OSA
Optical Society of America

BIOMED

OSA Biomedical Topical Meetings and Exhibit

April 7–10, 2002

Fontainebleau Hilton Resort and Towers
Miami Beach, Florida

Three collocated meetings:

Advances In Optical Imaging and Photon Migration (AOIPM)

Biomedical Optical Spectroscopy and Diagnostics (BOSD)

Optical Techniques in Neuroscience

The organizers of the Biomedical Topical Meeting gratefully acknowledge the support of the following Corporations and U.S. Government Agencies:

- United States Air Force
- United States Department of Energy
- Xenogen

About BIOMED

The Biomedical Optics meeting brings together three key meetings in the field:

- Advances in Optical Imaging and Photon Migration (AOIPM),
- Biomedical Optical Spectroscopy, Imaging, & Diagnostics (BOSD), and
- Optical Techniques in Neuroscience.

Leading experts attend the Biomed Topical Meeting. With over 350 attendees, this meeting affords the opportunity for participants to interact one on one with presenters. Multiple poster sessions allow for lively discussions about the latest research.

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Program Information

Advances in Optical Imaging and Photon Migration (AOIPM)

Scope

The recent emergence of biomedical optics as an intense and productive area of applied research has benefited from scientists and engineers being brought together from a variety of disciplines, including optical physics, electrical engineering, mathematical modeling, physiology, and computer science. The 2002 AOIPM meeting is intended as a primary forum for researchers from this diverse community to present and discuss the latest developments in optical imaging techniques for medical diagnostics, and recent progress in the study of photon migration in human tissue. Topics cover new and evolving methods and instrumentation, theoretical and numerical modeling, and a broad range of clinical applications. This meeting represents the fifth in a series held every two years in Florida.

Topics Presented

- Novel optical diagnostic techniques and instruments
- Optical tomography and transillumination of tissues
- Reconstruction algorithms for optical tomography
- Theory and modeling of light transport in tissue
- Time-of-flight and frequency domain systems
- Fluorescent lifetime imaging
- Confocal imaging and microscopy
- Optical coherence tomography
- 3D optical imaging of the neonatal brain
- Optical mammography
- Optical mapping of brain function and evoked response
- Optical biopsy
- Acousto-optic interactions and diagnostic applications

Invited Speakers

Linking the radiative transfer equation and the diffusion approximation, Jari Kaipio, *Univ. of Kuopio, Finland*

New imaging technologies for endoscopic applications, Hitoshi Mizuno, *Olympus Optical Co., Japan*

High sensitivity and specificity in human breast cancer detection with near-infrared imaging, Britton Chance, *Univ. of Pennsylvania, USA*

Biomedical Optical Spectroscopy, Imaging, & Diagnostics (BOSD)

Scope

The design of novel probes revealing the wealth of biochemical and structural information contained in optical signatures re-emitted from tissues offers new frontiers in the engineering of biomedical spectroscopy and diagnostics. Developments in fluorescence, phosphorescence, Raman, elastic scattering, reflectance, and nonlinear spectroscopies in tissues continue to fuel advances in diagnostic capability. Recent advances include progress in blood gas and blood constituent monitoring, in situ spectroscopic optical biopsy for disease detection and characterization, and novel methods of optical histopathology utilizing confocal, nonlinear, and near-field scanning microscopy. Innovations in optical assays promise to complement radionucleotide approaches. The objective and scope of this topical meeting will be to highlight these and other frontiers of biomedical optical engineering that are directed towards new screening and diagnostic procedures in the clinic and through joint sessions with the AOIPM meeting, to explore the applications of multi-spectral imaging to cells and tissues.

Topics Presented

- Reflectance spectroscopy of cells and tissues
- Fluorescence spectroscopy of cells and tissues
- Raman spectroscopy of cells and tissues
- Polarized light imaging and spectroscopy of cells and tissues
- Instrumentation for spectroscopic tissue characterization
- Light scattering properties of cells and organelles
- Models to interpret tissue spectral data
- Exogenous contrast agents for spectral diagnosis
- Application of cellular and molecular probes to tissues
- Advances in optical histopathology utilizing confocal, non-linear, and near-field microscopy
- Advances in cytometry
- Time-resolved and frequency-domain spectroscopy in medicine
- Blood gas and constituent monitoring
- *In vivo* tissue perfusion monitoring
- Chemometrics
- Extension of spectroscopic diagnostics to imaging modalities
- Clinical applications

Invited Speakers

Biologically relevant three-dimensional tissue phantoms for biomedical optics, Konstantin Sokolov, *Univ. of Texas-Austin, USA*

Real time calibrated fluorescence imaging of tissue in vivo by using the combination of fluorescence and cross-polarized reflection, Jianan Qu, *Hong Kong Univ. of Science and Tech., Hong Kong*

Imaging the mechanical properties of biological tissues, Sean J. Kirkpatrick, *Providence St. Vincent Medical Ctr. and Oregon Health & Science Univ., USA*

2002 Featured Area of Interest
Optical Techniques in Neuroscience

Scope

This meeting will review the state of the art of optical techniques in neuroscience, and will identify remaining problem areas, technological requirements, and gaps in understanding. The cross-fertilization of neuroscientists, optical scientists, engineers, physicists, and mathematicians should create an exciting educational atmosphere, stimulating discussion about new research directions and collaborations. Research presented will consider optical imaging of brain physiology/function on scales ranging from dendritic spines to the whole brain, and on temporal scales from sub-millisecond to seconds. The coupling between optical responses and physiological, biochemical, hemodynamic and biophysical components of neural activation will also be discussed.

Topics Presented

Cerebral (patho)-physiology

- Mapping of brain activity
- Neurovascular coupling
- Spreading depression
- Plasticity
- Epileptic activity

Optical approaches

- Microscopic measurements: Confocal, Two-photon, and optical coherence microscopy
- Intrinsic signals of brain:
- Slow intrinsic signals
- Fast intrinsic signal
- Near Infrared Spectroscopy and Diffusive Optical Imaging
- Development of optical contrast agents, including: voltage, temperature, calcium, and pH sensitive dyes
- Signal processing techniques, Photon migration algorithms

Invited Speakers

Near infrared topography of brain function, Hideaki Koizumi, *Hitachi Advanced Res. Lab., Japan*

Using intrinsic signal optical imaging to visualize cortical plasticity, Ron Frostig, *Univ. of California-Irvine, USA*

The hemodynamic response to increased neural activity in brain: An investigation of the intrinsic signals using electrophysiology, spectroscopy and laser Doppler flowmetry, John Mayhew, *Univ. of Sheffield, UK*

Voltag-sensitive dye recording: Membrane potential in a dendritic tree and population oscillations in the olfactory bulb, Lawrence Cohen, *Yale Univ., USA*

Optical imaging of fast, dynamic neurophysiological function, David Rector, *Los Alamos Natl. Lab., USA*

Approaches for quantification in biospectroscopy of turbid media, David Burns, *McGill Univ., Canada*

Joint Sessions

The AOIPM, BOSD and OTN will hold three joint sessions for all attendees. The following are the invited speakers for the joint sessions:

Joint Session 1: SuA

Digital holographic microscopy applied to the study of topology and deformations of cells with sub-micron resolution: Example of neurons in culture, Christian Depeursinge, *Swiss Federal Inst. of Tech., Switzerland*

Imaging the complexity of neuron behavior with fluorescent ion indicators, William Ross, *New York Medical Ctr., USA*

Bridging the gap between electrophysiology and circulation by laser-Doppler flowmetry, Martin Lauritzen, *Glostrup Hospital and Univ. of Copenhagen, Denmark*

Intra-operative intrinsic optical brain signals, Art Toga, *UCLA, USA*

Joint Session 2: MA

Fluctuation fluorescence correlation microscopy in living cells, Enrico Gratton, *Univ. of Illinois at Urbana-Champaign, USA*

Spectral encoding for endoscopic confocal microscopy and miniature endoscopy, Guillermo J. Tearney, *Massachusetts General Hospital, USA*

Confocal video imaging of human skin in vivo, Gerald Lucassen, *Phillips Res., Netherlands*

Joint Session 3: TuA

Clinical evaluation of optical breast imaging: What requirements of the clinician can be fulfilled? Thomas Moesta, *Robert Roessle Hospital, Germany*

Spectral imaging of the human breast for cancer detection, Sergio Fantini, *Tufts Univ., USA*

In vivo, early detection, quantitative grading and mapping of cervical cancers and precancers, based on the dynamic spectral imaging and analysis of the acetic acid-induced alterations in the tissue light scattering properties, Costas Balas, *Inst. of Electronic Structure and Laser, Greece*

Agenda of Sessions

All technical sessions will be held in the Brittany/Champagne meeting room and the Monaco meeting room of the Fontainebleau Hilton Resort and Towers. The poster sessions, exhibits, and coffee breaks, will be held in the Lemans/Bordeaux/Burgundy. Registration and Speaker/Presider check-in will take place in the French Rooms Foyer outside the meeting rooms.

Saturday, April 6, 2002		
4:00pm–8:00pm		Registration *French Rooms Foyer*

Sunday, April 7, 2002					
7:00am–7:00pm		Registration *French Rooms Foyer*			
10:00am–4:00pm		Exhibit Hours *Lemans/Bordeaux/Burgundy*			
8:00am–10:00am	SuA	Joint Session on Optics in Neuroscience *Brittany/Champagne*			
10:00am–10:30am		Coffee Break *Lemans/Bordeaux/Burgundy*			
10:30am–12:30pm	SuB	Optical Tomography: Theory I *Brittany/Champagne*	10:30am–12:45pm	SuC	Cerebral Vascular Physiology *Monaco*
12:30pm–2:00pm		Lunch on Your Own			
2:00pm–3:30pm	SuD	Poster Session 1 *Lemans/Bordeaux/Burgundy*			
3:30pm–4:00pm		Coffee break *Lemans/Bordeaux/Burgundy*			
4:00pm–5:30pm	SuE	Optical Tomography - Instrumentation *Brittany/Champagne*	4:00pm–5:45pm	SuF	Direct Optical Measurements of Neuronal Signals *Monaco*
5:30 pm-7:00pm		Dinner on Your Own			
7:00pm–8:30pm	SuG	Confocal and Interference Microscopy *Brittany/Champagne*	7:00pm–8:30pm	SuH	Tissue Physiology *Monaco*
8:30pm–10:00pm		Special Symposium: Advances in Neuroscience *Brittany/Champagne*			

Monday, April 8, 2002		
7:00am–7:00pm		Registration *French Rooms Foyer*
10:00am–4:00pm		Exhibit Hours *Lemans/Bordeaux/Burgundy*
8:00am–10:00am	MA	Joint Session on New Techniques in Microscopic Imaging *Brittany/Champagne*
10:00am–10:30am		Coffee break *Lemans/Bordeaux/Burgundy*

10:30am–12:30pm	MB	OCT – New Techniques *Brittany/Champagne*	10:30am–12:30pm	MC	Near Infrared Spectroscopy and Imaging *Monaco*
12:30pm–2:00pm		Lunch on Your Own			
2:00pm–3:30pm	MD	OCT – Clinical Applications *Brittany/Champagne*	2:00pm–3:30pm	ME	Raman & Multiphoton *Monaco*
3:30pm–4:00pm		Coffee Break *Lemans/Bordeaux/Burgundy*			
4:00pm–5:30pm	MF	Fluorescence Imaging and Spectroscopy *Brittany/Champagne*	4:00pm–5:30pm	MG	New Contrast Agents, Microscopies and Observations *Monaco*
5:30pm–7:30pm		Special Symposium and Reception: A View from NIH's Newest Institute: Opportunities and Challenges Donna Dean, PhD, Acting Director, National Institute for Biomedical Imaging and Bioengineering *Fontainebleau Ballroom A*			
7:30pm–9:00pm	MH	Acousto-optic and Other Techniques *Brittany/Champagne*	7:30pm–9:00pm	MI	Novel Cellular Characterization *Monaco*

Tuesday April 9, 2002					
7:00am–7:00pm		Registration *French Rooms Foyer*			
10:00am–4:00pm		Exhibit Hours *Lemans/Bordeaux/Burgundy*			
8:00am–10:00am	TuA	Joint Session on Cancer Imaging and Diagnosis *Brittany/Champagne*			
10:00am–10:30am		Coffee Break *Lemans/Bordeaux/Burgundy*			
10:30am–12:45pm	TuB	Optical Mammography *Brittany/Champagne*	10:30am–12:30pm	TuC	Clinical Fluorescence *Monaco*
12:30pm–2:00pm		Lunch on Your Own			
2:00pm–3:30pm	TuD	Poster Session 2 *Lemans/Bordeaux/Burgundy*			
3:30pm–4:00pm		Coffee Break *Lemans/Bordeaux/Burgundy*			
4:00pm–5:30pm	TuE	Diffuse In Vivo Imaging I *Brittany/Champagne*	4:00pm–5:30pm	TuF	Modeling and Optical Properties *Monaco*
5:30pm–7:30pm		Industry Roll-Out and Conference Reception *Fleur de Lis*			

Wednesday, April 10, 2002					
7:00am–12:00pm		Registration *French Rooms Foyer*			
8:00am–10:00am	WA	Optical Tomography – Theory II *Brittany/Champagne*	8:00am–10:00am	WB	Polarization & Backscatter *Monaco*
10:00am–10:30am		Coffee Break *French Rooms Foyer*			
10:30am–12:30pm	WC	Diffuse In Vivo Imaging II *Brittany/Champagne*	10:30am–12:30pm	WD	Fluorescence Potpourri *Monaco*

Technical Program

The program for the BIOMED Topical Meeting will be held from Sunday, April 7 through Wednesday, April 10, 2002 at the Fontainebleau Hilton Resort and Towers. The program will consist of 135 contributed oral presentations, 22 invited presentations, and 71 poster presentations.

Contributors

The organizers of the Biomedical Topical Meeting gratefully acknowledge the support of the following Corporations and U.S. Government Agencies:

United States Air Force
United States Department of Energy
Xenogen

Special Events

Please join us for three exciting new special events.

Sunday, April 7, 8:30pm–10:00 pm ***Advances in Neuroscience***

Co-chairs: David Boas, *Massachusetts General Hosp., USA;* and John George, *Los Alamos Natl. Lab., USA*

Keynote speakers: Amiran Grinvald, *IBM/Thomas J. Watson Research Ctr. and Rockefeller Univ., Israel* and Britton Chance, *Univ. of Pennsylvania, USA*

This special symposium will feature updated information on the Advances in Neuroscience. Keynote addresses will be followed by presentations from panel members Ron Frostig, *Univ. of California-Irvine, USA,* Lawrence Cohen, *Yale Univ., USA* and Arno Villringer, *Charite Hospital, Germany.*

Monday, April 8, 5:30pm-7:30pm ***A View from NIH's Newest Institute: Opportunities and Challenges***

Chair: Irene Georgakoudi, *MIT, USA*

Keynote Speaker: Donna Dean, *Acting Director of the National Institute for Biomedical Imaging and Bioengineering*
This event will include a presentation by Dr. Donna Dean, who will provide her perspectives on the impact of NIBIB on biomedical optics and the role of women in bioengineering. The presentation is expected to serve as the instigator for fruitful discussions and interactions between junior researchers and their peers in industry and academia and to raise awareness about issues particularly pertinent to women in our field. All conference attendees are encouraged to attend. Dr. Dean's presentation will be followed by a reception.

Tuesday, April 9, 5:30pm-7:30pm ***Industry Roll-Out and Reception***

Chair: Shabbir Bambot, *Spectrx, USA*

Participants in this special industry-focused symposium will each make a 10-minute presentation followed by 5 minutes of question and answers. This forum will provide an important focal point with which to stimulate interaction and discussion among attendees from academia, industry and medicine throughout the meeting. The symposium will conclude with a general discussion followed by a wine and cheese reception. Presentations will feature highlights from industry sponsors.

Poster Sessions

The BIOMED program committee has scheduled both oral and poster sessions. For poster sessions, each author is provided a poster board approximately 1.2 m high by 2.4 m wide (four feet by eight feet) on which to display a summary of their paper. Authors must remain in the vicinity of the poster board for the duration of the 90-minute poster session to answer any questions of attendees. The abstract and summary of both oral and poster papers are published in the *Advance Program* and the *Technical Digest.* Please note that poster papers are not supplied with any audiovisual equipment.

Postdeadline Papers

The purpose of postdeadline papers is to give participants the opportunity to hear new and significant material in rapidly advancing areas. Only those papers judged to be truly excellent and compelling in their timeliness will be accepted. The BIOMED technical program committee will accept a limited number of postdeadline papers for presentation. Papers reporting extraordinary results must be submitted to the meeting http://www.osa.org/biomed **no later than April 2, 2002.** Postdeadline papers brought to the meeting must be submitted to the Registration desk by Saturday, April 6, 2002 at 5:00pm local time**.**

Authors submitting postdeadline papers to the 2002 Biomedical Topical Meeting are required to submit a 35-word abstract, a 3-page summary, as well as the completed electronic submission form.

Additionally, each submission must be followed by an original, mailed, or fax copyright form. The copyright agreement form can be found on page 55, as well as on the meeting web page. Authors are encouraged to visit www.osa.org/biomed for detailed instructions on the electronic submission process, as well as a style guide. A technical paper received outside of the electronic submission format will not be accepted. Revisions will not be accepted.

Electronic Submission Form

On the submission form, authors are asked to provide vital pieces of information, including, but not limited to the paper title, presentation type, additional authors, and 35-word abstract, as well as the submitting author's contact information. This form must be completed in its entirety. Failure to do so will inhibit your ability to successfully submit your research and may misdirect the paper outside of the author's preferred scope.

Summary Preparation

The 3-page summary portion of the electronic submission can be submitted in the following formats: PostScript, TeX, Word, and Word Perfect. The summary must be typed with the page layout set to 8-1/2" x 11" page, and with standard, 1-inch margins on all sides. The author must include all text and figures, including the 35-word abstract, within the 3-page limit. Be sure to include all additional authors and their affiliations, as well as the 35-word abstract, on page 1 of your paper. Avoid the use of asterisks, acknowledgments, job descriptions, or footnotes. Use only black text and grey-scaled figures; color will not reproduce. References should be cited at the end of the 3-page summary. Upon acceptance, the 3-page summary will be reproduced directly by photo-offset from the material submitted by the author(s) and will be distributed to all meeting registrants at the meeting.

Adherence to the instructions for preparation of the abstract and summary is imperative. Any of the following conditions may result in rejection of a paper:

- Failure to submit the paper electronically by Noon EST, April 2, 2002, or in person at the registration desk by 5:00 PM EST on Saturday, April 6, 2002.
- Failure to submit the 35-word abstract.
- Failure to mail a completed copyright agreement.

All submissions will be reviewed by the program committee in Miami. The postdeadline presentation schedule will be posted in the registration area as soon as it is available.

Accepted postdeadline papers will be presented as poster papers either on Sunday, April 7 or Tuesday, April 9. Copies of the accepted postdeadline papers will be distributed at the meeting.

Technical Digest

The BIOMED Topical Meetings *Technical Digest* will comprise camera-ready summaries of the papers presented during the meeting. At the meeting, each registrant will receive a copy of the *Technical Digest*, with extra copies available on a pay and carry basis at a special price of $60. Following the meeting, Post Conference *Technical Digests* will be available from the OSA Customer Services Department.

Speaker and Presider Check-in

All speakers and presiders are requested to check-in at the registration desk. Authors requesting slide projectors are encouraged to preload and preview their slides at least 30 minutes before their session begins. Slides may be retrieved at the same location after the session. Presiders are requested to check-in at the registration desk for a quick review of equipment and procedures.

Audiovisual Equipment

The meeting room will contain the following audiovisual equipment:

Podium microphone
Lavaliere microphone
Data projector for computer presentation (computers not provided)
Projection pointer
Screen

The attendee will be responsible for the cost of any additional audiovisual equipment. To request equipment other than that listed, write or call with your request by **March 25, 2002.**

OSA Meetings and Exhibits
2010 Massachusetts Ave., NW
Washington, DC 20036-1023
Tel: 202.416.1994
Fax: 202.416.6100
avrequests@osa.org

Messages

Messages for participants at the meeting should be directed to the OSA/BIOMED Registration Desk. The address, telephone number and fax number for the Fontainebleau Hilton Resort and Towers are as follows:

Fontainebleau Hilton Resort and Towers
4441 Collins Avenue
Miami Beach, Florida 33140
Phone 305-538-2000
Fax 305-674-4607

Exhibits

An informal exhibit of tabletop displays featuring state of the art services and technologies will be held in conjunction with the BIOMED Topical Meetings. Ample time will be allowed for all attendees to visit the exhibits and speak with representatives from the industry.

Exhibit Hours:	
Sunday, April 7	10:00am–4:00pm
Monday, April 8	10:00am–4:00pm
Tuesday, April 9	10:00am–4:00pm

For information on exhibiting, please contact

OSA Meetings and Exhibits
2010 Massachusetts Avenue, NW
Washington, DC 20036-1023
Phone: 202-416-1950
Fax: 202-416-6100
E-mail: exhibits@osa.org

Letters of Invitations

Individuals requiring letters of invitation to obtain travel visas may contact OSA directly by e-mail at invitations@osa.org, by mail at 2010 Massachusetts Ave. NW, Washington, DC 20036, or by fax at 202-416-6100. Please include your name, address and reference the meeting to which the individual will be attending. If requesting for more than one individual please include the name and address for each person. Individuals from China should include a passport number, date of birth, and gender for the person requesting the invitation letter. All letters of invitation will be sent by airmail or by fax unless a Federal Express account number or credit card number with expiration date is provided on the original request. Please allow ample time for processing requests. OSA is not able to contact U.S. Embassies in support of an individual attempting to gain entry into the host country to attend an OSA meeting.

Registration Hours

Registration will be located in the French Rooms Foyer during the following hours:

Saturday, April 6	4:00pm–8:00pm
Sunday, April 7	7:00am–7:00pm
Monday, April 8	7:00am–7:00pm
Tuesday, April 9	7:00am–7:00pm
Wednesday, April 10	7:00am–12:00pm

Early Registration

SAVE MONEY! Register by March 11, 2002 and save $80. Early registration allows attendees quick pick-up of registration materials.

3 Ways to Register! Send in your registration form and payment by ONE of the following methods:

Mail:
OSA Finance Department
C/o BIOMED 2002 Registration,
Dept. 214, Washington, DC 20055-0214

Express Courier:
OSA Finance Department
BIOMED 2002 Registration
2010 Massachusetts Ave., NW
Washington, DC 20036-1023

By Fax: Send your registration form with credit card payment to **202-416-6100**. To avoid duplicate payment **DO NOT** fax your form more than once. Please keep your fax confirmation as proof of your registration.

FORMS RECEIVED WITHOUT PAYMENT INFORMATION WILL NOT BE PROCESSED!

OSA accepts VISA, MasterCard, American Express, Diner's Club, checks, money orders, and Bank drafts. All payment processed on a credit card will be in US dollars at the conversion rate used by their credit card.

Checks and money orders—All checks must be in US dollars and made payable to the Optical Society of America. Please indicate on the registration form the check number.

Bank drafts and wire transfers—Please indicate on your registration form which bank was used and when the deposit was made. Also, please notify OSA of the transfer to avoid any lost or unidentified payments.

Student registration-Individuals will receive discounted registration if they are at least a half time undergraduate or graduate student. They must provide student identification at the time of registration.

Emeritus members may also register at the discounted rate. To qualify for Emeritus membership, members must be fully retired and must have been an OSA member for at least 10 years. The member's age plus the number of years of membership in OSA must equal 75 years or more.

Become a member for $10! Nonmembers take advantage of this offer to become a member of OSA. To join pay the nonmember fee plus $10 and complete the membership form, which is on the back of the registration form, and submit it along with your registration form. **This offer is for Nonmembers joining OSA for the first time only.** This offer is not valid for renewals or student membership. Nonmember students interested in joining OSA need only to complete the membership form and submit it along with your registration form.

The registration fee for the Biomedical Topical Meetings includes admission to the technical sessions, the conference reception, refreshment breaks throughout the meeting, and the *Technical Digest*.

	On or before March 11, 2002	After March 11, 2002
OSA Member	$425 US	$505 US
Nonmember	$505 US	$585 US
Full-time student Member/Emeritus	$120 US	$150 US
Full-time student Nonmember	$150 US	$180 US
Neuroscience One Day	$225 US	$250 US

Refund Policy for Registration

A $50 service charge will be assessed for processing refunds. A letter requesting the refund should state the preregistrant's name and the amount of payment. Requests for preregistration refunds that are received no later than seven working days prior to the first day of the meeting will be honored. **NO REQUESTS FOR REFUNDS WILL BE CONSIDERED AFTER MARCH 25, 2002.**

Student Audiovisual Assistants

Students are needed to work as audiovisual projectionists and badge checkers in the technical session rooms. Work benefits include a waived registration fee in exchange for working any combination of 14 hours (2 days) during technical sessions as well as compensation of $7/hour worked. Only full-time undergraduate or graduate students (no postdoctoral students) may apply for these positions. Assignments to work on specific technical sessions are on a first-come, first-served basis. To sign up, please contact OSA Meetings and Exhibits at fax 202-416-6100, e-mail avstudent@osa.org, or mail OSA Meetings and Exhibits Department, 2010 Massachusetts Avenue, NW, Washington, DC 20036-1023 and specify the name of the meeting.

About Miami Beach

In only 100 years, Greater Miami and the Beaches has become a dynamic international crossroads of commerce, culture, year-round sports and outdoor activities, entertainment, dining, shopping, transportation, tourism, and conventions.

This tropical cosmopolitan city boasts some of the world's most beautiful beaches and ecological wonders such as the Everglades, right next to one of the world's most vibrant urban centers.

Miami's most renowned landmark hotel, the Fontainebleau Hilton Resort & Tower, is situated in the midst of 20 lush tropical acres overlooking the Atlantic Ocean.

For more information on Miami and its surrounding area, visit these sites:

- http://miami.metroguide.net/
- http://www.cnet1.com/gomiami/main01.htm
- http://www.miamiandbeaches.com/

Hotel Accommodations

A block of sleeping rooms has been reserved for the convenience of meeting attendees at the Fontainebleau Hilton Resort. The meeting rates are $150 USD per night, single/double occupancy, plus applicable state sales and lodging tax in the Hospitality Category. A deposit equal to one night's room rate is required by the housing deadline of March 4, 2002 to guarantee your accommodations. Attendees canceling all or part of a reservation at least 48 hours prior to

arrival will be refunded their entire deposit (if any). Group rates are in effect for the dates of Friday, April 5–Friday, April 12, 2002.

Reservations may be made using the enclosed housing form, by calling the toll-free reservation number 800-445-8667 and requesting the Optical Society of America group rate, or by going to the Fontainebleau web site at **www.fontainebleau.hilton.com** and using our group code **OSA**. The Fontainebleau Hilton must receive reservations **no later than March 4, 2002**. After this date, the hotel will release the balance of the rooms.

Please send your housing form to:

Fontainebleau Hilton Resort
4441 Collins Avenue
Miami Beach, FL 33140
Fax: 305-673-5351

Transportation

Airline Travel
The Optical Society of America has selected United Airlines as the official airline for this meeting. United Airlines is pleased to offer round-trip transportation discounts to BIOMED 2002 attendees. United will offer scheduled service in the United States and Canada at either (1) 5% discount off the lowest applicable discount fare, including First Class, or (2) a 10% discount off midweek coach fares when purchased 7 days in advance. An additional 5-10% discount will apply when tickets are purchased at least 60 days in advance of your travel date. To make your reservations, please call 800-521-4041 and use reference **ID number 598BW.**

Rental Cars
Avis Rent-A-Car is pleased to offer low rates with unlimited mileage to participants attending BIOMED. Please refer to **ID#D004076** to receive any discounts. Rates are available from March 26-April 12, 2002. Reservations can be made by calling 1-800-331-1600 or online at www.avis.com.

Ground Transportation
The Fontainebleau Hilton Resort is located approximately 20 minutes from the Miami International Airport. Attendees may use Super Shuttle to travel from the airport to the hotel for $13 per person one way. Shuttles may be found outside of the baggage claim exit of the airport.

Safety Tips

Miami Beach, Florida is a safe and exciting city; however, the following tips should be followed whenever you are traveling to an unfamiliar city or country:

- Always remove your conference badge when leaving the meeting or hotel
- Place all valuables in the hotel safe deposit box
- Use every locking device on your door (the night bolt, dead bolt, etc.)
- Become familiar with all fire exits
- Do not automatically open your room door without verifying who is there
- Check to see that any sliding glass doors/windows and any connecting room doors are locked
- Do not leave your luggage unattended
- Never reveal the number of your hotel room
- Ask the front desk or concierge desk about neighborhoods or streets to avoid
- Remain alert at all times

Abstracts

■ Saturday
■ April 6, 2002

Room: French Rooms Foyer

4:00pm–8:00pm
Registration

■ Sunday
■ April 7, 2002

Room: French Rooms Foyer

7:00am–7:00am
Registration

Room: Brittany/Champagne

8:00am–10:00am
SuA ■ Joint Session on Optics in Neuroscience

Arjun G. Yodh, Univ. of Pennsylvania, USA, Presider

Presider

SuA1 8:00am Invited
Digital holographic microscopy applied to the study of topology and deformations of cells with sub-micron resolution: Example of neurons In culture, *C. Depeursinge, E. Cuche, P. Dahlgren, A. Marian, F. Montfort, T. Colomb, Swiss Federal Inst. of Tech., Swizterland; P. Marquet, P.J. Magistretti, Lausanne Univ., Switzerland.*
Digital Holographic Microscopy is a new imaging technique with high resolution and real time observation capabilities: 40 nanometers in thickness, and half of a micron in width have been achieved for living neurons in cultures.

SuA2 8:30am Invited
Imaging the complexity of neuron behavior with fluorescent ion indicators, *William Ross, New York Medical Ctr., USA.*
Imaging techniques have been developed that can reveal aspects of the spatial heterogeneity of the neuron's behavior. Many of these techniques take advantage of fluorescent molecules that have been designed to change their emission intensity when the concentration of different ions or small molecules in their environment changes. Sensors for Ca2+ and Na+ are popular and indicators for Cl- and cAMP have been developed. These indicators can be injected into individual living neurons in the brain or in a piece of the brain. They spread throughout the cell and their fluorescence can be detected with sensitive cameras.

SuA3 9:00am Invited
Bridging the gap between electrophysiology and circulation by laser-Doppler flowmetry, *Martin Lauritzen, Univ. of Copenhagen, Denmark.*
Laser-Doppler flowmetry (LDF) monitoring of brain blood flow has a time resolution that is comparable to electrophysiological measurements. This talk summarizes current knowledge about the relationship between neuronal spiking, synaptic activity and cerebral blood flow during activation.

SuA4 9:30am Invited
Using intrinsic signal optical imaging to visualize cortical plasticity, *Ron Frostig, Univ. of California-Irvine, USA.*
Abstract not available.

Room: Lemans/Bordeaux/Burgundy

10:00am–10:30am
Coffee Break

Room: Lemans/Bordeaux/Burgundy

10:00am–4:00pm
Exhibit Hours

Room: Brittany/Champagne

10:30am–12:30pm

SuB ■ Optical Tomography: Theory I

Amir Gandjbakhche, National Inst. of Health, USA, Presider

Presider

SuB1 10:30am Invited

Linking the radiative transfer equation and the diffusion approximation, *J.P. Kaipio, T. Vilhunen, M. Vauhkonen, V. Kolehmainen, Univ. of Kuipio, Finland.*
In this paper we discuss an approach for the forward problem in optical diffusion tomography. The radiative transfer equation is used as the light propagation model in the vicinity of the laser sources and the diffusion approximation is used elsewhere with a Dirichlet boundary source model approximating the solution of the radiative transfer equation.

SuB2 11:00am

Optical tomographic image reconstruction with the three-dimensional equation of radiative transfer, *Gassan S. Abdoulaev, Andreas H. Hielscher, Columbia Univ., USA.*
Implementation of a three-dimensional image reconstruction scheme that is based on the equation of radiative transfer is presented. The scheme, which uses the finite-element method and a gradient minimization algorithm, allows for simultaneous reconstruction of absorption and scattering coefficients.

SuB3 11:15am

Anisotropic effect in light scattering and some implications in optical tomography, *Simon Arridge, Univ. Col. London, UK; Erkki Somersalo, Helsinki Univ. of Tech., Finland.*
In this paper a possible model for anisotropic light scattering is proposed, and applied on the equations used to model light propagation in optical tomography. A simultaneous reconstruction of anisotropic parameters and the absorption coefficient is presented.

SuB4 11:30am

Non-linear correction factor for accurate reconstruction of non-localized absorptive abnormalities, *Victor Chernomordik, David W. Hattery, Amir Gandjbakhche, Natl. Inst. of Health and Natl. Inst. of Child Health and Development, USA; Israel Gannot, Tel-Aviv Univ., Isreal; Giovanni Zaccanti, Univ. degli Studi di Firenze and INFM, Italy.*
A random walk model is used to calculate the absorptive contrast, originating from abnormalities in a turbid medium. Good agreement with Monte-Carlo, experimental data substantiates its application to quantify optical parameters of the tissue abnormalities.

Room: Monaco

10:30am–12:45pm

SuC ■ Cerebral Vascular Physiology

Arno Villringer, HU Berlin, Germany, Presider

Presider

SuC1 10:30am Invited

Intra-operative intrinsic optical brain signals, *Arthur W. Toga, UCLA, USA.*
Abstract not available.

SuC2 11:00am

Speckle contrast imaging of cerebral blood flow reveals new insights into the mechanisms of migraine headache, *Andrew K. Dunn, Hayrunnisa Bolay, Michael Moskowitz, David A. Boas, Massachusetts General Hospital and Harvard Medical School, USA.*
Speckle contrast imaging was used to image blood flow changes in the cortex of rats in a model of migraine headache. Results provide a previously unknown link between brain activity and transmission of headache pain.

SuC3 11:15am

Comparing CBV and Hb saturation changes in rat somatosensory cortex measured with fMRI and DOT, *A.M. Siegel, Tufts Univ. and Massachusetts General Hospital, USA; J.P. Culver, J.J.A. Marota, J.B. Mandeville, D.A. Boas, Massachusetts General Hospital and Harvard Medical School, USA.*
The time courses of both CBV and oxygenation following electrical forepaw stimulation were measured using Diffuse Optical Tomography (DOT). Results matched those obtained with fMRI. Thus, DOT can accurately measure the temporal and spatial evolution of cerebral hemodynamic events.

SuC4 11:30am

Which hemodynamic contrast best localizes neuronal activity? A diffuse optical tomography study, *J.P. Culver, A. Siegel, M.A. Franceschini, J.J. Marota, J.B. Mandeville, D.A. Boas, Massachusetts General Hospital and Harvard Medical School, USA.*
Diffuse optical tomography images were obtained of hemoglobin concentrations during functional activation of the rat somatosensory cortex. For stimulus duration of 15 seconds, total hemoglobin images provided a more focal response than deoxy-hemoglobin images.

Room: Brittany/Champagne

SuB5 11:45am
Analytical reconstruction methods in optical tomography with sampling and truncation of data, *Vadim A. Markel, John C. Schotland, Washington Univ.-St. Louis, USA.*
We derive and numerically test an analytic inversion algorithm for diffusion tomography in the slab measurement geometry, which can be applied to sampled and truncated data.

SuB6 12:00pm
The Kirchhoff Approximation in diffuse optical tomography, *Jorge Ripoll, Vasilis Ntziachristos, Massachusetts General Hospital and Harvard Medical School, USA.*
Analytical expressions for Diffuse Optical Tomography are generally limited to simple geometries such as a diffusive slab, a sphere or a cylinder. Imaging of tissues however involves solutions for diffuse media with complex boundaries, in which case the use of numerical methods is directed. Herein we consider analytical solutions of the diffusion equation for complex boundaries based on the Kirchhoff approximation, as a time-efficient surrogate of numerical methods. We examine the performance of the approximation as a function of the shape and size of the outer boundary assuming a compressed breast geometry and demonstrate that the accuracy of the calculation is not reduced compared to numerical approaches.

SuB7 12:15pm
Prior information and noise in three-dimensional optical image reconstruction, *M. Xu, W. Cai, M. Lax, R.R. Alfano, City Univ. of New York, USA.*
Optical image reconstruction for biomedical imaging and diagnostics is an inverse problem which requires regularization to stabilize the inverse process. Two essential elements in image reconstruction is prior information and noise. We clarify their different roles in reconstruction by adopting a statistical interpretation of inversion which results in a generalized Tikhonov regularization formalism. Reconstruction for a slab from the generalized Tikhonov regularization is presented.

12:30pm–2:00pm
Lunch on Your Own

Room: Monaco

SuC5 11:45am
Towards three-dimensional optical tomographic brain imaging in small animals, *G.S. Abdoulaev, A.H. Hielscher, J.M. Lasker, Columbia Univ., USA; M. Stewart, SUNY Downstate Medical Ctr., USA; A.Y. Bluestone, Columbia Univ. and SUNY Downstate Medical Ctr., USA.*
We are currently developing a small animal brain imaging system that uses continuous back-reflected light intensities. To validate the diffuse optical tomographic reconstruction algorithm for small geometries, on the order of 1 cm3, we report on a numerical feasibility study. To test this concept and dovetail current work using an in-vivo rat model of hippocampal epilepsy we have simulated this physiological phenomenon and show the resulting optical tomographic reconstruction results.

SuC6 12:00pm
Effects of duration, hypoxia and hypercapnia on rat brain hemodynamics during forepaw stimulation, *T. Durduran, G. Yu, D. Furuya, R. Choe, J.P. Culver, C. Cheung, J.H. Greenberg, A.G. Yodh, Univ. of Pennsylvania, USA.*
We employ a hybrid diffuse optical tomography/diffuse correlation spectroscopy instrument to measure rat brain hemodynamics. The effect of stimulation duration and ventilation state (hypoxia, hypercapnia) on somatosensory cortex activation is quantified by measurements during forepaw stimulation.

SuC7 12:15pm Invited
The hemodynamic response to increased neural activity in brain: An investigation of the intrinsic signals using electrophysiology, spectroscopy and laser doppler flowmetry, *John Mayhew, Univ. of Sheffield, UK.*
The research describes the use of optical imaging spectroscopy, laser Doppler flowmetry and electrophysiology to investigate the intrinsic signal sources underlying the hemodynamic response to neural activation which give rise to the BOLD fMRI response.

12:45pm–2:00pm
Lunch on Your Own

Room: Lemans//Bordeaux/Burgundy

2:00pm–3:30pm

SuD ■ Poster Session I

SuD1

Measurement of time-resolved Wigner functions for coherent backscatter from a turbid medium, *Frank Reil, John E. Thomas, Duke Univ., USA.*

We observe the time-resolved Wigner function of enhanced backscatter from a random medium using a novel two-window technique. This technique enables us to directly verify the phase-conjugating properties of random medium.

SuD2

Numerical analysis of time-gated confocal microscopy through anisotropically scattering media, *Marcus Magnor, Stanford Univ., USA; Wolfgang Rudolph, Univ. of New Mexico, USA.*

An efficient and fast simulation technique is used to calculate the confocal imaging contrast through anisotropically scattering media when time-gating techniques are applied. Optimal time-gate width is found to depend on object reflection characteristics, and forward-scattering media enhance imaging contrast only for non-absorbing objects.

SuD3

Resonant holographic imaging, *Arnab Sinha, George Barbastathis, MIT, USA.*

The diffraction efficiency of volume holograms is enhanced x 10 or more by use of a resonant optical cavity on the reference beam side. The enhanced efficiency and increased depth selectivity allow better depth imaging.

SuD4

Early diagnostics of diabetes mellitus using noninvasive imaging by computer capillaroscopy, *Yuri I. Gurfinkel, Central Clinical Hospital, Russia; Konstantin V. Ovsyannickov, Alexander S. Ametov, Igor A. Strokov, Russian Medical Acad., Russia; Alexander V. Priezzhev, Lomonosov Moscow State Univ., Russia.*

The obtained results show good potentialities for the application of noninvasive imaging by capillaroscopy for the screening of the population to reveal the people either already suffering from DM or belonging to a risk group.

SuD5

Preliminary results of imaging and diagnosis of nail fungal infection with optical coherence tomography, *Daqing Piao, Doug Abreski, Quing Zhu, University of Connecticut, USA.*

Nail fungal infection can lead to significant disability and predisposing diabetic patients to limb loose. Up to date, there is no method of diagnosising nail unit fungus quickly, accurately and non-invasively. In this study, imaging and diagnosing the nail unit fungus with OCT has been investigated. Preliminary in vivo studies demonstrate that OCT has a great potential to resolve a small amount of fungi which is extremly valuable for early detection and diagnosis of fungal infections.

SuD6

The effect of confocal detection on optical coherence tomography analysed by Monte Carlo simulation, *Masaki Hojo, Eiji Okada, Keio Univ., Japan.*

Confocal optical coherence tomography is known to improve the image of deeper region. The light propagation in a two layered model is predicted by Monte Carlo simulation and the difference from the boundary caused by detection system is discussed.

SuD7

Ultrasound induced improvement in OCT resolution, *J.O. Schenk, M.E. Brezinski, Brigham and Women's Hospital and Harvard Medical School, USA.*

Optical coherence tomography (OCT) is a rapidly emerging technology for high-resolution biomedical imaging. With commercially available diode sources, axial resolutions for OCT are generally in the range of 10–20 μm. Investigators have used solid state lasers to increase the resolution to less than 10 μm, such as the Kerr lens, mode locked, chromium Forsterite laser. However, these lasers require considerable expertise to use and generally costs are over $100,000. Since increasing resolution results in improved imaging, which is particularly important in areas such as early cancer detection where the analysis of nuclei would be useful, other methods for improving resolution should be pursued.

SuD8

Non-scanning optical coherence tomography with an angular-dispersion imaging scheme, *Eriko Umetsu, Kin Pui Chan, Naohiro Tanno, JSTC Yamagata and Yamagata Univ., Japan.*

A non-scanning approach based on off-axis interferometry has been developed for real-time optical coherence tomography. We demonstrate that cross-sectional image can be detected by demodulating the interferogram with an angular-dispersion imaging method.

SuD9

Video-rate full-field optical coherence reflectometry by use of a pair of CCD cameras, *Masahiro Akiba, Kin Pui Chan, Naohiro Tanno, JSTC Yamagata and Yamagata Univ., Japan.*

We demonstrate that horizontal cross-sectional images can be obtained at video rate by operating a pair of CCD cameras as heterodyne detector arrays in optical low-coherence reflectometry. Application to three-dimensional microscopy is presented.

SuD10

Boundary detection system for cartilage thickness measurement on OCT images, *Jadwiga Rogowska, Clifford M. Bryant, Mark E. Brezinski, Brigham and Women's Hospital, USA.*

A new semi-automatic image processing method for detecting cartilage boundaries in OCT is described. The boundary detection system consists of adaptive filtering technique for speckle reduction, edge detection, and edge linking by graph searching.

SuD11
A new method to monitor osteoarthritic cartilage in animal models, *J.G. Fujimoto, MIT, USA; D.L. Stamper, King's Col., USA; S.D. Martin, N.A. Patel, S. Plummer, M.E. Brezinski, Brigham and Women's Hospital and Harvard Medical School, USA.*
High-resolution polarization sensitive in-vitro imaging was performed of rat and rabbit normal and osteoarthritic articular knee cartilage. Images of normal and osteoarthritic cartilage were compared to determine if polarization sensitivity was lost in diseased cartilage.

SuD12
NIR imaging reconstruction with ultrasound guidance: Finite element method, *Minming Huang, Tuqiang Xie, Nanguang Chen, Quing Zhu, Univ. of Connecticut, USA.*
In this paper we report simulation results on combined imaging by simultaneously deploying an ultrasound transducer and NIR source detector fibers on a ring probe. Compared with the reflection geometry, the advantage of transmission geometry for NIR imaging is the reduced target dynamic range in depth. We show in the paper that with the aid of a priori target geometry information provided by co-registered ultrasound, NIR reconstruction of absorption coefficient can be improved from 30% to 85%.

SuD13
A diffusion equation-based reconstruction algorithm for optical tomography using a propagation-backpropagation strategy, *K. Veera Krishna Meera, R.M. Vasu, Indian Inst. of Science, India.*
We demonstrate a fast and reasonably accurate reconstruction algorithm for optical tomography based on the propagation-backpropagation strategy. The resulting algorithm resembles the ART of X-ray tomography and is able to reconstruct accurately the position and extent of inhomogeneity hidden in a highly scattering background.

SuD14
In vivo studies of low absorbing and scattering heterogeneity in breast imaging based on higher-order diffusion equations, *Yong Xu, Xuejun Gu, Huabei Jiang, Clemson Univ., USA.*
We report on both absorption and scattering images of in vivo human breast with a cyst using our third-order diffusion equations based reconstruction algorithm. To validate these in vivo images a series of low absorbing and scattering heterogeneity phantom experiments are conducted, in which we use one target consisting of distill water or mixer of water and very diluted Intralipid (0.05% and 0.1%) to mimic cyst regions. Scattering and absorption images of the female volunteer with a 2-cm cyst show a marked localized decrease in both scattering and absorption coefficients in the lesion.

SuD15
The diffusion approximation model for turbid media with a spatially varying refractive index: Impact of skin on optical breast imaging, *Qi Lu, Yong Xu, Huabei Jiang, Clemson Univ., USA.*
We present a study based on the diffusion approximation model which includes the spatial variation of the refractive index of turbid media. In optical imaging, the refractive index has been assumed as a constant to date. But in fact, the refractive index of the skin is much lager than that of the underlying tissue. We simulated with the skin thickness varying from 1 to 3mm and the refractive index of skin from 1.40 to 1.55. Our simulations show that both the refractive index and thickness of skin have significant impact on the reconstructed images. We are currently conducting phantom experiments to confirm the findings from simulations.

SuD16
Evaluation of optical properties of highly scattering media using moments of distributions of times of flight, *Adam Liebert, Heidrun Wabnitz, Dirk Grosenick, Michael Möller, Rainer Macdonald, Physikalisch-Technische Bundesanstalt Berlin, Germany.*
We propose a method to estimate optical properties of infinite and semi-infinite turbid media from first moment and variance of distributions of times of flight of photons. Limitations of the method are discussed.

SuD17
Novel approach to quantitative oximetry of breast lesions using two ad hoc near-infrared wavelengths, *Erica L. Heffer, Sergio Fantini, Tufts Univ., USA.*
We present a robust and non-invasive optical method to accurately measure the oxygen saturation of hemoglobin in breast lesions, introducing the concept that the optimal wavelength pair is dependent on the lesion oxygenation itself.

SuD18
Time-resolved of an absorptive inclusion hidden inside a turbid slab by different reconstruction techniques, *R. Esposito, I. Delfino, M. Lepore, P.L. Indovina, Complesso Universitario Montesantangelo, Italy.*
Results on a time-resolved imaging experiment about an absorbing object hidden inside a turbid slab have been reported. Images have been constructed by different algorithms and compared in terms of image quality parameters.

SuD19
Exploiting prior 2 dimensional or 3 dimensional spatial information for diffuse optical imaging, *Ang Li, Thomas J. Brukilacchio, Tufts Univ., USA; Quan Zhang, David A. Boas, Massachusetts General Hospital and Harvard Medical School, USA.*
We include x-ray images as priory information into the DOT image reconstruction.. The way of imposing the x-ray constraint is a variant of Tikhonov regularization in which spatial variance is allowed in the value of regularization parameter. The information of the spatial variance is based on the x-ray 3-D image. Simulations show the images’ resolution is improved with x-ray soft constraint.

SuD20
Theoretical and numerical assessment of photon migration in blood layers in regard to red cell aggregation measurements by light backscattering technique, *Alexander V. Priezzhev, Vladimir V. Lopatin, Ol'ga E. Fedorova, M.Y. Kirillin, Lomonosov Moscow State Univ., Russia.*
New method is proposed to calculate light scattering angular distributions resulting from photon migration in multiply scattering layers of concentrated suspensions of large particles of different sizes, shapes, and orientations, modeling the aggregating red blood cells. Results are in good agreement with Monte-Carlo simulations of the similar process. Both approaches are used to model the time course of backscattered light intensity, related to the experimentally measured spontaneous aggregation kinetics.

SuD21
Analysis of light propagation in three-dimensional neonatal head model by finite difference method, *Yuichi Fukui, Yusaku Ajichi, Kenji Tanaka, Eiji Okada, Keio Univ., Japan; Tsuyoshi Yamamoto, Hitachi, Ltd., Japan.*
The light propagation in the three-dimensional neonatal head model is calculated by the finite-difference method. The model consists of rectangular parallelepiped elements to approximate the curved boundary

SuD22
Ultrashort laser radiation transfer in heterogeneous biological tissues, *Zhixiong Guo, State Univ. of New Jersey, USA.*
Time-dependent short-pulsed laser radiation transport in heterogeneous biological tissues is simulated using discrete ordinates method (DOM) in multidimensional geometries. The time-dependent reflectance, transmittance and radiation field are obtained.

SuD23
Hybrid Monte Carlo-diffusion method for light propagation in three dimensional models with low-scattering layer, *Toshiyuki Hayashi, Yoshihiko Kashio, Eiji Okada, Keio Univ., Japan.*
The new approach is proposed to calculate the light propagation in the head model. The light propagation in the highly scattering medium is calculated by FEM and that in CSF is predicted by Monte Carlo.

SuD24
Influence of the depth of perfusion on Doppler spectrum analysed by Monte Carlo simulation, *Yohei Watanabe, Eiji Okada, Keio Univ., Japan.*
The Doppler power spectrum obtained from a tissue model with blood flow is predicted by Monte Carlo simulation. The depth of the blood flow affects the slope of the Doppler power spectrum. The results suggest that this phenomenon is caused by the effect of the multiple Doppler scattering by blood cells.

SuD25
Can absorption and scattering images of heterogeneous scattering media be simultaneously reconstructed using DC data, *Yong Xu, Xuejun Gu, Taufiquar Khan, Huabei Jiang, Clemson Univ., USA.*
In this report, we present a carefully designed phantom experimental study aimed to provide solid evidence that both absorption and scattering images of heterogeneous scattering media can be reconstructed independently from dc data. We also study the important absorption-scattering crosstalk issue. Finally, we discuss our results in light of recent theoretical findings on nonuniqueness for dc image reconstruction.

SuD26
Optical diffusion tomography signal-to-noise ratio expressions, *Charles L. Matson, Air Force Res. Lab., USA; Hanli Liu, Univ. of Texas-Arlington, USA.*
Fourier-domain signal-to-noise ratio expressions are presented for frequency-domain and continuous-wave optical diffusion tomography systems. The signal-to-noise ratio expressions are compared for these two types of systems and validated with laboratory data.

SuD27
A method to determine the optimal number of measurements for three-dimensional optical tomography for a physiologically realistic geometry, *Amit Joshi, Eva M. Sevick-Muraca, Texas A&M Univ., USA; Margaret J. Eppstein, Univ.of Vermont, USA.*
AEKF (approximate extended Kalman filter) based inversion algorithm is employed to develop a novel optimization criterion for determining optimal locations and the number of boundary measurements for three-dimensional optical image reconstruction. Hemispherical geometry, which is pertinent to breast cancer detection is used.

SuD28
Optical tomographic image reconstruction with quasi-Newton methods, *A.D. Klose, A.H. Hielscher, Columbia Univ., USA.*
Most of the currently existing image reconstruction algorithms for optical tomography (OT) can be formulated as an optimization problem. To find a minimum of an appropriately defined objective function, researchers in OT mostly rely on conjugate-gradient (CG) methods. In this work we have tested the performance of quasi-Newton methods, which prove to be superior to CG methods, both in terms of conversion time and image quality.

SuD29
Improvement of detection sensitivity of absorbing heterogeneity in turbid media with scanning null-line phased array system, *Yu Chen, Xavier Intes, Britton Chance, Univ. of Pennsylvania, USA; Qingming Luo, Huazhong Univ. of Science and Tech., China; Chenpeng Mu, Univ. of Pennsylvania, USA and Huazhong Univ. of Science and Tech., China.*
A scanning null-linephased array system is introduced and comparisonsof the detection sensitivity are made between scanning null-line, fixed null-line phased array and single source system.

SuD30
Monte Carlo analysis of influence of phase function on time-resolved reflectance spectroscopy, *Kenji Tanaka, Eiji Okada, Keio Univ., Japan; Ryuichiro Araki, Saitama Medical School, Japan; Yukari Tanikawa, AIST, Japan; Yukio Yamada, Univ. of Electro-communications, Japan.*
The time-resolved reflectance measured with small source-detector spacing is well approximated by the estimated scattering component predicted by Monte Carlo simulation under assumption of anisotropic scattering.

SuD31
Simulation of three compartment model of beacon delivery, *Ping Huang, Univ. of Pennsylvania, USA and Northern Jiaotong Univ., China; Britton Chance, Univ. of Pennsylvania, USA.*
The goal of our study is to develop a time-dependent three-compartment model of beacon delivery. To simulate our model using JSIM, we employed the Step function as input flow function.

SuD32
Bolus mapping of the NIR dye ICG in stroke patients with a multichannel topography, *M. Kohl-Bareis, Univ. of Applied Sciences, Germany; C. Buckow, H. Zank, H. Obrig, J. Steinbrink, A. Villringer, Humboldt Univ., Germany.*
Based on differences in the transit time of the NIR dye ICG images related to cerebral blood perfusion were measured with a multi channel topographic system. It is shown that there is a delay in bolus arrival time in areas found as necrotic in CT imaging.

SuD33
Noninvasive determination of optical properties of adult brain with frequency-domain near-infrared spectroscopy, *Jee H. Choi, Martin Wolf, Larisa P. Safanova, Antonios Michalos, Enrico Gratton, Univ. of Illinois at Urbana-Champaign, USA.*
Absolute optical values of layered structure of adult human forehead are measured with long-range multi-distance frequency-domain near-infrared spectroscopy. We found that tissue oxygenation is very narrowly distributed (STD ~3%) within the subject group whereas hemoglobin concentrations and optical parameters have relatively broader distribution.

SuD34
Reduced cerebral hemodynamic response in sleep disorders: A NIRS frequency-domain study, *A. Michalos, L.P. Safonova, U. Wolf, M. Wolf, Jee H. Choi, R. Gupta, C. Polzonetti, W.W. Mantulin, E. Gratton, Univ. of Illinois-Urbana-Champaign, USA; D.M. Hueber, B. Barbieri, ISS, Inc., USA.*
We applied NIRS to investigate changes in cerebral oxygenation and hemodynamics in sleep-disordered breathing; namely, snoring and obstructive sleep apnea. A detected reduced brain hemodynamic response to hypoxia may be a predictor of cerebrovascular morbidity.

SuD35
Age correlated changes in cerebral hemodynamics assessed by near-infrared spectroscopy, *L.P. Safonova, A. Michalos, U. Wolf, M. Wolf, J.H. Choi, R. Gupta, C. Polzonetti, W.W. Mantulin, E. Gratton, Univ. of Illinois-Urbana-Champaign, USA; D.M. Hueber, B. Barbieri,ISS, Inc., USA.*
Using near-infrared frequency-domain spectroscopy we observed cerebral hemodynamic changes in normal subjects during breath holding, which correlated with age. Snoring affected changes did not allow us to observe the age effect in a group of snorers.

SuD36
In vivo functional microscopic imaging based on multi-photon excitation: Principles and methods, *Shaoqun Zeng, Qingming Luo, Wei Zhang, Qian Liu, Chengjun Li, Qiang Lu, Ministry of Education and Huazhong Univ. of Science and Tech., China.*
Instrumentation was processed on the two-photon excitation microscope to access phosphorescence life-time measurements, deep image restoration, and quick longitudinal scanning, which allows in vivo measurements of the early response of the cortex with high resolution.

Room: Lemans//Bordeaux/Burgundy

SuD37
Analysis of multi-spectral reflectance of exposed brain tissue, *Kentaro Yokoyama, Kazushi Honjo, Motoshi Watanabe, Eiji Okada, Keio Univ., Japan; Atsushi Maki, Hitachi Ltd., Japan; Yukio Yamada, Univ. of Electro-communications, Japan; Hiroshi Iseki, Tokyo Women's Medical Univ., Japan.*
Multi-spectral reflectance from exposed brain tissue model are analysed by principal component analysis, and the results are applied to multiple regression analysis. These results suggest the possibility to measure oxgen saturation and blood volume.

SuD38
Monte Carlo analysis of light propagation in the exposed brain in the wavelength range 400-950 nm, *Motoshi Watanabe, Kazushi Honjo, Kentaro Yokoyama, Eiji Okada, Keio Univ., Japan.*
Since light propagation in tissue strongly depends on wavelength, the dependence of image on wavelength should be discussed. The light propagation in tissue in the wavelength range 400-950 nm is predicted by Monte Carlo simulation.

SuD39
Optimization of optical fiber position in nir imaging of the rat cranium, *Heng Xu, Hamid Dehghani, Brian W. Pogue, Keith D. Paulsen, Dartmouth Col., USA; Jeff F. Dunn, Dartmouth Medical School, USA.*
Simulations of near-infrared light propagation based upon MRI images of a rat cranium are used to determine the optimum arrangement for maximum sensitivity in the brain. Singular value decomposition analysis is used to provide a quantitative measure for amount of information obtained in different fiber arrangements.

SuD40
Cerebral hemodynamics during cortical spreading depression at different states of brain oxygenation and ventilation, *T. Durduran, G. Yu, J.P. Culver, C. Cheung, D. Furuya, J.H. Greenberg, A. G. Yodh, Univ. of Pennsylvania, USA.*
We measure cerebral blood flow, blood oxygen saturation and volume during KCl induced cortical spreading depression in rat brain. Changes in peak duration, peak-to-peak delay and spreading speed during normoxia, hypoxia, hypercapnia and hypocapnia are quantified.

SuD41
Monitoring cerebral hemodynamics using near-infrared spectroscopy during electro-convulsive therapy, *S. Nadgir, S. Fantini, M.A. Franceschini, Tufts Univ., USA; P.F. Renshaw, M. Henry, McLean Hospital, USA.*
Near-Infrared Spectroscopy (NIRS) is an effective technique for monitoring cerebral hemodynamics and oxygenation. We report a study of the cerebral hemoglobin concentration changes during electro- convulsive therapy (ECT) in human subjects.

SuD42
Diffuse optical tomography of hemoglobin concentrations, and cerebral blood flow in rat brain during focal ischemia, *Joseph P. Culver, Harvard Medical School, USA; Daisuke Furuya, Joel H. Greenberg, Turgut Durduran, Cecil Cheung, Arjun G. Yodh, Univ. of Pennsylvania, USA.*
We present novel continuous imaging of focal ischemia using diffuse optical measurements of hemoglobin concentration, oxygenation and flow during focal ischemia in rat brain through the intact skull.

Room: Lemans/Bordeaux/Burgundy

3:30pm–4:00pm
Coffee Break

Room: Brittany/Champagne

4:00pm–5:30pm

SuE ■ Optical Tomography: Instrumentation

Randall L Barbour, SUNY, USA, Presider

Presider

SuE1 4:00pm

Near-infrared spectroscopy and MRI co-registration of tumor tissue physiology, *Sean Merritt, Frederic Bevilacqua, Anthony J. Durkin, David J. Cuccia, Ryan Lanning, Bruce J. Tromberg, Gultekin Gulsen, Hon Yu, Jun Wang, Orhan Nalcioglu, Univ. of California-Irvine, USA.*

We studied the physiological changes in animal model tumors by co-registration of near-infrared spectroscopy and MRI. T2 weighted and Gd-DTPA enhanced MRI images correlate with changes observed in Hb, HbO2 and water concentrations measured by near-infrared spectroscopy.

SuE2 4:15pm

Instrumentation for imaging of breast lesions based on co-registered diffuse optical and X-ray tomography, *Thomas J. Brukilacchio, Ang Li, Tufts Univ., USA; Quan Zhang, Jonathan Stott, Tao Wu, Richard H. Moore, Daniel B. Kopans, Massachusetts General Hospital and Harvard Medical School, USA; David A. Boas, Tufts Univ., Massachusetts General Hospital, and Harvard Medical School, USA.*

The design and characterization of a multi-modality system is presented for imaging of breast lesions based on co-registered diffuse optical and X-Ray tomography. Inherent limitations of X-Ray are overcome by combination of two imaging modalities.

SuE3 4:30pm

A real-time system for dynamic optical tomography, *Christoph H. Schmitz, Harry L. Graber, Randall L. Barbour, SUNY Downstate Medical Ctr., USA; Joseph M. Lasker, Andreas H. Hielscher, Columbia Univ., USA; Yaling Pei, NIRx Medical Tech. Corp., USA.*

Presented are the operating characteristics of an integrated CW-near infrared tomographic imaging system capable of fast data collection and producing 2D/3D images of optical contrast features that exhibit dynamic behavior in tissue and other highly scattering media in real time. Results of preliminary in vivo studies on healthy and cancerous breast tissue are shown.

SuE4 4:45pm

Frequency domain diffuse optical multiplexing system for rapid hemodynamics, *Guoqiang Yu, Turgut Durduran, Daisuke Furuya, Regine Choe, Joel H. Greenberg, Arjun G. Yodh, Univ. of Pennsylvania, USA.*

A novel instrument, containing 5 wavelengths, 15 sources and 8 detectors is developed for spatially resolved near infrared spectroscopy in the frequency domain. By combining Frequency-Division Multiplexing and Time-Division Multiplexing techniques, one frame of measurement can be acquired in less than 1 second.

Room: Monaco

4:00pm–5:45pm

SuF ■ Direct Optical Measurements of Neuronal Signals

Matthias Kohl-Bareis, RheinAhrCampus, Germany, Presider

Presider

SuF1 4:00pm Invited

Optical monitoring of neural activity using voltage-sensitive dyes, *Lawrence Cohen, Maja Djurisic, Michal Zochowski, Matt Wachowiak, Chun Falk, Dejan Zecevic, Yale Univ., USA.*

Two examples of the use of voltage sensitive dyes in Neurobiology will be presented. In the first, a single neuron is stained by intracellular injection and measurements of membrane potential in the cell body and in the dendritic tree are used to study the propagation of action potentials and synaptic potentials in this complex structure. In the second example, the olfactory bulb of a turtle is stained by superfusing a concentrated solution of the dye over the dorsal surface of the bulb. In this case all of the neurons, processes, and glia are stained and single neuron resolution cannot be obtained. The measurements are population signals. The turtle bulb responds to a presentation of odorant with three oscillations that differ in their latency, duration, frequency, and location.

SuF2 4:30pm Invited

Optical imaging of fast, dynamic neurophysiological function, *David Rector, Kathleen Carter, Xincheng Yao, John George, Los Alamos Natl. Lab., USA.*

Fast evoked responses were imaged from rat dorsal medulla and whisker barrel cortex. To investigate the biophysical mechanisms involved, fast optical responses associated with isolated crustacean nerve stimulation were recorded using birefringence and scattered light. Such studies allow optimization of non-invasive imaging techniques being developed for use in humans.

Room: Brittany/Champagne

SuE5 5:00pm
Optical tomography of the breast using a 32-channel time-resolved imager, *J.C. Hebden, T. Bland, E.M.C. Hillman, A. Gibson, N. Everdell, D.T. Delpy, S.R. Arridge, M. Douek, Univ. Col. London, UK.*
Studies on volunteers are being performed to assess three-dimensional optical tomography as a means of detecting and specifying breast disease. The dual-wavelength instrument is employed to generate images of the tissue optical properties.

SuE6 5:15pm
Dynamic hemoglobin concentration imaging using a simultaneous two wavelength near-infrared diffuse optical tomography system, *Shudong Jiang, Brian W. Pogue, Keith D. Paulsen, Dartmouth Col., USA; Troy O. McBride, Vassar Col., USA.*
A simultaneous two wavelength near-infrared diffuse optical tomography system was demonstrated to image dynamic hemoglobin concentration and oxygen saturation in the forearm in response to different cuff pressures.

5:30pm–7:00pm
Dinner on Your Own

Room: Monaco

SuF3 5:00pm
Assessment of functional disorders in retina using transient changes in birefringence, *Taner Akkin, H. Grady Rylander III, Thomas E. Milner, Univ. of Texas-Austin, USA.*
In neural diseases such as glaucoma, nerve fibers can lose their functionality before cell death occurs. Measurement of transient changes of nerve birefringence as indicator of functionality may detect of diseases at an early stage.

SuF4 5:15pm
Functional fast neuronal signals in the visual and motor cortex detected by frequency-domain near-infrared spectroscopy, *Martin Wolf, Ursula Wolf, Jee H. Choi, Larisa P. Safonova, Rajarsi Gupta, Vlad Toronov, Antonios Michalos, L. Adelina Paunescu, Enrico Gratton, Univ. of Illinois-Urbana-Champaign, USA.*
With a low-noise frequency-domain near-infrared-spectroscopy instrument and highly effective filtering and extraction algorithms we detected functional fast signals, which are related to brain activity in the visual and motor cortex.

SuF5 5:30pm
Looking for the fast signal: Neuronal and hemodynamic evoked responses of the sensory-motor cortex, *M.A. Franceschini, Harvard Medical School and Tufts Univ., USA; J. Thompson, J.P. Culver, G. Strangman, D.A. Boas, Massachusetts General Hospital and Harvard Medical School, USA.*
In this paper we investigate the potential of near-infrared spectroscopy (NIRS) to monitor both the direct effects of neural activation (the so-called fast signal) and the consequent changes in local cerebral hemodynamics. To this end we mapped contra- and ipsi-lateral motor and sensorimotor cortex during hand tapping, hand tactile, and electrical median nerve stimulation.

5:30pm–7:00pm
Dinner on Your Own

Room: Brittany/Champagne

7:00pm–8:30pm

SuG ■ Confocal & Interference Microscopy

Lev T Perelman, Harvard Medical School, USA, Presider

Presider

SuG1 7:00pm Invited

New imaging technologies for endoscopic applications, *Hitoshi Mizuno, Akihiro Horii, Hiroki Hibino, Mamoru Kaneko, Kazuhiro Gono, Hirokazu Nishimura, Tetsuo Nonami, Olympus Optical Co.,Ltd., Japan.*

Magnifying endoscope, narrow band imaging, image analysis technique, endoscopic optical coherence tomography and Endomicroscope are introduced to observe the surface and inner structure of mucosa. These new imaging technologies are coordinated to provide more accurate diagnosis.

SuG2 7:30pm

A Novel GRISM-Based Probe for Spectrally Encoded Confocal Microscopy, *Costas Pitris, Brett Bouma, Milen Shiskov, Gary Tearney, Massachusetts General Hospital and Harvard Medical School, USA.*

This abstract demonstrates a novel spectrally encoded confocal microscopy (SECM) probe design, based on a double-prism-GRISM, which can be scaled without significant modification to < 5 mm in diameter to allow integration with medical endoscopes.

SuG3 7:45pm

High speed 3-D imaging using low coherence photorefractive holographic microscopy, *Y. Gu, C. Dunsby, Z. Ansari, M. Tziraki, P.M.W. French, Imperial Col. of Science, Tech., and Medicine, UK; D.D. Nolte, W. Headley, M.R. Melloch, Purdue Univ., USA.*

Wide-field low coherence photorefractive holography has the potential to acquire depth-resolved images at up to 1000 frames/second, including through scattering media. We have applied it to microscopy using a diverse range of light sources.

Room: Monaco

7:00pm–8:30pm

SuH ■ Tissue Physiology

Bruce J. Tromberg, Univ. of California-Irvine, USA, Presider

Presider

SuH1 7:00pm

Optical pharmacokinetics to assess the permeability of angiogenic neovasculature, *Irving J. Bigio, Boston Univ., USA; Judith R. Mourant, Los Alamos Natl. Lab., USA; Gerrit Los, Robert F. Mattrey, Univ. of California-San Diego, USA.*

The method of Optical Pharmacokinetics is used for noninvasive measurement of drug concentrations in tissue. A rapid sequence of such measurements, following administration of a short bolus of appropriate optical contrast agent, can be used to assess the permeability of neovasculature, hence angiogenesis.

SuH2 7:15pm

Investigation of tumor oxygen consumption and tumor vascular oxygen dynamics in response to pharmacological interventions by NIRS, *Jae G. Kim, Yulin Song, Hanli Liu, Univ. of Texas-Arlington, USA; Anca Constintanescu, Ralph P. Mason, Univ. of Texas Southwestern Medical Center at Dallas, USA.*

Estimation of tumor oxygen consumption and the effects of pharmacological interventions using hydralazine and nicotinamide to mammary adenocarcinomas 13762NF tumors grown on Fisher 344 rats are measured by near-infrared spectroscopy

SuH3 7:30pm

In-vivo quantification of optical contrast agents using a combined frequency-domain and steady state technique, *David J. Cuccia, Frederic Bevilacqua, Anthony J. Durkin, Sean Merritt, Bruce J. Tromberg, Gultekin Gulsen, Hon Yu, Jun Wang, Orhan Nalcioglu, Univ. of California-Irvine, USA.*

We measure the in-vivo time-dilution curves of contrast agents in a rat tumor model using broadband near-infrared spectroscopy and Gadolinium enhanced MRI. Results indicate differences in kinetics that may be useful for tracking changes in vasculature as a function of tumor status.

SuH4 7:45pm

In vivo spectroscopy of the calcaneous: A first step towards optical diagnosis of osteoporosis?, *Rinaldo Cubeddu, Antonio Pifferi, Paola Taroni, Alessandro Torricelli, Politecnico di Milano, Italy.*

Optical characterization of the human calcaneous was obtained in vivo from 600 to 1000 nm on 3 volunteers. The possibility to diagnose osteoporosis on the basis of the decrease of bone mineral content was investigated.

Room: Brittany/Champagne

SuG4 8:00pm
Optical coherence microscopy using a handheld probe and novel phase modulator, *P. Hsiung, A.D. Aguirre, T.H. Ko, I. Hartl, J.G. Fujimoto, MIT, USA.*
An optical coherence microscope is demonstrated using a hand-held probe and a reflective grating delay line for broadband phase modulation. Real time, cellular imaging with 3 um transverse resolution is achieved.

SuG5 8:15pm
High resolution thermal light oct for biological imagery, *A. Dubois, L. Vabre, A.C. Boccara, ESPCI, France.*
We have developed an interference microscope using a tungsten halogen lamp associated with a parallel detection technique to produce en-face (XY) tomographic images with ~1µm*1µm (longitudinal*transverse) resolution. The capabilities of our system are demonstrated by imaging inside various biological tissues

Room: Brittany/Champagne

8:30pm–9:30pm
Special Symposium: Advances in Neuroscience

Room: Monaco

SuH5 8:00pm
Correlation of 19F MRS of PFOB and NIR spectroscopy in evaluating the vascular density of breast tumors, *Yueqing Gu, Yulin Song, Jae G. Kim, Hanli Liu, Univ. of Texas-Arlington and Univ. of Texas Southwestern Medical Ctr., USA; Ralph Mason, Univ. of Texas Southwestern Medical Ctr., USA.*
The possibility of measuring tumor vascular volume in mammary adenocarcinomas 13762NF by both ^{19}F MRS of PFOB and NIRS were exploited. The dynamic changes in tumor vascular volume induced by vasoactive agents carbogen were investigated. The vascular densities of tumors were obtained by the ratio of tumor blood volume over the tumor's physical volume. And the relationship between the vascular density and the tumor size were studied.

SuH6 8:15pm
Low-noise, fast muscle functional imaging using LED continuous-wave (CW) imager, *Yuanqing Lin, Gwen Lech, Shoko Nioka, Xavier Intes, Britton Chance, Univ. of Pennsylvania, USA.*
This paper is focuses on optimizing the signal to noise ratio (SNR) of a near-infrared (NIR) continuous wave (CW) imager and its application to in vivo muscle metabolism

Room: Brittany/Champagne

8:30pm–9:30pm
Special Symposium: Advances in Neuroscience

■ Monday
■ April 8, 2002

Room: French Rooms Foyer

7:00am–7:00pm
Registration

Room: Brittany/Champagne

8:00am–10:00am
MA ■ Joint Session on New Techniques in Microscopic Imaging
Joseph A. Izatt, Duke Univ., USA, Presider Presider

MA1 8:00am Invited
Fluctuation fluorescence correlation microscopy in living cells, *Enrico Gratton, Univ. of Illinois-Urbana-Champaign, USA.*
Abstract not available.

MA2 8:30am Invited
Spectral encoding for endoscopic confocal microscopy and miniature endoscopy, *Guillermo J. Tearney, Milen Shishkov, Costas Pitris, Brett E. Bouma, Massachusetts General Hospital, USA.*
Encoding transverse spatial location by wavelength allows acquisition of high-resolution images via a single optical fiber. Research conducted in our laboratory demonstrates that spectral encoding may be useful for endoscopic confocal microscopy and miniature endoscopy.

MA3 9:00am
Structure and organization of cellular components measured in neoplastic tissues using angular low coherence interferometry, *Adam Wax, Changhuei Yang, Markus Müller, Irene Georgakoudi, Charles W. Boone, Ramachandra R. Dasari, Michael S. Feld, MIT, USA.*
We use angular low coherence interferometry (a/LCI) to measure the size of cell nuclei and organization of smaller cell components for sub-surface layers in living tissues, demonstrating its applicability for detecting early stages of neoplasia.

MA4 9:15am
Magnetically-inducible optical contrast agents for optical coherence tomography, *Farah J-J. Toublan, Kenneth S. Suslick, J. Josh Reynolds, Sarah H. Hartleben, Shoeb Sitafalwalla, Stephen A. Boppart, Univ of Illinois-Urbana-Champaign, USA.*
We present the development and use of sonochemically-generated microsphere contrast agents containing a suspension of iron-oxide particles. These microspheres represent a new class of magnetically-inducible optical contrast agents for diagnostic imaging techniques such as optical coherence tomography.

MA5 9:30am Invited
Confocal video imaging of human skin in vivo, *Gerald W. Lucassen, Sieglinde Neerken, Rob F.M. Hendriks, Philips Res. Lab., The Netherlands; Peter J. Caspers, Gerwin J. Puppels, Univ. Hospital Rotterdam, The Netherlands.*
We use confocal video imaging to obtain 3D images of human skin for e.g. skin layer thickness determination. Combination with fluorescence imaging and Raman spectroscopy gives new opportunities to characterise the human skin in vivo.

Room: Lemans/Bordeaux/Burgundy

10:00am–10:30am
Coffee Break

Room: Lemans/Bordeaux/Burgundy

10:00am–4:00pm
Exhibit Hours

Room: Brittany/Champagne

10:30am–12:30pm

MB ■ OCT-New Techniques

Brett E. Bouma, Massachusetts General Hospital, USA, Presider

Presider

MB1 10:30am

Phase resolved digital signal processing in optical coherence tomography, *Johannes F. de Boer, Boris Hyle Park, Massachusetts General Hospital, USA; Renu Tripathi, MIT, USA; Nader Nassif, Univ. of California-Irvine, USA.*

We present phase resolved digital signal processing techniques for Optical Coherence Tomography to correct for the non Gaussian shape of source spectra and for Group Delay Dispersion (GDD).

MB2 10:45am

Burn depth determination by high-speed fiber-based polarization sensitive optical coherence tomography at 1.3 micrometers, *B. Hyle Park, Chris Saxer, Shyam M. Srinivas, J. Stuart Nelson, Johannes de Boer, Massachusetts General Hospital and Univ. of California-Irvine, USA.*

We present a non-invasive method of assessing burn depth in vivo with high speed fiber based OCT.

MB3 11:00am

Mapping the depolarization properties of biotissues for increasing specificity of the OCT, *R. Kuranov, V. Gelikonov, A. Shakhov, A. Terentyeva, I. Turchin, V. Kamensky, Inst. of Applied Physics, Russia.*

To increase the specificity of the optical coherence tomography (OCT) the map of depolarizing properties of the biological tissues were acquired by means of crosspolarization OCT. The comparisons between tomogramms obtaining in orthogonal polarizations were performed.

MB4 11:15am

Multi-channel Mueller-matrix optical coherence tomography, *Shuliang Jiao, Lihong V. Wang, Texas A&M Univ., USA.*

A multiple-channel OCT system was built to measure the Mueller matrix of scattering biological tissue with a single scan as fast as conventional OCT. Birefringence, axis orientation, and diattenuation can be extracted.

MB5 11:30am

Phase-referenced fiber-based interferometer and processing scheme for use in color Doppler optical coherence tomography, *Cameron J. Pedersen, Volker Westphal, Andrew M. Rollins, Case Western Reserve Univ., USA; Joseph A. Izatt, Duke Univ., USA.*

We present a demonstration of a fiber-based low-coherence interferometer which cancels phase noise by incorporating a continuous wave light source as a phase-reference. Algorithms for Doppler velocity processing amenable to real time implementation are presented.

Room: Monaco

10:30am–12:30pm

MC ■ Near Infrared Spectroscopy and Imaging

Ron D. Frostig, Univ. of California-Irvine, USA, Presider

Presider

MC1 10:30am Invited

Optical topography: Practical problems and novel applications, *Hideaki Koizumi, Atsushi Maki, Tsuyoshi Yamamoto, Hitachi Ltd., Japan.*

We discuss optical topography (a form of NIRS imaging), covering the practical problems of spatio-temporal resolution and induced temperature increases, along with some novel applications

MC2 11:00am

Concurrent cerebral near-infrared spectroscopy and electroencephalography during all-night sleep, *Payal Aggarwal, Kathleen Chen, Maria Angela Franceschini, Sergio Fantini, Tufts Univ., USA; Bruce L. Ehrenberg, New England Medical Ctr., USA.*

We have performed near-infrared spectroscopy on the forehead of human subjects during all-night sleep. The evolution of the sleep stages during the night has been identified by electroencephalography.

MC3 11:15am

Multi channel NIR topography for the assessment of cortical activation, *M. Kohl-Bareis, Univ. of Applied Science, Germany; C. Buckow, H. Zank, H. Obrig, J. Steinbrink, A. Villringer, Humboldt Univ., Germany.*

We present maps of cortical activation measured with a multichannel topography system following motor tasks and visual stimulations. The analysis is based on signal magnitude, correlation coefficients and statistical tests and includes a hemodynamic response function.

MC4 11:30am

Cytochrom-c-oxidase measured in near-infrared spectroscopy - real signal or an artifact?, *K. Uludag, H. Obrig, R. Wenzel, M. Kohl-Bareis, A. Villringer, Humboldt Univ., Germany.*

The validity of measured Cytochrome-c-oxidase changes during physiological activation of the cerebral cortex using near-infrared light has been questioned by us in a previous theoretical study. Here, we use differential activation of visual areas rich and poor in Cytochrome-c-oxidase to further clarify this issue.

Room: Brittany/Champagne

MB6 11:45am
Optical elastography for determining strain in coronary vessels, *N. Iftimia, R.C. Chan, M. Shishkov, C. Kauffman, S. Houser, G.J. Tearney, B.E. Bouma, Harvard Medical School, USA; M. Kaazempur-Mofrad, R.D. Kamm, MIT, USA.*
The disruption of structurally compromised coronary plaque is thought to be the primary event causing heart attack. We have developed a new method for characterizing these vulnerable plaques using OCT and elastography.

MB7 12:00pm
12 KHz linear optical delay line, *Nan Guang Chen, Quing Zhu,Univ. of Connecticut, USA.*
We have developed a novel rotary mirror array as a linear, high speed, and high duty cycle optical delay line suitable for ultrafast optical coherence tomography and optical Doppler tomography.

MB8 12:15pm
Spectroscopic optical coherence tomography: Sources of error in extraction of localized absorption, *B. Hermann, B. Povazay, H. Sattmann, A. Fercher, W. Drexler, Inst. of Medical Physics, Austria; A. Unterhuber, Femtosecond Produktions GmbH, Austria; F. Krauzs, Vienna Tech. Univ., Austria.*
The effects of sample optical properties (scattering, refractive index), data acquisition (defocusing, speckle noise) and data processing (FFT/wavelet transform, algorithm properties) on the precision of extracting sample's absorption profile from optical coherence tomograms are investigated.

12:30pm–2:00pm
Lunch on Your Own

Room: Monaco

MC5 11:45am
Modeling of the hemodynamic response function for event related motor and visual stimuli as measured by near infrared spectroscopy, *D.A. Boas, G. Jasdzewski, G. Strangman, J.P. Culver, R. Poldrack, Massachusetts General Hospital, USA.*
The hemodynamic response function to motor and visual stimuli was measured by near infrared spectroscopy. A comparison with models of neuro-vascular coupling and hemodynamic response is made and implications discussed.

MC6 12:00pm
Volumetric imaging of hemodynamic effects in the human brain by three-dimensional diffuse optical tomography, *A.H. Hielscher, G. Abdoulaev, Columbia Univ., USA; C. Schmitz, R.L. Barbour, SUNY Downstate Medical Ctr., USA; A. Bluestone, Columbia Univ. and SUNY Downstate Medical Ctr., USA.*
We report on the first three dimensional tomographic localization of hemodynamic effects in the brain with diffuse optical tomography. Using a model-based iterative image reconstruction algorithms we localize spatial changes in oxy and deoxyhemoglobin.

MC7 12:15pm
Optical tomography with a time-resolved, photon-counting imager, *John George, Tara Abrams, David Rector, Los Alamos Natl. Lab., USA.*
We used a unique time-resolved photon -counting imager and a pulsed laser to detect and reconstruct small optical perturbations deep within a scattering phantom. This approach has strengths and limitations for noninvasive measurement of neural function.

12:30pm–2:00pm
Lunch on Your Own

Room: Brittany/Champagne

2:00pm–3:30pm

MD ■ OCT-Clinical Applications

Quing Zhu, Univ. of Connecticut, USA, Presider

MD1 2:00pm

Identification of vulnerable coronary plaque with intravascular OCT, *B.E. Bouma, H. Yabushita, I.K. Jang, C. Kauffman, M. Shishkov, N. Iftimia, H.T. Aretz, S. Houser, G.J. Tearney, Harvard Medical School and Massachusetts General Hospital, USA.*

Intravascular OCT was performed in patients following myocardial infarction. Atherosclerotic plaque type and structure were compared for disrupted and non-disrupted locations. Our results suggest that intravascular OCT provides an accurate method for identifying vulnerable plaques.

MD2 2:15pm

Ultrahigh resolution optical coherence tomography for quantitative measurement of retinal architectural morphology, *T.H. Ko, I. Hartl, R.K. Ghanta, J.G. Fujimoto, MIT, USA; W. Drexler, MIT, USA and Univ. of Vienna, Austria; L.A. Paunescu, N. Wang, J. Lem, J.S. Schuman, New England Medical Ctr. And Tufts Medical School, USA; S.E. Bursell, Joslin Diabetes Ctr. And Harvard Medical School, USA.*

We demonstrate an ultrahigh resolution OCT system capable of 1-3 ìm resolution. Retinal architectural morphology is visualized and quantified in humans and in animal models. This promises to improve diagnosis and tracking of retinal diseases.

MD3 2:30pm

Slit-lamp adapted, video-correlated real-time optical coherence tomography of the anterior segment, *Chetan A. Patil, Bradley A. Bower , Volker Westphal, Sung W. Jeon, , Andrew M. Rollins, Case Western Reserve Univ., USA; Yan Li, David Huang, Cleveland Clinic Foundation, USA; Joseph A. Izatt, Duke Univ., USA.*

We present a slit-lamp adapted optical coherence tomography (OCT) system capable of imaging the entire anterior segment of the eye in real time. Non-linear scan methods and automated anterior chamber dimension determination are also presented.

Room: Monaco

2:00pm–3:30pm

ME ■ Raman & Multiphoton

Anthony J. Durkin, Beckman Laser Inst. & Medical Clinic, USA, Presider

ME1 2:00pm

Development of optical fiber probes for biological Raman spectroscopy, *Jason T. Motz, Martin Hunter, Luis Galindo, John R. Kramer, Ramachandra R. Dasari, Michael S. Feld, MIT and Cleveland Clinic Foundation, USA.*

Raman spectroscopy has great potential for in vivo disease diagnosis. However, due to large optical fiber background, the diffusive nature of tissue and weak Raman cross-sections, careful optical design methods, including modeling, must be used to obtain useful information. We will discuss our methods and show preliminary results from this approach.

ME2 2:15pm

Advances in wavelength-shifted Raman spectroscopy, *Andrew J. Berger, Qingyuan Zhu, Louis A. Florence, Univ. of Rochester, USA.*

In biomedical Raman spectroscopy, strong autofluorescence from the sample usually confounds the detection of weak Raman bands. We have been investigating a computer-conrolled wavelength-shifting scheme to reduce the contribution of autofluorescence in a convenient manner.

ME3 2:30pm

Raman scattering studies of tumorigenic and non-tumorigenic cells: A carcinogenesis model, *Judith R. Mourant, Kurt W. Short, Susan Carpenter, James P. Freyer, Los Alamos Natl. Lab., USA.*

Analysis of Raman spectra from a pair of tumorigenic and non-tumorigenic cells suspended in phosphate buffered saline will be presented. This system allows examination of cellular changes associated strictly with carcinogenesis without interfering factors.

Room: Brittany/Champagne

MD4 2:45pm
Clinical evidences of OCT capabilities in multi-center and multi-disciplinary endoscopic OCT studies, *G. Gelikonov, V. Gelikonov, A. Sergeev, N. Shakhova, Russian Acad. of Sciences, Russia; F. Feldchtein, Russian Acad. of Sciences, Russia, and Imalux Corp., USA; N. Gladkova, E. Zagaynova, A. Shakhov, A. Terentieva, Nizhny Novgorod Medical Acad., Russia; O. Streltsova, Nizhny Novgorod Regional Hospital, Russia; G. Zuccaro, D. Conwell, J. Vargo, J. Richter, Cleveland Clinic Foundation, USA; U. Seitz, N. Soehendra, Univ. Eppendorf Interdisciplinary Endoscopy, Germany.*
To date, our in vivo OCT clinical research studies involved more than 2000 patients during 1994-2001. Performed international, multi-center, multi-disciplinary OCT studies reproducibly show that OCT has unique capabilities, not available for other diagnostic modalities.

MD5 3:00pm
Video-correlated real-time optical coherence tomography for clinical dermatology, *Sung W. Jeon, Volker Westphal, Albert Peng, Lian J. Li, Kevin D. Cooper, Andrew M. Rollins, Case Western Reserve Univ., USA; K. Divakara Rao, Joseph A. Izatt, Duke Univ., USA.*
An OCT system appropriate for evaluation in clinical dermatology is presented. Normal and a variety of diseased skin are imaged for demonstration. Correlated video enables accurate location of the OCT scan with respect to the skin surface.

MD6 3:15pm
High resolution in vivo imaging of osteoarthritic cartilage, *P. Herz, P. Hsiung, X.D. Li, A.D. Aguirre, T.H. Ko, J.G. Fujimoto, MIT, USA; S. Martin, N. Patel, K. Saunders, M. Brezinski, Brigham and Women's Hospital and Harvard Medical School, USA; D. Stamper, King's Col., USA.*
High resolution, in vivo imaging of osteoarthritic cartilage is performed during knee replacement surgery. Imaging of the cartilage in an intact knee joint in vitro is also demonstrated using a minimally invasive arthroscopic imaging probe.

Room: Lemans/Bordeaux/Burgundy

3:30pm–4:00pm
Coffee Break

Room: Monaco

ME4 2:45pm
Near infrared Raman spectroscopy for cancer detection in vivo, *Anita Mahadevan-Jansen, Amy Robichaux, Chad Lieber, Vanderbilt Univ., USA; Heidi Shappell, Darryl Ellis, Howard W. Jones III, Vanderbilt Univ. Medical Ctr., USA.*
Raman Spectroscopy can be effectively used as a 'biochemical biopsy" tool for detecting tissue abnormalities. Here, we show evidence from three distinct tissue types, cervix, ovary, and skin, that tissue Raman spectra can discriminate normal, precancerous and cancerous tissues in vivo.

ME5 3:00pm
Detecting breast cancer using Raman spectroscopy, *A.S. Haka, R.R. Dasari, M.S. Feld, MIT, USA; K.E. Shafer-Peltier, Northwestern Univ., USA; M. Fitzmaurice, Univ. Hospitals of Cleveland and Case Western Reserve Univ., USA; J. Crowe, Cleveland Clinic Foundation, USA.*
Raman spectroscopy provides detailed chemical information about biological tissue. Using a nine-component model of breast tissue it is possible to explain all of the major spectral features observed in normal and diseased samples. These model parameters are used to produce a diagnostic algorithm capable of differentiating normal/benign samples and malignant ones.

ME6 3:15pm
Selective corneal imaging with multiphoton microscopy, *Alvin T. Yeh, Nader Nassif, Aikaterini Zoumi, Bruce J. Tromberg, Univ. of California-Irvine, USA.*
Image forming signal properties in multiphoton microscopy are used for selective visualization of corneal tissue. Spectral filtering separates cellular from extracellular components. Images of the stroma are dependent on the polarization of the incident light.

Room: Lemans/Bordeaux/Burgundy

3:30pm–4:00pm
Coffee Break

Room: Brittany/Champagne

4:00pm–5:30pm

MF ■ Fluorescence Imaging and Spectroscopy

Thomas Foster, Univ. of Rochester, USA, Presider

Presider

MF1 4:00pm

Three-dimensional bayesian optical diffusion imaging with fluorescence, *A.B. Milstein, S. Oh, K.J. Webb, C.A. Bouman, Purdue Univ., USA; R.P. Millane, Univ. of Canterbury, New Zealand.*

A Bayesian strategy for imaging scattering and fluorescence parameters in turbid media is demonstrated in a computational study. The approach uses excitation and emission data, and incorporates a simple multiresolution procedure.

MF2 4:15pm

Fluorescence lifetime imaging with a blue picosecond diode laser, *D.S. Elson, S.E.D. Webb, J. Siegel, S. Lévêque-Fort, P.M.W. French, C. Anker, M.J. Lever, Imperial Col., UK; K. Lauritsen, M. Wahl, R. Erdmann, PicoQuant GmbH, Germany.*

Use of a blue picosecond laser diode allows a portable fluorescence lifetime imaging system. We show the application of the system to multi-well plate imaging of biological fluorophores and microscopic imaging of unstained tissue sections.

MF3 4:30pm

The use of spatially-resolved fluorescence to determine fluorophore distributions in layered media, *Dragana Stasic, Thomas J. Farrell, Michael S. Patterson, Hamilton Regional Cancer Ctr. and McMaster Univ., Canada.*

The measurement of fluorescence from layered geometries is examined. Using this, it is possible to recover information about the fluorophore concentration and thickness of a superficial tissue layer.

Room: Monaco

4:00pm–5:30pm

MG ■ New Contrast Agents, Microscopies, and Observation

Andrew J. Berger, Univ. of Rochester, USA, Presider

Presider

MG1 4:00pm

Metal nanoparticles as biospecific contrast agents for cancer imaging, *Konstantin Sokolov, Christina Robinson, Tom Collier, Rebecca Richards-Kortum, Univ. of Texas-Austin, USA; Michele Follen, Rueben Lotan, M.D. Anderson Cancer Ctr., USA.*

Optical imaging techniques have shown promise for pre-cancer detection; furthermore, there is significant interest in identifying cancer specific biomarkers. We present optically interrogated contrast agents based on metal nanocrystals for optical imaging with molecular specificity.

MG2 4:15pm

Spectroscopic studies of upconverting chelates, *Gregory W. Faris, Konstantinos S. Kalogerakis, Megan Hryndza, SRI Intl., USA.*

We are investigating the spectroscopy of the new type of reporter for biomedical diagnostics called upconverting chelates. These compounds do not photobleach, have narrow emission bands, and are not affected by autofluorescence.

MG3 4:30pm

High-speed scanning probes for internal and external cavity biomedical optics, *Zahid Yaqoob, Nabeel A. Riza, CREOL, USA.*

Novel miniaturized and hand-held scanning fiber-optic probes based on wavelength-multiplexing technique are introduced for internal and external cavity optical sensing. These high-speed probes can acquire sample data via Doppler and reflectance at sub-microsecond speed.

Room: Brittany/Champagne

MF4 4:45pm
Advantages of fluorescence-mediated tomography, a prelude to molecular interrogations in deep tissues, *Vasilis Ntziachristos, Edward Graves, Ralph Weissleder, Massachusetts General Hospital and Harvard Medical School, USA.*
We present certain experimental advantages of fluorescence measurements versus intrinsic contrast measurements pertaining to imaging the distribution of fluorochromes in tissue by means of a normalized Born expansion. Based on these observations we derive an appropriate reconstruction algorithm that concurrently uses intrinsic and fluorescence contrast that facilitates fluorescence-mediated molecular tomography in tissues in-vivo. In contrast to the standard Born approximation, the proposed algorithm does not require instrument calibration or absolute photon fluence measurements. Therefore it is ideally suited for experimental tomographic investigations of tissue in the near-infrared region. We have used this algorithm to image and quantify cancer associated cathepsin B expression in cancer animal models.

MF5 5:00pm
The use of referenced measurements in fluorescence-enhanced optical tomography, *Ranadhir Roy, Anuradha Godavarty, Eva M. Sevick-Muraca, Texas A&M Univ., USA.*
The performance of fluorescence-enhanced optical tomography is investigated by using different referencing schemes in a fully three-dimensional, gradient based truncated Newton reconstruction algorithm

MF6 5:15pm
Generalized adjoint sensitivities of the coupled frequency domain fluorescence diffusion equations, *Francesco Fedele, Jeffrey P. Laible, Margaret J. Eppstein, Univ. of Vermont, USA.*
General equations are derived with the adjoint method for Jacobian sensitivity matrices of complex fluence at both excitation and emission wavelengths. Finite element implementations of these equations are found to be computationally efficient and accurate.

Room: Monaco

MG4 4:45pm
Advances in development of a quadrature tomographic microscope, *Charles A. DiMarzio, Jay Corporon, Carol M. Warner, Judith Newmark, Northeastern Univ., USA.*
We discuss optical quadrature imaging, now integrated into a commercial microscope. It collects interferograms at four different phases, and combines these to display the complex field, and ultimately reconstruct three-dimensional maps of refractive index.

MG5 5:00pm
Light scattering spectroscopy detects changes in Alzheimer brain, *Eugene B. Hanlon, Department of Veterans Affairs, USA; Edward I. Vitkin, Lev T. Perelman, Harvard Medical School, USA.*
We are developing light scattering spectroscopy to identify absorption and scattering properties of senile plaques and neurofibrillary tangles in Alzheimer's brain. We expect this technique to detect early morphological and biochemical changes in Alzheimer's disease.

MG6 5:15pm
In vivo time-resolved optical spectroscopy of mice, *Edward E. Graves, Alexander Petrovsky, Ralph Weissleder, Vasilis Ntziachristos, Massachusetts General Hospital, USA.*
A time-correlated single photon counting (TCSPC) system has been developed for use with living specimens as part of a fluorescence-mediated molecular tomography scanner, and has been used to measure the optical properties of mouse tissues.

Room: Fontainebleau Ballroom A

5:30pm–7:30pm
Special Symposium and Reception: A View from NIH's Newest Institute: Opportunities and Challenges

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Room: Brittany/Champagne

7:30pm–9:00pm

MH ■ Acousto-Optic and Other Techniques

Yukio Yamada, Univ. of Electro-Communication, Japan, Presider

Presider

MH1 7:30pm

Monte Carlo simulations in acousto-photonic imaging, *Alex Nieva, Charles A. DiMarzio, Northeastern Univ., USA; David Boas, Massachusetts General Hospital, USA; Ronald A. Roy, Sebastien Manneville, Boston Univ., USA.*

Acousto-Photonic imaging (API) is a new technique for non-invasive medical imaging combining diffusive optical tomography (DOT) and focused ultrasound. Monte Carlo simulations are presented for the interaction of Near-Infrared light (NIR) and ultrasound in dense turbid media with high albedo.

MH2 7:45pm

Dental caries characterization with optical pathlength spectroscopy, *C. Mujat, A. Dogariu, CREOL, USA; M. van der Veen, Inspektor Res. Systems, The Netherlands; J.J. ten Bosch, Univ. of Groningen, The Netherlands.*

Optical pathlength spectroscopy offers the possibility to measure directly the distribution of photon paths inside a complex scattering medium. We used this technique to characterize dental caries lesions and compared this methodology with quantitative light fluorescence investigations.

MH3 8:00pm

Mechanisms of ultrasonic modulation of multiply scattered coherent light, *Lihong V. Wang, Texas A&M Univ., USA.*

An analytic model of the ultrasonic modulation of multiply scattered coherent light in scattering media is provided based on two mechanisms: the ultrasonic modulation of the index of refraction.

MH4 8:15pm

Determination of mean size of effective scatterers in turbid media from reflectance spectra using a small optical probe, *Maureen Johns, Hanli Liu, Cole A. Giller, Univ. of Texas, USA.*

A thin fiber optic probe is used to deliver and collect reflected light from turbid media. Spectral shape of the optical reflectance curves is used to determine average size of effective scatterers.

Room: Monaco

7:30pm–9:00pm

MI ■ Novel Cellular Characterization

Judith R. Mourant, Los Alamos Natl. Lab., USA, Presider

Presider

MI1 7:30pm

Classification of skin abnormalities using oblique-incidence diffuse reflectance spectroscopy, *A. Garcia-Uribe, N. Kehtarnavaz, M. Mehrubeoglu, G. Marquez, L. V. Wang, Texas A&M Univ., USA; V. Prieto, M. Duvic, M.D. Anderson Cancer Ctr., USA.*

This paper presents a technique for classifying skin abnormalities using oblique-incidence diffuse reflectance spectroscopy. The objective is to provide a non-invasive computer-assisted tool to dermatologists for lowering the number of unnecessary biopsies.

MI2 7:45pm

Evaluation of thermally induced macromolecular changes in cartilage using FT-IR spectroscopy, *Jong-In Youn, Eunha Kim, Thomas E. Milner, Univ. of Texas-Austin, USA.*

Photothermal effects following laser irradiation of cartilage were investigated using an infrared focal plane array camera and a Fourier transform infra-red (FT-IR) spectrometer. The results indicate that in response to Ho:YAG laser irradiation (l=2.1 mm) infrared absorption peaks of water and macromolecules decrease, respectively, due to dehydration and thermal denaturation. The methodology may be useful for quantitative investigation of the relationship between the clinically important phenomenon of accelerated stress relaxation and the kinetics of macromolecular denaturation.

MI3 8:00pm Invited

Imaging the mechanical properties of biological tissues, *Sean J. Kirkpatrick, Providence St. Vincent Medical Ctr. and Oregon Health & Science Univ., USA.*

It is well known that the mechanical properties of pathological tissues vary from that of healthy tissue. However, there is a lack of quantitative methods for optically evaluating the mechanical behavior of tissues for diagnostic purposes. Herein, laser speckle methods for imaging the mechanical properties of tissues for medical diagnostics will be discussed.

Room: Brittany/Champagne

MH5 8:30pm
RF- and laser-induced thermoacoustic tomography, *Minghua Xu, Xueding Wang, Lihong V. Wang, Texas A&M Univ., USA.*
A diffraction backprojection algorithm based on rigorous theory is used to reconstruct the cross-sectional image from the thermoacoustic measurement in a circular configuration. The results demonstrate imaging using electromagnetic absorption contrast and ultrasonic spatial resolution.

MH6 8:45pm
Non-linear acouto-optic imaging, *Juliette Selb, Lionel Pottier, Benoît Forget, François Ramaz, Albert Claude Boccara, Ecole Supérieure de Physique et Chimie Industrielles, France.*
To improve both the contrast and the spatial resolution of acousto-optic imaging, we use the second-harmonic signal. We have found quadratic variation of this signal with the acoustic pressure, and we show that it induces a strong reduction of the modulation zone.

Room: Monaco

MI4 8:30pm
Near-field scanning optical images of bacteria, *Ana M. de Paula, Claudilene R. Chaves, Haroldo B. Silva, Gerald Weber, Univ. Sao Francisco, Brazil.*
We present near field scanning optical microscopy and spectroscopy images of bacteria.Comparison of simultaneously obtained topographic and transmission images reveal details of the shape and absorption of the laser light by the cell membrane.

MI5 8:45pm
Near-field fluorescence imaging of A375 human melanoma cells, *A. Apostol, A. Dogariu, J. Biggerstaff, Univ. of Central Florida, USA; Kimberly Olvey, Vanderbilt Univ., USA.*
Fluorescence near-field super-resolution optical images were combined with a simultaneously detected three-dimensional topographical representation to provide pertinent information regarding protein distribution on tumor cell membrane. We successfully identified both surface and subsurface melanoma cell proteins.

■ Tuesday
■ April 9, 2002

Room: French Rooms Foyer

7:00am–7:00pm
Registration

Room: Brittany/Champagne

8:00am–10:00am
TuA ■ Joint Session on Cancer Imaging and Diagnosis

Jeremy C. Hebden, Univ. Col. London, UK, Presider

Presider

TuA1 8:00am Invited
Clinical evaluation of optical breast imaging: What requirements of the clinician can be fulfilled?, *Thomas Moesta, Robert Roessle Hospital, Germany.*
No abstract available.

TuA2 8:30am Invited
Spectral imaging of the human breast for cancer detection, *Sergio Fantini, Erica L. Heffer, Tufts Univ., USA.*
We present a novel spectral imaging approach for quantitative oximetry of breast tumors. This approach identifies and uses two optimal wavelengths that vary from case to case.

TuA3 9:00am
Optimal visual perception and detection of oral cavity neoplasia reflectance and fluorescence, *Ekaterina Svistun, Urs Utzinger, Rebecca Richards-Kortum, Univ. of Texas-Austin, USA; Rhonda Jacob, Adel El-Naggar, Ann Gillenwater, M.D. Anderson Cancer Ctr., USA.*
Ideal Observer model predicts optimal observation conditions for human observer in detecting oral cavity neoplasia reflectance and fluorescence. We test these predictions in determining effectiveness of multi-spectral imaging approaches to better identify margins of neoplasia.

TuA4 9:15am
Confocal imaging of basal cell cancers in vivo and in thick skin excisions ex vivo, *Milind Rajadhyaksha, Peter J. Dwyer, Lucid Inc. and Massachusetts General Hospital, USA; James M. Zavislan, Lucid Inc., USA; Thomas J. Flotte, Zeina Tannous, Salvador González, Massachusetts General Hospital, USA; Gregg M. Menaker, Northwestern Univ. Medical School, USA.*
Confocal images of nuclear and cellular detail in basal cell cancers in vivo (brightfield) and in acetowhitened skin excisions ex vivo (cross-polarized) correlate well to histopathology, leading to criteria for potential diagnosis and microsurgical guidance.

TuA5 9:30am Invited
In vivo, early detection, quantitative grading and mapping of cervical cancers and precancers based on the dynamic spectral imaging and analysis of the acetic acid-induced alterations in the tissue light scattering properties, *Costas Balas, Foundation for Res. and Tech., Greece.*
An imaging diagnostic method relaying on the measurement of the acetic acid-induced alterations in the scattering properties of cervix is presented. Clinical tests show that the alteration kinetics is correlated with the neoplasia grade.

Room: Lemans/Bordeaux/Burgundy

10:00am–10:30am
Coffee Break

Room: Lemans/Bordeaux/Burgundy

10:00am–4:00pm
Exhibit Hours

Room: Brittany/Champagne

10:30am–12:45pm

TuB ■ Optical Mammography

Gregory W Faris, SRI Intl., USA, Presider

Presider

TuB1 10:30am Invited

High sensitivity and specificity in human breast cancer detection with near-infrared imaging, *Britton Chance, Univ. of Pennsylvania, USA.*

The current tumor to tissue ratio obtained with intrinsic and extrinsic contrast agents is limited to approximately 2- to 3-fold and with this contrast, sensitivity/specificities of 80-90% are to be expected taking into account false positives due to cysts and false negatives due to adinocarcinomas which may not have fully developed angiogenic expression. Our next step in improving cancer detection is to increase the tumor to tissue ratio towards a factor of 10 and above. This can best be achieved by site directed, overt or stealth molecular beacons as described here.

TuB2 11:00am

Dynamic functional imaging of the healthy and cancerous breast by optical tomography, *Randall L. Barbour, Christoph H. Schmitz, Harry L. Graber, SUNY Downstate Medical Ctr., USA; Yaling Pei, NIRx Medical Tech. Corp., USA.*

Results from dynamic functional imaging studies of the breast are presented illustrating altered states of perfusion and an imbalance in tissue oxygen supply/demand in solid tumors.

TuB3 11:15am

Scanning laser-pulse mammography: matching fluid and off-axis measurements, *Heidrun Wabnitz, Adam Liebert, Michael Möller, Dirk Grosenick, Regine Model, Herbert Rinneberg, Physikalisch-Technische Bundesanstalt Berlin, Germany.*

The influence of a matching fluid on optical mammograms recorded by in-vivo scanning laser-pulse mammography was investigated and augmented by phantom measurements. Simultaneous off-axis scans allowed to determine the depth of an inhomogeneity.

Room: Monaco

10:30am–12:30pm

TuC ■ Clinical Fluorescence

Irene Georgakoudi, MIT, USA, Presider

Presider

TuC1 10:30am

A multimodal multispectral device for the detection of neoplasia in vivo of the cervix, *David Mongin, Shabbir Bambot, Anant Agrawal, Mark Faupel, SpectRx, Inc., USA; Lisa C. Flowers, Emory Univ., USA.*

Design features of our early prototypes that have shown diagnostic value have been combined into a single device and tested on a group of patients in a clinical setting using fluorescence and reflectance spectroscopy to detect cervical neoplasia.

TuC2 10:45am

Detection of fresh cervical tissue autofluorescence with laser scanning confocal microscopy, *Ina Pavlova, Rebekah Drezek, Kostantin Sokolov, Michele Follen, Rebecca Richards-Kortum, Univ. of Texas-Austin and MD Anderson CancerCtr., USA.*

The goal of this study was to image fresh cervical tissue slices with laser scanning confocal microscopy and capture autofluorescence from the epithelium and stroma. Images show distinct patterns in epithelial and stromal autofluorescence.

TuC3 11:00am Invited

Real time calibrated fluorescence imaging of tissue in vivo by using the combination of fluorescence and cross-polarized reflection, *Jianan Y. Qu, Hong Kong Univ. of Science and Tech., Hong Kong.*

We describe a calibrated fluorescence endoscopic technique that uses ratio image of autofluorescence to cross-polarized reflection for characterization of tissue pathology. We demonstrate that the system can differentiate early malignant lesions from normal tissues in vivo at different organ sites.

Room: Brittany/Champagne

TuB4 11:30am
Bulk optical properties of normal breast with endogeneous and exogeneous contrast, *Regine Choe, Turgut Durduran, Joseph P. Culver, Leonid Zubkov, Joseph M. Giammarco, Xavier Intes, Britton Chance, Arjun G. Yodh, Univ. of Pennsylvania, USA.*
The bulk optical properties of 52 healthy female breast tissues are measured in vivo in the parallel plate transmission geometry, and quantified using methods employing a priori spectral knowledge.

TuB5 11:45am
Monitoring breast tumor response to chemotherapy with broadband near-infrared tissue spectroscopy, *Dorota B. Jakubowski, Albert E. Cerussi, Frédéric Bevilacqua, Natasha Shah, Bruce J. Tromberg, Univ. of California-Irvine, USA; David Hsiang, John Butler, Randall F. Holcombe, Univ. of California-Irvine Medical Ctr., USA.*
NIR tissue spectroscopy was used to monitor a breast cancer patient during three cycles of presurgical chemotherapy. Lesion values of lipid, water, deoxygenated and oxygenated hemoglobin changed significantly within the first week, and continued to change throughout therapy.

TuB6 12:00pm
A compact, parallel-detection diffuse optical mammography system: Continued clinical studies, *Xuejun Gu, Yong Xu, Huabei Jiang, Clemson Univ., USA; Nicusor Iftimia, Harvard Medical School, USA; Laurie L. Fajardo, Johns Hopkins Medical Inst., USA.*
We have developed a compact, parallel-detection diffuse optical mammography system. We report on our continued clinical studies with this system on healthy and diseased breasts including lipomas, cysts, and invasive lobular carcinomas.

TuB7 12:15pm
Spatial variations in the optical and physiological properties of healthy breast tissue, *Natasha Shah, Albert Cerussi, Dorota Jakubowski, Ryan Lanning, Bruce Tromberg, Univ. of California-Irvine, USA.*
Multi-wavelength frequency-domain photon migration (FDPM) measurements were made on the healthy breast tissue of twenty-seven women to quantify the intra- and intersubject spatial variability of breast optical and physiological properties.

Room: Monaco

TuC4 11:30am
Relationship between the depth of a target in a turbid medium and the fluorescence measured using a variable aperture method, *Nirmala Ramanujam, Liu Quan, Univ. of Wisconsin, USA.*
This study shows the relationship between the depth of a target in a turbid medium and the fluorescence ratio profile measured using illumination and collection apertures with variable diameters and the same optical path.

TuC5 11:45am
Detection of radiation injured brain tissue using optical spectroscopy, *Wei-Chiang Lin, Anita Mahadevan-Jansen, Vanderbilt Univ., Nashville, USA; Steven A. Toms, Oregon Health & Science Univ., USA; Mahlon Johnson, Robert J. Weil, Vanderbilt Univ. Medical Ctr., USA.*
Differentiation between radiation injured brain tissues and recurrent brain tumors using optical spectroscopy was investigated in vivo. Preliminary results show that brain tissues with radiation injury possess a unique fluorescence spectral feature allowing accurate identification.

TuC6 12:00pm
Autofluorescence-based real time diagnosis for selective resection of tumors in neurosurgery, *Anna C. Croce, Sabina Fiorani, Donata Locatelli, Rosanna Nano, Giovanni Bottiroli, Mauro Ceroni, Univ. Pavia, Italy; Flavio Tancioni, Ermanno Giombelli, Eugenio Benericetti, Parma Hospital, Italy.*
Autofluorescence ex vivo and in vivo spectroscopy characterization of normal and tumor tissues of the brain and cranial nerves evidences differences in emission properties, providing a potential tool for real-time diagnostic purposes, during neurosurgical operation.

TuC7 12:15pm
Time-resolved fluorescence spectroscopy of primary brain tumors, *Laura Marcu, Cedars-Sinai Medical Ctr. and USC, USA; Reid C. Thompson, Keith L. Black, William H. Yong, Cedars-Sinai Medical Ctr., USA.*
We analyzed the time-resolved fluorescence spectra of various human brain tumors samples and determined characteristics of the fluorescence decay dynamics that can be used for intraoperative discrimination of brain tumor.

Room: Brittany/Champagne

TuB8 12:30pm
Validation of hemoglobin concentration imaging of breast tumors through comparison with pathological assessment, *Brian W. Pogue, Shudong Jiang, Keith D. Paulsen, Dartmouth Col., USA; Wendy A. Wells, Steven P. Poplack, Dartmouth-Hitchcock Medical Ctr., USA; Tor D. Tosteson, Norris Cotten Cancer Ctr., USA.*
Pathologically determined percentage vessel density measurement is used to compare with the percent blood volume, in order to estimate the validity of local hemoglobin concentrations reconstructed by near-infrared tomography of human breast cancer tumors.

12:45pm–2:00pm
Lunch on Your Own

Room: Monaco

12:30pm–2:00pm
Lunch on Your Own

Room: Lemans/Bordeaux/Burgundy

2:00pm–3:30pm
TuD ■ Poster Session II

TuD1
Commercial inverted microscope retrofitted for confocal scanning with multi-wavelength detection, spatially resolved spectroscopy, and fluorescence anisotropy, *Chad E. Bigelow, David L. Conover, Thomas H. Foster, Univ. of Rochester, USA.*
We have developed a confocal laser scanning retrofit to a commercial inverted microscope capable of multi-wavelength fluorescence detection, spatially resolved spectroscopy, and fluorescence anisotropy imaging. Examples in tumor spheroids, cells, and murine tumors are given.

TuD2
Determination of optical properties using multi-pixel measurements of frequency domain photon migration, *Michael Gurfinkel, Eva M. Sevick-Muraca, Texas A&M Univ., USA.*
This report describes a method used to determine the optical properties characteristic of a turbid medium using frequency-domain photon migration measurements acquired with an intensified charge-coupled device homodyne detection system. A comparison of the optical properties to those obtained with a well-characterized single-pixel detection system indicates accurate determination.

TuD3
Experimental frequency domain fluorescence tomography, *Margaret J. Eppstein, Univ. of Vermont, USA; Daniel J. Hawrysz, Anuradha Godavarty, Eva M. Sevick-Muraca, Texas A&M Univ., USA.*
The Bayesian APPRIZE algorithm is used to reconstruct fluorescence absorption from sparse and noisy measurements of emission fluence collected on a 4x8x8 cm^3 tissue-mimicking phantom with two fluorescent inclusions.

TuD4
Development of a 3D optical imaging system for in vivo detection of bioluminescence, *T.L. Troy, D.G. Stearns, D.N. Nilson, B.W. Rice, Xenogen Corp., USA.*
A 3D optical imaging system has been developed at Xenogen Corporation for detection of bioluminescence in small mammals such as mice. We describe the instrumentation and algorithms for photon transport. Images of tissue phantoms and bioluminescent mice will be presented.

TuD5
Minimizing mismatch of forward model and experimental measurements for fluorescence-enhanced optical imaging, *Anuradha Godavarty, Eva M. Sevick-Muraca, Texas A&M Univ., USA; Margaret J. Eppstein, Univ. of Vermont, USA.*
The impact of refractive index mismatch at 3D phantom surfaces on model mismatch is studied and a fluorescence 3D optical imaging system and algorithm is being developed to minimize empiricism and optimize measurement precision and accuracy.

TuD6
Fluorescence lifetime tomography using frequency-domain data, *Eric Shives, Yong Xu, Nicusor Iftimia, Huabei Jiang, Clemson Univ., USA.*
We present here fluorescence lifetime image reconstructions for heterogeneous lifetimes in a phantom study for two cases: lifetime varied with two different dyes and varied with two different oxygen concentrations with the same dye.

TuD7
Penetration depth of fluorescence-enhanced, frequency-domain photon migration imaging in tissue phantoms, *Jessica P. Houston, Eva M. Sevick-Muraca, Texas A&M Univ., USA.*
The penetration depth from which near-infrared emission light generated from micro to nanomolar concentrations of indocyanine green is systematically studied in tissue phantoms using a gain-modulated intensified charge coupled device system.

TuD8
Three-dimensional optical tomographic dynamic imaging of small tissue volumes, *Joseph M. Lasker, Andreas H. Hielscher, Columbia Univ., USA; Avraham Blustone, Columbia Univ. and SUNY, USA; Christoph Schmitz, Randall L. Barbour, SUNY, USA.*
We have developed a method for acquiring images of small geometries and explored the real-time response of the finger to partial occlusion of distal veins. Dual-wavelength images were collected, analyzed with time-series analysis and reconstructed in three-dimensional.

TuD9
The study of signal processing method in frequency domain for measuring oxygen saturation in biological tissue, *H.S. Lim, J.M. Kim, D.J. Lee, Chung-nam Natl. Univ., Korea.*
The frequency domain analysis in pulse oximetry signal processing can more easily extract the cardiac rate and amplitude of interest from time domain signal.

TuD10
Light-induced vasodilation: Spectral and aging effects, *Juan Rodriguez, Louisiana State Univ. Health Sciences Ctr. and Centenary Col. of Louisiana, USA; Ron Maloney, Martin Feelisch, Louisiana State Univ. Health Sciences Ctr., USA.*
Nearly half a century after its discovery, the precise origin of light-induced vasodilation (photorelaxation) continues to elude the biomedical community. Here we describe spectroscopic experiments that carefully characterize and identify the chromophore responsible for this phenomenon, and its decline in response with aging.

TuD11
Polarization-sensitive second harmonic generation in the cornea, *Nader Nassif, Alvin Yeh, Bruce Tromberg, Univ. of California-Irvine, USA.*
The corneal stroma is imaged by multiphoton microscopy. Second harmonic generation in stromal collagen is used to probe the symmetry elements of its nonlinear susceptibility via the polarization state of the incident light.

TuD12
Correction of fluorescence spectra using data from elastic scattering spectroscopy and a modified Beer's law, *Ousama M. A'Amar, Irving J. Bigio, Boston Univ., USA.*
We suggest a new method that permits an approximate correction of the spectral distortion of fluorescence due to scattering and absorption. This method is based on the utilization of a modification of Beer's law with data from an elastic scattering spectral measurement.

TuD13
Enhancing spectral content in multi-photon microscopy of biological tissues, *Aikaterini Zoumi, Alvin Yeh, Bruce J. Tromberg, Univ. of California-Irvine, USA.*
The structural origin of signals in multi-photon microscopy of biological tissues is determined. The combined use of two-photon excited fluorescence and second-harmonic generation in reflection geometry provides complementary information that allows non-invasive tissue characterization.

TuD14
Non-invasive characterization of human neck-tumors with near-infrared light spectroscopy, *U. Sunar, S. Nioka, X. Intes, T. Tao, J. Zhang, B. Chance, A. Yodh, Univ. of Pennsylvania, USA; J. Ripoll, Inst. for Electronic Structure and Laser, Greece; L. Loevner, D. Rosenthal, A. Kilger, Hospital of Univ. of Pennsylvania, USA; A. Akin, K. Pourrezaei, A. Daryoush, Drexel Univ., USA.*
Low-cost frequency domain photon migration instrument is used for neck-tumor analysis. Optical properties, absorption and scattering coefficients, are found at wavelengths 780 nm and 810 nm and accordingly hemoglobin concentration (in oxy- deoxy- and total forms), oxygen saturation, and blood volume fraction are calculated. We are able to identify normal and tumor regions in a human subject.

TuD15
Skin color reactions—Separation of contributing chromophores, *Georgios N. Stamatas, Nikiforos Kollias, Johnson & Johnson Co., USA.*
We have strong evidence that mixed vascular and pigment reactions cannot be visually separated and that blood stasis can be confused with pigmentation. The involvement of each chromophore can only be identified spectroscopically.

TuD16
Effect of mechanical pressure on the skin surface produced by fibre-optic probe in a blood microcirculation study, *Igor V. Meglinski, Douglas A. Greenhalgh, Cranfield Univ., UK; Stephen J. Matcher, Univ. of Exeter, UK.*
This work reviews photon correlation approach for skin blood microcirculation study. We show that even small mechanical pressure on the skin surface, produced by a probe, influence the results of in vivo skin blood microcirculation measurements.

TuD17
Paper withdrawn.

TuD18
In real time monitoring of biotussue heating by second harmonic generation technique, *A. Lalayan, E. Janunts, L. Aydinyan, Yerevan State Univ., Armenia.*
Second harmonic generation in collagen contained animal biotissue under picosecond laser irradiation have been studied during conventional and laser heating. Experimental comparison of second harmonic generation and two-photon fluorescence nonlinear optical phenomena has been performed in ordered native tissue.

TuD19
Measurement of particle/cellular size distribution in multi-layered skin models using polarized light spectroscopy, *Matthew Bartlett, Huabei Jiang, Clemson Univ., USA.*
We use polarized light to measure the particle/cell size distribution of polystyrene and cultured cells on top of an Intralipid phantom. We also present measurements of the cell size distribution of the epidermal layer in-vivo.

TuD20
NHE1 regulates stratum corneum acidification and permeability barrier homeostasis: Identification of acidic microenvironments with FLIM, *Martin J. Behne, Debra Crumrine, Walter M. Holleran, Peter M. Elias, Theodora M. Mauro, Univ. of California-San Francisco, USA; Nicholas P. Barry, Kerry M. Hanson, Robert W. Clegg, Enrico Gratton, Univ of Illinois-Urbana-Champaign, USA; Jamie Meyer, Univ. of Cincinnati, USA.*
Mammalian stratum corneum exhibits an acidic surface pH. We characterize the role of NHE1 in modulating pH and extracellular processing of secreted lipids, and visualize the epidermal pH gradient with FLIM, providing SC pH maps.

TuD21
Photostimulated luminescence dynamics and application of AgI and Ag of nanoparticles in medical imaging, *Wei Chen, Joel Roark, Nomadics, Inc., USA.; Alan Joly, Pacific Northwest Natl. Lab, USA.*
X-ray inducsed photostimulated luminescence may be applied for X-ray radiography, medical imaging and diagnostics. In this presentation, we demonstrate that the imaging resolution can be improved by nano-fabrication.

TuD22
Fluorescence imaging of mitochondrial localization and metabolism in malignant cells, *Joseph G. Hirschberg, Elli Kohen, Ceren Ornek, Marco Monti, John P. Berry, Univ. of Miami, USA.*
Keratinocytes, mastocytoma cells, wild-type osteosarcoma 143B and mutant mitochondrial DNA-deficient 143rho cells were studied by fluorescence imaging at 360nm and 436nm excitation. The method's further development by application of Fourier interferometry for fluorescence excitatioin imaging will be discussed, including potential for diagnostics and therapy.

TuD23
In vivo evaluation of a wideband, localised intensity modulated near infrared spectrometer, *Iain D.C. Tullis, David T Delp, Univ. Col. London, UK.*
An instrument capable of simultaneous measurement of intensity and phase shift of light transmitted through tissue over a wide frequency range is evaluated by detecting changes in cerebral scattering coefficient during spreading depression in the rat.

TuD24
Imaging skin cancer with polarized light, *Edward A. Bertrand, Hamilton Regional Cancer Ctr., Canada; Thomas J. Farrell, Glenn W. Jones, Raimond K.W. Wong, Michael S. Patterson, Hamilton Regional Cancer Ctr. and McMaster Univ., Canada.*
Inexpensive, commercially-available components are used to image skin cancer using polarized light. The polarization-resolved images eliminate glare and improve the resolution of sub-surface skin structures and may be used to guide the oncologist in treatment margin determination.

TuD25
Three-dimensional laser micromachining and imaging of biocompatible polymers, *Amy L. Oldenburg, John C. Selby, Stephen A. Boppart, Thomas E. Eurell, Univ. of Illinois-Urbana-Champaign, USA.*
Micromaching of three-dimensional structures in biocompatible elastomers with a femotosecond laser oscillator is demonstrated. This technique may be applicable to controlling the topography of scaffolding for cell micropatterning in tissue engineering.

TuD26
Imaging of absorption distribution in diffuse medium using backscattered light and integral operation, *Koichi Shimizu, Hirobumi Horie, Koji Akiyama, Yuji Kato, Hokkaido Univ., Japan.*
A technique has been developed to reconstruct the absorption-distribution in a diffuse medium using a single source-detector pair for a backscattering measurement. In a simulation the feasibility and the robustness of this technique was verified.

Room: Lemans/Bordeaux/Burgundy

TuD27
A streak camera as a multi-detector for diffuse optical tomography, *Patrick Poulet, C. Virginie Zint, Murielle Torregrossa, Inst. de Physique Biologique, France; Bernard Cunin, Laboratoire PHASE, France.*
A 7-arm light guide was used to transmit light scattered, under different orientations, by the object examined, to a streak camera. Seven time-resolved boundary re-emissions were measured simultaneously, from which absorption and scattering images were reconstructed.

TuD28
A new methodology for monitoring biological tissue temperature using near-infrared spectroscopy, *Veronica S. Hollis, David T. Delpy, Univ. Col. London, UK.*
Near-infrared spectroscopy is being used to determine tissue temperature by exploiting the temperature-dependence of the water spectrum. We are currently developing a temperature-prediction algorithm using spatially-resolved measurements and a novel combination of fitting techniques.

TuD29
Reflectance confocal imaging of non-histologically prepared breast tissue, *James M. Zavislan, Lucid, Inc., USA; Thomas A. Bonfiglio, Rochester General Hospital, USA.*
Waste breast tissue from mastectomies was imaged using near infra-red reflectance confocal microscopy. Morphologic and cellular features of normal and cancerous tissues were identified in the confocal images. Confocal images were compared to standard histologically-prepared sections of the same tissue.

Room: Lemans/Bordeaux/Burgundy

3:30pm–4:00pm
Coffee Break

Room: Brittany/Champagne

4:00pm–5:30pm
TuE ■ Diffuse In Vivo Imaging I
Hanli Liu, Univ. of Texas-Arlington, USA, Presider

TuE1 4:00pm
Three-wavelength LED CW imager, *Jun Zhang, Yuanqing Lin, Shoko Nioka, Britton Chance, Univ. of Pennsylvania, USA.*
This article describes our newly developed three-wavelength (730nm, 805nm and 850nm) light emitting diode (LED) CW imager for breast cancer imaging.

TuE2 4:15pm
Time resolved optical imaging of the newborn infant brain: Initial clinical results, *J.C. Hebden, E.M.C. Hillman, A. Gibson, N. Everdell, R. Yusof, D.T. Delpy, S.R. Arridge, T. Austin, J.H. Meek, Univ. Col. London, UK.*
A 32-channel instrument has been used to record temporal distributions of transmitted light across newborn infant heads at two near-infrared wavelengths. These data were acquired in order to generate 3D images of the brain.

Room: Monaco

4:00pm–5:30pm
TuF ■ Modeling and Optical Properties
Lihong V. Wang, Texas A&M Univ., USA, Presider

TuF1 4:00pm
Collection efficiency of a single optical fiber in turbid media for reflectance spectroscopy, *Paulo R. Bargo, Scott A. Prahl, Steven L. Jacques, Oregon Medical Laser Ctr. and Oregon Health and Science Univ., USA.*
The effect of optical properties on the optical fiber collection efficiency in turbid media was studied experimentally and modeled by Monte Carlo simulations. An analytic expression was obtained to estimate the collection efficiency.

TuF2 4:15pm
Analysis of spectral shape of the optical properties of heart tissue in connection with myocardial RF ablation therapy in the visible and NIR region, *Johannes Swartling, Sara Pålsson, Stefan Andersson-Engels, Lund Inst. of Tech., Sweden.*
The optical properties of pig heart tissue were measured after in-vivo ablation therapy. In-vitro samples were subjected to measurements with an optically integrating sphere set-up in the region 470 - 900 nm. The changes, e.g., a 50% increase in scattering, could serve as a basis for a simple detection method to guide the therapy.

Room: Brittany/Champagne

TuE3 4:30pm
Saggital optical tomography for the diagnosis of rheumatoid arthritis in finger joints, *A.H. Hielscher, A.D. Klose, Columbia Univ., USA; U. Netz, H.J. Cappius, J. Beuthan Free Univ. Berlin, Germany.*
Inflammatory processes as they occur during rheumatoid arthritis (RA) lead already in early stages of the disease to changes in the optical properties of joint tissues and fluids. In this work we report on in vivo studies involving human subjects, which show the potential of optical tomographic techniques for the early diagnosis of RA.

TuE4 4:45pm
Three-dimensional imaging of in vivo bones and joints, *Huabei Jiang, Yong Xu, Nicusor Iftimia, Clemson Univ., USA; L. Lyndon Key, Marcy B. Bolster, Medical Univ. of South Carolina, USA.*
We report full three-dimensional (3D) volumetric reconstruction of absorption images of in vivo bones and joints from near-infrared (NIR) tomographic measurements. Imaging experiments were conducted on human fingers and wrists embedded in cylindrical scattering media using a single-detection multi-channel diffuse optical imager. The volumetric optical images were recovered with our 3D finite element based reconstruction algorithm. Our results show that 3D imaging methods can provide details of the joint structure/composition that would be impossible from 2D imaging methods.

TuE5 5:00pm
Hemoglobin oxygen saturation tomography: Calibration in phantom studies and patient data analysis, *Subhadra Srinivasan, Brian W. Pogue, Shudong Jiang, Hamid Dehghani, Keith D. Paulsen, Dartmouth Col., USA; Steven P. Poplack, Dartmouth-Hitchcock Medical Ctr., USA.*
Oxygen Saturation Imaging has been calibrated relative to the measured pO2 values in tissue phantoms of Intralipid and blood. These calibration results are used to interpret the oxygen saturation of patient tumors and normal tissues.

TuE6 5:15pm
Oxygen saturation and blood-volume derivation from multi-wavelength time-resolved optical tomography data, *Elizabeth M. C. Hillman, Simon R. Arridge, Jeremy C. Hebden, David T. Delpy, Univ. Col. London, UK.*
We present an analysis of the accuracy of oxygen saturation and blood volume maps derived from temporal optical tomographic data. Simulations and then clinical data are used to demonstrate different techniques for extracting the parameters.

Room: Monaco

TuF3 4:30pm Invited
Approaches for quantification in biospectroscopy of turbid media, *David Burns, Claudia E. Gributs, McGill Univ., Canada.*
Methods which integrate statistical calibration with optical time of flight information will be presented. In particular, comparisons of statistical methods with model based techniques will be reviewed for a variety of biological samples.

TuF4 5:00pm
Simple and accurate approximations fo reflectance from a semi-infinite turbid medium, *Scott A. Prahl, Oregon Health and Science Univ., USA.*
Rational polynomial approximations are given for the total reflection from a semi-infinite turbid medium for normal collimated irradiance. These approximations have an error of less than 0.01 for any albedo or anisotropy.

TuF5 5:15pm
Accelerated reverse-path Monte Carlo model to simulate fluorescence in layered tissue, *Johannes Swartling, Stefan Andersson-Engels, Lund Inst. of Tech., Sweden; Annika M. K. Enejder, MIT, USA; Antonio Pifferi, Politecnico di Milano, Italy.*
A time-efficient Monte Carlo model for time-resolved fluorescence from layered tissue was developed. The computation time was reduced more than two orders of magnitude by reversing the photon paths in the computation of the fluorescence light.

Room: Fleur de Lis

5:30pm–7:30pm
Industry Roll-Out and Conference Reception

■ Wednesday
■ April 10, 2002

Room: French Rooms Foyer

7:00am–12:00pm
Registration

Room: Brittany/Champagne

8:00am–10:00am
WA ■ Optical Tomography Theory II

Andreas H. Hielscher, Columbia Univ., USA, Presider

Presider

WA1 8:00am
3-dimensional optical tomography: Modeling for imaging in the female breast, *H. Dehghani, B.W. Pogue, K.D. Paulsen, Dartmouth Col., USA.*
Optical tomography has the potential of detection and characterization of cancerous regions within physiological tissue. Reconstructed images of optical properties from boundary measurements of Near-Infrared light propagation within the female breast hold promise of providing clinically useful information about the infected tissue. Here, we describe our 3 dimensional model and discuss our image reconstruction algorithm.

WA2 8:15am
Optical tomography of a realistic head-shaped phantom, *A. Gibson, H. Dehghani, R.M. Yusof, E.M.C. Hillman, J.C. Hebden, M. Schweiger, S.R. Arridge, D.T. Delpy, Univ. Col. London, UK.*
Optical tomography images have been reconstructed from data generated using a head-shaped finite element model. The images were significantly improved when a priori information was included. Further results will be presented from a realistic phantom.

WA3 8:30am
A practical comparison between time-domain and frequency-domain diffusive optical imaging systems, *Jonathan J. Stott, David A. Boas, Massachusetts General Hospital and Harvard Medical School, USA.*
Given either a finite number of time gates or a small number of RF frequencies, we examine which system design yields the maximum usable information for diffusive optical tomography in both transmissive and reflective geometries.

Room: Monaco

8:00am–10:00am
WB ■ Polarization and Backscatter

Frederic Bevilacqua, Univ. of California-Irvine, USA, Presider

Presider

WB1 8:00am
Polarized reflectance spectroscopy instrument for the clinical setting, *Linda T. Nieman, Alexey Myakov, Konstantin Sokolov, Rebecca Richards-Kortum, Univ. of Texas-Austin, USA.*
We introduce a new clinical instrument based on polarized reflectance spectroscopy for the early detection of cancerous and precancerous lesions of the oral mucosa.

WB2 8:15am
Diffuse reflectance spectroscopy as an in vivo tool for characterizing changes in tissue organization during neoplastic development, *Irene Georgakoudi, Markus Mueller, Adam Wax, Maxim Kalashnikov, Martin Hunter, Ramachandra Dasari, Michael Feld, MIT, USA; Vadim Backman, Northwestern Univ., USA;Michael Wallace, Medical Univ. of South Carolina, USA; Brian Jacobson, Brigham and Women's Hospital, USA; Kamran Badizadegan, Children's Hospital, USA.*
Diffuse reflectance spectra are analyzed using a light-diffusion-theory-based model, which assumes that tissue scattering can be simulated by Mie scattering with an inverse power-law particle size distribution. Diagnostic information related to tissue organization is extracted.

WB3 8:30am Invited
Engineering three-dimensional epithelial tissue for biomedical optics, *Konstantin Sokolov, Christina Robinson, Rebecca Richards-Kortum, Univ. of Texas-Austin, USA; Rueben Lotan, M.D. Anderson Cancer Ctr., USA.*
Epithelial tissue is a dynamic structure with complex multi-component composition. To better understand the optical characteristics of this structure in connection with biochemical events underlying development of cancer we introduce engineered epithelial tissue phantoms.

Room: Brittany/Champagne

WA4 8:45am
SVD-based normalized-transformed scheme for real-time DC optical tomography, *Yaling Pei, NIRx Medical Tech. Corp., USA; Harry L. Graber, Randall L. Barbour, SUNY Downstate Medical Ctr., USA.*
An SVD-based normalized-transformed reconstruction scheme is described as a means to achieve real-time recovery of images from time-series DC intensity data. Results from numerical and experimental studies will be presented.

WA5 9:00am
Statistical analysis of non-linearly reconstructed near-infrared tomographic images, *Xiaomei Song, Brian W. Pogue, Troy O. McBride, Shudong Jiang, Keith D. Paulsen, Dartmouth Col., USA; Tor D. Tosteson, Dartmouth Medical School, USA.*
Optical tomography was evaluated with the mean-square error of the reconstructed images. Theoretical and experiment tests indicated that the objective function minimization was not always correlated with image error minimization.

WA6 9:15am
Quantification and enhancement of image reconstruction accuracy by frequency encoding of spatial information, *Harry L. Graber, R.L. Barbour, SUNY Downstate Medical Center, USA; Yaling Pei, NIRx Medical Tech. Corp., USA.*
A method, built around dynamic optical tomography techniques, for quantifying the degree to which image reconstruction algorithms correctly map the spatial locations of a medium's optical coefficients into the image domain, is described.

WA7 9:30am
Spectroscopic difference tomography using Monte Carlo simulation, *Quan Zhang, Jonathan Stott, David A. Boas, Massachusetts General Hospital, USA; Thomas J. Brukilacchio, Ang Li, Tufts Univ., USA.*
Monte Carlo simulations, using breast-shaped boundaries with simulated lesions embedded in them, were performed in order to study Spectroscopic Difference Tomography (SDT). The results suggest that SDT help to remove errors common to different wavelengths.

Room: Monaco

WB4 9:00am
Morphological information from polarized light scattering, *Judith R. Mourant, Toru Aida, Tamara M. Johnson, Susan Carpenter, James P. Freyer Los Alamos Natl. Lab., USA.*
Angularly-resolved, polarized, light scattering measurements of epithelial cells in both exponential and plateau phases of growth are compared. Monte Carlo simulations determine the structure sizes that scatter light which is collected in elastic-scattering/diffuse reflectance measurements.

WB5 9:15am
Time-resolved propagation of polarized light in scattering media: simulations and experiments, *Xueding Wang, Lihong V. Wang, Texas A&M Univ., USA; Chia-Wei Sun, C.C. Yang, Natl. Taiwan Univ., Taiwan.*
This paper presents our study of time-resolved propagation of polarized light in scattering media. Monte Carlo simulated time-resolved Stokes vectors of transmitted light were compared with the experimental results. A satisfying match has been obtained.

WB6 9:30am
Measuring cellular structure at submicron scale with scattering angle sensitive light scattering spectroscopy, *Vadim Backman, Northwestern Univ., USA; Venkatesh Gopal, Maxim Kalashnikov, Rajan Gurjar, Adam Wax, Irene Georgakoudi, Markus Mueller, Charles W Boone, Ramachandra R. Dasari, Michael S. Feld, MIT, USA; Kamran Badizadegan, Massachusetts General Hospital and Harvard Medical School, USA.*
Using an innovative technique for simultaneous measurement of angular and spectral distributions of light backscattered by live epithelial cells, we show that the organization of cells at submicron scale undergoes fundamental change with precancerous transformations.

Room: Brittany/Champagne

WA8 9:45am
Tumor optical properties determined in curved, short source-detector separation geometries, *Alper Corlu, Turgut Durduran, Joseph M. Giammarco, Monica J. Holboke, A.G. Yodh, Univ. of Pennsylvania, USA.*
The affect of the boundary curvature of small mouse tumors on their estimated bulk optical properties is examined using a finite element numerical approach. Noise-added numerical simulations are used to compare finite element solutions with commonly employed analytic solutions.

Room: French Rooms Foyer

10:00am–10:30am
Coffee Break

Room: Brittany/Champagne

10:30am–12:30pm
WC ■ Diffuse In Vivo Imaging II
Brian W. Pogue, Dartmouth Col., USA, Presider

Presider

WC1 10:30am
Breast imaging using the electromagnetic spectrum from near infrared to near DC, *K.D. Paulsen, D. Li, P.M. Meaney, B.W. Pogue, A. Hartov, Dartmouth Col., USA; T.D. Tosteson, Norris Cotton Cancer Ctr., USA.*
There is national interest in improving diagnostic breast imaging beyond current capabilities. Imaging with electromagnetic signals ranging from near infrared wavelengths to kilohertz electrical currents is possible and has been targeted at application to the breast. In this paper, we describe three imaging systems designed for the breast which exploit a common conceptual framework. Results from controlled phantom and human subject studies are presented which allow direct comparisons of these imaging technologies.

WC2 10:45am
Second-derivative optical mammography, *Vivian E. Pera, Erica L. Heffer, Tufts Univ., USA; Oliver Schütz, Horst Siebold, Siemens AG, Germany; Sylvia Heywang-Köbrunner, Linda Götz, Anke Heinig, Martin Luther Univ., Sergio Fantini, Tufts Univ., USA.*
We present a second-derivative scheme of image processing to enhance the detection of regions of higher absorbance in optical mammograms. The second-derivative images facilitate a spectral analysis that estimates the oxygenation level of breast lesions.

Room: Monaco

WB7 9:45am
Measurement and calculation of angular scatter change in mitochondria during calcium overload, *Nada N. Boustany, Nitish V. Thakor, Johns Hopkins Univ. School of Medicine, USA; Rebekah Drezek, Univ. of Texas-Austin, USA.*
Angular changes in light scatter from mitochondria are quantified in situ during calcium injury. The measured scatter changes resulting from calcium-induced mitochondrial rounding are compared to theoretical predictions of light scatter from ellipsoids and spheres.

Room: French Rooms Foyer

10:00am–10:30am
Coffee Break

Room: Monaco

10:30am–12:30pm
WD ■ Fluorescence Potpourri
Nimmi Ramanujam, Univ. of Wisconsin- Madison, USA, Presider

Presider

WD1 10:30am
Probing the local environment of green fluorescent protein (GFP) with fluorescence lifetime imaging (FLIM) and time-resolved fluorescence anisotropy imaging (tr-FAIM), *K. Suhling, D.M. Davis, D. Phillips, J. Siegel, S.E.D. Webb, P.M.W. French, Imperial Col. of Science, Tech., and Medicine, UK; S. Leveque-Fort, Lab. de Photophysique Moleculaire, France.*
Wide-field time-domain fluorescence lifetime imaging and time-resolved fluorescence anisotropy imaging of green fluorescent protein can be used to probe the biophysical environment of specific proteins.

WD2 10:45am
Fluorescence lifetime imaging of DNA microarrays for expression profiling, *Daniela Comelli, Cosimo D'Andrea, Gianluca Valentini, Rinaldo Cubeddu, Politecnico di Milano, Italy; Clarissa Consolandi, Gianluca De Bellis, Luigi Rossi-Bernardi, CNR-ITBA and Univ. degli Studi di Milano, Italy.*
Time resolved fluorescence imaging has been applied to DNA-microarray expression profiling. Discrimination between two fluorescent labels and quantification of the relative amount of each marker has been successfully achieved, providing a valid alternative to spectral reading of microarrays.

Room: Brittany/Champagne

WC3 11:00am
Time-resolved optical mammograph for clinical studies beyond 900 nm, *Rinaldo Cubeddu, Eleonora Giambattistelli, Fabrizio Messina, Luciano Pallaro, Antonio Pifferi, Paola Taroni, Alessandro Torricelli, Politecnico di Milano, Italy; Gian Maria Danesini, Casa di Cura S. Pio X, Italy.*
A time-resolved multi-wavelength optical mammograph working in the compressed breast geometry is constructed and effectively used in a clinical study. The first in vivo optical mammograms at wavelengths longer than 900 nm are presented.

WC4 11:15am
Quantitative analysis and imaging of subsurface heterogeneities using spatially structured illumination, *Frederic Bevilacqua, David J. Cuccia, Anthony J. Durkin, Bruce J. Tromberg, Univ. of California-Irvine, USA.*
Illumination with structured light allows for subsurface imaging and the determination of the optical properties over a large area. Both the average and the spatial variation of the optical properties can be determined.

WC5 11:30am
Contrast-enhanced dynamical diffuse optical tomography of breast, *X. Intes, Yu Chen, S. Nioka, A.G. Yodh, B. Chance, Univ. of Pennsylvania, USA; J. Ripoll, FORTH, Greece.*
We report results of a breast cancer investigation using a diffuse continuous wave optical apparatus. The protocol utilized an extrinsic contrast agent, Indocyanine Green (ICG). Local uptake of ICG enabled to distinguish between Tumor and healthy tissue.

WC6 11:45am
A method for the measurement of phase with high accuracy in intensity modulated optical imaging, *Ilkka Nissilä, Kalle Kotilahti, Tommi Noponen, Toivo Katila, Helsinki Univ. of Tech., Finland.*
An instrument and matching calibration method were developed for the measurement of phase with minimal systematic errors over a wide range of intensities. The instrument, method and factors affecting the quality of data are described.

Room: Monaco

WD3 11:00am
Fluorescence lifetime imaging of biological tissue: Microscopy, endoscopy and complex decay profiles, *J. Siegel, K.C. Benny Lee, A. Vlandas, G.L. Gambaruto, S.E.D. Webb, S. Lévêque-Fort, D.S. Elson, P.J. Tadrous, G.W.H. Stamp, A.L. Wallace, M.J. Lever, P.M.W. French, Imperial College of Science, Tech., and Medicine, UK; F. Alvarez, Paseo Manuel de Lardizabal, Spain.*
We have applied fluorescence lifetime imaging to the study of biological tissue using both microscopy and endoscopy. We describe the complex decay by the stretched exponential function and we extract the resulting continuous lifetime distribution.

WD4 11:15am
Fluorescence lifetime spectroscopy in multiply scattering media, *Eddy Kuwana, Eva M. Sevick-Muraca, Texas A&M Univ., USA.*
Comparisons of measurements made on a mixture of two dyes in Intralipid solution to the predictions incorporating optical diffusion equation and various decay kinetics models underscore the sensitivity of lifetime spectroscopy in tissue-like scattering media.

WD5 11:30am
Imaging of targeted fluorescence signal for tumor detectionusing dual-interfering-source excitation, *Yu Chen, Chenpeng Mu, Xavier Intes, Shoko Nioka, Britton Chance, Univ. of Pennsylvania, USA.*
Fluorescent field re-radiated from an object embedded in a highly scattering medium illuminated by dual-interfering-source possesses some unique features, i.e., amplitude null and 180° phase transition when the object is crossing the mid-plane between those two sources. This allows us to accurately localize the fluorescent object inside the turbid media. Using this method, we can image the location of an 8 mm mouse tumor labeled with fluorescent dye embedded 3 cm deep in the scattering media.

WD6 11:45am
NADH fluorescence monitoring in vivo as an assay for cellular damage in photodynamic therapy, *Brian W. Pogue, John F. Brandsema, Jonathan D. Pitts, Mary-Ann Mycek, Roger D. Sloboda, Dartmouth Col., USA; Carmen M. Wilmot, Julia A. O'Hara, Darmouth Medical School, USA.*
The endogenous fluorescence signal attributed to NADH is decreased in response to photodynamic damage to cells and tissues. This is being developed as a dosimetry tool to provide direct measurement of in vivo dose deposition.

Room: Brittany/Champagne

WC7 12:00pm
Determination of in vivo optical properties of breast tissue and tumors using a laser pulse mammograph, *Dirk Grosenick, Heidrun Wabnitz, Rainer Macdonald, Herbert Rinneberg, Physikalisch-Technische Bundesanstalt, Germany; Jörg Mucke, Christian Stroszczynski, K. Thomas Moesta, Peter Schlag, Humboldt Univ., Germany.*
We recorded time domain optical mammograms for a large number of patients and derived optical properties of tumors and of healthy breast tissue at two optical wavelengths. Tumors could be detected essentially due to increased absorption, and were characterized by increased hemoglobin concentration and, in most cases, decreased oxygen saturation. Similar properties were found for dense glandular tissue.

WC8 12:15pm
Nonlinear correction method for characterizing small absorbers in turbid media, *Nan Guang Chen, Quing Zhu, Univ. of Connecticut, USA.*
A simple nonlinear correction formula is incorporated to reduce errors caused by using linear perturbation models. Results from phantoms and excised tumors are presented.

Room: Monaco

WD7 12:00pm
Measurement of photosensitizer concentrations in tissue-simulating phantoms using fluorescence spectroscopy, *Kevin R. Diamond, Thomas J. Farrell, Michael S. Patterson, Hamilton Regional Cancer Ctr. and McMaster Univ., Canada.*
Fluorescence from a photosensitizer was measured with a single fiber detection scheme in contact and interstitial geometries. A 10.8% accuracy was achieved for a wide range of optical properties and fluorophore concentrations.

WD8 12:15pm
A semi-analytic model for fiber-based fluorescence measurements, *Scott A. Prahl, Oregon Health and Science Univ., USA.*
A semi-analytic model is presented for calculating the fraction of flurescent light returning to an optical fiber (which also delivers the excitation light). The model depends upon the observation that the collected light has been scattered only a few times.

Key to Authors and Presiders