey, Rowell Park Cancer Inst., USA. We quantified fluorescence photobleaching of bifunctional agent (HPHP-CD) during PDT with fluorescence imaging. HPHP-CD exhibit preferential uptake in tumors compared to surrounding normal tissue and longer wavelength emitting CD allowed monitoring photobleaching in deep tumors.

JMA71
Evaluation of Cerebral Energy Demand during Graded Hypercapnia and Validation of Optical Blood Flow Measurements against ASL fMRI, Stefan Carp, Maria A. Franceschini, David A. Boas, Young R. Kim, Massachusetts General Hospital, USA. We validate optical cerebral blood flow measurements against functional MRI in a rat model during graded hypercapnia. We test the iso-metabolic assumption and demonstrate an apparent increase in brain metabolism at higher inhaled CO2 levels.

JMA72
Characterization of Blood Flow, Oxygenation and Metabolism under Hypercapnia in Swine, Wesley Baker, R. C. Mesquita, R. S. Bessam, R. V. Babu, J. H. Greenberg, A. G. Yodh, J. A. Detre, R. Reddy, Univ. of Pennsylvania, USA. We employed diffuse reflectance and correlation spectroscopy to monitor the response of cerebral oxygenation and blood flow to hypercapnia in swine, and compared the oxygen consumption optically estimated to direct MRI measurements.

JMA73
Microvascular Blood Flow Mapping from Wide-Field Optical Fluctuations Measurements, Benjamin Samson1, M. Gros1, J. Ferezou1, P. Vitalis1, A. Rancillac1, Michael Allan1; 1CNRS, Fondation Pierre-Gilles de Gennes, Inst. Langevin, France, 2Lab Kastler-Brossel de l’École Normale Supérieure, France, 3ESPCI, Lab de Neurobiologie, France. We report new results in angiographic mapping of microvessels in vivo with a wide field optical detection scheme, enabling blood flow contrast measurements in minimally invasive conditions without exogenous marker.
JMA74
Dynamic Fluorescence Imaging for the Detection of Vascular Changes in Anti-Angiogenic Drug Therapy, Jonghuan Lee1, Thomas Pöschinger1, Sonia Hernandez1, Jianzhong Huang1, Tessa Johung1, Jessica Kandel1, Darrell J. Yamashiro1, Andreas H. Hielsher1; 1Columbia Univ., USA, 2Friedrich-Alexander-Univers. Erlangen-Nürnberg, Germany. We show that dynamic fluorescence imaging with indocyanine green can be used to detect changes in the vasculature of a small-animal Ewing sarcoma model in response to anti-angiogenic drug treatments.

JMA75
Improved Methods for Optical Determination of Uptake of Dye in vivo Rabbit Brain and in vitro Tissue Phantoms, Aysegul Ergin1, Mei Wang1, Jane Y. Zhang1, Shailendra Joshi1, Irving J. Bigio1; 1Boston Univ., USA, 2Columbia Univ., USA. Momentary saline flushes help differentiate the optical signals due to contrast agent in vasculature from that in tissue, enabling optical measurement of tissue uptake of dye in an animal model and in dynamic tissue phantoms.

JMA76
A Prototype Mammograph for Simultaneous Acquisition of Tomographic and Time-Resolved Data in Slab Geometry, Axel J. Hagen1, Dirk Grosenick1, Meike Stindl1, Rainer Erdmann1, Herbert Rinneberg1, Rainer Macdonald1; 1Physikalisch-Technische Bundesanstalt, Germany, 2PicoQuant GmbH, Germany. We have developed a prototype mammograph for simultaneous acquisition of tomographic and time-resolved data at fluorescence and laser wavelengths in slab geometry. System performance was tested on phantoms and on a volunteer.

JMA77
2-D Spectral Imaging Approach to Optical Mammography for Enhanced Resolution and Quantitative Oximetry, Yang Yu1, Ning Liu1, Angela Sassaroli1, Sergio Fantini1; 1Tsujis Univ., USA. 2Univ. of California, Irvine, USA. We present a spectral imaging system for 2-D breast mapping and quantitative in vivo oximetry. It acquires broadband spectra (650-900 nm) with a spectral density of 2 points/mm and a spatial density of 25 pixels/cm².

JMA78
Three-Dimensional MR-Guided Optical Spectroscopy of the Breast: Optimizing Probe Placement for Improved Image Quality, Michael A. Mastandano1, Colin M. Carpenter2, Subhadra Srinivasan2, Shudong Jiang2, Brian W. Pogue1, Keith D. Paulsen1; 1Dartmouth College, USA, 2Stanford Univ., USA. MRI-guided near infrared spectroscopy has been implemented with a user-positioned three-dimensional fiber interface, allowing acquisition of multiple planes of data and targeting of suspect regions from within the MR exam.

JMA79
Improvement of NIR Diffuse Optical Tomography in Patients with a Small Amount of Breast Tissue by Using Exogenous Contrast Agents, Yasaman Ardehshirpour, Nusratign Biswal, Quing Zhu2, Univ. of Connecticut, USA. In this paper, we have introduced a new method based on absorption contrast agents to reduce the effect of chest-wall on NIR diffuse light measurements in patients with a small amount of breast tissue.

JMA80
Implementation of MR-Guided Multi-Frequency NIR Diffuse Optical Tomography for Breast Imaging, Ning Liu1, David Thayer1, Yuting Lin, Min-Ying Su, Werner W. Rueck, Orhan Nalcioğlu, Gultekin Gulsen; 1Univ. of California at Irvine, USA. We describe the implementation of a multi-modality imaging platform, which integrates a multi-frequency, multi-wavelength optical tomography system with a 3.0 T MRI scanner to obtain the additional diagnostic information of suspicious breast lesions.

JMA81
Multispectral and Phase-Contrast Diffuse Optical Tomography of Breast Cancer During Neoadjuvant Chemotherapy, Xiaoping Liang1, Qizhi Zhang1, Stephen P. Stadl1, Stephen R. Grobmyer1, Huabei Jiang2, 1Crayton Pruitt Family Dept. of Biomedical Engineering, Univ. of Florida, USA, 2Dept. of Hematology and Oncology, Univ. of Florida, USA, 3Dept. of Surgery, Univ. of Florida, USA. Multispectral and phase-contrast DOT are used to track treatment progress in a cancer patient. Tumor shrinkage as well as significant changes of optical parameters was observed during the course of neoadjuvant chemotherapy from optical images.

JMA82
Development of a Frequency-Domain Multi-Spectral Breast Diffuse Optical Tomography Instrument, Han Y. Ban1, Soren D. Konecky2, David R. Busch2, Su Hyun Chang1, Sarvar Pathak1, Regine Choe1, Arjun G. Yodhi2; 1Univ. of Pennsylvania, USA, 2Beckman Laser Inst. and Medical Clinic, USA. We describe the current state and development of a 3rd generation Diffuse Optical Tomography breast imaging device. Preliminary data and results will be presented.

JMA83
Enhanced Phase-Contrast Diffuse Optical Tomography for in vivo Breast Imaging, Ruixin Jiang1, Xiaoping Liang1, Qizhi Zhang1, Stephen Grobmyer1, Laurie Fajardo2, Huabei Jiang2; 1Univ. of Florida, USA, 2Univ. of Iowa, USA. We present a two-step reconstruction method that can qualitatively and quantitatively improve the reconstruction of tissue RI distribution by PCDOT. The method is validated by phantom experiments and data from 42 human subjects.

JMA84
Multispectral Phase-Contrast Diffuse Optical Tomography for Breast Cancer Imaging, Ruixin Jiang1, Xiaoping Liang1, Qizhi Zhang1, Stephen Grobmyer1, Laurie Fajardo2, Huabei Jiang2; 1Univ. of Florida, USA, 2Univ. of Iowa, USA. We present a multispectral phase-contrast diffuse optical tomography method that is able to simultaneously reconstruct tissue refractive index and functional parameters such as hemoglobin concentration and oxygen saturation. We validate the method using numerical simulations.

JMA85
Bedside Monitoring of Cerebral Oxygenation Using DOT, Silvina L. Ferrada1, Brian R. White1, Ronny Donesbach1, Joseph P. Culver2; 1Dept. of Biomedical Engineering, Washington Univ. in St. Louis, USA, 2Dept. of Radiology, Washington Univ. in St. Louis, USA. We report use of high-density DOT imaging to obtain quantitative maps of OEF measured on the human occipital cortex. Analyses of pulse and respiration waveforms are used to separate arterial and venous weighted tissue compartments.

JMA86
Effects of Transcranial Magnetic Stimulation on Cerebral Hemodynamics Measured by Diffuse Correlation and Optical Spectroscopies, Ricksson C. Mesquita1, Meei N. Kwe1, Erin M. Buckley1, Peter Turkelbaum1, Amy L. Thomas1, Olfufunsho K. Faseyitan1, Mari Tobita2, John A. Detre2, Arjun G. Yodhi2, Roy H. Hamilton2; 1Dept. of Physics and Astronomy, Univ. of Pennsylvania, USA, 2Dept. of Neurology, Univ. of Pennsylvania, USA, 3Dept. of Physical Medicine and Rehabilitation, Univ. of Pennsylvania, USA, 4Dept. of Radiology, Univ. of Pennsylvania, USA. Diffuse optical and correlation spectroscopies were employed to determine oxygenation and blood flow changes before/during/after 20-minutes of transcranial magnetic stimulation. A localized increase in oxygenation and CBF on the ipsilateral side of stimulation is found.

JMA87
Validating an Anatomical Brain Atlas for Analyzing NIRS Measurements of Brain Activation, Matteo Caffini1, Alessandro Torricelli1, Rinaldo Cabiddu1, Anna Castor1, Jay Dubb1, David A. Boas2; 1Politecnico di Milano, Italy, 2CEMEX, Switzerland, 3Athinoula A. Martinos Ctr. for Biomedical Imaging, USA. We are validating the use of a brain atlas for analyzing NIRS data of brain activation to guide anatomical interpretation of the NIRS results when the subject’s true head anatomy is not available.
JMA88  
Improvement of NIR Diffuse Optical Tomography in Patients with a Small Amount of Breast Tissue by Using a Two-Layer Finite-Element Model, Yasaman Ardehishpour, Quing Zhu; Univ. of Connecticut, USA. In this paper, we have studied the improvement obtained by two-layer finite element based optical tomography in a group of patients who have a small amount of breast tissue.

JMA89  
MRI-Guided Fluorescence Molecular Tomography to Image Epidermal Growth Factor Receptor Status in Brain Tumors, Scott C. Davis1, Kimberley S. Samkoe1, Julia A. O’hana2, Keith D. Paules1, Summer L. Gibbs-Strauss3, Brian W. Pogue2; Dartmouth College, USA; Beth Israel Deaconess Medical Ctr., USA. The diagnostic potential of MRI-coupled fluorescence tomography of epidermal growth factor receptor (EGFR) status in brain cancer was demonstrated. Perfect diagnostic performance was observed between mice inoculated with EGFR(+) or EGFR(-) tumor cells.

JMA90  
Portable Optical Tissue Flow Oximeter for Evaluation of Revascularization Effect on Ischemic Muscle Hemodynamics, Guangqiang Yu, Yu Shang1, Youquan Zhao2, Ran Cheng, Lixin Dong1, Iarkin Daniel1, Suh P. Sahai1; Univ. of Kentucky, USA; Tianjin Univ., China. A portable diffuse optical tissue flow-oximeter has been developed for evaluation of revascularization effects on ischemic muscle blood flow and oxygenation. The revascularization repairs of macro-circulation result in acute blood flow improvements in muscle microvasculature.

JMA91  
Near-Infrared Functional Brain Imaging of Prefrontal and Motor Regions During a Step-Reaction Stroop Test, Benjamin T. Schmidt, Nancy H. Belick, Patrick Sparks, Theodore J. Huppert; Univ. of Pittsburgh, USA. Functional near-infrared spectroscopy was used to examine the interaction between prefrontal and premotor regions to a decision-based stepping task. Subjects were given instructional cues in a congruent and incongruent fashion and responded by stepping.

JMA92  
Nitroimidazole-Indocyanine Green Conjugates for Breast Cancer Hypoxia Imaging, Narsingh C. Biswal1, Christopher Pave1, Michael Smith2, Lisa T. Kahn1, Kevin P. Claffey1, Quing Zhu1; 1Dept. of Electrical and Computer Engineering, USA; 2Dept. of Chemistry, Univ. of Connecticut, USA, 3Dept. of Reconstructive Sciences, Univ. of Connecticut Health Ctr., USA; 4Dept. of Cell Biology, Univ. of Connecticut Health Ctr., USA. We present the optical properties of new nucleophilic imidazole compounds synthesized for tumor hypoxia imaging. The photophysical and hypoxic properties of these new molecules are evaluated and targeted for imaging breast cancer hypoxia.

JMA93  
Stimulus-Evoked Calcium Transients in Somatosensory Cortex are Inhibited After a Nearby Microhemorrhage, Flor A. Cianchetti, Nazomi Nishimura, Chris B. Schaffer; Cornell Univ., USA. We use femtosecond laser pulses to hemorrhage brain arterioles and then study changes in cell-resolved calcium transients using two-photon microscopy. We find that microhemorrhages lead to a loss of stimulus-evoked response in nearby neurons.

JMA94  
Quantification of Adipocytes Development in a Micro-Fluidic Reactor, Using 2-Photon Fluorescence Microscopy Imaging, Nikolaos Fourtagas, Ning Lai, William Rice, Kyungjun Lee, Irene Georgakoudi; TaFs Univ., USA. Intrinsinc fluorescence based redox ratio calculations are used to assess the differentiation of Adipocytes that are grown in an innovative micro-fluidic reactor and they are subject to a gradient of adipogenic hormone cocktail supply.

JMA95  
Autofluorescence Imaging of Fallopian Tube Carcinogenesis, Pierre Lane1, Sylvia F. Lane1, Jessica McAlpine1, Blake Gilks1, Steve Kallegger1, Dianne Miller1, David Huntsmann2, Calum MacAulay3; British Columbia Columbia Res. Ctr., Canada, 1Univ. of British Columbia, Canada, 2British Columbia Cancer Agency, Canada. The lumen of the human fallopian tube is accessible via endoscopy. We present fluorescence images from freshly resected fallopian tubes with corresponding pathology to support autofluorescence imaging for the early detection of intraepithelial lesions.

JMA96  
Novel Clinical Technology for Rapid Detection of Tissue Fluorescence Wavelength-Time Matrices, William Lloyd1, Ching-Wei Chang1, Robert Wilson2, Gregory Gilliespie1, Mary-Ann Mycek1; Univ. of Michigan, USA, 2Fluorescence Innovations, Inc., USA. Clinically-compatible technology was developed to measure wavelength- and time-resolved fluorescence intensities from biological tissues. Validation studies were conducted on tissue-stimulating phantoms and the results were consistent with theoretical predictions with < 4% deviation.

JMA97  
Precise Comparisons of 3-D Bronchial OCT Images with Histology, Zhilin Hu1, Wei Kang2, Rana Hejl2, Jeffrey Kern1, Andreau M. Rollins3; 1Case Western Reserve Univ., USA, 2Univ. Hospitals of Cleveland, USA, 3Natl. Jewish Health, USA. A precise comparison between three dimensional OCT image and the microscope histology image in vitro with fixed human tissue results in a better understanding to the diagnosis of the bronchial diseases by the OCT image.

JMA98  
Modeling of Zernike Optical Aberrations by MTF and PSF, Hossein Masalcdhan1, Erik Lotf1, Azfarin Lotf1, Kazem Jamshidi-Ghaleh2; 1Physics Dept., Smithsonian Inst., Islamic Azad Univ. of Bonab, USA, 2Optics and Laser Engineering Group of Bonab Univ., USA, 3Physics-Chemistry Dept., Rice Univ., USA, 4Tfabriz Univ., USA, 5Physics Dept., Tarbiat Modares Univ., USA. There is considerable interest in correcting the higher-order optical aberrations of the human eye, this type of capability could be used to eliminate the higher-order aberrations that have been caused by a prior surgical procedure.

JMA99  
Cerebral Blood Flow Imaging during Neurosurgery with Laser Speckle Contrast Imaging, Ashwin B. Parthasarathy, Kylie L. Weber1, Lisa M. Richards1, Mark G. Burnett1, Douglas J. Fox2, Andrew K. Dunn2; Univ. of Texas at Austin, USA, 2NeuroTexas Inst., USA. We present CBF images acquired during neurosurgery in humans, with Laser Speckle Contrast Imaging. Our images were obtained through an existing surgical microscope, adapted to acquire speckle images with minimum disturbance to the surgical procedure.

JMA100  
Do Low-Density Cerebral Oxyhemoglobin Measures Accurately Detect Variability of Cerebral Perfusion during Cardiac Surgery? Sergio A. Ramirez1, 2LeRone Simpson1, Harry Gruber1, Yong Xu1, Yating Pei1, Douglas Pfeil1, Vinay Tak2, Joshua Burke2, Wilson Ke1, Randall L. Barbour1, Daniel C. Lee2, 1SUNY Downstate Medical Ctr., USA, 2Brookline Hospital Ctr., USA, 3Interfaith Medical Ctr., USA. Neurocognitive deficits due to inadequate cerebral perfusion are prevalent sequelae of cardiac surgery. FDA approved noninvasive cerebral oximetry devices based on low-density arrays, are unlikely to yield accurate representation of complex heterogeneous cerebral perfusion.

JMA101  
A Multichannel Medical Device for Brain Imaging by Time-Domain INIRS, Davide Contini1, Lorenzo Spinelli1, Matteo Caffini1, Lucia M. G. Zuccelli1, Alberto Tosi1, Rinaldo Cubeddu1, Alessandro Torricelli2, Politecnico di Milano, Italy, 1IFN-CNR, Inst. of Fotonica and Nanotecnologies – Sezione di Milano, Italy. We developed and characterized on tissue phantoms a multichannel time-domain INIRS medical device. Preliminary in vivo measurements during motor tasks are reported to test the ability of the system to noninvasively measure brain cortex hemodynamics.
JMA102
Brain Connectivity Study in Verbal Fluency Task Using Near-Infrared Spectroscopy, *Ujjwal Chaudhary*, Joseph DeCerce, Gustavo Rey, Anuradha Godavarty; *Florida Intl. Univ.*, USA, *Miami Children’s Hospital*, USA. Near-infrared optical spectroscopy is employed in the frequency-domain, to map the pre-frontal brain activity in response to cognitive task(s). Brain activation and connectivity studies were performed on 15 normal adults during verbal fluency task.

JMA103
Noninvasive Optical Evaluation of Cerebral Autoregulation in Patients with Obstructive Sleep Apnea, *Ran Cheng*, Yu Shang, Daniel S. Kamen; Don Hages, Jr.; Guoqiang Yu; *Ctr. for Biomedical Engineering*, Univ. of Kentucky, USA, *College of Medicine*, Univ. of Kentucky, USA. A diffuse correlation spectroscopy and a frequency-domain tissue oximeter were combined to evaluate cerebral autoregulation in patients with obstructive sleep apnea. Differences in cerebral hemodynamics were found between the patients and healthy controls.

JMA104
Monte Carlo Simulation of Spatially Resolved Steady-State Diffuse Reflectance in Intralumenal Geometry, *Marc E. Vallee*, Thomas J. Farrell, Michael S. Patterson; *McMaster Univ.*, Canada. Monte Carlo simulations were used to investigate steady-state diffuse reflectance from tissue in an intralumenal geometry. Results were compared to Monte Carlo data for semi-infinite geometries. A significant divergence from flat geometry reflectance was found.

JMA105
Thermo/pH-Responsive and Reversible NIR Fluorescent Probes for Optical Molecular Imaging, *Tongping Chen*, Xingde Li; Johns Hopkins Univ., USA. We developed near-infrared fluorescent probes responsive to local temperature and pH change/modulation. The probes are based on cross-linked pluronic/PEI nanocapsules loaded with ICG which can be used for DNA or siRNA delivery and imaging.

JMA106
Exploratory Study on Laser Induced Hyperthermia Effected by Local Delivery of Gold Nanoshells in Laboratory and Animal Tissue Phantoms, *Yajuwendra Rathore*, Nimit L. Patel, Hanli Liu, *Alexandakis George*; Univ. of Texas at Arlington, USA. We have explored the possibility of using locally delivered gold nanoshells as a means for effecting locally confined thermal ablation treatments. Feasibility of the proposed method has been tested through laboratory and animal tissue phantoms.

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**NOTES**

Monday, April 12
Richelieu Room
1:30 p.m.–3:30 p.m.
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<td>Digital Holography and Three-Dimensional Imaging (DH)</td>
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**DMC • Metrology by Digital Holography and Profilometry**

Monday, April 12
4:00 p.m.– 6:00 p.m.

Myung K. Kim, Univ. of South Florida, USA, President
John Sheridan; Univ. College Dublin, Ireland, President

**DMC1 • 4:00 p.m.**
Enhanced Optical Depth Converter Based on Integral Imaging, Youngmin Kim1, Keehoon Hong1, Jae-Hyun Jung1, Joo Hong1, Yeuwen Lee1, Sung-Wook Min2, ByoungHo Lee3. 1School of Electrical Engineering, Seoul Natl. Univ., Republic of Korea, 2Dept. of Information Display, Kyung Hee Univ., Seoul, Republic of Korea. Improved optical depth converter by using a pair of curved lens array and convex mirror array is proposed. The proposed system is capable of orthoscopic/pseudoscopic image conversion with enhanced optical power efficiency.

**DMC2 • 4:45 p.m.**
Digital Holographic Interferometry of Translucent Objects, Georges Nehmetallah1, Partha P. Banerjee2, Nicolas V. Kakhtsar2, Sarat C. Prahara2. 1Univ. of Dayton, USA, 2Alabama A&M Univ., USA, 3DMS Technologies Inc., USA. We use a variation of digital holographic interferometry, viz., an inverse reconstruction method, to determine the 3-D shape and deformation of translucent objects such as water droplets.

**DMC3 • 5:30 p.m.**
Pattern Matching Estimator for Precise 3-D Particle Localization with Engineered Point Spread Functions, Sean Quiri2. 1Sri Rama Prasanna Pavan2, Rafael Piestun3. 1Univ. of Colorado at Boulder, USA, 2Caltech, USA. We present a 3-D particle localization estimator that uses phase retrieval to interpolate the calibration images of the point-spread-function and finds the best fit to the measured data. We analyze the application to double-helix microscopy.

**BMD • Novel Approaches in Microscopy**

Monday, April 12
4:00 p.m.– 6:15 p.m.

Caroline Boudouez; École Polytechnique Montréal, Canada., President
Alexander Egner; Max Planck Inst. for Biophysical Chemistry, Germany, President

**BMD1 • 4:00 p.m.**
Developments in Fluorescence Nanoscopy, Alexander Egner, Max Planck Inst. for Biophysical Chemistry, Germany. The resolution of conventional light microscopy is limited by diffraction. The principles of common methods to overcome the diffraction barrier and examples about their implementation and operation will be presented.

**BMD2 • 4:30 p.m.**
Polarization Sensitive Three-Dimensional Nanoscopy with a Double-Helix Microscope, Sri Rama Prasanna Pavan1, Jennifer G. DeLuca2, Rafael Piestun2. 1Caltech, USA, 2Univ. of Colorado, USA, 3Colorado State Univ., USA. We demonstrate polarization sensitive detection with 3-D super-localization of single-molecules and unveil 3-D polarization specific characteristics of single-molecules within the intracellular structure of PtK1 cells expressing photoactivatable green fluorescent protein.

**BMD3 • 4:45 p.m.**
Invited

**BME • Imaging and Spectroscopy Theory**

Monday, April 12
4:00 p.m.– 6:00 p.m.

Hamid Dehghani; School of Computer Science, UK, President
Amir H. Gandjbakhche; Natl. Inst. of Health, USA, President

**BME1 • 4:00 p.m.**
Light Propagation in Biological Media by Time-Domain Parabolic SP's Equations with Ray Divergence Effects, Jorge Bouza Dominguez, Yves Berube-Lauzière; Univ. de Sherbrooke, Canada. We present a novel time-dependent low-transport approximation to the radiative transfer equation. For several values of the optical parameters we compare its numerical solution with analogous calculations for the diffusion equation and Monte Carlo simulations.

**BME2 • 4:15 p.m.**
Rapid Spectral Analysis for Spectral Imaging, Steven L. Jacques; Oregon Health and Science Univ., USA. A rapid algorithm has been developed that uses matrix inversion to solve for the absorption spectra of a tissue using a lookup table for photon path length based on numerical simulations.

**BME3 • 4:30 p.m.**
An Empirical Method for Measuring Optical Properties with Structured Illumination beyond the Diffusion Regime, Timothy A. Erickson, James W. Tunnell; Univ. of Texas at Austin, USA.
Sinusoidally-structured illumination is used in concert with a phantom-based lookup-table (LUT) to map wide-field optical properties in turbid media with reduced albedos as low as 0.44. The LUT uses a single calibration standard.
**DMC • Metrology by Digital Holography and Profilometry—Continued**

**DMC4 • 4:45 p.m.**
Digital Holography Applied to Quantitative Measurement of Oil-Drop in Oil-Water Two-Phase Flows, Lei Tian, George Barbastathis; MIT, USA. We present a digital holography system applied to quantitative measurement of oil-drops in oil-water two-phase flows. Statistical analysis on measured size distributions shows that the distribution follows a lognormal distribution.

**DMC5 • 5:00 p.m.**
Depth Resolution of Phase Gradients Using Pulsed Digital Holography, Mikael Sjödahl, Erik Olson, Eynas Amer, Per Gren; Luleå Univ. of Technology, Sweden. A technique to gain depth information from a single pair image-plane Digital Holographic recording of a transient phase object positioned between a diffuser and an imaging system has been demonstrated.

**DMC6 • 5:15 p.m.**
Surface Shape Measurement of a Concave Mirror by Doppler Phase-Shifting Digital Holography, Daisuke Barada, Yuichi Kikuchi, Shigoe Kato,ato, Toshikko Yatagai; Utsunomiya Univ., Japan. The surface shape of a concave mirror was measured by Doppler phase-shifting digital holography. The surface shape measurement was performed in an environment with external disturbances in order to confirm the robustness of the system.

**BMD • Novel Approaches in Microscopy—Continued**

**BMD3 • 4:45 p.m.**
In vivo Fluorescence Cellular Imaging by Side-View Endomicroscopy, Pilhan Kim1, Euiheon Chung1, Hiroshi Yamashita2, Kenneth E. Hung3, Atsushi Mizoguchi2, Raju Kucherlapati2,4, Dai Fukumura1,5, Rakesh K. Jai1,2, Seok H. Yun1,5; Harvard Medical School, USA, 1Massachusetts General Hospital, USA, 2Tufts Medical Ctr., USA, 3Brigham and Women’s Hospital, USA, 4KAIST, Republic of Korea, 5Harvard-MIT Health Sciences and Technology, USA. We describe a rotational side-view endomicroscope for imaging gastrointestinal tracts in mice with single cell resolution. We demonstrate non-invasive comprehensive visualization of fluorescently labeled cells and microvasculature in vivo.

**BMD4 • 5:00 p.m.**
Topography and Refractometry of Biological Nanostructures Using Spatial Light Interference Microscopy (SLIM), Zhiou Wang, Gabriel Popescu; Univ. of Illinois at Urbana-Champaign, USA. We demonstrate Spatial Light Interference Microscopy’s (SLIM’s) ability to perform topography at a single atomic layer in graphene, refractometry of neurites of a live hippocampal neuron in culture and dynamic imaging of glial membranes.

**BMD5 • 5:15 p.m.**
A Hybrid Strategy for the Detection of Cell Membrane Potential Using Electromotility, Zhulid Yao1, Toyojiro Yamauchi2, Seungjun Oh3, Wonshik Choi4, Ramachandra R. Dasari5, Michael S. Feld5; 1MIT, USA, 2Hamamatsu Photonics, K. K., Japan, 3Korea Univ., Republic of Korea. Cell membrane electromotility, which is nanometer-scale membrane motion driven by changes in membrane potential, is measured using a hybrid quantitative phase microscopy scheme with features such as high detection sensitivity and multi-point measurement capability.

**BME • Imaging and Spectroscopy Theory—Continued**

**BME4 • 4:45 p.m.**
Multi-Layered Models for Prediction of Diffuse Reflectance Spectra of Skin and Lip, Shoji Takano, Wakana Fujita, Eiji Okada; Keio Univ., Japan. The multi-layered realistic models are designed to simulate the difference in diffuse reflectance spectra between skin and lip. The predicted reflectance spectra are compared with experimental results of five volunteers to evaluate the models.

**BME5 • 5:00 p.m.**
GPU Accelerated Monte Carlo Simulation for 3-D Photon Migration, Qianqian Fang, David A. Boas; Massachusetts General Hospital, USA. We report a massively parallel Monte Carlo algorithm that can be run on Graphics Processing Units (GPU). Using a low-cost graphics card, it is over 300x faster than the traditional CPU-based simulations.

**BME6 • 5:15 p.m.**
Reconstruction-Free Imaging of Kaposi's Sarcoma Using Multi-Spectral Data, Jana M. Kainerstorfer1, Franck Amoyel1, Moinuddin Hassan1, Martin Elder1, Robert Yarchan2, Kathleen M. Wiygul3, Thomas Uldrich3, Viktor Chernomordik3, Christoph K. Hitzenberger3, Amir H. Gandjbakhche4, Jason D. Riley4; 1Natl. Inst. of Health, Exxon Kennedy Shriver Natl. Inst. of Child Health and Human Development, PPB/LIMB/SAFB, USA, 2Natl. Inst. of Health, Natl. Inst. of Neurological Disorders and Stroke, Clinical Neuroscience Program, USA, 3Natl. Inst. of Health, Exxon Kennedy Shriver Natl. Inst. of Child Health and Human Development, PPB/LIMB/SAFB, USA, 4HIV and AIDS Malignancy Branch, Ctr. for Cancer Res., Natl. Cancer Inst., Natl. Inst. of Health, USA, 5Medical Univ. of Vienna, Ctr. for Biomedical Engineering and Physics, Austria. Multi-spectral imaging was used for Kaposi’s sarcoma lesion follow-up. Reconstruction of blood volume and oxygenation as well as Principal Component Analysis was performed and we demonstrate the relationship between the first principal component and blood.
### DMC7 • 5:30 p.m.
**Broadband 3-D Digital Holography for Depth Structure Visualization**, Dmitry V. Shabanov, Grigory V. Gelikonov, Valentin M. Gelikonov; Russain Acad. of Sciences, Russian Federation. Acquiring 3-D OCT images of strongly scattering media internal structure with units of microns resolution by means of 2-D holographic recording at scattered light interference reception at tens nanometers range using digital image reconstruction.

### DMC8 • 5:45 p.m.
**Wake Flows Analysis by Digital Color Holographic Interferometry**, Jean-Michel Desse*, Pascal Picart*, Patrice Tanhang*; 1Office Natl. d’Etudes et de Recherches Aérospatiales, France; 2Lab d’Acoustique de l’Univ. du Maine, France; 3Ecole Natl. Supérieure d’Ingénieurs du Mans, Univ. du Maine, France. Digital 3A holographic interferometry is shown for analyzing the variations in the refractive index induced by the wakeflow around a circular cylinder.

### BMD6 • 5:30 p.m.
**Logarithmic Output Active Illumination Microscopy**, Kengehe K. Chu, Daryl Lim, Jerome Mertz; Boston Univ., USA. We present an improved technique to enhance the dynamic range of multiphoton microscopy using real time feedback to control illumination power. Our system provides simultaneous improvement in weak-signal sensitivity and immunity to strong-signal saturation.

### BMD7 • 5:45 p.m.
**Comparison of Fluorescence Lifetime Correlation Spectroscopy and Background Corrected Fluorescence Correlation Spectroscopy**, Steffen Rueglinger, Peter Kapustke, Matthias Patting, Michael Wahl, Rainer Macdonald; 1Physikalisch-Technische Bundesanstalt, Germany, 2PicoQuant GmbH, Germany. Practical limits of Fluorescence-Lifetime Correlation Spectroscopy (FLCS) were explored. It shown that FLCS yields correct concentration values down to the picomolar range and that different signal components can be separated in a single detector setup.

### BMD8 • 6:00 p.m.
**Snapshot Image Mapping Spectrometer (IMS) for Hyperspectral Fluorescence Microscopy**, Liang Gao, Robert T. Kester, Tomasz S. Tkaczyk; Rice Univ., USA. Principle and prototype of high sampling (285x285x60 data cubes) Snapshot Image Mapping Spectrometer for Fluorescence Microscopy is presented. Preliminary imaging results of cell samples stained with multiple dyes are demonstrated and discussed.

### Conference Reception, Le Jardin
Holographic Stevenson, Femtosecond Quantitative DTuA3 applications.

David Brady, Duke Univ., USA, Presider

Tuesday, April 13
8:00 a.m.–10:00 a.m.

Digital In-Line Holographic Microscopy in 4-D, S. K. Jericho, M. H. Jericho, Jurgen Kreuzer, Dalhousie Univ., Canada. Digital in-line Holography with spherical waves has been developed into a new microscopy for microfluidic, biological and marine applications, that routinely achieves both lateral and depth resolution at the submicron level in 4-D imaging.

Thursday, April 15
8:30 a.m.–10:00 a.m.

Benefits of Spatial Partial Coherence for Applications in Digital Holographic Microscopy, Frank Dubois, Catherine Youressowsky, Christophe Minetti, Patrick Queckers; Université Libre de Bruxelles, Belgium. We investigate the use of partially spatial coherent illuminations for digital holographic microscopes (DHM) working in transmission. The major advantage is reduction of the speckle noise making it possible high image quality for biomedical applications.

Tuesday, April 13
9:00 a.m.–11:00 a.m.

Quantitative Study of Cellular Dynamic Response to Femtosecond Laser Photoporation Using Digital Holographic Microscopy, Maciej Antkowiak, David J. Stevenson, Frank J. Gunn-Moore, Kishan Dhakal; Univ. of St Andrews, UK. Digital Holographic Microscopy is used to study dynamic responses of living cells to femtosecond laser membrane photoporation. The results give new insight into the efficiency and toxicity of this novel optical method of drug delivery.

Tuesday, April 13
9:00 a.m.–11:00 a.m.

Quantitative Characterization of Cellular Adhesions with Total Internal Reflection Holographic Microscopy, William M. Ash III, David Clark, Chun Min Lo, Myung K. Kim; Univ. of South Florida, USA. Total Internal Reflection Holographic Microscopy (TIRHM) uses near-field phase shifts to quantitatively image cellular adhesions. Cell-substrate interfaces cause relative index of refraction and frustrated TIR to modulate the specimen’s phase profile. Dictyostelium Discoidium imagery presented.

Tuesday, April 13
8:00 a.m.–10:00 a.m.

Breeding and Building Molecules to Spy on Cells and Tumors, Roger Tsien; Univ. of California at San Diego, USA. New flavoproteins photogenerate singlet oxygen, enabling genetically encoded correlative light and electron microscopy. Synthetic peptides provide an amplifying mechanism for targeting fluorophores, MRI contrast agents, and drugs to sites of protease activity (e.g. tumors) in vivo.

Tuesday, April 13
9:00 a.m.–11:00 a.m.

Clinical Translation of Optical Imaging: Global Prospects to Improve Early Cancer Detection, Rebecca Richards-Kortum; Rice Univ., USA. Multi-modal optical-imaging has potential to improve early detection of cancer in underserved populations. This talk will present a vision to expand the role of optical-imaging in global cancer management, highlighting recent widefield and high-resolution imaging-technologies.
DTuA • Holographic Microscopy—Continued

DTuA5 • 9:30 a.m.
Real Time 3-D Cytomorphological Imaging Using Digital Holographic Microscopy and Fluorescence Microscopy for Space Biology, M. Fatih Toy1, Jonas Kühl1, Jérôme Parent1, Christophe Pache1,2, Marcel Egli1, Christian Depeursinge1; 1Advanced Photonics Lab, École Polytechnique Fédérale de Lausanne, Switzerland, 2Eidgenössische Technische Hochschule Zurich, Space Biology Group, Switzerland. A microscope operating in Digital Holographic Microscopy (DHM) and classical widefield epi-fluorescence microscopy in a time sequential manner is developed to study morphological alterations of mouse myoblast cells under simulated microgravity in real time.

DTuA6 • 9:45 a.m.
Wide Range Coherence Digital Holographic Microscope, Radim Chmelik1, Hana Uhlirova1, Pavel Kolman1, Pavel Vesely2; 1Inst. of Physical Engineering, Faculty of Mechanical Engineering, Brno Univ. of Technology, Czech Republic, 2Inst. of Molecular Genetics, Acad. of Sciences of the Czech Republic, Czech Republic. Off-axis achromatic DHM. Light sources from partially-coherent to completely spatially and temporally incoherent. High-quality (speckle-free) imaging, optical sectioning by coherence gating, half lateral resolution limit for incoherent compared to coherent illumination; quantitative phase contrast, numerical 3-D reconstruction.

10:00 a.m.–10:30 a.m. Coffee Break/Exhibits, Richelieu Room
<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tr>
<td>10:30 a.m.–12:30 p.m.</td>
<td>DTuB1  •  Diffractive Optics and Imaging</td>
<td>Cory Christenson; Univ. of Arizona, USA, Presider</td>
<td>Tuesday, April 13</td>
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<tr>
<td>10:30 a.m.–12:30 p.m.</td>
<td>DTuB2  •  Brain Monitoring and Imaging I</td>
<td>Turgut Durduran; ICFO-The Inst. of Photonic Sciences, Spain, Presider</td>
<td>Tuesday, April 13</td>
</tr>
<tr>
<td>10:30 a.m.–12:30 p.m.</td>
<td>DTuB3  •  Nanomaterials and Molecular Probes</td>
<td>Eva M. Sevick-Muraca; Univ. of Texas, USA, Presider</td>
<td>Tuesday, April 13</td>
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<tr>
<td>10:30 a.m.–12:30 p.m.</td>
<td>BTuB1  •  Invited Functional Connectivity DOT: Development and Clinical Implications in Infants</td>
<td>Brian K. White, Steve M. Liao, Silvina L. Ferradal, Terrie E. Inder, Joseph P. Culver, Washington Univ. in St. Louis, USA.</td>
<td>Tuesday, April 13</td>
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**DTuB1 • 10:30 a.m.**
Volume Diffractive Optics, Tim D. Gerke, Rafael Piestun; Dept. of Electrical Engineering, Univ. of Colorado at Boulder, USA. A new type of volume diffractive optical element is computer designed and experimentally fabricated. The volume elements are designed to perform diffractive functions including pattern generation and multiplexing.

**DTuB2 • 10:45 a.m.**
Resolution-Enhanced Curving-Effective Integral Imaging System for far 3-D Objects Using Direct Pixel Mapping, Zhang Miao, Piao Yongri, Kim Eun-Soo; D3RC, Dept. Electronics Eng., Kwangweon Univ., Republic of Korea. We propose a resolution-enhanced method for far 3-D objects in the curving-effective integral imaging system using direct pixel mapping. Experimental results can prove the feasibility of the proposed method.

**DTuB3 • 11:00 a.m.**
Enhancement of Pinhole Type Integral Imaging System Using Color Filters of Liquid Crystal Display Panel, Jae-Hyun Jung, Younghoon Kim, Yumin Lee, Byoungho Lee; School of Electrical Engineering, Seoul Natl. Univ., Republic of Korea. In pinhole type integral imaging, the viewing angle and resolution are limited by pinhole interval. For enhancement of viewing angle and resolution, we propose the pinhole type integral imaging using color filters of LCD panel.

**BTuB2 • 11:00 a.m.**
Concurrent MRI and Diffuse Correlation and Near-Infrared Spectroscopic Measurement of Cerebral Hemodynamic Response to Hypercapnia and Hyperoxia, Turgut Durduran; ICFO-The Inst. of Photonic Sciences, Spain, Presider.

**BTuB3 • 11:00 a.m.**
Application of NIR Fluorescence Optical Imaging for Quantification of HER2 Receptors Expression in vivo, Victor V. Chernomordik, Moinuddin Hassan, Rajat Zielinski, Jacek Capalá, Amir Gandjbakhche; Natl. Inst. of Child Health and Human Development, USA, Radiation Oncology Branch, Natl. Cancer Inst., USA. A novel method to characterize HER2 expression in breast carcinomas in vivo is proposed. Analysis of variations in fluorescent intensity at the tumor site (mouse model) after injection of HER2-specific fluorescent probes substantiates our approach.
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<th>Napoleon I</th>
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<tr>
<td>Digital Holography and Three-Dimensional Imaging (DH)</td>
<td>Biomedical Optics (BIOMED)</td>
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**DTuB • Diffactive Optics and Imaging—Continued**

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<th>Session</th>
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<th>Authors</th>
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<tr>
<td>11:15 a.m.</td>
<td>Reconfigurable Shack-Hartmann Sensor without Moving Elements, Raúl Martínez-Cuenca, Vicente Durán, Vicente Climent, Enrique Tajahuerce, Salvador Bará, Jorge Ares, Justo Arrieta, Manuel Martínez-Corradi, Jesús Lancis</td>
<td>Daisuke Barada, Hitoshi Kurosawa, Takashi Fukuda, Shigeo Kauta, Tsuruhide Yatagai, Utsunomiya Univ., Japan; AIST, Japan. Polarization gratings were formed on a write-once type polarization-sensitive medium and their polarization characteristics were evaluated. A circularly polarized beam splitting function was observed in an orthogonally circular polarization grating.</td>
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<td>11:30 a.m.</td>
<td>Simultaneous EEG and Near-Infrared Imaging for Investigation of Neurovascular Coupling and Neonatal Seizure, R. J. Cooper, Tapun Austro, N. L. Eeckel, A. P. Gibson, Jeremy C. Hebbeler</td>
<td>Imperial College London, UK; Royal Hospital, UK. We describe a study of neurovascular coupling in the visual cortex of neonates using simultaneous, co-located EEG and near-infrared imaging. We also discuss the application of this technology to the study of neonatal seizures.</td>
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<tr>
<td>11:45 a.m.</td>
<td>Clinical Trial on Bedside Monitoring of Cerebral Perfusion in Acute Stroke by Time-Domain Near-Infrared Reflectometry, Olivier Steinkellner, Clemens Gruber, Heidrun Wahnitz, Jens Steinbrink, Peter Brunner, Heike Müller, Gerhard Jän Jungheilings, Jochen B. Siebach, Hellmuth Obri, Rainer Macdonald</td>
<td>Impulsiv-Institut, Germany; Klinik für Neurologie und Ctr. for Stroke Res. Berlin, Charité - Univ. Berlin, Germany. We use optical tracking of an indocyanine green bolus to monitor cerebral perfusion on patients suffering an acute ischemic stroke. Intermediate results of an ongoing clinical trial are presented and compared to established imaging techniques.</td>
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**BTuB • Brain Monitoring and Imaging I—Continued**

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<tr>
<td>11:15 a.m.</td>
<td>Cortical and Superficial Responses to Motor Activation Retrieved by Time-Domain Optical Brain Imaging, Heidrun Wahnitz, Timm O. Sander, Alexander Jezzai, Frank Peters, Frederik Geisler, Michaela Wache, Stefanie Leistner, Bruno-Marcel Mackert</td>
<td>Neuroscience Technische Universität Berlin, Germany. We investigated cortical and superficial responses to motor activation retrieved by time-domain optical brain imaging. The study was performed in healthy subjects using two different imaging approaches: near-infrared diffuse reflectance imaging and near-infrared imaging. The results are presented and discussed.</td>
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<td>11:30 a.m.</td>
<td>Characterization of Fulleren Fluorescence Incorporated in Human Lens and Retinal Pigment Epithelial Cells, Paola Taranto, Cosimo D’Andrea, Gianluca Valentin, Rinaldo Cubedda, Dan-Ning Hu, Jean E. Roberts</td>
<td>Dept. of Physics, Politecnico di Milano, Italy; Tissue Culture Ctr., New York Eye and Ear Infirmary, USA; Dept. of Natural Sciences, Fordham Univ., USA. Time-resolved fluorescence spectroscopy and imaging was performed on fulleren incorporated in human lens and RPE cells after incubation at doses in the range 1–500 μmol to investigate correlation with intracellular distribution and toxicity.</td>
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<tr>
<td>11:45 a.m.</td>
<td>Bioconjugated ICG/Dox-Micellar Nanocapsules for Optical Molecular Imaging and Targeted Therapy, Yongying Chen, Toufic G. Jabbour, Xingde Li</td>
<td>Biomedical Engineering, Johns Hopkins Univ., USA. We reported on an approach to encapsulate indocyanine green and anticancer drug with polymeric micelles which can be bioconjugated for near-infrared molecular fluorescence imaging and potentially targeted therapy.</td>
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**BTuC • Nanomaterials and Molecular Probes—Continued**

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<th>Session</th>
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<tr>
<td>11:45 a.m.</td>
<td>Characterization of Plasmon Coupling between Gold Nanospheres Using Polarization Control, Matthew J. Crow, Kevin C. Seekell, Adam Wad</td>
<td>Mitt Univer., USA. Single gold nanospheres sense local dielectric environment but are influenced by plasmonic coupling of proximal pairs. Polarization control separates these two effects, allowing both RI sensing and measurement of interparticle distance, with potential biological applications.</td>
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**DTuB • Diffusive Optics and Imaging—Continued**

**DTuB7 • 12:00 p.m.**
Time-Domain Fluorescence Lifetime Optical Projection Tomography, *James McGinty*, Daniel Stuckey, Remain Laine, Khadija Tahir, Mark A. Neil, Jo V. Hajnal, Alex Sardini, Paul M. W. French; Imperial College London, UK. We present a platform for measuring the fluorescence lifetime distribution in mesoscopic samples (~0.1-1cm) based on optical projection tomography and time-gated imaging. This is applied to optically cleared embryos expressing a calcium sensing FRET probe.

**DTuB8 • 12:15 p.m.**
Tomographic Fourier Telescopy, *Daisy H. Garces*, William T. Rhodes, Nestor Peña Translaviñia; 1Univ. of the Andes, Colombia, 2Florida Atlantic Univ., USA. Fourier telescopy is usually applied to objects that can be modeled as planar. Tomographic principles, however, can be exploited to extend the realm of application to 3-D objects.

**BTuB6 • 12:00 p.m.**
Correlation Analysis during Resting State of the Whole Head with Near-Infrared Spectroscopy, *Rickson C. Mesquita*, Maria A. Franceschini; David A. Bows; 1Dept. of Physics and Astronomy, Univ. of Pennsylvania, USA, 2Athinoula A. Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA. Functional correlation analysis was performed on near-infrared data of the whole head during baseline. We generated correlation images that reflect coherent fluctuations across the brain, mainly in the contralateral side of the seed arbitrarily defined.

**BTuB7 • 12:15 p.m.**
Multi-Wavelength, Depth Resolved, Scattering and Pathlength Corrected in vivo Near-Infrared Spectroscopy of Brain Tissue, *Ilias Tachtсидis*, Terence S. Leung; Arnab Ghosh; Martin Smith; Chris E. Cooper; Clare E. Elwell; 1Dept. of Medical Physics and Bioengineering, Univ. College London, UK, 2Neurocritical Care, Natl. Hospital for Neurology and Neurosurgery, UK, 3Dept. of Biological Sciences, Univ. of Essex, UK. We report a novel methodology that combines NIR multi-distance frequency and broadband spectrometers to quantify brain tissue haemodynamics, oxygenation and metabolism. We show preliminary results in a young healthy adult during a CO2 challenge.

**BTuC8 • 12:15 p.m.**
Imaging Cells with Second-Harmonic Generation Active Nanocrystals, *Chia-Lung Hsieh*, Rachel Grange; Ye Pu; Demetri Psaltis; 1École Polytechnique Fédérale de Lausanne, Switzerland, 2Caltech, USA. We developed second-harmonic generation (SHG) active nanocrystals as cell imaging probes. Highly specific labeling of the nanocrystals on the HeLa cell membrane proteins was achieved by covalently coupling antibodies onto the nanocrystals.

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**NOTES**
**Biomedical Optics and 3-D Imaging Congress and Exhibition • April 11–14, 2010**

**DTuC • Biological Applications**

**DTuC1 • 1:30 p.m. Invited**

Digital Phase Holography of Biological Cells, Natan T. Shaked, Adam Wax; Duke Univ., USA. Interferometric phase microscopy has the potential of becoming a widely-used tool for quantitative measurements of biological cells. We introduce the current state of the art, the open questions, and solutions experimentally developed in our laboratory.

**DTuC2 • 2:00 p.m. Invited**

3-D Identification and Tracking of Biological Microorganisms Using Computational Microscopy, Bahram Javidi1, Mehdi DaneshPanah1, Inkyu Moon2, Saeed Bagheri3, Aran Anand4; 1Univ. of Connecticut, USA, 2Chosun Univ., Korea, Republic of, 3IBM T. J. Watson Res. Ctr., USA, 4MS Univ. of Baroda, India. We briefly overview applications of digital holographic microscopy (DHM) for real-time non-invasive three dimensional sensing, tracking, and recognition of living microorganisms such as single/multiple cell organisms, bacteria, etc. Analytical frameworks and experimental results are presented.

**DTuC3 • 2:30 p.m.**

Off-Axis Self-Interference Based DIC Imaging of Living Cells, Dan Fu1, Seungeun Oh2, Toyohiko Yamauchi3, Wonshik Choi4, Ramachandra R. Dasari1, Michael S. Feld1; 1MIT, USA, 2Hamamatsu Photonics K.K., Japan, 3Korea Univ., Republic of Korea. We developed a new DIC imaging method based on off-axis sample wavefront self-interference. It provides quantitative phase gradient imaging and is extremely simple to implement on any standard microscope. Live cell imaging is demonstrated.

**DTuC4 • 2:45 p.m.**

Volume Holographic Imaging of Biological Tissue Samples, Raymond Kostuk1, Jennifer K. Barton1, Yuan Luo1; 1Univ. of Arizona, USA, 2MIT, USA. Volume holographic filters incorporated into optical microscopy systems can extend imaging capability by providing wavefront selectivity and spectral information. These features are explored in the context of viewing biological tissue samples.
BTuD1
A Novel Hybrid Imaging System for Simultaneous Fluorescence Molecular Tomography and Magnetic Resonance Imaging, Florian Staker1, Christof Baltes2, Katerina Dikaiou1, Darya Vats1, Lucio Carrara2, Eduardo Charbon3, Jorge Rapol3, Markus Rudin4; 1Inst. for Biomedical Engineering, Univ. Zürich, Switzerland, 2AQUA Group, Ecole Polytechnique Fédérale de Lausanne, Switzerland, 3Inst. for Electronic Structure and Laser, Foundation of Res. and Technology Hellas, Greece, 4Inst. of Pharmacology and Toxicology, Univ. Zürich, Switzerland. An in vivo hybrid imaging system for simultaneous magnetic resonance and fluoresence molecular tomography imaging, providing adequate spatial resolution and quantification capabilities, is described. Imaging performance in vivo is demonstrated using a murine tumor model.

BTuD2
Optoacoustic Imaging of Adult Zebrafish, Daniel Razansky, Martin Distel, Rui Ma, Reinhard Koster, Vasili Nitzchriostos; Technical Univ. of Munich, Germany. Adult zebrafish is an important model organism not accessible by current optical imaging methods due to intense light scattering. Here selectvive-plane optoacoustic tomography yields high resolution whole-body reconstructions of the animal at late developmental stages.

BTuD3
Fluorescence Imaging Setup with Lifetime Resolution for Detection of Red Fluorescent Protein Expressed Tumors in Small Animals, Ilja Turchin, Michail Kleshnov, Anna Orlova, Ilia Fikov, Alexander Rasumov, Alexander Saitzskya; 1Inst. of Applied Physics, Russian Acad. of Sciences, Russian Federation, 2A.N. Bakh Inst. of Biochemistry, Russian Acad. of Sciences, Russian Federation. We present the setup for small-animal fluorescence imaging which combines reflectance technique with lifetime resolution and diffuse fluorescence tomography. The results of in vivo study with red fluorescent protein expressed tumors will be reported.

BTuD4
Fluorescence Tomography of Red-Shifted Fluorescent Proteins, Nikolaos C. Deliolanis1, Thomas Wurding1, Babhun A. Tannous2, Vasili Nitzchriostos1; 1Technische Univ. and Heimholtz Zentrum München, Germany, 2Harvard Medical School and Massachusetts General Hospital, USA. We report on a novel multi-spectral tomographic method that allows the 3-D visualization of fluorescent protein activity in small animals. We demonstrate the method imaging mCherry fluorescent protein expressing glioma tumors in mice.

BTuD5
Novel Near-Infrared Fluorescent Agent for Imaging Human Prostate Carcinoma in an Athymic Mouse Model, Kenneth M. Tichauer1, Jennifer L. Hickey2, Lisa Hoffman1, Keith St. Lawrence1,5, Leonard G. Layla1,4, Ting-Yim Lee3,4; 1Lawson Health Res. Inst., Canada, 2London Regional Cancer Program, Canada, 3Dept. of Chemistry, Univ. of Western Ontario, Canada, 4Dept. of Medical Biophysics, Univ. of Western Ontario, Canada, 5Dept. of Oncology, Univ. of Western Ontario, Canada. ‘Imaging Dia., Robarts Res. Inst., Canada. New near-infrared fluorescent agents have improved the depth sensitivity of fluoresence molecular imaging, Preliminary results from preclinical use of a near-infrared emitting, prostate cancer marker displayed adequate tumor contrast by 1 h after intravenous injection.

BTuD6
Accurate Study of FosPeg Distribution in a Mouse Model Using Fluorescence Imaging Technique and Fluorescence White Monte Carlo Simulations, Haijun Xie1, Haichun Liu1, Pontus Svensmark1, Johan Axelsson1, Susanna Grief1, Jesper Holm Lundemand1, Hanges Cheng1, Maria Kargaz1, Nils Bendsoe1, Peter Andersen1, Katarina Sundberg1, Stefan Anderson Engblom1; 1Dept. of Physics, Lund Univ., Sweden, 2Biolitec AG, Res. and Development, Germany, 3DTU Fotonik, Denmark, ‘Biomedical Optics and Applied Biophysics Lab, Dept. of Electrical Engineering and Computing, Natl. Technical Univ. of Athens, Greece, 4Dept. of Dermatology and Venereology, Lund Univ. Hospital, Sweden, 5Dept. of Oncology, Lund Univ. Hospital, Sweden. Fluorescence imaging is used for quantitative in vivo assessment of drug concentration. Light attenuation in tissue is compensated for through Monte-Carlo simulations. The intrinsic fluorescence intensity, directly proportional to the drug concentration, could be obtained.

BTuD7
The Dynamic Change of NADH Fluorescence Lifetime in PARP-1 Induced Cell Death, Han Wen Guo1, Yau-Huei Wei1, Hsing Wen Wang1; 1Inst. of Biophotonics, Natl. Yang Ming Univ., Taiwan, 2Inst. of Biochemistry and Molecular Biology, Natl. Yang Ming Univ., Taiwan. We imaged NADH fluorescence lifetime in HeLa cells treated with a PARP-1 activating agent, N-methyl-N’-nitro-N-nitrosoguanidine, and then pyruvate to prevent cell death. NADH lifetime may be a potential diagnostic/therapeutic biomarker in PARP-1 induced cell death.

BTuD8
Optical Discrimination of Intracellular Ca2+ Changes of Brain Induced by Cocaine and Ischemia, Ruling Pan1, Zhijia Yan1, Zhongchi Lai1, Congwei Dai1; 1Beihang Univ. Natl. Lab, USA, 2Dept. of Biology, Univ. of Illinois at Urbana-Champaign, USA, 3Dept. of Biomedical Engineering, SUNY Stony Brook, USA, 4Dept. of Anesthesiology, SUNY Stony Brook, USA. We use microscopic fluorescence imaging to study the effect of chronic cocaine exposure on the intracellular calcium concentration ([Ca2+]i) of cortical brain, and to compare with the brain [Ca2+]i changes induced by ischemic insults.

BTuD9
Handheld Video Rate Fluorescence Diffuse Optical Tomography, Metaxebya Solomon1, Brian R. White1, Adam Q. Bauer1, Gavin Perry1; 1Dept. of Biomedical Engineering, USA, 2Dept. of Radiology, Washington Univ. in St. Louis, USA. We developed a fiber-based video-rate fluorescence diffuse optical tomography that measures both fluorescence emission and reference transmission signals simultaneously. This design permits visualization of rapidly occurring physiological events in real time.

BTuD10
Early Detection of Tumor Vascular Response to Anti-Angiogenic Drugs with Optical Tomography, Molly L. Hixman1, Sonia L. Hernandez1, Jianzhong Huang1, Tessa Johang1, Hyun Soo Kim1, Yonghun Lee1, Fotos Vlachos2, Darrell J. Yamashiro1, Jessica Kandel1, Andreas H. Hielscher; Columbia Univ., USA. Using optical tomography we have imaged early vascular responses to anti-angiogenic treatments in a small animal tumor model. Optical images acquired from 1 to 7 days after drug administration show measurable changes in hemoglobin concentration.

BTuD11
Quantification of Fluorescence Target in Tissue Phantoms by Time-Domain Diffuse Optical Tomography with Phantoms – Total-Light Approach, Goro Nishimura1, Kamlesh Awasthi1, Kitsakorn Locharoenrat1, Shinpei Okawa1, Yukio Yamada1, 2London Inst., Japan, 3Univ. of Electro-Communications, Japan. We conducted time-domain fluorescence measurements with tissue phantoms. We could successfully apply total-light algorithm to reconstruct the absorption image of fluorescence target. This algorithm is potentially useful in the quantification of fluorophores in tissues.

BTuD12
Signal-Locking Fourier Transform SPR: A New Low-Noise Detection Technique for Biomolecular Interactions, Layne D. Williams1, Trinidad Ghoosh2, Kenny E. Fernandez3, Carlos H. Mastro Angelo1, Univ. of Utah, USA. A new frequency domain SPR technique for quantitative measurement of biomolecular interactions is presented with the goal of improved signal-to-noise ratio. The technique uses a microfluidic chemical modulator chip with Au sensing sites.
Tuesday, April 13
Richelieu Room
1:30 p.m.-3:30 p.m.

**BTuD13**
Screening Small Molecule Compounds for Protein Ligands with Label-Free, Optically Detected Microarray, Xiangdong Zhu, Y. Y. Fei, J. P. Landry, Y. S. Sun, Univ. of California at Davis, USA. Using a high-throughput label-free optical scanner we measured endpoints and binding kinetics of human vascular endothelial growth factor (VEGF) protein against 8,000 small molecule compounds (in microarray format) from NCI Developmental Therapeutics Program.

**BTuD14**
Optical Coherence Microscopy (OCM) and Full Field OCT (FFOCT) for Wavefront Correction in Dense Tissues, Claude A. Boccara, Sylvain Gigan, Michelle Roth, Jonas Binding, Inst. Langeron, France. Optical resolution is degraded by biological tissue-induced aberrations. To correct them wavefront measurements are performed either by measuring the wavefront distortion at the focus using OCM or by working on image quality optimization using FFOCT.

**BTuD15**
An Edge Detection Algorithm for Improving Optical Coherence Tomography Images of the Prostate Nerves, Shabah Clitchian, Nathaniel M. Fried, Univ. of North Carolina at Charlotte, USA. The cavernous nerves, responsible for erectile function, are at risk of injury during prostate cancer surgery. An edge detection algorithm is presented here for improved OCT prostate imaging, and identification and preservation of the nerves.

**BTuD16**
Forward-Viewing Endoscope of Appropriate Scanning Speed for 3-D OCT Imaging, Li Huo, Jiefeng Xi, Yongqiang Chen, Xingde Li, Johns Hopkins Univ., USA. A forward-viewing fiber-optic endoscope was developed with the scanning speed appropriate for 3-D real-time OCT imaging when using a high-speed swept source. The scanning speed was systematically analyzed. In vivo 3-D oral cavity imaging was performed.

**BTuD17**
Multiple Scattering Effects in Intralipid and Whole Blood Measured with Doppler Optical Coherence Tomography, Jeroen Kalkman1, Alexander V. Bykov2, Dirk J. Faber1,3, Ton G. van Leeuwen1,2,1 Dept. of Biomedical Engineering and Physics, Academic Medical Ctr., Netherlands, 2Optoelectronics and Measurement Techniques Lab, Univ. of Oulu, Finland, 3Ophthalmology Dept., Academic Medical Ctr., Netherlands, 4Biophysical Engineering Group, MIRA Inst. for Biomedical Technology and Technical Medicine, Univ. of Twente, Netherlands. Doppler Optical Coherence Tomography (OCT) measurements on flowing Intralipid and whole blood are performed. The effect of multiple scattering on the Doppler OCT attenuation and flow is analyzed and compared to Monte Carlo simulations.

**BTuD18**
Velocity Resolution and Minimum Detectable Velocity in Joint Spectral and Time Domain OCT, Ireneusz Gniukowski, Maciej Szulmowski, Jowena Gorczynska, Daniel Szalg, Andrzej Kowalczyk, Maciej Woitkowsk, Nicolaus Copernicus Univ., Poland. We present the analysis of the accuracy of velocity measurement by means of joint Spectral and Time domain Optical Coherence Tomography (STDOCT) method. Additionally, we determine the minimum detectable velocity.

**BTuD19**
Improvement in Dynamic Range of SS-OCT by Using True Logarithmic Amplifier, Bin Liu, Ehsan Azimi, Mark E. Brezinski, Brigham and Women’s Hospital, USA. A new method to increase the dynamic range of a swept source optical coherence tomography (SS-OCT) by using a true logarithmic amplifier is studied theoretically and tested experimentally.

**BTuD20**
Image Feature Identification for Optical Coherence Tomography of Colorectal Neoplasm, Chih Wei Lin, Wei Cheng Huang, Han Mo Chiu, Chia Wei Sun, Industrial Technology Res. Inst., Taiwan, Natl. Taiwan Univ. Hospital, Taiwan, Natl. Yang Ming Univ., Taiwan. Optical coherence tomography has potential for colorectal neoplasm detection. We develop three algorithms to identify the image feature of colorectal neoplasm. Preliminary results indicate that the image features are different between normal and abnormal tissues.

**BTuD21**
Quantized Optical Field Analysis in OCT: Deeper Insights and Future Directions, Mark E. Brezinski, Brigham and Women’s Hospital, USA. To date, the optical field in OCT has been treated primarily classically. This work examines the OCT interferometer in full quantization, identifying often ignored effects as such as quantum fluctuations, indistinguishable paths, radiation pressure, and photon statistics.

**BTuD22**
Performance of the Red-Shifted Fluorescent Proteins in Multispectral Optoacoustic Tomography (MSOT), Nikolaos C. Deliolanis, Jürgen Glaes, Ralph Schulz, Daniel Razansky, Vasileios Ntziachristos; Technische Univ. and Helmholtz Zentrum München, Germany. We report on the optoacoustic performance of red-shifted FPs in deep-tissue mouse multispectral optoacoustic tomography, that in particular cases can be more than 3 orders of magnitude better.

**BTuD23**
In vivo Photothermal Imaging of Tumor Using Gold Nanoparticles as Contrast Agent, Qizhi Zhang, Nobutaka Iwakuma, Parvathy Sharma, Brij M. Moudgil, Stephen R. Grobmyer, Huabei Jiang, Univ. of Florida, USA. In this study, we demonstrate that following intravenous administration of PEGylated gold nanoparticles to tumor bearing mice, accumulation of gold nanoparticles in tumors can be effectively imaged with photoacoustic tomography.

**BTuD24**
Correcting for Heterogeneous Fluence Profiles in Photoacoustic Imaging with Diffuse Optical Tomography, Adam Q. Bauer1, Ralph E. Nothdurft2, Chengu Li3, Liqong V. Wang2, Joseph P. Culver1, Washington Univ. School of Medicine, USA. Diffuse optical tomography and photoacoustic tomography were combined to measure the optical absorption coefficient of a tissue mimicking phantom. Heterogeneous fluence maps were calculated from DOT absorption reconstructions and used to correct PAT reconstructions.

**BTuD25**
In vivo Photothermal Imaging of Tumor Using Perfluorocarbon-Based Nanoparticles, Chunhong Kim1, Walter Akers2, Kevin Guo1, Ralph W. Farhadi1, Cai Xin1, Gregory M. Lanza2, Samuel Achilefu2, Liqong V. Wang1, Washington Univ. in St. Louis, USA; Washington Univ. School of Medicine, USA. We have developed perfluorocarbon nanoparticles loaded with near-infrared light absorbing dyes for photoacoustic tomography. We have successfully imaged nanoparticles in sentinel lymph nodes in rats in vivo using photoacoustic tomography.

**BTuD26**
In vivo Imaging of the Proximal Interphalangeal (PIP) Finger Joint with Three-Dimensional Photoacoustic Tomography, Yao Sun, Eric Sobel, Huabei Jiang, Univ. of Florida, USA. We study optimal scanning geometry for imaging finger joints by three-dimensional photoacoustic tomography using tissue phantom experiments, and the PIP finger joint in a human subject can be three-dimensionally imaged in our optimized spherical scanning.

**BTuD27**
A Triple Endoscope System for Alignment of Multispectral Images of Moving Tissue, Neil T. Clancy, Danail Stoianov, Vincent Sauvage, David James, Guang-Zhong Yang, Daniel S. Elson, Inst. of Biomedical Engineering, Imperial College London, UK. A three-channel rigid endoscope allowing simultaneous recording of stereoscopic and multispectral images has been developed. With appropriate calibration, the system allows for registration of multispectral images where the tissue or camera is moving.
BTuD28
Interplay of Chromatic Aberration and Scattering in Depth-Resolved Two-Photon Fluorescence Endoscopy, Yicong Wu, Xingde Li; Johns Hopkins Univ., USA. The influence of chromatic aberration of an objective lens and tissue scattering on depth-resolved two-photon fluorescence spectra measured by a fiber-optic endomicroscope is investigated. Proper calibration is proposed to restore the true depth-dependent fluorescence spectra.

BTuD29
Polarization Characterization of Laparoscope Systems for Polarization Resolved Tissue Imaging, Tobias C. Wood, Daniel S. Elson; Imperial College London, UK. Polarization resolved imaging techniques must be incorporated into standard imaging instruments to be used in the clinic. We present a characterization of the polarization properties of two commercial laparoscopes and detail the inherent difficulties.

BTuD30
Measurements of Wavelength Dependent Scattering Coefficients by Low Coherence Spectroscopy, Nienke Bosschaart, Maurice C. G. Adders, Dirk J. Faber, Ton G. van Leeuwen; Dept. of Biomedical Engineering and Physics, Biomedical Photonics, Univ. of Amsterdam, Netherlands. Scattering coefficients of weakly scattering polystyrene sphere solutions were measured by Low Coherence Spectroscopy (LCS) from 460 to 680 nm. The coefficients agree with Mie theory and can be measured independent of scattering anisotropy.

BTuD31
Optical Characterization of Coral Skeleton with Low-Coherence Enhanced Backscattering Spectroscopy, Vladimir Turzitskyy, Andrew Fang, Jennifer Fang, Jillian Henss, Margaret Siple, Valentina Stepanova, Jeremy D. Rogers, Hannah Wolfman, Andrew Radosevich, Valdon Backman, Luiza A. Marcellini; Northeastern Univ., USA. We have implemented Low-coherence Enhanced Backscattering (LEBS) as a tool for non-invasively measuring optical properties. We observe that coral skeletons that are susceptible to bleaching have smaller reduced scattering coefficients and fractal dimensions.

BTuD32
High Throughput Vibrational Cytometry Based on Coherent Anti-Stokes Raman Scattering Microscopy, Vladimir V. Yakovlev, Georgi Petrov, Rajan Annot; Univ. of Wisconsin at Milwaukee, USA. We demonstrate a feasibility of a high-throughput (>1,000 cells/s) vibrational cytometry using nonlinear Raman microscopy.

BTuD33
Using Fluorescence Lifetime Imaging Microscopy to Monitor Photofrin Uptake, Redistribution, and Intracellular Microenvironment, Shu-Chi Ye, Tony J. Collins, Regina W. Leong, Kevin R. Diamond, Qiqian Fang; McMaster Univ., Canada. Real-time dosimetry is important to photodynamic therapy treatments. In a cellular microscopy study, we measured the fluorescence lifetime changes of Photofrin® when it bonds to specific intracellular components at specific stages of the cellular uptake.

BTuD34
Assembly of a Widescreen Imaging Device and Segmentation of Multispectral Images for Cancer Screening, Sebastiao Pratavieira, Cristina Karachi, Vanderlei Bagnato, Sao Paulo Univ., Brazil. A simple widefield imaging device based on fluorescence and reflectance for cancer screening was assembled. A digital image processing combining both modes is proposed to objectively enhance lesion discrimination.

BTuD35
High Frame-Rate Dual-Wavelength Near-Infrared MR-Guided Dynamic Oximetry Imaging System, Zhiqiu Li, Verkaratamanan Krishnasamy, Scott C. Davis, Shudong Jiang, Keith D. Paulsen, Brian W. Pogue; Dartmouth College, USA. A NIR diffuse optical tomography system with spectrally-encoded sources at two wavelength bands allows simultaneous detection at high speed. It works with MR to provide images of high-contrast, fast changes in tissue oxygen saturation.

BTuD36
Quantitative Results of a Bi-Modal X-Ray fDOT System in a Cylindrical Geometry, Anne Plantat-Chérité, Anne Koenig, Jean-Guillaume Coutard, Lionel Hervé, Ludovic Lecomte, Marco Brambilla, Jean-Marc Dinten; CEA - LETI, France. We develop a new instrument that couple cylindrical fluorescence diffuse optical tomography to a micro XCT system. We focus on the effective coupling between both modalities via the fDOT algorithm. Quantitative results are provided.

BTuD37
In vivo X-ray Guided Diffuse Optical Tomography of Osteoarthritis in the Knee Joints, Qizhi Zhang, Zhen Yuan, Eric S. Soibel, Huabei Jiang; Univ. of Florida, USA. This pilot clinical study shows for the first time that X-ray guided diffuse optical tomography is a potential tool to image osteoarthritis in large joints such as the knee.

BTuD38
Fluorescent Mediated Tomography Using SPECT and CT Prior Information from Simultaneous Tri-Modal Imaging, Li Ji Cao, Wolfhard Semmler, Joerg Peter; German Cancer Res. Ctr., Germany. A multi-modal image reconstruction strategy is presented aimed at improving FMT by intrinsically co-registering SPECT-CT priors. Results from phantom experimental data illustrate that the strategy does suppress reconstruction artifacts and also facilitates quantitative analysis.

BTuD39
Trans-Rectal Ultrasound-Coupled Spectral Optical Tomography at 785nm and 830nm Detects Elevation of Total Hemoglobin Concentration in Canine Prostate Associated with the Development of Transmissible Venereal Tumors, Zhen Jiang1, Kenneth Bartels1, Gilbert R. Holyoak1, Jerry W. Ritchey2, Jerry S. Krasinski3, Charles F. Bunting1, Grenady Slobodov1, Dqing Piao1; 1: Oklahoma State Univ., USA, 2: Univ. of Oklahoma Health Sciences Ctr., USA. Spectral trans-rectal ultrasound-coupled optical tomography at 785nm and 830nm has revealed non-invasively longitudinal elevation of total hemoglobin concentration associated with development of transmissible venereal tumors in canine prostate over a 6-week time-course.

BTuD40
Imaging Molecular Signatures for Detection of Osteoarthritis by Combining Spectral and Spatial a-Priori Information, Zhen Yuan, Qizhi Zhang, E. Soibel, Huabei Jiang; Dept. of Biomedical Engineering, Univ. of Florida, USA, College of Medicine, Univ. of Florida, USA. The multi-wavelength spectroscopy of the joints using X-ray-guided spatial constraints provides 3-D images of oxygen saturation and water content with high resolution and improved quantitative capability.

BTuD41
A Low-Cost, Portable System for High-Speed Multispectral Optical Imaging, Ryan Sun, Matthew B. Bouchard, Sean A. Burgess, Andrew J. Radosevich, Elizabeth M. C. Hillman; Columbia Univ., USA. A simple new approach to multispectral optical imaging is presented that utilizes camera-synchronized LED illumination for high-speed acquisition. The developed system is also portable and very low-cost compared to conventional implementations of multispectral imaging.

BTuD42
Reconstruction of Raman Spectra Using Diffuse Light Propagation in 3-D, Jennifer-Lynn H. Deners1, Sabahdra Srinivasan1, Martin Isabelle2, Brian W. Pogue1, Michael D. Morris2; 1:Dartmouth College, USA, 2:Univ. of Michigan, USA. Simulations were completed to determine the effect of the propagation of Raman signal through a rat tibia. Reconstructed data show a shift in the Raman Spectra of less than 1nm as compared to original signal.
calibration of diffuse liquid phantoms based on Intralipid and Indian ink has been performed. Different techniques, instrumental set-ups and analysis methods led to compatible values for optical properties.

**BTuD48**

**BTuD49**
Accessing Accuracy in the Determination of Solid Tissue Phantom Optical Properties: A Sample Geometry Study, *Jean-Pierre Bouchard*, Israel Veilleux, Michel Fortin, Isabelle Noisieux, Rym Jelfdi, Ozyg Mermut; Inst. Natl. d’Optique, Canada. Accuracy of time resolved transmission characterization of solid tissue phantoms is investigated by measuring samples of various geometries with non negligible boundary effects. Relative invariance to geometry provides confidence on absolute accuracy of characterization.

**BTuD50**
Non-Negative Matrix Factorization to Remove Autofluorescence of Tissues and Improve FDOT, *Anne-Sophie Montmaquet*; Lionel Herde, Jean-Marc Dinten, Jérôme I. March, ICA LETI Minoter, France. Autofluorescence of biological tissues limits deep fluorescence markers detection. A spectroscopic approach and a blind source separation method are explored to remove the autofluorescence signal. We show how this preprocessing improves Fluorescent Diffuse Optical Tomography.

**BTuD51**
Simultaneous Speckle Contrast and Functional Brain Tissue Imaging System, *Dene A. A. Ringuette*, Hart Leyv, Elizabeth A. Munro, Xiaofan Jin, Ofer Levi; Univ. of Toronto, Canada. We demonstrate simultaneous in vivo reflectance and speckle contrast imaging system, utilizing VCSEL laser diode coherence modulation. By time multiplexing laser modes, VCSEL illumination noise is manipulated to enable a dual mode brain imaging operation.

**BTuD52**
Withdrawn

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**BTuD3**
Improved Detection Limits Using a Hand-Held Optical Imager with Coregistration Capabilities, *Sarah J. Erickson*, Sergio Martinez, Lizeth Caldera, Annalda Godarvorty, Florida Inst. Univ., USA. A hand-held optical imager has been developed with coregistration facilities. Summation of multiple scans (fluorescence intensity images) enabled deeper target detection under perfect and imperfect (100:1) uptake conditions in tissue phantoms and in vitro.

**BTuD4**
Diffraction Imaging Flow Cytometric and 3-D Morphological Analysis of Three Cell Lines, *Kenneth M. Jacobs*, Junhua Ding², Li V. Yang², Carissa L. Reynolds¹, Andrew E. Ekpenyong¹, Yuanning Feng¹, Mary A. Farwell¹, Jun Q. Lu¹, Xin-Hua Hu¹; East Carolina Univ., USA, “Tianjin Univ., China. Three cell lines were used to examine the capability of a recently developed diffraction imaging flow cytometer for cell differentiation. Comparison of the diffraction images with the confocal imaged based 3-D structures yields positive results.

**BTuD5**
Development of a Non-Contact Diffuse Optical Spectroscopy Probe for Extraction of Tissue Optical Properties, *Sheldon Bish*, James W. Tunnell; Univ. of Texas at Austin, USA. We developed a non-contact diffuse optical spectroscopy probe for extraction of tissue optical properties to mitigate the effects of probe contact pressure. Auto-focusing and cross polarization mechanisms improve depth of focus and reduce specular reflection.

**BTuD6**
Time-Domain Elliptical Localization of Point-Like Fluorescence Inclusions with Early Photons Arrival Times, *Julien Picchet*, Yes Berube-Lauzier, Un. de Sherbrooke, Canada. We introduce a novel approach for localizing a plurality of discrete fluorescent inclusions embedded in a thick scattering medium. It exploits time-domain experimental data and intersections of ellipses where inclusions are likely to be found.

**BTuD7**
Towards the Definition of Accurately Calibrated Liquid Phantoms for Photon Migration at NIR Wavelengths: A Multi-Laboratory Study, *Lorenzo Spinelli*², Antionio Pifferi¹, Alessandro Torricelli¹, Rinaldo Caveddha¹, Paola Di Ninni¹, Fabrizio Martelli¹, Giovanni Zaccanti¹, Florian Foschum³, Alvin Kieing³, Mikhaïl Mazerkena¹, Heidrun Waibl¹, Michel Karpzaï², Norbert Zilek³, Daniel Milly³, Adam Liebert³; Inst. di Fotonica e Nanotecnologie, Italy, ²Politecnico di Milano, Italy, ³Univ. degli Studi di Firenze, Italy. ¹Inst. für Laser technologies in der Medizin und Messechnik an der Univ. Ulm, Germany, ²Physikalisch-Techn. Bundesanstalt, Germany, ³Inst. of Biocybernetics and Biomedical Engineering, Poland. A multi-laboratory study for the accurate

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**BTuD43**
New Technique to Estimate Scattering Coefficient by Time-Resolved Measurement of Backscattered Light, *Masayuki Kawai*, Takeshi Namita, Yuji Kato, Koichi Shimizu; Graduate School of Information Science and Technology, Hokkaido Univ., Japan. A new simple technique to estimate the scattering coefficient of diffuse medium was developed. The feasibility of the proposed method was verified in the experiment using a liquid model phantom.

**BTuD45**
A Compact Time-Resolved near Infrared Spectroscopy Setup for Clinical Applications, *Patrick Poulet*¹, Marine Amouroux¹, Wilfried Uhring¹, Thierry Pebay³, Renee Chabrier¹, Nelly Tessandier¹, Marien Sand¹, Luc Matriller¹; ¹Lab d’Imagerie et de Neurosciences Cognitives, Univ. de Strasbourg, CNRS, France, ²Inst. d’Electronique du Solide et des Systemes, Univ. de Strasbourg, CNRS, France. A time-resolved NIRS instrument was assembled. The data analysis uses an initial fit to the Patterson’s model followed by variations fitted with the microscopic Beer-Lambert law. In vitro and preliminary in vivo measurements are presented.

**BTuD46**
Sensitive Detection of Optical Discrete Absorption and Lasing of Fused Silica by the Depopulation of the, *Fuat Bayrakken*, Şerife İpek Kaplan, Yeditepe Univ., Turkey. Ultraviolet light induced high resolution optical absorption spectra and resonance coherent fluorescence of spectroscopically pure fused silica have been studied, due to its potential applications in optoelectronics and flash and power optics and lasers.

**BTuD47**
Non-Contact Fluorescence Tomography: Sub-System Control Design for Exposure Control, *Fadi El-Ghoussein*, Daz Kepshure, Frederic Leblond, Brian Pogue; Thayer School of Engineering, Dartmouth College, USA. Non-contact fluorescence tomography of small animals needs to be automated to balance gain control and laser intensity avoiding saturation or noisy signals. System workflow is identified and the concept of automatic exposure control is tested.

**BTuD48**
Spectral Distortions Due to a Finite Spectral Bandwidth Light Source in Time-Resolved Diffuse Spectroscopy, *Andrea Farina*, Andrea Bassi, Paola Taroni, Daniela Comelli, Lorenzo Spinelli, Rinaldo Caveddha, Antonio Pifferi; Dept. di Fisica, Politecnico di Milano, Italy. We discuss the spectral distortions occurring when time-resolved diffuse spectroscopy is performed illuminating with a spectrally wide source. Theoretical and experimental investigations are given and a data analysis method to overcome the distortions is proposed.
BTuD58
Assessment of Tracking Devices towards Accurate Correagitation in a Hand-Held Optical Imager, Sergio Martines, Joseph DeCerce, Jean Gonzalez, Sarah J. Erickson, Anuradha Godavarty. Florida Intl. Univ., USA. A hand-held optical imager with automated correagitation capabilities is developed towards 3-D tomographic imaging. Multiple tracking devices are currently assessed in order to improve the accuracies in correagitation, and eventually the quality of image reconstructions.

BTuD59
Improved Multichannel TCSPC System and High Power ps Lasers for a Time Resolved Fluorescence Mammography, Michael Wahl1, Timo Röhlich1, Hans Jürgen Rahre2, Axel Hägen1, Dirk Groesbeck1, Rainer Macdonald1, Rainer Eitemann1; 1PicoQuant GmbH, Germany, 2Physikalisch-Technische Bundesanstalt, Germany. We developed a multichannel TCSPC instrument capable of measuring 8 time-resolved fluorescence channels with count rates exceeding 10 million cps in combination with powerful lasers at 735nm offering up to 160mW of power in picosecond pulsed regime.

BTuD60
An Imaging Pulse Oximeter Based on a Multi-Aperture Camera, Ali Basiri, Jessica Ramella-Roman; Catholic Univ. of America, USA. We present an imaging pulse oximeter capable of capturing 16 spectral images at the peak and trough of skin arterial pulse. Maps of arterial oxygen saturation agree with values obtained with a clinical pulse oximeter.

BTuD61
Widefield and High Resolution Fluorescence Imaging Using Vital Dye Contrast for Gastrointestinal Cancers, Naditi Thekkend, Timothy J. Muldoon, Alejandro D. Poloyardides, Nour Harraz, D. Maru, Shamila Anandanabaptii, Rebecca Richards-Kortum; 1Rice Univ., USA, 2Mount Sinai Medical Ctr., USA, 3Mount Sinai School of Medicine, USA. The ex vivo study evaluates widefield and high-resolution fluorescence imaging with vital-dye enhancement to improve endoscopic evaluation of metaplasia, dysplasia, and cancer in the gastrointestinal tract. Differences in epithelial features were observed.

BTuD62
Skin Haemoglobin Mapping: Comparison of Multi-Spectral Imaging and Selective R-G-B Analysis, Damin Jakovlevs, Janis Spigulis; Bio-Optics and Fiberoptics Lab, Inst. of Atomic Physics and Spectroscopy, Univ. of Latvia, Latvia. The multi-spectral imaging technique has been used for distant mapping of in vivo skin haemoglobin. Besides, potential of selective R-G-B analysis of skin images has been studied under bi-chromatic (532 nm and 635 nm) laser illumination.

BTuD63
Polarization-Sensitive Transmittance Imaging in Skeletal Muscle, Ali S. Shuaib, Xin Li, Gang Yao; Univ. of Missouri at Columbia, USA. We measured polarization sensitive transmittance images in skeletal muscles. The geometrical profiles of the transmitted images were quantitatively analyzed using a parametrical fitting method and showed significant polarization dependent trends.

BTuD64
Novel Multispectral Method for Simultaneous Color and Fluorescence Endoscopy, George Themelis1, Athanasios Sarantopoulos1, Florian R. Greten2, Valentin Becker3, Alexander Mening3, Goetzitz M. van Dam4, Vasili Nitzachristos3, 1Inst. for Biological and Medical Imaging, Technische Univ. München and Helmholtz Ctr. München, Germany, 2Medizinische Klinik, Klinikum rechts der Isar, Technische Univ. München, Germany, 3Dept. of Surgery and BioOptical Imaging Ctr. Groningen, Univ. Medical Ctr. Groningen, Netherlands. We present a novel multispectral imaging method that can easily be implemented in existing endoscopes to provide simultaneous color and fluorescence imaging. Results demonstrate increased performance and functionality over existing endoscopic systems.

BTuD65
Widefield Imaging and Point Spectroscopy for Noninvasive Diagnosis of Oral Precancer, Richard A. Schwartz1, Wen Guo1, Mark C. Pierce1, Rebecca Richards-Kortum1, Ann M. Gillenwater2, Vanda M. T. Stapanek1, Tao T. Le1, Vijayakshree S. Bhattar2, Darren M. Robley2; 1Rice Univ., USA, 2Univ. of Texas M.D. Anderson Cancer Ctr., USA, 3Beckman Laser Inst. and Medical Clinic, USA. The diagnostic potential and clinical utility of widefield imaging and point spectroscopy are examined based on measurements of patients with precancerous or cancerous oral lesions. Portable clinical instruments for widefield imaging and spectroscopy are described.

BTuD66
Instantaneous Spatial Light Interference Microscopy (iSLIM), Haofeng Ding, Gabriel Popescu; Univ. of Illinois at Urbana-Champaign, USA. We developed Instantaneous Spatial Light Interference Microscopy (iSLIM) as white light-based quantitative phase imaging method, which provides single-shot, speckle-free imaging at different colors (RGB) simultaneously. It is implemented as add-on module to phase contrast microscope.

BTuD67
Demonstration of Digital Optical Phase Conjugation, Meng Cui, Chenguang Yang; Caltech, USA. We demonstrate a digital optical phase conjugation method by combining phase-shifting holoigraphy with spatial phase shaping. Experimentally, we show that the system can compensate the wave-front distortion caused by a random scattering medium.

BTuD68
Spatial and Spectral Features of Optical Response to Peripheral Nerve Stimulation Suggest Vascular Origin, Debbie K. Chen1, Kelley Erb1, Angelo Sassaroli2, Peter R. Berghoff3, Sergio Fantini1, Tus1 Univ., USA, 2Boston Univ. School of Medicine, USA. Electrical stimulation of the human sural nerve induces an optical response on a 100 ms timescale. On the basis of its spectral and spatial dependence, we hypothesize that it is generated by vascular motion.

BTuD69
Withdrawn

BTuD70
Dual-Beam Fluorescence Diffuse Optical Tomography Using Nonlinear Upconverting Nanoparticles, Heichun Liu, Can T. Xu, Stefan Andersson-Engels; Dept. of Physics, Lund Univ., Sweden. A method to exploit the nonlinearity of upconverting nanoparticles to increase information quantity in fluorescence diffuse optical tomography, by including excitation with two beams simultaneously, is demonstrated. The increased information resulted in more accurate reconstructions.

BTuD71
In vivo Characterization of Myocardial Tissue by Time-Resolved Diffuse Optical Spectroscopy in Open Chest Pig, Andrea Farina1, Antonio Pifferi1, Alessandro Torricelli1, Lorenzo Spineti1, Davide Contini1, Rinaldo Cubeddu1, Luca Ascani2, Luca Pott3, Maria Giovanna Trivella4, Antonio L’Abbate, Stefano Pazzoli1, 1Dept. di Fisica, Politecnico di Milano, Italy, 2Scuola Superiore Sant’Anna, Italy, 3Inst. di Fisiologia Clinica del CNR, Italy. We show that time-resolved diffuse optical spectroscopy is a valuable tool for the in vivo characterization of the myocardial tissue of a pig. Measurements were carried out on the beating heart of the open chest pig.

BTuD72
Transcleral Visible Near-Infrared Absorption Spectroscopy for Quantitative Characterisation of Intraocular Tumors in ex vivo Porcine Eyes, Pontus Stenmark, Jorgen Krohn1, Can T. Xu, Dmitriy Khrypty1, Stefan Andersson-Engels; 1Dept. of Physics, Lund Univ., Sweden, 2Dept. of Clinical Medicine, Univ. of Bergen, Norway, 3Dept. of Ophthalmology, Haukeland Univ. Hosp., Norway. We present a study on 70 porcine eyes with intraocular tumours models for quantifying the melanin and haemoglobin concentrations. A correct concentration was obtained in 99.5% for haemoglobin and 84.4% for melanin of all measurements.
BTuD73  
Determining Melanin Content of in vivo Skin Using the Diffusing Probe, Sheng-Hao Tseng1,2;  
We determined the melanin concentration of in vivo skin using our diffusing probe. This probe can also recover hemoglobin and water concentrations and will be employed to quantify the skin melanin variation stimulated by the UV-radiation.

BTuD74  
Factors Affecting Retinal Reflectance, Iain Styles;  
Univ. of Birmingham, UK. We extend previous work on retinal reflectance modelling to examine the influence of additional parameters that have previously been omitted. The new parameters are shown to have a significant effect on the reflectance spectra.

BTuD75  
Improved Lifetime Analysis Using Angular-Domain Fluorescence Imaging in a Tissue-Like Phantom, Kenneth M. Tichauer1, Mohamadreza Najmimani2, Fartash Vasefi2,3, Ting-Yim Lee2,4, Bezena Kantinska1, Jeffrey J. L. Carson1;  
1Lauson Health Res. Inst., Canada, 2School of Engineering Science, Simon Fraser Univ., Canada, 3Dept. of Medical Biophysics, Univ. of Western Ontario, Canada, 4Imaging Div., Robarts Res. Inst., Canada.  
Angular-domain fluorescence imaging is defined by the use of an angular filter array to restrict detection of multiply-scattered photons for improved depth-spatial resolution. The benefits of its application to fluorescence lifetime imaging are presented.

BTuD76  
A Time-Domain Non-Contact Fluorescence Diffuse Optical Tomography Scanner for Small Animal Imaging, Yves Berube-Lauziere, Eric Lapointe;  
Univ. de Sherbrooke, Canada. We introduce a novel time-domain multi-view (over 360°) non-contact fluorescence diffuse optical tomography scanner for localizing fluorescent dyes in scattering media, eventually in small animals. Localization results of fluorescent inclusions in 3-D are presented.

BTuD77  
Multimodal Investigations of Biopolymers: Keratin and Cellulose, Maxwell S. Zimmerman;  
David C. Oerter1, Jennifer M. Marsh1, Jimmie L. Ward2, Eric O. Potma3;  
1Univ. of California at Irvine, USA, 2Procter and Gamble Co., USA. Nonlinear microscopy is used to develop a method for mapping the distribution of water and deuterated glycine in hair. A related method is also devised for monitoring the effects of water on cellulose-based fibers.

BTuD78  
Cell Division Stage in C. elegans Imaged Using Third Harmonic Generation Microscopy, Rodrigo Aviles-Espinosa1,2, G. J. Tseveendorj1,2, Susana I. C. O. Santos1, G. Filipidis1, A. J. Krompel1, M. Vlahos1, N. Tavernarakis1, A. Bradschweig2, W. Kaanders1, David Artigas3, Pablo Loza-Alvarez3;  
1ICFO, Spain, 2Inst. of Electronic Structure and Light, Foundation of Res. and Technology-Hellas, Greece, 3Inst. of Molecular Biology and Biotechnology, Foundation of Res. and Technology, Greece.  
We improved new methods to enhance contrast in 3-D fluorescence images by removing blur and restoring the out of focus light. Our research shows that relative fluorescence intensities are rarely preserved in deconvolved images.

BTuD79  
Quantitative Orientation-Independent DIC Microscopy with High Speed Switching Shear Direction, Michael Shribak;  
Marine Biological Lab, USA. The principal scheme of assembly for rapid changing the beam shear direction is described. Two beam-shearing assemblies were used in orientation-independent DIC microscope to obtain high fidelity phase (phase gradient) images at high NAs.

BTuD80  
Boston Univ., USA. A specimen chamber for crustacean nerve experiments was newly designed to maintain physiological temperatures and allow observation along the length of the specimen. The resulting data elucidate the origins of action potential-induced changes in birefringence.

BTuD81  
Real-Time Focal Modulation Microscopy Combined with Fluorescence Lifetime Imaging, Nanguang Chen, Uetz-Henry Wong, Shau Poh Cheng, Colin Sheppard;  
Natl. Univ. of Singapore, Singapore. We have developed a focal modulation microscope for real-time fluorescence imaging of thick tissues. Fluorescence lifetime images and intensity images can be obtained in the same time.

BTuD82  
Multiphoton Histology of Entire Intact Mouse Organs, Sonia Parra, Thomas Chia, Joseph P. Zinter, Michael J. Levene;  
Yale Univ., USA. We present multiphoton microscopy of intact mice and second harmonic imaging of entire intact, fixed and optically cleared mouse organs. We achieved imaging depths of several millimeters in mouse intestine, heart, lung, brain and other organs.

BTuD83  
Simulating Second Harmonic Generation from Tendon - Do We See Fibrils? Mathias Straper1,2, Marie-Claire Shanmugam-Klein1;  
1École Polytechnique de Montréal, Canada, 2Lab for Optics and Biosciences, École Polytechnique, CNRS, France.  
We simulated second harmonic generation microscopy images from Achilles tendon models and compared it with experimental images. We show that the characteristic striated pattern of these images is due to interferences between adjacent fibrils.

BTuD84  
Is Image Cytometry Possible with Deconvolved Fluorescence Images? Mahsa Ranji1, Diego Calzolari1, Ramesh Augustini1, Jeffrey H. Price1,2;  
1Univ. of Wisconsin at Milwaukee, USA, 2Burnham Inst. for Medical Res., USA.  
Deconvolution methods enhance contrast in 3-D fluorescence images by removing blur and restoring the out of focus light. Our research shows that relative fluorescence intensities are rarely preserved in deconvolved images.

BTuD85  
Angle-Resolved Light Scattering Study of NALM-6 and HL-60 Cells for White Blood Cell Differentiation, Jun Q. Liu, Huafeng Ding1, Carissa L. Reynolds1, Yunming Feng1, Li V. Yang1, Fred E. Bertrand1, Tom J. McConnell1, Xin-Hua Hu2;  
1East Carolina Univ., USA, 2Tianjin Univ., China. FDTD modeling and angle-resolved measurement of Mueller matrix elements have been conducted with suspensions of two white blood cell lines at three wavelengths. We found that S12 exhibits the largest difference.

BTuD86  
Withdrawn

BTuD87  
Blood Screening Using Diffraction Phase Cytometry, Mustafa Mir, Huafeng Ding, Zhi Wang, Krishnakumar Tanglela, Gabriel Popescu;  
Univ. of Illinois at Urbana-Champaign, USA. We demonstrate an automatic interferometry based blood smear analysis technique known as Diffraction Phase Cytometry (DPC) which provides detailed physiologically relevant information on the 2-D and 3-D morphology of individual blood cells.

BTuD88  
Determination of Water and Lipid Concentrations by Diffuse Optical Spectroscopy in Lipid Emulsions in the Wavelength Range of 1000 to 1500 nm, Rami Nachabe1, Benno H. H. Hendriks1 and H.J.C.M. Sterenberg1,2;  
1Philips Res., Netherlands, 2Erasmus Medical Ctr., Netherlands. We demonstrate that water and lipid content can be determined accurately by applying the diffusion approximation solution to spectra in the wavelength range of 1000 to 1500 nm.
BTuD89
Incorporation of Single Fiber Reflectance Spectroscopy into Ultrasound-Guided Endoscopy (EUS-FNA) of Mediastinal Lymph Nodes, Stephen C. Kanick, Cor van der Leest, Joachim Aerts, H.J.C.M. Sterenborg, Arjen Amelink, Eranus Medical Ctr., Netherlands, Amplia Hospital, Netherlands. We have incorporated a single fiber reflectance spectroscopy device into the EUS-FNA procedure. Here, we present quantitative metrics that describe the vascular physiology within normal and metastatic lymph nodes in patients undergoing EUS-FNA.

BTuD90
Design and Implementation of Fiber Optic Probe for Measuring Field Effect of Carcinogenesis with Low- Coherence Enhanced Backscattering Spectroscopy (LEBS), Nikhil N. Mutyal, Vladimir Turchynsky, Jeremy D. Rogers, Andrew Radoenovich, Hennant Ray, Michael J. Goldberg, Mohammed Jameel, Andrej Bogoevicih, Vadim Backman, Northwestern Univ., USA. We have implemented a fiber optic probe with capability to measure the field effect of carcinogenesis using LEBS. We evaluated this probe in study using a cohort of patients, AOM rats and present diagnostic marker.

BTuD91
Parametric and Empirical Spectral Analysis for Non-Invasive Diagnosis of Basal Cell Carcinoma, Jingjing Wang, Jianfeng Li, Xiaojing Fan, Brian C. Wilson, Jianye He, Jian Li, Northwestern Univ., USA. We compare parametric and empirical principle component analysis approaches to analyze diffuse reflectance spectra for the diagnosis of basal cell carcinoma and show that both approaches achieve comparable sensitivity and specificity of about 90%.

BTuD92
High Throughput Photoporation of Mammalian Cells Using Microfluidic Cell Delivery, Yoshihiko Arita, Robert F. Marchington, David J. Stevenson, Frank J. Gunn-Moore, Kings College, UK. Photoporation (optical injection) of mammalian cells using a tightly focused femtosecond laser beam is demonstrated within a microfluidic chip, providing delivery of cells to the beam and thus automating the system for high cell throughput.

BTuD93
Clinical Evaluation of a High-Resolution Microendoscope for Early Diagnosis of Cancer, Mark C. Pierce, Nadhi Thekkekkal, Kelsey Ronbach, Peter Thompson, Raymond Kaufmann, Ann Gillenwater, Sharmila Anandasabapathy, Rebecca Richards-Kortum, Rice Univ., USA, Methodist Hospital, USA, Univ. of Texas M.D. Anderson Cancer Ctr., USA, Mt. Sinai Medical Ctr., USA. We have developed a high-resolution fluorescence microendoscope capable of imaging sub-cellular morphology in vivo, in real-time. We report our latest results in clinical studies for early cancer detection in the cervix, oral cavity, and esophagus.

BTuD94
Diluted Homogenized Tissue Phantoms as Contrast Optimization Tools for Fluorescence Endoscopy: Modeling the Effects of the Dilution on the Measured Fluorescence, Mathieu Roy, Anthony Kim, Brian C. Wilson; Ontario Cancer Inst., Univ. of Toronto, Canada. We present Monte Carlo models that predict the measured fluorescence of tissue phantoms as a function of their concentration. These models represent a key step towards using diluted homogenized tissues for fluorescence contrast optimization studies.

BTuD95
Intraoperative δ-Aminolevulinic Acid-Induced Protoporphyrin IX Spectroscopic Quantification Improves Clinical Margin Delineation of Intracranial Tumors, Pablo A. Valdes, Federico Lebrón, Anthony Kim, Brian C. Wilson, Brent T. Harris, Keith D. Paulsen, David W. Roberts, Thayer School of Engineering, Dartmouth College, USA, Dartmouth Medical School, Dartmouth College, USA, Dept. of Medical Biophysics, Univ. of Toronto, Canada, Dept. of Pathology, Dartmouth-Hitchcock Medical Ctr., USA, Section of Neurosurgery, Dartmouth-Hitchcock Medical Ctr., USA. An intraoperative hand-held fiber-optics probe was used to estimate concentration of the fluorescent molecule protoporphyrin IX in vivo for different intracranial tumors, providing evidence that use of quantitative probe measurements improves clinical tumor margin delineation.

BTuD96
Identification of Abnormal Motor Cortex Activation Patterns in Children with Cerebral Palsy by Functional Near Infrared Spectroscopy, Bilal Khan, Fenghua Tian, Khosro Behbehani, Mario Romero-Ortega, Nancy J. Clegg, Mauricio R. Delgado, Hanli Liu, Alexandrakis George, Univ. of Texas at Arlington, USA, Texas Scottish Rite Hospital for Children, USA, Univ. of Texas Southwestern Medical Ctr. at Dallas, USA. We have developed near-infrared image metrics for the quantification of spatiotemporal cortical activation patterns in children with cerebral palsy that differentiate from pediatric controls. These metrics could serve as biomarkers for prognosis and treatment monitoring.

BTuD97
Towards Depth-Resolved Fluorescence-Guided Surgery Using Multi-Spectral Near-Infrared Light, Frederic Leblond, Zaven Ounanyan, Scott C. Davis, Venkataramanan Krishnaswamy, Pablo A. Valdes, Anthony Kim, Brian C. Wilson, Alex Hartoe, Brian W. Pogue, Keith D. Paulsen, David W. Roberts, Thayer School of Engineering, Dartmouth College, USA, Ontario Cancer Inst., Canada, Section of Neurosurgery, Dartmouth Hitchcock Medical Ctr., USA. It is shown that an analytic expression of fluorescence ratio detection can provide a direct estimate of depth in multi-spectral sub-surface imaging. This is supported by preliminary fluorescence data acquired with a broad-beam multi-spectral system.

BTuD98
Monitoring Myocardial Tissue Hemodynamics during Open Chest Surgery in Pig by Time-Resolved NIRS, Davide Contini, Lorenzo Spinelli, Alessandro Torricelli, Antonio Pifferi, Rinaldo Cubeddu, Luca Ascani, Luca Poti, Maria Giovanna Trivella, Antonio L. Abbate, Dept. di Fisica, Politecnico di Milano, Italy, IEN-CNR Sezione di Milano, Italy, Ctr. of Excellence for Information, Communication, and Perception Engineering, Scuola Superiore Sant’Anna, Italy, Photonic Networks Natl. Lab, CNIT, Italy, IEN Inst. of Clinical Physiology, Italy, Scuola Superiore Sant’Anna, Italy, Time-resolved NIRS measurements were performed on myocardial tissue during open chest surgery in pig to monitor tissue hemodynamics during ischemia and reperfusion periods.

BTuD99
Development of a Multi-Modality Imaging Platform for in vivo Tissue Assessment and Molecular Tracking, Matthew T. Rinehart, Jeffrey LaCroix, Tyler Drake, Kuo Hyun Kim, Michael DeSoto, Marcus Henderson, Jennifer Peters, David Katz, Adam Wax, Duke Univ., USA. We present a novel multimodality women’s health imaging platform combination of the fluorescent interferometry, endoscopic confocal microscopy, and Fourier-domain OCT. This optical platform will provide simultaneous information about microbical gel thickness, API distribution, and tissue integrity.

BTuD100
Fluorescence Visualization and Oral Lesion Risk, Calum MacAulay, Catherine Pohl, Leew Zhang, Pierre Lane, Misrim Rosin, BC Cancer Agency, Canada, Univ. of British Columbia, Canada, Vancouver General Hospital, Canada, Simon Fraser Univ., Canada. Visualization of tissue autofluorescence has been used for the clinical detection, localization and extent determination for oral cancers at risk lesions over the last four years. Presented is an update from over 6000 examinations.
BTuD101
Diffuse Optical Imaging of ICG Dynamics in the Diseased Breast with High Temporal Resolution, Christoph H. Schmitz1,2, Sophie Piper1, Paul Schneider1, Nassia Volkwein1, Nils Schreiter1, Alexander Poellinger1; 1NIRx Medizintechnik GmbH, Germany, 2Charité, Dept. of Neurology, Germany. Following intravenous ICG bolus injection, we obtained diffuse optical 3D images of the absorption contrast dynamics in the breast on 20 patients. We identified lesions based on local perfusion characteristics using a General Linear Model.

BTuD102
Time Resolved Study of Probe Pressure Effects on Skin Fluorescence and Reflectance Spectroscopy Measurements, Liang Lim, Narasimhan Rajaram, Brandon Nichols, James W. Tonnell; Univ. of Texas at Austin, USA. We conducted an in vivo experiment to study the effect of probe pressure on fluorescence and reflectance measurements. While these effects are minimal at low pressures, significant spectral distortions may occur at higher pressures.

BTuD103
Detectability of Hemodynamic Response to Thermal Pain in Pre-Frontal Cortex Using Diffuse Optical Tomography, Venkatagiri Krishnamurthy, Venkaiiah Kasuri, Fenghua Tian, Hanli Liu; Univ. of Texas at Arlington, USA. We have explored the possibility of using diffuse optical tomography as a potential non-invasive clinical tool to monitor hemodynamic changes induced by neurophysiological and cognitive activities in response to conscious awareness of noxious pain.

BTuD104
Infrared Surface Plasmon Resonance Biosensor, Robert E. Peale1, Justin W. Cleary2, Walter R. Buchwald2, Oliver Edwards2; 1Univ. of Central Florida, USA, 2AFRL, USA, 3Zyberwear Inc., USA. An infrared surface plasmon resonance biosensor is capable of recognition based on selective binding and on characteristic vibrational modes, thus providing enhanced sensitivity and selectivity. We present theoretical design considerations and first experimental investigations.

BTuD105
Optical Transmission Analysis of Nano-Hole Array as a Function of Incident Light Propagation Angles, Mohamadreza Najafimam1, Farzad Vasefi1, Bozena Kaminska1, Jeffrey J. L. Carson1; 1School of Engineering Science, Simon Fraser Univ., Canada, 2Imaging Program, Lawson Health Res. Inst., Canada, 3Dept. of Medical Biophysics, Univ. of Western Ontario, Canada. In this paper, we present the Finite Difference Time Domain (FDTD) analysis on the optical transmission of nano-hole arrays illuminated at various incident angles relative to the normal to the plane of the array.

BTuD106
A Method to Assess the Scattering-Free Absorption Properties of Nanostructured Materials, Cosimo D’Andrea, Andrea Farina, Paola Taromi, Antonio Pifferi, Katya Obratzsova, Calogero Sciascia, Guglielmo Taroni, Andrea Bassi, Rinaldo Cubeddu, Antonio Pifferi; Dept. of Physics, Politecnico di Milano, Italy. A technique to measure scattering-free absorption of small amounts of powder nanostructured materials, based on time-resolved diffuse optical spectroscopy, has been demonstrated and experimentally validated on two carbon materials.

BTuD107
Role of Collagen Scattering for in vivo Tissue Characterization, Paola Taromi, Andrea Bassi, Andrea Farina, Rinaldo Cubeddu, Antonio Pifferi; Dept. of Physics, Politecnico di Milano, Italy. The scattering properties of collagen in tissue were derived from ex vivo measurements on bovine tissues, and recognized in in vivo data on the human knee, suggesting potential for tissue characterization and diagnosis of osteoarticular diseases.
DTuC5 • Biological Applications—Continued

Phase-Sensitive Motility Imaging of Tumor Response to Drugs in Digital Holography, David D. Nolte, Kwan Jeong, John J. Turek; 'Dept. of Physics, Purdue Univ., USA; 'Dept. of Physics, Korea Military Acad., Republic of Korea; 'Dept. of Basic Medical Science, Purdue Univ., USA. We present the first time-course measurements of cytoskeletal anticancer drug action on osteogenic tumor spheroids through motility imaging based on the amplitude and phase information retrieved from digital holography.

DTuC6 • 3:15 p.m.
Doppler Optical-Microfluidic Approach for Red Blood Cell Aggregation Measurement: Principle and Method, Xiangqun Xu, Lingfeng Yu, Zhongping Chen; 'Zhejiang Sci-Tech Univ., China; 'Univ. of California at Irvine, USA. A novel platform that integrate microfluidic rheology and Doppler OCT technology is developed for quantifying red blood cell aggregation using variance/standard deviation of the Doppler frequency spectrum.
### DTuD • DH Tutorials

**Tuesday, April 13**  
4:00 p.m. – 5:20 p.m.  
Partha P. Banerjee; Univ. of Dayton, USA, Presider

**Digital Holography and Interferometry for Micro- and Nano-Photonics, Byoungho Lee; Seoul Natl. Univ., Republic of Korea.** General digital holography and interferometry technologies are explained. As their applications for micro- and nano-photonics, recent studies are reviewed.

### BTuE • New Ideas and Techniques

**Tuesday, April 13**  
4:00 p.m. – 6:00 p.m.  
Gabriel Popescu; Univ. of Illinois at Urbana-Champaign, USA, Presider

**BTuE1 • 4:00 p.m.**  
Recovery of Diffused Images through Nonlinear Instability, Dmitry V. Dytlov, Jason W. Fleischer; Princeton Univ., USA. We develop a method to recover diffused images by seeding spatial instability in a nonlinear medium. We observe the increase of image contrast and enhancement of signal resolution in noisy environments.

**BTuE2 • 4:15 p.m.**  
Evaluation of Multiple Sclerosis-Like Lesions in vivo with Coherent Anti-Stokes Raman Scattering Microscopy, Erik Belanger; Sophie Laffray, Réal Vallée, Daniel Côté; Univ. Laval, Canada. This study of multiple sclerosis is performed with an animal model called experimental autoimmune encephalomyelitis. After surgically exposing the spinal cord, demyelination is characterized using in vivo CARS microscopy and reflectance imaging.

**BTuE3 • 4:30 p.m.**  
Quantifying Mitochondrial Dynamics in Apoptotic Cells with Optical Gabor-Like Filtering, Robert M. Pasternack; Jing-Yi Zheng, Nada N. Boustany; Rutgers Univ., USA. We demonstrate a rapid throughput optical scatter method based on Gabor-like filtering to measure subcellular dynamics within single apoptotic cells. The technique is sensitive to a decrease in particle orientation consistent with apoptosis-induced mitochondrial fragmentation.

### DTuD2 • 4:00 p.m.  
**Tutorial**  
Selected Topics in 3-D Electro—Optical Image Processing, Joseph Rosen; Ben Gurion Univ. of the Negev, Israel. We review three different methods of generating digital holograms of three-dimensional real-existing objects illuminated by incoherent light. The methods are: 1. Scanning holography. 2. Multiple-viewpoint projection holography. 3. Fresnel incoherent correlation holography.

### BTuF • Biological and Drug Discovery Imaging

**Tuesday, April 13**  
4:15 p.m. – 6:15 p.m.  
Elizabeth M. Hillman; Columbia Univ., USA, Presider

**BTuF1 • 4:00 p.m.**  
Improved in vivo Fluorescence Tomography and Quantitation in Small Animals Using a Novel Multiview, Multispectral Imaging System, Craig Gardiner; Jolita Dutta; Gregory S. Mitchell; Sangsoo Ahn; Changqing Li; Peter Harvey; Russell Gershman; Stephen Sherry; James R. Mansfield; Simon R. Cherry; Richard M. Leahy; Richard M. Levenson; CRI, Inc., USA; Univ. of Southern California, USA; Univ. of California at Davis, USA; Brighton Consulting Group, USA. We report on the design and initial experimental results of a multiview, multispectral preclinical fluorescence tomography instrument, designed to improve quantitation of fluorescence molecular imaging in disease research and drug development.

**BTuF2 • 4:15 p.m.**  
Living Motion as Label-Free Imaging Contrast in Three-Dimensional Tissue-Based Drug Screening, David D. Nolte; Kwan Jeong; John Turek; Purdue Univ., USA. Motility contrast imaging (MCI) detects sub-cellular motion in living tissue as a fully endogenous imaging contrast agent. Three-dimensional imaging assays of anti-mitotic cancer drugs have extracted label-free functional signatures in tumors for the first time.

**BTuF3 • 4:30 p.m.**  
Imaging the Bio-Distribution of Molecular Probes Using Multispectral Cryoslicing Imaging, Athanasios Sarantopoulos; George Themelis; Ralf B. Schulz; Vasili Ntz Zachristos; Inst. for Biological and Medical Imaging, Technische Univ. München and Helmholtz Ctr. Munich, Germany. We report the development of a novel multispectral imaging system that is capable of creating um-resolution three dimensional color and fluorescence volumes of optical agents bio-distribution in small animals and organs using epi-illumination fluorescence imaging.
BTuF • New Ideas and Techniques—Continued

**BTuE4 • 4:45 p.m.**
Structure and Dynamics of Live Cells Studied by Fourier Transform Light Scattering (FTLS). **Huaofeng Ding**, Gabriel Popescu; Univ. of Illinois at Urbana-Champaign, USA. We studied static and dynamic light scattering from tissues and cells using Fourier transform light scattering (FTLS). And we also employed FTLS to measure actin-driven dynamics in live cells without fluorescence tagging.

**BTuE5 • 5:00 p.m.**
X-Ray Induced Fluorescence Optical Imaging Enabled by Injectable Nano-Scintillators, **Collin M. Carpenter**, Lamitha Sushanthea, Guilem Prats, Conroy Sun, Padmanabha R. Ravisetti, Lei Xing; Stanford Univ., School of Medicine, USA, 'SRI Intl., USA. Nanosized inorganic phosphor scintillators are being investigated for their potential to mediate X-ray activated optical imaging. This work investigates the feasibility of X-ray luminescence imaging using 50nm nano-scintillators.

**BTuE6 • 5:15 p.m.**
Cerenkov Luminescence Tomography for Small Animal Imaging, **Changqing Li**, Gregory S. Mitchell, Simon R. Cherry; Biomedical Engineering Dept., Univ. of California at Davis, USA. We have observed Cerenkov light emitted from beta-emitting radiotracers. Phantom and in vivo mouse imaging experiments demonstrate that sufficient Cerenkov photons are produced to allow reconstruction of radiotracers activity inside an object from surface measurements.

**BTuE7 • 5:30 p.m.**
Laser-Scanning Intersecting Plane Tomography (LSIPT) for High Speed 3-D Imaging, **Matthew B. Bouchard**, Lauren Grosberg, Sean A. Burgess, Elizabeth M. C. Hillman; Lab for Functional Optical Imaging, Dept. of Biomedical Engineering, Columbia Univ., USA. We describe a new optical planar imaging geometry for high speed volumetric optical imaging. A diagram and raytracing simulations of the new imaging geometry as well as initial phantom and image reconstruction results are presented.

**BTuF4 • 4:45 p.m.**
Förster Resonance Energy Transfer Reconstruction from Optical Backprojections in Turbid Media, **Vadim Y. Soloviev**, Surya P. Mohan, Simon R. Arridge, James McGinty, Romain Laine, Paul M. W. French, Daniel W. Stuckey, Alessandra Sardini, Joseph V. Hajnal; Univ. College London, UK, 'Imperial College London, UK, 'MRC Clinical Sciences Ctr., UK. We demonstrate the feasibility of FRET lifetime imaging on the basis of wide-field tomographic time-gating technique. We present FRET localization in 3-D turbid medium by applying a variant of the backprojection algorithm.

**BTuF5 • 5:00 p.m.**
Time Gated Optical Projection Tomography for 3-D Imaging of Highly Scattering Biological Models, **Andrea Bassi**, Daniele Brida, Cosimo D’Andrea, Gianluca Valentini, Sandro De Silvestri, Giulio Cerullo, Rinaldo Cuba; Natl. Lab for Ultrastand and Ultraintense Optical Science, Dept. di Fisica, Politecnico di Milano, Italy. An imaging technique that combines Optical Projection Tomography with ultrafast time gating is presented. The method provides high resolution reconstruction of scattering samples, which is suitable for 3-D imaging of biological models.

**BTuF6 • 5:15 p.m.**
Correction of Lateral Movement and Spherical Aberrations in Optical Projection Tomography, **Uido J. Birk**, Alex Darrell, Nikos Konstantinidis, Jorge Ripoll; Foundation for Res. and Technology - Hellas, Greece, 'Kirschhoff Inst. für Physik, Germany. We present two post-acquisition correction methods for in vivo Optical Projection Tomography to reconstruct specimens embedded in arbitrary refractive index, and to correct for movements of the specimens. Results obtained from Parhyale hawaiiensis are shown.

**BTuF7 • 5:30 p.m.**
Longitudinal Optical Imaging of Tumor Metabolism and Hemodynamics, **Melissa C. Skala**, Andrew Fontanelle, Lan Lan, Mark W. Dewhirst, Joseph A. Iaatz; Duke Univ., USA. Fluorescence redox ratio imaging of metabolic demand, absorption microscopy of hemoglobin oxygen saturation and Doppler optical coherence tomography of blood flow were combined to monitor oxygen supply and demand in a tumor model in vivo.
Non-Invasive Optical Measures of CBV, StO2, CBF Index, and rCMRO2 in Human Premature Neonates’ Brains in the First 6 Weeks of Life, Nadege F. Roche-Labarbe1, Stefan A. Carp1, Andrea Surova1, David A. Boas1, P. Ellen Grant2, Maria Angela Franceschini1; 1NMR Ctr., USA, 2Children’s Hospital, USA. FD-NIRS and DCS recordings in 11 premature neonates without brain injury (28 to 34 weeks GA) allowed for calculation of absolute HbT, CBV and StO2, an index of CBF and a more accurate rCMRO2.

Two-photon Imaging of the Oxygen Partial Pressure in Cerebral Microvasculature, Sava Sakadzic1, Emmanuel Roussakis2, Mohammad A. Yaseen1, Vivek J. Srinivasan1, Emiri T. Mandeville1, Anna Devor1,2, Eng H. Lo1, Sergei A. Vinogradov2, David A. Boas1; 1Massachusetts General Hospital, USA, 2Univ. of Pennsylvania, USA, 3Univ. of California at San Diego, USA. We report the first practical in vivo two-photon pO2 measurements in cortical microvasculature, made possible by using a two-photon-enhanced phosphorescent nanoprobe. New method features ~250-μm measurement depth, sub-second temporal resolution and requires low probe concentration.

Noninvasive Optoacoustic Monitoring of Multiple Physiological Parameters: Clinical Studies, Rinat O. Esenaliev, Yuriy Y. Petrov, Irina Y. Petrouva, Donald S. Prouge; Univ. of Texas Medical Branch, USA. We have developed an optoacoustic technique for noninvasive monitoring of important physiological parameters and tested our optoacoustic systems in clinics. Our data indicate that the accuracy of this technique can approach that of invasive techniques.
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<th>Napoleon I</th>
<th>Digital Holography and Three-Dimensional Imaging (DH)</th>
<th>Napoleon II</th>
<th>Biomedical Optics (BIOMED)</th>
<th>Napoleon III</th>
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7:30 a.m.–5:00 p.m. Registration Open  
10:00 a.m.–4:00 p.m. Exhibits Open

**DWA1 • 8:00 a.m. Invited**  
Compressive Holography of Diffuse Scatterers,  
David Brady, Kerlik Cho, Ryoichi Horisaki, Joouki Hahn, Sehoon Lim, Duke Univ., USA. We image the incoherent 3-D scattering density of objects from the covariance of 2-D scattered speckle field measurements using forward model regularization and constrained optimization. 3-D resolution consistent with spatial bandlimits is demonstrated.

**BWA1 • 8:00 a.m.**  
Quantification of Cerebral Blood Flow in the Adult Using Near-Infrared Spectroscopy Assisted by Subject-Individualized Monte Carlo Modeling,  
Jonathan T. Elliott1, M. Sehoon Lim; Ryoichi Horisaki1, Keith St. Lawrence1, M. Tichauer1, Ting-Yim Lee1,2, Kenneth M. Diop1,2, Lawrence1,2, Adam Gibson; Dept Medical Physics, UK. We present a method that is capable of imaging cerebral blood flow (CBF) using near-infrared spectroscopy to obtain the ability to properly account for extracerebral contamination. Accurate measurements of CBF were achieved using subject-individualized Monte Carlo assisted near-infrared spectroscopy.

**BWA2 • 8:15 a.m.**  
Phase Synchronization Approach to Cerebral Hemodynamics Assessment by Near-Infrared Spectroscopy,  
Feng Zheng, Angelo Sassaroli, Sergio Fantini; Biomedical Engineering Dept., Tufts Univ., USA. We show phase synchronization between oxy and deoxy-hemoglobin concentrations in the prefrontal cortex of a human subject at rest. This method has potential for studying cerebral connectivity and brain auto regulation in real time.

**DWA2 • 8:30 a.m. Invited**  
Digital Holography at Ultimate Shot Noise Level, F. Joud1, M. Atlan2, Michel Gross3; École Normale Supérieure, Univ. Paris, France, ‘Paris Tech, Univ. Paris, France. We present an off-axis phase-shifting digital holographic technique able to make digital holography at shot noise level. We discuss the advantages of this technique and we give application examples.

**BWA3 • 8:30 a.m.**  
Imaging Blood Flow and Cellular Morphology in Epilepsy with Diffuse Optical Tomography,  
Ruixin Jiang, Zhen Yuan, Xiaoping Liang, Qizhi Zhang, Paul Carney, Huabei Jiang; Univ. of Florida, USA. We present a method that is capable of imaging cerebral blood flow (CBF) and particle size/density in epilepsy using diffuse optical tomography. In vivo images during seizure onset are obtained using a multispectral DOT system.

**BWB1 • 8:00 a.m. Invited**  
Can Scattering Spectroscopy Detect Disease Earlier than Histopathology? Irving Bigio; Boston Univ., USA. Elastic scattering spectroscopy, in various incarnations, is proving to be sensitive to subtle changes in ultrastructure and/or microporperfusion that appear in histologically-normal tissue or microscopically-normal cells, but presage cellular changes or disease.

**BWB2 • 8:30 a.m.**  
Pilot Clinical Study for Quantitative Spectral Diagnosis of Non-Melanoma Skin Cancer,  
Narasimhan Rajatram1, Jason S. Reichenberg1, Michael R. Migden1, Tri H. Nguyen1, James W. Tonnell1; Univ. of Texas at Austin, USA. We report the results of a pilot clinical study using a combined diffuse reflectance/intrinsic fluorescence system on 40 patients with non-melanoma skin cancer and suggest a novel approach to analyze and spectrally diagnose skin lesions.
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<tr>
<th>DWA • Holography; Techniques and Algorithms — Continued</th>
<th>BWA • Brain Monitoring and Imaging II — Continued</th>
<th>BWB • Clinical Applications of Spectroscopy — Continued</th>
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<td><strong>DWA4 • 8:45 a.m.</strong> Real-Time Functional Brain Imaging of Attention Using Near-Infrared Spectroscopy, Benjamin Schmidt, Nancy Belak, Theodore J. Huppert; Univ. of Pittsburgh, USA. In this study, we demonstrate the application of a real-time neural-network model to monitor attention in a reading task using near-infrared spectroscopy (NIIRS).</td>
<td><strong>BWA5 • 9:00 a.m.</strong> Quantitative Cerebral Blood Flow Measurement of Ischemic Stroke in Mice with Multi Exposure Speckle Imaging, Ashvin B. Parihasarathy, S. M. Shams Kazmi, Anthony Saleaggio, Andrew K. Dunn; Univ. of Texas at Austin, USA. We show that changes in cerebral blood flow can be accurately estimated using the new Multi Exposure Speckle Imaging instrument. We also show that these estimates are unaffected by the presence of thin skull.</td>
<td><strong>BWB5 • 8:45 a.m.</strong> Imaging Breast Pathology in situ Using Broadband Scatter Spectroscopy and a K-Nearest Neighbor Classifier, Ashley M. Laughney1, Venkataramanan Krishnaswamy1, Pilar B. Garcia-Allende1, Wendy A. Wells2, Olga M. Conde3, Keith D. Paulsen1, Brian W. Pogue2; ’Tusher School of Engineering, Dartmouth College, USA; ’Univ. of Cantabria, Photonics Engineering Group, Spain; ’Dept. of Pathology, Dartmouth-Hitchcock Medical Ctr., USA. A reflectance imaging system acquired spectra from breast tissue and scattering parameters were linked to morphological features identified by a pathologist in 75 ROIs. A KNN algorithm discriminated between tissue pathologies with nearly 84% accuracy.</td>
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<td><strong>DWA3 • 9:00 a.m.</strong> Recovering of Complex Amplitude by Use of Bandwidth-Adapted Double FFT Algorithms, Pascal PICART1,2, Patrice Tankam1, Zer-jie Peng1, Junc-chang Li1,2; ENSIM, France; 1LAUM CNRS, France; 2Kunming Univ. of Science and Technology, China. Double FFT convolution algorithms based on the use of spectrum scanning and spherical reconstruction wave allow complex amplitude of large objects to be reconstructed. Experimental results in color holography illustrate the advantages of the method.</td>
<td><strong>BWA6 • 9:15 a.m.</strong> Simultaneous Imaging of Cortical Blood Flow and Oxygenation Change or Cellular Calcium Dynamics Using Dual-Wavelength Laser Speckle Contrast Imaging, Zhongchi Luo, Zhihua Yuan, Yinghan Pan, Congou Du; Stony Brook Univ., USA. A dual-wavelength laser speckle contrast imaging technique (DW-LSCI) is presented for simultaneous imaging of cerebral blood flow and hemoglobin oxygenation changes or fluorescent labeled cellular calcium dynamics at high spatiotemporal resolutions.</td>
<td><strong>BWB4 • 9:00 a.m.</strong> Partial Wave Spectroscopy and Its Relation to Nanoscale Disorder in Nuclear Architecture, Harirahan Subramaniam1, Dhanuvil Damania1, Krishnapal Solanki2, Yolanda Stypula3, Lasik Cherkezyan1, Asksh Tiwari1, Prabhakar Pradhan1, Dhananjay Kunte1, Hemant K. Rog1, Vadim Backman2, 1Northwestern Univ., USA, 2Northshore Univ. Health System, USA. Partial-wave spectroscopic microscopy (PWS) provides insights into the internal architecture of biological cells in terms of nanoscale disorder strength. Here we study its relation to the changes in cytoskeletal and nuclear architecture during early carcinogenesis.</td>
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<td><strong>DWA4 • 9:15 a.m.</strong> Height Impulse Response Function Analysis of Multiple-Wavelength Digital Holography, Carl C. Aleksoff, Hao Yu; 1Coherix Inc., USA; 2Univ. of Michigan, USA. The height measurement characteristics of multiple-wavelength digital holography can be characterized by a height impulse response function. We consider via this function how the distribution of wavelengths affects the height measurement performance.</td>
<td><strong>BWB5 • 9:15 a.m.</strong> Broadband Scatter Spectroscopy Imager for Breast Tumor Margin Delineation, Venkataramanan Krishnaswamy1, Ashley M. Laughney1, Kimberley S. Sansoe2, Wendy A. Wells2, Keith D. Paulsen1, Brian W. Pogue2; ’Tusher School of Engineering, Dartmouth College, USA; 1Dartmouth-Hitchcock Medical Ctr., USA. A broadband scanning scatter spectroscopy imaging system has been developed to allow intraoperative assessment of lumpectomy tumor margins based on localized tissue scatter measures. Results from preliminary phantom measurements are discussed.</td>
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Biomedical Optics and 3-D Imaging Congress and Exhibition • April 11–14, 2010

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**NOTES**

10:00 a.m.–10:30 a.m. **Coffee Break/Exhibits, Richelieu Room**

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**DWA • Holography: Techniques and Algorithms—Continued**

**DWA5 • 9:30 a.m.**
Physical Compensation of Spherical Phase in Digital Holographic Microscopy by Use of Spherical Recording Reference Wave, **Wei Juan Qu**, Lewis Rongwei Tan,Oi Choo Chew,Yingjie Yu, Anand Asundi; ’Ngee Ann Ct. of Innovation, NgeeAnn Polytechnic, Singapore, ’Dept. of Precision Mechanical Engineering, Shanghai Univ., China, ’School of Mechanical and Aerospace Engineering, Nanyang Technological Univ., Singapore. A spherical reference wave interferes with the object wave from a microscope objective or spherical illumination. A numerical plane reference wave is preferred for the numerical reconstruction of the phase introduced by the test specimen.

**DWA6 • 9:45 a.m.**
Spectral Aperture Code Design for Multi-Shot Compressive Spectral Imaging, **Peng Ye, Henry Arguello**, Gonzalo Arce; Univ. of Delaware, USA. In this paper, we propose the design of spectral aperture code patterns for CASSI admitting multi-shot measurements, which leads to improve imaging quality, as well as spectral band selectivity.

**BWA • Brain Monitoring and Imaging II—Continued**

**BWA7 • 9:30 a.m.**
Laser Speckle Imaging in the Spatial Frequency Domain, **Amaan Mashar, Tyler B. Rice, David J. Cuccia**, Bernard Choi, Anthony J. Durkin, David A. Boas; ’Univ. of California at Irvine, USA, ’Modulated Imaging Inc., USA, ’NMR, General Hospital, Harvard Medical School, USA. We present model development to calculate speckle contrast in the spatial frequency domain and show experimental results to demonstrate the effects of gating long path length photons using this method.

**BWA8 • 9:45 a.m.**
Three-Dimensional Diffuse Optical Tomography in the Human Brain, **Haijing Niu, Zi-Jing Lin, Fenghua Tian, Sameer Dhamne, Hanli Liu**; Univ. of Texas at Arlington, USA. We report the three-dimensional tomographic localization of the functional activation in the human brain. To this end we developed a new depth compensation algorithm (DCA), and its validity is illustrated by simulation and experimental evidence.

**BWB • Clinical Applications of Spectroscopy—Continued**

**BWB6 • 9:30 a.m.**
Quantitative Optical Spectroscopy for Pancreatic Cancer Detection, **Robert H. Wilson**, Malarika Chandra, William Lloyd, James Scheiman, Diane Simeone, Julienne Purdy, Barbara McKenna, Mary Ann Mycek; Univ. of Michigan, USA. We report novel optical diagnostic algorithms for clinical pancreatic tissue classification, including a photon-tissue interaction model developed to extract biophysical parameters from reflectance and fluorescence spectra to distinguish pancreatic adenocarcinoma from normal tissue and pancreatitis.

**BWB7 • 9:45 a.m.**
Fiber-Optic Spectrometer to Monitor Intra-Operative Hemodynamics, **Steve Jacques, Thai Pham, Kyle Perry, John Hunter, Frederick Treuher, Daniel S. Garrow**; Dept. of Surgery and Biomedical Engineering, Oregon Health and Science Univ., USA. Diffuse reflectance spectroscopy enables noninvasive measurement of blood fraction content and hemoglobin oxygen saturation during surgery. We created a spectrometer and observed the hemodynamic dynamics during esophagectomy.
Wavefront Imaging and Display

Wednesday, April 14
10:30 a.m.–12:30 p.m.
David Brady, Duke Univ., USA, Presider
Bahram Javidi, Univ. of Connecticut, USA, Presider

DWB1 • 10:30 a.m.  Invited
3-D Display and Interface Based on Wavefront Synthesis, Osama Matoba, Kouichi Nitte, Kobe Univ., Japan. A three-dimensional display system based on wavefront synthesis is presented. The system includes the detection of wavefront data of three-dimensional objects. Wide viewing zone with coherent amplification and wavefront manipulation are presented.

DWB2 • 11:00 a.m.  Invited
Avenues for Expanded Applicability in Photorefractive Based Holographic 3-D Displays, Cory Christensen1, P. A. Blanche2, R. Vooarakaranam2, A. Bahramian3, J. Thomas4, M. Yamamoto5, R. A. Norwood6, N. Pepphambarian7; 1Univ. of Arizona, USA, 2TIPD, LLC, USA, 3Nitto Denko Technical, USA. The first updatable three-dimensional holographic display based on a photorefractive polymer device, exhibiting a fast response, long persistency, and phase stability is discussed. Material and optical setup changes for new and broader applications are outlined.

BWC1 • 10:30 a.m.  Deep Tissue Temperature Measurements by Correcting for the Effect of Bound Water on the NIR Water Spectra, So Hyun Chung1, Albert E. Cerussi2, Sean Merritt3, Bruce J. Tromberg4; 1Univ. of Pennsylvania, USA, 2Univ. of California at Irvine, USA, 3Masimo Corp., USA. Using broadband Diffuse Optical Spectroscopy, deep tissue temperature was measured non-invasively by correcting bound water effect. Results from phantoms correlated with invasive thermal probe (R2=0.93, Δ TP=1.1±0.9°C, 28–48°C) and temperature in in vivo human forearms was measured.

BWC2 • 10:45 a.m.  Selective Excitation Light Fluorescence (SELF) Imaging, Mehrossou Khoshtagh2, Cadum MacAskill2; 1Cancer Imaging Dept., British Columbia Cancer Res. Ctr., Canada, 2Electrical Engineering Dept., Univ. of British Columbia, Canada. A system for SELF imaging is demonstrated. By using a multitude of illumination wavelengths or a weighted sum of illumination wavelengths, SELF imaging can highlight differences in the excitation spectra of fluorophores in the sample.

BWC3 • 11:00 a.m.  Gold Nanoshell Enhanced Fluorophores for Multi-Frequency near Infrared Fluorescence Optical Tomography, Marc Bartels1, Wentue Chen2, Rizia Batdari1, Naomi J. Halas1, Amit Joshi2; 1Dept. of Radiology, Baylor College of Medicine, USA, 2Dept. of Chemistry, Rice Univ., USA. We investigate reflectance mode multi-frequency domain optical imaging with novel theranostic silica core gold nanostructures with Indocyanine Green. From phase sensitive images from homodyne measurements we determine optimal measurement parameters for nanoshell enhanced fluorescent dyes.

BWC4 • 11:15 a.m.  Fluorescence Diffuse Optical Tomography Using Upconverting Nanoparticles, CaIX Xu, Johan Axelsson, Stefan Andersson-Engels; Dept. of Physics, Lund Univ., Sweden. In the fluorescent diffuse optical tomography (FDOT) problem, suppressing background is of utmost importance. We demonstrate autofluorescence-insensitive FDOT using upconverting nanoparticles and methods to exploit the nonlinearity to obtain reconstructions of higher resolutions.

BWC5 • 11:30 a.m.  Other Novel Probes and Tissue Studies

Biomedical Optics and Three-Dimensional Imaging (BIOMED)

Wednesday, April 14
10:30 a.m.–12:30 p.m.
Sergio Fantini; Tafts Univ., USA, Presider
Hani Liu; Univ. of Texas at Arlington, USA, Presider

BWC1 • 10:30 a.m.  Imaging, Mehrossou Khoshtagh2, Cadum MacAskill2; 1Cancer Imaging Dept., British Columbia Cancer Res. Ctr., Canada, 2Electrical Engineering Dept., Univ. of British Columbia, Canada. A system for SELF imaging is demonstrated. By using a multitude of illumination wavelengths or a weighted sum of illumination wavelengths, SELF imaging can highlight differences in the excitation spectra of fluorophores in the sample.

BWC2 • 10:45 a.m.  Selective Excitation Light Fluorescence (SELF) Imaging, Mehrossou Khoshtagh2, Cadum MacAskill2; 1Cancer Imaging Dept., British Columbia Cancer Res. Ctr., Canada, 2Electrical Engineering Dept., Univ. of British Columbia, Canada. A system for SELF imaging is demonstrated. By using a multitude of illumination wavelengths or a weighted sum of illumination wavelengths, SELF imaging can highlight differences in the excitation spectra of fluorophores in the sample.

BWC3 • 11:00 a.m.  Gold Nanoshell Enhanced Fluorophores for Multi-Frequency near Infrared Fluorescence Optical Tomography, Marc Bartels1, Wentue Chen2, Rizia Batdari1, Naomi J. Halas1, Amit Joshi2; 1Dept. of Radiology, Baylor College of Medicine, USA, 2Dept. of Chemistry, Rice Univ., USA. We investigate reflectance mode multi-frequency domain optical imaging with novel theranostic silica core gold nanostructures with Indocyanine Green. From phase sensitive images from homodyne measurements we determine optimal measurement parameters for nanoshell enhanced fluorescent dyes.

BWC4 • 11:15 a.m.  Fluorescence Diffuse Optical Tomography Using Upconverting Nanoparticles, CaIX Xu, Johan Axelsson, Stefan Andersson-Engels; Dept. of Physics, Lund Univ., Sweden. In the fluorescent diffuse optical tomography (FDOT) problem, suppressing background is of utmost importance. We demonstrate autofluorescence-insensitive FDOT using upconverting nanoparticles and methods to exploit the nonlinearity to obtain reconstructions of higher resolutions.

BWC5 • 11:30 a.m.  Other Novel Probes and Tissue Studies

Biomedical Optics (BIOMED)

Wednesday, April 14
10:30 a.m.–12:30 p.m.
Yang Pu; CCNY, USA, Presider

BWC1 • 10:30 a.m.  Near-Infrared Fluorescence Imaging and Tomography to Assess Lymphovascular Disorders, Eva M. Serick-Maraca; Univ. of Texas, USA. Currently there are no methods available with the sensitivity, spatial or temporal resolution to image the lymphatics non-invasively. Herein, we present NIR fluorescence imaging of human lymphatic function and describe lymphangiography using NIR fluorescence tomography.

BWC2 • 11:00 a.m.  Quantitative Image Analysis to Predict the Neoplastic Region in Oral Squamous Cell Carcinoma Using Multiple Fluorescent Contrast Agents, Kelsey J. Rosbach1,2, Michelle Williams1, Ann Gillenwater1, Rebecca Richards-Kortum1; 1Rice Univ., USA, 2Univ. of Texas M.D. Anderson Cancer Ctr., USA. Three probes targeting molecular or morphologic characteristics of cancer were topically applied to freshly resected oral tissue. Optical contrast was used to predict the region of neoplasia; predicted regions agree well with histopathology maps.

BWC3 • 11:15 a.m.  A Fiber-Optic Fluorescence Microscope Using a Consumer-Grade Digital Camera for in vivo Cellular Imaging, Dong Suk Shin1, Mark Pierce1, Ann Gillenwater1, Rebecca Richards-Kortum1; 1Rice Univ., USA, 2Univ. of Texas M.D. Anderson Cancer Ctr., USA. We demonstrate a fiber-optic fluorescence microscope using a consumer-grade camera for in vivo cellular imaging. This portable, inexpensive device may be useful as a diagnostic tool at the point-of-care in low-resources settings.
DWB4 • 11:45 a.m.
Improvement of Image Quality of Horizontal Scanning Holographic Display, Yasuhiro Takaki, Naoya Okada; Tokyo Univ. of Agriculture and Technology, Japan. The horizontal scanning holographic display offers a wide viewing angle and a large screen size. The reconstructed image quality is improved by compensating the scanning error and the focusing error in the hologram calculation process.

DWB5 • 12:00 p.m.
Digital Holographic Binocular Stereopsis, Takamori Nomura, Yutaka Morii; Waseda Univ., Japan. The stereopsis binocular vision based on a digital holography is proposed. In this study, preliminary experimental results using digital holograms recorded by two imaging devices are presented.

DWB6 • 11:45 a.m.
Changes of NADH and Collagen Contents as Biomarkers in Cancerous Prostate Tissue Analyzed by Selective Excitation Fluorescence, Yang Pu, Wuxiao Wang, Guichen Tang, Robert R. Alfano; Inst. for Ultrafast Spectroscopy and Lasers, CLINY, USA. The relative content changes of collagen and NADH in cancerous prostate tissue were demonstrated by selective excitation fluorescence (SEF) spectra with pump wavelength of 340nm. The changes may present fluorescent biomarker for prostate cancer detection.

DWB7 • 12:00 p.m.
Evaluation of an Ultra-Slim Objective for Second Harmonic Generation Imaging, Sara M. Landau, Brenda Raggett, Ilse Utzinger, Tomasz Tkaczyk, Michael Descour; Univ. of Arizona, USA; Rice Univ., USA. Non-linear microscopy has the potential to provide clinically useful information on the structure of biological tissue in vivo. By using a prototype, all-plastic, 0.8-mm diameter microscope objective, SHG images were acquired of rat-tail collagen fibers.

BWC5 • 11:30 a.m.
Using Optical Stretching to Explore Pluripotent Stem Cell's Mechanics Influences First Fate Decisions, Kevin Chalet, Penelope Hayden, Franciska Lautenschlager, Chea Lim, Alfonso Martinez-Arias, Jochen Guck; Univ. of Cambridge, UK. We measured the mechanical characteristics of pluripotent stem cells using the optical stretcher. We found dramatic differences between stem cells that retain their pluripotency and those that will eventually differentiate. We will discuss biological implications.

BWC6 • 11:45 a.m.
NIR Fluorescence Imaging for in vivo Assessment of Normal and Diseased Lymphatics, I-Chih Tan, John C. Rasmussen, Milton V. Marshall, Erik A. Maus, Caroline E. Fife, Latisha A. Smith, Eva M. Sevick-Marar; Univ. of Texas Health Science Ctr. Houston, USA; Memorial Hermann Ctr. for Lymphedema Management, USA. Near-infrared fluorescence imaging with microdose indocyanine green was used to visualize the normal and diseased lymphatic structure and quantify the lymphatic function in vivo. Lymphatic function was significantly improved after manual lymphatic drainage.

BWC7 • 12:00 p.m.
Real-Time Intra-Operative Fluorescence Imaging with Targeted Fluorophores, George Themelis, Athanasios Sarantopoulos, Niel J. Harlaar, Goetzten M. van Dam, Vasiliis Ntziachristos; Inst. for Biological and Medical Imaging, Technische Univ. München and Helmholtz Ctr. Munich, Germany; Dept. of Surgery and BioOptical Imaging Ctr. Groningen, Univ. Medical Ctr. Groningen, Netherlands. We present a multispectral imaging system for real-time measurement of fluorescence probes with molecular specificity to tumor biomarkers. Results demonstrate the capability to identify tumor with high specificity and provide real-time feedback to the surgeon.
Three-Dimensional Imaging of Light-Induced Refractive Index Gratings Using Digital Holographic Microscopy, Chau-Jern Cheng, Yu-Chih Lin, Han-Yen Tu; Inst. of Electro-Optical Science and Technology, Natl. Taiwan Normal Univ., Taiwan, Dept. of Electronic Engineering, St. John’s Univ., Taiwan. We propose and demonstrate a novel technique for in situ measuring light-induced refractive index gratings in epoxide resin using digital holographic microscopy, which offers the possibility of direct observation of holographic recording in microscopic view.

Diffuse Optical Perfusion and Oxygenation Monitoring in a Mouse Model of Hindlimb Ischemia, Rickson C. Mesquita, Nicolas SkaI, Meeri N. Kim, Jiuming Liang, Amar J. Majmundar, M. Celeste Simon, Arjun G. Youdh; Dept. of Physics and Astronomy, Univ. of Pennsylvania, USA, Abramson Family Cancer Res. Inst., Univ. of Pennsylvania, USA, Howard Hughes Medical Inst., Univ. of Pennsylvania, USA, Xi’an Jiaotong Univ., China, School of Medicine, Univ. of Pennsylvania, USA, Dept. of Cell and Developmental Biology, Univ. of Pennsylvania, USA. We employ diffuse correlation and reflectance spectroscopies to monitor perfusion and oxygenation in mice after hindlimb ischemia. Perfusion results were compared with laser Doppler flowmetry and validated as new tools to assess limb perfusion.

Limitations of Laser Surgery Navigation via Autofluorescence Imaging, Alexandre Douplik, Azhar Zam, Angelos Kalitzeos, Ralph Hohenstein, Emeka Nkenke, Florian Stelzl; Friedrich-Alexander Univ. Erlangen-Nürnberg, Germany. Laser surgery navigation via autofluorescence imaging was investigated and preliminary results are presented. The present study highlights the limitation of surgical navigation of cancer removal under conditions of high power effects in biological tissues.
### DWI • Entrepreneurship in Optics I
**Wednesday, April 14**
1:30 p.m.–3:30 p.m.
George Barbastathis; MIT, USA, Presider
Michel Gross; CNRS, France, Presider

### DWI • Photonic and Spectroscopy 1
**Wednesday, April 14**
1:30 p.m.–3:30 p.m.
Paul C. Beard; Univ. College London, UK, Presider
Wienelt Steenbergen; Univ. of Twente, Netherlands, Presider

### DWI • Clinical Applications of Diffuse Optics I
**Wednesday, April 14**
1:30 p.m.–3:30 p.m.
David Boas; Harvard Medical School, USA, Presider
Brian Pogue; Dartmouth College, USA, Presider

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**DWC • 1:30 p.m. Invited**
**Holographic Displays for Future TV, Frank C. Fan; AFC Technology Co., Ltd., China.** Real-time holographic display by simple aggregation of digital camera-projector array is demonstrated as the rudimentary holographic TV by holographic thoughts but getting rid of the necessity of coherent interference for conventional holography.

**DWC • 2:00 p.m. Invited**
**The Way of the OPTWARE, Hideyoshi Horimai; HolyMine Corp., Japan.** The concept that "Holographic Data Storage", "3D Display", "Holographic Printer", and "Fuzzy Search" link by light as a career defined "OPTWARE". In this presentation, latest progress will be introduced with real venture-challenging story.

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**BWE • Three-Dimensional Optoacoustic Imaging System and Its Applications for Functional and Molecular Imaging, Alexander Oranovsky1, Sergey Ermilov1, Richard Su1, Hans-Peter Brecht1, Andre Conjusteau1, Vyacheslav Nadtochesky1, Chauda Nirpen2, Ravi Shukla3, Ajit Zambre4, Raghuraman Kannan5, Fairway Medical Technologies Inc., USA; Seno Medical Instruments, USA; 1Univ. of Missouri, USA.** Optoacoustic system designed for three-dimensional whole body tomography of small animals is presented. Technical specifications, methods of signal and image processing and applications in functional imaging of vasculature and molecular imaging of cancer are discussed.

**BWE • Simultaneously Imaging Oxygen Saturation and Blood Flow Using Optical-resolution Photacoustic Microscopy, Junjie Yao1, Konstantin I. Maslov2, Liang V. Wang3; Washington Univ. in St. Louis, USA.** By the use of dual-wavelength light excitation and bidirectional motor scanning, optical-resolution photoacoustic microscopy images oxygen saturation and blood flow of the mouse ear simultaneously.

**BWE • Comparison of Classification Methods for Detection of Rheumatoid Arthritis with Optical Tomography, Ludquier D. Monotejo1, Julio D. Monotejo1, Hyun K. Kim2, Uwe J. Netz3, Christian D. K lone1, Sabine Blaschke1, P. A. Zsarga2, Gerhard A. Kline1, Jürgen Beuthan1, Andreas H. Hielscher1, 1Dept. of Biomedical Eng., Columbia Univ., USA; 2Dept. of Mathematics, Harvard Univ., USA; 3Laser- and Medizin-Technologie GmbH, Germany; 4Inst. for Medical Physics and Laser Medicine, Charite—Medical Univ., Germany; 5Dept. of Nephrology and Rheumatology, Georg August Univ., Germany; 6Dept. of Radiology, Georg August Univ., Germany; 7Dept. of Radiology, Columbia Univ., USA.** Using optical tomographic data from fingers affected by RA we compare the performance of 3 different classification methods. Linear discriminant and quadratic discriminant analysis methods yield high sensitivities while support-vector machine-based methods yield high specificities.

**BWE • Integrated Photoacoustic and Optical Coherence Microscopy and Its Biomedical Applications, Li Li1, Bin Tao1, Vassiliy Tsytaras2, Liang V. Wang2; Washington Univ. in St. Louis, USA.** We have developed a fast-scanning reflection-mode dual-modality microscope integrating photoacoustic microscopy and optical coherence tomography for microcirculation studies. Its potential applications in ophthalmology and neuroscience studies were demonstrated.

**BWE • Diffuse Optical Spectroscopy and Tomography for Monitoring Chemotherapy Efficacy in Locally Advanced Breast Cancer, Hang Sakimana, Anoma Gunasekara, Martin Yaffe, Gregory J. Czarnota; Sunnybrook Health Sciences Ctr., Canada.** Tomographic diffuse optical spectroscopy parameters of Hb, HbO₂, %water and scattering power can be used as an early detector of final pathologic tumour response in women treated with neoadjuvant therapy for locally advanced breast cancer.
### DW4 • 3:00 p.m.  
**Title to Be Announced, Kevin Curtis**; InPhase Technologies, USA. Abstract not available.

### BWE7 • 3:15 p.m.  
**Photoacoustic Imaging of Transgenic Mouse Embryos,** Jan Lauffer, Jon Cleary, Edward Zhang, Mark Lythege, Paul Beard; Univ. College London, UK. High resolution 3-D photoacoustic images were obtained in ex vivo transgenic mouse embryos for the study of the genetic origins of vascular malformation.

### BWF7 • 3:15 p.m.  
**Detection of Decreased Cerebral Blood Volume and Oxygen Saturation in Folate Deficient Rats Using Non-Invasive Near-Infrared Spectroscopy,** Berton Hallacoglu; Angelo Sassaroli; Irvan H. Rosenberg; Sergio Fantini; Aron Troen; ‘Dept. of Biomedical Engineering, Tufts Univ., USA, ‘Nutrition and Neurocognition Lab, Jean Mayer USDA Human Nutrition Res. Ctr. on Aging, Tufts Univ., USA. We report non-invasive, absolute measurements of cerebral hemodynamics with frequency-domain, near infrared spectroscopy on a rat model of vascular cognitive impairment. Folate deficiency was found to induce measurable hemodynamic changes.

### 3:30 p.m.–4:00 p.m. Coffee Break/Exhibits, Richelieu Room
DWD • Entrepreneurship in Optics II
Wednesday, April 14
4:00 p.m.–5:30 p.m.
George Barbastathis; MIT, USA, Presider
Michel Gross; CNRS, France, Presider

DWD1 • 4:00 p.m.
Invited
Title to Be Announced, Christophe Moser; Ondax, Inc., USA. Abstract not available.

Closing Remarks
4:30 p.m.–5:30 p.m.

Napoleon I
Digital Holography and Three-Dimensional Imaging (DH)

Napoleon II
Biomedical Optics (BIOMED)

Napoleon III
Biomedical Optics (BIOMED)

BWG • Photoacoustic Imaging and Spectroscopy II
Wednesday, April 14
4:00 p.m.–6:00 p.m.
Ben Cox; Univ. College London, UK, Presider
Roger Zemp; Univ. Alberta, Canada, Presider

BWG1 • 4:00 p.m.
Stimulated Raman Photoacoustic Imaging, Vladislav V. Yakovlev, Hao Zhang; Univ. of Wisconsin at Milwaukee, USA. We demonstrate a feasibility of molecular contrast imaging in deep tissue by successfully combining chemically-selective, stimulated Raman photoexcitation with ultrasound detection.

BWG2 • 4:15 p.m.
Optoacoustic Sensor with a Unique Open-Cavity Structure, Céline M. Chou1, Yan Zhou1, Yanbo Gao2, Theodore Norris1, Xueding Wang3, Cheri Deng3, Jing Yong Yeh1,2; 1Univ. of Michigan, USA, 2Univ. of Texas at San Antonio, USA. We demonstrate the feasibility of fabricating an open optical micro-cavity using a photonic crystal structure in a total-internal-reflection configuration. An optoacoustic sensor has been constructed based on this structure for sensitive, high-frequency ultrasound detection.

BWG3 • 4:30 p.m.
Quantitative Photoacoustic Tomography with Fluence-Dependent Absorbers, Ben Cox; Univ. College London, UK. In photoacoustic tomography, by using a contrast agent that absorbs only above or below a certain fluence threshold its concentration could be estimated using only singlewavelength images by varying the illumination intensity.

BWG4 • 4:45 p.m.
Quantitative Multiple-Source Photoacoustic Tomography, Roger Zemp; Univ. of Alberta, Canada. A technique for producing quantitative photoacoustic images is introduced when multiple optical sources are used. Simulations demonstrate that multiple-optical-source photoacoustic imaging can produce quantitative images of absorption perturbations in a known turbid background.

BWG • Clinical Applications of Diffuse Optics II
Wednesday, April 14
4:00 p.m.–6:00 p.m.
Robert J. Nordstrom; Univ. of Illinois at Urbana-Champaign, USA, Presider
Go van Dam; Univ. Medical Ctr. Univ. Medical Ctr. Groninge, Netherlands, Presider

BWH1 • 4:00 p.m.
Invited
Deep-Tissue Imaging of Morphology and Molecular Function with Multispectral Optoacoustic Tomography, Daniel Razansky; Technical Univ. of Munich, Germany. Multispectral optoacoustic tomography has been proving an excellent tool for simultaneous anatomical, functional and molecular interrogation of living tissues, owing to its versatile contrast and good spatial resolution. The talk deals with current applications, technical challenges and future perspectives of the method in biological research and the clinics.

BWH2 • 4:30 p.m.
Imaging the Binding State and Mobility of Water Molecules Using Diffuse Optical Spectroscopic Imaging (DOSI) and Diffusion-Weighted MRI, So Hyun Chung1, Hyeon Yu1, Min-Ying Sun1, Bruce J. Tromberg2; 1Univ. of Pennsylvania, USA, 2Univ. of California at Irvine, USA. Detailed tissue water property measurements were obtained in breast cancer patients using diffuse optical spectroscopic and diffusion weighted magnetic resonance imaging. Optical bound water index and apparent diffusion coefficients of MRI positively correlated (R=0.8, p<0.01).

BWH3 • 4:45 p.m.
Development of a Trans-Rectal Applicator toward Imaging Human Prostate-Cancer by Ultrasound-Coupled Near-Infrared Optical Tomography, Daqing Piao1, Zhen Jiang1, Grenady Slobodov2; 1Oklahoma State Univ., USA, 2Univ. of Oklahoma Health Sciences Ctr., USA. A trans-rectal optical tomography applicator for imaging human prostate is being developed. The optical applicator that contains 9 source and 13 detector channels is coupled to a bi-plane trans-rectal ultrasound probe with needle-biopsy assembly.
BWG5 • 5:00 p.m.
Towards Quantitative Imaging of Absorption Coefficients in Turbid Media by Combining Photoacoustic and Acousto-Optic Imaging, Wiendelt Steenbergen, Univ. of Twente, Netherlands. It is demonstrated by simulations that absolute absorption coefficient imaging is feasible by combining photoacoustic and acousto-optic imaging. The results give an outlook on truly quantitative chromophore imaging technology without use of computational models.

BWG6 • 5:15 p.m.
Deconvolution-Based Image Reconstruction for Photoacoustic Tomography in Circular Geometry, Chi Zhang, Changhui Li, Li Hong Wang, Dept. of Biomedical Engineering, Washington Univ. in St. Louis, USA. This paper introduces a deconvolution-based algorithm for photoacoustic tomography in circular geometry. As demonstrated by the in vivo experiment, this algorithm runs fast and provides good image quality when detection angles are sparse.

BWG7 • 5:30 p.m.
Integrated Photoacoustic Microscopy and Fiber-Optic Confocal Microscopy Using Signal Laser Source, Shuiliang Jiao1, Hao F. Zhang2, 1Univ. of Wisconsin at Milwaukee, USA. By employing a 2-2 fiber optical coupler in a laser-scanning optical-resolution photoacoustic microscope for delivering the illuminating laser light and collecting the back reflected photons, a fiber-optic confocal microscope is integrated with the photoacoustic microscope.

BWG8 • 5:45 p.m.
Multiphoton High-Resolution Photoacoustic Microscopy, Ryan L. Shelton, Brian E. Applegate; Texas A&M Univ., USA. We have developed a novel photoacoustic microscopy technique, Transient Ultrasonic Absorption Microscopy, which achieves all optical spatial resolution by fusing pump-probe spectroscopy with photoacoustic microscopy. This technique has the potential to enable cellular/subcellular photoacoustic imaging.

BWG • Photoacoustic Imaging and Spectroscopy II—Continued

BWH4 • 5:00 p.m.
Optical Pacing of the Embryonic Heart, Michael W. Jenkins1, Austin R. Duke2, Shi Gu1, Hillel J. Chiel1, Michiko Watanabe1, E. Duco Janse2, Andrew M. Rollins2; 1Case Western Reserve Univ., USA, 2Vanderbilt Univ., USA. We demonstrate the first optical pacing of an intact embryonic heart in vivo. Pulsed 1.875 μm infrared laser light was employed to lock the heart rate to the pulse frequency of the laser.

BWH5 • 5:15 p.m.
Assessment of Rotator Cuff Tendon Integrity with Single Detector PS-OCT, Christopher Rashidifard, Scott D. Martin, Ehsan Azimi, Namita Kamar, Bin Liu, Mark E. Brezinski; Brigham and Women’s Hospital, USA. A clinical need exists for superior technologies to assess the tendon intraoperatively. Polarization sensitive OCT imaging of human rotator cuff tendon can be utilized to assess tendon microstructure. PS-OCT Assessments are highly correlated with histopathology.

BWH6 • 5:30 p.m.
Assessment of Diabetic Foot Ulcers with DPDW Methodology: A Pilot Human Study, Michael Neidrauer, Leonid Zubkov, Michael S. Weingarten, Kambic Pourrezaei, Elisabeth S. Papazoglou; Drexel Univ., USA. Sixteen human diabetic foot ulcers were interrogated using Diffuse Photon Density Wave (DPDW) methodology of Near Infrared spectroscopy. Temporal changes of oxy- and total hemoglobin concentration were significantly different in healing vs. non-healing wounds.

BWH7 • 5:45 p.m.
Characterization of a Novel Biodegradable Photoluminescent Polymer for Lifetime Dependent Thermometry in Tissues, Nimit Patel1, Ajay Chaluksetti2, Jian Yang3, Bumsoo Han1, Hanli Liu, George Alexandrakis; 1Univ. of Texas at Arlington, USA, 2School of Mechanical Engineering, USA. We have characterized the biodegradable photoluminescent polymer (BPLP) for lifetime dependent thermometry in tissues. Temperature sensitivity of the polymer has been tested through laboratory experiments and Monte Carlo (MC) simulations.

Closing Remarks, Napoleon II
6:00 p.m. – 6:15 p.m
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<th>Time</th>
<th>DH Napoleon I</th>
<th>BIOMED Napoleon II</th>
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<td><strong>Saturday, April 10</strong></td>
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<td><strong>Sunday, April 11</strong></td>
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<td>Registration Open, Napoleon Lobby</td>
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<td>Opening Remarks</td>
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<td>8:00 a.m.–10:00 a.m.</td>
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<td>BSuA • BIOMED Sunday Plenary</td>
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<td>10:00 a.m.–10:30 a.m.</td>
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<td>Coffee Break, Richelieu Room</td>
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<td>10:30 a.m.–12:30 p.m.</td>
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<td>BSuB • Breast Cancer Imaging and Monitoring</td>
<td>BSuC • Optical Coherence Tomography I</td>
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<td>Lunch Break (on your own)</td>
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<td>BSuD • BIOMED Sunday Poster Session, Richelieu Room</td>
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<td>Coffee Break, Richelieu Room</td>
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<td>4:00 p.m.–6:00 p.m.</td>
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<td>BSuE • Imaging Theory</td>
<td>BSuF • Optical Coherence Tomography II (ends at 6:15 p.m.)</td>
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<td><strong>Monday, April 12</strong></td>
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<td>Opening Remarks (7:50 a.m.–8:00 a.m.)</td>
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<td>DMA • Fundamental Advances in Holography I</td>
<td>BMA • BIOMED Monday Plenary</td>
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<tr>
<td>10:00 a.m.–10:30 a.m.</td>
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<td>Coffee Break, Richelieu Room</td>
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<td>10:00 a.m.–4:00 p.m.</td>
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<td>Exhibits Open, Richelieu Room</td>
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<td>DMB • Fundamental Advances in Holography II</td>
<td>BMB • Cancer Monitoring and Imaging</td>
<td>BMC • Advances in Non-Linear Microscopy</td>
</tr>
<tr>
<td>12:30 p.m.–1:30 p.m.</td>
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<td>Lunch Break (on your own)</td>
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<tr>
<td>1:30 p.m.–3:30 p.m.</td>
<td>JMA • BIOMED/DH Joint Poster Session, Richelieu Room</td>
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<td>3:30 p.m.–4:00 p.m.</td>
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<td>Coffee Break/Exhibits, Richelieu Room</td>
<td></td>
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<tr>
<td>4:30 p.m.–6:00 p.m.</td>
<td>DMC • Metrology by Digital Holography and Profilometry</td>
<td>BMD • Novel Approaches in Microscopy (ends at 6:15 p.m.)</td>
<td>BME • Imaging and Spectroscopy Theory</td>
</tr>
<tr>
<td>6:00 p.m.–8:00 p.m.</td>
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**Key to Shading**

- DH Sessions
- BIOMED Sessions
- Joint Sessions
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<tr>
<td>7:30 a.m.–6:00 p.m.</td>
<td><strong>Registration Open, Napoleon Lobby</strong></td>
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<tr>
<td>7:50 a.m.–8:00 a.m.</td>
<td><strong>Opening Remarks</strong></td>
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<td><strong>DTuA • Holographic Microscopy</strong></td>
<td><strong>BTuA • BIOMED Tuesday Plenary</strong></td>
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<tr>
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<tr>
<td>1:30 p.m.–3:30 p.m.</td>
<td><strong>DTuC • Biological Applications</strong></td>
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<tr>
<td>3:30 p.m.–4:00 p.m.</td>
<td><strong>Coffee Break/Exhibits, Richelieu Room</strong></td>
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</tr>
<tr>
<td>4:00 p.m.–6:00 p.m.</td>
<td><strong>DTuD • DH Tutorials (ends at 5:20 p.m.)</strong></td>
<td><strong>BTuE • New Ideas and Techniques</strong></td>
<td><strong>BTuF • Biological and Drug Discovery Imaging (ends at 6:15 p.m.)</strong></td>
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<tr>
<td>7:30 a.m.–5:00 p.m.</td>
<td><strong>Registration Open, Napoleon Lobby</strong></td>
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<tr>
<td>8:00 a.m.–10:00 a.m.</td>
<td><strong>DWA • Holography: Techniques and Algorithms</strong></td>
<td><strong>BWA • Brain Monitoring and Imaging I</strong></td>
<td><strong>BWB • Clinical Applications of Spectroscopy</strong></td>
</tr>
<tr>
<td>10:00 a.m.–10:30 a.m.</td>
<td><strong>Coffee Break/Exhibits, Richelieu Room</strong></td>
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<tr>
<td>10:00 a.m.–4:00 p.m.</td>
<td><strong>Exhibits Open, Richelieu Room</strong></td>
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<tr>
<td>10:30 a.m.–12:30 p.m.</td>
<td><strong>DWB • 3-D Imaging and Display</strong></td>
<td><strong>BWC • Novel Probes and Tissue Studies</strong></td>
<td><strong>BWD • Clinical Applications of Imaging</strong></td>
</tr>
<tr>
<td>12:30 p.m.–1:30 p.m.</td>
<td><strong>Lunch Break (on your own)</strong></td>
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<tr>
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<td><strong>DWC • Entrepreneurship in Optics I</strong></td>
<td><strong>BWE • Photoacoustic Imaging and Spectroscopy I</strong></td>
<td><strong>BWF • Clinical Applications of Diffuse Optics I</strong></td>
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<tr>
<td>3:30 p.m.–4:00 p.m.</td>
<td><strong>Coffee Break/Exhibits, Richelieu Room</strong></td>
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<td>6:00 p.m.–6:15 p.m.</td>
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Biomedical Optics and 3-D Imaging: OSA Optics & Photonics Congress 2010
Update Sheet

**Tutorial Update:**
The following tutorial has been added to session DTuD•DH

**Tutorials.**

Hiroshi Yoshikawa; Nihon Univ., Japan.

Computer-Generated Hologram for 3-D Display–Point Oriented Approach

Tuesday, April 13, 2010
5:20 p.m. - 6:00 p.m.

**Biography:** Hiroshi Yoshikawa received a B.S. degree, M.S. degree and Ph.D. from Nihon University. He joined the faculty at Nihon University in 1985 where he currently holds the position of Professor of Electronics and Computer Science. He was a research affiliate of MIT Media Laboratory from 1988–1990. He is a member of OSA, SPIE, ITE (Institute of Television Engineers of Japan), and OSJ (Optical Society of Japan). His current research interests are electro-holography, computer generated holograms, display holography and computer graphics.

**Abstract:** Algorithm for the computer-generated hologram is reviewed. Point oriented approach uses object data as a collection of self-illuminated points. It is a very simple and powerful method for practical holograms.

**Presider Update:**

**Lee Perelman:** Harvard Medical School, USA, will preside over session BMB•Cancer Monitoring and Imaging, on Monday, April 12, 10:30 a.m.–12:30 p.m. in Napoleon II.

**Substituted Papers:**

The following paper will be presented in the DMC3 time slot: Wake Flows Analysis by Digital Color Holographic Interferometry, Jean-Michel Desse1, Pascal Picart2,3, Patrice Tankam1; 1Office Natl. d’Etudes et de Recherches Aérospatiales, France, 2Lab d’Acoustique de l’Univ. du Maine, France, 3Ecole Natl. Supérieure d’Ingénieurs du Mans, Univ. du Maine, France. Digital λλ holographic interferometry is shown for analyzing the variations in the refractive index induced by the wakeflow around a circular cylinder.

The following paper will be presented in the DMC8 time slot: Pattern Matching Estimator for Precise 3-D Particle Localization with Engineered Point Spread Functions, Sean Quirin1, Sri Rama Prasanna Pavani2, Rafael Piestun1; 1Univ. of Colorado at Boulder, USA, 2Caltech, USA. We present a 3-D particle localization estimator that uses phase retrieval to interpolate the calibration images of the point spread-function and finds the best fit to the measured data. We analyze the application to double-helix microscopy.

Paper BTuD26, In vivo Imaging of the Proximal Interphalangeal (PIP) Finger Joint with Three-Dimensional Photoacoustic Tomography, Yao Sun, Eric Sobel, Huabei Jiang; Univ. of Florida, USA. Will be presented in the BSuD96 time slot.

The following paper will be presented in the BWD7 time slot: BWD7p, Simulated Measurements of Optical Tissue Properties from Breast Tomosynthesis Guided Diffuse Spectroscopy, Kelly E. Michaelsen, Venkataramanan Krishnaswamy, Brian W. Pogue, Keith D. Paulsen; Dartmouth College, USA. This work studies an approach to combine tomosynthesis breast imaging with near infrared spectroscopy to determine tissue chromophore concentrations using spatial prior tomosynthesis data and correlated scatter information.

**Presenter Changes:**

JMA75, Improved Methods for Optical Determination of Uptake of Dye in vivo Rabbit Brain and in vitro Tissue Phantoms, will now be presented by Irving J. Bigio; Boston Univ., USA.

DMC7, Broadband 3-D Digital Holography for Depth Structure Visualization, will now be presented by Alexander Aleksandrovich Moiseyev; Russian Acad. of Sciences, Russian Federation.

BTuD12, Signal-Locking Fourier Transform SPR: A New Low-Noise Detection Technique for Biomolecular Interactions, will now be presented by Tridib Ghosh; Univ. of Utah, USA.

DTuD3, Broadband 3-D Digital Holography for Depth Structure Visualization, will now be presented by Alexander Aleksandrovich Moiseyev; Russian Acad. of Sciences, Russian Federation.

BWB7, Fiber-Optic Spectrometer to Monitor Intra-Operative Hemodynamics, will be presented by Steve Jacques; Oregon Health and Science Univ., USA.
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Update Sheet

Author Block Corrections:
Please note the following affiliation correction, 
BSuA, BMA and BTuA, Lihong Wang: Washington University in St. Louis, USA, Presider

Please note the following affiliation correction, 

The following paper’s author block has been updated, 
BTuD93, Clinical Evaluation of a High-Resolution Microendoscope for Early Diagnosis of Cancer, Mark C. Pierce1, Nadhi Thekkkek1, Kelsey Rosbach1, Peter Thompson2, Raymond Kaufman2, Ann Gillenwater3, Sharmila Anandasabapathy4, Doreen Ramogola-Masire5, Rebecca Richards-Kortum1; 1Rice Univ., USA, 2Methodist Hospital, USA, 3Univ. of Texas MD Anderson Cancer Ctr., USA, 4Mt. Sinai Medical Ctr., USA, 5Univ. of Botswana School of Medicine, Princess Marina Hospital, Botswana.

Withdrawals:
BsuD4 BTuD3 BTuD99
BsuD85 BTuD52 BWD7
BsuD96 BTuD73
JMA67 BTuD86

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JMA67   BTuD86

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