BIOMED

Biomedical Optics Topical Meeting and Tabletop Exhibit

March 19-22, 2006
Fort Lauderdale Grande Hotel and Yacht Club
Fort Lauderdale, Florida, USA

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Optical Society of America

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Diffuse Optical Imaging

- Vasilis Ntziachristos, *Harvard Medical School, USA*
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Optical Coherence Tomography

- Lihong Wang, *Texas A&M Univ., USA*
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Optical Microscopy Techniques and Technology

- David Rector, *Washington State Univ., USA*
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- Jerome Mertz, *Boston Univ., USA*

Optics in Neuroscience

- David Rector, *Washington State Univ., USA*
- Anna Devor, *Harvard Medical School, USA*
- Anna Roe, *Vanderbilt Univ., USA*
- Jay Nadeau, *McGill Univ., Canada*
- Diego Contreras, *Univ. of Pennsylvania, USA*
- Monica Fabiani, *Univ. of Illinois at Urbana-Champaign, USA*

Optics in Molecular Imaging and Drug Discovery

- Markus Rudin*, Animal Imaging Ctr., Switzerland*
- Vasilis Ntziachristos, *Harvard Medical School, USA*
- Brad Rice, *Xenogen Inc., USA*
- Gang Zheng, *Univ. of Pennsylvania, USA*
- Charles Lin, *Harvard Medical School, USA*

Optics in Cancer Research

- Gregory Faris, *SRI Intl., USA*
- Stefan Andersson-Engels, *Lund Univ., Sweden*
- Chris Contag, *Stanford Univ., USA*
- Irving Bigio, *Boston Univ., USA*
- Anita Mahadevan-Jansen, *Vanderbuilt Univ., USA*
- Albert Cerussi, *Univ. of California at Irvine, USA*
- Rebecca Richards-Kortum, *Rice Univ., USA*

Optical Nanotechnology

- Gregory Faris, *SRI Intl., USA*
- Tuan Vo-Dinh, *Oak Ridge Natl. Lab, USA*
- Rebekah Drezek, *Rice Univ., USA*
- Amir Gandjbakhche, *NIH, USA*
- Hedi Mattoussi, *NRL, USA*
- Jennifer Hollingsworth, *Los Alamos Natl. Lab, USA*

About Biomed

The Biomedical Optics meeting brings together leading scientists, engineers and physicians who are engaged in research using optical methods in biology and medicine. With over 400 attendees, this meeting affords attendees the opportunity to interact one-on-one with presenters. Multiple poster sessions allow for lively discussions about the latest research.

Meeting Topics

Diffuse Optical Imaging

Diffuse Optical Absorption and Scatter Tomography
Diffuse Fluorescence Tomography
Photoacoustic Tomography
Theoretical Methods for Optical Tomography
Theoretical Models for Optical Radiation Transport

Optical Spectroscopic Imaging and Diagnostics

Fluorescence Spectroscopy and Imaging
Phosphorescence Spectroscopy and Imaging
Reflectance Spectroscopy and Imaging
Mie Scattering Spectroscopy and Imaging
Raman Spectroscopy and Imaging
Tissue Biochemistry

Optical Coherence Tomography

OCT Technology Development
Spectral Domain OCT
Polarization-Sensitive OCT

Optical Microscopy Techniques and Technology

Microscopy *in vivo*
Spectral Microscopy
Multiphoton Microscopy
Nonlinear Microscopy

Optics in Neuroscience

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

Optics in Molecular Imaging and Drug Discovery

New Contrast Agents
Imaging of Molecular Reporters

Probe Development and Testing
Functional Imaging Applications

Optics in Cancer Research

Clinical Studies
Animal Model Studies
Optical Signatures for Cancer
Optical Instrumentation for Cancer Research
Combined Modality Imaging for Cancer Detection

Optical Nanotechnology

Metal Nanoparticles and Metal Nanoshells
Quantum Dots
Surface Enhanced Raman Scattering and Surface Enhanced Fluorescence
Single Molecule Techniques
Nanooptics
Nanoscale Microscopies
Nanoparticle Therapies

Invited Speakers

Diffuse Optical Imaging

The Role of Optics in Multi-Modality Functional Neuro-Imaging, *David Boas, Massachusetts General Hospital, USA*

Breast Tissue Optical Properties and Breast Cancer Risk, *Lothar Lilge, Univ. of Toronto, Canada*

Optical Methods for Tissue Hemo-Dynamics and Metabolism, *Turgut Durduran, Univ. of Pennsylvania, USA*

Optical Coherence Tomography

Recent Developments in Ultrahigh Resolution OCT: Towards Cellular and Functional Imaging, *Wolfgang Drexler, Univ. of Vienna, Austria*

Frequency Domain Functional Optical Coherence Tomography, *Zhongping Chen, Univ. of California at Irvine, USA*

Advances in Optical Imaging of Dynamic Three-Dimensional Engineered Tissues, *Steve Boppart, Univ. of Illinois, USA*

Joint Session on Optical Microscopy Techniques and Technology and Spectroscopic Imaging and Diagnostics

Imaging the Cancer Genome: High Resolution Microscopy and Quantitative Method, *Kevin Mills, The Jackson Lab, USA*

Confocal Microendoscopy: An Emerging Tool for In Situ Disease Diagnosis, *Art Gmitro, Univ. of Arizona, USA*

Using Optical Microscopy and New *in-vitro* Models to Probe Neural Dynamics from Milliseconds to Months, *Steve Potter, Georgia Tech, USA*

Title to Come, *Peter So, MIT, USA*

Phase Sensitive CARS Microscopy, *Eric Potma, Univ. of California at Irvine, USA*

Optofluidic Microscope: A Novel High Resolution Microscope-on-a-Chip System, *Changhuei Yang, Caltech, USA*

Optics in Neuroscience

Direct Comparison of Electrophysiological, Intrinsic Signal Imaging, Voltage Sensitive Dye Imaging, and fMRI Signals in Sensory Cortex of Nonhuman Primates, *Anna Roe, Vanderbilt Univ., USA*

High-Resolution Functional Optical Imaging: Sub-Millimeter Physiology of Living Tissue, *Elizabeth Hillman, Massachusetts General Hospital, USA*

Title to Come, *Anna Devor, Massachusetts General Hospital, USA*

Optics in Molecular Imaging and Drug Discovery

Optical Imaging in Drug Discovery Process, *Bohumil Bednar, Merck, USA*

Title to Come, *Paul Territo, Lilly, USA*

Title to Come, *Chris Schultz, Siemens, USA*

Optics in Cancer Research

Tissue Morphology and Novel Imaging Correlates - the Pathologist's Perspective, *Wendy Wells, Dartmouth College, USA*

Optical Nanotechnology

Activatable Nanoprobes for Molecular Imaging of Cancer, *Rebekah Drezek, Rice Univ., USA*

Photonic Explorers Based on Multifunctional Nano-Platforms for Biosensing and Photodynamic Therapy, *Yong-Eun Lee Koo, Univ. of Michigan, USA*

Visualizing Cellular Entry of Individual Virus Particles, *Xiaowei Zhuang, Harvard Univ., USA*

Joint Session on Diffuse Tomography and Optics in Cancer Research

Detection of Neoplasia in the Esophagus, *Chris Contag, Stanford Univ., USA*

Breast Cancer Diffuse Optical Imaging NTROI: Recent Progress, *Arjun Yodh, Univ. of Pennsylvania, USA*

Optical Spectroscopy for Management of Cancer Treatment, *Irving Bigio, Boston Univ., USA*

Network for Translational Research: Optical Imaging, *Wafik El-Deiry, Univ. of Pennsylvania, USA*

Publications

Conference Program

The printed 2006 BIOMED Conference Program will contain general program information and abstracts of the paper summaries. At the meeting, each registrant will receive a copy of the printed Conference Program. Extra copies can be purchased at the meeting for US $100.

Technical Digest

The 2006 BIOMED Technical Digest on CD-ROM will contain PDFs of paper summaries presented during the meeting as they were submitted by the authors. At the meeting, each registrant will receive a copy of the Technical Digest on CD-ROM. Extra copies can be purchased at the meeting for US$ 100.

Current Exhibitors

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Sunday, March 19, 2006		
7:30 a.m.–8:00 a.m.	**SA • Tutorial I: Cancer Pathology**	*Salons D and E*
8:00 a.m.–10:05 a.m.	**SB • Plenary I: NTROI and Cancer**	*Salons D and E*
10:05 a.m.–10:30 a.m.	**Coffee Break**	
10:30 a.m.–1:00 p.m.	**SC • Diffuse Optical Tomography: Clinical**	*Salon D*
10:30 a.m.–1:00 p.m.	**SD • Cancer**	*Salon E*
1:00 p.m.–2:00 p.m.	**Lunch (on your own)**	
2:00 p.m.–2:30 p.m.	**SE • Tutorial II: Spectroscopy**	*Salon D*
2:00 p.m.–4:20 p.m.	**SF • Nanobiophotonics**	*Salon E*
2:30 p.m.–4:30 p.m.	**SG • Spectroscopy and Imaging**	*Salon D*
4:30 p.m.–6:00 p.m.	**SH • Poster Session I**	*Atlantic Ballroom*
6:00 p.m.–7:30 p.m.	**Conference Reception**	*Salons D and E*
Monday, March 20, 2006		
7:30 a.m.–8:00 a.m.	**MA • Tutorial III: Optics in Neuroscience**	*Salons D and E*
8:00 a.m.–10:05 p.m.	**MB • Plenary II: Neuroscience and Spectroscopy**	*Salons D and E*
10:05 a.m.–10:30 a.m.	**Coffee Break/Exhibits**	
10:30 a.m.–1:00 p.m.	**MC • Spectroscopy: Blood Sensing**	*Salon D*
10:30 a.m.–1:00 p.m.	**MD • Neuroscience**	*Salon E*
1:00 p.m.–2:00 p.m.	**Lunch (on your own)**	
2:00 p.m.–3:30 p.m.	**ME • Poster Session II**	*Atlantic Ballroom*
3:30 p.m.–4:00 p.m.	**MF • Tutorial IV: DOT**	*Salon D*
3:30 p.m.–4:00 p.m.	**MG • Neuroscience Invited Speaker**	*Salon E*
4:00 p.m.–6:00 p.m.	**MH • Diffuse Optical Imaging: Theory**	*Salon D*
4:00 p.m.–6:00 p.m.	**MI • Neuroscience and Cancer**	*Salon E*
6:00 p.m.–7:30 p.m.	**Reception and Exhibit Hall open**	*Atlantic Ballroom*
Tuesday, March 21, 2006		
7:30 a.m.–8:00 a.m.	**TuA • Tutorial V: Optical Imaging in Drug Discovery**	*Salons D and E*
8:00 a.m.–10:05 a.m.	**TuB • Plenary III: Drug Discovery and Diffuse Tomography**	*Salons D and E*
10:05 a.m.–10:30 a.m.	**Exhibits/Coffee Break**	
10:30 a.m.–1:00 p.m.	**TuC • Molecular Imaging and Drug Discovery**	*Salon D*
10:30 a.m.–1:00 p.m.	**TuD • Spectroscopy: Scattering and Fluorescence**	*Salon E*
1:00 p.m.–2:00 p.m.	**Lunch (on your own)**	
2:00 p.m.–3:00 p.m.	**Special Session • Pre-planning Meeting for the NIH Optical Imaging Workshop**	*Salons D and E*
3:00 p.m.–3:30 p.m.	**Exhibits/Coffee Break**	
3:30 p.m.–4:00 p.m.	**TuE • Diffuse Optical Imaging Invited Speaker**	*Salon D*
3:30 p.m.–4:00 p.m.	**TuF • Spectroscopy: Novel Technologies**	*Salon E*
4:00 p.m.–6:00 p.m.	**TuG • Small Animal Imaging Methods**	*Salon D*
4:00 p.m.–6:00 p.m.	**TuH • Microscopy I**	*Salon E*
6:00 p.m.–7:15 p.m.	**TuI • Poster Session III**	*Atlantic Ballroom*
Wednesday, March 22, 2006		
7:30 a.m.–8:00 a.m.	**WA • Tutorial VI: Optical Coherence Tomography**	*Salons D and E*
8:00 a.m.–10:05 a.m.	**WB • Plenary IV: Optical Coherence Tomography and Microscopy**	*Salons D and E*
10:00 a.m.–10:30 a.m.	**Exhibits/Coffee Break**	
10:30 a.m.–1:00 p.m.	**WC • Optical Coherence Tomography I: Instrumentation**	*Salon D*
10:30 a.m.–1:00 p.m.	**WD • Technological Advances in Imaging**	*Salon E*
1:00 p.m.–2:00 p.m.	**Lunch (on your own)**	
2:00 p.m.–3:30 p.m.	**Exhibits/Coffee Break**	
3:30 p.m.–6:00 p.m.	**WE • Optical Coherence Tomography II: Applications**	*Salon D*
3:30 p.m.–6:00 p.m.	**WF • Microscopy II**	*Salon E*

Program Agenda

Notes

Abstracts

● Sunday, March 19, 2006 ●

SA • Tutorial I: Cancer Pathology

Salons D and E
7:30 a.m.–8:00 a.m.
SA • Tutorial I: Cancer Pathology
Wendy Wells; Dartmouth College, USA, Presider

SA1 • 7:30 a.m. ▸ Tutorial ◂
Tissue Morphology and Novel Imaging Correlates — The Pathologist's Perspective, *Wendy Wells; Dartmouth College, USA.* Today, optical imaging technology has the potential to improve the accuracy of disease detection and predict treatment response. A pathologist can provide the critical link between validation of novel optical imaging standards and clinical outcome.

SB • Plenary I: NTROI and Cancer

Salons D and E
8:00 a.m.–10:05 a.m.
SB • Plenary I: NTROI and Cancer
Houston Baker; Natl. Cancer Inst./NIH, USA, Presider

SB1 • 8:00 a.m. ▸ Invited ◂
Breast Cancer Diffuse Optical Imaging NTROI: Recent Progress, *Arjun Yodh; Univ. of Pennsylvania, USA.* No abstract available.

SB2 • 8:25 a.m. ▸ Invited ◂
Optical Spectroscopy for Management of Cancer Treatment, *Irving Bigio; Boston Univ., USA.* The vision for this multi-institutional Team is the clinical application of the methods of Elastic Scattering Spectroscopy and Optical Pharmacokinetics for early detection and for the management of photodynamic therapy in the treatment of cancer.

SB3 • 8:50 a.m. ▸ Invited ◂
Network for Translational Research: Optical Imaging, *Wafik S. El-Deiry; Univ. of Pennsylvania, USA.* No abstract available.

SB4 • 9:15 a.m. ▸ Invited ◂
Vertical Cross-Sectional Imaging of Colonic Neoplasia with Dual Axes Confocal Reflectance Microscopy Using Narrowband Source, *Tom Wang; Stanford Univ., USA.* No abstract available.

SB5 • 9:40 a.m. ▸ Invited ◂
Activatable Nanoprobes for Molecular Imaging of Cancer, *Rebekah Drezek; Rice Univ., USA.* No abstract available.

10:05 a.m.–10:30 a.m.
Coffee Break

SC • Diffuse Optical Tomography: Clinical

Salon D
10:30 a.m.–1:00 p.m.
SC • Diffuse Optical Tomography: Clinical
Arjun Yodh; Univ. of Pennsylvania, USA, Presider

SC1 • 10:30 a.m.
Breast Cancer Detection and Characterization Using 3D Diffuse Optical Tomography, *Regine Choe, Soren D. Konecky, Alper Corlu, Kijoon Lee, Turgut Durduran, Britton Chance, Arjun G. Yodh; Univ. of Pennsylvania, USA.* From *in vivo* three-dimensional diffuse optical tomography, the optical contrast of 30+ biopsy proven breast lesions were characterized according to mass type and correlation with demographic factors.

SC2 • 10:45 a.m.
Integration of Diffuse Optical Technology into Clinical Settings for Breast Health Applications, *Natasha S. Shah[1], Albert E. Cerussi[1], Deborah Gordon[1], Amanda Durkin[1], Brian Hill[1], Montana Compton[1], Lari Wenzel[2], Bruce J. Tromberg[1]; [1]Beckman Laser Inst., USA, [2]Ctr. for Health Policy Res., USA.* Diffuse optical techniques have been used in several clinical trials for breast health management. Issues regarding integration of these devices into a clinical setting such as operation by clinic personnel and patient-acceptance are addressed.

SC3 • 11:00 a.m.
Spectral- and Time-Resolved Optical Mammography by Means of a Pulsed Supercontinuum Light Source, *Lorenzo Spinelli[1], Andrea Bassi[2], Cosimo D'Andrea[2], Arianna Giusto[2], Johannes Swartling[3], Alessandro Torricelli[2], Antonio Pifferi[2], Rinaldo Cubeddu[2]; [1]Inst. di Fotonica e Nanotecnologie—CNR, Italy, [2]Politecnico di Milano, Dept. of Physics, Italy, [3]Univ. of Cambridge, Dept. of Chemical, UK.* The clinical feasibility of time-resolved optical mammography on a continuum wavelength spectrum, exploiting a supercontinuum light source and a parallel 32-channel time-correlated single-photon counting system, has been demonstrated by acquiring first images on healthy volunteers.

SC4 • 11:15 a.m.
Three-Dimensional Time-Resolved Optical Mammography of the Uncompressed Breast, *Louise C. Enfield, Adam P. Gibson, Nicholas L. Everdell, David T. Delpy, Jeremy C. Hebden, Simon R. Arridge, Michael Douek, Mohammad R. S. Keshtgar; Univ. College London, UK.* Initial results from 3D optical mammography are presented. Twelve patients with lesions have been imaged to date. Results suggest that optical mammography of the uncompressed breast may provide a practical alternative to other approaches.

SC5 • 11:30 a.m.
Diffuse Optical Tomography and Positron Emission Tomography of Human Breast, *Soren D. Konecky, Rony Wiener, Regine Choe, Alper Corlu, Kijoon Lee, Shyam M. Srinivas, Janet R. Saffer, Richard Freifelder, Joel S. Karp, Arjun G. Yodh; Univ. of Pennsylvania, USA.* We have acquired images of the breasts of four females with suspicious masses using Diffuse Optical Tomography and Positron Emission Tomography. The images are compared, and new types of contrast for cancer imaging are proposed.

SC6 • 11:45 a.m.
Responses to Median Nerve Stimulation as Recorded by Simultaneous Diffuse Optical Imaging and Magnetoencephalography, *Ilkka Nissilä, Steven Stufflebeam, Solomon G. Diamond, Theodore Huppert, Matti Hämäläinen, Maria Angela Franceschini; MGH/MIT/HMS Athinoula A. Martinos Ctr. for Biomedical Imaging, USA.* We measured hemodynamic responses using diffuse optical imaging simultaneouously with evoked magnetoencephalography signals using parametrically varied median nerve stimulation. The spatial locations of the DOI responses and MEG source estimates agreed with each other.

SC7 • 12:00 p.m.
Anatomically Constrained Optical Tomography of the Neonatal Brain, *Adam P. Gibson[1], Nicholas L. Everdell[1], Jeremy C. Hebden[1], Topun Austin[2], Flora Wong[2], Judith H. Meek[2], John S. Wyatt[2], Martin Schweiger[3], Simon R. Arridge[3]; [1]Dept. of Medical Physics, Univ. College London, UK, [2]Dept. of Paediatrics and Child Health, Univ. College London, UK, [3]Dept. of Computer Science, Univ. College London, UK.* We present our latest 3D optical tomography images of the neonatal brain, and discuss new image reconstruction techniques which incorporate prior anatomical information from MRI.

SC8 • 12:15 p.m.
Quantitative Estimation of Cerebral Hemodynamic Changes through the Multimodality Fusion of BOLD and Diffuse Optical Tomography, *Theodore J. Huppert, Solomon G. Diamond, David A. Boas; Harvard Univ., USA.* We describe a state-space model for the integration of multimodality data considering simultaneously the biophysics of the observation processes. We apply this model to experimental data from simultaneous BOLD and DOT imaging.

SC9 • 12:30 p.m.
Diagnosis of Osteoarthritis in the Finger Joints by Three-Dimensional Diffuse Optical Tomography: Pilot Clinical Results, *Zhen Yuan, Qizhi Zhang, Huabei Jiang; Dept. of Biomedical Engineering, Univ. of Florida, USA.* The pilot clinical study shows that finger joints can be quantitatively imaged by 3D

diffuse optical tomography. The reconstructed images and recovered optical properties have demonstrated significant differences between joints with and without osteoarthritis.

SC10 • 12:45 p.m.
Comparison of Static and Dynamic Optical Tomographic Imaging of Rheumatoid Joints, *Joseph Lasker, Daniel Ginat, Edward Dwyer, Andreas Hielscher; Columbia Univ., USA.* We evaluated the performance of static and dynamic optical tomographic imaging for characterizing rheumatoid joints. We found that information generated by each approach is complementary and that using both modalities together enhances the diagnostic potential.

SD • Cancer

Salon E
10:30 a.m.–1:00 p.m.
SD • Cancer
Stefan Andersson-Engels; Lund Inst. of Technology, Sweden, Presider

SD1 • 10:30 a.m.
Risk Stratification of Colon Cancer Using Low-Coherence Enhanced Backscattering Spectroscopy, *Young L. Kim, Yang Liu, Vladimir M. Turzhitsky, Ramesh K. Wali, Hemant K. Roy, Vadim Backman; Northwestern Univ., USA.* We demonstrate that spectroscopic analysis of uninvolved (i.e., colonoscopically and histologically normal) colonic mucosa using low-coherence enhanced backscattering (LEBS) spectroscopy has the potential for predicting neoplastic risk throughout the colon without the need for colonoscopy.

SD2 • 10:45 a.m.
Protoporphyrin IX Fluorescence Imaging of Glioma Tumor Growth in the Murine Brain, *Summer L. Gibbs, Julia OHara, Jack Hoopes, Brian Pogue; Dartmouth College, USA.* Aminolevulinic acid induced Protoporphyrin IX fluorescence accumulates preferentially in brain tumor tissue. Microscopic and macroscopic studies are contrasted to determine the utility as a diagnostic measure of tumor extent *in vivo* for tracking therapeutic response.

SD3 • 11:00 a.m.
Association of *in vivo* and *ex vivo* Measurements of Tissue Oxygenation and Photosensitizer Concentration in Patients with Intraperitoneal Carcinomatosis, *Hsing-Wen Wang, Jarod C. Finlay, Kijoon Lee, Timothy C. Zhu, Theresa M. Busch, Cameron J. Koch, Sydney M. Evans, Stephen M. Hahn, Arjun G. Yodh; Univ. of Pennsylvania, USA.* We have measured tissue oxygenation and drug concentration using *ex vivo* methods and in-vivo diffuse reflectance spectroscopy. The correlation of two methods is reported.

SD4 • 11:15 a.m.
***In vivo* Optical Characterization of Human Prostatic Tissue Using Time-Resolved Near Infra-Red Spectroscopy,** *Tomas Svensson[1], Stefan Andersson-Engels[1], Margrét Einarsdottir[2], Katarina Svanberg[2]; [1]Lund Inst. of Technology, Sweden, [2]Lund Univ. Hospital, Sweden.* This study successfully employs near infra-red time-resolved spectroscopy to measure optical properties of human prostatic tissue *in vivo* in connection with brachytherapy. Results will assist development of interstitial photodynamic therapy for prostate cancer.

SD5 • 11:30 a.m.
***In vivo* Fiber Confocal Microscopy for Detection of Oral Cavity Neoplasia,** *Kristen D. Carlson[1], Michelle Williams[2], Adel El-Naggar[2], Ann Gillenwater[2], Rebecca Richards-Kortum[3]; [1]Univ. of Texas at Austin, USA, [2]MD Anderson Cancer Ctr., USA, [3]Rice Univ., USA.* We have achieved *in vivo*, high-resolution imaging of normal and neoplastic oral mucosa using a fiber optic confocal microscope. *In vivo* confocal microscopy shows significant potential to aid in evaluation of oral lesions.

SD6 • 11:45 a.m.
Reflectance Confocal Microscopy for Imaging Pigmented Basal Cell Cancers *in vivo*, *Anna Liza C. Agero, Klaus J. Busam, Milind Rajadhyaksha, Yogesh Patel, Alon Scope, Cristiane Benvenuto-Andrade, Melissa Gill, Ashfaq A. Marghoob, Salvador González, Allan C. Halpern; Memorial Sloan-Kettering Cancer Ctr., USA.* Reflectance confocal microscopy (RCM) may permit *in vivo* diagnosis of pigmented basal cell carcinomas. RCM demonstrated distinctive aggregations of tumor cells forming cords and nodules of variable brightness, associated with bright granular and dendritic structures.

SD7 • 12:00 p.m.
Compression Induced Changes in the Physiological State of the Breast as Derived from Combined Frequency Domain Photon Migration and White Light Spectroscopy Measurements, *Stefan Carp, Tina Kauffman, Qianqian Fang, Elizabeth Rafferty, Daniel Kopans, David Boas; Massachusetts General Hospital, USA.* We use optical spectroscopy to characterize the influence of mammographic-like compression on the physiology of the breast. A reduction in total hemoglobin, as well as changes in optical scattering, lipid and water content are noted.

SD8 • 12:15 p.m.
Results of a Clinical Study for the Detection of Precancerous Conditions of the Cervix, *Tamara M. Powers[1], Harriet Smith[2], Kathy Bullock[2], Therese Bocklage[2], Alan Waxman[2], Meggan Zsemlye[2], Maxine Dorin[2], Betty Aranda[2], Lisa Marr-Lyon[1], Judith R. Mourant[1]; [1]Los Alamos Natl. Lab, USA, [2]UNM Health Science Ctr., USA.* We present the results of a small clinical trial to assess the ability of polarized and unpolarized elastic scattering spectroscopy to detect high grade squamous intraepithlial lesions (HGSIL) of the uterine cervix.

SD9 • 12:30 p.m.
Monte Carlo Based Model of Fluorescence: Theory and Application to Breast Cancer Diagnosis, *Gregory M. Palmer, Nirmala Ramanujam; Duke Univ., USA.* A Monte Carlo model of fluorescence is developed that can extract intrinsic fluorescence properties of tissue, independent of absorption and scattering. This model is shown to elucidate significant contrast between malignant and non-malignant breast tissues.

SD10 • 12:45 p.m.
Determining the Optical Properties of Tissue Phantoms Using an Interstitial Frequency Domain Technique, *Heping Xu[1,2], Michael S. Patterson[1]; [1]Dept. of Medical Physics, Juravinski Cancer Ctr., Canada, [2]Dept. of Medical Physics and Applied Radiation Sciences, McMaster Univ., Canada.* The effects of source anisotropy and inaccurate placement of fibers were examined. The optical properties can be recovered satisfactorily with interstitial frequency domain measurements if phase amplitude crosstalk is taken into account.

1:00 p.m.–2:00 p.m.
Lunch (on your own)

SE • Tutorial II: Spectroscopy

Salon D
2:00 p.m.–2:30 p.m.
SE • Tutorial II: Spectroscopy
Judith Mourant; Los Alamos Natl. Lab, USA, Presider

SE1 • 2:00 p.m. ▸ Tutorial ◂
Tutorial on Spectroscopy, *Judith Mourant; Los Alamos Natl. Lab, USA.* No abstract available.

SF • Nanobiophotonics

Salon E
2:00 p.m.–4:20 p.m.
SF • Nanobiophotonics
Amir H. Gandjbakhche; Natl. Insts. of Health, USA, Presider

SF1 • 2:00 p.m. ▸ Tutorial ◂
Tutorial on Nanobiophotonics, *Gregory Faris; SRI Intl., USA.* No abstract available.

SF2 • 2:30 p.m. ▸ Invited ◂
Visualizing Cellular Entry of Individual Virus Particles, *Xiaowei Zhuang; Harvard Univ., USA.* No abstract available.

SF3 • 2:55 p.m. ▸ Invited ◂
Photonic Explorers Based on Multifunctional Nano-Platforms for Biosensing and Photodynamic Therapy, *Yong-Eun Lee Koo; Univ. of Michigan, USA.* Nanoparticle based photonic explorers have been developed for intracellular sensing and tumor-specific photodynamic therapy. The design,

employing multifunctional nano-platforms loaded with active components, by encapsulation or covalent attachment, is universal and flexible.

SF4 • 3:20 p.m.
Dual Functionality of Gold Nanostructures for Contrast Enhancement and Photo-Thermal Therapy, *Tao Sun, Fusayo Saeki, Jingyi Chen, Michael J. Cobb, Younan Xia, Xingde Li; Univ. of Washington, USA.* We report on gold nanocages with sizes of 35-65 nm and tunable optical properties. The nanostructures can be bioconjugated for target delivery and potentially function as contrast and photo-thermal therapeutic agents.

SF5 • 3:35 p.m.
Two-Photon Excitation of Quantum Dot Based Nonradiative Energy Transfer, *Aaron R. Clapp[1], Thomas Pons[1,2], Igor L. Medintz[1], Joseph S. Melinger[1], Hedi Mattoussi[1]; [1]NRL, USA, [2]Johns Hopkins Univ., USA.* We demonstrate nonradiative energy transfer in a two-photon excited system with quantum dot donors and proximal dye acceptors. A prototype nanosensing scheme for maltose is also presented in this excitation mode.

SF6 • 3:50 p.m.
A Strategy for Photostable Proximity Bioassays, *Jeanne P. Haushalter, Gregory W. Faris; SRI Intl., USA.* Novel reporters based on juxtaposed lanthanide chelates and noble metal nanoparticles have the potential to enable new photostable proximity assays with high on/off ratios. Results achieved to date show good promise for this approach.

SF7 • 4:05 p.m.
Epi-Illumination Darkfield through a Microscope Objective for Imaging and Spectral Analysis of Nanoparticle Interaction with Cells in Culture, *Adam Curry, Adam Wax; Duke Univ., USA.* Existing darkfield illumination schemes are incompatible with many types of samples and/or procedures. We present a darkfield scheme which addresses these incompatibilities. We then apply the scheme to evaluate nanoparticles binding cancer cells in culture.

SG • Spectroscopy and Imaging

Salon D
2:30 p.m.–4:30 p.m.
SG • Spectroscopy and Imaging
Lihong V. Wang; Texas A&M Univ., USA, Presider

SG1 • 2:30 p.m.
Polar Nephelometer Based On a Rotational Confocal Imaging Setup for Scattering Measurements from Cells, *Jean Luc L. Castagner, Irving Bigio; Boston Univ., USA.* Rapid measurement of the angular distribution of light scattered by particles is achieved using a new type of polar nephelometer with a high angular precision and across many orders of magnitude of intensity.

SG2 • 2:45 p.m.
Using Multimodality Imaging Techniques to Assess Vascularity in AIDS-Related Kaposi's Sarcoma, *Abby Vogel[1,2], Moinuddin Hassan[1], Robert Yarchoan[1], Richard Little[1], Victor Chernomordik[1], Franck Amyot[1], Stavros Demos[3], Amir H. Gandjbakhche[1]; [1]NIH, USA, [2]Univ. of Maryland, USA, [3]Lawrence Livermore Natl. Lab, USA.* Three noninvasive techniques monitored angiogenesis in Kaposi's sarcoma patients: near-infrared spectroscopy, thermography, and laser Doppler imaging. Before and after combination cytotoxic and anti-angiogenesis therapy, blood volume, oxygenated-hemoglobin, temperature, and blood flow were analyzed.

SG3 • 3:00 p.m.
***In vivo* Multiphoton Fluorescence Lifetime Imaging of Free and Protein-Bound NADH in Normal and Pre-Cancerous Epithelia,** *Melissa C. Skala[1,2], Kristin M. Riching[1], Damiain K. Bird[1,3], Kristin M. Vrotsos[1], Annette Gendron-Fitzpatrick[1], Kevin W. Eliceiri[1], Nirmala Ramanujam[1,2]; [1]Univ. of Wisconsin, USA, [2]Duke Univ., USA, [3]Univ. of Melbourne, Australia.* Multiphoton fluorescence lifetime imaging microscopy (FLIM) is a three-dimensional functional imaging technique with cellular resolution. Multiphoton FLIM of the endogenous metabolic coenzyme NADH was utilized for the non-invasive characterization of epithelial pre-cancers.

SG4 • 3:15 p.m.
Study of Breast Tissue Composition Using Magnetic Resonance Imaging and Diffuse Optical Spectroscopy, *Catherine Klifa[1], Ang Li[2], Jona Hattangadi[1], Natasha Shah[2], Jessica Gibbs[1], Erin DeMicco[1], Margarita Watkins[1], Evelyn Proctor[1], Albert Cerussi[2], Bruce Tromberg[2], Nola Hylton[1]; [1]Univ. of California at San Francisco, USA, [2]Univ. of California at Irvine, USA.* We combined Magnetic Resonance Imaging (MRI) and Diffuse Optical Spectroscopy (DOS) to study breast tissue composition in 20 healthy volunteers. A combination of MRI and DOS measures was found to be associated with breast density.

SG5 • 3:30 p.m.
Spectral Imaging for Brain Tumor Margin Demarcation, *Steven C. Gebhart, Shovan K. Majumder, Anita Mahadevan-Jansen; Vanderbilt Univ., USA.* The transition from probe-based spectroscopy to spectral imaging induces lineshape changes in fluorescence and diffuse reflectance. Correcting these effects enables discrimination algorithms determined from probe-based spectroscopy to be applied for surgical guidance with spectral imaging.

SG6 • 3:45 p.m.
Novel Fluorochromes for Functional Imaging of Cancer, *Lanlan Zhou, Lily Moon, Mahsa Ranji, Lin Li, Bleu Zhong, Dana Blessington, Jerry Glickson, Wafik El-Deiry, Britton Chance; Univ. of Pennsylvania, USA.* In spite of no molecular beacon has been used in a significant trial with human breast cancer patients, biopsy specimens open the opportunity to image intrinsic and extrinsic signals of animal and human cancers.

SG7 • 4:00 p.m.
Comparison of Methods for Surface Reflection and Short Path Scatter Removal in Tissue Imaging, *Ian M. Stockford[1], Stephen P. Morgan[1], John A. Crowe[1], John G. Walker[1], Martin Pickstone[2], Mark Layton[2], Jo Howard[3], Kofi A. Anie[3], Asa'ah Nkohkwo[4]; [1]Univ. of Nottingham, UK, [2]Imperial College, UK, [3]Central Middlesex Hospital, UK, [4]Sickle Cell Society, UK.* Cross-polar detection and a dark-field technique to remove surface reflections and short path light from scattering media are compared. Simulations indicate that the dark-field technique exhibits better resolution at the expense of SNR.

SG8 • 4:15 p.m.
Optical Spectroscopy and Imaging as a Tool for Characterizing Silk as a Novel Biomaterial for Tissue Engineering Applications, *Irene Georgakoudi, Irene Tsai, David Kaplan; Tufts Univ., USA.* We report on optical signatures that characterize different silk phases and discriminate between silk, cells and collagen. These methods could be used to optimize conditions for functional tissue development in tissue engineering applications.

SH • Poster Session I

Atlantic Ballroom
4:30 p.m.–6:00 p.m.
SH • Poster Session I

SH1 • 4:30 p.m.
Live Cell Refractometry Using Hilbert Phase Microscopy, *Niyom Lue[1,2], Gabriel Popescu[1], Takahiro Ikeda[3], Kamran Badizadegan[4], Ramachandra R. Dasari[1], Michael S. Feld[1]; [1]M.I.T., USA, [2]Univ. of Massachusetts, USA, [3]Hamamatsu Photonics KK, Japan, [4]Harbard/ MGH, USA.* Using Hilbert phase microscopy developed in our laboratory, we determined the average refractive index of suspended epithelial cells. The technique requires no preparation and can be easily automated and integrated with flow cytometry.

SH2 • 4:30 p.m.
Three-Dimensional Visualization of Lymph Node Morphology Using OCT, *Freddy T. Nguyen[1], Wei Luo[1], Adam M. Zysk[1], Tyler S. Ralston[1], Eric J. Chaney[1], Daniel L. Marks[1], Amy L. Oldenburg[1], John Brockenbrough[2], Stephen A. Boppart[1]; [1]Univ. of Illinois at Urbana-Champaign, USA, [2]Carle Foundation Hospital, USA.* We report the first demonstration of OCT for the three-dimensional visualization of lymph node morphology and microarchitecture from human and carcinogen-induced rat mammary tumor specimens.

SH3 • 4:30 p.m.
Doppler-Optical Coherence Tomography (D-OCT) Velocimetry of Blood Flow in Murine Tumor Microvasculature, *Chetan A. Patil, E. Duco Jansen; Vanderbilt Univ., USA.* D-OCT can potentially be a useful tool for bench-top

research of tumor microvasculature and anti-angiogenic cancer therapies. We demonstrate D-OCT's capabilities by presenting velocimetric functional images of tumor microvasculature in a subcutaneously injected tumor model.

SH4 • 4:30 p.m.
Dermoscopy-to-Confocal Scanning Laser Microscopy Correlation of Melanocytic Neoplasms, *Alon Scope, Cristiane Benvenuto-Andrade, Anna-Liza Agero, Yogesh Patel, Allan Halpern, Salvador Gonzalez, Ashfaq Marghoob; Memorial Sloan-Kettering Cancer Ctr., USA.* Both confocal microscopy and dermoscopy acquire en-face images. Confocal microscopy allowed for precise correlation of important dermoscopic structures of melanoma and nevi with the microscopic tissue counterparts.

SH5 • 4:30 p.m.
A Diode Laser-Based Singlet Oxygen Monitor for Photodynamic Therapy; *in vitro* and *in vivo* Studies, *Seonkyung Lee[1], Danthu H. Vu[1], Michael F. Hinds[1], Steven J. Davis[1], Tayyaba Hasan[2], Alvin Liang[2]; [1]Physical Sciences Inc., USA, [2]Massachusetts General Hospital, USA.* Singlet oxygen is believed to be the active species in photodynamic therapy. We describe a real-time singlet oxygen monitor and its application to *in vivo* studies on tumor-loaded rats and healthy human skin with ALA photosensitizer.

SH6 • 4:30 p.m.
Breast Tissue Mie Scattering Parameter Estimation through Angle-Resolved Scattering Measurements, *Xin Wang[1], Brian Pogue[1], Shudong jiang[1], Roger Springett[1], Keith Paulsen[1], Wendy Wells[2]; [1]Dartmouth College, USA, [2]Dartmouth Medical School, USA.* The Mie-type scattering parameter (average particle size) can be estimated from the angular-scattering measurements taken in a goniometer system. Breast tissue samples were characterized in this manner, to estimate average particle size.

SH7 • 4:30 p.m.
Radiation Therapy Dosimetry With Optical Computed Tomography and MR Scanning, *Antonios E. Papadakis[1], Thomas G. Maris[1], Evangelos Pappas[1], Giannis Zacharakis[2], Anikitos Garofalakis[2], Sasha Atrops[2], Jorge Ripoll[2]; [1]Medical Physics Dept, Univ. Hospital of Heraklion, Univ. of Crete, Greece, [2]Inst. of Electronic Structure and Laser—Foundation of Res. and Technology Hellas, Greece.* We present a study for three-dimensional dose distribution maps of radiation treatment schemes applied in modern radiotherapy, based on the use of Polymer N-Vinylpyrolidone-Argon (VIPAR) polymer gel-dosimeters along with a novel Optical Computed Tomography system.

SH8 • 4:30 p.m.
Single Fiber Optical Probe in Real-Time Non-Invasive Cancer Diagnosis with Elastic Light Scattering Spectroscopy, *Murat Canpolat[1], James Kumi-Diaka[2], Michael J. Dauphinée[3]; [1]Akdeniz Univ., Turkey, [2]Florida Atlantic Univ., USA, [3]Rumbaugh-Goodwin Inst. for Cancer Res., USA.* Elastic light scattering spectroscopy was used to differentiate between cancerous and normal breast tissues in mice in an *ex vivo* experiment. A single optical fiber probe is used to deliver light to and from the tissues.

SH9 • 4:30 p.m.
Acute Effects of Combretastatin A4 Phosphate on Breast Tumor Hemodynamics Monitored by Near Infrared Spectroscopy, *Jae G. Kim[1], Dawen Zhao[2], Ralph P. Mason[2], Hanli Liu[1]; [1]Univ. of Texas at Arlington and UT Southwestern Medical Ctr. at Dallas, USA, [2]Univ. of Texas Southwestern Medical Ctr. at Dallas, USA.* We show the possibility of NIRS being used as a monitoring tool to detect the changes in tumor vasculatures followed by combretastatin A4 phosphate (CA4P) treatment.

SH10 • 4:30 p.m.
Application of Near Infrared Multi-Spectral CCD Imager System to Determine the Hemodynamic Changes in Prostate Tumor, *Manan Goel, Harsha Radhakrishnan, Liping Tang, Hanli Liu; Univ. of Texas at Arlington, USA.* Hemodynamic changes in implanted prostate tumors can be monitored non-invasively with high spatio-temporal resolution using multi-wavelength near infrared CCD imaging system. This technique aids studies of tumor vasculature and heterogeneity.

SH11 • 4:30 p.m.
Tumor Detection by Simultaneous Bilateral DOT Breast Imaging, *Yaling Pei[1], Harry L. Graber[1,2], Mark B. Farber[2], Christoph H. Schmitz[1,2], Yong Xu[1,2], Paul Toubas[2], Naresh Patel[2], Michael Katz[2], William B. Solomon[2], Randall L. Barbour[1,2]; [1]NIRx Medical Technologies, LLC., USA, [2]SUNY Downstate Medical Ctr., USA.* We have constructed a 64 channel dual breast imager for simultaneous bilateral time-series detection. Studies on 37 subjects (14 with cancer) shows that tumor detection and localization is possible with high sensitivity and specificity.

SH12 • 4:30 p.m.
Cytotoxical Effect of "Microexplosions" of Carbon Nanoparticles under Pulsed Laser Irradiation, *Boris Kogan[1], Georgy Vorozhtsov[1], Larisa Ostrovskaya[2], Natalia Bluchterova[2], Margarita Fomina[2], Valentina Rykova[2], Andrey Titov[3], Viktor Rakitin[4], Larisa Kvacheva[5]; [1]Organic Intermediates & Dyes Inst., Russian Federation, [2]Biochemical Physics Inst., Russian Federation, [3]Chemical Physics Inst., Russian Federation, [4]Inst. of Plant Physiology, Russian Federation, [5]A.N. Nesmeyanov Inst. of Organoelement Compounds, Russian Federation.* Antitumor effect of "microexplosions" of carbon nanoparticles under laser irradiation against some mice tumors and lymphoma P 388 cells has been studied. Analysis of gaseous products generating during pulsed heating of nanoparticles was performed.

SH13 • 4:30 p.m.
An Optical Method for Assessing Tumor Angiogenesis: Preliminary Results, *Kerry Lee Anderson[1], Irving J. Bigio[1], Robert Mattrey[2]; [1]Boston Univ., USA, [2]Univ. of California San Diego Medical Ctr., USA.* Anti-angiogenic therapy inhibits the creation of new blood vessels by tumors. These drugs reduce the permeability of tumor blood vessels. We propose an optical method for quantifying changes in vessel permeability to evaluate anti-angiogenic agents.

SH14 • 4:30 p.m.
Human Breast Cancer Identification by K-Space Analysis of Optical Coherence Tomography Images, *Adam M. Zysk, Stephen A. Boppart; Univ. of Illinois at Urbana-Champaign, USA.* Coherent tomographic imaging of mammary lesions has been demonstrated as an effective means for identifying margins between healthy and diseased tissue. We present k-space techniques for computational identification of human breast carcinomas in OCT images.

SH15 • 4:30 p.m.
Dye-Enhanced Confocal Microscopy as an Optical Pathology Tool, *Anna N. Yaroslavsky[1], John Novak[1], Elena Salomatina[2], Ivan Amat-Roldan[1]; [1]Harvard Medical School, USA, [2]Massachusetts General Hospital, USA.* Dye-enhanced multi-modal confocal microscopy provides an efficient real-time optical pathology tool. Reflectance and fluorescence confocal images are remarkably similar to histology. Fluorescence polarization registered from cancer is higher than that of other structures.

SH16 • 4:30 p.m.
Simultaneous Monitoring Tumor Vascular and Tissue Oxygen Tension Under Hyperbaric Oxygen Exposure, *Mengna Xia[1], Benjamin Levine[2], Ya Ren[3], Ralph Mason[3], Hanli Liu[1]; [1]Biomedical Engineering Program,Univ. of Texas at Arlington, USA, [2]Inst. of Exercise and Environmental medicine, UT Southwestern Medical Ctr. at Dallas, USA, [3]Dept. of Radiology, UT Southwestern Medical Ctr. at Dallas, USA.* We demonstrate the ability to simultaneously investigate breast tumor oxygen dynamics by Steady-state diffuse reflectance spectroscopy and FOXY oxygen sensor in response to hyperbaric oxygen intervention.

SH17 • 4:30 p.m.
Monte Carlo Model of Low-Coherence Enhanced Backscattering (LEBS) from Anisotropic Disordered Media, *Hariharan Subramanian, Prabhakar Pradhan, Young L. Kim, Yang Liu, Vadim Backman; Northwestern Univ., USA.* We report the development of first photon random walk model of low-coherence enhanced backscattering (LEBS) to further our understanding of origin of LEBS in biological tissue. The results are in good agreement with experimental data.

SH18 • 4:30 p.m.
Tumor Boundary Optical Labeling Using Fluorescence, *Xudong Xiao, Jeanne P. Haushalter, Khalid Amin, Zishan Haroon, Gregory W. Faris; SRI Intl., USA.* We describe a method of fluorescent labeling of tumor boundaries that uses an enzyme involved in the wound healing process to link infrared-labeled substrate into the tumor boundary.

SH19 • 4:30 p.m.
Improved Design of a Heterodyne Angle-Resolved Low Coherence Interferometry System Used for New Chemoprevention and Carcinogenesis Studies, *Kevin J. Chalut, John W. Pyhtila, Adam Wax; Duke Univ., USA.* Improvements have been made in existing angle-resolved interferometry system to enable greater accuracy and angular range for use in new chemopreventive/carcinogenisis studies.

SH20 • 4:30 p.m.
Suppression of Photodynamic Process by Some Dyes, *Vladimir A. Hovhannisyan, Hasmik A. Avetisyan; Yerevan Physics Inst., Armenia.* It is shown that some photochemically inactive dyes can partly or completely suppress photodynamic effect in Drosophila melanogaster. Energy transfer from photoexcited dyes is considered as the possible mechanism of photodynamic process inhibition.

SH21 • 4:30 p.m.
Optical Fourier Techniques for Medical Image Processing, *Rao D. V. G. L. N., Chandra S. Yelleswarapu; Univ. of Massachusetts, USA.* Photo-controlled absorption and polarization of Bacteriorhodopsin (bR) films are exploited to perform spatial filtering for screen film as well as digital mammograms. The results offer useful information to radiologists for early detection of breast cancer.

SH22 • 4:30 p.m.
Fluorene Derivative Doped Organic Modified Silica Nanoparticles as Biological Imaging Contrast Agents, *Kevin D. Belfield, Sheng Yao, Katherine J. Schafer-Hales; Univ. of Central Florida, USA.* A synthetic methodology was developed to entrap a highly efficient two-photon fluorescent dye 1 into organic modified silica nanoparticles. The nanoparticles synthesized exhibit uniform size contribution of about 20 nm in diameter.

SH23 • 4:30 p.m.
Optical Properties of Nanoshells for Diagnostic Imaging, *Anant Agrawal[1], Alex W. H. Lin[2], Min-Ho Lee[2], Rebekah Drezek[2], Joshua Pfefer[1]; [1]Food and Drug Administration, USA, [2]Rice Univ., USA.* Extinction and backscattering properties of gold nanoshells were investigated using spectrophotometry and optical coherence tomography (OCT). While trends were largely consistent between these measurements and Mie theory, quantitative agreement varied with wavelength and nanoshell geometry.

SH24 • 4:30 p.m.
Fabrication of Polydimethylsiloxane Phantoms for Optical Imaging Based on Quantum Dot Nanofluorophores, *David P. Klemer, Norman Medina, Daniel R. Klemer; Univ. of Wisconsin-Milwaukee, USA.* We describe a method for fabrication of polydimethylsiloxane (PDMS) phantoms suitable for optical fluorescence imaging systems based on quantum dot nanofluorophores in aqueous solution, and illustrate examples of phantom designs and measurements.

SH25 • 4:30 p.m.
Development of Laser Induced Fluorescence Sensor for the Detection of Human Breast Cancer Cell lines Conjugated with Gold Nanoparticles, *Chan Kyu Kim[1], Jagdish P. Singh[1], Alicia N. Musselwhite[2], Scott T. Willard[2], Paresh Chandra Ray[3]; [1]Diagnostic Instrumentation and Analysis Lab (DIAL), USA, [2]Dept. of Animal and Dairy Sciences, USA, [3]Dept. of Chemistry, USA.* An optical fiber sensor is developed for diagnosis of human breast cancer cell lines. Due to surface plasmon resonance the sensitivity of human breast cancer cell LIF technique can be improved by conjugating with nanoparticle.

SH26 • 4:30 p.m.
NIRS Measurement of the Pulsatile Component of Cerebral Blood Flow and Volume from the Arterial Oscillations, *George Themelis, Helen D'Arceuil, Solomon Gilbert Diamond, Sonal Thaker, Theodore James Huppert, David Boas, Maria Angela Franceschini; Athinoula A. Martinos Ctr., USA.* We present a method to noninvasively measure changes in pulsate cerebral blood flow (pCBF) and volume (pCBV) based on the shape of the heart beat pulse. We present preliminary data obtained from piglets.

SH27 • 4:30 p.m.
Neoadjuvant Chemotherapy Monitoring with Diffuse Optical Measurement of Blood Flow in Breast Tumors, *Regine Choe[1], Chao Zhou[1], Turgut Durduran[1], Guoqiang Yu[1], Natasha Shah[2], Amanda Durkin[2], Albert Cerussi[2], Bruce J. Tromberg[2], Arjun G. Yodh[1]; [1]Univ. of Pennsylvania, USA, [2]Univ. of California, Irvine, USA.* Preliminary results from diffuse optical spectroscopy and diffuse correlation spectroscopy on a patient going through a neoadjuvant chemotherapy demonstrate feasibility to utilize these methods for early response monitoring to the cancer therapy.

SH28 • 4:30 p.m.
Developing Photogrammetric Methods for Acquiring Realistic Head Surface Models of Newborn Infants for Optical Tomography, *Mauren Abreu de Souza, Jeremy C. Hebden, Adam P. Gibson, Veronique Sauret, Stuart Robson; Univ. College London, UK.* Three-dimensional optical imaging of the newborn infant brain requires precise knowledge of the head surface and the optode positions. Photogrammetric techniques are being developed which provide this information for infants in an intensive care environment.

SH29 • 4:30 p.m.
Incorporation of MR Structural Information in Diffuse Optical Tomography Using Helmholtz Type Regularization, *Phaneendra K. Yalavarthy, Colin M. Carpenter, Shudong Jiang, Hamid Dehghani, Brian W. Pogue, Keith D. Paulsen; Dartmouth College, USA.* A framework to incorporate analytical forms of structural MRI information is presented. This type of information gives superior quantitative results compared to standard NIR tomography and the covariance forms preserve the structural shape function expected.

SH30 • 4:30 p.m.
Diffuse Fluorescence Tomography Analysis of B-Scan Mode Geometry, *Dax Kepshire[1], Summer Gibbs[1], Scott Davis[1], Hamid Dehghani[2], Keith D. Paulsen[1], Brian W. Pogue[1]; [1]Thayer School of Engineering, Dartmouth College, USA, [2]Dept. of Physics, Univ. of Exeter, UK.* A fluorescence diffuse optical tomography system capable of producing B-scan-type images of localized fluorescence regions is presented. The B-Scan mode is analogous to ultrasound where the excitation and remission signals are delivered from the surface.

SH31 • 4:30 p.m.
Comparison of Frequency-Domain Transport and Diffusion-Based Reconstructions of Small Tissue Volumes, *Kui Ren, Guillaume Bal, Andreas H. Hielscher; Columbia Univ., USA.* Using frequency-domain transport- and diffusion-based algorithms we show that image reconstructions that employ the transport equation are in general of superior quality when small tissue volumes, as encountered in rodent or joint imaging, are considered.

SH32 • 4:30 p.m.
Tomographic Imaging of Oxygen in Tissue by Phosphorescence Lifetime: A Computational Study, *Sofia V. Apreleva, David F. Wilson, Sergei A. Vinogradov; Univ. of Pennsylvania, USA.* In this paper using numerical simulations we demonstrate feasibility of near infrared oxygen imaging in tissue by phosphorescence lifetime in time-domain and show reconstructions of hypoxic phantoms in cylindrical model.

SH33 • 4:30 p.m.
Analysis of 3-Dimensional Reconstruction in a MR-Guided NIR Tomography System, *Colin Carpenter, Brian Pogue, Phaneedra Yalavarthy, Scott Davis, Shudong Jiang, Hamid Dehghani, Keith Paulsen; Dartmouth College, USA.* The algorithms for near-infrared (NIR) diffuse optical tomography within magnetic resonance imaging (MRI) of the female breast are analyzed in both circular and curved slab geometries.

SH34 • 4:30 p.m.
Time-Gated Imaging through Murine Chest Cavities, *Mark J. Niedre, Gordon M. Turner, Vasilis Ntziachristos; Massachusetts General Hospital, USA.* Time-resolved measurements of femtosecond laser pulse transmission through mice were performed using a high speed gated image intensifier. Quantification of tissue optical properties and measurement of transmission characteristics at different time gates were obtained.

SH35 • 4:30 p.m.
Multispectral NIR Diffuse Optical Tomography System Development, *Shudong Jiang[1,2], Brian W. Pogue[1], Scott Davis[1], Keith D. Paulsen[1]; [1]Thayer School of Engineering, Dartmouth College, USA, [2]Dept. of Diagnostic Radiology, Dartmouth Medical School, USA.* A broadband 650-950nm transmission acquisition is implemented in conjunction with a frequency-domain imaging system. For

breast tissues and phantoms, most spectra can be obtained at all source-detection positions with an exposure time less than 40min.

SH36 • 4:30 p.m.
Development of Spectrally-Constrained Diffuse Optical Tomography for Imaging Exogenous Contrast Agents, *Scott C. Davis, Brian W. Pogue, Subha Srinivasan, Hamid Dehghani, Keith D. Paulsen; Dartmouth College, USA.* Spectrally-constrained diffuse tomography is used to image endogenous and exogenous tissue chromophore concentrations with higher accuracy than when using individual wavelengths. Reconstructed images from simulated data demonstrate that concentrations of Lutetium Texaphyrin are readily recovered.

SH37 • 4:30 p.m.
Surface Reconstruction from Contours for Non-Contact Fluorescence Molecular Tomography, *Tobias Lasser, Vasilis Ntziachristos; Lab for Bio-optics and Molecular Imaging, Ctr. for Molecular Imaging Res., MGH, USA.* We present an accurate surface extraction technique and demonstrate its use in complete-projection 360° non-contact Fluorescence Molecular Tomography (FMT) without matching fluids. This strategy is expected to yield unprecedented imaging performance in small animal FMT.

SH38 • 4:30 p.m.
Quantitative Reconstruction of Refractive Index Distribution and Imaging of Glucose Concentration Using Diffusing Light, *Xiaoping Liang, Qizhi Zhang, Huabei Jiang; Dept. of Biomedical Engineering, USA.* A two-step reconstruction method is adapted to improve the quantitative accuracy of refractive index reconstruction in phase contrast diffuse optical tomography (PCDOT). The possibility of PCDOT for recovering glucose concentration is demonstrated through phantom experiments.

SH39 • 4:30 p.m.
Absorption Properties of Breast: The Contribution of Collagen, *Paola Taroni, Daniela Comelli, Antonio Pifferi, Alessandro Torricelli, Rinaldo Cubeddu; Politecnico di Milano, Dept. of Physics, Italy.* The absorption spectrum of collagen (630–1000 nm) was measured and used—with hemoglobin, water, and lipids—to interpret the absorption spectra of healthy breast. Collagen accounts for up to 30% of breast volume.

SH40 • 4:30 p.m.
Comparison of CCD and Scanning Devices for Fluorescence Imaging of Inhomogeneities in Tissue-Like Phantoms and *in vivo*, *Jörn Berger[1], Thomas Betz[1], Jan Voigt[1], Rainer Macdonald[1], Bernd Ebert[1], David Mory[2], Jens Baumgärtel[2], Hellmuth Obrig[3]; [1]Physikalisch-Technische Bundesanstalt, Germany, [2]LTB Lasertechnik Berlin GmbH, Germany, [3]Dept. of Neurology, Charité—Univ. Medicine, Germany.* We compared camera based large area illumination systems versus a flying spot scanning device for fluorescence imaging of small inhomogeneities containing NIR dyes embedded in scattering tissue-like phantoms as well as for *in vivo* applications.

SH41 • 4:30 p.m.
Development of Head Probes for Optical Tomography and Topography of the Newborn Infant Brain, *Gilberto Branco, Nicholas L. Everdell, Adam P. Gibson, David T. Delpy, Jeremy C. Hebden, Rebeccah Slater, Anne Cantarella, Judith H. Meek; Univ. College London, UK.* Novel probes have been developed for optical tomography (whole-brain imaging) and optical topography (cortical mapping) of the newborn brain. These have been evaluated on a range of infants at rest and during functional stimulation.

SH42 • 4:30 p.m.
Tissue Refractive Index as a New Imaging Parameter for Diffuse Optical Tomography: Pilot Results in the Breast, *Huabei Jiang[1], Xiaoping Liang[1], Qizhi Zhang[1], Changqing Li[1], Stephen Grobmyer[2], Laurie Fajardo[3]; [1]Dept. of Biomedical Engineering, USA, [2]Dept. of Surgery, USA, [3]Dept. of Radiology, USA.* We describe an extension of diffuse optical tomography (DOT) technique for imaging phase-contrast due to the spatial variation of tissue refractive index. We demonstrate this phase-contrast DOT using pilot clinical data for breast cancer detection.

SH43 • 4:30 p.m.
Selection of Optimal Modulation Frequencies in Multi-Frequency DOT, *Ozlem Birgul, Mehmet Burcin Unlu, Roshanak Shafiiha, Gultekin Gulsen, Orhan Nalcioglu; Tu and Yuen Ctr. for Functional Onco Imaging, USA.* Use of multi-frequency DOT for reconstruction of optical properties is investigated. Choosing appropriate frequency values by considering system noise and using multi-parameter Tikhonov regularization, improvement is demonstrated using phantom data with multi-frequency reconstruction.

SH44 • 4:30 p.m.
Towards 3D Mapping and Correction of Optical Properties in Turbid Media Based on Spatially Modulated Illumination, *David Abookasis, David J. Cuccia, Joon S. You, Anthony J. Durkin, Bruce J. Tromberg; Laser Microbeam and Medical Program, Beckman Laser Inst., UCI, USA.* A simple technique for 3D mapping and correction of the absorption and reduced scattering coefficients in turbid media is suggested based on spatial patterns. Experimental results demonstrate the suggested technique.

SH45 • 4:30 p.m.
Fast Time-Resolved Optical Tomography for 3D Neonatal Functional Imaging, *David K. Jennions[1], Adam P. Gibson[1], Nicholas L. Everdell[1], Jeremy C. Hebden[1], Wolfgang Becker[2]; [1]UCL Medical Physics, UK, [2]Becker & Hickl GmbH, Germany.* We have added new TCSPC electronics to our 3D time-resolved imaging system. This will allow 3D functional images of the neonatal brain. We report on preliminary validation of the electronics.

SH46 • 4:30 p.m.
Fluorescence Molecular Tomography Based on A Priori Information, *Ahmed Serdaroglu[1], Birsen Yazici[1], Vasilis Ntziachristos[2]; [1]Dept. of Electrical, Computer, and Systems Engineering, Rensselaer Polytechnic Inst., USA, [2]Ctr. for Molecular Imaging Res., Dept. of Radiology, Massachusetts General Hospital, Harvard Medical School, USA.* We obtain fluorophore absorption reconstructions from small animals *in vivo* by incorporating anatomical information obtained from MRI into the optical measurements. The mismatch between the anatomical and functional images is accounted by using Tikhonov-based regularization approach.

SH47 • 4:30 p.m.
Finite Element Approximations for the Radiative Transfer Equation, *Marko Vauhkonen, Tanja Tarvainen, Ville Kolehmainen, Jari P. Kaipio; Univ. of Kuopio, Finland.* The radiative transfer equation is solved with the finite element method utilizing the streamline diffusion modification. Results of simulations are shown.

SH48 • 4:30 p.m.
Reconstruction Hidden Objects with Multiple Spackle Images Using Microlens Array for Medical Diagnostics, *David Abookasis, Joseph Rosen; BGU Univ., Israel.* A new method of seeing objects hidden in scattering medium from multiple speckle images is demonstrated. The entire noisy images from lens array are digitally processed to obtain the desired image of the hidden objects

SH49 • 4:30 p.m.
Modeling Photon Migration in Tissues with the Coupled Radiative Transfer Equation and Diffusion Approximation, *Tanja Tarvainen[1], Marko Vauhkonen[1], Ville Kolehmainen[1], Jari P. Kaipio[1], Juha Heiskala[2], Simon R. Arridge[3]; [1]Univ. of Kuopio, Finland, [2]BioMag Lab and Helsinki Brain Res. Ctr., Finland, [3]Univ. College London, UK.* Light propagation is modeled with the radiative transfer equation in sub-domains in which the assumptions of the diffusion approximation are not valid. The diffusion approximation is used elsewhere in the domain.

SH50 • 4:30 p.m.
Non-Invasive Assessment of the Mechanical Properties of Human Skin—Investigation of Effective Age Using an Optical Method, *Neil T. Clancy[1], Martin J. Leahy[1], Gert E. Nilsson[2]; [1]Univ. of Limerick, Ireland, [2]Inst.ionen för medicinsk teknik, Sweden.* A technique is described that uses novel imaging techniques to track the decay of an imprint made in the skin and hence, can infer the 'effective age' of the skin.

SH51 • 4:30 p.m.
Three-Dimensional Image Reconstruction of Human Finger Joints, *Alexander D. Klose[1], Rong Song[1], Alexander K. Scheel[2], Uwe Netz[3], Juergen Beuthan[3], Andreas H. Hielscher[1]; [1]Columbia Univ. New York, USA, [2]Georg August Univ., Germany, [3]Free Univ. Berlin, Germany.* We have developed a three-dimensional image reconstruction algorithm based on the equation of radiative transfer to recover

the spatial distribution of optical properties in finger joints. We show 3D reconstruction results of human finger joints.

SH52 • 4:30 p.m.
Time-Resolved Imaging of a Fluorescent Inclusion in a Turbid Medium Using a Gated CCD Camera, *Aurélie Laidevant[1], Anabela da Silva[1], Philippe Peltié[1], Jean-Marc Dinten[1], Cosimo D'Andrea[2], Lorenzo Spinelli[2], Gianluca Valentini[2], Rinaldo Cubeddu[2]; [1]Cea— Grenoble/ DRT—Leti, France, [2]INFM and INFN-CNR, Politecnico di Milano, Italy.* A time-gated camera was used to measure temporal profiles from a fluorescent inclusion embedded in a turbid medium. The mean time was correlated with the inclusion depth.

SH53 • 4:30 p.m.
Fluorescence Optical Tomography in Cylindrical Geometry for Small Animal Multimodality Tomographer, *Anabela Da Silva, Medhi Leabad, Jean-Marc Dinten, Philippe Peltié, Philippe Rizo; LETI-CEA Recherche Technologique, France.* A small animal tomographer dedicated to co-registration of fluorescence optical signal and X-rays measurements is under development. An exact analytical solution to the diffusion equation used for modelling the optical forward problem has been established.

SH54 • 4:30 p.m.
A Simplified Globally Convergent Reconstruction Method for 3-Dimensional Optical Tomography, *Jianzhong Su[1], Hanli Liu[1], Hua Shan[1], Michael V. Klibanov[2]; [1]Univ. of Texas at Arlington, USA, [2]Univ. of North Carolina at Charlotte, USA.* A novel method is presented for reconstruction of optical absorption coefficient from transmission Near-Infrared data with a continuous-wave source. This mathematical scheme has the potential to work for large data sets in highly heterogeneous background.

SH55 • 4:30 p.m.
Morphological Imaging of the Breast with Multi-Spectral Diffuse Optical Tomography, *Changqing Li[1], Lin Chen[1], Qizhi Zhang[1], Stephen Grobmyer[2], Laurie Fajardo[3], Huabei Jiang[1]; [1]Biomedical Engineering Dept., Univ. of Florida, USA, [2]Dept. of Surgery, Univ. of Florida, USA, [3]Dept. of Radiology, Univ. of Iowa, USA.* We report on initial *ex vivo* and *in vivo* results for morphological imaging of the breast using our multi-spectral diffuse optical tomography (MSDOT) method.

SH56 • 4:30 p.m.
Optical Fluorescence Imaging of Breast Cancer, *Leon Bakker[1], Martin van der Mark[1], Michiel van Beek[1], Marjolein van der Voort[1], Gert 't Hooft[1], Tim Nielsen[2], Thomas Koehler[2], Ronny Ziegler[2], Kai Licha[3], Martin Pessel[3]; [1]Philips Res., The Netherlands, [2]Philips Res., Germany, [3]Schering AG, Germany.* We report on the first fluorescence results obtained with the Philips Optical Mammoscope and Schering AG's omocianine dye. In preparation of a clinical trial, the fluorescence implementation, image reconstruction and first phantom results are presented.

SH57 • 4:30 p.m.
A Dual-Modality System for Dynamic Contrast Enhanced Imaging, *Gultekin Gulsen, Mehmet Burcin Unlu, Ozlem Birgul, Han Yan, Orhan Nalcioglu; Univ. of California, IRVINE, USA.* The goal of this study is to develop a dynamic DOT system as an adjunct to MRI. Such a combined system may provide complementary information and lead to increased specificity in breast cancer characterization.

SH58 • 4:30 p.m.
Towards Functional Optical Imaging in Layered Tissues Using Modulated Imaging, *Jessie R. Weber, David J. Cuccia, Frederic Ayers, Joon S. You, Anthony J. Durkin, Bruce J. Tromberg; Laser Microbeam and Medical Program, Beckman Laser Inst., UC Irvine, USA.* We present forward modeling and measurement of spatially modulated illumination in layered turbid tissue systems to provide quantitative, depth-resolved functional information in tissues including cortex, retina and skin.

SH59 • 4:30 p.m.
Diffuse Light Propagation in a Parallel Plate CW DOT Instrument with Non-Contact Detectors, *Kijoon Lee, Regine Choe, Alper Corlu, Soren D. Konecky, Turgut Durduran, Arjun G. Yodh; Univ. of Pennsylvania, USA.* In many DOT instrument, it is hard to generate viable reconstruction without a reference measurement. We show why the accuracy of forward model is often insufficient for absolute reconstruction, based on our transmission DOT instrument.

SH60 • 4:30 p.m.
FDTD-Simulation of Multiple Light Scattering in Dentin, *Jan Schäfer[1], Alwin Kienle[1], Florian Klaus Forster[1], Alfred Strey[2]; [1]Inst. für Lasertechnologien in der Medizin und Meßtechnik an der Univ. Ulm, Germany, [2]Univ. Ulm, Abteilung Neuroinformatik, Germany.* A two-dimensional finite difference time domain software has been developed to simulate light propagation in biological tissue. The phase functions of dentin slabs of various thicknesses were calculated, predicting the appearance of an interference peak.

SH61 • 4:30 p.m.
A Two-Layer Tissue Structure Model With a Tilted Interface Improves the Estimation Accuracy of Bulk Tissue Optical Properties, *Mini Das; Univ. of Connecticut, USA.* Reflectance measurement of breast is influenced by the underlying chest-wall with a tilted interface as seen by the probe. A two-layer tissue model with tilted interface improves the estimation accuracy in such tissue structures.

SH62 • 4:30 p.m.
Possibilities of Spatial Resolution Increasing in Optical Diffuse Tomography, *Olga V. Kravtsenyuk[1], Natalie A. Kalintseva[2], Vladimir V. Lyubimov[2], Alexander G. Murzin[2]; [1]Inst. of Electronic Systems and Lasers, Foundation for Res. and Technology, Greece, [2]Res. Inst. for Laser Physics, Russian Federation.* The use of the reconstruction algorithm based on a concept of average statistical trajectories for light energy transfer opens promising opportunities for the increasing of the spatial resolution using methods designed in the convenient optics.

SH63 • 4:30 p.m.
Spectral Measurement of the Relative Concentration of Two Chromophores in Localized Defects Within Turbid Media, *Ning Liu, Angelo Sassaroli, Sergio Fantini; Dept. of Biomedical Engineering, USA.* We present a spectral approach for assessing relative concentration of two chromophores in localized inhomogeneities within turbid-media. Initial experiments on highly scattering suspensions show that relative concentration of two dyes can be determined within 10%.

SH64 • 4:30 p.m.
Monte Carlo Modeling of Optoacoustic Signals from Large Veins: Implication for Noninvasive Monitoring of Cerebral Blood Oxygenation, *Igor Patrikeev, Yuriy Y. Petrov, Irina Y. Petrova, Donald S. Prough, Rinat O. Esenaliev; Univ. of Texas Medical Branch, USA.* We calculated optoacoustic signals in cylindrical geometry using modified Monte Carlo code and demonstrated good correlation of the signal parameters with blood effective attenuation coefficient which varies with oxygenation across a wide spectral range.

SH65 • 4:30 p.m.
Direct Reconstruction of Pharmacokinetic Rate Images of Indocyanine Green in Fluorescence Molecular Tomography, *Burak Alacam[1], Birsen Yazici[1], Xavier Intes[2], Britton Chance[3], Shoko Nioka[3]; [1]Rensselaer Polytechnic Inst., USA, [2]ART, Advanced Res. Technologies Inc, Canada, [3]Univ. of Pennsylvania, USA.* We propose a two-compartment model to present the pharmacokinetics of ICG around a tumor region. We introduce a method to directly reconstruct ICG pharmacokinetic rate images from boundary photon flux measurements using extended Kalman filtering.

SH66 • 4:30 p.m.
Diffusion of Polarized Light in Turbid Media, *Min Xu; Inst. for Ultrafast Spectroscopy and Lasers, USA.* Diffusion of polarized light in turbid media is investigated using random walk and found to be anisotropic when polarization of light persists after multiple scattering. Potential applications in biomedical optics will be presented.

SH67 • 4:30 p.m.
CW Detection of Near-Axis Scattered Light for Transillumination Imaging, *Kazuto Takagi, Yuji Kato, Koichi Shimizu; Graduate School of Information Science and Technology, Hokkaido Univ., Japan.* We propose a new technique to extract a near-axis scattered component from the diffused light through scattering

medium. By controlling the light propagation path, the diffusely scattered component is effectively suppressed. The feasibility was verified.

SH68 • 4:30 p.m.
Use of Perturbation Monte Carlo for Measurement of Optical Properties in an Extended Epithelial Tissue Model, *InSeok Seo, Joon S. You, Carole Hayakawa, Vasan Venugopalan; UC Irvine, USA.* A pMC based inverse solution for the determination of optical properties in an extended epithelial tissue model is experimentally validated.

SH69 • 4:30 p.m.
Laser-Doppler Spectrum Decomposition for Measurement of Distribution of Speed of Particles, *Adam Liebert, Norbert Zolek, Roman Maniewski; Inst. of Biocyberentics and Biomedical Engineering, Poland.* A novel method, based on decomposition of laser-Doppler spectrum, for measurement of distribution of speed of particles moving in a turbid medium was presented. Monte Carlo simulations were performed to validate proposed method.

SH70 • 4:30 p.m.
Improvement of Fluorescence Tomography Reconstructions with Higher Order Born Approximation of Diffuse Photon Density Waves, *Lionel F. Hervé, Anabela Da Silva, Anne Koenig, Jean-Marc Dinten, Jérôme Boutet, Michel Berger, Isabelle Texier, Philippe Peltié, Philippe Rizo; LETI-CEA Recherche Technologique, France.* We present the results of a fluorescence tomography experiment which shows that the quality of the fluorescence reconstruction is improved when the forward model is corrected from the optical properties variations of the probed medium.

SH71 • 4:30 p.m.
Quantitative Photoacoustic Tomography: Reconstruction of Optical Absorption Coefficient from Experimental Data, *Zhen Yuan, Huabei Jiang; Dept. of Biomedical Engineering,Univ. of Florida, USA.* We report on experimental demonstration of quantitative photoacoustic tomography for reconstructing the absolute absorption coefficient of heterogeneous media. Phantom results are obtained using a finite element-based reconstruction algorithm coupled with a scanning photoacoustic imaging system.

SH72 • 4:30 p.m.
Towards Fluorescence Mediated Laser Scanning Mammography: Phantom Experiments and Contrast Mechanisms, *Oliver Steinkellner[1], Dirk Grosenick[1], Ronny Ziegler[2], Tim Nielsen[2], Rainer Macdonald[1], Herbert Rinneberg[1]; [1]Physikalisch-Technische Bundesanstalt, Germany, [2]Philips Res., Germany.* We investigated the influence of dye concentration on contrast in imaging experiments on fluorescent breast-like phantoms. We discuss the reversal of fluorescence contrast at higher dye concentrations due to re-absorption of fluorescence light.

SH73 • 4:30 p.m.
Separately Reconstructing the Structural and Functional Parameters of a Fluorescent Inclusion Embedded in a Turbid Medium, *Baohong Yuan, Quing Zhu; Univ. of Connecticut, USA.* Unlike conventional fluorescence diffuse optical tomography, we separate the imaging procedure into two steps to respectively reconstruct the structural information and the functional information of a fluorescing target embedded in a turbid medium.

6:00 p.m.–7:30 p.m.
Conference Reception

● Monday, March 20, 2006 ●

MA • Tutorial III: Optics in Neuroscience

Salons D and E
7:30 a.m.–8:00 a.m.
MA • Tutorial III: Optics in Neuroscience
David Rector; Washington State Univ., USA, Presider

MA1 • 7:30 a.m. ▸ **Tutorial** ◂
Tutorial on Optics in Neuroscience, *David Rector; Washington State Univ., USA.* No abstract available.

MB • Plenary II: Neuroscience and Spectroscopy

Salons D and E
8:00 a.m.–10:05 p.m.
MB • Plenary II: Neuroscience and Spectroscopy
Anna Devor; Harvard Medical School, USA, Presider

MB1 • 8:00 a.m. ▸ **Invited** ◂
High-Resolution Functional Optical Imaging: Sub-Millimeter Physiology of Living Tissue, *Elizabeth M. Hillman; Massachusetts General Hospital, USA.* We have developed and applied new optical technologies for imaging the brain's neuronal and hemodynamic responses to stimulus, including 3D high-resolution Laminar Optical Tomography, video-rate 2-photon microscopy and simultaneous 2D optical imaging and fMRI.

MB2 • 8:25 a.m. ▸ **Invited** ◂
Direct Comparison of Electrophysiological, Intrinsic Signal Imaging, Voltage Sensitive Dye Imaging, and fMRI Signals in Sensory Cortex of Nonhuman Primates, *Anna Roe; Vanderbilt Univ., USA.* No abstract available.

MB3 • 8:50 a.m. ▸ **Invited** ◂
Optofluidic Microscope: A Novel High Resolution Microscope-on-a-Chip System, *Changhuei Yang; Caltech, USA.* We report the implementation of a novel microscope-on-a-chip system, termed "Optofluidic Microscope (OFM)". The OFM prototype is high resoluton, compact and capable of high throughput sample imaging. Further, it has the potential of achieving super-resolution.

MB4 • 9:15 a.m. ▸ **Invited** ◂
***In vivo* Quantification of Protein Interactions Using Lifetime Resolved FRET and FCS,** *Peter T. So; MIT, USA.* Microanalysis incorporating fluorescence lifetime-resolved resonance energy transfer and fluorescence correlation spectroscopy allows the kinetics and the thermodynamics of protein association to be quantified *in vivo*.

MB5 • 9:40 a.m. ▸ **Invited** ◂
Phase Sensitive CARS Microscopy, *Eric O. Potma; Harvard Univ., USA.* No abstract available.

10:05 a.m.–10:30 a.m.
Coffee Break/Exhibits

MC • Spectroscopy: Blood Sensing

Salon D
10:30 a.m.–1:00 p.m.
MC • Spectroscopy: Blood Sensing
Michael Feld; MIT, USA, Presider

MC1 • 10:30 a.m.
Spatially Resolved Measurement of Blood Oxygen Saturation in a Tissue Phantom Using Photoacoustic Spectroscopy, *Jan Laufer, Clare Elwell, Dave Delpy, Paul Beard; Univ. College London, UK.* Pulsed photoacoustic spectroscopy was used to make quantitative and spatially resolved measurements of blood oxygen saturation (SO2) in vitro with a performance comparable to that of a CO-oximeter.

MC2 • 10:45 a.m.
Non-Invasive Blood Analysis Using Raman Spectroscopy, *Marjolein van der Voort[1], Michiel van Beek[1], Gerald Lucassen[1], Pieter de Bokx[1], Wouter Rensen[1], Jan Engel[2]; [1]Philips Res. Europe, The Netherlands, [2]CQM, The Netherlands.* We have developed a non-invasive blood analysis method based on combined imaging and confocal Raman spectroscopy. With this technology, *in vivo* Raman spectra can be obtained that resemble *in vitro* spectra with respect to shape and intensity.

MC3 • 11:00 a.m.
***In vivo* Study of Blood Glucose Concentration Prediction with Optical Coherence Tomography,** *Veronika Sapozhnikova, Roman Kuranov, Donald Prough, Inga Cicenaite, Rinat Esenaliev; UTMB, USA.* The capability of optical coherence tomography (OCT) to predict blood glucose concentration changes within physiological range was studied *in vivo*. Accuracy of 2 mM in prediction of blood glucose concentration by OCT has been achieved.

MC4 • 11:15 a.m.
Alterations in Regional Oxygen Saturation (StO2) and Blood Volume (HbT) in Infants With Brain Injuries and ECMO, *P. Ellen Grant[1,2], George Themelis[1], Kara Arvin[2], Sonal Thaker[1], Kalpathy K. Krishnamoorthy[2], Heather Bortfeld[3], Maria Angela Franceschini[1]; [1]Mass General Hospital, USA, [2]Massachusetts General Hospital, USA, [3]Texas A&M Univ., USA.* To determine if quantitative regional StO2 and HbT measured with near infrared spectroscopy (NIRS) could detect differences between normal neonates and those with acute cerebral injury or on cardiopulmonary bypass.

MC5 • 11:30 a.m.
Real-Time Monitoring of Hemodynamic Changes in Neonatal Pig Brain with Head Trauma Injury, *Chao Zhou, Turgut Durduran, Guoqiang Yu, Stephanie Eucker, Stuart Friess, Rebecca Ichord, Susan Margulies, Arjun G. Yodh; Univ. of Pennsylvania, USA.* Diffuse optical techniques were used to continuously monitor hemodynamic changes in piglet brains after traumatic head injury. The potential for using all optical methods for long-term monitoring of human trauma patients is thus suggested.

MC6 • 11:45 a.m.
Modelling of Indocyanine Green Bolus with a Finite Element Model of the Adult Human Head and the Fick Principle, *Terence S. Leung[1], Ilias Tachtsidis[1], Clare E. Elwell[1], David T. Delpy[1], Martin Tisdall[2], Martin Smith[2], Simon Arridge[3]; [1]Dept. of Medical Physics & Bioengineering, Univ. College London, UK, [2]Dept. of Neuroanathesia, The Natl. Hospital for Neurology & Neurosurgery, UK, [3]Dept. of Computer Science, Univ. College London, UK.* Using the Fick principle and a finite element model of light distribution, ICG boluses were simulated in a head model, showing measurable changes in cerebral blood flow using NIR surface measurements despite the superficial contamination.

MC7 • 12:00 p.m.
Intrinsic Raman Spectroscopy Improves Analyte Concentration Measurements in Turbid Media, *Wei-Chuan Shih, Kate L. Bechtel, Michael S. Feld; MIT, USA.* We present a new technique, intrinsic Raman spectroscopy, which utilizes diffuse reflectance to correct sample turbidity-induced distortions in Raman spectra. This technique allows for improved analyte concentration measurements in turbid media.

MC8 • 12:15 p.m.
3D Reconstruction of B-lymphocytes with Confocal Images and Parallel FDTD Simulations of Light Scattering, *Robert S. Brock[1], Xin-Hua Hu[1], Douglas A. Weidner[1], Judith R. Mourant[2], Jun Q. Lu[1]; [1]East Carolina Univ., USA, [2]Los Alamos Natl. Lab, USA.* Mueller matrix elements of B-lymphocytes were obtained with reconstructed structures using a parallel FDTD code. By comparing with sphere models, we show that fine structure features of biological cells are important in modeling light scattering.

MC9 • 12:30 p.m.
Time-Resolved Multi-Wavelength Analysis for the Quantification of Chromophore Concentrations and Scattering Parameters in Turbid Media, *Cosimo D'Andrea[1], Lorenzo Spinelli[2], Andrea Bassi[1], Arianna Giusto[1], Davide Contini[1], Johannes Swartling[3], Alessandro Torricelli[1], Rinaldo Cubeddu[1]; [1]Politecnico di Milano, Italy, [2]IFN-CNR, Italy, [3]Univ. of Cambridge, UK.* We have developed and experimentally validated, on tissue-simulating phantoms and *in vivo*, a time-resolved spectral fitting analysis for direct evaluation of chromophore

concentrations and scattering parameters. Data have been acquired by a parallel time-resolved broadband system.

MC10 • 12:45 p.m.
Method for Recovering Quantitative Broadband Diffuse Optical Spectra from Layered Media, *Ang Li, Richard Kwong, Albert Cerussi, Carole Hayakawa, Bruce Tromberg; Beckman Laser Inst., USA.* The recovery of broadband diffuse optical spectra of both layers in a two-layer phantom is reported for the first time. The recovery uses a diffusion equation solution with relative multi-distance broadband diffuse optical reflectance measurements.

MD • Neuroscience

Salon E
10:30 a.m.–1:00 p.m.
MD • Neuroscience
Monica Fabiani; Univ of Illinois at Urbana-Champaign, USA, Presider

MD1 • 10:30 a.m.
Functional Imaging in Freely Moving Rats, *Randall L. Barbour[1,2], Yaling Pei[2], Harry L. Graber[1,2], Rehman Ansari[2], Christoph H. Schmitz[1,2], Matthew Holzer[1], Jeremy Barry[1], Robert Muller[1]; [1]SUNY Downstate Medical Ctr., USA, [2]NIRx Medical Technologies, LLC., USA.* We have developed an integrated DOT-EEG and behavioral recording system that provides, through a tethered head stage, concurrent recording in freely moving rats. Results show that EEG-gated signals (theta, LIA) have spatially distinct hemodynamic responses.

MD2 • 10:45 a.m.
Neurovascular Coupling in the Rat Somatosensory Cortex: A Non-Invasive Diffuse Optical Imaging and Electroencephalography Study, *Maria Angela Franceschini, Ilkka Nissilä, Weicheng Wu, Giorgio Bonmassar, David A. Boas; Mass General Hospital, USA.* In this work we investigated the relationship between electrical and hemodynamic responses relating to neuronal activation. To this aim diffuse optical imaging and electroencephalography were recorded simultaneously and noninvasively on rats during parametric forepaw stimulation.

MD3 • 11:00 a.m.
Functional Imaging of Rat Somatosensory Cortex using Optical Coherence Tomography, *Yu Chen[1], Aaron D. Aguirre[1], Lana Ruvinskaya[2], Anna Devor[2], David A. Boas[2], James G. Fujimoto[1]; [1]MIT, USA, [2]Massachusetts General Hospital and Harvard Medical School, USA.* Simultaneous OCT and video microscopy were performed on rat somatosensory cortex during forepaw stimulation. Fractional changes in localized regions of OCT images reveal a functional signal time-course similar to hemodynamic signal measured with video microscopy.

MD4 • 11:15 a.m.
Time Course of Activation of Human Occipital Cortex Measured with the Event-Related Optical Signal (EROS), *G. Gratton, K. A. Low, E. L. Maclin, C. R. Brumback, B. Gordon, Monica Fabiani; Beckman Inst., Univ. of Illinois at Urbana-Champaign, USA.* We recorded fast optical changes elicited by visual stimulation in occipital cortex from 19 young and 45 old human subjects. Faster propagation of activity from primary to secondary visual areas was observed in younger subjects.

MD5 • 11:30 a.m.
Diffuse Optical Tomography of Visual Cortex Activation in Humans, *Benjamin W. Zeff[1], Joseph P. Culver[1], Hamid Dehghani[2]; [1]Dept. of Radiology, Washington Univ. School of Medicine, USA, [2]School of Physics, Univ. of Exeter, UK.* We present diffuse optical tomography of brain activity in the human visual cortex. A new, high-density imaging instrument improves spatial sampling and allows better discrimination of the cortical hemodynamic response and background signals.

MD6 • 11:45 a.m.
Time Domain Optical Imager for Depth-Resolved 1.8 Hz Functional Imaging of the Adult Head, *Juliette J. Selb, Danny K. Joseph, David A. Boas; Athinoula A. Martinos Ctr., USA.* We developed a 32 source, 18 detector time-gated system using a pulsed laser and an ICCD camera. Multiple delay parallel detection and source time-multiplexing enable 1.8 Hz functional imaging of both hemispheres with depth discrimination.

MD7 • 12:00 p.m.
Optically Teasing Apart Neural Swelling and Depolarization, *Amanda J. Foust, David M. Rector; Washington State Univ., USA.* We measured voltage sensitive dye, scattered light and birefringence from nerves during potassium channel blockade. Birefringence followed membrane voltage while scattering was slower and long lasting, dissociating cellular swelling processes from membrane potential.

MD8 • 12:15 p.m.
Speckle Holography: A Noninvasive Technique for Imaging Nerve Activity, *Kurt J. Schoener, Daniel A. Dworkis, Theoden Netoff, Irving J. Bigio; Boston Univ., USA.* Results are presented for a novel optical imaging technology capable of distinguishing between resting and active states of a crayfish ventral nerve based on imaging of the action potential-induced swelling of the nerve's axons.

MD9 • 12:30 p.m.
Differential Heterodyne Mach-Zehnder Interferometer for Measurement of Nanometer-Scale Motions in Living Cells, *Christopher M. Fang-Yen, Seungeun Oh, Sen Song, Sebastian Seung, Ramachandra R. Dasari, Michael S. Feld; MIT, USA.* We have developed a novel differential heterodyne Mach-Zehnder interferometer for measuring sub-nanometer displacements in single cells. We describe efforts to measure voltage-dependent refractive index changes and mechanical fluctuations in cultured single neurons.

MD10 • 12:45 p.m.
Fast Optical Imaging of Neural Activation in Isolated Retina, *Xin-Cheng Yao, John S. George; Los Alamos Natl. Lab, USA.* We demonstrated fast imaging of activation in isolated frog retina using intrinsic optical responses associated with electrophysiological function. Dynamic optical responses were routinely observed in single pass experiments with ~1 micron and <10 ms resolution.

1:00 p.m.–2:00 p.m.
Lunch (on your own)

ME • Poster Session II

Atlantic Ballroom
2:00 p.m.–3:30 p.m.
ME • Poster Session II

ME1 • 2:00 p.m.
Time-Resolved Reflectance of Two-Layered Tissue Models Via Scaling of "White" Monte Carlo Simulations, *Robert H. Wilson, Karthik Vishwanath, Mary-Ann Mycek; Univ. of Michigan, USA.* Absorption-scaling methods were applied to Monte Carlo simulations of two-layered tissues by incorporating a path integral (PI) formalism. Times spent by photons in the top-layer can be significantly underestimated when determined using PI.

ME2 • 2:00 p.m.
3D Diffuse Optical Tomography of Finger Joints Based on Globally Convergent Method and Enhanced Initial Values Optimization Scheme, *Zhen Yuan, Qizhi Zhang, Huabei Jiang; Dept. of Biomedical Engineering,Univ. of Florida, USA.* We present an enhanced reconstruction algorithm for three-dimensionally imaging finger joint based on global convergent methods and enhanced initial values optimization scheme. The improved approach can provide quantitatively better images than our previous algorithm.

ME3 • 2:00 p.m.
Localizing Hemodynamic Activations in the Human Brain, *Petri Hiltunen[1], Juha Heiskala[2]; [1]Lab of Biomedical Engineering, Helsinki Univ. of Technology, Finland, [2]BioMag Lab, Helsinki Univ. Central Hospital, Finland.* Absorption changes due to brain activations were reconstructed from simulated measurement data. Results suggest that when certain assumptions hold, reconstruction of absorption change can be done using intensity data only.

ME4 • 2:00 p.m.
Reconstruction of Optical Properties of Tissue Based on Perturbation Monte-Carlo Method, *Tangbing Guan, Huijuan Zhao, Daoyin Yu, Feng Gao; College of Precision Instrument and Optoeletronics Engineering of Tianjin Univ., China.* A method for reconstruction of tissue optical properties, which uses perturbation Monte-Carlo approach to extract information for reconstruction

rapidly, is introduced. This method is demonstrated by solving the inverse problem of a layered tissue.

ME5 • 2:00 p.m.
Numerical and Analytical Approaches for Non-Contact Fluorescence Optical Tomography, *Lionel Hervé, Anabela da Silva, Jérôme Boutet, Anne Frassati, Jean-Marc Dinten, Philippe Peltié, Philippe Rizo; LETI-CEA Recherche Technologique, France.* A numerical and an analytical approach for the forward solver used in non contact fluorescence optical tomography have been considered. Experiments have been performed on a half cylinder like resin phantom with Alexa750 fluorophores inclusions.

ME6 • 2:00 p.m.
Moments of Distributions of Times of Flight of Photons for Depth-Resolved NIR Imaging: Measurements on a Physical Phantom, *Michal Kacprzak[1], Adam Liebert[1], Piotr Sawosz[1], Roman Maniewski[1], Heide Boeth[2]; [1]Inst. of Biocybernetics and Biomedical Engineering, Poland, [2]FH Koblenz, Univ. of Applied Science, RheinAhrCampus Remagen, Germany.* Time-resolved imaging system was constructed and experiments on a liquid physical phantom were carried out to show depth sensitivity of moments of measured distributions of times of flight of photons.

ME7 • 2:00 p.m.
Monte Carlo Simulations of Time-Resolved Fluorescence Excited in a Layered Turbid Medium, *Adam Liebert[1], Heidrun Wabnitz[2], Rainer Macdonald[2], Herbert Rinneberg[2]; [1]Inst. of Biocyberentics and Biomedical Engineering, Poland, [2]Physikalisch-Technische Bundesanstalt, Germany.* We developed an efficient Monte Carlo algorithm to model time- and distance-resolved fluorescence excited in layered tissue in reflectance geometry. The algorithm was applied to two-layered media. Maps of fluorescence generation probability were calculated.

ME8 • 2:00 p.m.
Comparison of Spatially Integral and Time-Resolved Reflectance for the Determination of the Optical Properties on Two Kinds of Optical Phantoms, *Aurélie Laidevant[1], Anabela da Silva[1], Michel Berger[1], Jean-Marc Dinten[1], Julie Falconet[2], Raphaël Sablong[2], Emmanuel Perrin[2], Hervé Saint-Jalmes[2]; [1]Cea— Grenoble/ DRT— Leti, France, [2]Universite Claude Bernard Lyon 1, France.* A comparison of a spatially-resolved and a time-resolved method have been peformed on two different optical phantoms. We present and discuss the results of the optical properties.

ME9 • 2:00 p.m.
Controlled Monte Carlo Method for Reflection Geometry, *Nanguang Chen; Natl. Univ. of Singapore, Singapore.* The Controlled Monte Carlo method is generalized for arbitrary geometries. Its implementation for the reflection geometry is exemplified in this paper. Simulation results are provided along with predictions from the diffusion equation.

ME10 • 2:00 p.m.
Time-Resolved Analytical Approach for Localization of a Fluorescent Inclusion in a Turbid Medium, *Aurélie Laidevant, Anabela da Silva, Jean-Marc Dinten; Cea— Grenoble/ DRT—Leti, France.* We developed a method based on the analytical expression of the mean time to localize a fluorescent inclusion embedded in a turbid medium. Experimental results are presented for a specific geometry.

ME11 • 2:00 p.m.
Comparison of Imaged ICG and Gd Kinetics with a DOT-MRI Instrument, *David R. Busch[1,2], Xavier Intes[2], Shoko Nioka[1], Britton Chance[1]; [1]Univ. of Pennsylvania, USA, [2]ART, Inc, Canada.* We present initial patient data comparing ICG and Gd kinetics in breast cancers, correlated to radiological diagnosis and pathology. Our optical system uses TRS for bulk properties and a fast CW system for kinetics imaging.

ME12 • 2:00 p.m.
Optimization of the Source-Detector Geometry for Diffuse Optical Tomography, *Xiaoman Xing, Kijoon Lee, Regine Choe, Arjun G. Yodh; Univ. of Pennsylvania, USA.* We use simulation and singular value analysis to optimize source-detector geometry for breast imaging in the parallel plane geometry.

ME13 • 2:00 p.m.
Source Intensity Optimization and Phantom Studies in Three-Dimensional Diffuse Optical Tomography, *Changqing Li, Huabei Jiang; Biomedical Engineering Dept., USA.* We describe a source intensity optimization method in three dimensional (3D) diffuse optical tomography (DOT) image reconstruction. The method is evaluated by phantom experiments.

ME14 • 2:00 p.m.
High Resolution Laser Speckle Contrast Imaging of Cerebral Blood Flow at Microscopic Scale during Functional Activation, *Jian Yu[1], David A. Boas[1], Andrew K. Dunn[2]; [1]Martinos Biomedical Imaging Ctr., Massachusetts General Hospital/Harvard Medical School, USA, [2]Dept. of Biomedical Engineering, Univ. of Texas at Austin, USA.* We developed a high resolution laser speckle contrast imaging system which enhanced the resolution to 4 microns. This allows us to study the hemodynamics to functional activation at single arteriole or venule level.

ME15 • 2:00 p.m.
Action Potentials in Invertebrate Nerves Studied by Modulated Light Changes, *M. D. McCluskey[1], J. J. Sable[2], A. J. Foust[1], G. Gratton[2], D. M. Rector[1]; [1]Washington State Univ., USA, [2]Univ. of Illinois, USA.* Event-related optical signals (EROS) were obtained from electrically stimulated lobster nerves, using a modulated light source and heterodyne detection system. Changes in birefringent light intensity corresponded with electrophysiological measurements of the action potential.

ME16 • 2:00 p.m.
Near Infrared Topography with Depth Information for the Detection of Face Perception in Infants, *Anna Blasi[1,2], Nick Everdell[1], Jem Hebden[1], Clare Elwell[1], Sarah Fox[2], Leslie Tucker[2], Agnes Volein[2], Gergely Csibra[2], Mark Johnson[2], Mark Johnson[2]; [1]Univ. College London, UK, [2]Ctr. for Brain and Cognitive Development (CBCD) Babylab, School of Psychology, Birkbeck College, Univ. of London, UK.* Near infrared intensity signals were recorded from 3 different depths of the visual cortex with a 30-channel system from 12 young infants to detect subtle differences in processing stimuli with different degrees of complexity.

ME17 • 2:00 p.m.
Local Cerebral Blood Flow Responses to Direct Stimulation in Somatosensory Cortex: Laser Doppler Flowmetric and Autoradiographic Analysis, *Zhongchi Luo[1,2], Jasbeer Dhawan[1], Helene Benveniste[1,3], Mei Yu[1], Andrew Gifford[1], Congwu Du[1]; [1]Medical Dept., Brookhaven Natl. Lab, USA, [2]Biomedical Engineering Dept., State Univ. of New York at Stony Brook, USA, [3]Dept. of Anesthesiology, State Univ. of New York at Stony Brook, USA.* We present the experiment results of *in vivo* laser Doppler flowmetry (LDF) and FDG (18Fluorodeoxyglucose) labeled *in vitro* autoradiography to study the local cerebral blood flow (LCBF) evoked by direct stimulation in the rat somatosensory cortex.

ME18 • 2:00 p.m.
Imaging Epilepsy Using Finite Element-Based Photoacoustic Tomography: Initial *in vivo* Results, *Qizhi Zhang[1], Zhao Liu[2], Paul R. Carney[2], Huabei Jiang[1]; [1]Dept. of Biomedical Engineering, Univ. of Florida, USA, [2]Div. of Pediatric Neurology, Univ. of Florida, USA.* We report on an exciting new application of our finite element-based photoacoustic tomography method for imaging epilepsy. Initial *in vivo* animal results are demonstrated and confirmed with EEG recordings.

ME19 • 2:00 p.m.
Low-Cost Four-Wavelength Continuous-Wave Near-Infrared Spectroscopy Instrument for Noninvasive Studies of the Human Brain, *Lauri Lipiäinen, Tommi Noponen, Kalle Kotilahti, Pekka Meriläinen; Helsinki Univ. of Technology, Finland.* A low-cost, versatile continuous-wave near-infrared spectroscopy instrument is presented, and the feasibility of the instrument for human brain studies is validated with representative phantom and physiological test measurements.

ME20 • 2:00 p.m.
Spectrally Resolved Neurophotonics: The Optical BOLD Effect and Vascular Components in the Mammalian Brain, *Kandice Tanner, Enrico D'Amico, Amy Kaczmarowski, Shwayta Kukreti, Joe Malpeli, William W. Mantulin, Enrico Gratton; Univ. of Illinois at Urbana Champaign, USA.* We developed a broad band spectral technique that is independent of the light transport modality to

separate optical changes in scattering and absorption in the cat's brain due to the hemodynamic signal following visual stimulation.

ME21 • 2:00 p.m.
Design and Characterization of a Two-Wavelength Multi-Channel Time-Resolved System for Optical Topography, *Davide Contini[1], Antonio Pifferi[1], Lorenzo Spinelli[2], Alessandro Torricelli[1], Rinaldo Cubeddu[1]; [1]Politecnico di Milano, Italy, [2]IFN-CNR, Italy.* We developed a fast 16-source 64-detector time-resolved system for functional NIR studies. Description of the main blocks of the system (injection optics, detection, and control) and system characterization are presented.

ME22 • 2:00 p.m.
Principal Component Analysis and LMS Filtering in Removing Surface Effects from Near-Infrared Spectroscopy Signals, *Jaakko Virtanen, Tommi Noponen, Pekka Meriläinen; Helsinki Univ. of Technology, Finland.* Signal processing methods can be used to remove surface effects from near-infrared-spectroscopic cerebral signals. In this study we successfully tested two methods: principal component analysis and least-mean-squares filtering.

ME23 • 2:00 p.m.
Evaluation of Phase Signals in Quantitative Near-Infrared Spectroscopy, *Tommi Noponen[1], Timo Kajava[1], Ilkka Nissilä[2], Kalle Kotilahti[3], Pekka Meriläinen[1]; [1]Helsinki Univ. of Technology, Finland, [2]Harvard Medical School, USA, [3]Helsinki Univ. Central Hospital, Finland.* We study the effect of continuous phase measurement on the estimation of concentration changes in quantitative near-infrared spectroscopy. We also assess the sensitivity of phase signals on the estimation of physiological changes in tissue.

ME24 • 2:00 p.m.
Quantitative Measurements of Dynamic Cell Morphometry and Intracellular Integral Refractive Index with Digital Holographic Microscopy, *Pierre M. Marquet[1], Pierre J. Magistretti[1,2], Benjamin Rappaz[2,3], Tristan Colomb[3], Jonas Kühn[3], Christian Depeursinge[3]; [1]Ctr. de Neurosciences Psychiatriques, Switzerland, [2]Brain Mind Inst., Switzerland, [3]Lab d'Optique Appliquée, Switzerland.* A digital holographic microscope, permitting to monitor cellular dynamics by measuring the cellular phase shift with a high temporal stability and a procedure allowing to calculate the refractive index and the cellular thickness are presented.

ME25 • 2:00 p.m.
Novel Multichannel Near Infrared Spectrophotometry System: Functional Studies of the Visual Cortex in Neonates, *Geert Morren, Daniel Haensse, Tanja Karen, Andrea S. Bauschatz, Derek Brown, Hans-Ulrich Bucher, Martin Wolf; Clinic of Neonatology, Switzerland.* Using a novel non-invasive near-infrared spectrophotometry imaging instrument, we measured the changes in cerebral oxy- and deoxyhemoglobin concentration in response to visual stimulation in 15 healthy term neonates.

ME26 • 2:00 p.m.
Intracranial Hematoma Detection Using Near Infrared Light and Local Reference Method, *Sergei I. Turovets[1], Peter S. Lovely[2], Don M. Tucker[2]; [1]NeuroInformatics Ctr., Univ. of Oregon, USA, [2]Electrical Geodesics, Inc., USA.* Simulations have been done to show feasibility of a new algorithm for intracranial hematoma detection. This is based on the local reference NIR method, and it holds promise of enhancing the predicting power of detection.

ME27 • 2:00 p.m.
A Differential *in vivo* Two Photon Microscopy Method for Quantitative Imaging of Dye Extravasation in Mouse Cortex, *Pascale Vérant[1], Raphaël Serduc[2], Jean Claude Vial[1], Clément Ricard[2], Chantal Remy[2], Jonathan Coles[2], Elke Brauer[3], Alberto Bravin[3], Boudewijn P. van der Sanden[2]; [1]CNRS, UMR 5588, Spectrométrie Physique, France, [2]INSERM research unit 594, France, [3]European Synchrotron Radiation Facility, France.* An improved two-photon microscopy technique for imaging blood brain barrier leakage in the cortex of mice.

ME28 • 2:00 p.m.
Brain Activation in the Visual and the Motor Cortex Assessed with Event-Related Functional Near Infrared Spectroscopy (fNIRS): Are the Results Reproducible? *Michael M. Plichta[1], Martin J. Herrmann[2], Christina G. Baehne[1], Ann-Christine Ehlis[1], Andreas J. Fallgatter[1]; [1]Lab for Psychophysiology and Functional Imaging, Germany, [2]Genomic Imaging, Univ. Hospital of Psychiatry and Psychotherapy Wuerzburg, Germany, Germany.* Human brain activation was recorded in two sessions on a CW-system to investigate the reproducibility of its spatial extent, location and magnitude. Reproducibility of the size and the location was excellent at the group level.

ME29 • 2:00 p.m.
Effects of Vasodilation on Intrinsic Optical Signals, *Enrico Gratton, Kandice Tanner, Erin Beitel, Enrico D'Amico, William W. Mantulin; Univ. of Illinois at Urbana-Champaign, USA.* Using a spectral technique, we showed that during visual stimulation of the cat brain there was an apparent change in water content. We developed a simple model to explain how vasodilation could cause this effect.

ME30 • 2:00 p.m.
Calculations of BOLD Signals by use of NIRS Photon Migration Hitting Density Functions, *Angelo Sassaroli[1,2], Sergio Fantini[1], Yunjie Tong[1], Blaise Frederick[2], Perry Renshaw[2]; [1]Tufts Univ., USA, [2]McLean Hospital, USA.* We present a comparison of NIRS data and BOLD signals concurrently acquired during motor area activation. The BOLD signals are calculated by applying a weighted average according to the photon migration hitting density function.

ME31 • 2:00 p.m.
Detection of Changes in Rat Spinal Cord Due to Peripheral Stimulation Using NIR Reflectance Spectroscopy, *Harsha Radhakrishnan, Yuan B. Peng, Arun K. Senapati, Christopher E. Hagains, Hanli Liu; Univ. of Texas at Arlington, USA.* Near infrared reflectance spectroscopy showed significant changes in light scattering and hemoglobin oxygen saturation on the ipsilateral side of the rat spinal cord during electrical stimulation of the plantar surface on the hind paw.

ME32 • 2:00 p.m.
Calibration in Laser Speckle Contrast Imaging, *Shuai Yuan[1,2], Andrew K. Dunn[1], David A. Boas[1]; [1]Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, Harvard Medical School, USA, [2]Dept. of Biomedical Engineering, Tufts Univ., USA.* We provided a novel calibration procedure in laser speckle contrast imaging that can efficiently compensate systematic errors in speckle contrast caused by speckle/pixel size mismatch and static scatters in the tissue.

ME33 • 2:00 p.m.
***In vivo* Detection of Intrinsic Optical Signal Changes in Rat Spinal Cord Due to Formalin Using a Multi-Wavelength CCD Camera,** *Manan Goel, Yuan B. Peng, Harsha Radhakrishnan, Hanli Liu; Univ. of Texas at Arlington, USA.* Significant changes in light reflectance were seen on ipsilateral side of rat spinal cord when injecting formalin on hind paw plantar surface, showing the effectiveness of near-infrared imaging in detecting intrinsic optical signal changes.

ME34 • 2:00 p.m.
Depth-Selective Analysis of Responses to Functional Stimulation Recorded with a Time-Domain NIR Brain Imager, *Heidrun Wabnitz[1], Michael Moeller[1], Alfred Walter[1], Rainer Macdonald[1], Rainer Erdmann[2], Olaf Raitza[3], Michal Kacprzak[4], Adam Liebert[4], Christoph Drenckhahn[5], Jens P. Dreier[5], Stefan Koch[5], Jens Steinbrink[5]; [1]Physikalisch-Technische Bundesanstalt, Germany, [2]Picoquant GmbH, Germany, [3]LOPTEK Glasfasertechnik, Germany, [4]Inst. of Biocybernetics and Biomedical Engineering, Poland, [5]Dept. of Neurology, Charité—Univ. Medicine Berlin, Germany.* A novel time-domain brain imager has been applied in motor and visual stimulation experiments. Analyzing time windows together with moments of measured time-resolved reflectance allowed us to separate superficial and cerebral responses.

ME35 • 2:00 p.m.
Coherences of Slow Oscillations in Near-Infrared Spectroscopy Signals and Other Cardiovascular Parameters, *Tiina Näsi[1], Tommi Noponen[1], Lauri Lipiäinen[1], Markku Paloheimo[2], Kalle Kotilahti[3], Pekka Meriläinen[1]; [1]Lab of Biomedical Engineering, Helsinki Univ. of Technology, Finland, [2]Dept. of Anesthesia and Intensive Care Medicine, Eye Hospital, Helsinki Univ. Hospital, Finland, [3]BioMag Lab, Helsinki Univ. Central Hospital, Finland.* Cardiovascular signals were recorded from head and arm using two near-infrared spectroscopy instruments, an intra-arterial and an intravenous blood pressure monitor, and an electrocardiograph. Slow spontaneous oscillations were investigated and coherences between signals were estimated.

ME36 • 2:00 p.m.
Characterization of Scalp- and Brain-Layer Heterogeneity for Near Infrared Spectroscopy, *Andrew J. Berger, Rolf B. Saager; Univ. of Rochester, USA.* Near-infrared monitoring of cerebral hemodynamics is hampered by biological noise. We propose noise reduction via a two-detector scheme and present measurements characterizing relevant heterogeneity scales for scalp and brain layers in human volunteers.

ME37 • 2:00 p.m.
Where Does Optical Imaging of Cancer Stand with Respect to Other Cancer Imaging Technologies? *Britton Chance, Shoko Nioka, Zhongyao Zhao, Lanlan Zhou, Lin Li, Lily Moon; Univ. of Pennsylvania, USA.* Diagnostic and therapeutic capabilities for heterogeneous cancers requires sub-mm resolution currently obtainable with snap frozen biopsies of human/small animal cancers with 2 and 3D scanning at 50 micron or better resolution.

ME38 • 2:00 p.m.
Proposal and Proof of Principle for a Novel Optical Biopsy Needle: Modulating an Optical Needle's Reflectivity Alters the Average Photon Path in Scattering Media, *Paul D. Simonson, Enrico D'Amico, Enrico Gratton; Univ. of Illinois, USA.* We show through Monte Carlo simulations and experiments that a novel optical needle can be used to probe different volumes of tissue in the needle's vicinity by simply modulating the needle's reflectivity.

ME39 • 2:00 p.m.
Simulation of Mitochondrial Function in Brain and Muscle Tissues, *Britton Chance, Ping Huang; Univ. of Pennsylvania, USA.* The goal of our study was to develop a model that can simulate the performance of oxygen diffusion and metabolism in brain and muscle tissues, especially oxygen delivery from capillary to mitochondria activating oxidative phosphorylation.

ME40 • 2:00 p.m.
Quantitative Determination of Blood Volume, Oxygenation, and Edema in Port Wine Stain Lesions, *Joon You, David Cuccia, Anthony Durkin, J. Stuart Nelson, Bruce Tromberg; Beckman Laser Inst., USA.* Clinical results suggest that quantitative mapping of vascular physiology and structures determined with Modulated imaging technique may be useful guide for effective treatments of Port-wine stains.

ME41 • 2:00 p.m.
Novel Approaches to High Resolution Recording of Emotion-Related PFC Signals in Different Ethnic Groups, *Britton Chance, Shoko Nioka, Qing Luo; Univ. of Pennsylvania, USA.* The optical method to distinguish blood concentration changes from blood oxygenation relating to the release of vasoactive substances from the mitochondria and other sources, or from the saturation changes due to activation of mitochondrial metabolism.

ME42 • 2:00 p.m.
Determination of Lipid Layer Thickness with Broadband Diffuse Optical Spectroscopy, *Richard Kwong, Albert Cerussi, Sean Merritt, Jason Ruth, Bruce Tromberg; Beckman Laser Inst., USA.* Broadband Diffuse Optical Spectroscopy (DOS) measurements performed on the forearm of ten random subjects are correlated with skin fold calipers values to show that DOS can be used to measure lipid layer thickness.

ME43 • 2:00 p.m.
A Discrete Ordinate Radiative Transfer Model of Human Skin Tissue: The Importance of Melanosome Scattering, *Kristian P. Nielsen[1], Jakob J. Stamnes[1], Knut Stamnes[2], Johan Moan[3]; [1]Univ. of Bergen, Norway, [2]Stevens Inst. of Technology, USA, [3]Norwegian Radium Hospital, Norway.* We have investigated the optical role of the size of melanosomes in human skin with a radiative transfer model based on the discrete ordinate method. We find that the melanosome size is of great importance.

ME44 • 2:00 p.m.
Assessment of Muscle Vascular Disease with Diffuse Light, *Guoqiang Yu, Turgut Durduran, Chao Zhou, Gwen Lech, Emile R. Mohler III, Arjun G. Yodh; Univ. of Pennsylvania, USA.* Near-infrared diffuse optical spectroscopies were used to measure noninvasively the dynamics of muscle blood flow, blood oxygenation, and oxygen consumption for evaluation of microcirculation and tissue metabolism in the patients with peripheral arterial disease (PAD).

ME45 • 2:00 p.m.
Use of Genetic Algorithms to Optimize Fiber Optic Probe Design for the Extraction of Tissue Optical Properties, *Gregory M. Palmer, Nirmala Ramanujam; Duke Univ., USA.* An approach for optimizing the probe geometry for extracting optical properties is developed. It was found that optical properties could be extracted with accuracies of better than 0.5 cm-1, while requiring no a priori assumptions.

ME46 • 2:00 p.m.
Near-Infrared Spectroscopy and the Swallowing Event, *Natalia G. Machado[1], Adrienne Perlman[2], Enrico Gratton[1]; [1]Dept. of Physics, USA, [2]Dept. of Speech and Hearing, USA.* In this work, we applied near infrared spectroscopy (NIRS) to observe brain hemodynamics in the frontal lobes during the swallowing event.

ME47 • 2:00 p.m.
Optical Microprobe for Blood Clot Detection, *Rodolfo G. Gatto[1], Enrico D'Amico[2], William Mantulin[2], Enrico Gratton[2], Fady Charbel[1]; [1]Univ. of Illinois at Chicago, USA, [2]Lab of Fluorescence and Dynamics, USA.* One of the major complications during vascular surgery is the formation of blood clot. We tested an animal model and assembled a prototype device that shows the blood clot signature spectrum and its temporary growth.

ME48 • 2:00 p.m.
Effect of Polarization Memory in Subsurface Polarization Imaging, *Ralph Nothdurft, Gang Yao; Univ. of Missouri at Columbia, USA.* Previous studies have demonstrated that the circularly cross-polarized light can significantly improve subsurface imaging contrast. We have shown in this study that such improvement is strongly influenced by sample optical properties.

ME49 • 2:00 p.m.
Study of Fluorescence Diffuse Optical Tomography: Forward Solutions Utilizing Zero Lifetimes Convolution Method, *Andhi Marjono[1], Yukio Yamada[1], Gao Feng[2]; [1]Mechanical Engineering and Intelligent Systems Dept., The Univ. of Electro-Communications, Japan, [2]College of Precision Instrument and Optoelectronics Engineering, Tianjin Univ., China.* We have developed simulations for the forward model solutions in order to calculate the distributions of fluorescence or emission light in the tissue by convoluting the solutions at zero lifetimes with an exponential function.

ME50 • 2:00 p.m.
***In vivo* Time-Resolved Multi-Distance Spectroscopy of Human Forehead: A Step Towards Optical Characterization of Brain Tissue,** *Daniela Comelli[1], Antonio Pifferi[1], Paola Taroni[1], Alessandro Torricelli[1], Rinaldo Cubeddu[1], Fabrizio Martelli[2], Giovanni Zaccanti[2], Jean-Michel Tualle[3]; [1]Politecnico di Milano, Italy, [2]Univ. degli Studi di Firenze, Italy, [3]Univ. Paris—Inst. Galilée, France.* Multi-distance time-resolved reflectance spectroscopy of *in vivo* human forehead was performed on five volunteers in the range 700–1000 nm. A Monte Carlo simulation based on a four-layer model was employed and compared with *in vivo* data.

ME51 • 2:00 p.m.
Polarized Light Spectroscopy for the Non-Invasive Investigation of Microvascular Red Blood Cell Proliferation in Dermal Tissue, *Jim O' Doherty[1], Joakim Henricson[2], Gert E. Nilsson[3], Martin J. Leahy[1], Folke Sjöberg[2]; [1]Univ. of Limerick, Ireland, [2]Univ. Hospital, Sweden, [3]Linköping Univ., Sweden.* This paper describes the construction and testing of a novel non-invasive imaging system based on the method of polarization spectroscopy. Computer simulations of the algorithm, Monte Carlo studies and *in vivo* testing have been performed.

ME52 • 2:00 p.m.
Absolute Quantification of Hemoglobin Derivative Concentrations and Reduced Scattering Coefficients from Turbid Media Using Steady State Reflectance Spectroscopy with Single Source-Detector Separation, *Dheerendra Kashyap, Hanli Liu; Univ. of Texas at Arlington, USA.* Steady state broadband (650–845nm) reflectance spectroscopy yields absolute concentrations of hemoglobin derivatives and reduced scattering coefficients values of blood-intralipid phantoms within 15% error using an algorithm developed from diffusion approximation.

ME53 • 2:00 p.m.
Direct Readout, Amplitude Cancellation, Hand Held Detector of PFC Blood Volume Signals, *Zhongyao Zhao, Bien Chu, Britton Chance; Univ. of Pennsylvania, USA.* The performance of a hand held battery operated NIR scanner of PFC signal is quantified.

ME54 • 2:00 p.m.
Fiber Probes for the Measurement of the Absorption Coefficient in Small Volumes: a Monte Carlo Analysis, *Roberto Reif, Irving J. Bigio; Boston Univ., USA.* Monte Carlo simulations are used to determine several fiber probe designs for which the effective pathlength of photons traveling in tissue is minimally sensitive to the scattering properties, enabling direct measurement of the absorption coefficient.

ME55 • 2:00 p.m.
Fluorescence Spectroscopy and SHG Imaging of an in vitro Collagen Model, *Nathaniel D. Kirkpatrick, Urs Utzinger; Univ. of Arizona, USA.* An *in vitro* measurement chamber was developed to measure fluorescence and second harmonic generated (SHG) light in collagen. This system combined with modeled fluorescence variation allows for accurate assessment of physiologic based changes in collagen.

ME56 • 2:00 p.m.
Diffuse Optical Spectroscopy of Superficial Volumes: Sensitivity to Optical Properties and Sample Thickness, *Sheng-Hao Tseng, Carole Hayakawa, Jerome Spanier, Anthony J. Durkin; Univ. of California, Irvine, USA.* We present a method for performing quantitative spectroscopy of superficial tissue volumes. We investigate the performance of this technique over a range of optical properties and by varying the top layer thickness of two-layer phantoms.

ME57 • 2:00 p.m.
Angled Probe Design for Scattering Measurements from a Small Tissue Volume, *Quan Liu, Nirmala Ramanujam; Dept. of Biomedical Engineering, USA.* An angled probe combined with a lookup table method was employed for measuring reduced scattering coefficients from a small tissue volume. The strategy was tested by both Monte Carlo simulated data and phantom experiments.

ME58 • 2:00 p.m.
Multi-Layer Scattering Tissue Phantom for Assessing Angle-Resolved Low Coherence Interferometry Precancer Diagnostic Technique, *Jeffrey D. Boyer, John W. Pyhtila, Adam Wax; Duke Univ., USA.* Scattering tissue phantoms are developed for assessment of promising optical precancer diagnostic technique. The tissue phantoms provide a valuable evaluation method for the low-coherence interferometry technique. Size determination results and phantom relevance are examined.

ME59 • 2:00 p.m.
Noninvasive, Quantitative Fluorescence Sensing in 3D Tissues: An Approach to *in vivo* Molecular Characterization of Engineered Tissue Constructs, *Malavika Chandra, Karthik Vishwanath, Greg D. Fichter, Elly Liao, Michael R. Francis, Scott Hollister, Mary-Ann Mycek; Univ. of Michigan, USA.* A method for noninvasive, quantitative characterization of tissues using molecular fluorescence was applied to porcine knee cartilage. Experimental and computational results agreed to within 5% and were reproducible with statistical significance across multiple biological samples.

ME60 • 2:00 p.m.
Minimal Scattering Events in Enhanced Backscattering (EBS) of Light: Origin of Low-Coherence EBS in Discrete Tissue Models, *Young L. Kim, Prabhakar Pradhan, Hariharan Subramanian, Hariharan Subramanian, Yang Liu, Min H. Kim, Vadim Backman; Northwestern Univ., USA.* We report that low-coherence EBS originates from the time-reversed paths of double scattering events in weakly scattering media, providing a potential method for the analysis of the low-coherence EBS signals from biological tissue.

ME61 • 2:00 p.m.
Spectral Encoding of Fluorescent Emission from Deeply Lying Inclusions—A FEM-Modeling Approach, *Johan Axelsson, Jenny Svensson, Ann Johansson, Stefan Andersson-Engels; Dept. of Physics, Sweden.* Spectral emission from fluorescent inclusions inside tissue is modeled in Femlab. The ratio between two wavelengths is studied for altering inclusion depths and sizes. Simple reconstruction of the depth is made based on modeled data.

ME62 • 2:00 p.m.
Classification of Raman Spectra of Colonic Tissues Using Pattern Recognition Technique, *Zhiwei Huang[1], Effendi Widjaja[2], Wei Zheng[1], Jianhua Mo[1], Colin Sheppard[1]; [1]Natl. Univ. of Singapore, Singapore, [2]Inst. of Chemical and Engineering Sciences, Singapore.* This study was to explore the ability of near-infrared (NIR) Raman spectroscopy and support vector machines (SVM) techniques for differentiation between normal, benign and cancer tissues in the colon.

ME63 • 2:00 p.m.
Combined Autofluorescence and White-Light Endoscopy for Improved Detection of Dysplastic Colonic Lesions, *Alexandre Douplik[1], Simon Zanati[2], Norman Marcon[2], Maria Cirocco[2], Brian Wilson[3], Johan Boehm[4], Sonya Rychel[4], John Fengler[4]; [1]Xillix Ltd, Canada, [2]Ctr. for Therapeutic Endoscopy and Endoscopic Oncology, St. Michael's Hospital, Univ. of Toronto, Canada, [3]Ontario Cancer Inst., Univ. of Toronto, Canada, [4]Xillix Technologies Corp., Canada.* We evaluated the Onco-LIFE Endoscopic Light Source and Video Camera in reducing the polyp miss rate during colonoscopy. Adding an Onco-LIFE autofluorescence exam to a white light exam increased detection of polyps by 18.7%.

ME64 • 2:00 p.m.
Water Content in a Forearm Measured by the Diffuse Reflectance Method over 1μm, *Goro Nishimura[1], Ikuhiro Kida[2], Mamoru Tamura[1]; [1]Biophys.Lab, RIES, Hokkaido Univ., Japan, [2]Oral Functional Sci., Grad. School of Dental Medicine, Hokkaido Univ., Japan.* The water content in a human forearm was determined by diffuse reflectance measurements *in vivo*. The water content, 52v/v%, was good agreement with the MRI measurements in the muscle region of the forearm.

ME65 • 2:00 p.m.
Cerebral Oxygenation Monitoring during Cardiac Bypass Surgery in Babies with Broad-Band Spatially Resolved Spectroscopy, *Jan Soschinski[1], Christiane Andre[1], Dmitri Geraskin[1], Uwe Fischer[2], Uwe Mehlhorn[2], Gerardus Bennink[2], Matthias Kohl-Bareis[1]; [1]RheinAhrCampus Remagen, Germany, [2]Pediatric Cardio-Thoracic Surgery, Univ. of Cologne, Germany.* Broad-band spatially resolved spectroscopy is used to monitor cerebral oxygenation during cardiac surgery in babies. The methodological focus is on an error estimation of the haemoglobin concentrations and separation of cerebral from skin signals.

ME66 • 2:00 p.m.
Changes in Concentrations of Oxidised Cytochrome Oxidase Measured Using Both Broadband and Four Wavelength Near Infrared Spectroscopy Reflect Changes in Oxygen Delivery during Hypoxaemia in Healthy Volunteers, *Martin M. Tisdall[1], Ilias Tachtsidis[2], Clare E. Elwell[2], Martin Smith[1]; [1]Natl. Hospital for Neurology and Nerosurgery, UK, [2]Dept. of Medical Physics and Bioengineering, UCL, UK.* Cranial broadband, and four wavelength, near infrared spectroscopy were used to measure changes in concentration of oxidised cytochrome oxidase in healthy volunteers during hypoxaemia. Significant changes, which reflect changes in cerebral oxygen delivery, are demonstrated.

ME67 • 2:00 p.m.
Cerebral Blood Flow Assessment with Indocyanine Green Bolus Transit Detection by Near-Infrared Spectroscopy before and after Acetazolamide Challenge in Humans, *Ilias Tachtsidis[1], Terence S. Leung[1], Martin Tisdall[2], David T. Delpy[1], Martin Smith[2], Clare E. Elwell[1]; [1]Univ. College London, UK, [2]Natl. Hospital for Neurology and Neurosurgery, UK.* Cranial near-infrared spectroscopy and intravenous injection of indocyanine green were used to calculate the blood flow index during rest and after an induced increase in cerebral blood flow following acetazolamide administration.

ME68 • 2:00 p.m.
The Role of Angular Measurements for Inverse Problems in Biomedical Optics, *Arnold D. Kim; Univ. of California, Merced, USA.* Using the theory of radiative transport, we analyze inverse problems for biomedical diagnostics. In particular, we study the role that angular measurements may have in solving problems of practical interest.

ME69 • 2:00 p.m.
Characterization of Breast Tissue Composition and Breast Cancer Risk Assessment Using Non-Invasive Transillumination Breast Spectroscopy (TIBS), *Robert A. Weersink, Kristina Blackmore, Samantha Dick, Brian C. Wilson, Michelle Nielsen, Lothar Lilge; Univ. Health Network, Canada.* Near infrared Transillumination Breast Spectroscopy (TIBS) is used to obtain major chromophore concentrations and scattering parameters. These are compared with mammographic density (which is highly correlated with breast cancer risk) to determine relevant associations.

ME70 • 2:00 p.m.
Raman Spectroscopic Evaluation of the Fixation and Re-Hydration of Single Human Platelets, *De Chen[1], Yong-Qing Li[1], Arthur P. Bode[2]; [1]Physics Dept., East Carolina Univ., USA, [2]Dept. of Clinic Pathology, East Carolina Univ., School of Medicine, USA.* We report on the use of Raman tweezers spectroscopy for the characterization and identification of human platelets for long-term freeze-dried preservation. The paraformaldehyde-fixed, lyophilized and rehydrated platelet samples were spectrally analyzed.

ME71 • 2:00 p.m.
Functional Optical Signal Analysis (fOSA): A Software Tool for NIRS Data Processing, *Peck H. Koh, Clare E. Elwell, David T. Delpy; Univ. College London, UK.* We have developed a software tool providing real-time analysis of multiple-channel NIRS signals. The program has been tested with a synthetic dataset and results are presented showing its application to an experimental dataset.

ME72 • 2:00 p.m.
Blood Flow Measurements and Clot Detection with Near-Infrared Spectroscopy, *Molly Rossow[1,2], Enrico Gratton[1], Enrico D'Amico[1], Williams W. Mantulin[1], Rodolfo Gatto[2]; [1]Dept. of Physics, USA, [2]Dept. of Neurosurgery, USA.* Detecting impeded blood flow and locating the clot causing it is a major challenge in neurosurgery. We propose an instrument that uses near-infrared spectroscopy to simultaneously detect clots and measure blood flow.

ME73 • 2:00 p.m.
Determination of Optical Parameters Through Light Scattering Study: B-lymphocytes, *Huafeng Ding, Jun Q. Lu, R. Scott Brock, Douglas A. Weidner, Thomas J. McConnell, Xin H. Hu; East Carolina Univ., USA.* Mueller matrix elements of B-lymphocytes were measured and compared to the FDTD calculated results with 3D reconstructed structures with confocal images. These results demonstrate a new method to quantitatively determine cellular optical parameters.

ME74 • 2:00 p.m.
Depth-Dependent Correlation of Optical Coherence Tomography Signal with Blood Glucose Concentration, *Roman V. Kuranov, Veronika V. Sapozhnikova, Donald S. Prough, Inga Cicenaite, Rinat O. Esenaliev; UTMB, USA.* Depth-dependent oscillation of correlation coefficient of OCT signal slope with blood glucose concentration was studied. Possible mechanisms of glucose-induced changes in OCT signal slope were discussed.

ME75 • 2:00 p.m.
Quantitative Noninvasive Optical Sensing in Tissue Engineered Oral Mucosal Constructs, *Karthik Vishwanath, Kenji Izumi, Malavika Chandra, Stephen E. Feinberg, Mary-Ann Mycek; Univ. of Michigan, USA.* Noninvasive characterization of *ex vivo* produced oral-mucosal equivalent (EVPOME) tissues was simulated using a Monte Carlo code to predict spatially-resolved fluorescence in a multi-layered tissue model. Relative contributions to surface fluorescence from endogenous fluorophores were quantified.

ME76 • 2:00 p.m.
To an Early Diagnosis of Cancers by Cellular Autofluorescence Imaging, *Karine Steenkeste[1], Ariane Deniset[1], Sandrine Leveque-Fort[1], Marie-Pierre Fontaine-Aupart[1], Sandrine Lecart[2], Sophie Ferlicot[3], Pascal Eschwege[4]; [1]Lab de Photophysique Moléculaire, CNRS UPR 3361, France, [2]Ctr. Laser de l'Univ. Paris-Sud, Ctr. de Photonique Biomédicale, France, [3]Service d'Anatomopathologie, Hôpital du Kremlin Bicêtre, Univ. Paris-Sud, France, [4]Service d'Urologie, Hôpital du Kremlin-Bicêtre, Univ. Paris-Sud, France.* We developed a method for early diagnosis of cancers based on spectrally- and time-resolved endogenous fluorescence as a contrast factor. Promising results have already been obtained for bladder cancers. A detailed clinical study is presented.

ME77 • 2:00 p.m.
Vibrational Spectroscopic Identification of α- and β-Thalassemia with Single-Cell Raman Tweezers, *Gui-wen Wang[1], Hui-lu Yao[1], Shu-shi Huang[1], Ping Chen[2], Yong-Qing Li[3]; [1]Biophysics Lab, Guangxi Acad. of Sciences, China, [2]First Affiliated Hospital, Guangxi Medical Univ., China, [3]East Carolina Univ., USA.* Raman-tweezers spectroscopy is used to study the identification and discrimination of blood samples from 12 patients with α-thalassemia HbH, 11 patients with β-thalassemia major, and 12 age-matched controls, for the diagnosis and screening of thalassemia.

ME78 • 2:00 p.m.
Algorithms for Muscle Oxygenation Monitoring Corrected for Adipose Tissue Thickness, *Dmitri Geraskin[1], Julia Franke[2], Petra Platen[2], Matthias Kohl-Bareis[1]; [1]RheinAhrCampus Remagen, Germany, [2]Inst. of Cardiology and Sports Medicine, German Sports Univ., Germany.* Optical spectroscopy is used to measure the subcutaneous lipid layer compared to ultrasound (adipose tissue thickness) and subsequently used as correction in algorithms monitoring muscle oxygenation during exercise under normal and hypoxic conditions.

MF • Tutorial IV: DOT

Salon D
3:30 p.m.–4:00 p.m.
MF • Tutorial IV: DOT
Brian Pogue; Dartmouth College, USA, Presider

MF1 • 3:30 p.m. ▸ **Tutorial** ◂
Tutorial on DOT, *Brian Pogue; Dartmouth College, USA.* No abstract available.

MG • Neuroscience Invited Speaker

Salon E
3:30 p.m.–4:00 p.m.
MG • Neuroscience Invited Speaker Session
Diego Contreras; Univ. of Pennsylvania, USA, Presider

MG1 • 3:30 p.m. ▸ **Invited** ◂
Applying Optical Imaging to Study Neurovascular Coupling in Cerebral Cortex: From Populational Scale to Single-Cell Single-Vessel Measurements, *Anna Devor[1,2,3], Elizabeth Hillman[1], Nozomi Nishimura[4], Istvan Ulbert[1,5], Suresh N. Narayanan[1], Ivan Teng[2], Andrew K. Dunn[6], David A. Boas[1], David Kleinfeld[4], Anders M. Dale[2,3]; [1]Martinos Ctr. for Biomedical Imaging, Harvard Medical School, USA, [2]Dept. of Neurosciences, Univ. of California at San Diego, USA, [3]Dept. of Radiology, Univ. of California at San Diego, USA, [4]Dept. of Physics, Univ. of California at San Diego, USA, [5]Inst. for Psychology of the Hungarian Acad. of Sciences, Hungary, [6]Dept. of Biomedical Engineering, Univ. of Texas at Austin, USA.* We use a suite of optical imaging technologies in conjunction with electrophysiological recordings and fMRI to address the question of coupling between the hemodynamic response and the underlying brain neuronal activity.

MH • Diffuse Optical Imaging: Theory

Salon D
4:00 p.m.–6:00 p.m.
MH • Diffuse Optical Imaging: Theory
Andreas Hielscher; Columbia Univ., USA, Presider

MH1 • 4:00 p.m.
Sensitivity Analysis for Frequency-Domain Optical Tomography of Small Tissue Volumes, *Xuejun Gu[1], Uwe Netz[2], Kui Ren[1], Jürgen Beuthan[2], Andreas H. Hielscher[1]; [1]Columbia Univ., USA, [2]Charité—Universitätsmedizin Berlin, Germany.* Performing numerical and experimental sensitivity analyses for small-volume optical tomography with the frequency-domain equation of radiative transfer, we show that source modulation frequencies in the range of 300–600 MHz often yield maximal signal-to-noise ratios.

MH2 • 4:15 p.m.
New Approach to Solving the Radiative Transport Equation, *Vadim A. Markel[1], George Y. Panasyuk[2], John C. Schotland[2]; [1]Dept. of Radiology, USA, [2]Dept. of Bioengineering, USA.* We propose a novel method for solving the linear radiative transport equation in a macroscopically homogeneous medium. The

method can be used with an arbitrary phase function of a medium consisting of spherically-symmetric microscopic scatterers.

MH3 • 4:30 p.m.
Simplified Spherical Harmonics Methods for Modeling Light Transport in Biological Tissue, *Alexander D. Klose[1], Edward W. Larsen[2]; [1]Columbia Univ. New York, USA, [2]Univ. of Michigan, USA.* We have developed simplified spherical harmonics methods for modeling light transport in tissue with diffusive and non-diffusive properties at visible and near-infrared wavelengths. They improve diffusion solutions, but are computationally less expensive than transport calculations.

MH4 • 4:45 p.m.
Magnification and Light Guiding in Dentin—Optical Effects Caused by Multiple Scattering, *Alwin Kienle, René Michels, Raimund Hibst; Inst. of lasertechnologies in medicine and metrology, Germany.* Pronounced anisotropic optical effects (magnification, light guiding) are investigated in disks and cubes of dentin. Using Monte Carlo simulations which consider the microstructure of dentin we show that these effects are caused by multiple scattering.

MH5 • 5:00 p.m.
Nth Order Perturbation Theory for the Diffusion Equation Revisited, *Angelo Sassaroli[1], Sergio Fantini[1], Fabrizio Martelli[2]; [1]Tufts Univ., USA, [2]Universita' Degli Studi di Firenze, Italy.* In this work we show that by rearranging the terms of the Neumann series we obtain the moments of the generalized temporal point spread function, that are used to develop a fourth order perturbation theory.

MH6 • 5:15 p.m.
Time-Resolved Lifetime Fluorescence Imaging _ An Inverse Model Based on Analytical Solutions, *Jason D. Riley, Moinuddin Hassan, Victor Chernomordik, Israel Gannot, Amir Gandjbakhche; Natl. Inst.s of Health, USA.* We present an inverse model for 3D localisation and lifetime characterisation of fluorophore masses embedded in otherwise uniform tissue-like phantoms. The inverse model uses unique analytical models of time-resolved fluorescence signals with generalised lifetime profiles.

MH7 • 5:30 p.m.
Spatial Deconvolution of 3-D Difuse Optical Tomographic Time Series: Influence of Background Medium Heterogeneity, *Yong Xu, Harry L. Graber, Randall L. Barbour; SUNY Downstate Medical Ctr., USA.* The ability of a spatial deconvolution algorithm to enhance reconstructed optical tomographic image quality was previously demonstrated. Here, additional computational studies show that introduction of complex medium geometry actually can improve the method's performance.

MH8 • 5:45 p.m.
Three-Dimensional Optical Imaging Using Spectral Constraints, *Subhadra Srinivasan[1], Hamid Dehghani[1], Brian W. Pogue[1], Frederic Leblond[2], Xavier Intes[2]; [1]Thayer School of Engineering, USA, [2]Advanced Res. Technologies (ART) Inc., Canada.* A novel scheme for implementing spectral constraints into a three-dimensional image reconstruction model is presented. This approach, based on selecting measurements relating to spatial areas of maximum heterogeneity, makes spectral imaging computationally efficient in 3-D.

MI • Neuroscience and Cancer

Salon E
4:00 p.m.–6:00 p.m.
MI • Neuroscience and Cancer
Mary-Ann Mycek; Univ. of Michigan, USA, Presider

MI1 • 4:00 p.m.
Video-Rate Two-Photon Microscopy of Cortical Hemodynamics *in vivo*, *Matthew Bouchard[1], Svetlana Ruvinskya[2], David A. Boas[2], Elizabeth M. C. Hillman[2]; [1]Northeastern Univ., USA, [2]Massachusetts General Hospital, USA.* A video-rate two-photon microscopy system was constructed for optimized *in vivo* imaging of functional activation and hemodynamics in rat brain. The system has been used to explore the vascular mechanisms underlying functional responses and baseline oscillations.

MI2 • 4:15 p.m.
Mapping Cerebral Hemodynamics in Brain Cortex by Multi-Channel Time-Resolved Near-Infrared Spectroscopy, *Alessandro Torricelli[1], Davide Contini[1], Antonio Pifferi[1], Lorenzo Spinelli[2], Rinaldo Cubeddu[1], Laila Craighero[3], Luciano Fadiga[3]; [1]Politecnico di Milano—Dept. Physics, Italy, [2]IFN-CNR, Italy, [3]DBSTA—Section of Human Physiology—Univ. of Ferrara, Italy.* A multi-channel time-resolved system for functional near-infrared spectroscopy was used to map cerebral hemodynamic response in brain cortex. Measurements over the motor area as identified by transcranial magnetic stimulation show high sensitivity of the system.

MI3 • 4:30 p.m.
Cerebral Response to Auditory Oddball Task Using Multi-Distance Near-Infrared Spectroscopy, *Yunjie Tong[1], Jeffrey M. Martin[1], Angelo Sassaroli[1], Evan J. Rooney[2], Peter R. Bergethon[2], Sergio Fantini[1]; [1]Tufts Univ., USA, [2]Medical School of Boston Univ., USA.* Multi-distance near-infrared spectroscopy (NIRS) was used to map the brain functional response to an auditory oddball task. Activation patterns (increase in oxy-hemoglobin, decrease in deoxy-hemoglobin) were observed at both sides of the frontal lobe.

MI4 • 4:45 p.m.
Non-Invasive Optical Response to Electrical Stimulation in Peripheral Nerves, *Jeffrey M. Martin[1], Yunjie Tong[1], Angelo Sassaroli[1], Debbie Chen[1], Patricia Clervil[2], Peter R. Bergethon[3], Sergio Fantini[1]; [1]Tufts Univ., USA, [2]New England Medical Ctr., USA, [3]Boston Univ. School of Medicine, USA.* We report non-invasive optical measurements on the sural nerve of a human subject during electrical stimulation. We observed a fast optical response (time scale of 10–100 ms) associated with electrical stimulation of the nerve.

MI5 • 5:00 p.m.
Diffuse Optical Measurements of Tissue Blood Flow and Oxygenation during Interstitial Prostate PDT, *Guoqiang Yu, Turgut Durduran, Chao Zhou, Jarod C. Finlay, Timothy C. Zhu, Theresa M. Busch, S. Bruce Malkowicz, Stephen M. Hahn, Arjun G. Yodh; Univ. of Pennsylvania, USA.* A multi-modal diffuse optical instrument has been developed for real-time monitoring of tumor blood flow and oxygenation during prostate photodynamic therapy. Ultimate goal is to correlate those hemodynamic responses with patient outcomes.

MI6 • 5:15 p.m.
Breast Tumor Biochemical Responses to Neoadjuvant Chemotherapy Can Be Observed Using Diffuse Optical Spectroscopy, *Albert Cerussi[1], Natasha Shah[1], Montana Compton[1], Amanda Durkin[1], Bruce Tromberg[1], David Hsiang[2], Rita Mehta[2], Choong Baick[2], John Butler[2]; [1]Beckman Laser Inst. and Medical Clinic, USA, [2]Chao Comprehensive Cancer Ctr., USA.* Non-invasive measurements of near-infrared absorption and scattering coefficients reveal important early physiologic changes in tumors in response to pre-surgical (neoadjuvant) chemotherapy. Such early biochemical changes could be used to predict final pathological outcome.

MI7 • 5:30 p.m.
Changes in Optical Blood Flow and Oxygenation of Head and Neck Tumors during Chemo-Radiation Therapy, *Ulas Sunar, Harry Quon, J. Zhang, J. Du, T. Durduran, C. Zhou, G. Yu, A. Kilger, R. Lustig, L. Loevner, S. Nioka, Britton Chance, Arjun G. Yodh; Univ. of Pennsylvania, USA.* rBF, SO2 and THC in superficial neck tumor nodes of 7 patients were measured during chemo-radiation therapy period. Results suggest daily based therapy monitoring and optical methods have potential advantages for therapeutics.

MI8 • 5:45 p.m.
Optical Tomographic Imaging of Tumor Hemodynamics during Anti-VEGF Treatment in Mice, *James M. Masciotti, Frank A. Provenzano, Joey C. Papa, Junho Hur, Xeujun Gu, Qi Wu, Alexander Klose, Darell Yamashiro, Jessica Kandel, Andreas H. Hielscher; Columbia Univ., USA.* We use dynamic optical tomographic imaging to monitor immediate effects of an injectable anti-VEGF treatment. As early as 8 minutes after the drug is administered, measurable changes can be observed, which herald long-term vascular destruction.

6:00 p.m.–7:30 p.m.
Exhibits/Reception

● Tuesday, March 21, 2006 ●

TuA • Tutorial V: Optical Imaging in Drug Discovery

Salons D and E
7:30 a.m.–8:00 a.m.
TuA • Tutorial V: Optical Imaging in Drug Discovery
Vasilis Ntziachristos; Massachusetts General Hospital, USA, Presider

TuA1 • 7:30 a.m. ▸ **Tutorial** ◂
Tutorial on Optical Imaging in Drug Discovery, *Vasilis Ntziachristos; Massachusetts General Hospital, USA.* No abstract available.

TuB • Plenary III: Drug Discovery and Diffuse Tomography

Salons D and E
8:00 a.m.–10:05 a.m.
TuB • Plenary III: Drug Discovery and Diffuse Tomography
Vasilis Ntziachristos; Massachusetts General Hospital, USA, Presider

TuB1 • 8:00 a.m. ▸ **Invited** ◂
Title to Come, *Bohumil Botnar; Merck, USA.* No abstract available.

TuB2 • 8:25 a.m. ▸ **Invited** ◂
Title to Come, *Paul Territo; Lilly, USA.* No abstract available.

TuB3 • 8:50 a.m. ▸ **Invited** ◂
Title to Come, *Christian Schultz; Siemens, USA.* No abstract available.

TuB4 • 9:15 a.m. ▸ **Invited** ◂
Breast Tissue Optical Properties and Breast Cancer Risk, *Lothar Lilge; Univ. Health Network, Canada.* No abstract available.

TuB5 • 9:40 a.m. ▸ **Invited** ◂
Optical Methods for Tissue Hemo-Dynamics and Metabolism, *Turgut Durduran; Univ. of Pennsylvania, USA.* Diffuse correlation spectroscopy and optical spectroscopy are combined to measure cerebral blood flow and oxygenation. Cerebral rate of oxygen metabolism is hence measured on animals and humans during functional activation and in the clinic.

10:05 a.m.–10:30 a.m.
Coffee Break/Exhibits

TuC • Molecular Imaging and Drug Discovery

Salon D
10:30 a.m.–1:00 p.m.
TuC • Molecular Imaging and Drug Discovery
Brad Rice; Xenogen Corp., USA, Presider

TuC1 • 10:30 a.m.
***In vivo* Characterization of Her-2/neu Carcinogenesis in Mice Using Fluorescence Molecular Tomography,** *Helen Shih, Vasilis Ntziachristos; Massachusetts General Hospital, USA.* We reconstruct bio-markers in Her-2/neu mice using Fluorescence Molecular Tomography (FMT) and appropriate fluorescent probe strategies including protease up-regulation and specific antibody based imaging.

TuC2 • 10:45 a.m.
Non-Invasive, Continuous Monitoring of a Vascular Targeting Drug by Diffuse Optical Blood Flow and Blood Oxygenation Measurements, *Ulas Sunar, Sosina Makonnen, H. W. Wang, T. Durduran, C. Zhou, G. Yu, William M. F. Lee, Arjun G. Yodh; Univ. of Pennsylvania, USA.* We present a pilot study on vascular targeting drug combretastatin A4-phosphate (CA4P) in K1735 malignant melanoma tumor models. Results show that CA4P induces a drastic decrease in blood flow and oxygen saturation.

TuC3 • 11:00 a.m.
Fluorescent Imaging of Vascular Shutdown *in vivo*, *Gianluca Valentini[1], Cosimo D'Andrea[1], Raffaele Ferrari[1], Antonio Pifferi[1], Rinaldo Cubeddu[1,2], Michele Martinelli[2], Claudia Natoli[2], Paolo Ubezio[2], Raffaella Giavazzi[2]; [1]Politecnico di Milano, Italy, [2]Inst. Farmacologico Mario Negri, Italy.* We demonstrated that fluorescence imaging with Indocyanine Green can be used to measure the volume of vasculature *in vivo*. Tumors treated with Vascular Damaging Agent gave a strongly depleted signal, which confirmed an effective vascular shutdown.

TuC4 • 11:15 a.m.
***In vivo* Imaging of VEGF Expression for Monitoring Molecular Response to Cancer Therapy,** *Sung Chang, Imran Rizvi, Nicolas Solban, Tayyaba Hasan; Massachusetts General Hospital, USA.* We developed a novel optical molecular specific contrast agent that targets vascular endothelial growth factor (VEGF). We tested the agent in mouse tumor models and detected increased VEGF expression *in vivo* following cobalt chloride treatment.

TuC5 • 11:30 a.m.
Two-Color *in vivo* Imaging of Fluorescent Cells in Mice, *Anikitos Garofalakis[1], Giannis Zacharakis[1], Heiko Meyer[1], Stelios Psycharakis[1], Clio Mamalaki[2], Georgia Fousteri[2], Joseph Papamatheakis[2], Dimitris Kioussis[3], Vasilis Ntziachristos[4], Eleftherios N. Economou[1], Jorge Ripoll[1]; [1]I.E.S.L.—FO.R.T.H., Greece, [2]I.M.B.B., Greece, [3]N.I.M.R., UK, [4]C.M.R.—M.G.H., USA.* Fluorescence Molecular Tomography can provide volumetric images of fluorescent concentration. We apply a spectral unmixing algorithm capable of separating tomographic images originating from SNARF- and GFP-fused cells in the spleen of transgenic mice *in vivo*.

TuC6 • 11:45 a.m.
Fluorescence Lifetime Imaging Microscopy Detects Altered Metabolic Function in Living Human Cancer Cell Models, *Dhruv Sud, Wei Zhong, David Beer, Mary-Ann Mycek; Univ. of Michigan, USA.* A unique FLIM system sensed key molecules involved in metabolic pathways in living cellular models of human esophageal cancer progression. Functional imaging studies revealed endogenous, optical biomarkers that are clinically detectable in human tissue.

TuC7 • 12:00 p.m.
Cellular Imaging with High-Performance Two-Photon Absorbing Fluorescent Contrast Agents, *Kevin D. Belfield, Katherine J. Schafer-Hales, Sheng Yao, Peter K. Frederiksen, Emmanuel Vrotsos, Kiminobu Sugaya; Univ. of Central Florida, USA.* A new series of high-performing two-photon absorbing fluorescent contrast agents for cellular imaging were prepared. The spectral properties of these photostable, highly fluorescent, fluorophores, along with two-photon fluorescence imaging of live cells are presented.

TuC8 • 12:15 p.m.
Oblique-Incidence Reflectivity Difference Microscopes for Label-Free High-Throughput Detection of Biochemical Reactions in Microarray Format, *X. D. Zhu[1], J. P. Landry[1], Y. S. Sun[1], J. P. Gregg[2], K. S. Lam[2], X. W. Guo[3]; [1]Dept. of Physics, Univ. of California at Davis, USA, [2]School of Medicine, Univ. of California at Davis, USA, [3]Bio-Rad Labs, USA.* We describe recently developed oblique-incidence optical reflectivity difference microscopes for label-free/high-throughput detection of biomolecular reactions on DNA/protein microarrays. We present examples of application of this technique to DNA-DNA hybridization, antibody-antigen capture, and protein-small-molecule binding reactions.

TuC9 • 12:30 p.m.
Estimating CMRO2 with Multi-Modality Imaging Using a Multi-Compartment Vascular Model, *Monica S. Allen[1], Theodore J. Huppert[2], David A. Boas[2]; [1]Univ. of Texas, USA, [2]Harvard Univ., USA.* We propose a novel multi-compartment Windkessel model, which utilizes multi-modality measured NIRS and fMRI data, and estimate the hemodynamic vascular and metabolic changes separated into three compartments (arteriolar, capillary and venous).

TuC10 • 12:45 p.m.
***In vivo* Imaging of Doxorubicin Using Frequency Domain Fluorescence Lifetime Imaging Microscopy,** *Xiaowen Dai, Alan Elder, Johannes Stwartling, Clemens Kaminski; Dept. of Chemical Engineering, UK.* We demonstrate the use of LED based frequency domain FLIM for the study of intracellular doxorubicin distributions. FLIM gives functional information beyond that from steady-state measurements and we discuss its potential applications for controlled release.

TuD • Spectroscopy: Scattering and Fluorescence

Salon E
10:30 a.m.–1:00 p.m.
TuD • Spectroscopy: Scattering and Fluorescence
Vadim Backman; Northwestern Univ., USA, Presider

TuD1 • 10:30 a.m.
Partial-Wave Spectroscopy to Detect The Initial Stage of Colon Carcinogenesis, *Yang Liu[1], Prabhakar Pradhan[1], Xu Li[1], Young L. Kim[1], Ramesh K. Wali[2], Hemant K. Roy[2], Vadim Backman[1]; [1]Biomedical Engineering Dept., Northwestern Univ., USA, [2]Evanston Northwestern Healthcare, USA.* We developed partial-wave spectroscopy that is sensitive to nano-structural alterations in living cells and provides information beyond what conventional light microscopy reveals. It enables detection of the earliest pre-neoplastic changes in rat colonic epithelial cells.

TuD2 • 10:45 a.m.
Assessing Epithelial Cell Nuclear Morphology with Azimuthal Light Scattering Spectroscopy, *Chung-Chieh Yu[1], Condon Lau[1], James W. Tunnell[1], Martin Hunter[1], Maxim Kalashnikov[1], Christopher Fang-Yen[1], Stephen F. Fulghum[2], Kamran Badizadegan[1,3], Ramachandra R. Dasari[1], Michael S. Feld[1]; [1]MIT, USA, [2]Newton Labs Inc., USA, [3]Massachusetts General Hospital, USA.* We report azimuthal light scattering spectroscopy (phi/LSS), a novel technique for assessing epithelial-cell nuclear morphology. The feasibility of detecting cancer using phi/LSS is demonstrated by measuring phi/LSS spectra from normal and cancerous human colonic mucosa.

TuD3 • 11:00 a.m.
Endoscopic Fourier-Domain Angle-Resolved Low Coherence Interferometry for Assessing Nuclear Morphology in Human Epithelial Tissues, *John W. Pyhtila, Jeff D. Boyer, Kevin J. Chalut, Adam Wax; Duke Univ., USA.* Endoscopic Fourier-domain angle-resolved low coherence interferometry has been developed for depth resolved light scattering spectroscopy. System capabilities are demonstrated by determining the nuclei size in tissue phantoms, cell cultures and *ex vivo* human esophageal epithelium.

TuD4 • 11:15 a.m.
Sequential Estimation of Optical Properties of a Two-Layered Epithelial Tissue Model from Depth-Sensitive Ultraviolet-Visible Diffuse Reflectance Spectra, *Quan Liu, Nirmala Ramanujam; Dept. of Biomedical Engineering, Duke Univ., USA.* A sequential estimation method that incorporates a composite probe design was developed for the estimation of optical properties of a two-layered epithelial tissue model from diffuse reflectance spectra measured in the UV-VIS region.

TuD5 • 11:30 a.m.
Time-Resolved Diffuse Reflectance at Null Source-Detector Separation: A Novel Approach to Photon Migration, *Antonio Pifferi[1], Alessandro Torricelli[1], Lorenzo Spinelli[1], Rinaldo Cubeddu[1], Fabrizio Martelli[2], Giovanni Zaccanti[2], Samuele Del Bianco[3], Alberto Tosi[4], Franco Zappa[4], Sergio Cova[4]; [1]Dip. Fisica—Politecnico di Milano, Italy, [2]Dip. Fisica—Univ. di Firenze, Italy, [3]CNR—Inst. di Fisica Applicata "Nello Carrara", Italy, [4]Dip. Elettronica e Informazione—Politecnico di Milano, Italy.* We demonstrate that time-resolved reflectance measurements at a null interfiber distance yield higher contrast and better spatial resolution as compared to longer distances. The experimental feasibility using a time-gated single-photon avalanche diode is presented.

TuD6 • 11:45 a.m.
Assessing Sarcomere Structure Changes in Whole Muscle, *Jinjun Xia[1], Amanda Weaver[2], David E. Gerrard[2], Gang Yao[1]; [1]Univ. of Missouri-Columbia, USA, [2]Purdue Univ., USA.* The biomechanical functions of striated muscles are maintained by the repeating sarcomere units. We conducted several experiments to demonstrate that optical scattering properties measured in whole muscles are correlated with the underneath sarcomere structure changes.

TuD7 • 12:00 p.m.
Phosphorescence and Fluorescence Measurements of Human Tissues Using UV LED Excitation, *R. R. Alfano, Alexandra Alimova, Sriramoju Vidyasagar, Alvin Katz; City College of New York, USA.* Using UV LED excitation, fluorescence and phosphorescence measurements were performed on normal and malignant breast tissues. Cancerous tissues demonstrated a weaker ratio of phosphorescence to fluorescence intensity compared to normal glandular and adipose tissue.

TuD8 • 12:15 p.m.
Depth Sensitive Optical Spectroscopy for Noninvasive Detection of Oral Cavity Neoplasia, *Richard A. Schwarz[1], Rebecca Richards-Kortum[1], Ann M. Gillenwater[2]; [1]Rice Univ., USA, [2]Univ. of Texas M.D. Anderson Cancer Ctr., USA.* A ball lens coupled fiber optic probe provides the ability to conduct depth sensitive spectroscopic measurements of oral epithelial tissue. Fluorescence and reflectance measurements of normal and abnormal human oral sites *in vivo* are reported.

TuD9 • 12:30 p.m.
***In vivo* Fluorescence Spectroscopy during Breast Core Needle Biopsy,** *Changfang Zhu[1], Elizabeth Burnside[2], Gale Sisney[2], Josephine Harter[3], Nirmala Ramanujam[4]; [1]Dept. of Electrical and Computer Engineering, Univ. of Wisconsin—Madison, USA, [2]Dept. of Radiology, Univ. of Wisconsin, School of Medicine, USA, [3]Dept. of Pathology, Univ. of Wisconsin, School of Medicine, USA, [4]Dept. of Biomedical Engineering, Duke Univ., USA.* We carried out clinical trials where we measured breast tissue fluorescence spectra during core needle biopsy. This study demonstrated the feasibility of *in vivo* fluorescence spectroscopy for assessing breast tissue composition during clinical biopsy procedure.

TuD10 • 12:45 p.m.
Time-Resolved Confocal Fluorescence Detection Reveals Detailed Structure and Biochemistry of Epithelial Tissue, *Yicong Wu, Jianan Y. Qu; Dept. Electrical and Electronic Engineering, Hong Kong Univ. of Science and Technology, Hong Kong Special Administrative Region of China.* A time-resolved confocal autofluorescence spectroscopy system was developed to obtain the information on the fine structure and localized biochemistry of epithelial tissue. The technique can potentially provide accurate information for the diagnosis of tissue pathology.

1:00 p.m.–2:00 p.m.
Lunch (on your own)

Special Session • Pre-planning Meeting for the NIH Optical Imaging Workshop

Salons D and E
2:00 p.m.–3:00 p.m.
Special Session • Pre-planning Meeting for the NIH Optical Imaging Workshop
Lihong Wang, Texas A&M Univ., USA, Presider

Speakers (5 minutes per speaker):
Opening Remarks, *Yantian Zhang, NIH, USA*
Confocal Microscopy, *Milind Rajadhyaksha, Memorial Sloan-Kettering Cancer Center, USA*
Optical Coherence Tomography, *James G. Fujimoto, MIT, USA*
Diffuse Optical Tomography, *Brian W. Pogue, Dartmouth College, USA*
Optical Molecular Imaging, *Vasilis Ntziachristos, Massachusetts General Hospital, USA*
Industrial Perspective of Optical Imaging, *Thomas Krucker, Novartis, USA*
Skin Cancer Detection with Spectroscopy and Photoacoustic Tomography, *Lihong Wang, Texas A&M Univ., USA*

Panel Discussion (25 minutes)
Gregory Faris, SRI Intl., USA, Moderator

3:00 p.m.–3:30 p.m.
Exhibits/Coffee Break

TuE • Diffuse Optical Imaging Invited Speaker

Salon D
3:30 p.m.–4:00 p.m.
TuE • Diffuse Optical Imaging Invited Speaker Session
Joseph P. Culver; Washington Univ. in St. Louis, USA, Presider

TuE1 • 3:30 p.m. ▸ **Invited** ◂

The Role of Optics in Multi-Modality Functional Neuro-Imaging, *David Boas; Martinos Ctr. for Biomedical Imaging, Massachusetts General Hospital, USA.* No abstract available.

TuF • Spectroscopy: Novel Technologies

Salon E
3:30 p.m.–4:00 p.m.
TuF • Spectroscopy: Novel Technologies
Alexander Oraevsky; Fairway Medical Technologies Inc, USA, Presider

TuF1 • 3:30 p.m.
Upconverting Chelate Cell Assay Development, *Xudong Xiao, Jeanne P. Haushalter, Kenneth T. Kotz, Gregory W. Faris; SRI Intl., USA.* We report application of upconverting chelates to a cell surface assay. EGFR on A431 cells is labeled using europium DOTA and imaged using an upconversion microscope.

TuF2 • 3:45 p.m.
Discrimination of Single Human Chromosomes Using Confocal Raman-Tweezers Spectroscopy, *Jenifer Ojeda[1], Changan Xie[2], Yong-Qing Li[1], Fred Bertrand[1], John Wiley[1], Thomas McConnell[1]; [1]East Carolina Univ., USA, [2]Univ. of Utah, USA.* We demonstrated that different numbered human chromosomes could be discriminated and sorted with confocal Raman-tweezers spectroscopy, and the result was confirmed with G-band technique.

TuG • Small Animal Imaging Methods

Salon D
4:00 p.m.–6:00 p.m.
TuG • Small Animal Imaging Methods
Joseph P. Culver; Washingtoh Univ. in St. Louis, USA, Presider

TuG1 • 4:00 p.m.
***In vivo* Small Animal Imaging Using Combined MR-DOT System,** *Ozlem Birgul, Gultekin Gulsen, Roshanak Shafiiha, Mehmet Burcin Unlu, Orhan Nalcioglu; Tu and Yuen Ctr. for Functional Onco Imaging, USA.* We developed a simultaneous MR-DOT system for small animal imaging. MRI image is used as *a priori* information for DOT reconstruction providing accurate geometry and boundary condition. Performance is demonstrated *in vivo* with ENU tumor bearing rat.

TuG2 • 4:15 p.m.
The Influence of Heterogeneous Optical Properties on Fluorescence Diffusion Tomography of Small Animals, *Saskia Bjoern, Joseph P. Culver, Sachin V. Patwardhan; Mallinckrodt Inst. of Radiology, USA.* We evaluated the influence of optical property maps on inversion of fluorescence data from mice. For highly absorbing regions (5x background) of sufficient size, heterogeneous optical property maps provide significant improvements over homogeneous maps.

TuG3 • 4:30 p.m.
Performance of Fluorescent Molecular Tomography in Highly Heterogeneous Media, *Antoine P. Soubret, Vasilis Ntziachristos; MGH Harvard Medical School, USA.* We study the influence of absorption heterogeneity and background fluorescence in three-dimensional fluorescent tomographic reconstruction. We further experimentally demonstrate methods that yield highly accurate tomographic performance appropriate for *in vivo* imaging.

TuG4 • 4:45 p.m.
***In vivo* Bioluminescence Tomography Using Multi-Spectral and Multiple-Perspective Image Data,** *Chaincy Kuo, Haroon Ahsan, John J. Hunter, Tamara L. Troy, Heng Xu, Ning Zhang, Brad W. Rice; Xenogen Corp., USA.* A diffuse bioluminescent tomographic algorithm is validated with a tissue phantom, and *in vivo* experiments in which calibrated sources are implanted within living tissue. Longitudinal metastasis animal model data are analyzed.

TuG5 • 5:00 p.m.
A Direct Linear Reconstruction Method for Spectrally Resolved 3D Bioluminescence Tomography, *Hamid Dehghani[1], Robert Diplock[2], Brian W. Pogue[3], Michael S. Patterson[4]; [1]Univ. of Exeter, UK, [2]McMaster Univ., Canada, [3]Dartmouth College, USA, [4]Juravinski Cancer Ctr., Canada.* Spectrally-resolved BioLuminescence Tomography is used to image Luciferase activity within a 3D mouse model using multi-wavelength data from multiple bioluminescence sources. Images show the sources reconstructed accurately using a fast, direct and linear 3D algorithm.

TuG6 • 5:15 p.m.
Autofluorescence Removal from Fluorescence Molecular Tomography Data, *Giannis Zacharakis[1], Anikitos Garofalakis[1], Stelios Psycharakis[1], Heiko Meyer[1], Clio Mamalaki[2], Georgia Fousteri[2], Joseph Papamatheakis[2], Dimitris Kioussis[3], Vasilis Ntziachristos[4], Eleftherios N. Economou[1], Jorge Ripoll[1]; [1]FORTH—IESL, Greece, [2]FORTH—IMBB, Greece, [3]NIMR—MRC, UK, [4]MGH—CMIR, USA.* We present a study on three-dimensional mapping and removal of autofluorescence from fluorescence molecular tomography (FMT) data, both for phantoms and small animal *in vivo* measurements in reflection geometry.

TuG7 • 5:30 p.m.
Whole Body Animal Examination by Fluorescence Tomography, *Anne Koenig[1], Lionel Hervé[1], Anabela Da Silva[1], Jean-Marc Dinten[1], Jérôme Boutet[1], Michel Berger[1], Isabelle Texier[1], Philippe Peltié[1], Philippe Rizo[1], Véronique Josserand[2], Jean-Luc Coll[2]; [1]LETI-CEA, France, [2]Animage GRCP Inserm U578, France.* A fluorescent diffuse optical tomography instrument has been developed in our laboratory. Taking into account in-homogeneities, it allows whole body examination. Experimental results obtained with this system on mice deep lung tumours examination are presented.

TuG8 • 5:45 p.m.
A Non-Contact Fluorescence Tomography System for Small Animal Imaging, *Ralf B. Schulz, Jörg Peter, Wolfhard Semmler; German Cancer Res. Ctr., Germany.* We describe the implementation of a gantry-based fluorescence tomographic imaging system for *in vivo* application, featuring a free beam laser source and a non-contact detection system rotating around an animal fixed in the rotational axis.

TuH • Microscopy I

Salon E
4:00 p.m.–6:00 p.m.
TuH • Microscopy I
Jerome Mertz; Boston Univ., USA, Presider

TuH1 • 4:00 p.m.
Graded-Field Autoconfocal Microscopy, *Kengyeh Chu, Ran Yi, Jerome Mertz; Boston Univ., USA.* We have improved a transmission-mode confocal microscope that employs a second harmonic crystal in place of a pinhole by making it more sensitive to phase gradients, producing images resembling DIC but with improved depth penetration.

TuH2 • 4:15 p.m.
Confocal Light Scattering Spectroscopic Microscopy for Monitoring Individual Subcellular Organelle, *Hui Fang, Le Qiu, Saira Salahuddin, Edward Vitkin, Mark D. Modell, Eugen B. Hanlon, Irving Itzkan, Lev Perelman; Harvard Medical School, USA.* We report development of a novel optical imaging technique capable of non-invasively monitoring single subcellular organelles in a living cell without use of exogenous contrast agents common to optical microscopy.

TuH3 • 4:30 p.m.
Confocal Reflectance Microscope with a Dual-Wedge Scanner, *William C. Warger II, Stephen A. Guerrera, Charles A. DiMarzio; Northeastern Univ., USA.* Here we present a point-scanning, reflectance confocal microscope with a dual-wedge scanner that could dramatically reduce the size of current commercial reflectance confocal microscopes.

TuH4 • 4:45 p.m.
Multi-Modality Microscopy Combining Multiphoton and Optical Coherence Microscopy Using an Ultrafast Laser Source, *Shuo Tang, Tatiana B. Krasieva, Zhongping Chen, Bruce J. Tromberg; Beckman Laser Inst., USA.* Multiphoton microscopy and optical coherence tomography (OCT) are combined on a single platform to provide simultaneous functional and

structural information about tissues in three imaging channels including second harmonic generation, two-photon excited fluorescence, and OCT.

TuH5 • 5:00 p.m.
Probe-Based and Bifocal Approaches for Phase-Referenced Low Coherence Interferometry, *Christopher M. Fang-Yen, Mark C. Chu, Seungeun Oh, Sebastian Seung, Ramachandra R. Dasari, Michael S. Feld; MIT, USA.* We present probe-based and bifocal variations of the dual-beam low coherence interferometer for measuring sub-nanometer path differences with transverse resolution ~1 micron. Scanning images of a fly compound eye and single cheek cells are demonstrated.

TuH6 • 5:15 p.m.
Digital Holographic Microscopy Applied to Diffraction Tomography of a Cell Refractive Index, *Florian Charrière[1], Tristan Colomb[1], Etienne Cuche[2], Pierre Marquet[3], Christian Depeursinge[1]; [1]Ecole Polytechnique Fédérale de Lausanne, Switzerland, [2]Lyncée Tec SA, Switzerland, [3]Ctr. de Neurosciences Psychiatriques, Dept. de Psychiatrie DP-CHUV, Site de Cery, Switzerland.* We present a approach of 3-dimensional refractive index tomography of biological specimen, based on the high accuracy phase measurement provided by Digital Holographic Microscopy, recorded for a complete rotation of the specimen in the setup.

TuH7 • 5:30 p.m.
Quantitative Biological Microscopy of Cells by Digital Holography, *Christopher J. Mann, Myung K. Kim; Univ. of South Florida, USA.* Holograms of biological objects are acquired using digital holographic microscopy. The reconstructed phase images display high resolution, quantitative measurements of optical thickness with a resolution of several nanometers.

TuH8 • 5:45 p.m.
Observation of Apparent Membrane Tension in Red Blood Cells Using Actively Stabilized Hilbert Phase Microscopy, *Gabriel Popescu[1], Takahiro Ikeda[2], Catherine A. Best[3], Keisuke Goda[4], Kamran Badizadegan[3], Ramachandra R. Dasari[1], Michael S. Feld[1]; [1]Spectroscopy Lab, M.I.T., USA, [2]Hamamatsu Photonics KK, Japan, [3]Harvard Medical School/ Mass. Gen. Hospital, USA, [4]Dept. of Physics, M.I.T., USA.* Stabilized Hilbert phase microscopy delivers quantitative phase images at millisecond and nanometer scales. We quantified the thermal membrane fluctuations in red blood cells and performed the first no-contact measurement of cytoskeleton-induced cell membrane tension.

TuI • Poster Session III

Atlantic Ballroom
6:00 p.m.–7:15 p.m.
TuI • Poster Session III

TuI1 • 6:00 p.m.
Intraoperative Monitoring of Depth Dependent Hemoglobin Concentration Changes during CEA by Time-Resolved Reflectance, *Chie Sato[1], Yoko Hoshi[1], Miho Shimada[2], Takekane Yamaguchi[3], Mitsuru Seida[3], Yoshihisa Ota[3], I-e Yu[3]; [1]Tokyo Inst. of Psychiatry, Japan, [2]High Energy Accelerator Res. Organization, Japan, [3]Tokyo Metropolitan Toshima Hospital, Japan.* We investigated the depth sensitivity of analysis to absorption change by two analytical methods for the time-resolved reflectance of four-layered media obtained from Monte Carlo simulation and for *in vivo* measurements data during carotid endarterectomy.

TuI2 • 6:00 p.m.
Multi-Spectral Reflection Photoplethysmography: Potential for Skin Microcirculation Assessment, *Janis Spigulis, Lasma Gailite; Univ. of Latvia, Latvia.* Technique for simultaneous recording of reflection photoplethysmography signals in broad spectral band (violet to NIR) has been developed, and its potential for assessment of blood microcirculation at various depths from the skin surface is discussed.

TuI3 • 6:00 p.m.
Optical Properties of Animal Tissue as Diabetes Progresses, *Michael Weingarten[1], Elisabeth Papazoglou[2], Leonid Zubkov[2], Linda Zhu[2], Kambiz Pourrezaei[2], Som Tyagi[3]; [1]Drexel Univ. College of Medicine, USA, [2]School of Biomedical Engineering, Drexel Univ., USA, [3]Dept. of Physics, Drexel Univ., USA.* DPDW methodology in the near infrared was used to calculate absorption and scattering in wounds of healthy and diabetic rats. Differences observed as diabetes progresses can be correlated to the delayed healing observed in diabetics.

TuI4 • 6:00 p.m.
Measurement of Skin Pigmentation *in vivo* with Multispectral Dermoscopy, *Jesse Weissman, Thomas Hancewicz, Hao Ouyang, Peter Kaplan; Unilever Res. & Development, USA.* Multispectral dermoscopy is presented as a useful method for non-invasively measuring the contribution of melanin and hemoglobin to skin pigmentation. Images generated from reflectance spectra demonstrate the origin of coloration in different lesions.

TuI5 • 6:00 p.m.
Optical Approach to Detect Vascular Function Changes Induced by Cocaine in Living Rat Brain, *Congwu Du[1], Zhongchi Luo[1,2], Mei Yu[1], Helene Benveniste[1,3]; [1]Brookhaven Natl. Lab, USA, [2]Dept. of Biomedical Engineering, SUNY at Stony Brook, USA, [3]Dept. of Anesthesiology, SUNY at Stony Brook, USA.* In this study, we present an optical approach to simultaneously detect the effects of the drug such as cocaine on vascular functional changes in living rat brain.

TuI6 • 6:00 p.m.
Application of Near Infrared Spectroscopy to Study Hot Flashes in Women, *Vikrant Sharma[1], Pradheep Raman[1], Anna Ratka[2], Hanli Liu[1]; [1]Univ. of Texas at Arlington, USA, [2]Univ. of North Texas Health Science Ctr., USA.* We introduce a novel application of near infrared spectroscopy (NIRS) to study hot flashes, the most reported symptom of menopausal transition. A three-wavelength, continuous wave NIRS system was developed for this application.

TuI7 • 6:00 p.m.
Value of Autofluorescence Measurements at the Eye, *Dietrich Schweitzer, Frank Schweitzer, martin Hammer; Experimental Ophthalmology, Univ. of Jena, Germany.* The value of 2-dimensional measurement of fluorescence intensity, fluorescence spectra, and fluorescence lifetime mapping are compared for clinical diagnostics in ophthalmology. Measurements of dynamic fluorescence permits both sensitive detection and local discrimination of fluorophores.

TuI8 • 6:00 p.m.
Point Spread Imaging for Measurement of Skin Translucency and Scattering, *Zhi-xing Jiang, Peter Kaplan; Unilever Res. and Development, USA.* There is currently no universal definition for skin translucency let alone a measurement method. We propose and demonstrate the use of polarized point spreading imaging for noninvasive measurement of skin scattering properties and translucency.

TuI9 • 6:00 p.m.
Determination of Optical Properties of Chicken Breast Tissue Using Three-Fiber Based Diffuse Reflectance Method, *Shinichi Miki, Seishi Tanaka, Yoshiaki Shimomura; Industrial Technology Ctr. of Nagasaki, Japan.* A three-fiber based diffuse reflectance method was used to quantify the values of the reduced-scattering coefficients and the fraction of fat and water of chicken breast tissue using electronically tuned Ti:sapphire laser.

TuI10 • 6:00 p.m.
Ranpirnase Enhances Efficacy of Radiation on A549 Human Lung Cancer Xenografts of Nude Mice Assessed by Diffuse Optical Spectroscopies, *Ulas Sunar, Chao Zhou, T. Durduran, G. Yu, Arjun G. Yodh, Intae Lee; Univ. of Pennsylvania, USA.* Ranpirnase (ONC) induced a significant increase in blood flow and oxygen saturation, along with significant growth inhibition in NSCLC. ONC may be a promising drug for the treatment of NSCLC patients.

TuI11 • 6:00 p.m.
Chemiluminescence as Tool to Assess UVA-Induced Oxidative Stress and the Efficacy of Sunscreens, *Paulo R. Bargo, Melissa Chu, Curtis A. Cole, Nikiforos Kollias; Johnson & Johnson Consumer Products Worldwide, USA.* Chemiluminescence was used to measure UVA-induced oxidative stress *in vivo* and sunscreens efficacy in reducing oxidative stress. A photostable sunscreen showed 76% less free radical counts compared to control, while a non-photostable sunscreen showed 32% reduction.

TuI12 • 6:00 p.m.
Path Length Correction for Haemoglobin Concentration Measurement in Exposed Cortex by Multi-Spectral Imaging, *Koichiro Sakaguchi[1], Shunsuke Furukawa[1], Takushige Katsura[2], Atsushi Maki[2], Hideo Kawaguchi[2], Eiji Okada[1];*

[1]*Dept. of Electronics and Electrical Engineering, Keio Univ., Japan,* [2]*Advanced Res. Lab, Hitachi Ltd., Japan.* The changes in the cerebral haemoglobin concentrations are measured. The wavelength dependence of the optical path lengths is estimated from the multi-spectral image of the exposed cortex in order to improve the haemoglobin concentration measurement.

TuI13 • 6:00 p.m.
Imaging Pulmonary Inflammation Using Fluorescence Molecular Tomography, *Vasilis Ntziachristos, Stephen Windsor; Massachusetts General Hospital, USA.* Quantitative imaging of fluorescent signatures deep in animal models of lung diseases can enable the study of various molecular pathways and treatment effectiveness. We demonstrate imaging of COPD related signatures using Fluorescence Molecular Tomography (FMT).

TuI14 • 6:00 p.m.
Fluorescence Molecular Tomography of Small Animals Using the Radiative Transfer Equation for Curved Geometries, *Alexander D. Klose, Andreas H. Hielscher; Columbia Univ. New York, USA.* We have developed a fluorescence image reconstruction algorithm for three-dimensional whole-body small animal imaging. The image reconstruction technique employs a light propagation model based on the equation of radiative transfer for curved geometries.

TuI15 • 6:00 p.m.
Time-Domain Fluorescence Molecular Tomography Based on Generalized Pulse Spectrum Technique, *Feng Gao[1], Wei Liu[1], Huijuan Zhao[1,2], Yukari Tanikawa[2,3], Andhi Marjono[3], Yukio Yamada[3]; [1]Tianjin Univ., China, [2]Natl. Inst. of Advanced Industrial Science and Technology, Japan, [3]Univ. of Electro-Communications, Japan.* Based on previously developed the generalized pulse spectrum technique, we propose an algorithm of time-domain Fluorescence Molecular Tomography for simultaneous reconstruction of both the fluorescence yield and lifetime and validate the methodology with simulated data.

TuI16 • 6:00 p.m.
Comparison of Simplified Monte Carlo Simulation and Diffusion Approximation for Fluorescent Signal from Phantoms with Typical Mouse Optical Properties, *Guobin Ma[1], Jean-François Delorme[1], Pascal Gallant[1], David A. Boas[2]; [1]ART Advanced Res. Technologies Inc., Canada, [2]Massachusetts General Hospital, Harvard Medical School, USA.* Fluorescent signals from mouse-tissue-like phantoms are computed using both Monte Carlo simulation and diffusion approximation. The relative difference is less than 30% for a fluorophore placed in the middle of a 3mm separated source-detector pair.

TuI17 • 6:00 p.m.
Assessment of Luminescent Source Reconstruction Using Single-View Bioluminescence Tomography, *Jack M. Virostko, E. Duco Jansen; Vanderbilt Univ., USA.* Constant light-emitting beads were used to assess bioluminescent source reconstruction using Living Image® 3D Analysis (Xenogen, Alameda, CA). The effects of source depth and tissue heterogeneity on reconstruction accuracy and multiple source discrimination were investigated.

TuI18 • 6:00 p.m.
Sensitivity Characterization of a Time-Domain Fluorescence Imager: Explore Optix, *Guobin Ma, Pascal Gallant, Laura McIntosh; ART Advanced Res. Technologies Inc., Canada.* Empirical relations of fluorescence signal to background ratio is established from experimental data over a wide range of parameters, and the sensitivity of eXplore Optix using Cy5.5 for known tissue optical properties is predicted.

TuI19 • 6:00 p.m.
Specific Detection of NO and 15NO from Solution-phase Reactions Involving NO-Generating Organic, Inorganic, and Biochemical Samples Using a Mid-infrared Laser, *Khosrow Namjou[1], George B. Richter-Addo[2], Jun Yi[2], Zaki N. Zahran[2], Patrick J. McCann[1]; [1]Ekips Technologies, USA, [2]Univ. of Oklahoma, USA.* NO is an important signaling agent in biology. We have utilized a mid-infrared laser spectrometer for the specific detection of NO and 15NO generated from chemical and biochemical samples.

TuI20 • 6:00 p.m.
Time-Domain Fluorescence Molecular Tomography: A FEM-Diffusion-Based Forward Model, *Feng Gao; Tianjin Univ., China.* We present a time-difference-finite-element solution to the coupled diffusion equations describing fluorescence propagation in tissue under ultra-short laser pulse excitation. Numerical simulations are given to validate the methodology and obtain information for the inverse issue.

TuI21 • 6:00 p.m.
Three-Dimensional Tomographic Imaging of Bioluminescent Cancer Cells Embedded in a Tissue-Like Phantom, *Lu Yin[1], Senhu Li[1], Wouter Driessen[2], Sean Sullivan[2], Huabei Jiang[1]; [1]Dept. of Biomedical Engineering, Univ. of Florida, USA, [2]Dept. of Pharmaceutics,Univ. of Florida, USA.* We show that a 5mm-diameter target containing different concentrations of bioluminescent cancer cells in a 3x3cm cubic tissue-like phantom can be three-dimensional imaged using our finite element-based bioluminescence tomography techniques.

TuI22 • 6:00 p.m.
***In vivo* Fluorescence Lifetime Imaging of Optical Probes in Small Animals,** *David J. Hall, David R. Vera; Univ. of California, San Diego, USA.* Time domain optical molecular imaging has enabled *in vivo* fluorescence lifetime measurements for the discrimination of near infrared probes in small animals. Results from a commercially available system and a full-field prototype will be presented.

TuI23 • 6:00 p.m.
Effects of Laser Pulse Energy, Geometric Confinement and Material Stiffness on Laser-Induced Cell Lysis in a Microfluidic Chip, *Marlon S. Thomas, G. P. Li, Mark Bachman, Chris Sims, Nancy Allbritton, Vasan Venugopalan; Univ. of California, Irvine, USA.* We are evaluating the effects of laser-induced cell lysis in microfluidic devices fabricated from PDMS and PMMA. To measure the spatial extent of damage following laser-induced cell lysis, adherent cells and viability assays are used.

TuI24 • 6:00 p.m.
***In vivo* Three-Dimensional Bioluminescence Tomography of Gene Expression: Pilot Results,** *Huabei Jiang[1], Lu Yin[1], Nathalie Toussaint[2], Sean Sullivan[2], Qiang Wang[1], Qizhi Zhang[1]; [1]Dept. of Biomedical Engineering, Univ. of Florida, USA, [2]Dept. of Pharmaceutics, Univ. of Florida, USA.* We report on for the first time *in vivo* 3D bioluminescence tomography of gene expression based on our finite element reconstruction algorithm. The initial results obtained show that luciferase can be clearly detected.

TuI25 • 6:00 p.m.
Multispectral *in vivo* Fluorescence Imaging: What's Needed, What's Not, *James R. Mansfield, Richard M. Levenson; CRI, Inc., USA.* Use of fluorescent labels for *in vivo* imaging has been limited by tissue autofluorescence, now largely avoidable using multispectral imaging. Automated methods, choice of sensor and means of improving signal to noise will be presented.

TuI26 • 6:00 p.m.
OCT Assessment of Subsquamous Barrett's Epithelium, *Michael J. Cobb, Melissa P. Upton, Yuchuan Chen, Daniel J. MacDonald, Joo Ha Hwang, Michael B. Kimmey, Xingde Li; Univ. of Washington, USA.* We demonstrate OCT can accurately distinguish subsquamous Barrett's epithelium (SBE) from surrounding tissue using freshly excised human esophagi. Detection sensitivity and specificity of SBE and high-grade dysplasia will also be discussed.

TuI27 • 6:00 p.m.
OCT Elastography Technique for Micro-Scale Measurements of Elastic Modulus of Atherosclerotic Tissue, *Jadwiga Rogowska, Nirlep Patel, Mark E. Brezinski; Brigham and Women's Hospital/Harvard Medical School, USA.* In this paper we evaluate OCT elastography as a method for assessing Young's modulus of vascular tissue. The system was calibrated with tissue-mimicking phantoms and the elastic modulus of the atherosclerotic arterial samples was estimated.

TuI28 • 6:00 p.m.
Automatic Feature Extraction from Three-Dimensional Optical Coherence Tomography of Human Skin, *Yoshiaki Yasuno[1], Yasuaki Hori[1], Masahiro Yamanari[1], Violeta Dimitrova Madjarova[1], Shuichi Makita[1], Masahide Itoh[1], Toyohiko Yatagai[1], Shingo Sakai[2], Masayuki Matsumoto[2]; [1]Univ. of Tsukuba, Japan, [2]Kanebo Cosnetics INC., Japan.* A segmentation algorithm specially designed for 3D OCT of human skin is presented. A-scan oriented and en face oriented

algorithms determine the thickness map of epidermis, the density and the 3D shapes of the infundibulums.

TuI29 • 6:00 p.m.
Endoscopic Fourier Domain Optical Coherence Tomography for Bladder Cancer Diagnosis, *Zhenguo Wang, Hongyu Wang, Zhijia Yuan, Zilu Wu, Yingtian Pan; SUNY at Stony Brook, USA.* We report a newly developed endoscopic OCT system which incorporates Fourier-domain optical coherence tomography and MEMS mirror for endoscopic laser scanning to improve the frame rate and the dynamic range of the imaging system.

TuI30 • 6:00 p.m.
Dual Band Supercontinuum Light Source for Optical Coherence Tomography, *Hui Wang, Rollins M. Andrew; Case Western Reserve Univ., USA.* We demonstrated an optimized dual band supercontinuum light source with two bands exactly at 830 nm and 1300 nm. The two bands are broad and have enough power and low noise.

TuI31 • 6:00 p.m.
Demonstration of Simple Side-Viewing Bare Fber Probe for Common-Path OCT, *Utkarsh Sharma, Jin U. Kang; Johns Hopkins Univ., USA.* We demonstrate a side-viewing bare fiber probe for common-path OCT using a 49° angle cleaved single mode fiber. The combined advantages of common-path OCT and extremely simplified probe design may greatly simplify Endoscopic OCT instrumentation.

TuI32 • 6:00 p.m.
***In vivo* Imaging of Bone Regeneration Induced by Angiogenic and Osteoinductive Hydrogel Scaffolds,** *Jennifer Patterson, Susan W. Herring, Patrick S. Stayton, Xingde Li; Univ. of Washington, USA.* Hydrogel scaffolds releasing angiogenic and osteoinductive molecules were used to induce bone growth in a bone defect model. Optical coherence tomography was utilized to characterize morphological changes during the temporal progression of bone regeneration.

TuI33 • 6:00 p.m.
Polyvinyl Alcohol Cryogel—Tissue Mimicking Material for Vascular Optical Elastography, *Gijs van Soest[1], Frits Mastik[1], Anton F. W. van der Steen[1,2]; [1]Erasmus MC, The Netherlands, [2]Interuniversity Cardiology Inst. of the Netherlands, The Netherlands.* We present a quantitative OCT analysis, and stress measurements, of PVA cryogel atherosclerotic vessel phantom for optical elastography. The optical parameters and elasticity can be tuned to match those of *in vivo* vascular tissue.

TuI34 • 6:00 p.m.
4D Visualization of Early Embryonic Chick Development Using Optical Coherence Tomography, *Lars Thrane[1], Kambiz Norozi[2], Finn Pedersen[1], Talat M. Yelbuz[2]; [1]Risoe Natl. Lab, Denmark, [2]Medical School Hannover, Germany.* 4D visualization of early embryonic chick development is demonstrated with micron-scale resolution using optical coherence tomography. Early development of a chick embryo and a chick embryo eye are visualized in 3D.

TuI35 • 6:00 p.m.
Measurement of Collagen Content of Coronary Artery Plaque by Polarization Sensitive Optical Coherence Tomography (PS-OCT), *Sonya Shortkroff[1,2], Susanne D. Giattina[1], Brian K. Courtney[3], Paul R. Herz[4], Michelle Harman[1], Deborah L. Stamper[1,2], Bin Liu[1,2], James G. Fujimoto[4], Mark E. Brezinski[1,2]; [1]Brigham and Women's Hospital, USA, [2]Harvard Medical School, USA, [3]Stanford Univ. Medical Ctr., USA, [4]MIT, USA.* This study demonstrates that PS-OCT not only can identify the presence of collagen in coronary plaques but also can estimate collagen content. This technology provides an improved method for risk stratification of coronary plaques.

TuI36 • 6:00 p.m.
Effect of Corneal Hydration on Corneal Refractive Index, *Young L. Kim, Joseph T. Walsh, Thomas K. Goldstick, Matthew R. Glucksberg; Northwestern Univ., USA.* We report the effect of changes in corneal hydration on corneal refractive index using optical coherence tomography. The results demonstrate that the measurement of refractive index is a quantitative indicator of corneal hydration.

TuI37 • 6:00 p.m.
Spectrally Controlled Supercontinuum Generation, *Fiorenzo G. Omenetto[1], Natalie A. Wolchover[1], Mackenzie R. Wehner[2], Anatoly Efimov[3], Matyt R. Ross[3], V. R. K. Kumar[4], A. K. George[4], J. C. Knight[4], A. Taylor[5], N. Joly[6], P. St J. Russell[7]; [1]Tufts Univ., USA, [2]Yale Univ., USA, [3]Los Alamos Natl. Lab, USA, [4]Univ. of Bath, UK, [5]Los Alamos Nat Lab, UK, [6]U. of Lille, France, [7]Max Plank Inst., Germany.* We present here developments that offer photonic crystal fiber-based supercontinuum of unprecedented breadth (>2500 nm) and smoothness. The spectral coverage (350 nm–3000 nm) and quality of this radiation is very appealing for biomedical applications.

TuI38 • 6:00 p.m.
High Resolution Imaging of Corneal Tissues by Full-Field Optical Coherence Tomography, *Masahiro Akiba[1], Kin Pui Chan[1], Yasufumi Fukuma[2]; [1]Yamagata Promotional Organization for Industrial Technology, Japan, [2]Topcon Corp., Japan.* The feasibility of high resolution full-field optical coherence tomography for ophthalmic imaging is studied using a thermal light source and a CCD camera. Imaging result of excised porcine cornea showing the morphological structure is presented.

TuI39 • 6:00 p.m.
Quantitative Characterization of Spectrograph Entrance Slit Width on Roll-off of Fourier Domain Optical Coherence Tomography Signals, *Kelly E. Braun; Duke Univ., USA.* The effect of spectrograph slit width on the depth sensitivity of Fourier domain optical coherence tomography is investigated. A relationship between the two is derived mathematically and supported experimentally.

TuI40 • 6:00 p.m.
Frequency Estimation in Optical Coherence Tomography Using Adaptive Notch Filter, *Yueli Chen, Peter Willett, Quing Zhu; Electrical and Computer Engineering, Univ. of Connecticut, USA.* We present a novel frequency estimation technique for Doppler optical coherence tomography using an adaptive notch filter. The images of an intralipid conduit using this technique have shown good noise robustness and fine resolution.

TuI41 • 6:00 p.m.
Characterization of Tissue Birefringence with a High Speed Polarization Sensitive OCT System, *Gultekin Gulsen, Hon Yu, Orhan Nalcioglu; Univ. of California, IRVINE, USA.* The design and implementation of a polarization sensitive OCT system is described. An iterative algorithm is used to calculate the Jones matrix of the sample. The performance of the system is evaluated with muscle samples.

TuI42 • 6:00 p.m.
Improved Optical Design for Fast Scanning RMA, *Nan Guang Chen, Linbo Liu; Natl. Univ. of Singapore, Singapore.* We have developed a double-pass rotary mirror array for fast scanning optical delay line with improved optical coupling. Such a device is ideal for real-time optical coherence tomography.

TuI43 • 6:00 p.m.
***In vivo* Dynamic Imaging of Arterioles of Human Fingers Using 1.3-μm All-Optical-Fiber OCT,** *Masato Ohmi; Graduate School of Medicine, Osaka Univ., Japan, Japan.* We demonstrate *in vivo* time-sequential imaging of arterioles of human fingers using an all-optical-fiber OCT at 1.3 micron, where expansion and contraction of the arteriole can be observed clearly. A unique imaging method is presented.

TuI44 • 6:00 p.m.
Characterizing of Tissue by Dispersion Induced Chirping in Optical Coherence Tomography, *Bin Liu[1,2], Mark E. Brezinski[1,2]; [1]Brigham and Women's Hospital, USA, [2]Harvard Medical School, USA.* A grating based delay line is controlled to induce dispersion in optical coherence tomography imaging. The spatial frequency of chirping signal indicates that might provide additional diagnostic information about tissue, presumable through the uncertainty principle.

TuI45 • 6:00 p.m.
Single Detector Polarization Sensitive Optical Coherence Tomography for Diagnosis of Histopathology, *Bin Liu, Mark E. Brezinski; Brigham and Women's Hospital, USA.* Comprehensive characterization of single vs. dual detector polarization sensitive optical coherence tomography (PSOCT) suggests the potential applications of single detector PSOCT in diagnosis of histopathology.

TuI46 • 6:00 p.m.
Super-Resolution Wide-Field Imaging: Objective-Launched Standing Wave Total Internal Reflection Fluorescence Microscopy, *Euiheon Chung, Daekeun Kim, Peter T. C. So; MIT, USA.* Standing wave total internal reflection fluorescence microscopy is a wide-field super-resolution technique with PSF FWHM better than 1/5 of emission wavelength. An enhanced lateral resolution is demonstrated in objective-launched geometry by imaging cellular actin cytoskeleton.

TuI47 • 6:00 p.m.
Real-Time Phase Recovery of Biological Cell in Digital Holographic Microscopy by Use of a Self-Calibration Hologram, *Tristan Colomb[1], Jonas Kühn[1], Florian Charrière[1], Pierre Marquet[2], Nicolas Aspert[3], Christian Depeursinge[1]; [1]Ecole polytechnique fédérale de Lausanne, Switzerland, [2]Ctr. de Neurosciences Psychiatriques, Dept. de psychiatrie DP-CHUV, Site de Cery, Switzerland, [3]Lyncée Tec SA, Switzerland.* We demonstrate in Digital Holographic Microscopy a self-calibration hologram method allowing aberrations compensation and a real-time biological cell phase recovery by using a single hologram without adjustment of any parameters.

TuI48 • 6:00 p.m.
Three-Dimensional Polarization Tuning at the Focal Field of a Lens, *Ayman F. Abouraddy[1], Kimani C. Toussaint[2]; [1]MIT, USA, [2]Univeristy of Chicago, USA.* We propose an approach to optical microscopy that enables control over the three-dimensional polarization vector at the focal spot of a high-numerical-aperture lens. The input field is linearly polarized and no polarization optics are required.

TuI49 • 6:00 p.m.
Microfluidic Sorting System Based on Waveguide Integration and Diode Laser Bar Trapping, *Robert W. Applegate[1], Jeff Squier[1], Tor Vestad[2], John Oakey[2], David W. M. Marr[1], Philippe Bado[3], Mark A. Dugan[3], Ali A. Said[3]; [1]Colorado School of Mines, USA, [2]Metafluidics, Inc., USA, [3]Translume, Inc., USA.* We demonstrate integrated optical particle sorting in microfluidic structures. Fluorescent particles are excited using an integrated waveguide network and manipulated with a diode laser bar trapping scheme that sorts based upon their fluorescence.

TuI50 • 6:00 p.m.
Diffraction Phase Microscopy, *YongKeun Park[1], Gabriel Popescu[1], Takahiro Ikeda[2], Kamran Badizadegan[3], Ramachandra R. Dasari[1], Michael S. Feld[1]; [1]M.I.T., USA, [2]Hamamatsu Photonics KK, Japan, [3]Harvard/ MGH, USA.* We developed diffraction phase microscopy as a new technique for quantitative phase imaging of biological structures. It combines common path interferometry with single shot phase imaging, which provides stability and speed.

TuI51 • 6:00 p.m.
Time Resolved Fluorescence Microscopy to Visualize the Dynamics of Optoinjection, *Pedro A. Quinto-Su, Amy N. Hellman, Vasan Venugopalan; Univ. of California, Irvine, USA.* We develop a time resolved fluorescence microscopy system to image the dynamics of optoinjection produced by the delivery of a highly focused pulsed Nd:YAG (λ=532nm, 6ns) laser microbeam to the cell membrane of PtK2 cells.

TuI52 • 6:00 p.m.
Fluorescence Lifetime Imaging Microscopy (FLIM) Measures Oxygen Gradients in Microfluidic Bioreactors, *Dhruv Sud, Geeta Mehta, Khamir Mehta, Jennifer Linderman, Shuichi Takayama, Mary-Ann Mycek; Univ. of Michigan, USA.* A unique FLIM system was employed to quantitatively image extracellular oxygen distributions in perfused micro-bioreactors. We report effects of cell density on oxygen consumption and the first such measurement of oxygen gradients formed within micro-bioreactors.

TuI53 • 6:00 p.m.
Time- and Spectrum-Resolved Multiphoton Fluorescence Sampling Imaging Microscopy, *Junle Qu, Hanben Niu, Lixin Liu, Ziyang Lin, Baoping Guo, Lei Wang, Zhe Fu, Tao Hu; Inst. of Optoelectronics, China.* We report the development of a multiphoton fluorescence sampling imaging microscope that is based on a high repetition rate picosecond streak camera and provides time- and spectrum-resolved imaging at high spatial resolution.

TuI54 • 6:00 p.m.
Direct Measurement of Particle Diameter Distributions in Dark-Field Microscopy, *Jing-Yi Zheng, Nada N. Boustany; Rutgers, The State Univeristy of New Jersey, USA.* Optical scatter imaging (OSI), a dark-field method using Fourier filtering, provides image pixel intensities that encode local particle diameter. Alterations in particle size distributions obtained from OSI pixel histograms are presented for apoptosis resistant cells.

TuI55 • 6:00 p.m.
LED-Based Phase Imaging Interference Microscopy with Multi-Wavelength Optical Phase Unwrapping, *Nilanthi Warnasooriya, Myung K. Kim; Univ. of South Florida, USA.* LED-based phase imaging interference microscopy is a technique that combines phase shifting interferometry with multi-wavelength optical phase unwrapping. It is used to obtain phase maps of an object without 2π discontinuities and with reduced noise.

TuI56 • 6:00 p.m.
Pulsed Laser Microbeam Cell Lysis: Analysis of Biological Response by Hydrodynamic Modeling and Fluorescence Assays, *Amy N. Hellman[1], Kaustubh R. Rau[2], Pedro A. Quinto-Su[3], Vasan Venugopalan[3]; [1]Univ. of California, San Diego, USA, [2]Tata Inst. of Fundamental Res., India, [3]Univ. of California, Irvine, USA.* Time resolved imaging and fluorescent assays were used to examine the biological response of confluent cell cultures to pulsed laser microbeam cell lysis using cavitation bubbles generated by Nd:YAG nanosecond laser pulses at 532 nm.

TuI57 • 6:00 p.m.
Graded-Field White-Light Microscopy, *Ran Yi, Kengyeh Chu, Jerome Mertz; Boston Univ., USA.* We describe the theory of a new technique of phase contrast imaging using aperture apodization with white-light illumination.

TuI58 • 6:00 p.m.
Precision Targeting with a Tracking Adaptive Optics Scanning Laser Ophthalmoscope, *Chad E. Bigelow[1], Daniel X. Hammer[1], R. Daniel Ferguson[1], Nicusor V. Iftimia[1], Teoman E. Ustun[1], Benjamin A. Rockwell[2], Cynthia A. Toth[3]; [1]Physical Sciences Inc., USA, [2]AFRL/HEDO, USA, [3]Duke Univ. Eye Ctr., USA.* We have designed and built a novel imaging system combining scanning laser ophthalmoscopy, active image stabilization, and adaptive optics for precise imaging and targeting of retinal structures. System capabilities are demonstrated in humans and animals.

TuI59 • 6:00 p.m.
Color Structured Illumination Microscopy for Imaging in Noisy Environments, *Leo G. Krzewina, Myung K. Kim; Univ. of South Florida, USA.* In addition to single-exposure optical sectioning, color structured illumination microscopy may be applied within noisy environments often encountered in biological imaging. Advantages over other techniques are demonstrated by both computer modeling and experiment.

TuI60 • 6:00 p.m.
MEMS-Based Single Fiber Reflectance Confocal Microscope System (SFCM) for *in vivo* Cellular Imaging, *Hyun Joon Shin[1,2], Kristen Carlson[3], Hyejun Ra[4], Daesung Lee[4], Olav Solgaard[4], Rebecca Richards-Kortum[1]; [1]Rice Univ., USA, [2]Korea Inst. of Science and Technology, Republic of Korea, [3]Univ. of Texas at Austin, USA, [4]Stanford Univ., USA.* Single fiber reflectance confocal microscope based on 2-axis micro scanning mirror is demonstrated. 140×100 μm FOV, 1.4 μm lateral, and 20 μm axial resolution at 8-frames/s are achieved. We get images of biological tissue.

TuI61 • 6:00 p.m.
Infrared Optical Microfluidics for Simple Bioassays, *Kenneth T. Kotz, Yu Gu, Gregory Faris; SRI Intl., USA.* We describe the use of 1.5 micron light for the transport of droplets and the performance of a simple bioassay based on horseradish peroxidase.

TuI62 • 6:00 p.m.
Microscopic Fluorescence Studies on Brain Intracellular Ca2+ Responses to Ischemia with and without Ca2+- Channel Blockade, *Congwu Du[1], Agnes Wolf[1,2], Yinette Perez[1,3], Yingtian Pan[2], Helene Benveniste[1]; [1]Brookhaven Natl. Lab, USA, [2]Dept. of Biomedical Engineering, SUNY at Stony Brook, USA, [3]Commmunity College Inst.,Community College, USA.* This study presents the experimental results of intracellular calcium responses to ischemia with and without

calcium channel blockade with nimodipine in the brain using fluorescence microscopic imaging.

TuI63 • 6:00 p.m.
Confocal Mosaicing of Basal Cell Carcinomas in Mohs Micrographic Surgical Skin Excisions, *Yogesh G. Patel, Kishwer S. Nehal, Allan C. Halpern, Milind Rajadhyaksha; Memorial Sloan-Kettering Cancer Ctr., USA.* Confocal mosaicing rapidly detects basal cell carcinomas in 100mm2 large skin excisions. Acetowhitening (concentrations 1–10%, duration 0.5–5 minutes) of excisions enhances cancer-to-dermis contrast. These methods may potentially guide Mohs surgery in real-time without histology.

TuI64 • 6:00 p.m.
Dynamic Light Microscopy, *Shahrooz M. Amin[1], Gabriel Popescu[1], Kamran Badizadegan[2], Ramachandra R. Dasari[1], Michael S. Feld[1]; [1]M.I.T., USA, [2]Harvard/ Mgh, USA.* We developed dynamic light microscopy as a new technique that combines inverted microscopy and dynamic light scattering for measuring high-numerical aperture light scattering from biological structures in both static and dynamic conditions.

TuI65 • 6:00 p.m.
Coherence Reflectance Confocal Microscope Using a Synthesized Broadband Source, *Zhao Wang[1], Christopher Glazowski[2], James M. Zavislan[2,3]; [1]Univ. of Rochester, Dept. of Biomedical Engineering, USA, [2]Inst. of Optics, USA, [3]Dept. of Biomedical Engineering, USA.* A coherence reflectance confocal microscope was built using a broad-band light source synthesized from multiple high-power semiconductor lasers. The resolution of the microscope was measured as well as the image power spectrum of skin tissue.

TuI66 • 6:00 p.m.
Noise Model for Laser Speckle Contrast Imaging, *Chao Zhou, Turgut Durduran, Tamas Szabados, Guoqiang Yu, Regine Choe, Xiaoman Xing, Joel H. Greenberg, Douglas J. Durian, Arjun G. Yodh; Univ. of Pennsylvania, USA.* We have developed a noise model for laser speckle contrast imaging. Its dependence on the sliding window size, exposure time, beta, and correlation time is revealed. The accuracy of the model is tested with experiments.

TuI67 • 6:00 p.m.
Real Time 3D Two-Photon Microscopy for Neurology, *Balazs Rozsa[1], Gergely Katona[1], E. Sylvester Vizi[1], András Lukács[2], Zoltán Várallyay[3], Attila Sághy[4], László Valenta[4], Pál Maák[4], Júlia Fekete[5], Ákos Bányász[5], Róbert Szipőcs[5,1]; [1]Inst. for Experimental Medicine, Hungary, [2]Femtonics Ltd., Hungary, [3]Furukawa Electric Inst. of Technology Ltd., Hungary, [4]Budapest Univ. of Technology and Economics, Hungary, [5]Res. Inst. for Solid State Physics and Optics, Hungary.* We propose a two-photon microscope scheme capable of real time, 3D investigation of the neural activity in a 0.6 x 0.6 x 0.2 mm3 volume with sub-micrometer spatial resolution.

TuI68 • 6:00 p.m.
Second Harmonic Diagnostics for Laser Welding and Ablation of Skin, *Asatur A. Lalayan; Yerevan State Univ., Armenia.* Optical harmonic generation is used to monitor denaturation of collagen in skin during photoheating. The change in amplitude of a second harmonic response from welded and ablated area of the samples has been determined.

TuI69 • 6:00 p.m.
Design of a Nonlinear Endomicroscope Biopsy Probe, *Heejin Choi, Shih-Chi Chen, Daekeun Kim, Peter T. C. So, Martin L. Culpepper; MIT, USA.* This paper introduces nonlinear optical (NLO) endomicroscope for non-invasive tissue optical biopsy. This NLO endomicroscope is composed of micro-optical components including micro-prism, GRIN lens, multi-axis high speed scanning actuators integrated at proximal end of endoscope.

TuI70 • 6:00 p.m.
Characterizations of Pulsed Laser Delivery with Fibers in Multiphoton Microscopy, *Daekeun Kim, Peter T. C. So; MIT, USA.* We investigate optical fibers which can be used for pulsed laser delivery. Fibers are compared in terms of spectral distortion and pulse broadening. Multiphoton efficiency, and point spread function are also measured.

TuI71 • 6:00 p.m.
Second-Harmonic-Generation Imaging of Collagen Fiber in Photo-Aged and Natural-Aged Mouse Dermis, *Masahiro Ito[1], Yoshifumi Asaine[2], Takeshi Yasui[1], Tsutomu Araki[1]; [1]Grad. Sch. Engg. Sci., Osaka Univ., Japan, [2]Sch. Engg. Sci., Osaka Univ., Japan.* Second-harmonic-generation (SHG) imaging is applied to observe collagen fiber structure in photo-aged mouse dermis and normal one. Difference of collagen fiber structure between them is clearly visualized as high contrast SHG images.

TuI72 • 6:00 p.m.
Quantum Dot (QD) Fluorochromes for Exploration of Nanocompartments in Living Cells, *Elli Kohen[1], Joseph Hirschberg[1], Dalgis Mesa[1], Kerim M. Gattas-Asfura[1], Annellys Hernandez[1], Christian A. Echeverri[1], Michael Carman[2], David M. Naistat[1], Roger M. Leblanc[1]; [1]Univ. of Miami, USA, [2]Univ. of Pennsylvania, USA.* Photostable, highest emission QD fluorochromes are introduced for enzyme-organelle studies in nanocompartments of living cells. Progress towards intracellular localizations is foreseeable using high-resolution digital photography applied to genomics, proteomics, diagnostics-prognostics, and drug trials.

TuI73 • 6:00 p.m.
Two Photon Absorption Fluorescence Imaging to Characterize Microfluidic Device Performance, *Dawn N. Schafer[1], Rebecca Chadwick[1], Wafa Amir[1], Robert Applegate[1], Jeff Squier[1], Emily Gibson[2], Ralph Jimenez[2], Tor Vestad[1], David Marr[1]; [1]Colorado School of Mines, USA, [2]Univ. of Colorado at Boulder, USA.* Two-photon absorption fluorescence imaging is used to quantitatively measure 3D flow and mixing in microfluidics. This is an important characterization tool for developing optimal microfluidic devices for use in the study of biological molecular dynamics.

TuI74 • 6:00 p.m.
Imaging Properties of Scanning Photon Microscope, *Alexander Khmaladze, Myung K. Kim; Univ. of South Florida, USA.* Scanning photon microscopy techniques as a method of bio-imaging with further gain in resolution and focal depth is demonstrated. The use of position-sensitive detector enables the determination of 3D features of the imaged surface.

TuI75 • 6:00 p.m.
Illumination and Effective Collection Volumes for Fiber Optic Probes in Tissue, *Dean Tai, Christian Soeller, Darren Hooks, John Harvey, Bruce Smaill; Univ. of Auckland, New Zealand.* Fluorescence collection volumes of different optical fibres in tissue were characterized using 2-photon techniques. A 3D illumination model was also developed and validated. This study provides important information for optical probe design in biomedical applications.

TuI76 • 6:00 p.m.
Back to Television Scanning Optical Microscopy?, *Zenon Hrytskiv, Anatolii Pedan, Wolodymyr Shkliarskyi; Lviv Polytechnic Natl. Univ., Ukraine.* Advantages of television scanning optical microscopy in comparison with cameral microscopy are discussed. Peculiarities of new types of cathode-ray tubes with very high spatial resolution, as source of scanning beam, are stated.

TuI77 • 6:00 p.m.
The Confocal Microscope as Used in Biometrics, *Steven W. Green; U. of New Mexico, USA.* A novel method of human identification using a confocal microscope is presented. The confocal microscope is characterized as a feasible biometric tool used for the imaging of the nail bed through the fingernail.

● Wednesday, March 22, 2006 ●

WA • Tutorial VI: Optical Coherence Tomography

Salons D and E
7:30 a.m.–8:00 a.m.
WA • Tutorial VI: Optical Coherence Tomography
Lihong V. Wang; Texas A&M Univ., USA, Presider

WA1 • 7:30 a.m. ▸ Tutorial ◂
Tutorial on Optical Coherence Tomography, *Lihong Wang; Texas A&M Univ., USA.* No abstract available.

WB • Plenary IV: Optical Coherence Tomography and Microscopy

Salons D and E
8:00 a.m.–10:05 a.m.
WB • Plenary IV: Optical Coherence Tomography and Microscopy
Stephen A. Boppart; Beckman Inst., Univ. of Illinois at Urbana-Champaign, USA, Presider

WB1 • 8:00 a.m. ▸ Invited ◂
Recent Developments in Ultrahigh Resolution OCT: Towards Cellular and Functional Imaging, *Wolfgang Drexler; Univ. of Vienna, Austria.* No abstract available.

WB2 • 8:25 a.m. ▸ Invited ◂
Frequency Domain Functional Optical Coherence Tomography, *Zhongping Chen; Univ. of California at Irvine, USA.* No abstract available.

WB3 • 8:50 a.m. ▸ Invited ◂
Confocal Microendoscopy: An Emerging Tool for *in situ* Disease Diagnosis, *Arthur F. Gmitro, Andrew R. Rouse, Anthony A. Tanbakuchi, Joshua A. Udovich; Univ. of Arizona, USA.* The confocal microendoscope is an instrument for optical biopsy that allows in situ imaging of tissue at the cellular level. Several promising clinical applications are emerging for this type of novel instrumentation.

WB4 • 9:15 a.m. ▸ Invited ◂
Using Optical Microscopy and New in-vitro Models to Probe Neural Dynamics from Milliseconds to Months, *Steve Potter; Georgia Tech, USA.* No abstract available.

WB5 • 9:40 a.m. ▸ Invited ◂
Imaging the Cancer Genome: High Resolution Microscopy and Quantitative Method, *Kevin Mills; Jackson Lab, USA.* To probe the biophysical properties of interphase chromosomes involved in cancer development, we are using a mouse lymphoma model and combining genetic analyses with high-resolution 4Pi microscopy and innovative new image analysis algorithms.

10:05 a.m.–10:30 a.m.
Coffee Break/Exhibits

WC • Optical Coherence Tomography I: Instrumentation

Salon D
10:30 a.m.–1:00 p.m.
WC • Optical Coherence Tomography I: Instrumentation
Johannes F. de Boer; Wellman Ctr., MGH, HMS, USA, Presider

WC1 • 10:30 a.m.
Design Criteria of an Adaptive Optics—OCT/SLO System, *Adrian Bradu[1], Adrian Gh Podoleanu[1], David Merino[2], Chris Dainty[2]; [1]Kent Univ., UK, [2]Natl. Univ. of Ireland Galway, Ireland.* Two possible arrangements of a system able to produce high resolution images of the retina are analyzed. The system acquires OCT and Confocal images and correct them for aberrations using an Adaptive Optics closed-loop.

WC2 • 10:45 a.m.
Two Deformable Mirror Adaptive Optics System for *in vivo* Retinal Imaging with Optical Coherence Tomography, *Robert J. Zawadzki[1], Stacey S. Choi[1], John S. Werner[1], Steven M. Jones[2], Diana Chen[2], Scot S. Olivier[2], Yan Zhang[3], Jungtae Rha[3], Barry Cense[3], Donald T. Miller[3]; [1]Dept. of Ophthalmology & Vision Science, UC Davis, USA, [2]Lawrence Livermore Natl. Lab, USA, [3]School of Optometry, Indiana Univ., USA.* A novel adaptive optics system is proposed that cascades two wavefront correctors for the purpose of more effective compensation of ocular aberrations. Two different implementations are evaluated for use with optical coherence tomography.

WC3 • 11:00 a.m.
Retinal Imaging Using Adaptive Optics Spectral Domain Optical Coherence Tomography and Line Scanning Laser Ophthalmoscopy, *Nicusor V. Iftimia, Daniel X. Hammer, Chad E. Bigelow, Daniel R. Ferguson; Physical Sciences, Inc., USA.* The design of a retinal imaging system is presented. Adaptive optics OCT and line scanning laser ophthalmoscopy are employed. Both large field and small field high resolution imaging of the retina is demonstrated.

WC4 • 11:15 a.m.
Pump Probe Molecular Contrast Optical Coherence Tomography Utilizing the Photodegradation of SDC5712, *Emily J. McDowell, Zahid Yaqoob, Changhuei Yang; Caltech, USA.* We demonstrate the use of the near-infrared dye SDC5712 as a contrast agent for pump-probe molecular contrast OCT in both tissue phantoms and biological samples, providing up to 20 dB of contrast in initial studies.

WC5 • 11:30 a.m.
Molecular Imaging of Hemoglobin for Vasculature Mapping Using Ground State Recovery Pump-Probe Optical Coherence Tomography (gsrPPOCT), *Brian E. Applegate, Joseph A. Izatt; Duke Univ., USA.* Ground-state recovery pump-probe OCT allows for 3D spatially resolved molecular imaging of nonfluorescent species. We have used it for vasculature mapping based on transient absorption in hemoglobin.

WC6 • 11:45 a.m.
3×3 Coupler-Based Homodyne Optical Coherence Microscopy, *Zahid Yaqoob, Jeff Fingler, Xin Heng, Changhuei Yang; Caltech, USA.* We present a homodyne optical coherence microscope (OCM) for high-resolution en face imaging. The OCM exploits the inherent phase shifts of 3×3 fiber-optic couplers to simultaneously obtain complete quadrature amplitude and phase information of samples.

WC7 • 12:00 p.m.
Resolving the Complex Conjugate Ambiguity in FD-OCT by Harmonic Lock-In Detection of the Spectral Interferogram, *Andrei B. Vakhtin, Kristen A. Peterson, Daniel J. Kane; Southwest Sciences, Inc., USA.* A new method of resolving the complex conjugate ambiguity in FD-OCT, where the quadrature components of the interferogram are obtained by simultaneous acquisition of the first and second harmonics of the phase-modulated interferogram, is presented.

WC8 • 12:15 p.m.
Quadrature Projection Complex Conjugate Resolved Fourier Domain Optical Coherence Tomography For Real Time Full Depth Imaging, *Marinko V. Sarunic, Brian E. Applegate, Joseph A. Izatt; Duke Univ., USA.* We present full range imaging with Fourier Domain optical coherence tomography using a novel phase stepping algorithm. Real time *in vivo* imaging of human eye anterior segment is demonstrated.

WC9 • 12:30 p.m.
Paired Angle Rotation Scanning (PARS) Needle for Optical Coherence Tomography, *Jigang Wu, Michael Conry, Chunhui Gu, Fei Wang, Zahid Yaqoob, Changhuei Yang; Caltech, USA.* We present a novel forward-imaging probe—Paired Angle Rotation Scanning OCT (PARS-OCT) probe. The probe uses two rotating angled GRIN lenses to achieve forward scanning of the output beam in a cone region.

WC10 • 12:45 p.m.
Phase-Shifted Delay Line Filter for Moving Scatterer Sensitive Spectral Domain Optical Doppler Tomography, *Hongwu Ren, Daniel J. MacDonald, Tao Sun, Michael J. Cobb, Xingde Li; Dept. of Bioengineering, USA.* A phase-shifted delay line filter is implemented in a spectral domain optical Doppler tomography system to suppress the influence of stationary scatterers on blood flow rate estimation.

WD • Technological Advances in Imaging

Salon E
10:30 a.m.–1:00 p.m.
WD • Technological Advances in Imaging
Jorge Ripoll; IESL, Greece, Presider

WD1 • 10:30 a.m.
***In vivo* Functional Imaging Using Photoacoustic Microscopy,** *Lihong V. Wang, Hao F. Zhang, Konstantin Maslov, George Stoica; Texas A&M Univ., USA.* Photoacoustic microscopy extends the current depth limit of the high resolution optical imaging modalities while maintaining a comparable ratio of imaging depth to axial resolution. Based on spectral measurements, functional imaging is achieved *in vivo*.

WD2 • 10:45 a.m.
Differential Optical Imaging for Cancer Detection Using Inspiratory Contrast, *Sanhita Dixit, Kenneth T. Kotz, Khalid Amin, Gregory Faris; SRI Intl., USA.* We demonstrate significant signal contrast using inspiratory contrast agents such as oxygen and carbon dioxide during *in vivo* optical imaging. Differential imaging exploits changes in the concentration of oxy- and deoxyhemoglobin during gas inhalation.

WD3 • 11:00 a.m.
Modulated Imaging: Advancements in Diffuse Optical Tomography and Spectroscopy, *David J. Cuccia[1], Frederic Bevilacqua[1], Ang Li[1], Anthony J. Durkin[2], Ron D. Frostig[3], Bruce J. Tromberg[1]; [1]Laser Microbeam and Medical Program, Beckman Laser Inst., UC Irvine, USA, [2]Laser Microbeam and Medical Program, Beckman Laser Inst., USA, [3]Dept. of Neurobiology and Behavior, UC Irvine, USA.* We present results demonstrating the capabilities of spatially modulated illumination methods to enable high-resolution tomography and quantitative spectral imaging in turbid biological systems.

WD4 • 11:15 a.m.
Complete-Angle Projection Diffuse Fluorescence Molecular Tomography with Early Photons, *Mark J. Niedre, Gordon M. Turner, Vasilis Ntziachristos; Massachusetts General Hospital / Harvard Univ., USA.* In this work we demonstrate diffuse fluorescence tomography using early transmitted photons and complete-angle projection. We describe instrumentation and reconstruction algorithms and show preliminary images of complex fluorescent phantoms and of mice with implanted fluorophores.

WD5 • 11:30 a.m.
High Frequency, ICCD Diffuse Optical Tomography System for Separation of Optical Properties in Small Tissue Volumes, *Sachin V. Patwardhan, Joseph P. Culver; Washington Univ. School of Medicine, USA.* As a basis for small animal quantitative fluorescence tomography we present an ICCD based tomography system that provides optical property maps using frequency domain data between 100–1250MHz.

WD6 • 11:45 a.m.
Stereoscopic Imaging through Turbid Media Using Couple of Microlens Array, *David Abookasis, Joseph Rosen; Bgu univ., Israel.* A new method for 3D imaging of hidden objects in a turbid media is experimentally tested. Objects hidden between two biological tissues at different depths are recovered, and their 3D locations are computed.

WD7 • 12:00 p.m.
White Light Diffuse Optical Tomography and Validation of Optimum Wavelengths for CW DOT, *Alper Corlu[1], Turgut Durduran[1], Regine Choe[1], Kijoon Lee[1], Martin Schweiger[2], Simon R. Arridge[2], Arjun G. Yodh[1]; [1]Univ. of Pennsylvania, USA, [2]Univ. College London, UK.* We have previously presented derivation of optimum measurement wavelength sets based on unique and simultaneous recovery of chromophore concentrations and scattering coefficients.We now introduce a white light imaging setup to validate our theoretical findings.

WD8 • 12:15 p.m.
Analysis of Biological Tissue Textures Using Measurements of Backscattered Polarized Light, *Alexander Sviridov[1,2], Ulissi Zachary[1], Victor Chernomordik[1], Moinuddin Hassan[1], Albert Boccara[3], Amir Gandjbakhche[1]; [1]Natl. Inst.s of Health (NIH), USA, [2]Inst. for Laser and Information Technologies of Russian Acad. of Sciences, Russian Federation, [3]Ecole Superinieure de Physique et de Chimie Industrielle de Paris (ESPCI), France.* To enhance visibility of hidden anisotropic structures of biological tissues, geometry of sample illumination was optimized. Imaging of Pearson correlation coefficient of the degree of polarization was used to determine regions of statistical similarities.

WD9 • 12:30 p.m.
Rapid Near-Infrared Optical Tomography by Spread-Spectral-Encoding of Single Broadband Light Source, *Hao Xie[1], Daqing Piao[1], Brian W. Pogue[2], Weili Zhang[1]; [1]Oklahoma State Univ., USA, [2]Dartmouth College, USA.* A novel spread-spectral-encoding technique that utilizes single broadband light source to achieve video-rate near-infrared diffuse optical tomography is demonstrated. This approach presents the potential of implementing near-infrared diffuse optical tomography at catheter-scale.

WD10 • 12:45 p.m.
Design and Validation of a Diffuse Optical Tomography System with Improved Spatial Resolution for Functional Brain Imaging, *Danny K. Joseph, Theodore J. Huppert, Maria A. Franceschini, David A. Boas; Martinos Ctr. for Biomedical Imaging, USA.* We describe a diffuse optical tomography system that combines frequency encoding with time-division multiplexing to enable overlapping measurements of brain activation. The observed improvement in spatial resolution is confirmed by functional magnetic resonance imaging.

1:00 p.m.–2:00 p.m.
Lunch (on your own)

2:00 p.m.–3:30 p.m.
Exhibits/Coffee Break

WE • Optical Coherence Tomography II: Applications

Salon D
3:30 p.m.–6:00 p.m.
WE • Optical Coherence Tomography II: Applications
Adrian Podoleanu; Univ. of Kent, UK, Presider

WE1 • 3:30 p.m. ▸ Invited ◂
Advances in Optical Imaging of Dynamic Three-Dimensional Engineered Tissues, *Stephen A. Boppart; Beckman Inst., Univ. of Illinois at Urbana-Champaign, USA.* Recent advances in OCT and multiphoton microscopy have enabled nondestructive monitoring of cell dynamics and distributions in 3-D engineered tissues. Dynamic cell processes including migration, proliferation, and mechanical restructuring are observed during engineered tissue development.

WE2 • 4:00 p.m.
High Speed Spectral Domain Phase Microscopy for Quantitative Cell Surface and Cytoplasmic Flow Measurements, *Audrey K. Ellerbee[1], Tony L. Creazzo[2], Joseph A. Izatt[1]; [1]Duke Univ., USA, [2]Duke Univ., Neonatal Perinatal Inst., USA.* We demonstrate cellular applications for high-speed SDPM using a system with 19kHz maximum line-rate. Two-dimensional phase B-scan images taken at 13Hz show flow sensitivity in a single-celled organism.

WE3 • 4:15 p.m.
***In vivo* Three Dimensional Fourier-Domain Optical Coherence Tomography for Soft and Hard Oral Tissue Measurements,** *Violeta D. Madjarova[1], Yoshiaki Yasuno[1], Shuichi Makita[1], Yasuaki Hori[1], Masahiro Yamanari[1], Masahide Itoh[1], Toyohiko Yatagai[1], Masami Tamura[2], Toshiyuki Nanbu[2]; [1]Univ. of Tsukuba, Japan, [2]Shofu Inc., Japan.* 1310 nm SSOCT with 11.6 μm resolution for 3-D *in vivo* imaging with 112 dB sensitivity is demonstrated. Volume distributions of caries lesions below a tooth filling, early caries lesion and alveolar bone measurements were performed.

WE4 • 4:30 p.m.
Image Registration in Ophthalmic Spectral-Domain Optical Coherence Tomography, *Shuliang Jiao, Chunyan Wu, Robert Knighton, Giovanni Gregori, Carmen A. Puliafito; Bascom Palmer Eye Inst., Univ. of Miami School of Medicine, USA.* Fundus images generated from high-speed ophthalmic spectral-domain optical coherence tomography solved the registration problem for both normal density (512×128) and high density OCT images (2048×32). Feature based algorithm was used for high density image registration.

WE5 • 4:45 p.m.
Phenotyping Transgenic Embryonic Murine Hearts Using Optical Coherence Tomography, *Michael W. Jenkins, Debashish Roy, David L. Wilson, Huayun Deng, Monica Montano, Michiko Watanabe, Andrew Rollins; Case Western Reserve Univ., USA.* We used OCT to characterize the morphological phenotype of a HEXIM -/- embryonic heart (E13.5) from a HEXIM +/+ littermate. The HEXIM-mutant was distinguished from the wiltype, by growth retardation (absent left ventricle) and asymmetry.

WE6 • 5:00 p.m.
Volumetric Imaging of Chick Embryo Heart Development *in vivo* Using a High Speed Doppler Spectral Domain OCT Microscope, *Anjul M. Davis[1], Florence G. Rothenberg[2], Joseph A. Izatt[1]; [1]Duke Univ., USA, [2]Duke Univ. Medical Ctr., USA.* 1300nm Doppler spectral-domain OCT microscopy provides a high-speed, high-resolution solution for imaging of developmental processes in small animals. We present 3D volume renderings, Doppler images and M-mode Doppler recordings elucidating cardiac development in chick embryos.

WE7 • 5:15 p.m.
Optically-Modulated MEMS Scanning Endoscope for Optical Coherence Tomography, *Changho Chong[1], Keiji Isamoto[1], Jonathan Evans[2], Hiroshi Toshiyoshi[3]; [1]Santec corporation, Japan, [2]Santec USA corporation, USA, [3]Inst. of Industrial Science(IIS), Univ. of Tokyo, Japan.* This paper presents a novel configuration of MEMS scanning endoscope actuated by external optical modulation at wavelength of 1550nm, while wavelength of 1310nm range is used as the probe beam for optical coherence tomography.

WE8 • 5:30 p.m.
Mid-Infrared Optical Coherence Tomography: Application in Tissue Engineering, *Christopher S. Colley[1], Jeremy C. Hebden[1], David T. Delpy[1], Evgeny A. Zibik[2], Wing H. Ng[2], Luke R. Wilson[2], John W. Cockburn[2], Kristian M. Groom[2], Mark Hopkinson[2]; [1]Univ. College London, UK, [2]Univ. of Sheffield, UK.* The world's first mid-infrared optical coherence tomography (MIR-OCT) system is introduced. It utilizes custom-built quantum cascade lasers as broadband MIR sources and has been designed to characterize the structure and biochemical content of bioengineered tissues.

WE9 • 5:45 p.m.
An Inverse Scattering Method for Catheter-Based Optical Coherence Tomography, *Daniel L. Marks, Tyler S. Ralston, P. Scott Carney, Stephen A. Boppart; U. of Illinois at Urbana-Champaign, USA.* By physically modelling the scattering of a broadband Gaussian beam projected from an azimuthally scanned catheter, we formulate an inverse scattering solution for optical coherence tomography for intravascular or gastrointestinal imaging.

WF • Microscopy II

Salon E
3:30 p.m.–6:00 p.m.
WF • Microscopy II
Irene Georgakoudi; Tufts Univ., USA, Presider

WF1 • 3:30 p.m.
Integration of a Double-Clad Photonic Crystal Fiber, a GRIN Lens and a MEMS Mirror for Nonlinear Optical Microscopy, *Ling Fu[1], Ankur Jain[2], Huikai Xie[2], Charles Cranfield[1], Min Gu[1]; [1]Ctr. for Micro-Photonics, Australia, [2]Dept. of Electrical and Computer Engineering, Univ. of Florida, USA.* We report on a prototype of a nonlinear optical endoscope based on a double-clad photonic crystal fiber and a GRIN lens to improve the detection efficiency and a MEMS mirror to steer the beam.

WF2 • 3:45 p.m.
All-Chirped-Mirror Pulse Compressor for Nonlinear Microscopy, *Gabriel F. Tempea[1], Boris Považay[2], Andreas Assion[1], Andreas Isemann[1], Wladimir Pervak[3], Michael Kempe[4], Andreas Stingl[1], Wolfgang Drexler[5]; [1]Femtolasers Produktions GmbH, Austria, [2]2Inst. of Medical Physics, Christian Doppler Lab, Austria, [3]3Max-Planck-Inst. für Quantenoptik, Germany, [4]Carl Zeiss Jena GmbH, Res. Ctr., Germany, [5]Inst. of Medical Physics, Christian Doppler Lab, Austria.* The dispersion of scanning microscope optics (including a 40x/1.2 objective) was compensated with chirped mirrors over 170nm@800nm. The autocorrelation trace recorded at the focus of the microscope indicated a pulse duration below 12fs.

WF3 • 4:00 p.m.
Time-Resolved Multiphoton Multifocal Fluorescence Microscopy Applied to Biomedical Imaging, *Ariane Deniset[1], Sandrine Lévêque-fort[1], Marie-Pierre Fontaine-Aupart[1], Gérard Roger[2], Patrick Georges[2]; [1]Lab de PhotoPhysique Moléculaire CNRS UPR 3361, France, [2]Lab Charles Fabry, Inst. d'optique UMR 8501, France.* Two-photon microscopy is a key method for biomedical imaging but time consuming for three-dimensional and fluorescence lifetime images. To speed up acquisitions, we have developed a time-resolved multifocal multiphoton microscope.

WF4 • 4:15 p.m.
Two-Photon Absorption of Oxyhemoglobin and Methemoglobin for Microscopic Imaging, *Gunay Yurtsever[1], Tong Ye[1], Katherine Weaver[1,2], Warren S. Warren[2]; [1]Duke Univ., USA, [2]Ctr. for Molecular and Biomolecular Imaging, Duke Univ., USA.* We measured two-photon absorption of oxyhemoglobin and methemoglobin with modest laser powers. In combination with our previous work on melanin tissue imaging, this shows two-photon absorption imaging of hemoglobin state is feasible.

WF5 • 4:30 p.m.
Two-Photon Fiber-Optic Scanning Endoscope, *Mon T. Myaing, Daniel J. MacDonald, Xingde Li; Univ. of Washington, USA.* We present a flexible fiber-optic scanning endoscope for two-photon fluorescence imaging and demonstrate it on live cells. Two-dimensional beam scanning at kilohertz frequencies was achieved using a PZT tube to actuate a double-clad fiber.

WF6 • 4:45 p.m.
Dynamic and Structural Visualization of Muscle Structure in Drosophila with Multimodal Harmonic Generation Microscopy, *Catherine Greenhalgh, Richard Cisek, Bryan Stewart, Virginijus Barzda; Univ. of Toronto, Canada.* Multimodal non-linear microscopy was used to investigate the structure and functional dynamics of muscle from larvae and adult Drosophila. Multimodal technology proved to be a powerful tool for a photobleaching free method of physiological investigations.

WF7 • 5:00 p.m.
Confocal Reflectance Theta Line-Scanning Microscope for Imaging Human Skin, *Peter J. Dwyer[1], Charles A. DiMarzio[2], William J. Fox[3], James M. Zavislan[4], Milind Rajadhyaksha[5]; [1]Dept. of Electrical Engineering, USA, [2]Northeastern Univ., USA, [3]Lucid, Inc., USA, [4]Univ. of Rochester, USA, [5]Memorial Sloan-Kettering Cancer Ctr., USA.* A confocal reflectance theta line-scanning microscope provides axial resolution of 1.7–9.2 μm and lateral resolution of 1.0–1.7 μm within full thickness epidermis. *In vivo* images of human skin provide nuclear, cellular and architectural detail.

WF8 • 5:15 p.m.
Integrated Semiconductor Bio-Sensors for *in vivo* Cellular and Neural Imaging, *Ofer Levi, Thomas T. Lee, Meredith M. Lee, James S. Harris; Stanford Univ., USA.* Semiconductor integrated optical bio-sensors optimization for fluorescence, reflection, and index of refraction sensing is reviewed. Applications include bio-diagnostics, *in vivo* fluorescence-based cancer continuous monitoring and minimally invasive neural activity imaging.

WF9 • 5:30 p.m.
Phase Subtraction Cell Counting Method for Live 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. This method could revolutionize the clinician's ability to determine embryo viability for IVF procedures.

WF10 • 5:45 p.m.
Quasi-Confocal Fluorescence Sectioning with Dynamic Speckle Illumination, *Cathie Ventalon, Jerome Mertz; Boston Univ., USA.* We present a new linear fluorescence microscopy technique that relies on dynamic speckle illumination and provides depth discrimination in thick tissue. We demonstrate quasi-confocal imaging in a mouse brain labeled with green fluorescent protein.

Key to Authors and Presiders

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Biomedical Optics Program Update Sheet

Additional Information about the NIBIB/NIH-Sponsored Special Session on Tuesday, March 21, 2:00 p.m.–3:00 p.m., Salons D and E

Expert Panel Discussion about Accelerating Clinical Translation of Optical Imaging

The NIBIB/NIH-sponsored Optical Imaging Workshop will focus on problems, challenges, success and lessons learned taking optical techniques from the bench to the bed-side. The session will feature opening remarks by Dr. Yantian Zhang (NIH) followed by talks from academic and industry researchers involved in transitioning optical technology from the laboratory to the clinic. A 25 minute panel discussion will follow with the goal of providing input to NIH on how the NIH can facilitate the medical application of optical technologies.

Invited Speaker Change

Mary Cole from Genetech California will present TuB2, **Illuminating Drug Discovery.**

Poster Presentation Swap

Two poster presentations, SH22 and TuI54, have been swapped. Here are the revised details:
TuI54, **Fluorene Derivative Doped Organic Modified Silica Nanoparticles as Biological Imaging Contrast Agents**, *Kevin D. Belfield, Sheng Yao, Katherine J. Schafer-Hales; Univ. of Central Florida, USA.*
SH22, **Direct Measurement of Particle Diameter Distributions in Dark-Field Microscopy,** *Jing-Yi Zheng, Nada N. Boustany; Rutgers University, USA.*

Updated Author Block

TuI2, **Multi-Spectral Reflection Photoplethysmography: Potential for Skin Microcirculation Assessment,** *Janis Spigulis, Lasma Gailite and Alexey Lihachev; Univ. of Latvia, Latvia.*

Updated Presentation Title

TuB3, **The Optical Method in Molecular Imaging,** *Christian Schultz; Siemens, USA.*

Change to Presenting Author

Alexander Khmaladze, Univ. of South Florida, USA, will present TuH7.

Correction to Spelling of Speaker's Name

TuB1, **Optical Imaging in the Drug Discovery Process,** *Bohumil Bednar; Merck, USA.*
OSA regrets the error.

Withdrawn Oral Papers

TuI51
WF3

Withdrawn Posters

ME76
TuI23
TuI77