Biomedical Optics (BIOMED)

Topical Meeting and Tabletop Exhibit

Collocated with:

Digital Holography and Three-Dimensional Imaging (DH)
Laser Applications to Chemical, Security and Environmental Analysis (LACSEA)

March 16-19, 2008
Hilton St. Petersburg Bayfront
St. Petersburg, Florida, USA

Postdeadline Submissions Deadline: February 19, 2008 at 12:00 p.m. EST (17.00 GMT)
Hotel Reservation Deadline: February 12, 2008
Pre-Registration Deadline: February 21, 2008
Spring Optics and Photonics Congress

Join your colleagues March 16-20 in St. Petersburg, Florida!

Collocated Topical Meetings

Biomedical Optics (BIOMED)
Digital Holography and Three-Dimensional Imaging (DH)
Laser Applications of Chemical, Security and Environmental Analysis (LACSEA)

Dates and Location
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To find out more about how to exhibit at one of these meetings, please contact Anne Jones at 202.416.1942 or email ajones@osa.org. Reserve your exhibit space today!

Exhibitors

Biomedical Optics International
Advanced Research Technology
Biophotonics International
Boston Electronics
Coherent
Continuum
Femtolasers
Hamamatsu
ISSI
Lattice
MicronOptics

Digital Holography and Three-Dimensional Imaging (DH)
Nanoplus
NovaWave
Ocean Optics
Oxxius
Photo-Sonics
PicoQuant GmbH
Spectra-Physics – A Division of Newport Corporation
Swamp Optics
Time-Bandwidth Products

Topics to be Discussed

BIOMED Topics
- Methods for Diffuse Optical Imaging and Tomography
- Methods for Optical Spectroscopy and Spectroscopic Imaging
- Optical Coherence Tomography
- Optical Microscopy Techniques
- Photonic Biomedical Nanotechnology
- Optics in Neuroscience
- Optics in Diagnostics and Clinical Translation

DH Topics
- Digital holography theory and systems
- Diffractive optics
- Optical data storage
- Phase unwrapping and phase retrieval
- Computer generated holograms
- Spatial light modulators for holography
- Incoherent digital holography
- Holographic optical elements
- 2D and 3D pattern recognition
- Optical correlators
- Three-dimensional imaging and
• Optics in Molecular and Small Animal Imaging
• Optical Therapeutics

**LACSEA Topics**

• Laser-analytical Systems
• New Optical and Photonic Sources
• Laser-analytical Optics
• Prediction and Theoretical Treatment of UV, VIS, NIR, MIR and THz Spectra
• Application of Laser-analytical Systems to chemical, biophysical and biochemical analysis, homeland security and environmental measurements in industry as well as basic research.

**About Optics and Photonics Congresses**

OSA created [Optics and Photonics Congresses](#), clusters of new and established *topical meetings* in order to bring together leaders among communities within optics.

**Corporate Sponsors**
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.

Biomedical Optics (BIOMED) Meeting Topics To Be Considered:

Methods for Diffuse Optical Imaging and Tomography

- Diffuse Imaging and Spectroscopy: Clinical and in vivo Applications
- Instrumentation for Diffuse Optical Imaging
- Theoretical Methods and Image Reconstruction for Optical Tomography
- Photoacoustic Tomography
- Diffuse Fluorescence Tomography
- Fluorescence Lifetime Tomography and Imaging
- Diffuse Correlation Spectroscopy
- Transport-Regime Modeling and Imaging

Methods for Optical Spectroscopy and Spectroscopic Imaging

- Fluorescence Spectroscopy and Imaging
- Phosphorescence Spectroscopy and Imaging
- Reflectance Spectroscopy and Imaging
- Mie Scattering Spectroscopy and Imaging
- Raman Spectroscopy and Imaging
- Multi-Modal Spectroscopy and Imaging
- Tissue Biochemistry
- Spectroscopy and Imaging in Tissue Engineering

Optical Coherence Tomography

- OCT Technology Development
- OCT Light Source Development
- Ultrahigh Resolution and Ultrahigh Speed OCT
- Functional OCT (Doppler, Polarization Sensitive and Others)
- Contrast Enhancement Techniques in OCT
- Optical Coherence Microscopy
- Phase Sensitive OCT Technology
- Biomedical and Clinical Applications of OCT

Optical Microscopy Techniques

- Microscopy in vivo
- Spectral Microscopy
- Multiphoton Microscopy
- Nonlinear Microscopy
- Novel Forms of Microscopy

**Photonic Biomedical Nanotechnology**

- Metal Nanoparticles
- Quantum Dots
- Inorganic/Organic Hybrid Materials
- Multifunctional Nanoparticles
- Surface Enhanced Raman Scattering and Surface Enhanced Fluorescence
- Single Molecule Techniques
- Nanoscale Microscopies
- *In vitro* and *in vivo* Nanoparticle Applications

**Optics in Neuroscience**

- Optical Instrumentation and Technology in the Neurosciences
- Functional Imaging Techniques
- Optical Imaging within Multimodal Neuroimaging
- Biophysics and Physiology of Functional Neuroimaging
- Neuron Biology

**Optics in Diagnostics and Clinical Translation**

- Translational Research in the areas of:
  - Optical Spectroscopy (Fluorescence, Reflectance, Raman)
  - Multi-Spectral Imaging
  - Endoscopic Microscopy
  - Diffuse Optical Absorption and Scatter Tomography

**Optics in Molecular and Small Animal Imaging**

- Novel Molecular and Functional Contrast Agents
- *In vivo* Imaging of Molecular Reporters
- Whole Body Imaging of Small Animals
- Intravital Microscopy
- Dynamic Functional Imaging
- Molecular And Functional Imaging Applications

**Optical Therapeutics**

- Low Level Laser Therapy
- Photodynamic Therapy
- Interstitial Laser Hyperthermia and Interstitial Photocoagulation
- Laser Tissue Ablation and Optical Breakdown
BIOMED Program Committee

Gregory Faris; SRI Intl., USA, **General Chair**
David Rector; Washington State Univ., USA, **General Chair**

Vasilis Ntziachristos; Harvard Medical School, USA, **Vice Chair**
Lihong Wang; Washington Univ. in St. Louis, USA, **Vice Chair**

Methods for Diffuse Optical Imaging and Tomography
Elizabeth M. Hillman; Columbia Univ., USA, **Chair**
Turgut Durduran; Univ. of Pennsylvania, USA.
Amir H. Gandjbakhche; NIH, USA.
Adam Gibson; Univ. College London, UK.
Alexander D. Klose; Columbia Univ., USA.
Brian Pogue; Dartmouth College, USA.

Methods for Optical Spectroscopy and Spectroscopic Imaging
Irene Georgakoudi; Tufts Univ., USA, **Chair**
Arjen Amelink; Erasmus Univ., Netherlands.
Laura Marcu; Univ. of California at Davis, USA.
Eric O. Potma; Univ. of California at Irvine, USA.
Nirmala Ramanujam; Duke Univ., USA.
Adam Wax; Duke Univ., USA.

Optical Coherence Tomography
Wolfgang Drexler; Cardiff Univ., UK, **Chair**
Peter E. Andersen; Risoe Natl. Lab, Denmark.
Johannes F. de Boer; Wellman Ctr., Massachusetts General Hospital, Harvard Medical School, USA.
Jim Fujimoto; MIT, USA.
Rainer A. Leitgeb; Ecole Polytechnique Fédérale de Lausanne, Switzerland.
Adrian Podoleanu; Univ. of Kent at Canterbury, UK.
Maciej Wojtkowski; Inst. of Physics, N. Copernicus Univ., Poland.

Optical Microscopy Techniques
Tony Wilson; Univ. of Oxford, UK, **Chair**
Alberto Diaspro; Univ. of Genoa, Italy.
Stefan Hell; Max Planck Inst., Germany.
Erik Manders; Univ. of Amsterdam, Netherlands.
Jerome Mertz; Boston Univ., USA.
Ammasi Periasamy; Univ. of Virginia, USA.

Optical Therapeutics
Lothar Lilge; Ontario Cancer Inst., Canada, **Chair**
Raimund Hibst; Inst. fur Lasertechnologien, Germany.
Jean-Claude Kieffer; INRS-Energie Materiaux et Telecom, Canada.

Optics in Diagnostics and Clinical Translation
Rebecca Richards-Kortum; Rice Univ., USA, **Chair**
Andrew J. Berger; Inst. of Optics, Univ. of Rochester, USA.
Thomas Foster; Univ. of Rochester, USA.
Anita Mahadevan-Jansen; Vanderbilt Univ., USA.
Andrew Rollins; Case Western Reserve Univ., USA.
Andres F. Zuluaga; Remicalm LLC, USA.
Optics in Molecular and Small Animal Imaging
Joseph P. Culver; Washington Univ. in St. Louis, USA, Chair
Peter Choyke; Ctr. for Cancer Res., NIH, USA.
Charles Lin; Wellman Labs of Photomedicine, Massachusetts General Hospital, Harvard Medical School, USA.
Bradley Rice; Xenogen Corp., USA.
Giannis Zacharakis; Foundation for Res. and Technology Hellas (FORTH), Inst. of Electronic Structure and Laser (IESL), Greece.

Optics in Neuroscience
Arno Villringer; Charite Univ. Medical Ctr., Humboldt Univ., Germany, Chair
David Boas; Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA.
David T. Delpy; Univ. College London, UK.
Winfried Denk; Max Planck Inst. for Medical Res., Germany.
Andreas Hielscher; Columbia Univ., USA.

Photonic Biomedical Nanotechnology
Rebekah Drezek; Rice Univ., USA, Chair
Ji-Xin Cheng; Purdue Univ., USA.
Xingde Li; Univ. of Washington, USA.
Hedi Mattoussi; NRL, USA.
Konstantin V. Sokolov; Univ. of Texas MD Anderson Cancer Ctr., USA.
BIOMED Invited and Tutorial Speakers by Topic Category

Methods for Diffuse Optical Imaging and Tomography

Plenary Speaker

BSuF3, Optical Imaging of Breast Cancer from an Industrial Perspective; Martin B. van der Mark¹, Leon Bakker¹, Michiel van Beek¹, Claas Bontus², Bernhard Brendel², Rick Harbers¹, Thomas Koehler², Anais Leproux¹, Tim Nielsen², Marjolein van der Voort¹, Falk Uhleman², Andrea Wiethoff², Ronny Ziegler², Andy Ziegler², Kai Licha³, Lueder Fels⁴, Martin Pesset⁴, Stephanie van de Ven⁵, Sjoerd Elias⁶, Willem Mali⁶, Peter Luijten⁶;¹Philips Res. Europe-Eindhoven, The Netherlands, ²Philips Res. Europe-Hamburg, Germany, ³Philips Medical Systems-Best, The Netherlands, ⁴Bayer-Schering Pharma, Germany, ⁵Univ. Medical Ctr. Utreacht, The Netherlands.

Tutorial Speaker

BSuC1, Recent Advances in Optical Tomographic Imaging; Andreas Hielscher; Columbia Univ., USA.

Invited Speakers

BSuC2, Clinical Translational Impact of Diffuse Optics in Breast Cancer; Bruce Tromberg; Univ. of California at Irvine, USA.

BMA2, High Resolution Photoacoustic Imaging for Characterizing Vascular Anatomy and Function; Paul C. Beard; Univ. College London, UK.

Methods for Optical Spectroscopy and Spectroscopic Imaging

Tutorial Speaker

BTuB1, Seeing inside the Body with Microendoscopy and Endoscopic Microscopy; Gary Tearney; Wellman Ctr. for Photomedicine, Massachusetts General Hospital, USA.

Invited Speakers

BTuA3, The Role of Light Scattering Spectroscopy in Spectral Diagnosis of Disease; Michael S. Feld¹, Condon Lau¹, Obrad Scepanovic¹, Sasha McGee¹, Jelena Mirkovic¹, Chung-Chieh Yu¹, Steve Fulghum², James Tunnell³, Irene Georgakoudi⁴, Kate Bechtel⁵;¹MIT Spectroscopy Lab, USA, ²Newton Labs Inc., USA, ³Univ. of Texas at Austin, USA, ⁴Tufts Univ., USA.

BWD1, Multimodality Nonlinear Optical Imaging; Ji-Xin Cheng; Purdue Univ., USA.

Optical Coherence Tomography

Tutorial Speaker

BMB1, Fourier Domain OCT and its Applications; Joseph Izatt; Dept. of Biomedical Engineering, Duke Univ., USA.

Invited Speakers

BMB2, Ophthalmic Applications of Birefringence and Flow Contrast Optical Coherence Tomography; Yoshiaki Yasuno; Univ. of Tsukuba, Japan.
BTuB2, Interferometric Spectrally Encoded Endoscopy; Dvir Yelin1, Brett E. Bouma2, John J. Rosowski3, Michael E. Ravicz2, Guillermo J. Tearney1; 1Technion, Israel, 2Wellman Ctr. for Photomedicine, USA, 3Massachusetts Eye and Ear Infirmary, USA.

Optical Microscopy Techniques

Tutorial Speaker

BTuA1, High Throughput Tissue Imaging and Bioinformatics; Peter T. C. So; MIT, USA.

Invited Speakers

BMF1, Contrasts and Resolution in Light Sheet Based Microscopy (SPIM, DSLM, LSFM); Ernst Stelzer; European Molecular Biology Lab, Germany.

BTuA2, Dual-Color Superresolution Imaging Using Genetically Expressed Probes; Hari Shroff1, Catherine G. Galbraith2, James A. Galbraith2, Helen White1, Jennifer Gillette1, Scott Olenych5, Michael W. Davidson5, Eric Betzig1; 1Howard Hughes Medical Inst., Janelia Farm Res. Campus, USA, 2Natl. Inst. of Dental and Craniofacial Res., NIH, USA, 3Natl. Inst. of Neurological Disorders and Stroke, NIH, USA, 4Natl. Inst. of Child Health and Human Development, NIH, USA, 5Natl. High Magnetic Field Lab and Dept. of Biological Science, Florida State Univ., USA.

Photonic Biomedical Nanotechnology

Tutorial Speaker

BSuA1, Nanoparticles in Molecular Imaging of Cancer: Opportunities and Challenges; Konstantin V. Sokolov; Univ. of Texas MD Anderson Cancer Ctr., USA.

Invited Speakers

BSuA2, Darkfield Microspectroscopy: From Single Nanoparticle Biosensing to Live Cell Molecular Imaging; Adam Wax; Dept. of Biomedical Engineering, Duke Univ., USA.

BWA3, Multifunctional QDs for Molecular Imaging and siRNA Delivery; Xiaohu Gao; Univ. of Washington, USA.

Optics in Neuroscience

Tutorial Speaker

BME1, When the Brain Turns Red or Pale: Introduction to Non-Invasive Optical Brain Imaging; Jens Steinbrink, Hellmuth Obrig; Charité Univ. Medicine, Germany.

Invited Speakers

BME2, Multidimensional Functional Optical Imaging of the Brain; Elizabeth M. Hillman; Columbia Univ., USA.

BTuA4, The Glass Brain: Visualization of Neuronal Networks in the Whole Mouse Brain by Ultramicroscopy; Hans-Ulrich Dodt, N. Jähring, K. Becker; Vienna Univ. of Technology, Austria.

Optics in Diagnostics and Clinical Translation
Plenary Speakers

BSuF2, Optical Molecular Imaging to Aid in Cancer Screening: Challenges of Clinical Translation; Rebecca Richards-Kortum¹, David Javier¹, Sharmila Ananda², Ann Gillenwafer²; ¹Rice Univ., USA, ²MD Anderson Cancer Ctr., USA.

BSuF4, Clinical Molecular Imaging in the Gastrointestinal Tract; Thomas D. Wang; Univ. of Michigan, USA.

Tutorial Speaker

BWA1, Optical Technologies for Early GI Cancer Detection: Many Ways to Skin a Cat? Brian C. Wilson; Univ. of Toronto, Canada.

Invited Speakers

BMA4, Optical Biomarkers in Breast Cancer; Nirmala Ramanujam; Dept. of Biomedical Engineering, Duke Univ., USA.

BWA2, Fluorescence Imaging and Spectroscopy for Oral Cancer Detection; Ann M. Gillenwater; Univ. of Texas MD Anderson Cancer Ctr., USA.

Optics in Molecular and Small Animal Imaging

Tutorial Speaker

BMA1, Photoacoustic Microscopy and Computed Tomography; Lihong V. Wang; Washington Univ. in St. Louis, USA.

Invited Speakers

BMA3, Activatable Fluorescence Probes for the Cancer-Cell Specific Molecular Imaging of Cancer; Hisataka Kobayashi; Natl. Cancer Inst., NIH, USA.

BSuF1, Applications and Directions in Fluorescence Guided Surgical Interventions; Stephen J. Lomnes; GE Global Res., USA.

Optical Therapeutics

Tutorial Speaker

BWB1, Developing Conformal Therapy Treatment Planning for Photodynamic Therapy; Lothar Lilge¹, ², Augusto Rendon¹, ²; ¹Ontario Cancer Inst., Canada, ²Univ. of Toronto, Canada.

Invited Speakers

BWA4, Effects of Low Intensity Laser Light on Wound Healing in the Rat; Ethne L. Nussbaum, Tony Mazzulli, Kenneth P. H. Pritzker, Facundo Las Heras, Lothar Lilge; Univ. of Toronto, Canada.

BWB2, To Be Announced; Jean-Claude Kieffer; INRS Énergie, Matériaux et Télécommunications, Canada.
## Agenda of Sessions

<table>
<thead>
<tr>
<th>Time</th>
<th>Grand Bay Ballroom North</th>
<th>Grand Bay Ballroom South</th>
<th>Harborview</th>
<th>Williams/Demens Room</th>
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<tr>
<td><strong>Saturday, March 15, 2008</strong></td>
<td>Registration (in Main Lobby)</td>
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<td><strong>Sunday, March 16, 2008</strong></td>
<td>Registration (at Conference Registration Desk)</td>
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<td>6:30 a.m.–6:30 p.m.</td>
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<tr>
<td>8:00 a.m.–10:00 a.m.</td>
<td>BSuA • Nanoparticle Probes for Molecular Imaging</td>
<td>BSuB • Optical Imaging of Breast Cancer</td>
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<tr>
<td>10:00 a.m.–10:30 a.m.</td>
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<tr>
<td>10:00 a.m.–4:00 p.m.</td>
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<tr>
<td>10:30 a.m.–12:30 p.m.</td>
<td>BSuC • Methods for Diffuse Optical Imaging</td>
<td>BSuD • Optical Techniques in the Clinic</td>
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<td>Lunch Break</td>
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<tr>
<td>1:30 p.m.–3:30 p.m.</td>
<td>BSuE • BIOMED Poster Session I (Foyer)</td>
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<td>4:00 p.m.–6:30 p.m.</td>
<td>BSuF • Plenary I: Workshop on Contrast for in vivo Imaging</td>
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<td>7:00 a.m.–6:00 p.m.</td>
<td>Registration (at Conference Registration Desk)</td>
<td>BMA • Plenary II: Strategies for Functional Imaging and Diagnostics</td>
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<td>BMC • Reconstruction Methods for Diffuse Optical Tomography</td>
<td>DMB • 3-D Imaging II</td>
<td>LMB • MIR Laser-Based Trace Gas Sensing</td>
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<td>BMD • BIOMED Poster Session II (Foyer)</td>
<td>DMC • Digital/Electronic Holography</td>
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<td>BMF • Advances in Microscopy</td>
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### Key to Shading

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<td>7:00 a.m.–6:00 p.m.</td>
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<td>7:30 a.m.–10:00 a.m.</td>
<td>Coffee Break (St. Petersburg Ballroom)</td>
<td>10:30 a.m.–12:30 p.m.</td>
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<td>10:30 a.m.–12:30 p.m.</td>
<td>Lunch Break</td>
<td>12:30 p.m.–12:40 p.m.</td>
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<td>12:30 p.m.–1:30 p.m.</td>
<td>Coffee Break (St. Petersburg Ballroom)</td>
<td>3:30 p.m.–4:00 p.m.</td>
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<td>3:30 p.m.–4:00 p.m.</td>
<td>6:00 p.m.–6:10 p.m.</td>
<td>BIOMED Closing Remarks</td>
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<td>Thursday, March 20, 2008</td>
<td>Registration (at Conference Registration Desk)</td>
<td>7:30 a.m.–3:30 p.m.</td>
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<td>7:30 a.m.–3:30 p.m.</td>
<td>Coffee Break (Foyer)</td>
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<td>1:30 p.m.–3:30 p.m.</td>
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Biomedical Optics (BIOMED) Abstracts

• **Saturday, March 15, 2008**

  **Main Lobby**
  4:00 p.m.–6:00 p.m.
  Registration Open

• **Sunday, March 16, 2008**

  **Conference Registration**
  6:30 a.m.–6:30 p.m.
  Registration Open

  **Grand Bay Ballroom North**
  7:50 a.m.–8:00 a.m.
  BIOMED Opening Remarks

  **BSuA • Nanoparticle Probes for Molecular Imaging**

  Grand Bay Ballroom North
  8:00 a.m.–10:00 a.m.
  **BSuA • Nanoparticle Probes for Molecular Imaging**
  Konstantin V. Sokolov; Univ. of Texas MD Anderson Cancer Ctr., USA, Presider

  **BSuA1 • 8:00 a.m.**
  **Tutorial**
  Nanoparticles in Molecular Imaging of Cancer: Opportunities and Challenges, Konstantin V. Sokolov; Univ. of Texas MD Anderson Cancer Ctr., USA. Nanotechnology offers unique opportunities for cancer detection, therapy and the ability to monitor therapeutic interventions. I will highlight this potential in context of challenges that need to be overcome in clinical applications of nanoparticles.

  **BSuA2 • 8:45 a.m.**
  **Invited**
  Darkfield Microscopy: From Single Nanoparticle Biosensing to Live Cell Molecular Imaging, Adam Wax; Dept. of Biomedical Engineering, Duke Univ., USA. Darkfield microscopy enables detailed studies of the plasmonic features of noble metal nanoparticles. Shifts of the plasmon resonance of individual nanoparticles can be exploited for sensing applications or to achieve molecular imaging using targeted immunolabelling.

  **BSuA3 • 9:15 a.m.**
  Biodegradable Nanoshells for Optical Contrast and Controlled Release, Timothy Troutman, Marek Romanowski; Univ. of Arizona, USA. Liposome-supported arrays of gold nanodots exhibit plasmon resonance, making them useful as contrast agents in optical imaging techniques and degradable to components of clearable size. Encapsulated volume can be released with high energy incident light.

  **BSuA4 • 9:30 a.m.**
  Stabilized Micellar Formulation of Indocyanine Green for Near-Infrared Imaging, Victoria B. Rodriguez, Scott M. Henry, Allan S. Hoffman, Patrick S. Stayton, Suzie H. Pun, Xingde Li; Univ. of Washington, USA. We report micellar formation of indocyanine green (ICG) nano complex. The nano-complex has a small size (30-40nm), low cytotoxicity and low critical micelle concentration (1 mg/L), and significantly improves ICG thermal and photostability.

  **BSuA5 • 9:45 a.m.**
  Photonic Shell-Crosslinked Nanoparticle Probes for Optical Imaging and Monitoring, Nam S. Lee¹, William L. Neumann¹, John N. Freskos², Tim A. Marzani¹, Jeng J. Shtieh¹, Richard B. Dorshow¹, Karen L. Wooley¹; ¹Washington Univ. in St. Louis, USA, ²Imaging Solutions, Covidxien, USA. Photonic shell-crosslinked nanoparticles (SCKs) were prepared via crosslinking between fluorophores and micelles. These unique photonic SCKs will be discussed, including their abilities to undergo pH-sensitive swelling/deswelling, which affects enhancement/quenching of the fluorescence.

  **BSuB • Optical Imaging of Breast Cancer**

  Grand Bay Ballroom South
  8:00 a.m.–10:00 a.m.
  **BSuB • Optical Imaging of Breast Cancer**
  Nimmi Ramanujam; Biomedical Engineering Dept., Duke Univ., USA, Presider

  **BSuB1 • 8:00 a.m.**
  In vivo Breast Cancer Characterization and Therapy Monitoring Using Diffuse Optical Methods Based on Endogenous Optical/Exogenous Fluorescence Contrast, Regine Cho¹, Soren D. Konecky¹, Alper Corlu¹, Kijoon Lee¹, Turgut Durduıran¹, Chao Zhou², Brian J. Czerniecki³, Julia C. Tchou³, Angela DeMichele³, Mark A. Rosen³, Mitchell D. Schnall³, Britton Chance³, Arjun G. Yodh³; ¹Univ. of Pennsylvania, USA, ²Hospital of Univ. of Pennsylvania, USA. Characterization of tumor-to-normal endogenous optical contrast from 3-D diffuse optical tomography, neoadjuvant chemotherapy monitoring with additional blood flow information, and 3-D fluorescence DOT with exogenous contrast agent injection are presented.
BSuB2 • 8:15 a.m.  
Spectrally Constrained Optical Breast Imaging with Co-Registered X-Ray Tomosynthesis, Qianqian Fang, Stefan A. Carp, Juliette Selb, Richard Moore, Daniel B. Kopans, Eric L. Miller, Dana H. Brooks, David A. Boas; 1Massachusetts General Hospital, USA, 2Tufts Univ., USA, 3Northeastern Univ., USA. We imaged 65 patients with a combined optical and tomosynthesis imaging system. The bulk optical properties from 72 healthy breasts and the reconstructed images using a spectrally-constrained algorithm for healthy and tumor breasts are reported.

BSuB3 • 8:30 a.m.  
Time-Resolved Optical Mammography from 635 to 1060 nm for Collagen Quantification, Paola Taroni, Arianna Giusto, Antonio Pifferi, Lorenzo Spinelli, Alessandro Torricelli, Rinaldo Cubeddu; Dept. of Physics, Politecnico di Milano, Italy. We upgraded our time-resolved optical mammograph, adding a longer wavelength (1060 nm) to aid collagen quantification. Images were collected from volunteers at 7 wavelengths between 635 and 1060 nm, deriving breast tissue composition (including collagen).

BSuB4 • 8:45 a.m.  
3-D MR Guided NIRS: Optimization of Computation and Breast Interface for in vivo Imaging, Colin M. Carpenter, Subhadra Srinivasan, Brian W. Pogue, Shudong Jiang, Hamid Dehghani, Keith D. Paulsen; Dartmouth College, USA. 3-D MRg-NIRS imaging of breast cancer has been studied in simulation and in vivo using parallel plate and circular geometries. Optimal methods to minimize errors in measurement and modeling are presented.

BSuB5 • 9:00 a.m.  
Design of a Digital Optical Tomography System for Dynamic Breast Imaging, Yang Li, Andres M. Bur, Christopher J. Fong, Molly L. Flexman, Rabah A. Abdii, Randall L. Barbour, Andreas H. Hielscher; 1Columbia Univ., USA, 2SUNY Downstate Medical Ctr., USA. We present the design of an optical breast imaging system based on digital conversion, processing, and filtering techniques. The system consists of 128 silicon photodiode detectors, 64 excitation points, and 4 near-infrared laser diodes.

BSuB6 • 9:15 a.m.  
Fluorescence and Reflectance Spectroscopy and Spectral Imaging for Evaluating Surgical Margin Status during Breast Cancer Resection, Matthew D. Keller, Shovan K. Majumder, Mark C. Kelley, Ingrid M. Meszoely, Fouad I. Boudou, Anita Mahadevan-Jansen; 1Dept. of Biomedical Engineering, Vanderbilt Univ., USA, 2Div. of Surgical Oncology and Endocrine Surgery, Vanderbilt Univ. Medical Ctr., USA, 3Div. of Surgical Pathology, Vanderbilt Univ. Medical Ctr., USA. Fluorescence and reflectance spectroscopy and spectral imaging were used to try to evaluate the status of surgical margins following partial or total mastectomies. Classification thus far has achieved 96% specificity and 85% sensitivity.

BSuB7 • 9:30 a.m.  
Dynamic Functional and Mechanical Response of Breast Tissue to Compression, Stefan Carp, Juliette Selb, Qianqian Fang, Richard Moore, Daniel Kopans, Elizabeth Rafferty, David Boas; Massachusetts General Hospital, USA. We characterize the functional and mechanical response of breast tissue to external compression by optically monitoring tissue chromophore concentrations in parallel with tissue reaction force measurements. We estimate tissue metabolism using a partial occlusion model.

BSuB8 • 9:45 a.m.  
Elastic Scattering Spectroscopy Scanning of Sentinel Lymph Nodes for Intraoperative Diagnosis of Breast Cancer Metastases, Martin R. Austwick,2,3, Santosh Somasundaram, Wayne Chicken,2 Benjamin Clark,2 Charles A. Mosse,2 Mary Falzon,2 Gabrijela Kocjan,2 Irving Bigio,2 Mohammed Keshtgar,2 Stephen Bown;1 Natl. Medical Laser Ctr., Univ. of College London, UK, 2Pathology Dept., Royal Free and Univ. College Medical School, UK, 3Dept. of Biomedical Engineering, Boston Univ., USA. Sentinel Node biopsy is a clinical technique for detecting metastatic spread in breast cancer. We demonstrate how Elastic Scattering Spectroscopy scanning is sensitive to malignant morphological changes and can be used for rapid intraoperative diagnosis.

St. Petersburg Ballroom  
10:00 a.m.–10:30 a.m.  
Coffee Break

St. Petersburg Ballroom  
10:00 a.m.–4:00 p.m.  
Exhibits Open
BSuC • Methods for Diffuse Optical Imaging

Grand Bay Ballroom North
10:30 a.m.–12:30 p.m.
BSuC • Methods for Diffuse Optical Imaging
Gregory Faris; SRI Intl., USA, Presider

BSuC1 • 10:30 a.m. Tutorial
Recent Advances in Optical Tomographic Imaging, Andreas Hielscher; Columbia Univ., USA. Practical examples encountered in clinical and preclinical imaging such as monitoring of tumor growth and regression as well as arthritic disease progression will be presented.

BSuC2 • 11:15 a.m. Invited
Clinical Translational Impact of Diffuse Optics in Breast Cancer, Bruce Tromberg; Univ. of California at Irvine, USA. Abstract not available.

BSuC3 • 11:45 a.m.
NIR Oximetry for Characterization of Tissues in Diabetics, Shudong Jiang1, Benjamin B. Williams2, Nadeem Khan1, Brian B. Pogue1, Harold M. Swartz1; 1Thayer School of Engineering, Dartmouth College, USA, 2Dept. of Diagnostic Radiology, Dartmouth Medical School, Dartmouth College, USA. The dynamic processes of forced hyperoxia and hypoxia in the plantar surface of the foot were characterized by a combined approach using NIR spectroscopy and electron paramagnetic resonance with great reproducibility.

BSuC4 • 12:00 p.m.
Recovery of Indocyanine Green Bolus in the Cortex of Adult Humans from Time-Resolved in vivo Fluorescence Measurements, Heidrun Wabnitz1, Alexander Jelzow1, Rainer Macdonald1, Hellmut Obrig1, Jens Steinbrink1; 1Physikalisch-Technische Bundesanstalt, Germany, 2Charité-Universitätsmedizin Berlin, Germany. Indocyanine green bolus tracking to assess cerebral perfusion may benefit from fluorescence detection. We present a novel approach to depth-discriminated retrieval of the bolus shape by empirical estimation of time-resolved intra- and extracerebral sensitivity functions.

BSuC5 • 12:15 p.m.
Time-Resolved 3-D Optical Imaging of Electromagnetic Wave in Pig Myocardium, Bogdan G. Mitrea1, Marcel Wellner1-2, Arvydas Mattiukas3, Arkady Pertsov1; 1Dept. of Pharmacology, State Univ. of New York, USA, 2Physics Dept., Syracuse Univ., USA, 3Dept. of Physics, Kaunas Univ. of Technology, Lithuania. We report a fast laser-scanning system for imaging rapidly propagating electromagnetic waves inside the ventricular wall with 1 ms time resolution. The system uses a novel biaxial scanning algorithm and near-infrared voltage-sensitive dyes.

BSuD • Optical Techniques in the Clinic

Grand Bay Ballroom South
10:30 a.m.–12:30 p.m.
BSuD • Optical Techniques in the Clinic
Rebecca Richards-Kortum; Rice Univ., USA, Presider

BSuD1 • 10:30 a.m.
Detection and Follow-up of Neonatal Brain Injuries with FD-NIRS, Andrea Surova, P. Ellen Grant, Juliette Selb, Elizabeth Warren, Nadege Roche-Labarbe, Maria Angela Franceschini; Athinoula A. Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA. We use Frequency-Domain Near-Infrared Spectroscopy to detect brain injuries in neonates by noninvasively measuring cerebral oxygenation and blood volume. Correlation of our data with subsequent diagnoses suggests the effectiveness of FD-NIRS as a bedside monitor.

BSuD2 • 10:45 a.m.
Blood Flow Responses to Photodynamic Therapy with Two Photosensitizers: Photofrin and Motexafin Lutetium (MLu), Gaoqiang Yu1,2, Theresa M. Buschi1, Turgut Durduran1, Chao Zhou1, Xiaonan Xing1, Timothy Zhu1, Jarad C. Finlay1, S. Bruce Malkowicz1, Stephen M. Hahn1, Arjun G. Yodh2; 1Univ. of Pennsylvania, USA, 2Univ. of Kentucky, USA. Diffuse correlation spectroscopy has been applied for real-time monitoring of tumor blood flow responses to photodynamic therapy using two photosensitizers: Photofrin and Motexafin lutetium (MLu). The different photosensitizers exhibited different blood flow dynamics during PDT.

BSuD3 • 11:00 a.m.
Non-invasive Measurement of Cerebral Autoregulation of Acute Ischemic Stroke Patients with Diffuse Correlation/Wave Spectroscopy, Turgut Durduran, Chao Zhou, Brian L. Edlow, Gaoqiang Yu, Regine Choe, Meeri N. Kim, Brett L. Cucchiara, Mary E. Palt, Qaisar Shah, Scott E. Kasner, Joel H. Greenberg, John A. Detre, Arjun G. Yodh; Univ. of Pennsylvania, USA. The development of diffuse correlation/wave spectroscopy for non-invasive measurement of blood flow allowed measurement of cerebral autoregulation in acute ischemic stroke by comparing infarcted and healthy hemispheres.
BSuD4 • 11:15 a.m.
Disruption of Dynamic Cerebral Autoregulation in Ischemic Stroke Patients Assessed by Continuous-Wave NIRS, Juliette J. Selb1, Susanne Muehlschlegle2, Solomon G. Diamond3, Mari Angela Franceschini4, Lee H. Schwamm2, David A. Bacs2; 1Athinaoula Martinos Ctr. for Biomedical Engineering, Massachusetts General Hospital, USA, 2Massachusetts General Hospital, USA, 3Dartmouth College, USA, 4Athinaoula Martinos Ctr. for Biomedical Engineering, Massachusetts General Hospital, USA. NIRS-monitored spontaneous cerebral oscillations in healthy subjects and stroke patients showed good correlation between hemispheres at cardiac frequency in both groups, but significantly reduced correlation at respiratory frequency for patients, possibly revealing impaired cerebral autoregulation.

BSuD5 • 11:30 a.m.
Diffuse Optical Measurements of Cerebral Blood Flow and Oxygenation in Patients after Traumatic Brain Injury or Subarachnoid Hemorrhage, Meeri N. Kim1, Turgut Durdu12, Suzanne Franço3, Erin M. Buckley1, Chao Zhou1, Guoqiang Yu1, Brian L. Edlow4, Eileen Mahoney-Wilensky1, M. Sean Grady1, Josh Levine1, John A. Detre1, Joel H. Greenberg4, Arjun G. Yodli1; 1Dept. of Radiology, Univ. of Pennsylvania, USA, 2Dept. of Neurosurgery, Univ. of Pennsylvania, USA, 3Dept. of Neurology, Univ. of Pennsylvania, USA. In order to explore its feasibility as a bedside monitor, a hybrid diffuse optical device was used to measure cerebral blood flow and oxygenation in patients with traumatic brain injury or subarachnoid hemorrhage.

BSuD6 • 11:45 a.m.
Frequency-Domain Optical Imaging with GHz Multipixel Detection, Uwe J. Netz1, Jürgen Beuthan1, Andreas H. Hielsher2; 1Charité- Univ.-Medizin Berlin, Germany, 2Columbia Univ., USA. A GHz frequency-domain optical imaging system enables 2-D detection of phase and amplitude information. Performance and frequency dependence was investigated using optical tissue phantoms for small geometries relating to small animal and finger joint imaging.

BSuD7 • 12:00 p.m.
Simultaneous Multi-Wavelength Laminar Optical Tomography Imaging of Dermal Lesions, Seán A. Burgess1, Baohong Yuan1, Matthew B. Bouchard1, Désirée Ratner2, Elizabeth M. C. Hillman3; 1Columbia Univ., USA, 2Columbia Univ. Medical Ctr., USA. We report on a laminar optical tomography system developed for imaging skin cancer. The system simultaneously measures absorption at three wavelengths to extract depth resolved information for invasion depth determination and lesion boundary mapping.

BSuD8 • 12:15 p.m.
Optically-Calibrated Functional Magnetic Resonance Imaging, Theodore J. Huppert12, Solomon G. Diamond23, David A. Bacs2; 1Univ. of Pittsburgh, USA, 2Massachusetts General Hospital, USA, 3Dartmouth College, USA. We describe how diffuse optical imaging can be used to enhance functional magnetic resonance imaging by providing additional temporal and spectroscopic information. We apply this model to experimental data from concurrent fMRI and optical measurements.

12:30 p.m.—1:30 p.m.
Lunch Break

BSuE • BIOMED Poster Session I

BSuE1
Optimization of Surface-Enhanced Luminescence for Bioassays, Chia-Pin Pan, Traci Brooks, Abneesht Srisastava, Gregory W. Faris; SRI Intl., USA. We are developing silver nanoparticle surface-enhanced lanthanide chelate luminescence as a proximity bioassay. We have studied different organic linkers and preparation procedures to attach covalently fluorescence dyes and lanthanide chelates to the nanoparticles.

BSuE2
Near-Infrared Quantum Dots Imaging in the Mouse Brain, Jeongkyu Youn1, Nayeun Won2, Sunghee Kim2, Jee Hyun Choi3; 1Korea Inst. of Sci. and Tech., Republic of Korea, 2Dept. of Chemistry, POSTECH, Suriname. Near-infrared fluorescence quantum dot (QD) was applied to the mouse brain in vivo to determine the sensitivity and the maximum detectable depth of QD. We also monitored the clearance of QD over time.

BSuE3
Paper Withdrawn
BSuE4
Quantification of Dendrimer Nanoparticle Targeting on Tumor Cells by Two-Photon Excitation Fluorescence through a Dual-Clad Optical Fiber, Yu-Chung Chang¹, Thommy P. Thomas¹, Jing Yong Ye¹,², Alina Kotlyar³, Zhengyi Cao², Istvan J. Majoros², James R. Baker, Jr.¹, Theodore B. Norris¹,²; ¹Ctr. for Ultrafast Optical Science, Univ. of Michigan, USA, ²Michigan Nanotechnology Inst. for Medicine and Biological Sciences, Dept. of Internal Medicine, Univ. of Michigan, USA. We report the use of a dual-clad optical fiber to conduct quantitative two-photon excited fluorescence measurements in vitro and in vivo inside tumors. The ability to detect nanomolar concentrations of targeting nanoparticles is demonstrated.

BSuE5
Paper Withdrawn

BSuE6
Development of a Novel Hyperspectral Darkfield Microscopy System for Characterization of Nanoparticle Sensors, Matthew J. Crow, Adam Wax; Duke Univ., USA. We present a novel hyperspectral darkfield microscopy scheme that utilizes an epi-illumination light train for improved characterization of the sensing capacity of noble metal nanoparticles. Validation experiments are presented to characterize the new system.

BSuE7
Temporal Binding Affinity of Immunotargeted Nanoparticles for Potential Point of Care Diagnostic Applications, Lissent R. Bickford¹, Joseph Chang¹, Kun Fu¹,², Ying Hu¹, Tse-Kuan Yu¹, Rebekah A. Drezek¹; ¹Rice Univ., USA, ²MD Anderson Cancer Ctr., USA. We demonstrate the potential of using nanoparticles for point of care cancer diagnostic imaging applications by achieving optical contrast between normal and cancerous epithelial cells at minimal incubation times through optimization of nanoshell-cell conjugations.

BSuE8
The Use of Gold Nanoshells in Cancer Imaging and Therapy, James Chen Yong Kali, Rachel Cheng Yi Wan¹, Tzu-Hao Chou¹, Malini Carolene Olivo¹, Subodh G. Mhaisalkar¹, Colin J. R. Sheppard¹; ¹Div. of Bioengineering, Natl. Univ. of Singapore, Singapore, ²School of Materials Science and Engineering, Nanyang Technological Univ., Singapore, ³School of Electrical and Electronic Engineering, Nanyang Technological Univ., Singapore, ⁴Div. of Medical Sciences, Natl. Cancer Ctr. Singapore, Singapore. This paper describes the synthesis and application of gold nanoshells as promising molecular contrast agent in reflectance based imaging and potential photothermal cancer therapeutics with enhanced cellular destruction in combination with photodynamic therapy.

BSuE9
Use of Lectin-Conjugated Nanoparticles for Detection of Cell Death, Rostyslav Bilgy³, Andriy Tomyn³, Oľga Zelikova³, Natalia Mitina³, Alexander Zaichenko³, Rostyslav Stoika³; ³Inst. of Cell Biology, Natl. Acad. of Sciences of Ukraine, Ukraine, ⁴Lviv Polytechnic Natl. Univ., Ukraine. Developed fluorescent-labeled latex nanoparticles with conjugated lectin molecules were utilized for detection of dying cells; their binding with cells is based on novel plasma membrane marker of cell death—change in glycoprotein exposure level.

BSuE10
Gold Nanoparticles as Contrast Agent for in vivo Photoacoustic Tomography of Tumor, Qizhi Zhang¹, Nobutaka Iwakuma¹, Matthew Delano¹, Parvesh Sharma¹, Changfeng Wu¹, Jason McNeil¹, Stephen R. Grobmyer², Huabei Jiang³; ¹Univ. of Florida, USA, ²Universtity of Florida, USA, ³Clemson Univ., USA. We demonstrate that gold nanoparticles can be utilized as a good contrast agent for in vivo tumor (human breast cancer, BT474) imaging with photoacoustic tomography (PAT) in an animal model.

BSuE11
Fibronectin Adsorption to Nanopatterned Silicon Surfaces, Ildar Salakhutdinov, Pamela J. VandeVord, Olena Polyvoda, Howard W. Matthew, Hitesh Handa, Guangzhao Mao, Gregory W. Auner, Golam M. Newaz; Wayne State Univ., USA. This study investigated the adsorption of fibronectin to a rectangular diffraction grating silicon surface with 350 nm period and a corrugation depth of 90 nm. Results demonstrated a significantly positive effect on the fibronectin binding.

BSuE12
Characterization of Magnetic Properties of Magnetite (Fe₃O₄) Nanoparticles Synthesized by Co-Precipitation Process at Room Temperature, Mohammad E. Khosroshahi, Mohammadreza Tahiri; Amirkabir Univ. of Technology, Iran (Islamic Republic of). Synthesis of Fe₃O₄ nanoparticles was carried out by chemical solution method at room temperature. The results indicated particles of ~ 40 nm using 0.9 M NaOH at 750 rpm and saturation magnetization of 82 emu/g.

BSuE13
Sensitivity and Specificity of 3-D Optical Mammography, Louise C. Enfield, Adam P. Gibson, Nick L. Everdell, Jeremy C. Hebdon, Simon R. Arridge, Anita Sharma, Richard Sainsbury, Michael Dowek, Mohammed Keshtgar; Univ. College London, UK. Optical tomography is being developed to detect and specify disease in the female breast. Assessors were trained to interpret optical images, then presented with images from further patients. The sensitivity was 85.8% and the specificity 66.8%.
BSuE14
3-D Optical Mammography of the Uncompressed Breast, Adam P. Gibson\textsuperscript{1}, Louise C. Enfield\textsuperscript{2}, Martin Schweiger\textsuperscript{1,3}, Simon R. Arridge\textsuperscript{4}, Michael Douek\textsuperscript{1}, Jeremy C. Hebden\textsuperscript{1}; \textsuperscript{1}Dept. of Medical Physics and Biomedical Engineering, Univ. College London, UK, \textsuperscript{2}Dept. of Computer Science, Univ. College London, UK, \textsuperscript{3}Dept. of Surgery, Univ. College London, UK. We have successfully performed optical tomography of the uncompressed breast on 52 volunteers with breast lesions. We describe a new method for image reconstruction which draws prior information from the optical image itself.

BSuE15
How Feedback from Human Subjects Can Enhance Clinical Performance of Optical Mammography, Norma Morris, Jeremy C. Hebden, Louise C. Enfield, Adam P. Gibson, Anita Sharma, Victoria Armstrong; Univ. College London, UK. We report findings of a study aiming to improve research process and outcomes by eliciting detailed feedback on their experience from patient-volunteers taking part in early clinical evaluation of an optical breast imaging system.

BSuE16
Effects of Compression on Transillumination Measurements of Blood Flow and Chlorophore Concentrations in Human Breast Tissue, David R. Busch\textsuperscript{1}, Chao Zhou\textsuperscript{1}, G. Yu\textsuperscript{1}, Regine Choe\textsuperscript{1}, Turgut Durdurian\textsuperscript{2,3}, Mark Rosen\textsuperscript{1}, Mitchell D. Schnall\textsuperscript{1}, Arjun G. Yodh\textsuperscript{1}; \textsuperscript{1}Univ. of Pennsylvania, USA, \textsuperscript{2}Hospital of the Univ. of Pennsylvania, USA. We combine diffuse optical spectroscopic and correlation measurements of human breast tissue under compression. We expect a contrast between healthy (organized) and cancerous (chaotic) vascular response. Initial results suggest significant flow changes under compression.

BSuE17
Pressure-Enhanced Near-Infrared Breast Imaging of Normal Subjects, Shudong Jiang, Brian W. Pogue, Ashley M. Laughney, Keith D. Paulsen; Thayer School of Engineering, Dartmouth College, USA. Fast frame rate frequency domain tomography of normal breast tissue showed correlation between applied pressure and total hemoglobin, water and scattering amplitude, but no significant changes in tissue oxygen saturation and scattering power.

BSuE18
Next Generation Heterodyne Multi-Spectral Breast Imager, Han Y. Bani\textsuperscript{1}, Kijoon Lee\textsuperscript{2}, Soren D. Konecky\textsuperscript{3}, Regine Choe\textsuperscript{1}, Arjun G. Yodh\textsuperscript{1}; \textsuperscript{1}Univ. of Pennsylvania, USA, \textsuperscript{2}Nanjing Technological Univ., Singapore. We describe a Diffuse Optical Tomography breast imaging device. Frequency domain heterodyne measurements are made by modulating a laser source and detecting the transmitted light with a gain-modulated image intensifier coupled to a CCD.

BSuE19
Simultaneous Bilateral Optical Tomography of Vascular Dynamics of the Breast Using High-Density Sensing Arrays, Christoph H. Schmitz\textsuperscript{1}, Rehana Ansari\textsuperscript{2}, Rabah Al Abdii\textsuperscript{3}, Randall Andronica\textsuperscript{2}, Randall L. Barbour\textsuperscript{1,3}; \textsuperscript{1}NIRx Medizintechnik GmbH, Germany, \textsuperscript{2}SUNY Downstate Medical Ctr., USA, \textsuperscript{3}NIRx Medical Technologies LLC, USA. Instrumentation is described allowing simultaneous bilateral diffuse optical imaging of the breasts’ vascular dynamics with high spatial probe density. We introduce concurrent measurement of tissue displacement, allowing for monitoring of external and internal tissue pressure.

BSuE20
Hemodynamically Constrained Dynamic Diffuse Optical Tomography under Mammographic Compression, Eleonora Z. Vidolov\textsuperscript{1}, Stefan Carp\textsuperscript{2}, Eric Miller\textsuperscript{3}, David Boas\textsuperscript{4}, Dana Brooks\textsuperscript{2}; \textsuperscript{1}Northeastern Univ., USA, \textsuperscript{2}Massachusetts General Hospital, Athinoula A. Martinos Ctr. for Biomedical Imaging, USA, \textsuperscript{3}Tufts Univ., USA, \textsuperscript{4}Massachusetts General Hospital, USA. We analyze a hemodynamically constrained metabolic model, describing temporal changes of oxygen saturation in the breast due to mammographic-like compression. We test how the recovery of metabolic parameters is influenced by measurement characteristics and approximations.

BSuE21
Effect of Tilted Chest-Wall on Breast Lesion Reconstruction, Yassaman Ardeshirpour, Minming Huang, Quing Zhu; Univ. of Connecticut, USA. In this paper, we have investigated the effect of the tilted chest-wall under the breast tissue and the mismatch between the tilted-interface of the lesion and reference sides on the reconstruction of a target.

BSuE22
Reconstruction of Sequential Male Breast Images for Early Detection of Tissue Structural Changes by Multi-Probe Laser Reflectometry, P. S. Pandian\textsuperscript{1}, M. Kumaravel\textsuperscript{2}, Megha Singh\textsuperscript{1}; \textsuperscript{1}Biomedical Engineering Dpt., Indian Inst. of Technology, Madras, India, \textsuperscript{2}Central Electronics Ctr., Indian Inst. of Technology, Madras, India, \textsuperscript{3}Ct. for Biomedical Engineering, SGN Educational Foundation, India. The reflectance profiles and optical parameters are obtained by a laser reflectometer and Monte Carlo simulation of tissues. These images are helpful in therapeutic measures by photodynamic therapy to affected tissues.
BSuE23
Shadow Effect of Large Lesions in Optical Tomography Breast Imaging, Chen Xu, Quing Zhu; Electrical and Computer Engineering Dept., Univ. of Connecticut, USA. When a highly-absorbing lesion is imaged with optical tomography in reflection geometry, most photons are absorbed by top portion of lesion. We use photon-tracking technique to quantify this light-shadow effect as function of target size.

BSuE24
Phosphorescence Lifetime Tomography in Optically Heterogeneous Media, Sofia V. Apreleva, Sergei A. Vinogradov; Univ. of Pennsylvania, USA. We have previously demonstrated that phosphorescence lifetime imaging (PLI) allows determination of oxygen in homogeneously absorbing/scattering media. Herein we show that PLI can perform equally well in heterogeneous environments relying only on measurements of phosphorescence.

BSuE25
Mechanism of the Ultrasonic Modulation of Fluorescence in Turbid Media, Baohong Yuan1, John Gamelin2, Quing Zhu2; 1Catholic Univ. of America, USA, 2Univ. of Connecticut, USA. The interaction of a focused ultrasound beam with fluorescent molecules excited by a modulated light source was investigated. Components with new frequencies occur because of nonlinear interactions and can be used for lifetime imaging.

BSuE26
Incorporation of Structural Apriori Information in Fluorescence Molecular Tomography, Damon E. Hyde1, Ralf Schulz2, Eric Miller1, Dana Brooks1, Vasilis Ntziachristos2; 1Northeastern Univ., USA, 2GSF - Natl. Res. Ctr. for Environment and Health, Germany. We examine the use of X-ray CT anatomical structure as prior information in obtaining fluorescence molecular tomography (FMT) reconstructions. Results indicate that structural information drastically improves reconstructions when imaging spatially dispersed targets.

BSuE27
Differential Optical Imaging Using Vasoactive Agents for Cancer Detection, Sanhita S. Dixit, Kenneth T. Kots, Ashley D. Gibbs, Juan M. Orduna, Zishan Haroon, Khalid Amin, Gregory W. Faris; SRI Intl., USA. Infrared transillumination is used to detect cancerous tissue in a human xenograft mouse model. Vasoactive agents are used to provide exogenous contrast by altering response from blood chromophores hemoglobin and oxyhemoglobin.

BSuE28
Recovery of Absolute Absorption Coefficient Maps of Heterogeneous Media by Photoacoustic Tomography Coupled with Diffusion Optical Reconstruction Algorithm, Zhen Yuan, Qiangel Wang, Huabei Jiang; Dept. of Biomedical Engineering, Univ. of Florida, USA. We describe novel reconstruction methods that allow for quantitative recovery of optical absorption coefficient of heterogeneous media using photoacoustic measurements. Images of optical properties are obtained from both diffusion equation-based-regularized Newton method and photoacoustic data.

BSuE29
High Resolution Imaging of Optical Absorption Coefficient in Multi-Centimeter-Size Turbid Media Using Combined Photoacoustic and Diffusing Light Measurements, Lu Yin, Qiang Wang, Huabei Jiang; Dept. of Biomedical Engineering, Univ. of Florida, USA. We introduce a method that can provide high resolution images of optical absorption coefficient from PAT. Acoustic measurements in PAT are combined with DOT measurements to separate the product of absorption coefficient and photon density.

BSuE30
Source and Detector Fiber Optimization for Depth Sensitivity in Endoscopic Near Infrared Tomography, Matthew E. Eames1, Daqing Piao2, Hamid Dehghani1; 1Univ. of Exeter, UK, 2Oklahoma State Univ., USA. Endoscopic Optical tomography is a technique for noninvasive tissue-specific cancer detection in internal organs. This study demonstrates that multiple arrays of fibers within an elliptic-shaped probe increases contrast compared to single array within a cylindrical-probe.

BSuE31
Sagittal-imaging Trans-rectal Optical Tomography Reconstruction with Structural Guidance: Initial Simulative Study, Guan Xu1, Cameron Musgrove1, Charles F. Bunting1, Hamid Dehghani2, Daqing Piao2; 1School of Electrical and Computer Engineering, Oklahoma State Univ., USA, 2School of Physics, Univ. of Exeter, UK. The reconstruction of sagittal trans-rectal optical tomography for prostate imaging is presented with assumption of structural guidance from trans-rectal ultrasound. The spatial prior combined with Jacobian weighing improves the recovery of lesion depth.

BSuE32
A Proposed Deep Tissue Imaging Scheme Based on Turbidity Suppression Optical Phase Conjugation, Emily J. McDowell, Zahid Yaqoob, Changheui Yang; Caltech, USA. We propose an imaging scheme based on turbidity suppression optical phase conjugation (TSOPC), allowing for depth selective targeting of planes within a turbid medium.
BSuE33
Globally Convergent Reconstruction Algorithm for Diffusion Tomography of Prostate, Hua Shan1, Natae Pantog1, Jianzhong Su1, Hanli Liu1, Michael V. Klubanov2; 1Univ. of Texas at Arlington, USA; 2Univ. of North Carolina at Charlotte, USA. A new method is presented for reconstruction of optical coefficient from NIRS data with continuous-wave sources. This Globally Convergent Reconstruction scheme has a potential for monitoring prostate cancers with multifocal inclusions in highly heterogeneous backgrounds.

BSuE34
Diffusion vs. Monte Carlo for Image Reconstruction in Mesoscopic Volumes, Amir K. Irmamahboob, Elizabeth M. C. Hillman; Lab for Functional Optical Imaging, Dept. of Biomedical Engineering, Columbia Univ., USA. Diffusion is an attractive choice for imaging in scattering media, yet it is not valid in small or highly absorbing volumes. We explore its validity on image-reconstruction of absorption and scattering contrast in mesoscopic volumes.

BSuE35
An Efficient Jacobian Reduction Method for Image Reconstruction Using Diffuse Optical Tomography, Matthew E. Eames1, Brian W. Pogue1, Phaneendra K. Yalavarthy1, Hamid Dehghani1,2; 1Univ. of Exeter, UK; 2Thayer School of Engineering, Dartmouth College, USA. Using a Jacobian reconstruction method using experimental data, we show a dramatic increase in image reconstruction time in 3-D DOT, without detriment to image quality.

BSuE36
3-D Image-Guided NIR Absorption and Scatter Tomography Using Boundary Element Method, Subhadra Srinivasan, Colin Carpenter, Brian W. Pogue, Keith D. Paulsen; Thayer School of Engineering, Dartmouth College, USA. A boundary element method (BEM) was developed for image-guided NIR tomography, using only surface discretization. Fluence was calculated on a patient specific mesh, and reconstruction recovered optical properties (mean error = 6%) in multi-layered media.

BSuE37
Heuristic Analytical Solution of the Time Dependent Radiative Transfer Equation for a Semi-Infinite Medium, Fabrizio Martelli1, Angelo Sassaroli1, Antonio Pifferi1, Alessandro Torricelli1, Lorenzo Spinelli1, Giovanni Zaccanti1; 1Dept. of Fisica, Univ. degli Studi di Firenze, Italy, 2Dept. of Biomedical Engineering, Tufts Univ., USA, 3Politecnico di Milano, Italy, 4Inst. for Photonics and Nanotechnologies, Consiglio Nazionale delle Ricerche, Italy. The Green's function of the time dependent radiative transfer equation for the semi-infinite medium is derived by an heuristic approach based on the extrapolated boundary condition and an almost exact solution for the infinite medium.

BSuE38
Normalized Adult Head Model for the Image Reconstruction Algorithm of NIR Topography, Hiroshi Kawaguchi, Eiji Okada; Dept. of Electronics and Electrical Engineering, Keio Univ., Japan. A normalized head model to estimate spatial sensitivity profiles is constructed for image reconstruction of NIR topography. The image reconstructed with the normalized head model is almost equivalent to that with the customized head model.

BSuE39
A PDE-Constrained Optimization Approach to Optical Tomography, Xuejun Gu, Andreas H. Hielscher; Columbia Univ., USA. We report on the first formulation of the inverse problem in optical tomography within the framework of PDE-constrained optimization and combine Newton's method and Krylov subspace solvers, which reduce memory requirements and increase convergence speed.

BSuE40
Parallelization of Transport-Theory Based Optical Tomography Algorithms by Domain Decomposition, Xuejun Gu, Andreas H. Hielscher; Columbia Univ., USA. We applied a domain-decomposition method that provides a suitable framework for parallelization of optical tomographic algorithm based on frequency-domain radiative transfer equation. This leads to substantial reduction in memory requirements and increased computation speed.

BSuE41
Source Estimation with Spatial Filter for Fluorescence Diffuse Optical Tomography, Shinpei Okawa, Yukio Yamada; Univ. of Electro-Communications, Japan. A spatial filter which estimates a fluorescent source is proposed. Some simulations in CW cases demonstrate that the spatial filters with an update of the forward model successfully localize the distribution of the sources.

BSuE42
Light Transport in Soft Tissue Based on Simplified Spherical Harmonics Approximation to Radiative Transport Equation, Michael K. Chu1, Alexander D. Klose2, Hamid Dehghani1; 1Univ. of Exeter, UK, 2Dept. of Radiology, Columbia Univ., USA. The SP+ approximation is implemented into NIFAST. Results are presented on a small geometry and are shown for SP, SP+ and SP++. Further work is underway to test the accuracy using Monte Carlo data.
**BSuE43**
Efficient Solving of Linear Equation Systems for Image Reconstruction in Multispectral Diffuse Optical Tomography, Bernhard Brendel, Tim Nielsen; Philips Res. Europe, Germany. We present a modified ART algorithm for reconstruction in multispectral diffuse optical tomography that convergences much faster than conventional ART and CG methods. The comparison of the algorithms is based on reconstruction of simulated data.

**BSuE44**
Nonlinear Reconstruction of Continuous Wave Diffuse Optical Tomography Using Fitted Diffusion Coefficients, Ronny Ziegler1,2, Bernhard Brendel1, Andy Ziegler1, Tim Nielsen1, Herbert Rinneberg1; 1Philips Res. Europe - Hamburg, Germany, 2Free Univ. of Berlin, Germany, 3Physikalisch-Technische Bundesanstalt, Germany. We present a nonlinear DOT reconstruction using CW data collected in cup geometry. An estimated breast shape with fitted optical properties is used as a start image to reach convergence of the nonlinear reconstruction algorithm.

**BSuE45**
A Simple Convergence Condition for the Born Series in the Forward Problem of Optical Tomography, Vadim A. Markel1, John C. Schotland2; 1Dept. of Radiology, Univ. of Pennsylvania, USA, 2Dept. of Bioengineering, Univ. of Pennsylvania, USA. We provide a sufficient condition for the convergence of the Born series in the forward problem of optical tomography. The condition depends only on upper bound for the inhomogeneity but not its spatial extent.

**BSuE46**
Bayesian Techniques in Fluorescence Tomography, Chaincy Kuo, Brad W. Rice; Xenogen Corp., Caliper Life Sciences, USA. Fluorescence tomography problems can be ill-posed, particularly when background fluorescence is high. We propose methods to improve robustness and present a new algorithm which reduces the intensity of artifacts.

**BSuE47**
Fluorescence Diffuse Optical Tomography: A Model Reduction by a Wavelet-Multiresolution Method, Anne Frassati1, Anabela da Silva1, Jean-Marc Dinten1, Didier Georges2; 1CEA-Léti-Minatec Recherche Technologique, France, 2Control Systems Dept., GIPSA-lab, France. The forward model for diffuse optical tomography is established by solving coupled partial differential equations by the finite element method. The aim is to reduce the computation time by using a wavelets decomposition.

**BSuE48**
Light Propagation in Biological Tissue: A Multiscale Approach, Alwin Kienle, Jan Schäfer, Rene Michels; Inst. of Lasertechnologies in Medicine and Metrology, Germany. Light propagation in biological tissue is investigated in three scales. Maxwell equations are applied to consider the tissue’s microstructure. Based on these results transport theory and diffusion theory are used to handle large tissue volumes.

**BSuE49**
Optimal Selection of the Regularization Parameter for Optical Topography Image Reconstruction, Teresa M. M. Correia, Adam P. Gibson, Jeremy C. Hebdon; Univ. College London, UK. Deblurring and optical topography inverse problems were used to identify an adequate method to select the regularization parameter. The L-curve, the weighted Full Width Half Maximum and the weighted contrast methods produce meaningful image reconstructions.

**BSuE50**
On the Transition from Ballistic to Diffusive Transport in Highly Scattering Turbid Slabs as Observed in the Angular Spectrum: Monte Carlo Simulations, Yaqin Chen1,2, Jörg Peter1, Wolfram Semmler1, Ralf B. Schulz1; 1German Cancer Res. Ctr., Germany, 2Britton Chance Ctr. for Biomedical Photonics, Wuhan Natl. Lab for Optoelectronics, China, 3Inst. for Biomedical and Molecular Imaging (IBMB), GSF Natl. Ctr. for Health and Environment, Germany. We study light transport in turbid slabs by an angle-resolved transmission measurement technique. Monte Carlo results show two distinct slopes in attenuation curves, contributing to change from ballistic to diffuse regime with increasing slab thickness.

**BSuE51**
A Simplified Spherical Harmonics Approximated-Radiation Transport Model for Three Dimensional (3-D) Photon Migration in Small Volume Tissues, Zhen Yuan1, Xinhua Hu2, Huabei Jiang3; 1Dept. of Biomedical Engineering, Univ. of Florida, USA, 2Dept. of Physics, East Carolina Univ., USA. We derived simplified spherical harmonics approximated-radiation transport equations in 3-D. We solved the P3 approximated-transport equations using FE methods. We observed the developed model can improve diffusion approximation solutions in transport-like homogeneous or heterogeneous medium.
BSuE52
Telegrapher's Equation for Light Transport in Tissue with Substantial Absorption, Reindert Graaff, Bernhard J. Hoenders; 1Dept. of Biomedical Engineering, Univ. Medical Ctr. Groningen and Univ. of Groningen, Netherlands, 2Inst. for Theoretical Physics, Univ. of Groningen, Netherlands. The applicability of the Telegrapher’s Equation was investigated for increasing the accuracy of time-resolved diffusion theory for substantial absorption. The solution in steady-state is accurate within 10% for tissue-equivalent scatterers with any absorption coefficient.

BSuE53
Monte Carlo Model for Incoherent Light Propagation in Human Skin, Jorge Carlos Gonzalez Trujillo, Jose Angel Mendez Gamboa, Mario Perez Cortes; Univ. Autonoma de Yucatan, Mexico. We developed a Monte Carlo simulation code for white light absorption and scattering into a seven-layered human skin model. We also model a tumor inside skin and we observed light behavior by its presence.

BSuE54
Comparative Investigation into the Influence on the Measured Radiance Due to Inclusion Location, Size and Contrast for NIRS Diffuse Optical Imaging System, Min-Chun Pan1, Chien-Hung Chen1, Liang-Yu Chen2, Min-Cheng Pan1; 1Natl. Central Univ., Taiwan, 2Tungnan Univ., Taiwan. This study investigates the influence on the measured radiance due to an inclusion location, size, and contrast to find regularity with three defined measures for a criterion of judging the limit on the measuring system.

BSuE55
Noninvasive Diffuse Optical Measurement for Monitoring Hemodynamic Response of Radiation Treatment in Head and Neck Tumors, Shih-Ki Liu1, Regine Cheol2, Soren D. Konecky1, Turgut Durdur1, Ulas Sanar1, Alex Kilger1, Harry Quon1, Britton Chance1, Arjun G. Yodh1; 1Dept. of Physics and Astronomy, Univ. of Pennsylvania, USA, 2Dept. of Radiation Oncology, Univ. of Pennsylvania, USA. This study further explores the feasibility of diffuse optical spectroscopy (DOS) and diffuse correlation spectroscopy (DCS) to measure hemodynamic responses of head and neck tumors during the chemotherapy and radiation therapy.

BSuE56
Diffuse Light Quantification of Peripheral Artery Disease (PAD), Xiaoman Xing1, Emile R. Mohler1, Turgut Durdu1, Chao Zhou1, Gwen Lecht1, Arjun Yodh1, Guangyang Yu1,2; 1Univ. of Pennsylvania, USA, 2Univ. of Kentucky, USA. A diffuse optical instrument has been developed and applied for quantification of skeletal muscle blood flow and oxygenation in patients with peripheral artery disease (PAD). The hemodynamic information differentiates the normal from diseased tissues.

BSuE57
NIRS-Based Quantitative Measurement of Autoregulatory Effects on Microvascular Hemoglobin Oxygenation: Assessment of Differences between Non-Diabetic and Type II Diabetic Subjects, Onyeoziri R. Nwanguma1, Harry L. Graber1,2, Rahul Valluru1, Randall L. Barbour1,2; 1SUNY Downstate Medical Ctr., USA, 2NIRx Medical Technologies, LLC, USA. By examining oxy- and deoxy-hemoglobin NIRS image time series, we have derived indices of the competency of autoregulation. Applying these data from forearms of type II diabetics and normal subjects reveals statistically significant differences.

BSuE58
Monitoring Muscle Hemodynamics by Time-Domain Near Infrared Spectroscopy during Muscle Contractions Induced by Functional Electrical Stimulation, Davide Contin1, Lorenzo Spinelli1, Alessandro Torricelli1, Rinaldo Cubeddu1, Franco Molteni2, Simona Ferrante3, Alessandra Pedrocchi1, Giancarlo Ferrigno1; 1HIT, ULTRAS-INFM-CNR and IFN-CNR, Dept. di Fisica, Politecnico di Milano, Italy, 2Ctr. di Riabilitazione Villa Beretta, Ospedale Valduce, Italy, 3NITLAB - TBMLAB, Dept. di Bioingegneria, Politecnico di Milano, Italy. A time-domain NIRS multichannel system was used to monitor hemodynamic changes in the muscle of six healthy volunteers and four hemiplegic patients during knee flex-extension induced by functional electrical stimulation for rehabilitation purposes.

BSuE59
Detecting Rheumatic Arthritis by Artificial Intelligent Multi-Parameter Classifications of Optical Tomographic Images, Christian D. Klose1, Alexander D. Klose1, Alexander Scheel1, Uwe Netz1, Jochen Beuthan1, Andreas H. Hielsher1; 1Columbia Univ., USA, 2Univ. of Göttingen, Germany, 3Free Univ. of Berlin, Germany. We demonstrate that sensitivity and specificity in detecting rheumatoid arthritis from optical tomographic images can be greatly increased when an artificial intelligent multi-parameter classifications method, called Self-Organizing Mapping (SOM), is used.

BSuE60
Development of a Broadband Multi-Detector NIRS System for Measuring Regional Cerebral Blood Flow, Mamadou Diop1,2, Jonathan Elliott1, Kenneth Tichauer1,2, Lynn Kevulis1, Ting-Yim Lee1,2, Keith St Lawrence1,2; 1Lawson Health Res. Inst., Canada, 2Dept. of Medical Biophysics, Univ. of Western Ontario, Canada. Cerebral blood flow can be measured by broadband spectroscopy using water absorption to determine the optical pathlength. An 8-channel system was developed and its ability to track regional flow was tested in a phantom.
BSuE61
NIRS-Based Quantitative Measurement of Autoregulatory Effects on Microvascular Hemoglobin Oxygenation: Concept, Simulations and Experimental Control Studies, Harry L. Graber1,2, Yong Xu1,2, Yaling Pei3, Randall L. Barbour1,2; 1SUNY Downstate Medical Ctr., USA, 2NIRx Medical Technologies, LLC., USA. A general approach is described, wherein the method of functional diffuse optical tomography is used to study responses of vascular autoregulation at a previously unrecognized level of detail. Method validation findings also are presented.

BSuE62
Activation of Lateral Prefrontal Cortex during a Complex Cognitive Task, Ceyhun E. Kirimli1, Sura Sumer2, Sinem B. Erdogan1, Nermi Topaloglu1, Ata Akin1; 1Bogazici Univ., Turkey, 2Univ. Twente, Netherlands. This study total of 13 schizophrenic patients and 13 healthy controls were evaluated with fNIRS. The purpose was to measure oxyhaemoglobin and deoxyhaemoglobin concentrations from both groups to support “hypofrontality” hypothesis in schizofrenics patients.

BSuE63
Hypofrontality in Schizophrenics Evaluated by Near Infrared Spectroscopy, Sinem Serap1, Hasan Herken1, Ata Akin1; 1Inst. of Biomedical Engineering, Bogazici Univ., Turkey, 2Pamukkale Univ., Turkey. In this study total of 13 schizophrenic patients and 13 healthy controls were evaluated with fNIRS. The purpose was to measure oxyhaemoglobin and deoxyhaemoglobin concentrations from both groups to support “hypofrontality” hypothesis in schizophrenics patients.

BSuE64
Evaluation of Co-Activation of Antagonistic Muscles Using Near Infrared Spectroscopy, Burcu S. Erdogan1, Can A. Yucesoy1, Peter A. Huijing2,3, Ata Akin1; 1Bogazici Univ., Turkey, 2Univ. Twente, Netherlands, 3Vrije Univ., Netherlands. Effects of co-activation of isometrically active antagonistic wrist muscles was investigated using near infrared spectroscopy (NIRS). Our results show that NIRS is a promising tool for enhancing our understanding of muscle mechanics during activity.

BSuE65
A Multimodal Non-Invasive Technique for Monitoring Physical Fatigue, Vishal Saxena1,2; 1AppWave, USA, 2Univ. of Southern California, USA. This paper investigates a multimodal imaging approach to study muscle physiology under physical stress. An imaging technique (near-infrared spectroscopy and mid-infrared imaging) is used to monitor the physiological changes that occur during physical fatigue.

BSuE66
Time-Resolved Transmittance of Small Samples: Investigation of Bone Tissue for Diagnostic Purposes, Paola Taroni1, Daniela Comelli1, Andrea Farina1, Antonio Pifferi1, Alan Kienle2, Eduardo Margallo-Balbás3, P. J. French1, Leo J. van Ruijven4; 1Dept. of Physics, Politecnico di Milano, Italy, 2Inst. für Lasertechnologien in der Medizin und Messtechnik, Germany, 3TU Delft, Electronic Instrumentation Lab, Netherlands, 4Dept. of Functional Anatomy, Academic Ctr. for Dentistry Amsterdam, Netherlands. Absorption spectra of bone samples, and in turn bone tissue composition, were estimated from time-resolved spectroscopy combined with a model of light propagation in small volumes. Bone optical properties show significant correlation with biological properties.

BSuE67
Time-Resolved in vivo Spectroscopy of Human Prostate Evaluated Using White Monte Carlo, Erik Alerstam1, Tomas Svensson1, Margreit Einarsdottir1, Katarina Scanberg2, Stefan Andersson-Engels1; 1Lund Univ., Dept. of Physics, Sweden, 2Lund Univ. Hospital, Dept. of Oncology, Sweden. We report on the possibility to do reliable and accurate in vivo spectroscopy of human prostate, using time-resolved spectroscopy in combination with Monte Carlo-based data evaluation.

BSuE68
Quantitative Cerebral Metabolism Measurements with NIRS: Application to Neonatal Brain Injury, Kenneth M. Tichauer1,2, Jennifer Hadaway1,2, Daisy Y. L. Wong1, R. Jane Rylett1, Ting-Yim Lee2,3, Keith St. Lawrence2,3; 1Lawson Health Res. Inst., Canada, 2Imaging Res. Labs, Robarts Res. Inst., Canada, 3Dept. of Medical Biophysics, Univ. of Western Ontario, Canada, 4Cell Biology Res. Group, Robarts Res. Inst., Canada. A near-infrared technique has been developed to measure cerebral metabolic rate of oxygen quantitatively and non-invasively at the bedside. The ability of these measurements to diagnose hypoxic-ischemic insult severity was assessed in the newborn piglet.
BSuE69
Water State Measurements on Turbid Thick Tissue Phantoms and *in vivo* Breast Tissues Using Broadband Diffuse Optical Spectroscopy, So Hyun Chung1,2, Albert E. Cerussi1, Catherine Klifa1, Hyeon-Man Baek1, Özlem Birgul1, Gultekim Gulsen1, Sean I. Merritt1, David Hsiang1, Bruce J. Tromberg1,2,3; 1Beckman Laser Inst., Univ. of California at Irvine, USA, 2Dept. of Biomedical Engineering, Univ. of California at Irvine, USA, 3Magnetic Resonance Science Ctr., Radiology, Univ. of California at San Francisco, USA, 4Tu and Yuen Ctr. for Functional Onco-Imaging, Dept. of Radiological Sciences, Univ. of California at Irvine, USA, 5Masimo Corp., USA, 6Dept. of Surgery, Univ. of California at Irvine Health Care, USA.
Molecular disposition of water has been measured non-invasively in the NIR using Diffuse Optical Spectroscopy in thick tissues. The water binding state has provided significant pathological information of breast tissues.

BSuE70
Transillumination Breast Spectroscopy (TiBS): Near-Infrared Optical Spectroscopy to Monitor Bulk Tissue Changes for Breast Cancer Risk Reducing Interventions, Samantha N. Dick1,2, Kristina Blackmore1, Ellen M. Greenblatt1, Lothar Lilge1,2,3; 1Ontario Cancer Inst., Univ. Health Network, Canada, 2Reproductive Biology Unit, Mount Sinai Hospital, Canada, 3Div. of Biophysics and Bioimaging, Univ. of Toronto, Canada.
Transillumination Breast Spectroscopy (TiBS) uses near-infrared technology to monitor physiologic changes in bulk breast tissue. Interim analysis demonstrates TiBS’s sensitivity towards minor changes on tissue composition, enabling monitoring for efficacy of risk reducing interventions.

BSuE71
Percent Breast Density Using Transillumination Breast Spectroscopy and Partial Least Squares Regression Methods, Kristina M. Blackmore1, Lothar Lilge1,2; 1Mount Sinai Hospital, Canada, 2Ontario Cancer Inst., Canada.
The ability of transillumination breast spectroscopy to predict percent density is demonstrated using partial least squares regression methods. Optical spectroscopy provides an alternative to mammography assessed density permitting frequent and early use.

BSuE72
Accuracy of the Frequency-Domain Multi-Distance Method to Retrieve the Brain Absorption Coefficient at Different Ages: Monte-Carlo Simulations, Juliette J. Selb1, David A. Boas1, Ellen Grant1, Maria Angela Franceschini1; 1Athinoula A. Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA, 2Dept. of Radiology, Massachusetts General Hospital, USA. Using Monte-Carlo simulations in realistic head models segmented from MRI scans, we determine the accuracy of the multi-distance frequency-domain method to recover the brain absorption coefficient from premature infants to adults.

BSuE73
Measurements of Hemoglobin Concentrations in the Human Forehead Using Time-Resolved Reflectance, Louis Gagnon1,2, Juliette Selb1, David A. Boas1, Rick D. Hoge2, Frédéric Lesage1,2; 1Inst. de Génie Biomédical, Ecole Polytechnique de Montréal, Canada, 2Ctr. Recherche Inst. Universitaire de Gériatrie de Montréal, Canada, 3Athinoula A. Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA. We present *in vivo* measurements of baseline physiology done on the forehead of five subjects with a time-resolved system. Baseline oxyhemoglobin, deoxyhemoglobin, and total hemoglobin concentrations and oxygen saturation are recovered and compared to literature.

BSuE74
Scattering Characterization of TiO2/Polyurethane Phantom Using Frequency-Domain Optical Imaging, Banghe Zhu1, Steven Regalado1, Vivian Sueiras1, Thu Huong Nguyen1, Steven L. Ponder1, Anuradha Godavarty2; 1Florida Intl. Univ., USA, 2Imaging Diagnostic Systems Inc., USA. An optical imaging system employing frequency domain photon migration (FDPM) technique is used to characterize the TiO2/polyurethane optical phantoms. A standardized model relating the reduced scattering coefficient and the concentration of TiO2 scatters is derived.

BSuE75
Spectral Extension of Time-Resolved Transmittance Spectroscopy up to 1100 nm for the *in vivo* Quantification of Collagen in Breast Tissue, Paola Taroni, Andrea Bassi, Daniela Comelli, Antonio Pifferi, Rinaldo Cabeddu; Dept. of Physics, Politecnico di Milano, Italy. The extended optical characterization of collagen (610-1080 nm) revealed an absorption peak (1020 nm) of interest to quantify collagen *in vivo*, as shown by the first absorption spectra of breast measured over the same range.
BSuE76
A Hybrid Multi-Distance Phase and Broadband Spatially Resolved Algorithm for Resolving Absolute Concentrations of Chromophores in the Near-Infrared Light Spectrum: Results from Studies in Dynamic Phantoms, Ilias Tachtsidis¹, Terence S. Leung², Bilal Tahiri³, Clare E. Elwell⁴, Matthias Kohl-Bareis⁵, Markus Graner⁶, Chris E. Cooper⁷; ¹Univ. College London, UK, ²RheinAhrCampus Remagen, Germany, ³Univ. of Essex, UK. We report a novel methodology that combines NIR multi-distance frequency and broadband spectrometers to quantify chromophores in a turbid media using spatially resolved algorithm. Preliminary results showed good agreement between theoretical and calculated concentrations.

BSuE77
Investigating Cross-Talk in Cytochrome C Oxidase Concentration Quantification Using Near Infrared Spectroscopy in a Two-Layered Model, Terence S. Leung², Ilias Tachtsidis¹, Clare E. Elwell⁴, Martin Tisdall⁵, Caroline Pritchard⁶, Martin Smith⁷, Chris Cooper⁷; ¹Dept. of Medical Physics and Bioengineering, Univ. College London, UK, ²Natl. Hospital for Neurology and Neurosurgery, UK, ³Dept. of Biological Sciences, Univ. of Essex, UK. The cross-talk issue in the quantification of concentration changes in oxidized cytochrome c oxidase in the human head has been investigated using a two layered model representing the scalp/skull and brain layers.

BSuE78
The Spatial Sensitivity Profile for Various Source Detector Separations in NIR to Eliminate Skin Effect in Brain Imaging, Ahu N. Turkoğlu, Ayse E. Erkan, Omer Saylı, Deniz Neseşhrili, Ata Akin; Bogazici Univ., Turkey. We investigated the contribution of photons crossing the surface by liquid phantom experiments and MCML simulations. The first 3mm is found to be negligible in an array probe design eliminating skin contamination on NIRS measurements.

BSuE79
Comparison of Parametric and Non-Parametric Data Analysis Packages for Near-Infrared Spectroscopy Functional Activation Studies, Anna Blasi¹, Peck Hui Koh¹, Clare E. Elwell⁴, Sarah Fox-Lloyd⁵, Sotaro Shimada⁶; ¹Univ. College London, UK, ²Ctr. for Brain and Cognitive Development (CBCD), Babylab, School of Psychology, Birkbeck College, Univ. of London, UK, ³Meiji Univ., Japan. NIRS data from functional activation studies in two infants was processed using parametric and non-parametric approaches for optical topography signal analysis. The choice of analysis approach and data rejection strategies are important.

BSuE80
Steady-State Reflectance Spectroscopy Used to Quantify Hemodynamic and Optical Properties of Tissue: Demonstration of Heterogeneities of Human Prostates, Dhreenendra Kashyap¹, Disha Pesuwan¹, Jeffrey A. Cadeddu², Hanli Liu³; ¹Univ. of Texas at Arlington, USA, ²Univ. of Texas Southwestern Medical Ctr. at Dallas, USA. Heterogeneities in hemoglobin derivative concentrations and light scattering properties taken from ex vivo human prostate glands are demonstrated by using steady-state, single source-detector separation (1-3 cm) reflectance spectroscopy.

BSuE81
Fluorescence Lifetime Discrimination of Two Fluorophores with a Full-Field Time-Domain System, Ulaş Sunar, Salman Farshchi, David J. Hall; Univ. of California at San Diego, USA. We utilized full-field time domain system to simultaneously image two fluorophores, and discriminated them via their fluorescence lifetime contrast. Lifetime contrast allowed the individual fluorophore pharmacokinetics to be measured in different organs.

BSuE82
Design Considerations for a Combined MicroCT and Fluorescence Diffuse Optical Tomography System, Dax Kesphire¹, Niculaa Mincu¹, Michael Hutchins⁵, Frederic Leblond⁶, Brian W. Pogue¹, Mario Khayat¹; ¹Theager School of Engineering, USA, ²Advanced Res. Technologies, ART Inc., Canada. An imaging system combining X-ray microCT and fluorescence diffuse optical tomography is being developed for small animal functional imaging. The methodology for selecting the optimal source-detector geometry and subsequent system design are presented.

BSuE83
DOT Guided Quantitative Fluorescence Molecular Tomography with a Fiber-Free Multi-Angle Non-Contact Transmission System, Yiqong Tan, Huabei Jiang; J. Crayton Pruitt Family Dept. of Biomedical Engineering, Univ. of Florida, USA. Diffuse optical tomography (DOT) guided quantitative fluorescence molecular tomography (FMT) is implemented by a non-contact, multi-angle transmission system based on finite element algorithms. This DOT guided FMT approach is evaluated using extensive phantom experiments.

BSuE84
Three-Dimensional Bioluminescence Tomography Assisted by Diffuse Optical Tomography, Qizhi Zhang, Lu Yin, Yiqong Tan, Zhen Yuan, Huabei Jiang; University of Florida, USA. We present experimental evidence that the quantitative accuracy of bioluminescence tomography (BLT) can be significantly improved by incorporating prior spatial distribution of optical properties of heterogeneous media obtained from diffuse optical tomography (DOT).
BSuE85
Transport Theory-Based Multi-Spectral Imaging of Tissue Chromophores Concentrations, Hyun Keol Kim, James Masciotti, Andreas Hiescher; Columbia Uniu., USA. We introduce a transport-theory multi-spectral inverse method for direct recovery of the chromophores concentrations inside tissues. Numerical and experimental results show that the direct method produces more accurate results than the conventional approach.

BSuE86
Near Infrared Fluorescent Imaging of Tumor Boundaries Using Tissue Transglutaminase Substrates, Chia-Pin Pan1, Khalid Amin1, Yihui Shi1, Jeanne P. Haushalter1, Charles S. Greenberg2, Zishan Haroon1, Gregory W. Faris3; 1SRI Intl., USA, 2Duke Univ. Medical Ctr., USA. A novel strategy is developed to optically image tumor boundaries by cross-linking near infrared fluorescent-labeled tissue transglutaminase substrates into tumor boundary tissue.

BSuE87
Sensitivity Analysis of Fluorescence Signals for Diffuse Optical Imaging of Small Animals, Matthieu Boffèty1,2, Anne Sentenac1, Marc Allain1, Marc Massonneau1, Rémi Carminati1; 1Lab EM2C - Ecole Centrale Paris, France, 2Quidd SAS, France, 3Inst. Fresnel, Univ. Aix-Marseille, France. We study the sensitivity of a fluorescence diffuse optical tomography system to the fluorophores diffuse depth in a brain-skull geometry, using an advanced photon transport equation and a statistical analysis accounting for a noise model.

BSuE88
Time-Resolved Scanning Molecular Imaging System for Small Animals, Marco Brambilla, Lorenzo Spinelli, Alessandro Torricelli, Antonio Pifferi, Rinaldo Cubeddu; Politecnico di Milano, Italy. We present a compact system for small animals fluorescence imaging capable of producing projective images of the fluorophore distribution into the sample with 4mm spatial resolution and 200fmol sensitivity, independently from inclusion position.

BSuE89
A Method for Improving the Spatial Resolution of Images Acquired with a Flat Microlens-Coupled Detector, Daniel Unholtz, Ralf B. Schulz, Wolfhard Semmler, Jörg Peter; German Cancer Res. Ctr., Germany. An iterative subtraction method that improves a recently developed mapping algorithm is presented. This approach allows high-resolution image calculation from acquired sensor data of a very flat optical detector assembly based on a microlens array.

BSuE90
A New Water-Soluble Near-Neutral Ratiometric Fluorescent pH Indicator, Sheng Yao1, Katherine J. Schaefer-Hales2, Kevin D. Belfield1; 1Univ. of Central Florida-CREOL, USA, 2Emory Univ. School of Medicine, USA. We report a new near-neutral pH indicator whose pKa of ~7.0 was determined by both absorption and fluorescence methods. It has a distinctive isoemissive point, good dispersion in cell cytosol, and low cytotoxicity.

BSuE91
Fluorene-Based Two-Photon Fluorescent Probes for Specific Biomolecule Labeling and Oligopeptide Conjugation, Alma R. Morales1, Katherine J. Schaefer-Hales2, Kevin D. Belfield1; 1Univ. of Central Florida, USA, 2Winship Cancer Inst., Emory Univ. School of Medicine, USA. Two-photon absorbing amine-reactive fluorenyl-based probes were synthesized for biomolecule labeling and oligopeptide conjugation. Conventional and two-photon fluorescence microscopy imaging of H1299 and HeLa cells, incubated with novel efficient two-photon absorbing fluorescent probes, is demonstrated.

BSuE92
Fluorescent Images of in situ Mouse Ischemic Colons, Mahsa Ranji, Shoko Nioka, Britton Chance; Univ. of Pennsylvania, USA. The redox ratio known as NADH/[Fp+NADH], gives a measure of steady-state tissue metabolism. Fluorescent redox images of the healthy and dead mouse colons showed a significant reduction of redox ratio due to sever ischemia.

BSuF • Plenary I: Workshop on Contrast for in vivo Imaging

Grand Bay Ballroom North and South
4:00 p.m.–6:30 p.m.
BSuF • Plenary I: Workshop on Contrast for in vivo Imaging
Elizabeth M. Hillman; Columbia Univ., USA, Presider

BSuF1 • 4:00 p.m. Invited
Applications and Directions in Fluorescence Guided Surgical Interventions, Stephen J. Lomme; GE Global Res., USA. A key applications space for advanced optical imaging and sensing technologies and molecular imaging agents is in aiding surgical and interventional procedures. Challenges and opportunities in the clinical translation of these technologies are discussed.
**BSuF2 • 4:30 p.m.**

**Plenary**

**Optical Molecular Imaging to Aid in Cancer Screening:**

**Challenges of Clinical Translation,** Rebecca Richards-Kortum, David Javier, Sharmila Ananda, Ann Gillenwater;

1Rice Univ., USA, 2MD Anderson Cancer Ctr., USA. We review progress toward clinical application of optical molecular imaging for detection of precancer. We discuss: biomarker selection, contrast agent development, development of high resolution optical imaging systems, and regulatory approval for pilot clinical studies.

**BSuF3 • 5:00 p.m.**

**Plenary**

**Optical Imaging of Breast Cancer from an Industrial Perspective,** Martin B. van der Mark, Leon Bakker, Michiel van Beek, Claas Bontus, Bernhard Brendel, Rick Harbers, Thomas Koehler, Anais Leproux, Tim Nielsen, Marjolein van der Voort, Falk Uhlemann, Andrea Wiethoff, Ronny Ziegler, Andy Ziegler, Kai Licha, Lueder Fels, Martin Pessel, Stephanie van de Ven, Sjoerd Elias, Willem Mali, Peter Luijten;

1Philips Res. Europe-Eindhoven, Netherlands, 2Philips Res. Europe-Hamburg, Germany, 3Philips Medical Systems-Best, Netherlands, 4Bayer-Schering Pharma, Germany, 5Univ. Medical Ctr. Utrecht, Netherlands. This paper discusses our diffuse optical tomography system, the proof-of-principle results obtained in phantoms studies, our initial experience in patients and the impact on the breast cancer care cycle.

**BSuF4 • 5:30 p.m.**

**Plenary**

**Clinical Molecular Imaging in the Gastrointestinal Tract,**

Thomas D. Wang; Univ. of Michigan, USA. Fluorescent-labeled peptides are being developed as molecular probes to target pre-cancerous tissue in vivo for imaging with novel methods of wide area endoscopy and confocal microscopy as a guide for biopsy in the gastrointestinal tract.
Monday, March 17, 2008

Conference Registration
7:00 a.m.–6:00 p.m.
Registration Open

BMA • Plenary II: Strategies for Functional Imaging and Diagnostics

Grand Bay Ballroom North and South
7:30 a.m.–10:00 a.m.
BMA • Plenary II: Strategies for Functional Imaging and Diagnostics
Joseph P. Culver; Washington Univ. in St. Louis, USA, Presider

BMA1 • 7:30 a.m.
Photoacoustic Microscopy and Computed Tomography, Lihong V. Wang; Washington Univ. in St. Louis, USA. A pulsed laser produces a rapid small temperature rise in biological tissue, which leads to emission of ultrasonic waves due to thermoelastic expansion. The short-wavelength ultrasonic waves are then detected to form high-resolution tomographic images.

BMA2 • 8:15 a.m.
High Resolution Photoacoustic Imaging for Characterizing Vascular Anatomy and Function, Paul C. Beard; Univ. College London, UK. A novel high resolution optical ultrasound imaging system has been developed and used to obtain 3-D images of the superficial vascular anatomy of the mouse brain, skin and implanted tumours and demonstrate the quantitative spectroscopic capability of the technique.

BMA3 • 8:45 a.m.
Activatable Fluorescence Probes for the Cancer-Cell Specific Molecular Imaging of Cancer, Hisataka Kobayashi; Natl. Cancer Inst., NIH, USA. Activatable fluorescence probes dramatically improve the target-to-background signal ratios compared with conventional probes. By applying such activatable probes to cancer-specific cell-surface markers it should be possible to improve the sensitivity and specificity of cancer imaging.

BMA4 • 9:15 a.m.
Optical Biomarkers in Breast Cancer, Nirmala Ramanujam; Dept. of Biomedical Engineering, Duke Univ., USA. This work focuses on the identification of optical biomarkers in solid tumors in the breast and early neoplastic transformations in stratified squamous epithelial tissues. Biomarkers can potentially provide early cancer identification and guide treatment decisions.

St. Petersburg Ballroom
10:00 a.m.–4:00 p.m.
Exhibits Open

BMB • OCT and Ophthalmic Applications

Grand Bay Ballroom North
10:30 a.m.–12:30 p.m.
BMB • OCT and Ophthalmic Applications
Wolfgang Drexler; Cardiff Univ., UK, Presider

BMB1 • 10:30 a.m.
Tutorial Fourier Domain OCT and its Applications, Joseph Izatt; Dept. of Biomedical Engineering, Duke Univ., USA. Abstract not available.

BMB2 • 11:15 a.m.
Invited Ophthalmic Applications of Birefringence and Flow Contrast Optical Coherence Tomography, Yoshiaki Yasuno; Univ. of Tsukuba, Japan. Further contrast mechanisms of ophthalmic optical coherence tomography (OCT) are summarized. The contrast mechanisms include scattering optical coherence angiography (S-OCA), Doppler OCA (D-OCA), and polarization sensitive OCT (PS-OCT).

BMB3 • 11:45 a.m.
Invited Toward in vivo Imaging of Photoreceptor Morphology and Function, Boris Hermann1, Cris Torti1, Enrique J. Fernández2, Peter Ahnelt3, Boris Povazay1, Bernd Hafer1, Angelika Unterhuber1, Alison Binns3, Tom Margrain1, Wolfgang Drexler1; 1School of Optometry and Vision Inst., Cardiff Univ., UK, 2Lab de Optica, Univ. de Murcia, Spain, 3Dept. of Physiology, Medical Univ. of Vienna, Austria. The integration of adaptive optics and an achromatizing lens into an ultra-high resolution OCT system enables three-dimensional imaging of photoreceptor morphology. Optophysiology might lead to the extraction of depth-resolved information about retinal function.

BMB4 • 12:00 p.m.
Invited Ultra High-Resolution Optical Coherence Tomography for Non-Contact Ocular Imaging of Small Animals, Marco Ruggeri, Hassan Wehbe, Shuliang Jiao, Jianhua Wang, Maria Elena Jockovich, Philip J. Rosenfeld, James C. Major, Craig McKeown, Carmen A. Puliafito; Bascom Palmer Eye Inst., USA. An ultra-high resolution spectral domain OCT system was built for non-contact imaging of retina and anterior segment of small animals. Short imaging time and high imaging quality make the system promising for high throughput applications.
High Speed, Spectrometer Based Optical Coherence Tomography at 1050 nm for Isotropic 3-D OCT Imaging and Visualization of Retinal and Choroidal Vasculature, Boris Považay, Boris Hermann, Vedran Kajić, Bernd Hofer, Wolfgang Drexler; Cardiff Univ., UK. Spectrometer based optical coherence tomography at 1050nm with >70nm of spectral bandwidth, acquiring 48k depth scans per second for deeper penetration and isotropic visualisation of the full three dimensional choroidal vasculature is demonstrated in vivo.

Improved Sensitivity by Applying Spectral Unmixing Prior to Fluorescence Tomography, Heng Xu, Chaincy Kuo, Brad Rice; Caliper Life Sciences, USA. Spectral unmixing technique was applied to the fluorescence tomography data acquired at multiple wavelengths to reduce the unwanted fluorophore signals and significantly improved the sensitivity and localization of the target fluorophore.

Multispectral Fluorescence Enhanced Diffuse Optical Tomography Evaluated with Weight Matrix Free Algorithm, Pontus Svenmark1, Johan Axelsson1, Martin Schweiger2, Athanasis Zacharopoulos, Simon R. Arslide2, Stefan Andersson-Engels3; 1Dept. of Physics, Lund Univ., Sweden, 2Dept. of Computer Science, Univ. College London, UK. We present a novel multispectral scheme for fluorescence enhanced diffuse optical tomography. Reconstructions are performed using a weight matrix free algorithm. Initial multispectral reconstructions are shown.

Inferring Intra-Myocardial Electrical Wave Orientation from Epi-Fluorescence Recordings in Cardiac Tissue: Sensitivity to the Photon Transport Model, Olivier Bernus, Christian W. Zemlin2, Arvydas Matiukas2, Arkady M. Pertsov2, Christopher J. Hyatt2; 1Univ. of Leeds, UK, 2SUNY Upstate Medical Univ., USA. The subsurface electrical wave orientation in cardiac tissue is inferred from epi-fluorescence measurements. It is calculated using coupled electrophysiological and photon transport models. We compare Monte Carlo and diffusion based models, showing only minor differences.
BMD1
NIRS-Based Quantitative Measurement of Autoregulatory Effects on Microvascular Hemoglobin Oxygenation: Applications to Assessment of Traumatic Brain Injury, Randall L. Barbour1,2, Gerald T. Voelbel1, Jean Lengenfelder3, Glenn Wylike1, Yaling Pei2, Harry L. Graber1,3, John DeLuca1; 1SUNY Downstate Medical Ctr., USA, 2NIRx Medical Technologies, LLC., USA, 3Kessler Medical Rehabilitation Res. and Education Ctr., USA. We have developed a method for dividing the hemoglobin signal into six discrete categories that correspond to different states of vascular autoregulation. Here we use it to reveal physiologically meaningful differences among three subject groups.

BMD2
Validation of Optical Measurements of Cerebral Blood Flow and Volume with SPION and ASL fMRI, Stefan A. Carp, Young R. Kim, Guangping Dai, David A. Boas, Maria Angela Franceschini; Athinoula A. Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA. We attempt to validate optical measurements of cerebral blood volume and blood flow in a rat model during a hypercapnic challenge using functional MRI. Initial results show good correlation between optical measurements and MR results.

BMD3
Investigating Neurovascular Coupling in Rat Brain with Optical Imaging and Physiological Modeling, Rickson C. Mesquita1, Meryem A. Yucel1, Ata Akin2, Anna Devor3,4, Theodore J. Huppert1; 1State Univ. of Campinas, Brazil, 2Boğaziçi Univ., Turkey, 3Univ. of California at San Diego, USA, 4Massachusetts General Hospital, USA, 5Univ. of Pittsburgh, USA. Using parametric stimulation applied to somatosensory cortex in rats, we were able to predict oxygenation changes measured with optical spectroscopy from neuronal activity by two different and independent approaches.

BMD4
System Identification of Prefrontal Cortex in the Presence of Cognitive Tasks, Sergül Aydöre1, Kwon Mihçak2, Ata Akin2; 1Electrical and Electronic Engineering Dept., Boğaziçi Univ., Turkey, 2Electrical and Electronic Engineering Dept., Boğaziçi Univ., Turkey, 3Inst. of Biomedical Engineering, Boğaziçi Univ., Turkey. This paper explains the connectivity between regions of prefrontal cortex by using statistical and algebraic methods and shows the differences between healthy and schizophrenic people, which may lead to the explanation for their concentration difficulties.

BMD5
Fast Optical Signal Not Detected in Awake Behaving Monkeys, Harsha Radhakrishnan, Helen Deng, Leeland Ekstrom, Wim Vanduffel, Maria Angela Franceschini; Athinoula A. Martinos Ctr. for Biomedical Imaging, USA. In awake monkeys during visual stimulation, we were able to measure hemodynamic responses and visual evoked potentials with optimal SNR, but failed to detect any fast optical signal. The usefulness of this signal is questioned.

BMD6
ARX Model Approach to Data Acquired from Healthy and Migraine Subjects, Esin Karahan1, Ata Akin1, Hayrünnisa Bolay2; 1Inst. of Biomedical Engineering, Boğaziçi Univ., Turkey, 2Dept. of Neurology, Gazi Univ., Turkey. This study investigates the brain hemodynamic responses of migraine and healthy subjects to breathing task with ARX model. Analysis has shown that the amplitude of peak response of migraineurs is five folds smaller (p<0.05).

BMD7
Intrinsic Optical Imaging of the Rat Lumbar Spinal Cord, Nicolas Brieu1, Eric Beaumont2, Frédéric Lesage3; 1Ecole Polytechnique, Canada, 2Univ. de Montréal, Canada. The neuronal activity in the spinal cord of the rat was studied with intrinsic optical imaging. Hemodynamic responses and activation areas were reproducibly identified by using both bloc and continuous stimulation and associated processing.

BMD8
Simultaneous Acquisition of Time-Domain fNIRS and fMRI during Brain Cortex Activity, Davide Contini1, Alessandro Torricelli1, Antonio Pifferi1, Lorenzo Spinelli1, Rinaldo Cubeddu1, Luca Nocetti1, Carlo A. Porro2, Patrizia Baraldi1; 1IIT, ULTRAS-INFM-CNR and IFN-CNR, Dept. di Fisica, Politecnico di Milano, Italy, 2Azienda Ospedaliera-Univ. di Modena, Italy, 3Dept. di Scienze Biomediche, Univ. di Modena e Reggio Emilia, Italy. A time-domain fNIRS system was developed for simultaneous acquisition with fMRI. Preliminary results indicate the potentiality of the system. To our knowledge this is the first time-domain fNIRS and fMRI study on human brain.
BMD9
Depth Selectivity in Time-Domain Optical Brain Imaging Based on Time Windows and Moments of Time-of-Flight Distributions, Heidrun Wabnitz1, Adam Liebert2, Davide Contini3, Lorenzo Spinelli3, Alessandro Torricelli3; 1Physikalisch-Technische Bundesanstalt, Germany, 2Inst. of Biocybernetics and Biomedical Engineering, Poland, 3IIT, ULTRAS-INFM-CNRL, IFN-CNRL, Dept. di Fisica, Politecnico di Milano, Italy. Different approaches to discriminate between cerebral and extracerebral absorption changes are compared by means of diffusion and Monte-Carlo simulations and applied to functional stimulation experiments. The influence of instrument response and signal-to-noise ratio are discussed.

BMD10
Generalized Linear Models to Interpret Time Domain NIRS: Effect of a Prolonged Stimulation on Cerebral Hemodynamics, Michele Butti1, Giuseppe Baselli1, Anna M. Bianchi1, Matteo Caffini1, Davide Contini3, Lorenzo Spinelli3, Alessandro Torricelli3, Sergio Cerutti3, Rinaldo Cubeddu2; 1Politecnico di Milano, Dept. di Bioingegneria, IIT Unit, Italy, 2IIT, ULTRAS-INFM-CNRL and IFN-CNRL, Politecnico di Milano Dept. di Fisica, Italy. A Generalised Linear Model (GLM) was used to interpret time domain NIRS data during a Go-NoGo task to identify cerebral areas activated during a sustained attention protocol in a control group.

BMD11
Self-Adaptive Method to Uncouple Cortex-Related Brain Activation from Superficial Effects, Antonio Pifferi, Lorenzo Spinelli, Davide Contini, Alessandro Torricelli, Rinaldo Cubeddu; IIT, ULTRAS-INFM-CNRL and IFN-CNRL, Dept. di Fisica, Politecnico di Milano, Italy. A method for separating upper from lower layer changes in time-resolved functional brain imaging is presented, and applied to the brain monitoring of a finger tapping exercise, permitting to uncouple superficial from deeper activation.

BMD12
Depth-Resolved Imaging of Stimulus Evoked Fast Intrinsic Optical Signals Associated with Retinal Activation, Xincheng Yao, Youbo Zhao, Chris Gorga; Univ. of Alabama at Birmingham, USA. A near infrared video microscopy was constructed to do depth-resolved imaging from photoreceptor and inner layers of isolated retina. Dynamic functional images disclosed transient intrinsic optical changes associated with activities of photoreceptors and postsynaptic neurons.

BMD13
Nonlinearity of Hemodynamic Response in Motor Cortex Measured by Near Infrared Spectroscopy, Vikrant Sharma1,2, Gopinath Kaundinya1, Renuka Parlapalli1, Richard Briggs3, Hanli Liu4; 1Univ. of Texas at Arlington, USA, 2Baylor Res. Inst., USA, 3Univ. of Texas Southwestern Medical Ctr. at Dallas, USA. Nonlinearity of hemodynamic response is used to decouple neuronal activity by modeling neural adaptation. This study is to investigate the nonlinearity in oxy-hemoglobin and deoxy-hemoglobin concentrations obtained using near infrared spectroscopy by varying stimulus durations.

BMD14
Real-Time Assessment of Mental Workload with Near-Infrared Spectroscopy: Potential for Human-Computer Interaction, Sergio Fantini, Angelo Sassaroli, Yunjie Tong, Leanne H. Hirshfield, Audrey Girouard, Erin Tracey Solovey, Robert J. K. Jacob; Tufts Univ., USA. We used machine learning techniques to analyze functional near-infrared spectroscopy (fNIRS) data from the brain of human subjects to classify different levels of mental workload. Preliminary results show potential for fNIRS in human-computer interaction research.

BMD15
Statistical Data Analysis in Functional Near Infrared Spectroscopy of the Brain in a Low Signal to Noise Ratio Regime, Angelo Sassaroli, Yunjie Tong, Christian Benes, Sergio Fantini; Tufts Univ., USA. We present some shortcomings of the standard t-test when it is applied to multiple comparisons. We propose an algorithm (Dubey/Armitage-Parmar) that represents a better compromise between statistical errors of type I and type II.

BMD16
High-Speed Optical Recordings of Excitability Changes in Neuronal Tissue, Martin Muschol; Univ. of South Florida, USA. Using optical recordings of electrical activity, we have investigated whether stimulation patterns affects the excitability of neurohypophysial axons. We find that different stimulation pattern significantly alter axonal excitability which, in turn, underlies neurohypophysial hormone release.

BMD17
A Multimodal Non-Invasive, in vivo Technique for Monitoring Vascular Status of Tumors, Vishal Saxena; Univ. of Southern California & Appwave, USA. The brain tumor vascularization is studied by near-infrared spectroscopy technique for measuring hemoglobin dynamics and, the findings are correlated with magnetic resonance imaging and conventional histopathological procedures to capitalize on the strengths of each method.
BMD18
NIR Imaging of Labeled Human Neural Tissue: Computational Feasibility Studies, Sergei I. Turovets1, Don M. Tucker2; 1NeuroInformatics Ctr., Univ. of Oregon, USA, 2Electrical Geodesics, Inc. USA. Simulations are done to explore feasibility of fDOT for imaging the human brain lesions. A FD layered slab model for intracranial tumors is developed and the capacity of NIR fluorescent signals for detection is predicted.

BMD19
Joint Attention Studies Using Diffuse Optical Imaging, Nitin Yadav, Banghe Zhu, Anuradha Godavarty; Florida Intl. Univ., USA. Optical imaging was performed on healthy adults to study the responses of the brain to social interactive tasks. Differences in activation in the pre-frontal brain regions was observed in response to joint attention based paradigms.

BMD20
fNIR Data Classification Using Wavelet Transforms and Neural Networks for Attention Monitoring, Alireza Akbardeh, Meldem Izzetoglu, Scott Bunce, Kambiz Pourrezaei, Banu Onural; Drexel Univ., School of Biomedical Engineering, USA. This study investigates the potential of wavelet transforms and two different neural classifiers on the classification of fNIR data for automated attention monitoring. It showed that fast and accurate classification of targets/non-targets is reachable.

BMD21
Neurovascular Coupling in the Human Visual Cortex Studied by Diffusing-Wave Spectroscopy (DWS) and Electroencephalography, Markus Ninck1, Leonie Koban1, Jun Li2, Franck Jaillon1,2, Gregor Dietsche1, Thomas R. Elbert1, Johanna Kissler1, Thomas Gissler1; 1Univ. Konstanz, Germany, 2Nat. Univ. of Singapore, Singapore. We use diffusing-wave spectroscopy (DWS) and electroencephalography (EEG) to detect visual activity in humans elicited by steady-state flickering.

BMD22
A Simultaneous NIRS-EEG Study of Seizure in the Mouse Brain, Seungduk Lee1, Minah Lee2, Dalkwon Koh1, Beop-Min Kim1, Jee Hyun Choi2; 1Dept. of Biomedical Engineering, Yonsei Univ., Republic of Korea, 2Korea Inst. of Science and Technology, Republic of Korea. We measured hemodynamic responses of seizure in the mouse brain using frequency-domain near infrared spectroscopy and electroencephalogram. Our results show that the cerebral oxygenation and hemodynamics in the mouse brain can be stably monitored.

BMD23
Linear Image Reconstruction for a Diffuse Optical Mammography System in a Non-Compressed Geometry Using Scattering Fluid, Tim Nielsen, Bernhard Brendel, Ronny Ziegler, Falk Uhlemann, Claas Bontjes, Thomas Koehler; Philips Res. Europe, Germany. We present a linear reconstruction scheme for diffuse optical mammography. We show that the reconstruction has to be initialized properly if there is a mismatch between the optical properties of scattering fluid and breast tissue.

BMD24
A Multi-Modality Image Reconstruction Platform for Diffuse Optical Tomography, Qianqian Fang1, Stefan A. Carp1, Juliette Selb1, Richard Moore1, Daniel B. Kopans2, Eric L. Miller2, Dana H. Brooks3, David A. Bao1; 1Massachusetts General Hospital, USA, 2Tufts Univ., USA, 3Northeastern Univ., USA. We present a software platform for image reconstruction and data analysis for diffuse optical tomography. The structure, algorithm and functionalities of the platform are reported together with the sample results produced by the platform.

BMD25
Continuous Wave and Time-Resolved Fluorescence Diffuse Optical Tomography: Comparison for Different Lifetimes and Optical Properties, Nicolas Ducros1, Anabela da Silva1, Jean-Marc Dinten1, Françoise Peyrin2; 1CEA-Léti-Minatec, France, 2C. de Recherche et d’Applications en Traitement de l’Image et du Signal (CREATIS), Inst. Natl. des Sciences Appliquées de Lyon, France. This paper aims at determining fluorescence lifetimes and optical properties leading to reconstruction benefits when employing the time-resolved method rather than the continuous wave method.

BMD26
Fluorescence Diffuse Optical Tomography of Heterogeneous Complex Shape Objects, Lionel F. Hervé, Anne Koenig, Anabela Da Silva, Jérôme Boutet, Michel Berger, Jean-Marc Dinten, Philippe Petitè, Philippe Rizo; Micro Technologies for Biology and Healthcare Div., CEA, Léti-Minatec, France. External shape management is challenging for fluorescence tomography. We implement the finite differences method with arbitrary boundaries and present validations on a phantom and on a mouse with a fluorescent tube inserted inside the lungs.
BMD27
Depth Sensitivity Analysis of High-Density Imaging Arrays for Mapping Brain Function with Diffuse Optical Tomography, Hamid Dehghani, Brian R. White, Benjamin W. Zeff, Joseph P. Culver; 1Univ. of Exeter, UK, 2Washington Univ., USA. Developing diffuse optical tomography methods for neuroimaging of humans is challenging due geometry and light level constraints. Analysis of multi-distant high-density imaging arrays show feasibility of imaging up to 20-mm depth within the adult brain.

BMD28
A Fast Diffuse Optical Fluorescent Tomography Algorithm Reducing the Impact of Small-Animal Surface Boundaries, Simon Fortier, Frederic Leblond, Nicolas Robitaille; ART Inc., Canada. We present a fast algorithm finding light transport solutions in volumes with curved surfaces. We show that mishandling surface boundaries in small-animal fluorescence imaging can severely limit the quality of tomography images.

BMD29
A Location-Adaptive, Frequency-Specific Cancellation Algorithm to Improve Optical Brain Functional Imaging, Fenghua Tian, Suresh Prajapati, Hanli Liu; Dept. of Bioengineering, Univ. of Texas at Arlington, USA. The signal to noise ratio of brain imaging is poor because of the spontaneous noises. An algorithm to cancel two most pronounced noises related to the arterial pulsation and the blood pressure variation was developed.

BMD30
Compensation of Emission Light Waveguiding in Fluorescence Molecular Tomography, Pouyan Mohajerani, Joshua Kempner, Wael Yared; 1Georgia Tech, USA, 2VisEn Medical, Inc., USA. We present a method for identification and compensation of image regions that evidence waveguiding of emission light in fluorescence molecular tomography. Two in vivo case studies are conducted and demonstrate significant improvements in reconstructions.

BMD31
Localization of Fluorescent Objects in the Presence of Heterogeneous Background in Fluorescent Tomography, Pouyan Mohajerani, Ali A. Eftekhar, Ali Adibi; Georgia Tech, USA. We propose a method for object localization in fluorescent tomography (FT) in the presence of highly heterogeneous background. Simulation results demonstrate effective localization of target objects for highly heterogeneous background distributions.

BMD32
Time-Domain Spatial Localization of Fluorescent Inclusions in Thick Scattering Media with Early Photons, Vincent Robichaud, Yves Bérubé-Lauzière; Univ. de Sherbrooke, Canada. We present a 2-step time-of-flight approach to localize in 3-D, with 1mm precision, small fluorescent inclusions in thick scattering media using arrival times of early fluoresced snake photons.

BMD33
Full Time-Resolved Fluorescence Diffuse Optical Tomography Using Total Light Approach, Andhi Marjono, Akira Yano, Shinpei Okawa, Yukio Yamada, Feng Gao; 1Univ. of Electro-Communications, Japan, 2Tianjin Univ., China. Time-domain fluorescence diffuse optical tomography (FDOT) is developed by using a combination of full time-resolved scheme and total light approach for image reconstruction. The goal of this study is reconstructing embedded fluorophore concentrations in tissues.

BMD34
Optimal Source-Modulation Frequencies for Small-Geometry Frequency-Domain Optical Tomography, Hyun Keol Kim, Uwe J. Netz, J. Beuthan, Andreas Hielscher; 1Columbia Univ., USA, 2Charité-Univ.-Medizin Berlin, Germany. To find optimal frequencies, we present numerical and phantom studies on small-geometry frequency-domain optical tomography, and found that best results were achieved in the 600-800MHz frequency range.

BMD35
CT Imaging of Biological Tissue Using Backscattered Light, Takeshi Namita, Yuji Kato, Koichi Shimizu; Graduate School of Information Science and Technology, Hokkaido Univ., Japan. For cross-sectional imaging of an animal body, the technique using backscattered light and repetitive inverse solution was developed. The effectiveness of the new technique was verified in simulation and the experiment using biological tissue.

BMD36
Wavelength Optimization in Spectral Near Infrared Tomography, Matthew E. Eames, Brian W. Pogue, Hamid Dehghani; 1Univ. of Exeter, UK, 2Dartmouth College, USA. A method is developed to show that instead of using data from the entire spectrum, only selected spectral bands are required to improve image reconstruction accuracy in spectral diffuse optical tomography.
BMD37
Suppression of Skin Perfusion on NIR Diffuse Optical Topography by Depth Selective Method, Mamiko Fujii, Akira Kawamaka, Kiyoshi Nakayama; Faculty of Science and Technology, Sophia Univ., Japan. We propose an image reconstruction method that suppresses undesirable effects of skin circulation for NIR diffuse optical topography by a filtering algorithm. Proposed method selectively extracts target signals at deeper region from contaminated observation data.

BMD38
Inverse Solution Regularized with the Edge-Preserving Constrain for NIR DOT, Min-Cheng Pan¹, Liang-Yu Chen², Min-Chun Pan², Chien-Hung Chen³; ¹Tungnan Univ., Taiwan, ²Natl. Central Univ., Taiwan. To remedy the low spatial resolution of diffuse optical tomography, an iterative solution to the optimization problem is developed using the Tikhonov regularization with the edge-preserving constraint as a prior knowledge into the objective function.

BMD39
CW and Time Domain Methods to Prepare Accurately Calibrated Liquid Diffusive Phantoms at NIR Wavelengths, Lorenzo Spinelli¹, Fabrizio Martelli¹, Andrea Farina¹, Antonio Pifferi¹, Alessandro Torricelli¹, Rinaldo Cubeddu¹, Giovanni Zacchetti¹; ¹Inst. for Photonics and Nanotechnologies, Consiglio Nazionale delle Ricerche, Politecnico di Milano, Italy. Two procedures for CW and time-resolved instrumentations are described to calibrate at NIR wavelengths the reduced scattering coefficient of a diffusive medium and the absorption coefficient of an absorber with standard errors smaller than 2%.

BMD40
Frequency Domain Optical Tomography Instrument with High Modulation Frequencies for Imaging Small Geometries, James M. Masciotti, Gesa L. Franke, Hyun K. Kim, Andreas H. Hielscher; Columbia Univ., USA. We present a frequency domain optical tomography instrument for imaging small geometries. The instrument employs modulation frequencies up to 1 GHz which allows yields better separation of absorption and scattering and more accurate reconstructions.

BMD41
Calibration Techniques for Small Animal Bimodality X-CT and Fluorescence Diffuse Optical Tomography, Anabela Da Silva, Mathieu Debourseau, Thomas Bordy, Jean-Marc Dinten, Philippe Pelleté, Philippe Rio; CEA-Léa-Minacé, France. A small animal tomograph designed for the dual acquisitions of fluorescence optical and X-ray signals is presented. Dedicated geometrical and optical calibration techniques have been developed and are exposed.

BMD42
Spectral Imaging Instrument for Optical Mammmography, Ning Liu, Yang Yu, Angelo Sassaroli, Sergio Fantini; Dept. of Biomedical Engineering, Tufts Univ., USA. We present a spectral imaging system for 2-D projection mammography that acquires broadband spectra (600-1,000nm) with a tandem scan of illumination/detection fibers. Scanning speed: 3.5cm/s; temporal sampling: 57ms; spatial sampling: 2mm×2mm.

BMD43
A Multitude of Laser Sources for Pulsed and Continuous Excitation in Diffuse Optical Tomography, Kristian Lauritsen¹, Dietmar Klemme¹, Martin Langkopp¹, Michael Wahl¹, Axel Hagen¹, Oliver Steinkellner¹, Dirk Grosenick¹, Rainer Macdonald¹, Rainer Erdmann¹; ¹PicoQuant GmbH, Germany, ²Physikalisch-Technische Bundesanstalt, Germany. We report latest results developing high power pulsed lasers for time resolved/cw intensity DOT. These lasers were used for fluorescence imaging on phantoms for optical mammography with contrast agents in reflectance and transmission.

BMD44
Estimates of Fluorescence Lifetime of Targets Deeply Embedded in Turbid Medium, a Step to a Functional Imaging of Tissue Abnormalities, Victor V. Chernomordik, Moinuddin Hassan, Jason Riley, Amir H. Gandombacheh; Natl. Inst. of Child Health and Human Development, USA. A novel method for estimating lifetime of deeply embedded fluorophores, based on scaling relations for photon migration is presented. It is experimentally substantiated for targets embedded in turbid medium, using our lifetime fluorescence imaging system.

BMD45
Recording of Artifact-Free Reflection Data with a Laser and Fluorescence Scanning Mammograph for Improved Axial Resolution, Oliver Steinkellner¹, Axel Hagen¹, Christian Stadelhoff¹, Dirk Grosenick¹, Rainer Macdonald¹, Herbert Rinneberg¹, Ronny Ziegler¹, Tim Nielsen¹; ¹Physikalisch-Technische Bundesanstalt, Germany, ²Philips Res. Europe, Germany. We developed a method to record artifact-free diffuse reflectance in a parallel plate scanning fluorescence mammograph and used reflection data together with transmission data for reconstruction based fluorescence imaging at improved axial resolution.
BMD46
Monitoring of Contrast Agent Inflow into Human Brain by Multichannel Time-Resolved Diffuse Reflectometry, Michal Kacprzak1, Adam Liebert1, Joanna Maczewska2, Piotr Sawosz2, Leszek Krolicki2, Roman Maniewski1; 1Inst. of Biocybernetics and Biomedical Engineering PAS, Poland, 2Dept. of Nuclear Medicine, Medical Univ. of Warsaw, Poland. Time-resolved optical imager allowing for recording of distributions of times of flight of photons for 32 source-detector pairs is presented. It was applied in in-vivo experiments during bolus of optical contrast agent.

BMD47
Imaging of Optically Turbid Medium with Fluorescence Inclusions by Multichannel Time-Resolved Measurements, Michal Kacprzak, Adam Liebert, Piotr Sawosz, Roman Maniewski; Inst. of Biocybernetics and Biomedical Engineering, Polish Acad. of Sciences, Poland. We present construction of a multichannel time-resolved measurement system and results of its application in imaging of fluorescence excited in an inclusion filled with ICG and located in optically turbid medium.

BMD48
Three-Dimensional Fluorescence Tomography Studies Using a Novel Hand-Held Probe Based Optical Imager, Jiajia Ge, Banghe Zhu, Anuradha Godavarty; Florida Intl. Univ., USA. A novel hand-held probe based optical imager is developed and used to demonstrate the feasibility of three-dimensional (3-D) tomography on slab phantoms. Fluorescence target localization in 3-D is also demonstrated without tomographic analysis.

BMD49
A Hand-Held Probe-Based Optical Imager with Self-Registration Facilities, Steven Regalado, Banghe Zhu, Jiajia Ge, Anuradha Godavarty; Florida Intl. Univ., USA. A novel hand-held probe-based optical imager with self-registration facilities is developed towards breast cancer diagnosis. Initial experimental studies on slab tissue phantoms have demonstrated the feasibility of co-registered measurements towards future tomography studies.

BMD50
Comparison of Spatial Resolution and Temporal Response between Two Continuous-Wave Diffuse Optical Imagers, Renuka Parlapati1, Fenghua Tian1, Vikrant Sharma1, Suresh Prajapati1, Hanli Liu1; 1Univ. of Texas at Arlington, USA. We present a comprehensive comparison of spatial resolutions and temporal responses between two continuous-wave diffuse optical imaging systems. This study shows a large difference in spatial resolution, while their temporal responses are comparable.

BMD51
Advantages Found for 10 fs Pulses in Multiphoton Microscopy, Peng Xi, Yair Andageko, Lindsay R. Weisel, Vadim V. Lozovsky, Marcos Dantus; Michigan State Univ., USA. After compensation of high-order chromatic dispersion 10 fs pulses are found to produce much greater signal, less photobleaching, and allow deeper penetration in two-photon microscopy.

BMD52
A Shack-Hartmann Wavefront Sensor Based Adaptive Optics System for Multiphoton Microscopy, Jae Won Cha, Peter T. C. So; MIT, USA. The imaging depth of two-photon microscopy is limited by aberration resulted from inhomogeneous refractive-index distribution in a specimen. With adaptive optics, the resolution and signal level can be preserved at greater depth.

BMD53
Three-Dimensional Lithographic Microfabrication Based on Multiphoton-Induced Wide Field Illumination, Daekeun Kim, Peter T. C. So; MIT, USA. 3-D multiphoton laser writing microfabrication has good resolution but has relatively low throughput. We suggest 3-D multiphoton-induced wide field illumination lithography, and it can be a viable high throughput system for patterning tissue engineering substrates.

BMD54
Two-Photon Imaging for the Non-Invasive Assessment of Electric Field Effects on Osteogenic Stem Cell Differentiation, Marie C. Hronik-Tupa1, William Rice1, Mark Cronin-Golomb1, Gordana Vunjak-Novakovic2, David Kaplan1, Irene Georgakoudi1; 1Tufts Univ., USA, 2Columbia Univ., USA. We present the use of two-photon excited fluorescence and second harmonic generation, to monitor electric field effects on osteogenic differentiation of human mesenchymal stem cells in terms of cellular morphology, biochemical composition and collagen deposition.

BMD55
Two-Photon Microscopy with Adaptive Illumination Power, Kengyeh K. Chu, Daryl Lim, Jerome Mertz; Boston Univ., USA. We have introduced a feedback loop into a two-photon microscope to hold emitted fluorescence to a constant, enhancing effective dynamic range and increasing sensitivity at darker portions of an image without significantly changing overall exposure.
BMD56
Analysis of a Two-PMT System for Simultaneous Back- and Forward-Fluorescence Detection in Multiphoton Microscopy, Ricardo Toledo-Crow, Songhui Shi, Yongbiao Li; Memorial Sloan-Kettering Cancer Ctr., USA. A two-PMT system was analyzed as an opportunity to improve the S/N ratio in a multiphoton microscope. Conditions under which this arrangement is optimal and sub-optimal are presented and discussed with representative data.

BMD57
Far Field Reflection Microscopy Based on Optical Diffraction Tomography, Filip Drešković, Guillaume Maire, Hugues Giovannini, Kamal Belkebir, Patrick Chaumet, Anne Talneau, Anne Sentenac; 1Inst. Fresnel, France, 2Lab de Photonique et de Nanostructures, France. Optical diffraction tomography in a reflection scheme is well adapted to the study of high index contrast samples. Using diffraction models that involve multiple scattering, we compare our experimental data to the modeling predictions.

BMD58
Cell Biology Explored with Digital Holographic Microscopy, Christian Depeursinge, Pascal Journet, Benjamin Rappaz, Pierre Magistretti, Tristan Colomb, Pierre Marquet; 1Ecole Polytechnique Fédérale de Lausanne, Switzerland, 2Ctr. de Neurosciences Psychiatriques, Switzerland. DHM (Digital Holographic Microscopy) sheds new light on mechanisms affecting cell structure and dynamics including organelles, vesicles, nucleus, membranes. Overview of results is given for different cell types and tissues.

BMD59
Surface Topography of Cellular Membrane on Nanometer Scale Using White-Light Quantitative Phase Microscope, Toyohiko Yamauchi, Hidenao Iwai, Mitsuharu Miwa, Yutaka Yamashita; Hamamatsu Photonics K. K., Japan. We developed a Linnik-type interference microscope with a low-coherent light source and obtained a full-field topographic image of a cellular membrane on a nanometer scale without using staining dye or a reflection-enhancement agent.

BMD60
Femtosecond Cellular Transfection Using a Non-Diffracting Light Beam, Xanthi Tsampoula, Veneranda Garcés-Chávez, Muriel Comrie, David James Stevenson, Ben Agate, Tom Brown, Frank Gunn-Moore, Kishan Dholakia; 1School of Physics and Astronomy, Univ. of St. Andrews, UK, 2School of Biology, Univ. of St. Andrews, UK. Foreign DNA introduction inside the living cell has been demonstrated using a Bessel beam. This obviates the need to locate precisely the cell membrane permitting two-photon photoporation along a line leading to successful transfection.

BMD61
Measuring the Spatio-Temporal Field of Focusing Ultra Short Pulses, Pamela R. Bowlan, Pablo Gabolde, Rick Trebino; School of Physics, Georgia Tech, USA. We present a technique for measuring the spatio-temporal intensity and phase, E(x,y,z,t), of an ultra short pulse at or near the focus with high spatial and spectral resolution.

BMD62
A Localized Surface Plasmon Microscope by the Use of a Zeroth-Order Bessel Beam with the Optimized Polarization in the Illumination System, Kouyou Watanabe, Goro Terakado, Hiroshi Kan; Muroran Inst. of Technology, Japan. We propose a localized surface plasmon microscope with a zeroth-order Bessel beam illumination. The microscope visualizes the refractive index distribution on the metal from the reflected intensity. The optimization of the polarization is also discussed.

BMD63
Improved Imaging Property of the Scanning Total Internal Reflection Fluorescence Microscope by the Use of Optimally Polarized Illumination, Goro Terakado, Kouyou Watanabe, Hiroshi Kan; Muroran Inst. of Technology, Japan. We report on an improvement of an imaging property in the two-photon excited total internal reflection fluorescence microscope. The developed microscope, which employs optimally polarized illumination, provides a point spread function with a single peak.

BMD64
Effects of Pupil Functions on Tightly Focused Radially Polarized Beams in Microscopy, Elijah Y. S. Yew, Colin J. R. Sheppard; Div. of BioEngineering, Natl. Univ. of Singapore, Singapore. We examine the effects of tightly focusing a radially polarized beam with uniform, Gaussian or Bessel-Gauss pupil functions. FWHM is smallest for a uniform amplitude profile while the Bessel-Gauss beam results in the largest FWHM.

BMD65
Sensitivity Enhancement for Total Internal Reflection Fluorescence Imaging Using Dielectric Thin Films, Kyujung Kim, Eun-Jin Cho, Yong-Min Huh, Donghyun Kim; Yonsei Univ., Republic of Korea. Evansen field enhancement was investigated experimentally based on dielectric thin films in TIRF microscopy. Field intensity enhancement measured by microbeads and live-cell imaging relative to that of a control without dielectric films was polarization dependent.
BMD66
Phase Subtraction Cell Counting Method and Dry Mass Determination for Assessment of Viability of Mouse Embryos, William C. Warger II, Judith A. Newmark, Carol M. Warner, Charles A. DiMarzio; Northeastern Univ., USA. The phase subtraction cell counting method has produced accurate, non-toxic cell counts in live mouse embryos beyond the eight-cell stage. Here we describe the combination of the cell count and dry mass to assess viability.

BMD67
Modeling DIC Microscope Images of Thick Objects Using a Product-of-Convolutions Approach, Heidy Sierra, Charles DiMarzio, Dana Brooks; Northeastern Univ., USA. A three-dimensional forward model which attempts to capture phase delays has been developed to simulate microscope images from thick heterogeneous transparent objects. Intensity images were calculated successfully predicting the appearance of Difference Interference Contrast images.

BMD68
Multimodal Intravital Microscopy of Oxygen Transport in Tumor Microvasculature, Casey M. deDeugd, Mamta Wankhede, Brian S. Sorg; Univ. of Florida, USA. Key oxygen transport parameters in tumor microvessels were quantified using a novel combination of intravital microscopy techniques. Results indicated a strong relationship between red blood cell flux and hemoglobin saturation in tumor microvessels.

BMD69
Optical Temperature Measurement in Aqueous Nanodroplets for PCR, Hanyoup Kim, Sanhita Dixit, Chia-Pin Pan, Gregory W. Faris; Molecular Physics Lab, SRI Intl., USA. We are investigating temperature measurements of nanoliter droplets to support polymerase chain reaction (PCR) assays. A fluorescence quenching method appears most promising for this application.

BMD70
Optimizing Fluorescence Collection in Multiphoton Microscopy, Joseph P. Zinter, Michael J. Levene; Yale Univ., USA. Efficient fluorescence collection is critically important when maximizing imaging depth in multiphoton microscopy. Here we present an optimized, large-aperture fluorescence collection system for use with Hamamatsu GaAsP photomultiplier tubes.

BMD71
Evaluation of Cultured Corneal Epithelial Cells and Epithelial Thickness by Full-Field Optical Coherence Tomography, Masahiro Akiba1, Akira Kubota2, Charles Reisman1, Yasufumi Fukuma1, Kohji Nishida1, Kinpui Chant; 1TOPCON Advanced Biomedical Imaging Lab, USA, 2Tohoku Univ. Graduate School of Medicine, Japan. The growth process of cultured corneal epithelial cells has been evaluated by full-field optical coherence tomography. Three different layers of the epithelium were discriminated and the thickness of corneal epithelium was quantitatively measured.

BMD72
Contrast Enhancement in Imaging the Tears and Contact Lenses with Optical Coherence Tomography, Shuliang Jiao, Jianhua Wang, Yunxin Jiao, Carmen A. Puliafito; Bascom Palmer Eye Inst., Univ. of Miami Miller School of Medicine, USA. Optical scattering biocompatible medium (Intralipid in the current experiment) was proposed and tested as contrast agent for optical coherence tomography in the study of tear dynamics and tear exchange in contact lens wearers.

BMD73
Quasi-Simultaneous OCT/SLO Imaging, Irina Trifanov1, Michael Hughes1, Richard Rosen2, Adrian Podoleanu1; 1Univ. of Kent, UK, 2New York Eye and Ear Infirmary, USA. Quasi-simultaneous OCT and SLO images are produced without the need to split the signal from the retina. A chopper synchronized with the transverse scanner periodically blocks-off the reference beam in the OCT.

BMD74
Dynamic Imaging of Small Arteries and Veins of Human Fingers by Optical Coherence Tomography, Mitsuo Kurobara, Toshie Fuji, Masato Ohmi, Masanitstu Haruna; Graduate School of Medicine, Osaka Univ., Japan. In vivo dynamic OCT imaging of small arteries and veins of human fingers are demonstrated. We can observe pulsation of the artery in synchronization with heartbeat, leading to a screening of aging of blood vessels.

BMD75
Calibration of Blood Flow Measurement with Spectral Domain Optical Coherence Tomography, Hassan M. Welhe1, Marco Ruggeri1, Shuliang Jiao2, Giovanni Gregori2, Carmen A. Puliafito1, Weizhao Zhar; 1Bascom Palmer Eye Inst., USA, 2Dept. of Biomedical Engineering, Univ. of Miami, USA. We developed a technique that automatically measures retinal blood flow using spectral domain optical coherence tomography (SD-OCT). In this paper we present methods we used to calibrate the measurements.
BMD76
Contrast Enhancement in Optical Coherence Tomography (OCT), Enock Jonathan, Jan S. Dam; CSIR, Natl. Laser Ctr., South Africa. We demonstrate experimentally human saliva as an inexpensive and easy-to-use contrast-enhancing medium in OCT imaging. After treatment with fresh human saliva, in-vivo human fingertip, palm and nail-fold region images displayed more contrast and feature visibility.

BMD77
Automated Processing and Classification of Cervical Images Using Optical Coherence Tomography, Wei Kang¹, Xin Qi¹, Margarita Kareta², Jerome Belinson³, Andrew Rollins³; ¹Case Western Reserve Univ., USA, ²Imalux Corp., USA, ³Cleveland Clinic Foundation, USA. We developed image processing techniques for OCT imaging of the uterine cervix and proposed two features for classification of normal/CIN1 and CIN2/CIN3 images. The sensitivity and specificity of the algorithm were 90.9% and 91.7%, respectively.

BMD78
Fourier Domain OCT at 840 nm Utilizing a Linear k Spectrometer, Zhilin Hu, Andrew M. Rollins; Case Western Reserve Univ., USA. This work describes a novel Fourier domain OCT equipped with linear wave number spectrometer at 840 nm. The linear k spectrometer eliminates the computing time of the interpolation and improves the fall-off of FDOCT image.

BMD79
1/f Noise in Spectrometer-Based Optical Coherence Tomography, Emily J. McDowell¹, Marinka V. Sarunic², Changxuei Yang³; ¹Caltech, USA, ²Simon Fraser Univ., Canada. We document and analyze the effect of 1/f noise on the detection sensitivity of spectrometer-based optical coherence tomography systems, finding that such noise sources lead to a degradation in SNR for increasing integration times.

BMD80
Strained Quantum Well InGaAs/GaAlAs/GaAs SLDs and SOAs for HR OCT at 840 and 1060 nm Bands, Vladimir Shidlovski, E. V. Andreeva, Yu. O. Kostin, P. I. Lapin, A. A. Lobintsov, M. V. Shramenko, S. D. Yakubovich; Superlum, Ireland. SLDs and SOAs for HR OCT basing on strained InGaAs/AlGaAs/GaAs QWs at 850 and 1060 nm with ASE/gain bandwidths of 40-50 nm and output power ex SM fiber of up to 50mW are reported.

BMD81
Multiplexed Low-Coherence Interferometry Instrument for Measuring Microbicidal Gel Thickness Distribution, Tyler Drake, Francisco Robles, Adam Wax; Duke Univ., USA. We present a multiplexed low coherence interferometry (LCI) system for in-vivo human vaginal imaging of microbicidal gel distribution. In-vitro testing demonstrated high accuracy and linearity of LCI in measuring gel coating thickness up to 500μm.

BMD82
Quasi-Single Shot Axial-Lateral Parallel Time Domain Optical Coherence Tomography Using an InGaAs Camera, Yuuki Watanabe, Manabu Sato; Graduate School of Science and Engineering, Yamagata Univ., Japan. We developed axial-lateral parallel time-domain optical coherence from a single interference image. We obtained OCT images of a moving human finger in vivo by subtracting a DC image based on averaged interference images.

BMD83
Low-Cost Solution for Artifact Free Images in Fourier-Domain Optical Coherence Tomography, Sébastien Vergnole, Gay Lamouch, Marc L. Dufour; Natl. Res. Council -Industrial Materials Inst., Canada. We present an efficient and low cost artifact removal setup that relies on a piezolectric fiber stretcher to generate a transverse modulation. Performing a Fourier processing in the transverse direction leads to artifact free images.

BMD84
Displacement Estimation in Optical Coherence Tomography Imagery Based on Speckle Tracking, Gijs van Soest¹, Hervé Flesch¹, Anton F. W. van der Steen²; ¹Erasmus MC, Netherlands, ²Interuniversity Cardiology Inst. of the Netherlands, Netherlands. We present a method for analysis of displacement in OCT data. We show that tissue motion can be tracked with high accuracy based on M-mode speckle imaging. Materials with different stiffness can be identified.

BMD85
Real-Time Video-Rate Harmonically Detected Fourier Domain Optical Coherence Tomography, Andrei B. Vakhtin, Kristen A. Peterson, Daniel J. Kane; Southwest Sciences, Inc., USA. Real-time video-rate complex-conjugate-resolved subsurface imaging is demonstrated using harmonically detected Fourier domain OCT at 795 nm. Work toward implementing the method at 1300 nm in both broadband and swept-source configurations is presented.
BMD86
Swept Source Optical Coherence Tomography with Nonuniform Frequency Domain Sampling, Sherif S. Sherif, Costel Flueraru, Youxin Mao, Shoude Change; Inst. for Microstructural Sciences, Canadian Natl. Res. Council, Canada. Swept Source Optical Coherence Tomography requires complex hardware and/or numerical interpolation to obtain an image using the discrete Fourier transform (DFT). We describe a simpler and more accurate inversion method based on the nonuniform DFT.

BMD87
Degradation of Axial Resolution in Optical Coherence Tomography due to Scattering and Absorption in Skin Tissue, Dirk H. P. Schneiderheinze, Timothy R. Hillman, David D. Sampson; Univ. of Western Australia, Australia. We examine the effects of scattering and absorption in skin tissue upon the axial resolution of ultrahigh-resolution optical coherence tomography. By modeling the frequency dependence of the optical properties, we quantify the depth-dependent axial resolution.

BMD88
Real-Time Imaging of Radiofrequency Cardiac Ablation Using Optical Coherence Tomography, Christine P. Fleming1, Hui Wang1, Guy Amit2, Kara J. Quan1, Andrew M. Rollins2; ‘Case Western Reserve Univ., USA, ‘MetroHealth Medical Ctr., USA. Catheter ablation using radiofrequency (RF) energy is a clinical procedure to destroy abnormal conduction pathways, and cure arrhythmias. We present real-time imaging of lesion formation during in vitro application of RF energy on the endocardium.

BMD89
Functional Assessment of Cutaneous Wound Healing Using Spectral-Domain Optical Coherence Tomography, Michael J. Cobb, Yicong Wu, Addie Waren, Daniel J. MacDonald, Xingde Li; Univ. of Washington, USA. We show that spectral-domain optical coherence tomography can monitor blood flow in and around the wound bed during the cutaneous wound healing process in a mouse model.

BMD90
Supercontinuum Based Ultrahigh Resolution Fourier Domain Optical Coherence Tomography for in vivo Dermatology, Stefan Kray, Felix Spöler, Michael Först, Heinrich Kurz; Inst. of Semiconductor Electronics, RWTH Aachen Univ., Germany. A Fourier domain optical coherence tomography system is demonstrated, employing a commercial supercontinuum light source for the 1300nm wavelength region. Ultrahigh axial resolution of <4.4μm, imaging depths of >1mm and 100dB sensitivity are achieved.

BMD91
Paper Withdrawn

BMD92
Optical Coherence Tomography Techniques in Dental Implant Investigations, Iulian Ionita; Univ. of Bucharest, Romania. FD-OCT with Swept Source was used to obtain 3-D image of the peri-implant tissue (soft and hard) in the case of mandible fixed screw. 1350 nm centered source give better images than 850 nm source.

St. Petersburg Ballroom
3:30 p.m.–4:00 p.m.
Coffee Break

BME • In vivo Imaging for Neuroscience

Grand Bay Ballroom North
4:00 p.m.–6:00 p.m.

BME • In vivo Imaging for Neuroscience
Jens Steinbrink; Charité Univ. Medicine, Germany, Presider

BME1 • 4:00 p.m. 
Tutorial
When the Brain Turns Red or Pale: Introduction to Non-Invasive Optical Brain Imaging, Jens Steinbrink, Hellmuth Obrig; Charité Univ. Medical Ctr., Germany. This tutorial introduces non-invasive optical brain imaging to the newcomers in the field. Based on a comparison to the well established absorption spectroscopy in a cuvette, the lecture motivates the most recent technological challenges.

BME2 • 4:45 p.m. 
Invited
Multidimensional Functional Optical Imaging of the Brain, Elizabeth M. Hillman1, Brenda Chen1, Sean A. Burgess1, Andrew J. Radoshevich1, Matthew B. Bouchard1, Amir K. Irmahboub1, Aniruddha Das2, Bruno Cauli2; ‘Columbia Univ., USA, ‘Ctr. for Neurobiology and Behavior, Columbia Presbyterian Medical Ctr., USA, ‘Univ. Pierre et Marie Curie, France. Optical brain imaging in rodents allows investigation of normal physiology and the effects of disease. Multi-scale imaging and delineation of multiple sources of contrast can reveal contributions of individual cells and processes to ensemble activity.

BME3 • 5:15 p.m.
Phase-Encoded Retinotopic Mapping in Humans with DOT, Brian R. White1, Benjamin W. Zeff1, Bradley L. Schlaggar2, Hamid Dehghani1, Joseph P. Culver3; ‘Dept. of Physics and School of Medicine, Washington Univ. in St. Louis, USA, ‘Dept. of Radiology, Washington Univ. in St. Louis, USA, ‘School of Physics, Univ. of Exeter, UK. We have developed a high-density neuroimaging DOT system with improved depth discrimination and lateral resolution. The advantages are demonstrated through cortical maps of phase-encoded traveling waves in the full visual field of adult humans.
BME4 • 5:30 p.m.
Haemodynamic Response Measured by NIRS to Physiological Intermittent Cerebral Activation during Quiet Sleep in Healthy and Sick Premature Neonates, Nadege Roche-Labarbe1,2, Guy Kongolo1, Reinald Grebe1, Fabrice Wallois1,2; 1GRAMFC, Faculte de Medecine Amines, France, 2GRAMFC, Neuropediatric Functional Explorations Unit, North Hospital, France, 3Pediatric Intensive Care Unit, North Hospital, France. Simultaneous NIRS and EEG recordings in premature neonates, six healthy and four presenting neurological distress (29 to 35 weeks GA) showed bursts of neuronal activity during quiet sleep are associated with a stereotyped haemodynamic response.

BME5 • 5:45 p.m.
Evoked Optical Response under Wake, Sleep and Anesthetized States, Jennifer L. Schei, Amanda J. Foust, Manuel J. Rojas, Jinna A. Navas, David M. Rector; Washington State Univ., USA. Concurrent electrical and optical measurements of auditory cortex responses exhibits state dependent hemodynamic activity. When compared to wake, quiet sleep elicits large, late optical signals, REM signals are large, while isoflurane signals are phase shifted.

BMF • Advances in Microscopy
Grand Bay Ballroom South
4:00 p.m.–6:00 p.m.
BMF • Advances in Microscopy
Tony Wilson; Univ. of Oxford, UK, Presider

BMF1 • 4:00 p.m. Invited
Contrasts and Resolution in Light Sheet Based Microscopy (SPIM, DSLM, LSFM), Ernst Stelzer; European Molecular Biology Lab, Germany. Abstract not available.

BMF2 • 4:30 p.m.
Optical Design for Spatial-Spectral Volume Holographic Imaging System, Paul J. Gelsinger1, Yuan Lo1, George Barbastathis2, Raymond Kostuk3, Jennifer K. Barton3; 1College of Optical Sciences, Univ. of Arizona, USA, 2Dept. of Mechanical Engineering, MIT, USA, 3Dept. of Electrical and Computer Engineering, Univ. of Arizona, USA. We present a design for a holographic imaging system that acquires spatial and spectral information about a volume object. Our design provides a solution to the field of view issues related to volume holographic imaging.

BMF3 • 4:45 p.m.
Pushing the Limits of Dynamic Speckle Illumination Microscopy, Daryl Lim, Cathie Ventonal, Jerome Mertz; Boston Univ., USA. Dynamic speckle illumination (DSI) microscopy is a widefield fluorescence imaging technique that provides depth discrimination even in scattering media. We discuss theoretical and practical results geared towards the optimization of this relatively new technique.

BMF4 • 5:00 p.m.
Fourier Analysis and Synthesis Tomography: High-Resolution Long-Range Volume Imaging of Cells and Tissue, Daniel Feldkuhn, Kelvin Wagner; Univ. of Colorado at Boulder, USA. We present a light-efficient imaging technique that measures the sample’s fluorescent or coherent spatial spectrum using projected dynamic interference patterns, a fast single-pixel detector, and large low-resolution optics, effectively decoupling depth-of-field and working-distance from resolution.

BMF5 • 5:15 p.m.
Microscope on a Chip—A Complete On-Chip High-Resolution Optofluidic Microscope, Xiquan Cui1, Xin Heng2, Weitui Zhong1, Paul W. Sternberg1, Demetri Psaltis2, Changhuei Yang2; 1Caltech, USA, 2Ecole Polytechnique Federale de Lausanne, Switzerland. We report the first complete on-chip high-resolution (~0.9 μm) optofluidic microscope. It’s smaller than a U.S. quarter and yet can achieve resolution comparable to a conventional microscope with 20x objective.

BMF6 • 5:30 p.m.
Background Reduction with Two-Color Two-Beam Multiphoton Excitation, Demirhan Kobat, Guanghao Zhu, Chris Xu; Cornell Univ., USA. By comparing axial excitation profiles, we present experimental proof which demonstrates that two-color two-beam multiphoton excitation offers a better signal to background ratio than conventional single beam multiphoton excitation.

BMF7 • 5:45 p.m.
Microscopic Imaging of Oxygen by Two-Photon-Excited Phosphorescence, Olga S. Finikova1, Artem Y. Lebedev1, Alexei Aprelev2, Thomas Troxler1, Feng Cao1, Carmen Garnacho1, Silvia Muro1, Robin M. Hochstrasser1, Sergei A. Vinogradov1; ‘Univ. of Pennsylvania, USA, 2Drexel Univ., USA. Microscopic oxygen distributions in heterogeneous phantoms and cells were visualized by means of two-photon laser scanning microscopy, using phosphorescent probes with controllable quenching parameters and enhanced two-photon absorption cross-sections.

St. Petersburg Ballroom
6:30 p.m.–8:00 p.m.
Conference Reception
BTuA • Plenary III: Imaging and Diagnostics in Tissue

Grand Bay Ballroom North and South
7:30 a.m.–10:00 a.m.

BTuA • Plenary III: Imaging and Diagnostics in Tissue
Irene Georgakoudi; Tufts Univ., USA, Presider

BTuA1 • 7:30 a.m. 
Tutorial
High Throughput Tissue Imaging and Bioinformatics, Peter T. C. So; MIT, USA. Image informatics has been shown to be an important new paradigm in understanding cell biology. We extend this approach to study tissue level physiology and pathology based on high throughput two-photon microscopy.

BTuA2 • 8:15 a.m. 
Invited
Dual-Color Superresolution Imaging Using Genetically Expressed Probes, Hari Shroff1, Catherine G. Galbraith2, James A. Galbraith1, Helen White1, Jennifer Gillette3, Scott Olengich4, Michael W. Davidson5, Eric Betzig1; 1Howard Hughes Medical Inst., Janelia Farm Res. Campus, USA, 2Natl. Inst. of Dental and Craniofacial Res., NIH, USA, 3Natl. Inst. of Neurological Disorders and Stroke, NIH, USA, 4Natl. Inst. of Child Health and Human Development, NIH, USA, 5Natl. High Magnetic Field Lab and Dept. of Biological Science, Florida State Univ., USA. We report dual-color superresolution imaging using endogenously expressed fluorescent proteins. An imaging resolution of 20-30 nm facilitates study of the ultrastructural relationship between proteins present in adhesion complexes at the surfaces of whole, fixed cells.

BTuA3 • 8:45 a.m. 
Invited
The Role of Light Scattering Spectroscopy in Spectral Diagnosis of Disease, Michael S. Feld1, Condon Lau1, Obraz Szczepanovic2, Sasha McGee3, Jelena Mrkovic3, Chung-Chieh Yu4, Steve Falghum2, James Tunnell2, Irene Georgakoudi5, Kate Bechtel1; 1MIT Spectroscopy Lab, USA, 2Newton Labs Inc., USA, 3Univ. of Texas at Austin, USA, 4Tufts Univ., USA. Light scattering spectroscopy (LSS), which contributes to diffuse tissue reflectance, provides important diagnostic information. However, the presence of blood vessels provide an alternate interpretation. A revised view of the role of LSS will be presented.

BTuA4 • 9:15 a.m. 
Invited
The Glass Brain: Visualization of Neuronal Networks in the Whole Mouse Brain by Ultramicroscopy, Hans-Ulrich Doft, N. Jährling, K. Becker; Vienna Univ. of Technology, Austria. Visualization of neuronal networks in the whole mouse brain is possible by ultramicroscopy using a special method to make tissue optically transparent. This method also allows the three-dimensional visualization of drosophilae and whole mouse embryos.

St. Petersburg Ballroom
10:00 a.m.–10:30 a.m.

Coffee Break

St. Petersburg Ballroom
10:00 a.m.–4:00 p.m.
Exhibits Open

BTuB • Methods in Microendoscopy

Grand Bay Ballroom North
10:30 a.m.–12:30 p.m.

BTuB • Methods in Microendoscopy
Xingde Li; Univ. of Washington, USA, Presider

BTuB1 • 10:30 a.m. 
Tutorial
Seeing inside the Body with Microendoscopy and Endoscopic Microscopy, Gary Tearney; Wellman Ctr. for Photomedicine, Massachusetts General Hospital, USA. In this paper, we report the use of advanced optical fiber devices and single-mode light sources for ultraminiature 3-D endoscopy and large area, comprehensive microscopy of the coronary arteries and gastrointestinal tract of human patients.

BTuB2 • 11:15 a.m. 
Invited
Interferometric Spectrally Encoded Endoscopy, Dvir Yelin1, Brett E. Bouma2, John J. Rosowski3, Michael E. Ravicz2, Guillermo J. Tearney2; 1Technion, Israel, 2Wellman Ctr. for Photomedicine, USA, 3Massachusetts Eye and Ear Infirmary, USA. Using low coherence interferometry, spectrally encoded endoscopy (SEE) is capable of volumetric subsurface reflectance and Doppler imaging. The technique is demonstrated by imaging a variety of samples through miniature fiber optic endoscopic probes.
Bladder Cancer:

Bladder Cancer:

Microendoscopy, Kehrlößer, fluorescence

Combining have

USA. Fluorescence confocal mosaicing detects basal cell carcinomas in 10-20 mm-large Mohs surgical skin excisions within 5-9 minutes, compared to 20-45 minutes for frozen histology. Confocal mosaicing microscopy may enable rapid pathology-at-the-bedside to guide Mohs surgery.

BTuC4 • 12:15 p.m.

High-Resolution Imaging within Tissue by Fiber

Microendoscopy, Timothy J. Muldoon1, Dawn L. Nida1, Mark C. Pierce1, Ann Gillenwater2, Rebecca Richards-Kortum1; 1Rice Univ., USA; 2Univ. of Texas M.D. Anderson Cancer Ctr., USA. A simple and robust fiber bundle endomicroscope can be used for high-resolution contact imaging within living tissue. Combining this technique with molecular imaging strategies enables monitoring of biological systems over time at the subcellular level.

BTuC5 • 10:45 a.m.

Optical Pharmacokinetics Measurement of Photosensitising Drug Concentrations for Photodynamic Therapy, Martin Austwick1, Josephine Woodhams1, Charles A. Mosse1, Caroline Elliot-Laizè1, Vadzim Chalav1, Alexander J. MacRobert1, Irving J. Bigio2, Stephen Bown1; 1Natl. Medical Laser Ctr., UK; 2Dept. of Biomedical Engineering, Boston Univ., USA. Measuring the concentration of a photosensitising drug non-invasively could provide substantial benefits for photodynamic therapy (PDT). ALSiPc tissue levels were assessed from the OP spectra and correlated well with chemical extraction.

BTuC3 • 11:00 a.m.

Longitudinal Monitoring of 4T1-Tumor Physiology in vivo with Doxorubicin Treatment via Diffuse Optical Spectroscopy, Karthik Vishwanath, Hong Yuan, Laura Moore, Janelle Bender, Mark Dewhurst, Nimmi Ramanujam; Duke Univ., USA. A diffuse optical spectrometer was used to monitor 4T1 breast carcinoma tumors implanted in mice. Animals treated with doxorubicin showed relative increased oxygen saturation and decreased blood volume vs. controls, over a 10 day period.

BTuC2 • 10:45 a.m.

Fluorescence Confocal Mosaicing Microscopy of Basal Cell Carcinomas to Potentially Guide Mohs Surgery, Daniel S. Gareau, Billy Huang, Yongbiao Li, Iana Aranda, Kishwer Nehal, Milind Rajadhyaksha; Memorial Sloan-Kettering Cancer Ctr., USA. Fluorescence confocal mosaicing detects basal cell carcinomas in 10-20 mm-large Mohs surgical skin excisions within 5-9 minutes, compared to 20-45 minutes for frozen histology. Confocal mosaicing microscopy may enable rapid pathology-at-the-bedside to guide Mohs surgery.

BTuC • Light for Therapeutics and Diagnostics

Grand Bay Ballroom South
10:30 a.m.–12:30 p.m.

Grand Bay Ballroom South
10:30 a.m.–12:30 p.m.

Light for Therapeutics and Diagnostics
Lothar Lilge; Ontario Cancer Inst., Canada, Presider

Light for Therapeutics and Diagnostics
Lothar Lilge; Ontario Cancer Inst., Canada, Presider

BTuC5 • 11:30 a.m.

Single-Cell Partial Wave Spectroscopic Microscopy, Harirahan Subramanian1, Prabhatkr Pradhan2, Dhananjay Kunte2, Nicholas Deep1, Hemant K. Roy1, Vadim Backman1; 1Northwestern Univ., USA; 2Evansion Northwestern Healthcare, USA. Partial-wave spectroscopic microscopy (PWS) provides unprecedented insights into the nano-architecture of living biological cells. We demonstrate the capability of PWS to diagnose pre-cancerous changes in histologically normal cells far earlier than any existing detection technique.

Novel Polymers for Intraocular Lenses Enabling Photo-

Triggered Drug Delivery, Hee-Chool Kim, Jens Tröger, Daniel Kehrlüser, Julia Liese, Norbert Hampff; Philosoph-Univ. Marburg, Germany. Posterior capsule opacification (PCO) is a common complication of cataract surgery. To address this problem we have developed drug delivery polymers allowing repeated drug release in a non-invasive and controlled manner.

BTuC6 • 11:45 a.m.

Quantifying the Field Effect of Carcinogenesis with Low-Coherence Enhanced Backscattering Spectroscopy (LEBS), Vladimir Turzhitskij1, Young L. Kim1, Prabhatkr Pradhan2, Hemant K. Roy2, Randall E. Brand2, Jay L. Hoogheem1, Michael J. Jung2, Mohammed Jameel2, Nahla Hasabou1, Vadim Backman1; 1Northwestern Univ., USA; 2Evansion-Northwestern Healthcare, USA. We have evaluated LEBS as a tool for detecting the field effect of carcinogenesis in 219 rectal biopsy patients and 86 duodenal biopsy patients and present several LEBS parameters that are potentially diagnostic.
BTuC7 • 12:00 p.m.
An Intraoperative Ratiometric Fluorescence System for in vivo Imaging, Eduardo H. Moriyama, Antony Kim, Arjen Bogaards, Lothar Lilge, Brian C. Wilson; Ontario Cancer Inst., Canada. We have developed a fluorescence imaging system based on the ratiometric correction method designed for in vivo detection of Protoporphyrin IX (PpIX) fluorescence and demonstrated its potential use for detection and visualization of brain tumors.

BTuC8 • 12:15 p.m.
Design and Verification of an Endoscopic Pre-Cancer Detection System Based on Angle-Resolved Low Coherence Interferometry (a/LCI), Yizheng Zhu, Neil G. Terry, William J. Brown, Adam Wax; Dept. of Biomedical Engineering, Duke Univ., USA. This paper presents the design and implementation of a portable endoscopic a/LCI system for clinical pre-cancer detection through accurate sizing of cell nuclei. System performance is evaluated in ex vivo measurements.

12:30 p.m.–1:30 p.m.
Lunch Break

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BTuD • Optical Cancer Diagnostics

Grand Bay Ballroom North
1:30 p.m.–3:30 p.m.
BTuD • Optical Cancer Diagnostics
Urs Utzinger; Univ. of Arizona, USA, Presider

BTuD1 • 1:30 p.m.
Multispectral and Hyperspectral in vivo Imaging of the Oral Cavity for Neoplastic Tissue Detection, Darren M. Rohlcy1, Cristina Kurachi1, Adel El-Naggar1, Michelle D. Williams2, Ann Gillenwater2, Rebecca Richards-Kortum1; 1Rice Univ., USA, 2Univ. of Texas MD Anderson Cancer Ctr., USA. We present results from a pilot clinical trial of 25 patients using narrowband reflectance, polarized reflectance, and fluorescence multispectral as well as fluorescence hyperspectral optical microscopy to aid in the identification of neoplastic oral lesions.

BTuD2 • 1:45 p.m.
Spectroscopic Evaluation of Oral Tissue: The Impact of Anatomy, Sasha McGee1, Jelena Mirkovic1, Vartan Mardrossian2, Alphi Elackattu2, Gregory Grillone2, Zimmern Wang2, Sadru Kabani1, George Gallagher3, Robert Pister4, Luis Galindo1, Chung-Chieh Yu1, Condon Lau1, Ramachandra Dasari2, Michael Feld1; 1MIT, USA, 2Dept. of Otolaryngology, Head and Neck Surgery, Boston Univ. School of Medicine, USA, 3Oral and Maxillofacial Pathology, Boston Univ. Goldman School of Dental Medicine, USA, 4Dept. of Anatomic Pathology, Boston Medical Ctr., USA. We have collected 800 in vivo reflectance and fluorescence spectra from the oral cavity of 82 healthy volunteers. We show that spectroscopy can characterize normal anatomical variation by providing parameters that reflect tissue physical properties.

BTuD3 • 2:00 p.m.
Developing Optical Biomarkers to Characterize the Progression of Barrett’s Esophagus to Pre-Cancer, Nadhi Thekke1, Bertha Valle1, Dipen Maru2, Sharmila Anandasabapathy1, Rebecca Richards-Kortum1; 1Rice Univ., USA, 2Univ. of Texas M D. Anderson Cancer Ctr., USA. Esophageal pre-cancer biomarkers can be optically detected in tissue using confocal microscopy and specific stains. Developing and characterizing these optical biomarkers ex vivo is necessary to be able to detect them in vivo.

BTuD4 • 2:15 p.m.
Hyperoxic/Hypercapnic Gas Inhalation as a Route to Increase Contrast from Tumor Tissue in Near-Infrared Imaging of Breast Tissue, Sanhita Dixit1, Hangoup Kim1, Brendan Visser1, Christopher Comstock1, Gregory Faris1; 1SRI Intl., USA, 2Dept. of Radiology, Univ. of California at San Diego, USA. We explore inhalation protocols to implement hyperoxic/hypercapnic gas inspiration in a clinical setting. These inspired gases could yield sufficient contrast from abnormal tumor vasculature in breast tissue using differential optical imaging in the near infrared.

BTuD5 • 2:30 p.m.
Tumor Angiogenesis of Carcinoma in situ, Early-Stage Invasive and Larger Breast Cancers Imaged by Optical Tomography with Ultrasound Localization, Quing Zhu1, Chen Xu1, Mark Kane1, Yasaman Ardesthinpor1, Laura Mariano1, Nancy Baccaro3, Malini Iyers3, Poornima Hegde3, Susan Tannenbaum1, Scott Kurzman1, Peter Deckers2; 1Univ. of Connecticut, USA, 2Univ. of Connecticut Health Ctr., USA. We present a spectrum of breast-tumor angiogenesis distributions from DCIS, early-stage-invasive cancers to advanced cancers. The complexity of the angiogenesis distributions suggests that intrinsic vascular contrast has a significant clinical role in distinguishing early-stage-invasive cancers.
BTuD6 • 2:45 p.m.
Early Cancer Diagnosis Using Quantitative Spectroscopic Imaging: A Feasibility Study, Condon Lau1, Jelena Mirkovic1, Chung-Chih Yu1, Geoffrey O’Donoghue1, Kamran Badizadegan1, Sasha McGee1, Alphi Elackattu2, Elizabeth Steir2, Gregory Grillon2, Antonio de las Morenas2, Ramachandra Dasari3, Michael Feld1; 1MIT, USA, 2Boston Medical Ctr., USA. We have extended quantitative spectroscopy from a single pixel, contact probe to a wide area, non-contact imaging system. Quantitative Spectroscopic Imaging is used to distinguish high grade from low grade dysplasia and non-dysplastic tissue.

BTuD7 • 3:00 p.m.
Accuracy of in vivo Light Scattering for Detection of HSIL and Cancers of the Cervix, Judith R. Mourant1, Therese J. Boeklage1, Tamara M. Powers1, Alan Waxman2, Megan M. Zsemlye3, Maxine H. Dorin1, Heather M. Greene1, Harriet O. Smith1; 1Los Alamitos Natl. Lab, USA, 2Univ. of New Mexico, USA. In vivo light scattering data have been analyzed for 151 patients. Physiological parameters correlate with light scattering. Sensitivities in the 80’s and specificities in the 60’s were obtained for a disease threshold of HSIL+.

BTuD8 • 3:15 p.m.
In vivo Fluorescence Imaging to Target HER2 Receptor, Moinuddin Hassan, Sang Bong Lee, Jason Riley, Victor Chernomordik, Jack Capala, Amir H. Gandhiakhche; NIH, USA. The goal of our study is to develop a non-invasive optical method for monitoring of HER2 receptor in-vivo and HER2-specific delivery of therapeutic agents to individualize treatment of HER2-positive cancers (breast cancer).

BTuE • Functional Neural Imaging

Grand Bay Ballroom South
1:30 p.m.–3:30 p.m.
BTuE • Functional Neural Imaging
David Boas; Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA, Presider

BTuE1 • 1:30 p.m.
Effect of GABA on Somatosensory Evoked Potentials and Hemodynamic Evoked Responses, Harsha Radhakrishnan, Weicheng Wu, Stefan Carp, David A. Boas, Maria A. Franceschini; Athinoula A. Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA. To investigate the neurovascular coupling, we performed simultaneous diffuse optical imaging and EEG measurements in rats while modulating the neuronal activity by topical infusion of GABA on the brain surface.

BTuE2 • 1:45 p.m.
Analysis of Optical Signals Associated with the Electrical Stimulation of Peripheral Nerves, Debbie K. Chen1, Yunjie Tong1, Angelo Sassaroli1, Jeffrey M. Martin2, Peter R. Bergegon2, Sergio Fantini1; 1Tufts Univ., USA, 2Boston Univ., USA. We report the possible origins of optical responses to electrical stimulation of the median nerve in human subjects. The optical signals are ~0.2% in amplitude, and peak ~100 ms after the 0.1 ms stimulus.

BTuE3 • 2:00 p.m.
Detection of Ca2+-Dependent Neuronal Activity Simultaneously with Dynamic Changes in Cerebral Blood Flow, Blood Volume and Oxygenation in Somatosensory Cortex of the Live Rat Brain, Congwu Du1,2, Zhongchi Luo1,3, Mei Yu1, Helene Benveniste1,2, 1Brookhaven Natl. Lab, USA, 2Dept. of Anesthesiology, SUNY at Stony Brook, USA, 3Dept. of Biomedical Engineering, SUNY at Stony Brook, USA. We present our first in vivo results of simultaneous detection of intracellular calcium transients along with cerebral blood flow, blood volume and tissue oxygenation in rat somatosensory cortex during activation induced by electrical forepaw stimulation.

BTuE4 • 2:15 p.m.
Can Functional Near-Infrared Spectroscopic (fNIRS) Imaging Detect Deception? Fenghua Tian1, Rhonda Dobbs1, Alejandro Del Carmen1, Frank A. Kezel1, Hanli Liu2; 1Dept. of Bioengineering, Univ. of Texas at Arlington, USA, 2Dept. of Criminology and Criminal Justice, Univ. of Texas at Arlington, USA, 3Dept. of Psychiatry, the Univ. of Texas Southwestern Medical Ctr. at Dallas, USA. We report two studies on the capability of fNIRS brain imaging to detect deception. We demonstrate that fNIRS has potential to be a new approach to detect deception that has important applications for homeland society.

BTuE5 • 2:30 p.m.
Optical Stimulation of the Central Nervous System in vitro, Jonathan M. Cayce1, Chris Kao1, Jonathan D. Malphrus1, Peter Konrad2, Duco Jansen1, Anita Mahadevan-Jansen1,2; 1Dept. of Biomedical Engineering, Vanderbilt Univ., USA, 2Dept. of Neurosurgery, Vanderbilt Univ., USA. Optical stimulation in the central nervous system could potentially provide less invasive techniques for procedures involving stimulation of neurons in Neurosurgery. Optical stimulation of the thalamocortical brain slice model indicated a frequency and wavelength dependence.
BTuE6 • 2:45 p.m.
Complete Optical Neurophysiology: Toward Optical Stimulation and Recording of Neural Tissue, Fred A. Wininger, Jennifer L. Schei, David M. Rector; Washington State Univ., USA. Optical methods to stimulate and record neural activity provide artifact free and noncontact neurophysiological procedures. Focused mid-infrared light alters membrane potential and activates individual neural processes; simultaneous intrinsic scattered light changes report neural activity patterns.

BTuE7 • 3:00 p.m.
Non-invasive Optical Detection of Functionally-Stimulated Neural Activity in the limulus Compound Eye, B. Hyle Park1, Chris L. Passaglia2, Johannes F. de Boer; 1Wellman Ctr. for Photomedicine, Massachusetts General Hospital, Harward Medical School, USA, 2Boston Univ., USA. Recent studies have indicated the potential of phase-sensitive interferometry to non-invasively detect transient structural changes that accompany action potential propagation. We present a demonstration of optical detection of functionally-stimulated activity in the limulus compound eye.

BTuE8 • 3:15 p.m.
In vivo Real Time Combined Diffuse Reflectance-OCT Monitoring of Vasoconstriction and Vasodilatation, Alexandre Douplik1,2, D. Morofke1, S. Chiu1, V. Bouchelev1, L. Mao1, V. Yang1, A. Vitkin1; 1Xillix Ltd., Canada, 2Graduate School in Advanced Optical Technology, Univ. Erlangen-Nürnberg, Germany. A combined Diffuse Reflectance Spectroscopy–Optical Coherence Tomography approach was conducted on externalized intact rat gut in vivo during both vasoconstriction and vasodilatation. A reproducible correlation was found between the derived metrics.

St. Petersburg Ballroom
3:30 p.m.–4:00 p.m.
Coffee Break

BTuF • BIOMED Poster Session III

Foyer
4:00 p.m.–6:00 p.m.
BTuF • BIOMED Poster Session III

BTuF1
Novel Polymers for Intraocular Lenses Enabling Photo-Induced Tuning of Focal Length, Jens Tröger, Martin Schraub, Hee-Cheol Kim, Norbert Hampp; Philipps-Univ. Marburg, Germany. We have developed polymers where we can non-invasively induce a change in refractive index which is great enough to be interesting for the concept of in vivo tunable IOL’s by employing a photoinduced cycloaddition reaction.

BTuF2
Erbium:YAG Laser Emulsification of Grade 4+ Porcine and Human Cataracts Using a Germanium Oxide Fiber Probe, Nicholas J. Scott1, Susan R. Trammell1, Nathaniel M. Fried1, Priscila Wittmann2, Ashley K. Behrens2, Alexei Tchapyjnikov3, Ken Levin1, Danh Tran2; 1Univ. of North Carolina at Charlotte, USA, 2Wilmer Eye Inst., Johns Hopkins Hospital, USA, 3Infrared Fiber Systems, USA. Previous studies reported difficulty emulsifying hard cataracts with Erbium:YAG laser. This preliminary ex vivo tissue study demonstrates successful Er:YAG laser emulsification of Grade 4+ cataracts using a germanium oxide / sapphire optical fiber delivery system.

BTuF3
Sampling Fluorescent Drug in Tissue with a Depth Dependent Sensitive Fiber Probe or Interstitial Sampling, Brian W. Pogue, Kristen Larue, W. Sheng, Tim Monahan, Dax Kepshire; Dartmouth College, USA. Fluorescence fiber probes were designed to sample tissue layers or along an implanted fiber track. Pancreas tumor measurements show the high heterogeneity present, and quantify the minimum number of measurements for accurate dosimetry in PDT.

BTuF4
Medium-Power Tissue Ablation Using 1940 nm Thulium Fiber Laser, Vladimir Lemberg, Dmitry D. Rozhetskin, Chris Jadczak; Lumenis Inc., USA. Ablation rate was measured for the laser power output ranging from 2 to 9 W delivered through 50 and 200 μm fibers to three different types of tissue. The slopes of interpolation curves were estimated.

BTuF5
Controlled Injury of the Dermal Collagen in CO2 Microablative Method, Vladimir Lemberg1, Haim Epstein1, 2Lumenis, Inc., USA, 2Lumenis Ltd., Israel. The feasibility of producing controllable injury to dermal collagen by using a novel CO2 laser based microablation method was studied. An ex vivo dose response histological study was performed as well as preliminary clinical testing.

BTuF6
Comparison of the Mie Theory and T-Matrix Methods for Estimating the Size of Cell Nuclei, Michael G. Giacomelli, Kevin J. Chalut; Duke Univ., USA. We investigate the accuracy of inverse light scattering cell nuclei size predictions derived from Mie theory with the T-matrix method over a range of aspherical nuclei relevant to cancer detection and monitoring.
BTuF7  
Modeling Advances for Measuring Spheroidal Geometries Using Angle-Resolved Low Coherence Interferometry,  
Cyrus Amoozegar, Michael G. Giacomelli, Kevin J. Chalut, Adam Wax; Duke Univ., USA. The relative efficacy of a modified Mie theory model and a T-matrix method model in determining the geometry of spheroidal scatterers is determined through comparison of scattering distributions of optical phantoms to these two models.

BTuF8  
Real-Time Blood Monitoring via Coherent Raman Spectroscopy, Arthur Dogariu1, Alexander Goltsov2, Marlan O. Scully1,2; 1Princeton Univ., USA, 2Texas A&M Univ., USA. We demonstrate a real-time method of blood analysis. Using a novel coherent Raman technique we record the vibrational spectrum from picoliters of whole blood in milliseconds. This method will allow real-time, in vivo, blood monitoring.

BTuF9  
Non-Invasive Characterization of Mineralized Silk Films Using Light Scattering, Sharad Gupta, Martin Hunter, David L. Kaplan, Irene Georgakoudi; Tufts Univ., USA. Light scattering spectroscopy is used as a non-invasive technique to characterize mineralization of silk films. Acquired scattering data is analyzed to provide information about the overall content as well as the organization of mineral deposits.

BTuF10  
An Endoscope Compatible Low-Coherence Enhanced Backscattering Spectroscopy Probe for Cancer Screening, Jeremy D. Rogers1, Vladimir M. Turzhitsky2, Nikhil N. Mutyal3, Andrew Gomes1, Alexey Kromin4, Vadim Backman5; 1Northwestern Univ., USA, 2Optical Sciences Ctr., USA. Low-coherence Enhanced Backscattering Spectroscopy (LEBS), an angular resolved spectroscopic technique developed by our group, has been shown to detect early forms of cancer. Here, we implement the technique in an endoscope compatible probe.

BTuF11  
Quantifying Microarchitectural and Light Scattering Differences between Tumorigenic and Non-Tumorigenic Cell Models of Tissue: Analysis with Unified Mie and Fractal Model, Min Xu; Dept. of Physics, Fairfield Univ., USA. Microarchitectural differences between tumorigenic and non-tumorigenic cell models of tissue are quantified by unified Mie and fractal analysis of polarized light scattering spectroscopy. Differentiation based on their resulting different light scattering characteristics is discussed.

BTuF12  
Concentric Sphere Mie Theory Model: Applications to Nanoshell Spectra Prediction and Design of Anti-Reflection Coatings for Optical Traps, Ying Hu1, Timo A. Nieminen1, Lissett R. Bickford1, Rebekah A. Drezek1; 1Rice Univ., USA, 2Ctr. for Biophotonics and Laser Science, School of Physical Sciences, Univ. of Queensland, Australia. We develop a Lorenz-Mie solution for multilayer concentric spheres and present two separate studies on evaluating nanoshell spectra and anti-reflection coatings for improved optical trapping.

BTuF13  
Simulations of Light Scattering from B-Cells with Inhomogeneous Nuclei Using a Improved FDTD Program, R. Scott Brock1, Xin-Hua Hu1, Douglas A. Weidner1, Judith R. Mournant2, Jun Q. Lu1; 1East Carolina Univ., USA, 2Los Alamos Natl. Lab, USA. We have significantly improved the accuracy and efficiency of a previously developed parallel FDTD program by including correction for numerical dispersion. The updated program is used to investigate the effect of inhomogeneous nuclei in B-cells.

BTuF14  
Analysis of Particle Size Distributions from Spectral Reflectance Measurements on Small Tissue Volumes, Roberto Reif1, Yakov Gitin2, Eladio Rodriguez-Diaz2, Chris Atkinson2, Ousama A’Amar3, Satish K. Singh4, Irving J. Bigio5; 1Boston Univ., USA, 2Boston Medical Ctr., USA. Mie theory has been used to describe the reduced scattering coefficient from a model that extracts optical properties from a reflectance spectrum. Preliminary results are presented from normal and inflamed colon mucosa.

BTuF15  
High-Throughput, Multiplex Aperture-Coded Raman Spectrometer for Biomedical Diagnostics, Christy A. Fernandez1, S. Lim1, Bobby D. Guenther1, David J. Brady1, Scott T. McCain2; 1Duke Univ., USA, 2Blue Angel Optics, USA. Over the past couple of years, we have developed an aperture coded Raman spectrometer whose performance is optimized for extended, incoherent sources. We describe results conveying the potential for in vivo biomedical diagnostics.

BTuF16  
Comparison of Tumor and Healthy Tissues Using Raman Spectroscopy, Aisha Hilliard4, Paula Magee3, Jafar G. Naeini4, Tim Kate4; 1Winston-Salem State Univ., USA, 2Wake Forest Univ., USA, 3Princeton Univ., USA. Raman-scapring measurements of tumor and healthy tissues are reported. The ratio of peak-intensity at 860cm⁻¹ and 1300cm⁻¹ increases from 0.37±0.01 (healthy tissue) to 0.51±0.01 (malignant tissue), consistent with pathological criterion of nucleus-to-cytoplasm ratio increase for infiltrating carcinoma.
BTuF17
Measurement of Skin Texture through Polarization Imaging, Paulo R. Bargo, Nikiforos Kollias; Johnson & Johnson Consumer Products Co., USA. Polarization imaging was used to determine skin texture/roughness. The imaging setup used wide illumination angles and co-polarized imaging to enhance surface texture. The system was used to evaluate skin texture as a function of age.

BTuF18
Depth-Sensitive Spectroscopic Measurements of Patients with Oral Mucosal Lesions, Richard A. Schwartz1, Wen Gao1, Crystal E. Weber1, Rebecca Richards-Kortum4, Ann M. Gillenwater2; 1Rice Univ., USA, 2Univ. of Texas M.D. Anderson Cancer Ctr., USA. Spectroscopic measurements of 58 patients with oral mucosal lesions are presented and compared with histopathology. The performance of a depth-sensitive fiber optic probe that enables preferential interrogation of epithelial and stromal regions is evaluated.

BTuF19
Early Detection of Rheumatoid Arthritis in Humans by Fluorescence Imaging, Bernd Ebert1, Jörg Berger1, Jan Voigt1, Rainer Macdonald2, Thomas Fischer2, Kai Licha1, Michael Schirner1; 1Physikalisches-Technische Bundesanstalt, Germany, 2Dept. of Radiology, Charite Campus Mitte, Medizinische Fakultät der Humboldt Univ. zu Berlin, Germany. The agent indo-cyanine green has been investigated for early detection of rheumatoid arthritis using fluorescence imaging. Different distributions of fluorescence intensity are found for healthy and inflamed finger joints after injection of an ICG bolus.

BTuF20
In vivo Reperfusion Dynamics of Autofluorescence during Prolonged Renal Warm Ischemia for Early Prediction of Tissue Function and Ability to Recover, Rajesh N. Raman1, Christopher D. Pivetti2, Dennis L. Matthews3, Christoph Troppmann2, Stauros G. Demos1, 2; 1Univ. of California at Davis, Dept. of Applied Sciences, USA, 2Univ. of California at Davis Medical Ctr., Dept. of Surgery, USA, 3Lawrence Livermore Natl. Lab, USA, 4Univ. of California at Davis Medical Ctr., Dept. of Urology, USA. Autofluorescence dynamics of kidneys in situ in response to different durations of prolonged ischemia is characterized in rats using a relaxation model. Relaxation times increased with injury time and are compared to post-operative survival outcome.

BTuF21
Statistical Analysis of Spatial Extent of Hemoglobin-Concentration Change in Exposed Cortex Measured by Multi-Spectral Imaging, Kaichiro Sakauchi1, Shunsuke Furukawa1, Eiji Okada1, Takushige Katsura2, Kyoko Yamazaki2, Hideo Kazuguchi1, Atsushi Makii1; 1Dept. of Electronics and Electrical Engineering, Keio Univ., Japan, 2Advanced Res. Lab, Hitachi Ltd., Japan. The spatial extents of the concentration changes in hemoglobin caused by brain activation are investigated by an ANOVA-test. The wavelength dependence of the optical path length affects the spatial extents of the hemoglobin concentrations.

BTuF22
Factors Influencing the Accuracy of Determining Tissue Physiology Quantitatively Using Optical Spectroscopy, Janelle E. Bender, Laura K. Moore, Karthik Visheanath, Nirmala Ramanujam; Duke Univ., USA. The accuracy of quantifying optical properties using optical spectroscopy and a Monte Carlo model of light transport was assessed. We show accurate extractions from single and multi-absorber phantoms, independent of probe and instrument.

BTuF23
Lookup Table-Based Inverse Model for Determining Tissue Optical Properties, Narasimhan Rajaram, James W. Tunnell; Dept. of Biomedical Engineering, The Univ. of Texas at Austin, USA. We present a lookup table based-inverse model for determining tissue optical properties from steady-state diffuse reflectance spectra that is valid for fiber-based probe geometries with close source-detector separations and tissues with low albedos.

BTuF24
Probe Contact Pressure Effects on in vivo Diffuse Reflectance and Fluorescence Spectroscopy, Yalin Ti, Wei-Chiang Lin; Florida Intl. Univ., USA. The effects of probe contact pressure on in vivo diffuse reflectance and fluorescence spectroscopy was investigated. Spectral alterations induced by contact probe pressure and the minimal pressure required to induce such effects are reported here.

BTuF25
Diffuse Optical Reflectance Image in Skeletal Muscle, Gang Yao, Janaka Ramasinghesagara; Univ. of Missouri-Columbia, USA. We studied the diffuse reflectance images in skeletal muscles. Our results suggested that sarcomere structures played important roles in modulating light propagation in whole muscle and were responsible for the unique reflectance patterns observed.
BTuF26
Noninvasive Determination of Optical Parameters from One Reflectance Image and Extension to Depth-Resolving, Cheng Chen, Jun Q. Lu, Kenneth M. Jacobs, Xin H. Hu; East Carolina Univ., USA. The problem of determining optical parameters from one reflectance image has been solved for homogeneous tissue phantoms within the radiative transfer theory. We further extend this method for depth-resolving in heterogeneous phantoms of pigmented lesions.

BTuF27
Imaging of Laser-Excited Autofluorescence Fading Rates: Novel Technique for Tissue Surface Structure Studies, Janis Spigulis, Alexey Lihachev, Renars Eirts; Univ. of Latvia, Latvia. Experimental methodology for imaging of laser-excited tissue autofluorescence fading rates has been developed and clinically tested. Details of the equipment and image processing are described, along with measurement results confirming feasibility of the novel technology.

BTuF28
Optimal Filters for Recovery of Object Model Parameters from Optical Images, Iain Styles; Univ. of Birmingham, UK. We describe a procedure for selecting optimal filters that can be used in conjunction with an appropriate model to obtain parameters describing the composition of an object from optical images.

BTuF29
Optical Properties of Rat Heads Measured by the Diffuse Reflectance Method over 1 Micrometer, Goro Nishimura, Mamoru Tamura; Hokkaido Univ., Japan. Time-of-flight measurements over 1 micrometer wavelength using a Streak camera system monitor the optical parameters of rat heads. With respect to the hemodynamic change, the temporal response function was essentially not affected.

BTuF30
Electrical and Metabolic Imaging of Cardiac Ischemia, Matthew B. Bouchard1, Sean A. Burgess1, Philip Moussazadeh2, Andrew J. Radosевич1, Joseph P. Wuskell1, Leslie M. Loev1, Arkady Pertsov1, Elizabeth M. C. Hillman1; 1Lab for Functional Optical Imaging, Dept. of Biomedical Engineering, Columbia Univ., USA, 2Univ. of Connecticut Health Ctr., Richard D. Berlin Ctr. for Cell Analysis and Modeling, USA, 3Dept. of Pharmacology, State Univ. of New York, Upstate Medical Univ., USA. A high-speed CCD camera-based imaging system employing frequency modulated multi-spectral illumination sources is under development to image intrinsic and exogenous fluorophores. The system will be used to investigate electrical and metabolic function during cardiac ischemia.

BTuF31
Quantitative Imaging of Platelet Aggregation in a Microchannel Using an Interfacial Collision Reactor, Taisuke Hirono1,2, Shinpei Okawa1, Yukio Yamada1; 1Univ. of Electro-Communications, Japan, 2Kowa Co., Ltd., Japan. We have developed an interfacial collision reactor which enables biochemical reaction between solid biological cells and liquid reagent in a laminar micro flow. Applying this technique, quantitative imaging of platelet aggregation was succeeded and assessed.

BTuF32
Development of a New Sensitive and Rapid Detection Method of Specific DNA Sequences, Amos Danielli1, Ady Arie1, Noga Porat1, Marcelo Erlich1; 1Tel-Aviv Univ., Israel, 2Univ. of Illinois, USA. Sensitive detection of DNA sequences is experimentally demonstrated by attaching magnetic beads to fluorescent-labeled DNA probes and applying alternating magnetic field gradient. This enables elimination of the scattering noise from the solution by synchronous detection.

BTuF33
Transient Fluorescence Spectroscopy Applied to Lifetime Studies of DPA-Tb as Related to Bacterial Spores, Anali Makoui, Dennis K. Killinger; Univ. of South Florida, USA. The fluorescence lifetimes of the individual emission lines of the DPA-Tb complex have been measured in different solvents using a new technique, Transient Fluorescence Spectroscopy (TFS).

BTuF34
Integrated Raman and Angular-Scatter Microscopy (IRAM), Andrew J. Berger, Zachary J. Smith; Inst. of Optics, Univ. of Rochester, USA. Raman spectroscopy studies a target chemically, while angularly-resolved elastic light scattering probes morphology. We have combined these modalities on a microscopic platform. The optical system and data from beads and immune cells are discussed.

BTuF35
Monitoring Hemodynamic Changes in Preterm Infants Using Optical Spectroscopies and Doppler Ultrasound, Erin M. Buckley, Moeri N. Kim, Turgut Durduran, Guoqiang Yu, Regine Choe, Chao Zhou, Susan Shultz, Chandra M. Sehgal, Daniel J. Licht, Peter H. Arger, Hallam H. Hurt, Noah M. Cook, Arjun G. Yodh; Univ. of Pennsylvania, USA. Diffuse correlation and optical spectroscopies are used to monitor cerebral blood flow and oxygenation in premature infants during changes in angular head-of-bed position. Subsequent transcranial Doppler ultrasound measurements corroborate our findings.
BTuF36
Combined NIRS and EEG Studies and the Development of a Novel Reconstruction Software for Optical Tomography, Tommy N. Noponen1, Tiina Näsä1, Petri Hiltunen1, Jaakko Virtanen2, Kalle Kotilahti3, Lauri Lipiäinen2, Pekka Meriläinen3; 1Turku PET Ctr., Turku Univ., Central Hospital, Finland, 2Lab of Biomedical Engineering, Helsinki Univ. of Technology, Finland. This paper summarizes some of the latest progress in near-infrared spectroscopy (NIRS) and optical tomography research at Helsinki University of Technology and briefly describes the main results of three works carried out recently.

BTuF37
Two-Photon Luminescence Imaging Using Gold Nanorods as Bright Contrast Agents, Nicholas J. Durr1, Benjamin A. Holfeld2, Timothy Larson1, Danielle K. Smith1, Brian A. Korgel1, Konstantin Sokolov1,2, Adela Ben-Yakar1; 1Univ. of Texas at Austin, USA, 2Univ. of Texas M.D. Anderson Cancer Ctr., USA. Gold nanorods were used as molecularly targeted contrast agents for two-photon luminescence imaging of cancer cells 160 microns inside a tissue phantom. Nanorod labeled cells exhibit three orders of magnitude brighter signal than unlabeled cells.

BTuF38
Single- and Two-Photon Excited Autofluorescence of Epithelial Tissue, Wei Zheng, Dong Li, Yieong Wu, Jianan Qu; Hong Kong Univ. of Science and Technology, China. Single-and two-photon excited fluorescence spectra were measured at the same location in tissue. The results revealed that TPF and SPF signals are different and TPF signal provides more accurate information on tissue morphology.

BTuF39
Dynamic Imaging of Collagen Remodeling during Angiogenesis, Nathaniel D. Kirkpatrick, Stylianos Andrew, James Haying, Urs Utzinger1,2; 1Dept. of Biomedical Engineering, Univ. of Arizona, USA, 2Dept. of Electrical and Computer Engineering, Univ. of Arizona, USA, 3Cardiovascular Innovation Inst., Univ. of Louisville, USA. Based on analysis of SHG from fibrillar collagen and 2PEF as well as coherent transmitted light from vascular cells, angiogenic sprouts and growing neovessels actively and differentially remodel existing collagen fibrils.

BTuF40
In vivo Assessment of Microvascular Blood Content in the Rectal Mucosa Using Polarization-Gated Spectroscopy: Applications for Colon Cancer Screening, Andrew J. Gomes1, Young Kim2, Vladimir Turzhitsky2, Jeremy Rogers1, Vadim Backman1; 1Northwestern Univ., USA, 2Purdue Univ., USA. Our group has developed a polarization-gated spectroscopy probe capable of interrogation of the colonic microvascular blood content. A human pilot study demonstrated that the rectal blood content is elevated in the presence of colonic neoplasia.

BTuF41
Optical Characterization of Myocardial Infarction: An in vivo Study, Yalin Ti, Wei-Chiang Lin; Florida Intl. Univ., USA. The effects of myocardial infarction on in vivo diffuse reflectance and fluorescence characteristics of myocardial tissue were investigated. Spectral alterations induced by infarct development in myocardial tissue are reported.

BTuF42
Lesion Thickness Assessment Using a Fiber Optic Probe, Bevin Lin1, Dennis L. Matthews1,2, Shiva Sharareh1, Stavros G. Demos1,2; 1Ctr. for Biophotons, Univ. of California at Davis, USA, 2Lawrence Livermore Natl. Lab, USA, 3Biosense Webster Inc., USA. Dual fiber spectroscopy explores NIR light scattering to assess cardiac tissue lesion formation during RF tissue ablation. This feasibility study demonstrates optical spectroscopy potential to address conditions that remain poorly controlled in current clinical practice.

BTuF43
Optical Reflectance Spectroscopy for Detection of Renal Cell Carcinoma Using Model-Driven Analysis, Aditya V. Mathker1, Dheerendra Kashyap1, Dishan L. Peswani1, Karim Bensalah2, Wareef Kabbani1, Altug Tuncel1, Jeffrey Cadeddu2, Hanli Liu1; 1Univ. of Texas at Arlington, USA, 2Univ. of Texas Southwestern Medical Ctr. at Dallas, USA. We have developed an effective new methodology using short-separation, optical reflectance spectroscopy to differentiate between normal tissue and renal cell carcinoma and also between benign and malignant carcinoma using reflectance model-driven analysis.

BTuF44
Feasibility of Detecting Prostate Adenocarcinoma Using Optical Reflectance Spectroscopy, Dishan L. Peswani1, Aditya Mathker1, Dheerendra Kashyap1, Karim Bensalah1, Wareef Kabbani1, Jung Hun Oh1, Jeffrey Cadeddu1, Jean Gao1, Hanli Liu1; 1Univ. of Texas at Arlington, USA, 2Univ. of Texas Southwestern Medical Ctr. at Dallas, USA. We introduce a novel application of optical reflectance spectroscopy to detect positive surgical margins for prostate adenocarcinoma during laparoscopic prostatectomy to monitor hemodynamic and light scattering changes.
BTuF45
Monte Carlo Model of Stricture Formation in Esophageal Photodynamic Therapy, Norris W. Preger1, Linda R. Jones1, Daryl Reynolds1, Herbert C. Wolfsem1, Michael B. Wallace1; 1College of Charleston, USA, 2Div. of Gastroenterology and Hepatology, Mayo Clinic, USA. A Monte Carlo simulation was developed for esophageal PDT. It was tested on a photosensitized pig esophagus model and compared to a published account of stricture formation in pigs. The simulation correctly predicted the damage.

BTuF46
Raman Spectroscopy: Potential for Detecting Tissue Coagulation during Laser Therapy, Matthew Rodrigues1, Robert Weersink1, William Whelani1, 1Ryerson Univ., Canada, 2Ontario Cancer Inst., Photonics Res. Ontario, Princess Margaret Hospital, Canada, 3Univ. of Prince Edward Island, Canada. Raman spectra of bovine muscle and albumen tumors were acquired before and after laser heating. Results demonstrate that Raman spectroscopy is sensitive to changes occurring in tissues during heating, indicating potential for monitoring thermal therapies.

BTuF47
Colposcopy Based on 3-D Imaging and Motion Tracking, Tao T. Wu, Jianan Y. Qu; Dept. of Electronic and Computer Engineering, Hong Kong Univ. of Science and Technology, China. A colposcopic optical imaging system is built to measure the 3-D surface topology of cervix and track the motion of patient. The imaging system can potentially improve the accuracy of colposcopic diagnosis of cervical cancer.

BTuF48
Compact Polarization Camera with Liquid-Crystal Retarder for Patterning of Biological Textures, Alexander P. Sviridov1,2, Zachary Ulisii2, Victor Chernomordik2, Moinuddin Hassan2, Albert C. Boccaro1, Amir Gandjakhchir2; Inst. for Laser and Information Technologies of Russian Acad. of Sciences, Russian Federation, 2Nat. Inst. of Health, USA, 3Ecole Superieure de Physique et de Chimie Industrielle de Paris (ESPCI), France. The designed camera allows illumination with polarized light and consequently capturing two orthogonally polarized images using liquid crystal retarder and polarizer. Real time mapping of polarization degree and correlation coefficient were built into image processing.

BTuF49
Intraoperative Delineation of Nonmelanoma Skin Cancers: An in vivo Pilot Trial, Anna N. Yaroslavsky1, Munir Al-Arashi1, Elena Salomatinia1, Andrew Nelson1, Victor A. Neel1; 1Harvard Medical School, USA, 2Massachusetts General Hospital, USA. This pilot clinical trial in the Mohs environment demonstrates that multi-spectral polarization reflectance and fluorescence imaging enables intraoperative guidance of nonmelanoma skin cancer treatments.

BTuF50
A Marker of Accumulation of Elastin Cross-Links in Facial Skin Based on Blue Fluorescence Imaging, Gabriela Oana Cula, Paulo R. Bargo, Sheng-Hao Tseng, Nikiforos Kollias; Johnson and Johnson, USA. Blue-excited fluorescence imaging is used to study solar elastosis. We find that blue fluorescence increases with age. This trend correlates well with the accumulation of elastotic material in skin due to natural aging and photoaging.

BTuF51
A Novel Confocal System to Provide High Precision Non-Contact Measurements of Optical Media Applied to the Human Eye, Austen Hearn1, Robin Taylor1, Richard Holley1, Tony Wilson1; 1Lein Applied Diagnostics Ltd., UK, 2Dept. of Engineering Science, Univ. of Oxford, UK. There are few affordable devices for the non-contact measurement of corneal thickness. This paper introduces a low cost instrument capable of measuring the position of interfaces within the human eye with micron level precision.

BTuF52
Characterization of a Multiphoton Endomicroscope, Heejin Choi, Shih-Chi Chen, Martin L. Culppeam, Peter T.C. So; MIT, USA. A multiphoton endomicroscope features a double clad photonic crystal fiber for light delivery and collection. Two thermally driven actuators and fiber resonator in its distal end provide three axis raster scanning.

BTuF53
A Novel High-Throughput Scanning Microscope for Label-Free Detection of Protein and Small-Molecule Chemical Microarrays, Y. Y. Fei, Xiangdong Zhu, J. P. Landry, Y. S. Sun, X. B. Wang, J. T. Liu, K. S. Lam; Univ. of California at Davis, USA. We describe a novel scanning optical microscope that enables high-throughput label-free detection of end-points and kinetics of multiple biomolecular reactions on microarrays with more than 10,000 protein or small-molecule targets.

BTuF54
Morphological Feature Quantification of Colonic Crypt Pattern Using Microwave Integrated OCT Scanner, Xin Qi, Yinseng Pan, Zhihun Hu, Wei Kang, Michael V. Sivak, Andrew M. Rollins; Case Western Reserve Univ., USA. There is a close correlation between colonic crypt morphological patterns and histopathological diagnosis. We have conducted an in vitro colonic tissue study to quantify the morphological features of crypts using our microwave-integrated OCT scanner.
BTuF55
A Miniature Optical Device for Noninvasive, Fast Characterization of Tumor Pathology, Justin Y. Lo¹, Bing Yu¹, Gregory M. Palmer¹, Thomas F. Kuech², Nirmala Ramanujam²; ¹Duke Univ., USA, ²Univ. of Wisconsin at Madison, USA. An optical spectroscopy system for cancer diagnostics is miniaturized. The performance of the device is validated with phantom studies. Absorption and scattering coefficients are extracted with high accuracy with an inverse Monte Carlo model.

BTuF56
FPGA-Based Electronics for Confocal Line-Scanners with Linear Detector Arrays, Sanjewa Abytunuge, Ricardo Toledo-Crow, Milind Rajadhyaksha; Memorial Sloan-Kettering Cancer Ctr., USA. Linear detector arrays are conveniently driven by FPGA-based electronics and enable simple line-scanning confocal microscope configurations. Their responsibility and signal-to-noise ratio for reflectance line-scanning is comparable to that of standard APD detectors for point-scanning.

BTuF57
Fluorescence Endomicroscopy with Out-of-Focus Background Rejection, Nenad Bozinovic, Cathie Ventalon, Timothy Ford, Jerome Mertz; Boston Univ., USA. We present a novel fluorescence endomicroscope that provides out-of-focus background rejection. Our technique is based on structured and speckled laser illumination.

BTuF58
Integrated Surface Acquisition for Hand-Held Probes, Thomas Wendler¹, Irène Faure de Papeyre³, Tobias Lasser¹, Nassir Navab¹; ¹Computer Aided Medical Procedures (CAMP), TUM, Germany, ²Ecole Supérieure d’Electricité, France. Tracked handheld probes were recently introduced in intra-operative functional imaging, where a priori information on the surface is often helpful. An integrated system for simultaneous acquisition of surface and functional information is described and evaluated.

BTuF59
Optically Controlled Droplet Adhesion and Coalescence: A New and Versatile Microfluidic Technique, Sanhita Dixit, Gregory Faris; SRI Intl., USA. We report on a new technique to control nanoliter aqueous droplet adhesion and coalescence. The thermal Marangoni effect is used to drive droplet motion. Surface-active molecules are used to form adhering boundaries between drops.

BTuF60
Assessment of Second Harmonic Properties of Tumor Collagen: Determining the Structural Relationship between Reactive Stroma and Healthy Stroma, Xiaoxing Han¹, Ryan M. Burke⁵, Edward B. Brown⁵; ¹Inst. of Optics, Univ. of Rochester, USA, ²Dept. of Biomedical Engineering, Univ. of Rochester, USA. We utilize the polarization and directionality of second harmonic generation to determine structural relationships between fibrillar collagen in mouse mammary tumor models and the healthy mammary fat pad.

BTuF61
In vivo Second-Harmonic-Generation Imaging of Dermal Collagen Fiber Using a Mode-Locked Cr:Forsterite Laser, Takeshi Yasui, Yu Takahashi, Tsutomu Araki; Osaka Univ., Japan. We applied a mode-locked Cr:Forsterite laser with a center wavelength of 1250 nm for second-harmonic-generation (SHG) imaging to increase a probing depth, and demonstrated optical-sectioning SHG imaging of dermal collagen fiber.

BTuF62
Femtolaser Precision Photodestruction of Collagen Fibers, Vladimir A. Hochamisyanyan, Wen Lo, Chen Yuan Dong; Dept. of Physics, Natl. Taiwan Univ., Taiwan. Non-ablative, non-thermal destruction of collagen fiber by femtosecond Ti:Sa laser was revealed. Irreversible increase in twophoton-autofluorescence and decrease in SHG intensities were recorded using multiphoton imaging. Controllable photomodification of collagen fibers in biotissues was demonstrated.

BTuF63
High-Speed en face Scanning Optical Coherence Microscopy, Linbo Liu, Nanguang Chen, Colin Sheppard; Natl. Univ. of Singapore, Singapore. A high-speed, high-efficiency, high-duty-cycle, path-length maintaining and linear beam scanner is proposed for en face scanning optical coherence microscopy, which provides a line rate up to 3 kHz, ±1.8° scanning range and 90% duty cycle.

BTuF64
Blood Vessel 3-D Imaging Using Electronically Controlled Optics Lens-Based Confocal Microscopy, Mubtaz Sheikh, Nabeel A. Riza; College of Optics, CREOL, Univ. of Central Florida, USA. A commercial confocal microscope WITec AlphaSNOM is modified by including a sample path electronically controlled lens to achieve no-moving parts axial scanning microscopy. Shown are three dimensional imaging results of a blood vessel.
BTuF65
Confocal Fluorescence Imaging to Detect the Drug-Induced Abnormality of Intracellular Ca²⁺ in Rat Brain, Rubin Pan¹, Jiong Chen¹, Anat Biegon¹, Jasbeer Dhawan¹, Yingtian Pan¹, Congwu Du³,⁴; ¹Education Program of Brookhaven Natl. Lab, USA, ²Dept. of Biomedical Engineering, SUNY at Stony Brook, USA, ³Medical Dept., Brookhaven Natl. Lab, USA, ⁴Dept. of Anesthesiology, SUNY at Stony Brook, USA. We have demonstrated a microscopic method of measuring intracellular calcium ([Ca²⁺]) in the brain using the fluorescence calcium indicator Rhod2 to characterize cocaine-induced abnormality of the brain [Ca²⁺] with cellular morphological visualization.

BTuF66
Engineering of a Line-Scanning Confocal Microscope toward Imaging Epithelial Tissues, Daniel S. Gareau, Sanjee Abeytunge, Milind Rajadhyaksha; Memorial Sloan-Kettering Cancer Ctr., USA. A confocal reflectance line-scanning microscope provides optical sectioning of 1.4 μm and shows promise to image nuclear and cellular detail in human tissues. Line-scanning may be a simpler alternative to point-scanning for imaging epithelial tissues.

BTuF67
Fluorescence Tomography with the Frequency Domain Equation of Radiative Transfer, Alexander D. Klose, Hyun K. Kim, Andreas H. Hielscher; Columbia Univ., USA. We have developed an image reconstruction algorithm for fluorescence tomography based on the frequency domain equation of radiative transfer. Transport properties of tissue become significant when strong light absorption is encountered in small animal tissue.
• Wednesday, March 19, 2008 •

Conference Registration
7:00 a.m.–6:00 p.m.
Registration Open

Grand Bay Ballroom North and South
7:30 a.m.–10:00 a.m.
BWA • Plenary IV: Molecular Imaging and Therapeutics
Rebekah Drezek; Rice Univ., USA, Presider

BWA1 • 7:30 a.m.  Tutorial
Optical Technologies for Early GI Cancer Detection: Many Ways to Skin a Cat? Brian C. Wilson; Univ. of Toronto, Canada,
The detection of early cancer in the colon and esophagus are critical to successful treatment. Many endoscopic imaging and spectroscopic techniques have been investigated, with varying results. The challenges have driven many biophotonics advances.

BWA2 • 8:15 a.m.  Invited
Fluorescence Imaging and Spectroscopy for Oral Cancer Detection, Ann M. Gillenwater; Univ. of Texas MD Anderson Cancer Ctr., USA. We present results demonstrating how depth-resolved fluorescence and reflectance spectroscopy can non-invasively and objectively discriminate between normal and neoplastic oral mucosa with improved sensitivity and specificity, and describe their implications for improved oral cancer screening.

BWA3 • 8:45 a.m.  Invited
Multifunctional QDs for Molecular Imaging and siRNA Delivery, Xiaohu Gao; Univ. of Washington, USA. In this talk, I present a recent development of multifunctional quantum dots for ultrasensitive detections, molecular imaging and traceable drug delivery.

BWA4 • 9:15 a.m.  Invited
Effects of Low Intensity Laser Light on Wound Healing in the Rat, Ethne L. Nussbaum, Tony Mazzulli, Kenneth P. H. Pritzker, Facundo Las Heras, Lothar Lilge; Univ. of Toronto, Canada. Biomodulation of bacteria is a potential effect of exposing wounds to laser light, dependent upon wavelength and radiant exposure. Significant reduction in normal flora or increased presence of pathogenic bacteria in wounds can delay healing.

St. Petersburg Ballroom
10:00 a.m.–4:00 p.m.
Exhibits Open

BWB • Optical Therapeutics

Grand Bay Ballroom North
10:30 a.m.–12:30 p.m.
BWB • Optical Therapeutics
Seokkyung Lee; Physical Sciences Inc., USA, Presider

BWB1 • 10:30 a.m.  Tutorial
Developing Conformal Therapy Treatment Planning for Photodynamic Therapy, Lothar Lilge1,2, Augusto Rendon1,2; 1Ontario Cancer Inst., Canada, 2Univ. of Toronto, Canada. Photodynamic Therapy undergoes currently a renaissance as treatment modality for solid tumors, which is due to novel photosensitizers absorbing beyond 700nm and the application of treatment planning concepts from ionizing radiation therapy.

BWB2 • 11:15 a.m.  Invited
To Be Announced, Jean-Claude Kieffer; INRS Énergie, Matériaux et Télécommunications, Canada. Abstract not available.

BWB3 • 11:45 a.m.
Multi-Modality Optical Imaging of Vascular Responses to Photodynamic Therapy in Mouse Window Chamber Model, Mantu Khurana1, Hazel A. Collins2, Eduardo H. Moriyama3, Adrian Mariampillai1, Harry L. Anderson2, Brian C. Wilson1; 1Ontario Cancer Inst., Univ. of Toronto, Canada, 2Univ. of Oxford, UK. We demonstrate multi-modal optical imaging in a window-chamber vascular model to investigate the response to photodynamic therapy using novel photosensitizers with high 2-photon cross-section, and show that (micro)vessel closure is feasible at clinically-realistic doses.

BWB4 • 12:00 p.m.
Use of Magnetic Fields to Probe and Alter Photodynamic Processes in Photosensitizers, Ozzy Mermut1, Jean-Pierre Bouchard2, Jean-Francois Cormier1, Patrice Desroches1, Michel Fortin1, Pascal Gallant1, Sébastien Leclair1, Isabelle Noisieux1, Marcia L. Vernon1, Kevyn R. Diamond2, Michael S. Patterson2; 1INO (Natl. Optics Inst.), Canada, 2Juravinski Cancer Ctr., Canada. Spin states of Type I photosensitizer radicals are perturbed using weak magnetic fields (~200mT) to affect their luminescence, measured using time-domain photon counting. Magneto-photosensitization effects on photodynamic pathways in liposome cell phantoms are examined.
BWC5 • 12:15 p.m.
Three-Dimensional Mapping of Photosensitizer Distribution for Interstitial Photodynamic Therapy
Dosimetry, Johan Axelsson¹, Ann Johansson¹, Johannes Swartling², Stefan Andersson-Engels³; ¹Dept. of Physics, Lund Univ., Sweden, ²SpectraCure AB, Sweden. A reconstruction scheme is adopted for retrieval of photosensitizer concentration in human prostate. The scheme utilizes interstitially positioned optical fibers. Results, based on modeled data, indicate potential for homogeneous and heterogeneous photosensitizer distribution reconstruction.

Grand Bay Ballroom South
10:30 a.m.–12:30 p.m.
BWC • Techniques for Functional Neural Imaging
David Rector; Washington State Univ., USA, Presider

BWC1 • 10:30 a.m.
Multiphoton Fluorescence Lifetime Imaging of NADH in Epileptic Rat Brain Tissue Reveals Metabolic Abnormalities, Thomas H. Chiu, Anne Williamson, Michael J. Levene; Yale Univ., USA. Abnormal neuronal-astrocytic metabolic coupling is hypothesized in temporal lobe epilepsy. FLIM of hippocampus from rodent epilepsy models demonstrates abnormalities in the distribution of bound and unbound NADH in response to stimulation, indicating underlying metabolic pathology.

BWC2 • 10:45 a.m.
Combining Laser Doppler Speckle Contrast Imaging and Optical Coherence Tomography for Quantitative Imaging of Cortical Blood Flow in Rat Brain, Zhongchi Luo¹–², Zhenguo Wang¹, Zhihua Yuan¹, Congwu Du², Yingtian Pan¹; ¹Dept. of Biomedical Engineering, Stony Brook Univ., USA, ²Medical Dept., Brookhaven Natl. Lab, USA, ³Dept. of Anesthesiology, Stony Brook Univ., USA. We quantify the relative flow mapping of laser Doppler speckle contrast imaging with frequency-domain optical coherence Doppler tomography by calibrating co-registered cerebral arterioal/arterial blood flow changes such as induced by cocaine challenge.

BWC3 • 11:00 a.m.
The Effect of Methylphenidate on Brain Hemodynamics of Attention-Deficit/Hyperactivity Disorder Measured by Functional Near Infrared Spectroscopy, Nermin Topaloğlu², Ercan Kara¹, Esin Karahan³, Sinem Burcu Erdoğan¹, Sinem Saraç¹, Özgün Öner³, Bedriye Öncel³, Kerim Münir³, Koray Çiçic³, Ata Akin¹; ¹Inst. of Biomedical Engineering, Bogazici Univ., Turkey, ²Dept. of Child Psychiatry, SB Diskapi Children’s Hospital, Turkey, ³Dept. of Psychiatry, Ankara Univ. School of Medicine, Turkey, ⁴Inst. of Biomedical Engineering, Stony Brook Univ., USA. Fifteen ADHD adults were evaluated with fNIRS during Stroop task. The aim was to examine methylphenidate-induced hemodynamic changes during cognitive activity. It is found that methylphenidate decreased oxyhemoglobin levels. The reason may be vasoconstriction.

BWC4 • 11:15 a.m.
Simultaneous Imaging of Cerebral Blood Flow and Partial Pressure of Oxygen During Cortical Spreading Depression, Sava Sakadžić⁴, Shiue Yuan¹, Ergin Dilekkoz³, Svetlana Ruvinskaya¹, Mark H. Shalinsky¹, Sergei A. Vinogradov⁴, Cenk Aytaç²; ¹Dept. of Radiology, Massachusetts General Hospital, Harvard Medical School, USA, ²Stroke and Neurovascular Regulation Lab, Dept. of Radiology, Massachusetts General Hospital, Harvard Medical School, USA, ³Stroke Service and Neuroscience Intensive Care Unit, Dept. of Neurology, Massachusetts General Hospital, Harvard Medical School, USA, ⁴Dept. of Biochemistry and Biophysics, Univ. of Pennsylvania, USA. We develop a novel imaging technique that provides real-time two-dimensional maps of partial pressure of oxygen and cerebral blood flow in rats and mice by combining phosphorescence lifetime imaging with laser speckle contrast imaging.

BWC5 • 11:30 a.m.
Study of Neurovascular Coupling via Simultaneous MEG DOI Acquisition, Wannet Ou¹, Ilkka Nissila², Harsha Radhakrishnan¹, David A. Boas², Matti S. Hämäläinen³, Maria Angela Franceschini²; ¹MIT, USA, ²Athinoula A. Martinsos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA. Our simultaneous magnetoencephalography and diffuse optical imaging measurements in five subjects during median nerve stimulation show a good correlation of the hemodynamic evoked response with MEG deflection N20 and Peak 3, but not with P35.
BWC6 • 11:45 a.m.
Time-Resolved Functional Near-Infrared Spectroscopy at Null Source-Detector Separation, Antonio Pifferi1, Alessandro Torricelli1, Lorenzo Spinelli1, Davide Contini1, Rinaldo Cubeddu1, Fabrizio Martelli1, Giovanni Zaccanti2, Alberto Tosi3, Alberto Dalla Mora4, Franco Zappa1, Sergio Cova1; 1Dept. Fisica, Inst. Italiano di Tecnologia, Politecnico di Milano, Italy, 2Dept. Fisica, Univ. degli Studi di Firenze, Italy, 3Dept. Elettronica e Informazione, Politecnico di Milano, Italy. We demonstrate the feasibility of time-resolved diffuse reflectance at a small source-detector separation using a time-gated single-photon avalanche diode both with measurements on heterogeneous phantoms and with in vivo detection of a task-related brain activation.

BWC7 • 12:00 p.m.
Correlation between Optical Coherence Tomography (OCT) and Optical Intrinsic Signal Imaging (OISI) during Functional Brain Activation, Yu Chen1, Aaron D. Aguirre1,2, Lana Ruvinskaya1, Anna Devor1, David A. Boas1,2, James G. Fujimoto1; 1MIT, USA, 2Harvard-MIT Health Sciences and Technology, USA, 3Massachusetts General Hospital, USA. Simultaneous OCT and OISI were performed on rat somatosensory cortex during forepaw stimulation. The depth-integrated OCT signal correlates well with OISI signal, while OCT resolves layer-specific dynamics in functional activation patterns indicating retrograde vessel dilation.

BWC8 • 12:15 p.m.
Quantitative Measurement of Hemodynamics during Early Cardiovascular Development Using Spectral Doppler Velocimetry, Anjul M. Davis1, Florence Rothenberg2, Neal Shepherd1, Joseph Izzati1; 1Duke Univ., USA, 2Univ. of Cincinnati College of Medicine, USA. The study of hemodynamic effects on embryonic cardiovascular development has been limited by technology. Here we present an extension to Doppler OCT which may provide insight in the relationship between blood flow and heart development.

12:30 p.m.–1:30 p.m.
Lunch Break

BWD1 • 1:30 p.m. Invited
Multimodality Nonlinear Optical Imaging, Ji-Xin Cheng; Purdue Univ., USA. Coherent anti-Stokes Raman scattering, sum-frequency generation and two-photon excitation fluorescence microscopy are combined on the same platform for multimodality imaging of complex biological systems such as the central nervous system and atherosclerotic lesions.

BWD2 • 2:00 p.m.
High Speed, Optically Sectioned Fluorescence Lifetime Imaging Utilizing Time-Gated Nipkow Disk or Multifocal Multiphoton Time Correlated Single Photon Counting Microscopy, Clifford Talbot1, James McGinty1, Ewan McGhee1, David Grant1, Sunitil Kumar1, Gordon Kennedy1, Ian Munro1, Patrick Courtney1, W. Zhang1, Tom Bunney2, Tony Magee2, Dan Davis1, Matilda Katan1, Chris Duusby1, Mark Neil2; 1Dept. of Physics, Imperial College London, UK, 2Chemical Biology Ctr., Imperial College London, UK, 3Perkin Elmer Inc., UK, 4Cancer Res. UK Ctr. for Cell and Molecular Biology, Chester Beatty Labs, Inst. of Cancer Res., UK, 5Dept. of Biomedical Sciences, Imperial College London, UK, 6Div. of Cell and Molecular Biology, Imperial College London, UK. We report two optically sectioned fluorescence lifetime systems that exhibit better signal to noise per unit time than conventional time correlated single photon counting systems. Both systems are applied to biologically relevant samples.

BWD3 • 2:15 p.m.
Quantitative Spectroscopic Imaging for Early Cancer Diagnosis, Chung-Chieh Yu1, Jelena Mirkovic1, Condon Lau1, Geoffrey O’Donoghue1, Sasha A. McGee1, Alphi Elackattu; 1Univ. of Cincinnati College of Medicine, USA. The study of hemodynamic effects on embryonic cardiovascular development has been limited by technology. Here we present an extension to Doppler OCT which may provide insight in the relationship between blood flow and heart development.

BWD4 • 2:30 p.m.
Optical Coherence Tomography versus High-Frequency Ultrasound for Diagnosis and Staging of Bladder Cancer, Zhijia Yuan, Zhenguo Wang, Jingxuan Liu, Yingtian Pan; SUNY at Stony Brook, USA. We present experimental results to examine the utility and potential limitations of 1.3μm spectrum-domain optical coherence tomography and high-frequency ultrasound for diagnosis and staging of cancers induced in rat bladders following AT-27 cells induction.
BWD5 • 2:45 p.m.
3-D Image-Guided Raman Characterization in a Phantom Study, Subhadra Srinivasan1, Matthew V. Schulmerich2, Brian W. Pogue1, Michael D. Morris3; 1Thayer School of Engineering, Dartmouth College, USA, 2Univ. of Michigan, USA. We demonstrate model-based image reconstruction of Raman measurements obtained experimentally. Results show that Raman characterization with accurate localization is possible with anatomical priors. This method has been extended to Raman imaging of dog tibia in vivo.

BWD6 • 3:00 p.m.
Development of Combined Raman Spectroscopy — Optical Coherence Tomography (RS-OCT), Chetan A. Patil4, Nienke Bosschaart5, Jeffrey S. Nyman1, Dirk J. Faber1, Ton G. van Leeuwen3, Anita Mahadevan-Jansen1,1 Vanderbilt Univ., USA, 2Univ. of Twente, Netherlands, 3Vanderbilt Univ. Medical Ctr., USA, 4Academic Medical Ctr., Univ. of Amsterdam, Netherlands. We report the development of a combined RS-OCT system able to perform precision guided RS of features within OCT. The device’s potential is demonstrated on breast and bone samples, and in vivo skin lesions.

BWD7 • 3:15 p.m.
Quantitative Coherent Anti-Stokes Raman Scattering (CARS) Microscopy of Skin Optical Clearing Dynamics, Maxwell Zimmerley1, Bernard Choi1, Eric O. Potma2; 1Dept. of Chemistry, Univ. of California at Irvine, USA, 2Beckman Laser Inst., Univ. of California at Irvine, USA. CARS microscopy is used to quantitatively investigate the process of skin optical clearing. Using glycerol and dimethyl-sulfoxide as the clearing agents, we find that tissue scattering is a highly nonlinear function of agent concentration.

BWE • Molecular Imaging Using Fluorescence

Grand Bay Ballroom South
1:30 p.m.—3:30 p.m.

BWE • Molecular Imaging Using Fluorescence
Vasilis Ntziachristos; GS-F-Natl. Res. Ctr. for Environment and Health, Germany, Presider

BWE1 • 1:30 p.m.
Dynamic Molecular Imaging: Anatomical Co-Registration and Dynamic Contrast Enhancement, Elizabeth M. Hillman4, Matthew B. Bouchard4, Sean A. Burgess1, Kirk Gossage1, James R. Mansfield1, Richard M. Levenson2; 1Columbia Univ., USA, 2Cambridge Res. and Instrumentation (CRI), USA. A new approach to acquiring and analyzing small animal molecular imaging data is presented. By imaging the in-vivo dynamics of a dye or targeted probe, improved contrast and all-optical anatomical co-registration can be achieved.

BWE2 • 1:45 p.m.
Fluorescence Lifetime Tomography for Whole Body Small Animal Imaging, Ralph E. Notchurdf, Sachin Patwardhian, Walter Akers, Samuel Achilefu, Joseph P. Culver; Washington Univ. in St. Louis, USA. Fluorescent lifetime provides a rich approach to quantitative molecular in vivo imaging. Here we report in vivo FLT-tomography using full spatial sampling for 3-D localization, and time-resolved (up to >1 GHz) analysis of lifetime contrasts.

BWE3 • 2:00 p.m.
In vivo FMT and Oxymetry Measurements for Combined Imaging of Tumor Physiology and Function, Rosy Favicchio1, Giannis Zacharakis2, Anikitos Garofalakis3, Clio Mamalaki3, Sifis Papamathakis1, Jorge Ripoll1; 1Inst. of Molecular Biology and Biotechnology, FORTH, Greece, 2Inst. of Electronic Structure and Laser, FORTH, Greece. We describe a modified setup for combined in vivo FMT and 3-D rendering of oxygen distribution used to measure change in hypoxic burden during tumour growth whilst simultaneously probing for fluorescence activity.

BWE4 • 2:15 p.m.
Multi-Spectral Imaging of Tissue-Specific Fluorescence Tomography Data, Giannis Zacharakis1, Stylianos Psycharakis1, Anikitos Garofalakis3, Heiko Meyer1, Rosy Favicchio1, Clio Mamalaki3, Jorge Ripoll1; 1Foundation for Res. and Technology Hellas (FORTH), Inst. of Electronic Structure and Laser (IESL), Greece, 2Foundation for Res. and Technology Hellas (FORTH), Inst. of Molecular Biology and Biotechnology (IMBB), Greece. We present a study that combines multi-spectral approaches with the fluorescence molecular tomography for imaging fluorophores with overlapping signatures and for removing autofluorescence signals, for improved contrast, detection limits and quantification accuracy.

BWE5 • 2:30 p.m.
Quantification of Point-Like Fluorescent Sources in Small Animals, Daria C. Coms4, Thomas J. Farrell5, Michael S. Patterson5; 1Juravinski Cancer Ctr., Canada, 2McMaster Univ., Canada. We propose a technique for the in vivo determination of depth and strength of fluorescent point-like sources, with particular application to the study of bone metastases in small animals. Measurements in tissue-simulating media are reported.
BWE6 • 2:45 p.m.
Time-Domain Fluorescence Lifetime Tomography, James McGinty, Khadija B. Tahir, Vadim Y. Soloviev, Romain Laine, Alex Sardini, Clifford B. Talbot, Christopher Dunsky, Ian Munro, Daniel S. Elson, Jo V. Hajnal, Mark A. A. Neil, Simon R. Arridge, Paul M. W. French; 1Imperial College London, UK, 2Univ. College London, UK. We present a platform for fluorescence lifetime tomography utilising tuneable supercontinuum excitation and wide-field time-gated technology. Applied to optical projection and diffuse fluorescence tomography, we demonstrate 3-D time-resolved fluorescence reconstruction in transparent and scattering phantoms.

BWF1 • 4:00 p.m.
Spectral Optical Coherence Tomography Using Scanning Optical Frequency Comb Generator, Tomasz Bajraszewski, Maciej Wojtkowski, Maciej Szkulmowski, Wojciech Fojt, Andrzej Kowalczyk; Nicolaus Copernicus Univ., Poland. New concept of Spectral OCT method using optical frequency comb is demonstrated. This technique overcomes some limitations of Fourier-domain OCT techniques. High resolution cross-sectional images of biological samples obtained with the presented technique are shown.

BWE7 • 3:00 p.m.
MRI-Coupled Fluorescence Tomography of Murine Glioma Metabolic Activity, Scott C. Davis, Summer L. Gibbs-Strauss, Hamid Delghani, Brian W. Pogue, Keith D. Paulsen; 1Dartmouth College, USA, 2Univ. of Exeter, UK, 3Dartmouth College, USA. Protoporphyrin IX fluorescence activity in mouse model gliomas is imaged in nude mice using an MRI-coupled spectroscopy scanner. Segmented MR images acquired simultaneously with fluorescence spectra are used to guide fluorescence yield reconstruction.

BWF2 • 4:15 p.m.
Fourier Domain Low Coherence Transillumination Computed Tomography, Andrew S. Thomas, Bradley A. Bowser, Yuankai K. Tao, Joseph A. Izatt; Duke Univ., USA. We introduce an extension of Fourier Domain OCT to computed tomographic imaging in thick highly scattering tissues.

BWE8 • 3:15 p.m.
Separation of Target Fluorescence Signal from in vivo Autofluorescence Background Based on Their Temporal Signatures, Guobin Ma, Bruno Guerrero, Anader Benyamin-Seeyar, Mario Khayat; ART Advanced Res. Technologies, Inc., Canada. A novel method is presented to separate target fluorescence signal from autofluorescence background in vivo using their temporal features based on a priori knowledge. The method is tested for GFP labeled tumors in mouse brain.

St. Petersburg Ballroom
3:30 p.m.–4:00 p.m.
Coffee Break

BWF • Optical Coherence Tomography: Novel Techniques and Functional Imaging

Grand Bay Ballroom North
4:00 p.m.–6:00 p.m.
BWF • Optical Coherence Tomography: Novel Techniques and Functional Imaging
Adrian Podoleanu; Univ. of Kent at Canterbury, UK, Presider

BWF3 • 4:30 p.m.
Coherence Length Improvement by Quasi-Phase Continuous Tuning in Wavelength Swept Laser Source for OCT, Changho Chong, Takuya Suzuki, Atsushi Morosawa, Tooru Sakai; Santec Corp., Japan. The quasi-phase continuous tuning technique is proposed to improve the coherent build-up of gain, resulting in narrower instantaneous linewidth, thus longer coherence length. We demonstrated the improvement by a factor of two at 20kHz rate.

BWF4 • 4:45 p.m.
In vivo Three-Dimensional Fourier Domain Optical Coherence Tomography of Subpleural Alveoli Combined with Intra Vital Microscopy in the Mouse Model, Sven Meissner, Michael Mertens, Alexander Krüger, Arata Tabuchi, Wolfgang Kuebler, Edmund Koch; 1Univ. of Technology Dresden, Germany, 2Charité Berlin, Germany. Simultaneous Fourier domain optical coherence tomography and dark-field intravital microscopy were used for in vivo imaging of alveolar dynamics in the ventilated mouse. Quantification of the images revealed an alveolar expansion with increased end-inspiratory-pressure.

BWF5 • 5:00 p.m.
Photothermal Optical Coherence Tomography for Molecular Contrast Imaging, Melissa C. Skala, Stella Marinakos, Ashutosh Chilkoti, Joseph A. Izatt; Duke Univ., USA. Photothermal optical coherence tomography with laser-heated gold nanorods as the photothermal source is proposed as a novel molecular imaging technique. A description of the technique and validation experiments are reported.
BWF6 • 5:15 p.m.
A Cardiac Study on Zebrafish Using a Dual Beam Doppler OCT System, Mircea Mijat, Nicusor V. Ifimia, D. X. Hammer, R. D. Ferguson, D. Vu, A. Ferrante; Physical Sciences Inc., USA. We present a high-throughput fiber optics-based Doppler SDOCT system that measures heart rate and blood velocity, and generates a flow map of the major blood vessels on zebrafish for cardiac studies.

BWF7 • 5:30 p.m.
Simplified Single Channel High-Speed Polarization Sensitive Retinal SDOCT, Mingtao Zhao, Joseph A. Izatt; Duke Univ., USA. Polarization sensitive OCT (PSOCT) provides additional contrast for retinal imaging. We have constructed and tested a compact, single channel and single camera, high-speed (17,000 A-scans/sec) polarization sensitive SDOCT (PS-SDOCT) system for retinal imaging.

BWF8 • 5:45 p.m.
Three-Dimensional Endoscopic Optical Coherence Tomography (OCT) using Fourier Domain Mode Locked (FDML) Lasers, Yu Chen1, Desmond C. Adler1, Robert Huber2, Chao Zhou1, Joseph M. Schmitt1, James Connolly4, James G. Fujimoto1; MIT, USA, 2Ludwig-Maximilians-Univ. München, Germany, 3LightLab Imaging, Inc., USA, 4Beth Israel Deaconess Medical Ctr., USA. We have developed an endoscopic OCT system based on an FDML laser. In vivo three-dimensional imaging at 100 kHz with 9 × 7 μm (transverse by axial) resolution is demonstrated in the rabbit gastrointestinal tract.

BWG • Instrumentation and Techniques for Tissue Imaging

Grand Bay Ballroom South
4:00 p.m.–6:00 p.m.

BWG • Instrumentation and Techniques for Tissue Imaging

Lihong Wang; Washington Univ. in St. Louis, USA, Presider

BWG1 • 4:00 p.m.
A Fast 512-Channel System for Real-Time Photoacoustic Imaging of Small Animals, Anastasios Maurudis1, John Gamelin1, Andrés Aguirre1, Nathan White1, Michael Khalil1, Raj Shah1, Diego Castillo1, Fei Huang1, Raumlil Shah1, Lihong V. Wang1, Quing Zhu1; 1Univ. of Connecticut, USA, 2Washington Univ. in St. Louis, USA. A fast 512-channel tomographic photoacoustic system for small animal imaging using a curved ultrasound array has been developed. For the first time, real-time tomographic imaging for functional photoacoustic studies is possible. Initial characterization/imaging is presented.

BWG2 • 4:15 p.m.
A New Wireless Multichannel Near Infrared Imaging System, Thomas L. Muehlemann, Martin Wolf, Daniel V. Haenssle; Univ. Hospital Zurich, Switzerland. Near-infrared imaging (NIRI) quantifies hemoglobin in tissue. To optimize the comfort, reduce the weight of the sensor and provide free movement, we miniaturized NIRI and designed a wireless sensor.

BWG3 • 4:30 p.m.
High Speed Processing of Frequency Domain Images, David Watt, Kameron Harmon, Abneesh Srivastava, Gregory W. Faris; SRI Intl., USA. We are developing a system to process high frame rate frequency domain images using field programmable gate arrays. This has applications in diffuse optical imaging or fluorescence lifetime imaging.

BWG4 • 4:45 p.m.
Development of a Trans-Rectal Optical Tomography Probe for Concurrent Sagittal Imaging with Trans-Rectal Ultrasound, Zhen Jiang, Guan Xu, Amal Elgawadi, Daqing Piao; Oklahoma State Univ., USA. A first-of-its-kind trans-rectal near-infrared optical tomography probe for non-invasive sagittal imaging of prostate has been developed. This trans-rectal NIR probe is designed to attach to a commercial biplane trans-rectal ultrasound for concurrent NIT/US imaging.

BWG5 • 5:00 p.m.
High-Resolution Virtual Optical-Sectioning Imaging and Tomography for 3-D Modeling of Biomedical Specimens, Joris J. J. Dirckx; Jan A. N. Buystaert; Univ. of Antwerp, Belgium. HROPFOS is an optical tomography technique capable of imaging bony structures as well as soft tissue in high resolution (2 μm), by means of optical-sectioning of cleared and fluorescent specimens.

BWG6 • 5:15 p.m.
Deep Optical Sectioning in Turbid Media with Dual-Axes Confocal Microscopy: Toward in vivo Optical Biopsy, Jonathan T. C. Liu1, Michael J. Mandella1, James M. Crawford2, Christopher H. Contag1, Thomas D. Wang3, Gordon S. Kino4; 1Stanford Univ., USA, 2Univ. of Florida, USA, 3Univ. of Michigan, USA. Toward developing dual-axes confocal microscopy for gastrointestinal disease detection, we quantitatively investigate the optical-sectioning ability of this technology through reflectance experiments in a tissue phantom, and also obtain deep fluorescence image sections of tissue specimens.
Hyperspectral in vivo Two-Photon Microscopy of Intrinsic Fluorophores, Andrew J. Radosevich, Matthew B. Bouchard, Sean A. Burgess, Roman Stolper, Brenda Chen, Elizabeth M. C. Hillman; Dept. of Biomedical Engineering, Columbia Univ., USA. In vivo two-photon imaging of intrinsic fluorescence allows metabolic function to be evaluated on a cellular level. A method of validating, identifying and separating the fluorophores present in an in vivo two-photon image is described.

3-D Fluorescence Imaging in Turbid Media by Using Time Gated Data Acquisition, Vadim Soloviev¹, Simon Arridge¹, Cosimo D’Andrea², Marco Brambilla², Gianluca Valentini², Rinaldo Cubeddu³; ¹Dept. of Computer Science, Univ. College London, UK, ²CNR-INFM and CNR-IFN, Dept. di Fisica, Politecnico di Milano, Italy, ³Inst. for Molecular and Biological Imaging (IMBI) GSF, Germany. We demonstrate the feasibility of fluorescence imaging experimentally on the basis of a time gating technique completely in the time domain by using a small number of time steps.

Grand Bay Ballroom North
6:00 p.m.–6:10 p.m.
BIOMED Closing Remarks
Biomedical Optics (BIOMED) Postdeadline Paper Abstracts

• Sunday, March 16, 2008 •

BSuE • BIOMED Poster Session I

Foyer
1:30 p.m.–3:30 p.m.
BSuE • BIOMED Poster Session I

PDPBSuE1
Monitoring of Acute Wound Healing, Elisabeth S. Papazoglou, Michael S. Weingarten, Leonid Zubkov, Michael Neidrauer, Linda Zhu, Kambiz Pourrezaei; School of Biomedical Engineering, Drexel Univ., USA. Optical properties of wounds in hairless rats were assessed using DPDW methodology. An increase in absorption and scattering coefficients and a decrease in blood saturation was observed in wounds compared to control sites.

PDPBSuE2
Heterodyne Polarization Coherent Anti-Stokes Raman Scattering (HP-CARS) Microscopy for High Contrast Bioimaging, Fake Lu, Wei Zheng, Zhiwei Huang; Natl. Univ. of Singapore, Singapore. We report a heterodyne-detected polarization coherent anti-Stokes Raman scattering (HP-CARS) microscopy for high sensitive and high contrast biomolecular vibration imaging.

• Monday, March 17, 2008 •

BMD • BIOMED Poster Session II

Foyer
1:30 p.m.–3:30 p.m.
BMD • BIOMED Poster Session II

PDPBMD1
Inverse Solution Regularized with the Edge-Preserving Constraint for NIR DOT, Min-Cheng Pan, Liang-Yu Chen2, Min-Chun Pan3, Chien-Hung Chen2; 1Tungnan Univ., Taiwan, 2Natl. Central Univ., Taiwan. To remedy the low spatial resolution of diffuse optical tomography, an iterative solution to the optimization problem is developed using Tikhonov regularization with the edge-preserving constraint as a prior knowledge into the objective function.

• Tuesday, March 18, 2008 •

BTuF • BIOMED Poster Session III

Foyer
4:00 p.m.–6:00 p.m.
BTuF • BIOMED Poster Session III

PDPBTuF1
A 3-D Image-Based Guidance System for Handheld Optical Imaging Devices, Fred S. Azar1, Albert Cerussi2, Benoit De Roquemaurel1, Elizabeth Flannery1, Bruce J. Tromberg3; 1Siemens Corporate Res. Inc., USA, 2Univ. of California at Irvine, USA. We present a novel 3-D visualization and guidance system for handheld optical imaging devices. The system enables more accurate longitudinal studies, 3-D reconstruction of optical handheld measurements and joint analysis with other imaging modalities.

PDPBTuF2
Tissue Turbidity Suppression by Optical Phase Conjugation, Zahid Yagoob, Emily McDowell, Changhui Yang; Caltech, USA. Light scattering in tissue may appear random but it is causal and deterministic in nature. We report on our findings into the use of optical phase conjugation (TS-OPC) for tissue turbidity suppression.

PDPBTuF3
Optical Tomographic Imaging of Hemodynamic Effects in Arthritic Joints, Andreas H. Hielscher, Joseph M. Lasker, Chris J. Fong, Edward Dwyer; Columbia Univ., USA. We performed dynamic imaging studies on healthy volunteers and patients diagnosed with rheumatoid arthritis (RA) in proximal-interphalangeal finger joints. We observed pronounced differences between the hemodynamic effect occurring in healthy volunteers and patients with RA.

PDPBTuF4
Large Depth-of-Field Lensfree Imaging and Characterization of Cells over an Ultra-Wide Field-of-View, Ting-Wei Su1, Sungkyu Seo1, Anthony Erlinger1, Aydogan Ozcan1,2; 1Electrical Engineering Dept., Univ. of California at Los Angeles, USA, 2Biomedical Engineering IDP, Univ. of California at Los Angeles, USA. A high-throughput on-chip imaging-platform that can rapidly characterize >100,000 cells within a depth-of-field of >1mm, and over a field-of-view of ~10cm² is introduced. This imaging-system can monitor multiple object-planes without any lenses or mechanical scanning.
PDPBTuF5
Measurement of Optical Disorder Strength due to the Nanoscale Refractive Index Fluctuations of Tissues/Cells: Inverse Participation Ratio (IPR) Analysis of Transmission Electron Microscopy (TEM) Images, Prabhakar Pradhan1, Vladimir Turzhitsky1, Alexander Heifetz1, Dhwanil Damania1, Hariharan Subramanian1, Hemant K. Roy1, Vladimir Mincu2, Hariharan Prabakaran1, 1Northwestern Univ., USA, 2Evanston-Northwestern Healthcare, USA. An IPR imaging technique is developed for the first time to analyze TEM images of cells/tissues by projecting them to optical lattices and quantifying their short-range nanoscale refractive-index fluctuations/correlations. Applications for pre-cancer detections are discussed.

PDPBTuF6
Diffuse Optical Spectroscopic Imaging Applications in Human Muscle, Jason Rieth, Sophie Chung, Albert Cerussi, Bruce Tromberg; Beckman Laser Inst., Univ. of California at Irvine, USA. Diffuse optical spectroscopic imaging measures absolute concentrations of DeoHb and HbO2, water, bulk lipid. Broadband spectra allow deep tissue temperature measurement, and sensitivity to myoglobin. Clinically translatable tests demonstrate applications to human muscle.

PDPBTuF7
In vivo Assessment of Chronic Diabetic Wounds with DPDW Methodology, Elisabeth S. Papazoglou, Michael S. Weingarten, Leonid Zubkov, Michael Neidrauer, Kambiz Pourrezaei; School of Biomedical Engineering, Drexel Univ., USA. Optical properties of diabetic wounds in human subjects were assessed over several weeks using DPDW methodology. Preliminary results indicate that differences in optical properties can be seen between wounds with different healing behaviors.

PDPBTuF8
Imaging of Cystic Breast Lesions by Spectral Diffuse Optical Tomography, Anaïs Leproux1, Marjolein van der Voort1, Martin van der Mark1, Leon Bakker1, Tim Nielsen2, Bernhard Brendel1, Falk Uhlmann3, Andrea Wiethoff2, Stephanie van den Berg1, Peter Luijten3, Willem Mali3; 1Philips Res., Netherlands, 2Philips Medical Systems, Netherlands, 3Univ. Medical Ctr. Utrecht, Netherlands. In this study, cystic breast lesions were imaged by spectral diffuse optical tomography. Spectroscopic analysis of the lesions elucidated their high water content and low total hemoglobin content.

PDPBTuF9
Why Acquiring Excitation Data Improves the Quality of Reconstructed Fluorescence Images for Highly Heterogeneous Diffusive Media, Frederic Leblond1, Niculae Mincu1, Nicolas Rokitaile2, Simon Fortier3, Mario Khayat4, Brian W. Pogue5; 1Thayer School of Engineering, Dartmouth College, USA, 2Advanced Res. Technologies Inc., Canada. Diffuse optical fluorescence tomography often relies on the assumption that samples are homogeneous. This degrades the correspondence between tomography data sets and model predictions. We provide evidence that data normalization significantly improve on this situation.

PDPBTuF10
Comparison of the Fluorescent Protein Performance in Deep-Tissue Small-Animal Imaging Applications, Nikolaos Delilannis1,2, Thomas Wurzinger1,2, Bukhos A. Tinnou1,2, Khalid Shahi1, Vasilis Ntziochristos1,2, Ralph Weissleder1,2; Ctr. for Molecular Imaging Res., Massachusetts General Hospital and Harvard Medical School, USA. The comparison of various fluorescent proteins for deep tissue molecular imaging applications is presented. Experimental results and theoretical model prediction show the superiority of the red-shifted fluorescent proteins.

PDPBTuG • BIOMED Postdeadline Session

Grand Ballroom North and South
6:00 p.m.–7:00 p.m.

PDPBTuG • BIOMED Postdeadline Session
Presider to Be Announced

PDPBTuG1 • 6:00 p.m.
Biological Studies Using High-Throughput 3-D Tissue Cytometry Based on Two-Photon Microscopy, HyukSang Kwon, Peter T. C. So; MIT, USA. High throughput 3-D tissue cytometry based on two-photon microscopy has been applied to investigate the muscle architecture of whole mouse tongue and study cardiovascular diseases using mouse heart.

PDPBTuG2 • 6:10 p.m.
In vivo Optical Coherence Tomography of Mouse Skin Wound Healing, Zhihui Yuan, Julia Zakehaleva, Hugang Ren, Weiliam Chen, Yingtian Pan; SUNY Stony Brook, USA. We examined the utility of OCT for in vivo imaging of skin healing using murine transcutaneous wound model. OCT identifications as validated by corresponding histology demonstrate its potential for noninvasive, high-resolution monitoring of wound healing.
Investigation of the Motor Cortex Function in Children with Cerebral Palsy Using Functional Near-Infrared Spectroscopic Imaging, Fenghua Tian1, Mauricio R. Delgado2,3, Nancy J. Clegg2, Mario I. Romero-Ortega2, Hanli Liu1; 1Dept. of Bioengineering, Univ. of Texas at Arlington, USA, 2Dept. of Neurology, Texas Scottish Rite Hospital, USA, 3Dept. of Neurology, Univ. of Texas Southwestern Medical Ctr., USA. This study investigates the ability and reliability of functional near-infrared spectroscopic (fNIRS) imaging to detect motor cortical activity during upper extremity movement in normal children and children with cerebral palsy.

Spectral-Encoding Design to Parallelize Sources in Near Infrared Tomography during Magnetic Resonance Imaging of the Breast, Zhiqiu Li, Colin Carpenter, Venkataramanan Krishnaswamy, Scott C. Davis, Shudong Jiang, Keith D. Paulsen, Brian W. Pogue; Dartmouth College, USA. A NIR diffuse tomography system with spectrally-encoded sources allows simultaneous detection of all data. It can provide images of high-contrast, fast changes in tissue optical properties to be overlayed on the magnetic resonance breast scan.

Bessel Beam Based Spectral Domain High Resolution OCT with a 0.6mm Effective Diameter Axicon Providing Extended Focusing Range, Kye-Sung Lee, Jannick Rolland; CREOL and Florida Photonics Ctr. of Excellence, College of Optics and Photonics, Univ. of Central Florida, USA. We report on the measured sensitivities of Bessel beam and Gaussian beam based SDOCTs and show invariant SNR and resolution images with a 0.6mm effective diameter axicon across a 4mm depth of focus.