Bioimaging Technologies 2010

The International Workshop on Bioimaging Technologies for Enhanced Healthcare

24th-25th April 2010 University of British Columbia, Vancouver, CA

General Co-Chairs

M. Jamal Deen, McMaster University

Warren Grundfest, University of California, Los Angeles

Technical Co-Chairs

Qiyin Fang, McMaster University

Bruce Tromberg, University of California, Irvine

Local Organization Chair

Peyman Servati, University of British Columbia

Bioimaging Technologies 2010

The International Workshop on "Bioimaging Technologies for Enhanced Healthcare"

Welcome to the international workshop on **"Bioimaging Technologies for Enhanced Healthcare"**. This workshop is being hosted under the auspices of The **Canada-California Strategic Innovation Partnership (CCSIP)** and selected collaborating institutions in **Canada** and **California**. It is our fervent hope that the workshop will realize the expectation of being a "catalyst for collaborative Research, Development and Delivery (RD&D) between two innovation-intensive jurisdictions: California, one of the most dynamic innovation engines on earth; and Canada, a leading country in university research intensity." The workshop format has been specially formulated to promote the "development of new models of bilateral collaboration" and "bring together brilliant minds and innovation resources from California and Canada."

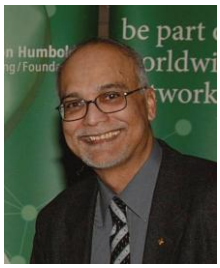
While the workshop is in the broad area of bioimaging technologies to improve healthcare, we have decided to devote a significant portion of time to focus on "**Endoscopic Technologies for Minimally Invasive Diagnosis**". To bring fruition to some of the ideas that will be discussed and to translate technologies to practice, our workshop has successfully attracted world-class clinicians, scientists and engineers. This group of participants has also come together with the specific goal of researching and developing customized engineering solutions to pressing problems in endoscopic diagnostic imaging. In addition to the clinicians, engineers, scientists, attendees of the workshop will also include business officials, government and funding agencies representatives. Our workshop will feature tutorial lectures and panel discussions on the following and related topics.

- Minimally-invasive diagnostic and therapeutic devices (endoscope, laparoscope, endovascular catheters, etc.) their demonstrated significant benefits to both the patients and the health care system in terms of early detection, effective treatment, speedy recovery and lowered overall cost.
- Development of a bilateral collaborative research and technology development roadmap by a team of researchers from Canada and California who are focused on developing engineering solutions to enhance existing endoscopic diagnostic and treatment procedures.
- Establishment of strategies for a bilateral research network(s) though market research, industry outreach, lobbying, and in exploring potential funding opportunities and specific new collaborative research projects.

We hope that you will find the planned program stimulating, rewarding and interesting. We also encourage you to strengthen existing contacts and collaborations and develop new ones.

Program Chairs

Deen, M. Jamal PhD
Professor



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Research Interests

Micro-, Nano- and Opto-electronics for life and environmental sciences; Biosensors, Imaging Systems, Micro- and Nano-systems

Recent Research Projects

High-speed, High-sensitivity Silicon-Based Photodetection Systems for Biomedical Applications

Fluorescent and auto-fluorescence spectroscopic imaging are important techniques that can be used to provide information on the functional properties of tissues and can also serve as a useful diagnostic indicator. In auto-fluorescence spectroscopy, the detected spectrum can be used to diagnose the affected tissue, as it has a different spectrum than a normal tissue. Recording the intensity of the response of a sample tissue in both time and wavelength domains show that the peak of the fluorescence response decays with time. This leads to the idea of using this time domain response, instead of only the spectrum, to diagnose the tissue is preferable.

Fang, Qiyin Ph.D.
Assistant Professor

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Short Bio

Dr. Fang is an assistant professor of Engineering Physics and Canada Research Chair in Biophotonics at McMaster University. He is also a member of the McMaster School of Biomedical Engineering. Prior to his current position at McMaster, Dr. Fang was a research scientist in the Minimally Invasive Surgical Technology Institute at the Cedars-Sinai Medical Center in Los Angeles.
Dr. Fang obtained both of his graduate degrees (M.Sc. Applied Physics; PhD. Biomedical Physics) from the East Carolina University, where he studied nanosecond laser pulse interaction with soft biological tissue both experimentally and theoretically. His undergraduate degree (BS Physics) is from Nankai University.

Research Interests

Dr. Qiyin Fang's current research interests include optical spectroscopic and imaging technologies for minimally invasive diagnosis and guided therapy; miniaturized MOEMS sensors and imaging systems; and advanced optical microscopy and their emerging applications.

Grundfest, Warren S. MD.
Professor

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Short Bio

Dr. Warren S. Grundfest is the former Chair of Bioengineering at UCLA where he holds appointments as Professor of Bioengineering, Electrical Engineering and Surgery. He serves as the Senior West Coast Clinical Advisor and Portfolio Manager for Nanomedicine and Biomaterials for TATRC (the Telemedicine and Advanced Technology Research Center of the U.S. Army). He serves as a Panel Member for several NIH Study Sections, and FDA and DoD review committees. He is one of the nation's foremost experts on image-guided therapies and medical device development. His research interests include minimally invasive surgery, optical diagnostics, medical robotics, and advanced medical imaging technologies. Dr. Grundfest is past President of IMBISPS, and is a Fellow of the American College of Surgeons, AIMBE, ASLMS, and SPIE. He currently serves as Chair of the AIMBE Council of Societies. He holds 15 patents, has 5 more pending, and has authored 200+ papers and 46 book chapters. He has been involved with multiple corporate and venture technology development programs.

Tromberg, Bruce J. Ph.D.
Professor

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Research Interests

Diffuse Optical Spectroscopy and Imaging, Non-linear Optical Microscopy, Photodynamic Therapy, Optical Biology / Physiology

Biosketch

Dr. Tromberg is the Director of the Beckman Laser Institute and Medical Clinic (BLI) at the University of California, Irvine. He is a Professor in the departments of Biomedical Engineering and Surgery and has been a member of the BLI faculty since 1990. Dr. Tromberg is principal investigator of the Laser Microbeam and Medical Program (LAMMP), a National Institutes of Health (NIH) National Biomedical Technology Center. His research interests include the development of new technologies for non- and minimally-invasive imaging in biology and medicine and the biologic origins of intrinsic optical signals

General Information

Vancouver Bio-imaging Workshop
The International Workshop on
"Bioimaging Technologies for Enhanced Healthcare"
April 24-25 (Sat-Sun), 2010
Fred Kaiser Building, Rooms 2020 & 2030,
University of British Columbia
2332 Main Mall, Vancouver BC V6T 1Z4 CANADA

Lodging

We have reserved a limited number of suites in the West Coast Suites at UBC , which is 5 minutes walk from the meeting room. You can now book the room directly online, or call 1.888.822.1030 and mention Group "Canada-California Bioimaging Workshop". Since we have only a limited number of rooms reserved, please book the rooms as soon as possible. The group rate of $129/night (plus tax) is valid for April 20-28. Please contact Dr. Qiyin Fang and/or Dr. Peyman Servati if you have problems book one of the reserved rooms. The ECS conference is held in downtown Vancouver, which is quite far from UBC. We recommend you to stay in a hotel close by the conference after Sunday.

Registration

The workshop is by invitation only. Please send e-mail to Dr. Qiyin Fang to confirm your registration. Registration Deadline: Monday, April 5 Registration Fee: $300 CAD or USD. This workshop is not for profit and the registration fee covers the cost for catered meals (two lunches and one dinner/reception) and conference room rentals. By paying the registration fee, you agree to the following confidentiality agreements.
Please send your payment in check (Pay to: McMaster University/CCSIP Bioimaging Workshop) to:
Ms. Laura Kobayashi
Attn: CCSIP Bioimaging Workshop
ETB 405
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Official Sponsors:

Canada-California Strategic Innovation Partnership (CCSIP)	
International Science & Technology Partnership ISTP-Canada	University of California System
McMaster University	University of California, Los Angeles
University of Toronto	University of California, Irvin
University of Waterloo	Beckman Laser Institute & Medical Clinic
McGill University	

This international workshop is being hosted under the auspices of The Canada-California Strategic Innovation Partnership (CCSIP) and collaborating institutions in Canada and California. The workshop is expected to be a "catalyst for collaborative Research, Development and Delivery (RD&D) between two innovation-intensive jurisdictions: California, one of the most dynamic innovation engines on earth; and Canada, a leading country in university research intensity." It is to promote the "development of new models of bilateral collaboration" and "bring together brilliant minds and innovation resources from California and Canada." This workshop will focus on "Endoscopic Technologies for Minimally Invasive Diagnosis" and will bring together clinicians, scientists and engineers with the specific goal of researching and developing customized engineering solutions to pressing problems in endoscopic diagnostic imaging. Attendees of the workshop will include clinicians, engineers, scientists, business officials, government and funding agencies representatives and will feature the following and related topics.

CCSIP Bioimaging Confidentiality Agreement

By accepting these confidentiality terms for the CCSIP "Bioimaging Technologies for Enhanced Healthcare" workshop (hereafter refers as Bioimaging Workshop), you declare that (i) you are a personnel duly authorized by participating Company to receive Confidential Information, and (ii) the participating company is bound with respect to the following terms and conditions:

The Bioimaging Workshop Confidential Information is the information related to the research and development activities disclosed during the Bioimaging Workshop closed sessions and marked or indicated as confidential.

This Memorandum sets forth the terms and conditions under which Confidential Information is provided to the participating Company.

For a period of three (3) years from the date of the meetings, the Participating Company agrees with respect to all Confidential Information:

- to hold Confidential Information in confidence and not to publish, reproduce or disclose Confidential Information to any third party;
- to use the same care and discretion to avoid disclosure, publication or dissemination of Confidential Information as the Participating Company uses with similar information of its own which it does not desire to disclose, publish or disseminate;
- to use Confidential Information for the sole purpose of developing and furthering Participating Company's interest in working and collaborating with other participants of the Bioimaging Workshop group (hereafter refers as the "Purpose");
- to limit access to Confidential Information to its sole officers and employees who have a need to know in relation to the Purpose, who shall be duly advised by the Participating Company of their obligations in respect of Confidential Information, and to apply reasonable efforts to assure compliance with the terms hereof by said officers and employees.

Neither this Memorandum nor any disclosure of Bioimaging Workshop confidential information hereunder grants the Participating Company any license under any patents, copyrights or trade secrets.

Bioimaging Workshop participants provide Confidential Information to the Participating Company on an "as is" basis, and without guaranty of any kind, including without limitation the implied guaranty of accuracy and fitness for any particular purpose.

Participating Company/Institution:

_____

Participant Name: _____

Signature: _____

Campus Map I

Walking Directions (15 minute walk)

Fred Kaiser Building (bottom arrow) to West Coast Suite (right arrow):

Head northwest on Main Mall toward University Blvd → Turn right at University Blvd → Turn left at Wesbrook Mall

→ Turn left at Student Union Blvd (Destination will be on the right)

Fred Kaiser Building (bottom arrow) to Ponderosa Centre (left arrow –dinner reception)

Head northwest on Main Mall toward University Blvd → Turn left at University Blvd → Turn right at W Mall

Ponderosa Centre (left arrow) to West Coast Suite (right arrow):

Head southwest on W Mall toward University Blvd → Turn left at Wesbrook Mall → Turn left at Student Union Blvd (Destination will be on the right)

Program Overview

Saturday		Sunday	
8:30- 9:00	**Breakfast (catered)**	**8:10-8:30**	**Breakfast (catered)**
9:00 - 10:30	Opening & Clinical	**8:30 - 10:30**	Functional imaging
10:45 - 11:30	Clinical Panel discussion	**10:30 - 11:30**	Functional imaging Panel
11:30 - 13:30	**Lunch (catered)**	**11:30 - 13:00**	**Lunch (catered)**
13:30 - 15:30	Endomicroscopy	**13:00 - 14:30**	Molecular imaging
15:30 - 16:00	*Coffee Break*	**14:30 - 15:00**	*Coffee Break*
16:00 - 17:30	Microsensors & Microfluidics	**15:00 - 16:00**	Panel Discussion
18:00 - 18:30	Break	**16:00 - 16:15**	Concluding remarks
18:30 - 21:30	**Reception**	**16:30 - 18:30**	**Final Report draft**

List of Participants

Institution	Name	Institution	Name
McMaster	David Andrews, John Brash, Jamal Deen, Qiyin Fang, Mike Patterson, Herbert Schellhorn Ravi Selvaganapathy, Frances Tse, Dave Williams, Chang-Qing Xu	**UCLA**	William H. Yong, Eric Dutson, Warren Grundfest, Rahul Singh, Zach Taylor,
Toronto	Stewart Aitchison, Louis Liu, Brian Wilson,	**UC Irvine**	ZhongPing Chen, Eric Potma, Bruce Tromberg, Brian Wong
BC Cancer	Calum MacAulay, Stephen Lam, Haishan Zeng	**Texas A&M**	Brian Applegate, Javier Jo, Kristen Carlson Maitland,
Waterloo	Vassili Karanassions, Qing-Bin Lu	**Buffalo**	Alexander N. Cartwright,
McGill	Vamsy Chodavarapu	**Cedars-Sinai**	Daniel Farkas, Pramod Butte
UBC	Peyman Servati, Shuo Tang	**Nankai**	Qian Sun, Yudong Li,
Calgary	Orly Yadid-Pecht,	**XiDian**	Yiqi Zhuang
Polytechnique	Caroline Boudoux	**IMECAS**	Haiying Zhang, Hao Yang
Simon Fraser	Marinko V. Sarunic		
Laval	Daniel Cote		

Industrial

INO	Ozzy Mermut	**Spectral Applied Research**	Richard Berman
OneLight Corp	Nick MacKinnon	**MDA Medical:**	Benny Yeung

Detailed Program

Saturday Morning		
Overview: Clinical needs & technology capabilities		***Chair: Jamal Deen***
9:00 - 9:10	Opening Welcome	*Warren Grundfest & Jamal Deen*
9:10 - 9:30	Overview translation in optical imaging	*Warren Grundfest*
9:30 - 10:00	Robotics	*Dave Williams*
10:00 - 10:30	Endoscopy	*Brian Wong*
10:30 - 10:45	**Coffee Break**	
10:45 - 11:30	Clinical Panel Discussion:	*Moderator: Louis Liu*
Clinical Panel:	*Louis Liu, Frances Tse, Brian Wong, Dave Williams, Warren Grundfest*	
11:30 - 13:30	**Group Lunch & Networking**	
Saturday Afternoon		
Endomicroscopy: OCT, in-vivo confocal & multiphoton imaging		***Chair: Bruce Tromberg***
13:30 - 14:00	OCT	*Zhongping Chen*
14:00 - 14:30	in-vivo multiphoton imaging	*Daniel Côté*
14:30 - 15:30	Panel Discussion: endomicroscopy	*Moderator: Bruce Tromberg*
Panel:	*Eric Potma, Caroline Boudoux, Kristen Maitland, Shuo Tang, Brian Applegate*	
15:30 - 16:00	**Coffee Break**	
Micro/Nano sensing & microfluidics		***Chair: Vassili Karanassios***
16:00 - 16:30	Micro/Nano biosensors	*Jamal Deen*
16:30 - 17:00	Microfluidics & Lab-on-a-chip	*Vamsy Chodavarapu*
17:00 - 18:00	Panel Discussion: micro/nano devices	*Moderator: Stewart Aitchison*
Panel:	*Rahul Singh, Chang-Qing Xu, Zach Taylor, Ravi Selvaganapathy*	
18:30 - 21:30	**Reception**	
Sunday Morning		
Functional Imaging		***Chair: Frances Tse***
8:30 - 9:15	PDT: new developments	*Mike Patterson*
9:15 - 9: 45	Fluorescence endoscopy	*Haishan Zeng*
9:45 - 10:15	Raman & CARS	*Eric Potma*
10:15 - 10:30	Coffee Break	
10:30 - 11:30	Panel Discussion	*Moderator: Brian Wilson*
Panel:	*Mike Patterson, Haishan Zeng, Qiyin Fang, Javier Jo, Brian Wilson*	
11:30 - 13:00	**Lunch Break**	
Sunday Afternoon		
Molecular Imaging, drug discovery, and biomaterials		***Chair: Qiyin Fang***
13:00 - 13:30	Optical imaging in drug discovery	*David Andrews*
13:30 - 14:00	Molecular Imaging	*Christopher Contag*
14:00 - 14:30	Biomaterials and biocompatibility	*John Brash*
14:30 - 15:00	Coffee Break	
15:00 - 16:00	Panel Discussion	*Moderator: Calum MacAulay*
Panel:	*David Andrews, Herb Schellhorn, Christopher Contag, Daniel Farkas, Shu Chien*	
16:00 - 16:15	**Concluding remarks**	***Jamal Deen & Warren Grundfest***

List of Participants

A

Aitchison, J. Stewart Ph.D.
Professor

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Research Interests

Micro and Nanofabrication of integrated optical circuits for optical sensing and signal processing.

Sample Bio-imaging Research Project

Our research has focused on the development of integrated lab-on-a-chip devices based on surface plasmons, photonic nanowires and direct fluorescence detection. We are working on the integration of nano-Bragg grating sensors based on silicon on insulator waveguides integrated with a PDMS based micro-fluidic chip. The photonic nanowire allows us to optimize the overlap of the optical mode with the sample to be measured.

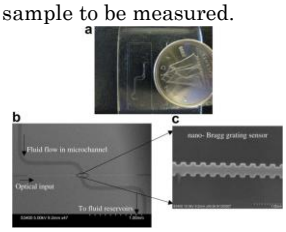

Fig 1. (a) the PDMS chip showing the fluidic reservoirs, (b,and c) the SOI chip fabricated using electron beam lithography

We are also working on the development of an integrated, flow cytometer for CD4 cell counts in blood. Our aim it to produce a single use chip which can carry out a CD4 count in a 5 mL sample. The device is based on passive microfluidics with the aim of reducing complexity and facilitating integration in to a hand held device. The prototype chip contains four major elements for 1) Sample injection, 2) reagent mixing, 3) cell counting and 4) waste collection. In order to simplify the chip design sample injection is achieved by capillary forces and hydrodynamic pressure. Our key focus has been on the optimization of the detection chamber to ensure a uniform monolayer of cells is readily imaged.

Andrews, David Ph.D.
Professor

Biochemistry and Biomedical Sciences
Canada Research Chair in Membrane Biogenesis
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Research Interests

Molecular mechanisms of the assembly of subcellular membranes, regulation of apoptosis by Bcl-2 family proteins, drug discovery, image based high content screening, automated image analysis.

Sample Bio-imaging Research Project

Using Fluorescent Proteins and Automated Live Cell Imaging to Study Membrane Biogenesis

Fluorescent proteins are most often used as tags to identify the subcellular localization of proteins in live cells. They can also be used as organelle specific markers and as reporters for both protein:protein interactions and cellular processes such as organelle assembly. When fluorescent proteins are used as reporters, assays do not have to 'endpoint'. The advantages to maintaining cell viability throughout screening includes facilitating functional cloning and time course experiments that can extend over prolonged periods. We are exploring the use of fluorescent proteins for image based genetic screens in yeast and human cells. We have discovered some surprising effects on the regulation of the expression of exogenous genes in cells that create difficulties for screening. Using high resolution automated fluorescent imaging and the yeast specific gene deletion library, the effect of 5100 non-essential genes on the assembly of proteins into the endoplasmic reticulum was examined. Automated analysis of colocalization, texture and morphology features was carried out for > 75,000 images. Multidimensional clustering of the images and support vector machines were used to classify the images of the different strains of yeast. An array of phenotypes including changes in ER morphology as well as other processes required to maintain the unique protein and lipid composition of the organelle were revealed. Our preliminary data suggest that a surprising diversity of information can be recorded in image based genetic screens using live cells and fluorescent proteins.

Applegate, Brian E. PhD
Assistant Professor

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Research Interests

Optical and Molecular imaging for biomedical applications: Optical Coherence Tomography/Microscopy, Multiphoton Microscopy, Fluorescence Lifetime Imaging, and Photoacoustic Microscopy.

Sample Bio-imaging Research Project

Multiphoton coherence domain molecular imaging of melanoma with Pump-Probe Optical Coherence Microscopy

High-resolution optical molecular imaging currently plays an essential role as a research tool for biology, biochemistry, and the biomedical sciences. The prevailing high-resolution optical molecular imaging modalities based upon fluorescence need exogenous tags in order to probe the majority of biomolecular species because of their poor intrinsic fluorescence. In addition to the increased experimental complexity, these tags may potentially interfere with the process under study or even prove toxic to the sample. The need for exogenous tags also impedes applications in humans since any tag must garner FDA approval. It is therefore desirable to develop high-resolution molecular imaging techniques which do not rely on fluorescent tags, but rather exploit physical phenomena which are more common in biomolecules. Pump-probe spectroscopy is a well established tool in molecular physics for measuring the spectrum and dynamics of molecular species which are poor fluorophores. The foundation of the technique lies in the detection of transient changes in probe attenuation induced by the pump radiation. Optical Coherence Microscopy (OCM) is the combination of low coherence interferometry with confocal microscopy. OCM provides enhanced imaging depth over confocal microscopy because scattered light is filtered by both the coherence gate and

the confocal gate. We have fused pump-probe spectroscopy with optical coherence microscopy to yield Pump-Probe Optical Coherence Microscopy (PPOCM). The addition of pump-probe spectroscopy introduces a third gate due to the nonlinear dependence of the signal strength on light intensity similar to multiphoton fluorescence microscopy. The resulting imaging modality, simultaneously generates a structural image (OCM) and molecular image (PPOCM) of endogenous chromophores.
As an initial demonstration we have imaged a biopsied section of a fixed human nodular melanoma. The results are shown in Fig. 1. The structural (OCM) and melanin (PPOCM) images are shown in panels B and C. The PPOCM/OCM ratio image in panel D provides relative chromophore concentration over small lateral distances and cancels the speckle noise to yield a high contrast, low noise molecular image of melanin. We are currently developing a second generation system based around a commercial microscope that will feature much greater imaging speed.

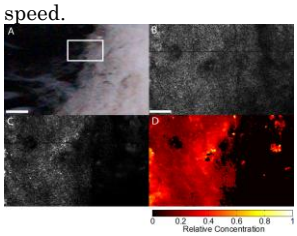

Fig. 1. A) Light microscope image of the fixed nodular melanoma sample. The scale bar is 100 µm. The box indicates the approximate region where the OCM and PPOCM images were recorded. B) OCM image. The scale bar is 20 µm. C) PPOCM image. D) PPOCM/OCM ratio image depicting the relative melanin concentration. Images B), C), and D) have the same field of view and scale.

B

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Spectral Applied Research

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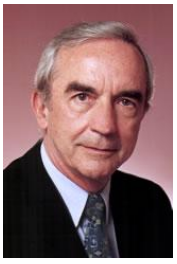
Brash, John L. Ph. D.
Professor



Director, School of Biomedical Engineering
McMaster University

Research Interests

Professor John Brash was educated at the University of Glasgow (BSc, PhD). He is currently Distinguished University Professor and Director of the School of Biomedical Engineering at McMaster. He has worked in biomaterials and biocompatibility research for some 35 years, with emphasis on materials for use in blood contact. These are required for devices such as vascular grafts, coronary stents, and heart valves. Both mechanistic and materials development work has been pursued. The behaviour of proteins at interfaces is an important continuing emphasis. He is the author of over 200 publications, most of which are in the biomaterials area.

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Research Interests

The Laboratory for Advanced Spectroscopic Evaluation (LASE), was founded in 1995 to study and characterize semiconductor devices consisting of homo- and hetero-structures of III-V materials, such as GaAs/InGaAs/AlGaAs and GaN/AlGaN/InGaN, and II-VI materials such as ZnSe/ZnCdSe/ZnTe and ZnO. Over the years, we have expanded our research to include characterization and fabrication. We routinely use ultrafast spectroscopy to characterized semiconductor nanostructures. In addition, we fabricate devices from III-Nitrides materials and hybrid organic/semiconductor nanocrystal nanostructures. In addition, we are also involved in developing optical techniques in biosensing and non-destructive testing. The current focus of our lab is on new materials and devices for sensors and photovoltaics.

Chen, Zhongping Ph.D.
Professor

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Research Interests

Optical coherence tomography,
intravascular imaging, endoscopic nonlinear optical imaging.

Biosketch

Dr. Zhongping Chen is a Professor of Biomedical Engineering and the Director of Functional Optical Coherence Tomography Laboratory at University of California, Irvine. He is a Co-Founder of OCT Medical Imaging Inc.. Dr. Chen received his B.S. degree in Applied Physics from Shanghai Jiao Tong University in 1982, his M. S. degree in Electrical Engineering from Cornell University in 1987, and his Ph.D. degree in Applied Physics from Cornell University in 1993. He is a Fellow of the American Institute of Medical and Biological Engineering (AIMBE), a Fellow of SPIE, and a Fellow of the Optical Society of America.
Dr. Chen's research interests encompass the areas of biomedical photonics, microfabrication, biomaterials and biosensors. His research group has pioneered the development of functional optical coherence tomography, which simultaneously provides high resolution 3-D images of tissue structure, blood flow, and

birefringence. He has published more than 150 peer-reviewed papers and review articles and holds a number of patents in the fields of biomaterials, biosensors, and biomedical imaging.

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I direct the Sensor Microsystems Laboratory in the Department of Electrical and Computer Engineering at McGill University. I obtained my Ph.D. degree in Electrical Engineering from University at Buffalo, The State University of New York in 2006. My research group is part of the BioElectrical and BioSystems research initiatives. My specific research interests are in the areas of CMOS Sensor Microsystems, Biochemical Sensors, Mixed-Signal VLSI Design, Nanostructured Sensor Materials, and Polymeric MEMS/Microfluidics.

Contag, Christopher H. Ph.D.
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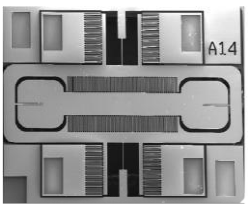
Research Interests

Noninvasive optical measures of biological function in living systems.

Sample Bio-imaging Research Project

Micro-optical designs are enabling the development of miniaturized microscopes that can reach inside the body to interrogate disease states microscopically. This is leading to an emerging field of in vivo pathology that is changing the diagnostic paradigm from biopsy and conventional histopathology to one of point-of-care histopathology coupled with telepathology. These advances are closing the gap between the patient and the pathologist and have the potential of accelerating diagnosis and guiding therapy. While recent advances in this field have been significant, many issues must be resolved before this clinical transformation may be fully realized. There are technological and translational advances that are driving this field and are leading towards in vivo microscopy becoming a standard clinical tool. By removing the spatiotemporal separation between the pathologist and patient, we can accelerate clinical diagnosis and advance clinical care for patients with a wide variety of diseases.



micro-mirror

Côté, M. Daniel Ph.D.
Professor

Canada Research Chair in Biophotonics
CRULRG - Université Laval
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Research Interests

In vivo imaging, live animal imaging, coherent Raman microscopy, myelin, multiple sclerosis, histopathology

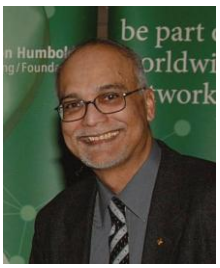
Biography

Multimodal live animal imaging

Daniel Côté is an NSERC Canada Research Chair in Biophotonics at Universite Laval and is part of its Neurophotonics Program and Biophotonics Program. Prior to his appointment, Daniel Côté received his Ph.D. in physics from the University of Toronto in 2003 for his work on far infrared radiation spectroscopy and nonlinear optics. From 2002 to 2004, as a post-doctoral fellow at the Ontario Cancer Institute (with Alex Vitkin and Brian Wilson), he focussed his efforts on biomedical optics problems, in particular on polarimetry and tissue optics for disease diagnosis. From 2004 to 2006, he was a Research Fellow at Wellman Center and Harvard Medical School (with Charles Lin), where he worked on combining new optical techniques to study the kinetics of circulating cells and the progression of diseases in live animals (with techniques such as one- and two-photon immunofluorescence, second harmonic and coherent anti-Stokes scattering imaging). His current research interests revolves around the development and application of new in vivo imaging technologies for use in neuroscience. For instance, an in vivo video rate imaging platform with real-time movement correction is used to study demyelination in multiple sclerosis and nerve injuries with coherent Raman imaging. In addition, endoscopic systems are being developed for accessing deep parts of the brain in vivo with these imaging modalities.

D

Deen, M. Jamal PhD
Professor



Senior Canada Research Chair in Information Technology
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Research Interests

Micro-, Nano- and Opto-electronics for life and environmental sciences; Biosensors, Imaging Systems, Micro- and Nano-systems

Recent Research Projects

High-speed, High-sensitivity Silicon-Based Photodetection Systems for Biomedical Applications

Fluorescent and auto-fluorescence spectroscopic imaging are important techniques that can be used to provide information on the functional properties of tissues and can also serve as a useful diagnostic indicator. In auto-fluorescence spectroscopy, the detected spectrum can be used to diagnose the affected tissue, as it has a different spectrum than a normal tissue. Recording the intensity of the response of a sample tissue in

both time and wavelength domains show that the peak of the fluorescence response decays with time. This leads to the idea of using this time domain response, instead of only the spectrum, to diagnose the tissue is preferable.
In this research, an imaging system used to capture the time and wavelength domain responses of auto-fluorescence signals is being developed. First, similar to commercial spectroscopy systems, our system will be very sensitive and capable of detecting very low levels of light with acceptable signal-to-noise ratios. Our imaging system will have a time-domain resolution to be able to capture light with ns time resolution due to the fast detector response time. Also, the imaging system will be sensitive at the wavelengths of interest for functional imaging. In addition, we are also researching novel avalanche photodiodes operating as single-photon detectors, and that can been designed in a standard CMOS technology. We have already demonstrated the viability of some designs. At the circuit level, the peripheral circuits (quench and reset switches, active quench, monostable, gating) needed for the high-performance operation of the avalanche photodiodes are being improved to provide ns time resolution. This will allow us to develop small, portable and low-cost high-speed, high sensitivity imaging systems for biomedical applications

Dutson, Erik MD
Physician

Surgery, Ronald Reagan UCLA Medical Center
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Clinical Interests

Bariatric Surgery, Colorectal (colon, rectum and anus), Fundoplication, Gastrointestinal, General Surgery, Laparoscopic Surgery, Minimally Invasive Surgery, Urgent Gastrointestinal Surgery

F

Fang, Qiyin Ph.D.
Assistant Professor

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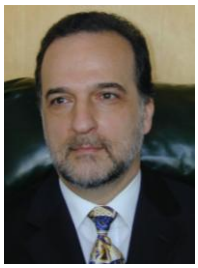
Short Bio

Prior to his current position at McMaster, Dr. Fang was a research scientist in the Minimally Invasive Surgical Technology Institute at the Cedars-Sinai Medical Center in Los Angeles.
Dr. Fang obtained both of his graduate degrees (MSc. Applied Physics; PhD. Biomedical Physics) from the East Carolina University, where he studied nanosecond laser pulse interaction with soft biological tissue both experimentally and theoretically. His undergraduate degree (BS Physics) is from Nankai University.

Research Interests

Dr. Qiyin Fang's current research interests include optical spectroscopic and imaging technologies for minimally invasive diagnosis and guided therapy; miniaturized MOEMS sensors and imaging systems; and advanced optical microscopy and their emerging applications.



Farkas, Daniel L. Ph.D.
Professor

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Research Professor, Biomedical Engineering, Univ. of Southern California
Chairman, Spectral Molecular Imaging, Inc.

Research Interests

Translational and interdisciplinary research and its management; Technology and knowledge transfer, entrepreneurship
Biophotonics, Biomedical Engineering, Biophysics, Robotics
Molecular imaging, *in vivo* imaging, medical applications of bioimaging
Optical cancer diagnostics; fast neuroimaging; lasers in medicine and surgery
Minimally invasive surgery and related technologies; The Operating Room and clinical environments of the future
Spectral/hyperspectral imaging, acousto-optics, lasers, optical coherence tomography

Bio-imaging Research Project

1. Spectral imaging-based diagnosis/staging of cancer (cytopathology, histopathology, in vivo, early clinical detection)
2. Quantitative DNA methylation analysis for pharmacoepigenomics, biological analysis of stem and tumor cells, tissue
3. Superresolution microscopy (based on 3-D standing wave illumination)
4. Heterodyned Optical Coherence Tomography for Fluorescence imaging
5. Advanced endoscopy (multimode, spectral, coherence-based) for clinical uses
6. Very early Alzheimer's Disease detection by optical imaging in the retina
7. Digital Operating Room development (hardware, software, lighting systems, multitasking, electronic checklists)
8. Multimode optical imaging in animals (instrumentation and new agent development; chemotherapy

G

Grundfest, Warren S. MD.
Professor

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Short Bio

Dr. Warren S. Grundfest is the former Chair of Bioengineering at UCLA where he holds appointments as Professor of Bioengineering, Electrical

Engineering and Surgery. He serves as the Senior West Coast Clinical Advisor and Portfolio Manager for Nanomedicine and Biomaterials for TATRC (the Telemedicine and Advanced Technology Research Center of the U.S. Army). He serves as a Panel Member for several NIH Study Sections, and FDA and DoD review committees. He is one of the nation's foremost experts on image-guided therapies and medical device development. His research interests include minimally invasive surgery, optical diagnostics, medical robotics, and advanced medical imaging technologies. Dr. Grundfest is past President of IMBISPS, and is a Fellow of the American College of Surgeons, AIMBE, ASLMS, and SPIE. He currently serves as Chair of the AIMBE Council of Societies. He holds 15 patents, has 5 more pending, and has authored 200+ papers and 46 book chapters. He has been involved with multiple corporate and venture technology development programs.

J

Jo, Javier A. Ph.D.
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Research Interests

Tissue fluorescence spectroscopy and imaging; multimodal optical imaging; biomedical signal and image processing

Sample Research Project

General Research Focus:
The current focus of my laboratory is to develop optical spectroscopy and imaging technologies, and related signal and image processing tools for quantifying nondestructively the structure, molecular composition, and physiological state of biological tissues with both macroscopic and microscopic resolutions. Our hope is that some of our developing technologies will help to clinically detect diseases during their early stages, guide interventions, as well as monitor and personalize treatments.

Fluorescence Lifetime Imaging Microscopy (FLIM) Technology:
We have developed three FLIM instruments that are being used for tissue and cellular imaging: a) Endoscopic FLIM system based on an ICCD time-gated approach, b) Real-time scanning FLIM system based on a direct fluorescence decay recording approach, and c) Multi-photon FLIM system based on TCSPC (with Dr. Alvin Yeh, TAMU-BME). The first two systems are being used for ex-vivo and in-vivo tissue imaging. The third system is being used for tissue and cellular imaging. In addition, we are developing real-time algorithms for FLIM data analysis. Our developing FLIM technology is being applied to basic and clinical research in the areas of cancer diagnosis and atherosclerosis.

Multimodal Optical Imaging Combining OCT and FLIM (with Dr. Brian Applegate, TAMU-BME):
Early pathological tissue transformations are often accompanied by both morphological and biochemical changes from their normal state. Hence, an optical imaging modality capable of detecting both should provide the best sensitivity and specificity for the early diagnosis of deceases. OCT is a widely used non-invasive optical imaging modality that can provide high contrast cross-sectional images and volumes with micron scale resolution in three dimensions. FLIM is a noninvasive imaging modality capable of generating 2-D maps of local concentrations of relevant endogenous fluorophores. We have developed a multimodal optical imaging technology integrating high-resolution OCT and multispectral FLIM for simultaneous high-speed coregistered micro-anatomical and biochemical tissue imaging. This technology is being evaluated for early diagnosis of oral epiyhelial cancer and for intravascular imaging of atherosclerosis.

Multi-resolution Optical Imaging Integrating Wide-Field FLIM and Confocal Reflectance Microscopy (with Dr. Kristen Maitland, TAMU-BME):
We are developing a novel multi-resolution fiber optic endoscope combining wide-field FLIM and reflectance confocal microscopy. This technology will be evaluated in-vivo for
the early detection of epithelial cancer. This novel technology has significant potential to become a clinical diagnostic and screening tool, a navigation system for guiding standard biopsy and surgical intervention, and a tool for quantitative evaluation of responses to current and novel chemopreventive and therapeutic interventions.

K

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Research Interests

Micro- and nano-analytical chemistry (metrology): instrumentation, methodology and fundamental studies.

Micro- and nano-samples by inductively coupled plasma (ICP) atomic emission and ICP-mass spectrometry (ICP-MS). The overall aim is to develop instrumentation, techniques and methodology for accurate and precise chemical analyses of micro- or nano-size samples. Example projects include analysis of single nano-particles, individual nano-volume cells and tiny amounts of metallo-enzymes (e.g., for metallomic applications), methods for rapid determination of the stoichiometry of quantum dots and other nanomaterials; molecular detection by atomic spectroscopy via immunoassays of element tagged antibodies; determinations in micro- or nano-size samples of other biological interest; collection and analysis of airborne particulate matter and determination of the chemical form of species (i.e., chemical speciation) and homogeneity of materials a-particle-at-a-time. To improve the quality of analytical data, to address resolution questions and interference problems and, in an attempt to make spectrochemical measurement systems smarter, mathematical methods are applied to chemical problems (i.e., chemometrics) and signal processing and artificial intelligence methods are used in a number of projects.

Paradigm shift in classical chemical analysis: Taking the lab to the sample via **micro-miniaturization.** Is there a fundamental reason why minute amounts of sample should be measured using large-scale instruments (as is the typical case)? Making instrument-size compatible with the size of the sample leads to instrument miniaturization. Research in this area is aimed at **making instruments smaller, cheaper, faster and smarter** via integration of chip-based, low-power, shirt-pocket size smart-systems that can be used in the field (i.e., outside a laboratory). Example projects include development of chip-based micro-fluidic devices (e.g., MEMS) in a variety of substrates for inorganic, organic, biological (e.g., DNA) and clinical samples, **micro-ITV for battery-operated micro-plasma devices (MPDs) as light or ion sources**, **micro optical or mass spectrometers** that utilize portable, palm-size and **wireless**

data-acquisition systems, and instruments on-a-chip. Efforts geared toward making micro-instruments smarter include integration of mathematical, signal processing and artificial intelligence methods.

Karmali, Mohamed A. MD.
Professor

Pathology and Molecular Medicine, McMaster University. Adjunct Professor, Department of Nutritional Sciences and the Dalla Lana School of Public Health, University of Toronto.
Mohamed Karmali is a specialist in Internal Medicine and Medical Microbiology. Formerly the Head of Microbiology at Toronto's Hospital for Sick Children, he is currently Director-General of two programmes in the Public Health Agency of Canada (PHAC): Laboratory for Foodborne Zoonoses and the Office of Biotechnology, Genomics, and Population Health.

Research Interests

Dr. Karmali has a special interest in studying the biology, ecology, epidemiology, and public health significance of emerging foodborne and waterborne bacterial pathogens. In the early 1980s he led a team that made pioneering contributions in establishing the etiological relationship between Verocytotoxin (VT)-producing *Escherichia coli* (VTEC) and hemolytic uremic syndrome (D+HUS), the leading cause of acute renal failure in children, which was then of unknown cause. He has since published numerous original reports on the microbiology, pathogenesis, and epidemiology of VTEC infections, and was awarded the American Society of Microbiology's 2009 Becton Dickinson Award for research in clinical microbiology.

Recent Research Projects

Dr. Karmali's recent research has focused on comparative genomic analysis to identify emerging pathogens. He is keen to participate in the application of advanced genomics, biotechnology, and nanotechnology devices for the remote detection of pathogens in food and water since this has major public health implications.
In addition to his activities on emerging pathogens Dr. Karmali also heads up the Office of Biotechnology, Genomics, and Population Health (OBGPH) in the Public Health Agency of Canada. One of OBGPH's major areas of interest is the development of biomarkers for the early detection of risk for chronic diseases and for adverse outcomes of infectious diseases. This type of work lends itself to technology innovations for population screening applications.

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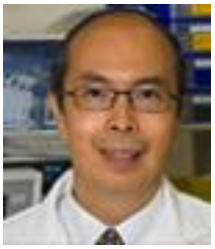

Lam, Stephen MD.
Professor of Medicine

Chair, Lung Tumor Group, BC Cancer Agency;

Research Interests

Dr. Lam's research interest is lung cancer control through early detection and personalized therapy.
Dr. Lam's research includes developing a comprehensive approach for the management of lung cancer by identifying people at highest risk of the disease using a multi-faceted model that integrates socio-demographic factors, smoking, clinical data and biomarkers in the sputum or blood. Imaging technologies such as autofluorescence bronchoscopy and spiral CT scan are then applied to detect the cancer early to achieve the best outcome with treatment. He and his colleagues are also studying novel natural products as well as prescription drugs to reduce the risk of lung cancer.

Regina Leung, B.Eng
Research Student

Electrical and Biomedical Engineering,
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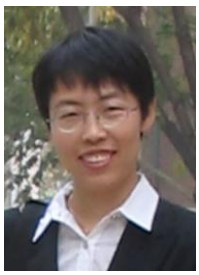
Short Bio

Regina Leung is currently a research assistant working in the biophotonics lab group under Dr. Qiyin Fang. She recently completed her undergraduate degree in the Electrical and Biomedical engineering program at McMaster University. Regina will be going to U of T in the fall of 2010 to begin her graduate studies in Clinical Biomedical Engineering (MHsc).

Research Interests

Regina Leung is currently working with graduate researchers in Dr.Fang's biophotonics lab group to test and optimize deconvolution algorithms for time-domain fluorescene decay lifetime estimations which has applications in functional diagnostic imaging and real time cavity surface profiling. She performs data simulations using Matlab and experimental data processing and analysis to study the mathematical model for time-domain fluorescence decay. Her other research interests include assistive technologies for the elderly and disabled, medical robotics, and power assist exoskeletons.



Li, Yudong Ph.D.
Professor

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Web:
http://physics.nankai.edu.cn/grzy/yudongli/

Research Interests

Ultrafast Optics; Nonlinear optics; Micro-, Nano-structure fabrication.

Liu, Louis W.C. MEng, MD, PhD, FRCPC
Assistant Professor

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Research Interests

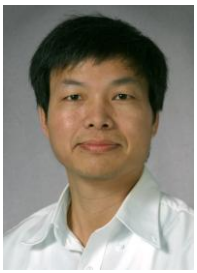
Clinical research in functional bowel disease and neurogastroenterology. Biomedical instrumentations in endoscopic diagnostic imaging

Bio-sketch

Dr. Liu completed his Bachelor, Masters and PhD in Engineering at McMaster University. He further pursued his medical training and received his Doctor of Medicine in 1998 at McMaster University. Dr. Liu completed his Internal Medicine

Residency Training in the University of Toronto and his GI fellowship in McMaster University. He started his clinical and academic appointment at McMaster University in 2003. Since January 2007, he has been holding an academic appointment as Assistant Professor in the University of Toronto and maintaining his clinical practice at the Toronto Western Hospital (TWH) of University Health Network. His clinical expertise includes gastrointestinal motility; he established and supervised the GI Clinical Motility Unit at the TWH. He takes an active role in undergraduate and post-graduate residency medical education. He held the Clinician Scientist Award of Canadian Institute of Health Research and had been funded by Physicians Services Incorporated Foundation and Canadian Association of Gastroenterology for his research. He has published 30 abstracts, 3 book chapters, and 26 peer reviewed articles.

Lu, Qing-Bin Ph.D.
Associate Professor



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Research Interests

Femtochemistry, femtobiology and femtomedicine; Ultrafast biophotonics; Time-resolved spectroscopy and imaging; Molecular pathways of DNA damage and cell death; Cancer research, molecular mechanisms and development of novel anticancer drugs; Environmental sciences; Ozone hole and global climate change

Sample Bio-imaging Research Project

Dr. Lu received his PhD in physics from the University of Newcastle Australia in 1997. He was a postdoctoral fellow and then a Research Associate position at Rutgers University in New Jersey, USA, where he conducted research on electron-induced reactions of molecules at ice surfaces. This led to the discovery of an electron-transfer mechanism (Lu et al. 1999) and a new mechanism for the formation of the ozone hole (Lu et al., 1999; 2001; 2009). Holding a Canadian Institutes of Health Research (CIHR) Senior Research Fellowship, Dr. Lu subsequently joined the radiation sciences group of Dr. Leon Sanche at the University of Sherbrooke (2000-2002) and the Femtochemistry and Femtobiology group of Dr. Ahmed Zewail at the California Institute of Technology (2002-2003). Dr. Lu joined the faculty of the University of Waterloo, Canada in 2004, where he is currently an Associate Professor in Physics, Chemistry and Biology. He is holding a CIHR New Investigator Award and an Ontario's Ministry of Research and Innovation Early Researcher Award. At Waterloo, Dr. Lu is directing a femtobiology and femtomedicine laboratory which is equipped with state-of-the-art ultrafast laser spectroscopic techniques for biomedical research. This technology is capable of seeing biochemical reactions at the molecular level with close relevance to diseases and their treatments and may lead to the birth of a new frontier—femtomedicine (Lu, Mut. Res. Rev. 2010). Dr. Lu's team has recently revealed the molecular reaction mechanisms of several important anticancer drugs and discovered a new molecular pathway for reductive damage to aqueous DNA under ionizing irradiation (Lu et al., 2007; Wang et al., 2006; 2007; 2009; 2010). His team aims to develop novel therapies for more effective cancer treatments, including radiotherapy, chemotherapy and photodynamic therapy. Concurrently, Dr. Lu continues to make pioneering contributions to developing a new theory of the ozone hole and a new theory of global warming and cooling (Lu, Physics Reports, 2010; Lu, 2010).

M

MacAulay, Calum Ph.D.
Associate Professor

Department of Pathology
Associated Member Physics, UBC
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Research Interests

My research has concentrated on the early detection and treatment of cancer using quantitative imaging tools in microscopy, light tissue interactions and understanding the genetic and molecular events driving the neoplastic process.
The teams I have worked with have had a strong drive to translate their work in to actual clinical tools and processes. In the field of tissue fluorescence for cancer detection and management we invented/developed; 1) imaging devices for early lung cancer detection (LIFE, Xillix) which have approval for clinical use in almost all jurisdictions in the world and is part of standard of care for lung cancer staging in North America, 2) direct fluorescence visualization devices (VELScope, LED and Identafi 3000, Trimera) which have FDA & Health Canada approval and have changed clinical practice. These devices are used for Oral cancer screening and defining the surgical field for lesion resection and has altered recurrence rates post surgery (from ~30% to close to 0). The automated cytometry systems the team developed are in clinical use (with regulatory approvals) for; 1) early lung cancer screening using (Perceptronix Medical Inc.), 2) quantitative oral brushing cytology (PMI) and 3) for cervical screening (Motic-Landing, China) where it has been used to screen ~300,000 women to date and is in a state clinical trial to establish if the methodology can become one of the defacto cerevical screening methodologies for China.
The group has recently developed a new form of fluorescence imaging, selective excitation light fluorescence (SELF) imaging which makes use of differences in the absorption spectra of fluorophores for recognition. This imaging is enabled by a spectrally programmable light source (Onelight, Tidal Photonics), developed at the BCCA, which can reproducibly generate almost any visible light illumination profile (intensity as a function of wavelength) desired. When combined with tunable optical filter fluorescence EEM imaging is possible.
Further areas of interest are modeling and understanding the pre-invasive neoplastic process in epithelial tissue at multiple space scales (tissue, cell, protein, epigenetic and genetic levels) using a systems biology approach and measuring and understanding the relationship between clonal populations of transformed cells within a cancer.

MacKinnon, Nicholas Ph.D.
President

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Research Interests

Spectrally programmable illumination systems for surgical imaging; hyperspectral tissue imaging, image sensor calibration: fluorescence and multispectral imaging of tissues

Background and Previous Research

Nick MacKinnon is President, CEO and founder of OneLight Corporation in Vancouver, Canada and has been involved with a number of major cancer research projects in academic groups and medical technology start-ups. He was a member of the Cancer Imaging team at the BCCRC has worked closely with the tem developing autofluorescence and multispectral imaging methods for early cancer screening and treatment. He was a founding shareholder of Vancouver-based LED Medical Diagnostics and one of the inventors of its highly successful product, the VELscope, which has now screened over two million patients for oral cancer. He provides the vision and entrepreneurial spirit for OneLight Corporation's development and growth. Nick is a graduate of the University of Waterloo and the Biomedical Engineering program of the BC Institute of Technology.

His background includes sales and marketing and over twenty-five years in development of clinical and research medical devices while working in both academic research with the BC Cancer Agency's Cancer Research Centre and with several medical device and instrument companies. He has been an investigator, Core Director, and consultant on a number of multimillion dollar National Institutes of Health research and program project grants, including several affiliated with Texas-based research groups at UT Austin, MD Anderson Cancer Center and Rice University as well as The Beckman Laser Institute. He has raised millions of dollars in angel and strategic partner investment for OneLight Corporation and many millions in other grant funded research.

Maitland, Kristen Ph.D.
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Research Interests

Dr. Maitland's current research interests include confocal microscopy along with other optical imaging and spectroscopy techniques for disease detection, diagnosis, and treatment; and endoscope and miniature optics development for improved access for in vivo applications.

Marinov, Ognian Ph.D.
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Bio-sketch

Ognian Marinov (M.Sc. 1986, Ph.D. 1996) joined the Faculty of Electronics at Technical University – Sofia in 1987. He visited ENSEA – Cergy, France, in 1994 and 1995, RWTH – Aachen, Germany, in 1998, and McMaster University – Hamilton, Canada, in 2000, where he is at present.

Research Interests

His research includes industrial and scientific projects on Design and fabrication of measurement instruments; Development of automatic test systems; Characterization and modeling of electronic devices; Design, fabrication and implementation of sensors and systems for power network measurements; Design of integrated circuits; Reliability and quality characterization; Low frequency noise; Characterization of polymeric electronic devices. He has authored or co-authored of more than 50 publications. His current areas of research interest are Low frequency noise in devices and breakdown; Micro-power circuit design; Organic electronics; and Technology and automation of measurements and characterization.

Mermut , Ozzy
INO

P

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Bio-sketch

Mike Patterson received his B.Sc. in Physics from Queen's University in 1973 and M.Sc. in Applied Nuclear Physics from McMaster University in 1976. After working for 4 years as a medical physicist, he returned to graduate school and earned his Ph.D. from the University of Toronto for his research in ultrasonic imaging. Since joining the Juravinski Cancer Centre in 1984, his research has focused on optical methods for diagnosis and treatment of cancer. Mike has been the Head of the Medical Physics Department since 1994 and is a professor in McMaster's Departments of Radiology and Medical Physics and Applied Radiation Sciences. From 1998 to 2000 he served as Chair of the Canadian Organization of Medical Physicists and is currently a member of the editorial board for the journal Physics in Medicine and Biology. He is an author of about 200 publications in various fields of medical physics.

Research Interests

Biomedical optics, Photodynamic therapy, Optical spectroscopy, Radiation physics, Optical imaging, Radiation therapy, Signal processing, Medical imaging

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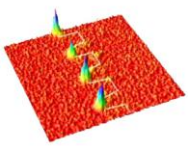
Research Interests

Nonlinear microscopy, nano-plasmonics, single molecule spectroscopy, biomedical imaging.

Bio-imaging Research Project

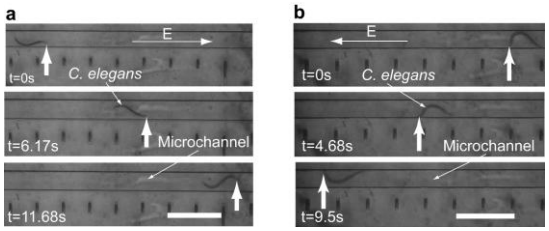
Chemical imaging of molecular and biological systems.

The ability to see the cell's molecular machinery at work has contributed immensely to our understanding of cellular functioning. Optical microscopy in



combination with selectively labeling of molecular compounds lies at very foundation of our ability to zoom into the microscopic world of cells. Thanks to the molecular sensitivity of fluorescence microscopy, the cell's dynamic pathways can now be followed with high spatial and temporal resolution.

Despite the triumph of fluorescence microscopy, there are several complications associated with the use of fluorescent labels, which can significantly compromise certain cellular and tissue imaging applications. Chemically selective imaging without fluorophores can be achieved with vibrational microscopy. The intrinsic molecular bond vibrations leave molecular specific fingerprints in the vibrational spectrum. However, the weakness of these spectroscopic features has limited the use of vibrational contrast for real-time cellular imaging. But not anymore. In recent years, new molecular imaging techniques, such as coherent anti-Stokes Raman scattering microscopy, or CARS in short, have been developed for rapid vibrational imaging of living cells. In our work, we advance and apply novel imaging techniques for unveiling the molecular secrets of microscopic biological systems. In addition, we apply similar imaging tools to interrogate nano-structured samples, down to the single molecule level.



S

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Research Interests and Bio

Herb E. Schellhorn obtained his B.Sc. and M.Sc in microbiology at the University of Guelph and conducted his PhD studies at North Carolina State University examining catalase regulation in E. coli. Following postdoctoral studies at Yale University he accepted a position at McMaster University. His current primary interest is in the determination of factors affecting bacterial virulence and persistence of E. coli in the natural environment. He also has interests in the use of adenovirus vector technology to examine the role of gulononlactone oxidase expression on vitamin C synthesis in mammalian physiology. He is an expert in gene expression technologies and has a proven track record of working in the area of bacterial molecular biology. He has collaborations with the Public Health Agency of Canada and Environment Canada He is director of the McMaster-Innsbruck exchange program and has developed technology training initiatives that have provided key molecular biology training to research students.

Selvaganapathy, P. Ravi Ph.D.
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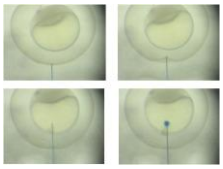
Research Interests

Micro and Nano fluidic devices, Biosensors, Micro- and Nano-systems

Sample Research Project

Microfluidic devices for biological studies



The scale of operation of microfluidics is similar to biological cells, embryos and small organisms that was widely used and studied for understanding the biological mechanisms behind diseases. This scale similarity allows microfluidics to provide a unique, precise and gentle tool to transport, position, manipulate and control the environment and perform experiments and analysis at the single cell/organism level. Many of the methods of analysis involve biological imaging. We have recently developed several microfluidic devices that can precisely control and transport living biological entities. One method using rectified electrokinetic transport is capable of precise transportation of cells, embryos and larves across microscopic distances. Similarly another device is capable of injecting an embryo and delivering and extracting biomolecules from local regions. Another device uses the electrotactic behaviour of small organisms such as nematode to reliably transport and position them in specific locations for imaging. Microfluidic technology and its integration with imaging will provide a unique tool to manipulate and control living organisms and their environment and could potentially be a invaluable part of the biologists tool kit.

Servati, Peyman, Ph.D.
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Research Interests

Nanowires, Nanocomposites, Mechanically flexible electronics, Nanocomposite fibers, Nanowire sensors, Disposable medical sensors, Nanocomposite solar cells

Singh, Rahul Ph.D.
Assistant professional researcher

UCLA

Research Interests and Bio

Dr. Singh received his B.Sc. in Electrical Engineering at Southern Methodist University in 1997. He completed his Master's and Ph.D. in EE at UCLA in 1999 and 2005, respectively. He is currently a postdoc pursuing acoustics resesarch with applications in dentistry and biomedical engineering.

Sun, Qian Ph.D.
Professor

Director of Tianjin Key Lab of Information Materials and Technology
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Research Interests

Nonlinear optics and nonlinear materials. Nanostructure fabrication and application.

T

Tang, Shuo Ph.D.
Assistant Professor

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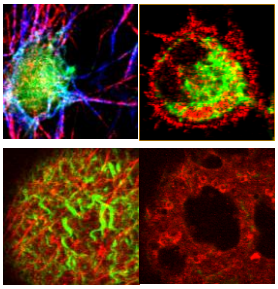
Research Interests

Biophotonics, biomedical optics, optical tissue imaging instrumentation, optical coherence tomography, multiphoton microscopy, endoscopy, cancer imaging

Sample Biophotonics Research Projects

Project 1: Multimodality structural and functional optical imaging



This research focuses on developing multimodality optical imaging by integrating multiphoton microscopy (MPM) with optical coherence tomography (OCT). By combining the advantages of multiphoton microscopy on cellular imaging and optical coherence tomography on tissue imaging, the multimodality imaging is capable of structural and functional imaging of cells and tissues with complementary resolutions, penetration depths and contrasts.

Project 2: Endomicroscopy for in vivo imaging

For in vivo imaging of internal organs, we develop endomicroscopes using optical fibers and miniature optical scanners. Through optical fibers, femtosecond pulses can be delivered to excite tissues and re-emitted fluorescence signal can be collected to reveal tissue structures and functions. A miniature scanner at the distal end scans a laser beam to acquire 2D or 3D images.

Taylor, Zachary D. Ph.D.
Postdoctoral Scholar

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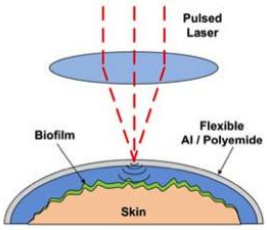
Research Interests

Optical and optoelectronic and laser based techniques for medical sciences. Lifetime fluorescence imaging. Laser microscopy. THz imaging systems, components, and devices.

Recent Research Projects

Bacterial Biofilm Disruption Using Laser Generated Shockwaves



Wound infections are increasingly difficult to manage due antibiotic resistant bacterial strains. Additionally, infected wounds develop bacterial biofilms that allow the bacteria to persist in the wound by providing an anchor for the bacteria to mechanically adhere, maintaining wound hydration, and forming a chemical barrier to antibiotics. Destruction of the biofilm improves the effectiveness of traditional antibacterial measures and reduces the time to heal. The most common treatment method is debridement which has proven to be both ineffective and very invasive.

The goal of this project is to develop a laser generated shockwave system capable of providing mechanical pulses with high enough instantaneous stress to dislodge the biofilm while maintaining an average stress below levels deemed harmful to the surrounding healthy tissues. The shockwaves by are generated by striking a metal film deposited on an thin plastic substrate with a Q-swtiched ND:YAG laser. The laser pulse energy is sufficient to ablate the metal film and the resulting shockwave is propagated through the substrate to the patient. A shockwave pulse width of < 10 ns and peak stress of > 500 MPa have been measured using optical displacement interferometry. Preliminary experiments using biofilms grown on agar plates suggest support the efficacy of this technique and suggest that laser generated shockwaves can also be used to kill the biofilm producing bacteria.

Lifetime Fluorescence Imaging with Applications to Failed Wounds

An emerging area of study in the biomedical sciences is lifetime fluorescence imaging which uses the decay time of a laser induced autofluorescence to create contrast in an image. This differs from standard fluorescence imaging systems that use the intensity and/or wavelength of a sample's fluorescence to generate contrast. In lifetime fluorescence imaging the sample is pumped with a short fall time (~ 1-2 ns) laser source and the lifetime of the induced fluorescence is measured over 10's of nanoseconds. The fluorescence lifetime (typically exponential) at each pixel location is extracted and false color map is defined for the range of lifetimes. Preliminary results suggest that this technique can locate abnormal collagens and areas of ossification in failed wounds

This project consists of 2 main goals The first is to establish the effectiveness of this technique at providing information useful to the early diagnosis of a failed wounds. The second is to build a real-time lifetime fluorescence imaging system based on a focal plane array of sensitive detectors. Our current system uses a 1024x1024 cooled, iCCD camera with a time resolution of 2 ns coupled to a pulsed UV illumination diode. This system is capable of differentiating between collagen and elastin over a wide FOV.
Through the use of the focal plane array and image processing algorithms we hope to develop a real time imaging system capable of generating contrast in clinical situations where other imaging modalities cannot.

Tromberg, Bruce J. Ph.D.
Professor

Biomedical Engineering and Surgery
Beckman Laser Institute and Medical Clinic,
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Research Interests

Diffuse Optical Spectroscopy and Imaging, Non-linear Optical Microscopy, Photodynamic Therapy, Optical Biology / Physiology

Biosketch

Dr. Tromberg is the Director of the Beckman Laser Institute and Medical Clinic (BLI) at the University of California, Irvine. He is a Professor in the departments of Biomedical Engineering and Surgery and has been a member of the BLI faculty since 1990. Dr. Tromberg is principal investigator of the Laser Microbeam and Medical Program (LAMMP), a National Institutes of Health (NIH) National Biomedical Technology Center. His research interests include the development of new technologies for non- and minimally-invasive imaging in biology and medicine and the biologic origins of intrinsic optical signals

Tse, Frances MD.
Assistant Professor

Division of Gastroenterology, McMaster University.

Bio-Sketch

Dr. Tse received her medical degree (M.D.) from the University of Calgary in 1998, and trained in Internal Medicine and Gastroenterology at McMaster University. She then completed a two-year clinical and research fellowship in advanced therapeutic endoscopy including endoscopic retrograde cholangiopancreatography (ERCP) and endosocopic ultrasound (EUS) at McGill University under the mentorship of Dr. Alan Barkun, Dr. Josee Parent and Dr. Pascal Burtin. She joined the Division of Gastroenterology at McMaster University in 2005. She is now a member of the Farncombe Family Digestive Health Research Institute and Director of the Training Program in Adult Gastroenterology.

Clinical Interests

Dr. Tse's clinical interests are EUS, ERCP, endoscopic mucosal resection, and therapeutic endoscopy. Her research interests are in endoscopy training and evaluation of endoscopic technologies.

W

Williams, Dafydd Rhys MD
Professor

Department of Surgery of the Michael G. DeGroote School of Medicine
Director of the McMaster Centre for Medical Robotics, St. Joseph's Healthcare Hamilton,.
The McMaster Centre for Medical Robotics is dedicated to developing innovative robotic technologies to support the delivery of medical and surgical care to patients in remote terrestrial and extraterrestrial environments.

Previous to this role, Dr. Williams served as a NASA mission specialist on STS-118 (August 8 to 21, 2007), the 119th space shuttle flight, the 22nd flight to the station, and the 20th flight for *Endeavour*. Dr. Williams took part in three of the four spacewalks, the highest number of spacewalks performed in a single mission. He spent 17 hours and 47 minutes outside, a Canadian record.

Dr. Williams graduated from McGill University, Montréal, Quebec, with a Bachelor of Science, Major in Biology (1976). He obtained a Master of Science from the Physiology Department, a Doctorate of Medicine and a Master of Surgery from the Faculty of Medicine, McGill University (1983).

Research Interests

Among his academic endeavors and clinical interests, Dr. Williams' interests include cardiopulmonary-cerebral resuscitation, pre-hospital emergency cardiac care, space medicine, critical care aero-medical transport, robotic and telerobotic surgery.

Wilson, Brian Ph.D.
Professor

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Research Interests

Laser Biophysics

The focus of the research of the Laser Biophysics group is the development and application of new therapeutic and diagnostic techniques based on the use of lasers and other optical technologies. In this translational research, a wide range of methodolo- gies are used: theoretical and experimental studies of light transport in tissues, development of light sources/optical-fiber light delivery devices and of optical dosimeters, photobiological studies at the cellular and tissue level, in vivo optical spectroscopy of tissues, development of prototype clinical instruments, and co-operative clinical trials.

Wong, Brian J.F. MD, PhD, FACS
Professor

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Biomedical Engineering, and Surgery
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Research Interests

Tissue shape change and reshaping, tissue thermoviscoelasticity, clinical applications of optical coherence tomography

Biosketch

Dr. Wong is Professor and Vice-Chairman of the Department of Otolaryngology-Head and Neck Surgery at UC Irvine. He is also the director of the Division of Facial Plastic Surgery at UCI and of the Facial Plastic Surgery program at the Beckman Laser Institute (BLI) as well. Dr. Wong is currently the principle investigator on two NIH grants and one grant from the US Department of Defense. His laboratory is at the BLI and focused primarily on the development of technology to reshape living tissues (cartilage in particular) using optical and other technologies. Dr. Wong also works on applications of OCT technology in the management of diseases of the head, neck and upper airway. He also holds academic appointments in Biomedical Engineering and Surgery. Clinically, Dr. Wong is double board-certified in facial plastics surgery and otolaryngology. His clinical focus is on maxillofacial trauma reconstruction and aesthetic rhinoplasty.

X

Xu, Chang-qing, Ph.D.
Professor

McMaster University

Dr. Xu is a professor in the Department of Engineering Physics at McMaster University. He received his PhD degree from the University of Tokyo (Japan) in 1991. After graduation, he joined the Oki Electric Industry Co., Ltd. (Japan), and worked as Research Leader since 1994. From 2000 to 2001, he worked for the Nanyang Technological University (Singapore).

Research Interests

Dr. Xu has worked on nonlinear optic materials and devices, semiconductor laser diodes and amplifiers, waveguide devices such as wavelength converters, optical filters and switches. He has authored or co-authored over 170 publications in refereed journals and conference proceedings, and has over 40 patents on photonic devices and applications. His current research interests include optoelectronics and optical sensors for laser display, telecommunication and biomedical applications.

Y

Yadid-Pecht, Orly. DSc FIEEE
Professor

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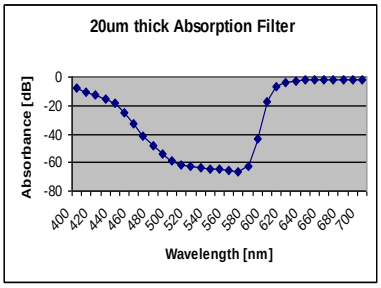
Research Interests

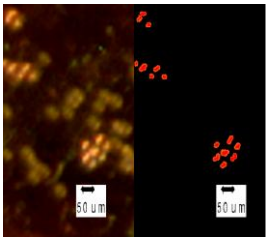
Image Sensors, Micro and Nano systems, Smart Sensors, Biosensors

Sample Bio-imaging Research Project

Low Light CMOS Contact Imager with an integrated Poly-Acrylic Emission Filter for Fluorescence Detection

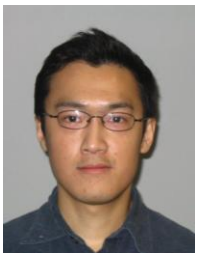


This project presents the fabrication of a low cost poly-acrylic acid (PAA) based emission filter integrated with a low light CMOS contact imager for fluorescence detection. The process involves the use of poly-acrylic acid as an adhesive for the emission filter. The poly-acrylic solution was chosen due its optical transparent properties, adhesive properties, miscibility with polar protic solvents and most importantly its bio-compatibility with a biological environment. The emission filter, also known as an absorption filter, involves dissolving an absorbing specimen in a polar protic solvent and mixing it with the PAA to uniformly bond the absorbing specimen and harden the filter. The PAA is optically transparent in solid form and therefore does not contribute to the absorbance of light in the visible spectrum. Many combinations of absorbing specimen and polar protic solvents can be derived, yielding different filter characteristics in different parts of the spectrum.



We report a specific combination as a first example of implementation of our technology. The filter reported has excitation in the green spectrum and emission in the red spectrum, utilizing the increased quantum efficiency of the photo sensitive sensor array. The thickness of the filter (20um) was chosen by calculating the desired SNR using Beer-Lambert's law for liquids, Quantum Yield of the fluorophore and the Quantum Efficiency of the sensor array. The filters promising characteristics makes it suitable for low light fluorescence detection. The filter was integrated with a fully functional low noise, low light CMOS contact imager and experimental results using fluorescence polystyrene micro-spheres are presented

Yeung, Benny
System Design Engineer



Space Missions Unit
MacDonald, Dettwiler and Associates
Email Address:
Benny.Yeung@mdacorporation.com

Research Interests

Benny Yeung holds a Bachelor of Applied Science and a Master of Applied Science in Mechanical Engineering, both from the University of Toronto in Ontario, Canada. His research at the University of Toronto was on development of a smart gripper for automotive robotics assembly. Afterwards he worked for the Samuel Lunenfeld Research Institute of Mount Sinai Hospital in Ontario, Canada as a robotics specialist, where he provided day-to-day engineering support for the high-throughput automation systems in the department for molecular biology experiments focusing on cancer research. Since then he has been working for the Space Missions unit of MacDonald, Dettwiler and Associates in Ontario, Canada as a system design engineer. His work at MDA focuses on medical robotics, including creating a prototype microsurgical robot, and is currently involved in planning the development of several new surgical robotics systems in a variety of applications. He has published patents on his surgical robotics invention under the United States Patent and Trademark Office, the European Patent Office and World Intellectual Property Organization.

Yeh, Shu-chi
M.A.Sc. Student

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Short Bio

Allison Yeh is currently a second year master's student of Biomedical Engineering at McMaster University. She is working in the Biophotonics lab group under Dr. Qiyin Fang. She was also an award holder of NSERC CGS-M scholarship from 2009-2010. Prior to her graduate study at McMaster, she received bachelor degree of Physiotherapy in Chung Shan Medical University in Taiwan.

Research Interests

Allison Yeh's current research involves the project of PDT dosimetry in cancer research, mainly using fluorescence lifetime imaging microscopy. She is also interested other microscopic applications and computational design preferably with a focus on the applications of nano probes, in vivo imaging, and FLIM analysis. Some fields in biophotonics are particularly intesting to her; namely in the area of in vivo drug dosimetry; nanoparticles for molecular imaging and therapy, and clinical-involved cancer research.

Z

Yong, William H.
Associate Professor

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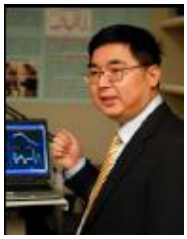
Research Interests

Dr. Yong is an Associate Clinical Professor and teaches medical and dental students as well as residents and fellows in pathology, neuropathology, neurosurgery, and neurology. As an attending neuropathologist at the UCLA Medical Center, his clinical expertise includes brain and pituitary tumors as well as neuromuscular pathology. He is also a neuropathology consultant for the West Los Angeles Veterans Administration Hospital. He currently directs the Brain Tumor Translational Resource (BTTR)- a brain tumor biorepository dedicated to a cure for brain cancers. The focus of this resource is to develop the tools and logistics to power a broad range of brain tumor research labs in the UCLA Neuro-oncology program. He has an interest in biospecimen research to improve the usability of tissue specimens for biomarker assays and individualized molecular profiling for patients. The lab also focuses on ways to speed the delivery of specimen derivatives to researchers. His laboratory has developed novel software including an artificial report generator (SPARG) to enable medical software development without the privacy concerns of real databases and an image-enhanced program (Pathtracker) for tracking movement of materials in and out of biorepositories. The laboratory has interests in whole slide digital imaging (WSDI) and radio frequency identification (RFID) tags as tools to improve tracking and rapid delivery of biospecimen derivatives to researchers. He is a co-investigator and neuropathologist in research programs on brain tumors, stroke, and dementia.

Zeng, HaiShan Ph.D.
Associate Professor



British Columbia Cancer Research Centre, Vancouver Canada.

A senior scientist with the Integrative Oncology Department (Imaging Section) of BC Cancer Agency, an associate professor of Dermatology and Skin Science at the University of British Columbia (UBC), and associate member of UBC Physics and Pathology. Dr. Zeng received a B.Sc. degree on electronic physics from Peking (Beijing) University, a M.Sc. degree on electronic physics and devices from the Chinese Academy of Sciences, and a Ph.D. degree on medical physics from UBC.

Research Interests

For over 20 years, Dr. Zeng's research has been focused on developing various optical imaging and spectroscopy techniques for improving early cancer detection. He has published over 60 referred journal papers and has 20 granted patents related to optical diagnosis and therapy. Two medical devices derived from these patents, fluorescence endoscopy and VELscope® have passed regulatory approval and are currently in clinical uses around the world.

Recent Research Projects

Fluorescence Endoscopy Imaging System for Early Cancer Detection

This presentation summarizes our experiences on the development of a fluorescence endoscopy imaging system for early cancer detection in the respiratory and gastrointestinal (GI) tract. The system utilizes tissue autofluorescence to provide real time video imaging of the examined organ. It is used by a physician in adjunct to conventional white-light endoscopy. Suspicious areas are identified in pseudo color to guide biopsy. A multi-center clinical trial has demonstrated that in the lung, the relative sensitivity of white-light imaging + fluorescence imaging vs. white-light imaging alone was 6.3 for intraepithelial neoplastic lesion detection and 2.71 when invasive carcinomas were also included. The following issues will be discussed: 1)

spectroscopy study design for imaging system development; 2) architecture of different imaging systems; 3) different imaging modalities (white-light imaging, dual channel fluorescence imaging, combined fluorescence/reflectance imaging, and simultaneous imaging and spectroscopy); 4) mechanism of fluorescence detection; and 5) clinical applications.

Zhang, Haiying Ph.D.
Professor

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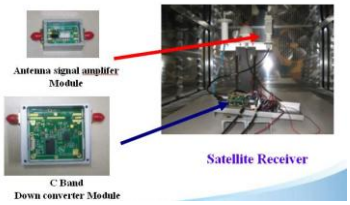
Research Interests

RFIC design, MMIC design, SoC for healthcare, information technology for medical equipments

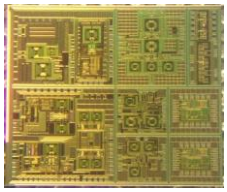
Recent Research Projects

RFICs and modules for wireless communication systems

The radio frequency (RF) and wireless market has expanded to unimaginable dimension, and the RF design is still a challenge for wireless communication systems. Based on Si, SiGe and GaAs technology, we are working on RFICs for next generation wireless communication systems, such as, LTE, IMT-Advanced, UWB and 60GHz millimeterwave communication. As the member of CWPAN(the Chinese Wireless Personal Area Network Standardization Organization), most of our works base on Chinese standards.



At the same time, we also develop RF modules for different applications. Kinds of Satellite Receiver modules have applied to some important projects.



Medical Electronics

Combining wireless communication technology with bio-medical instruments, we are developing portable medical instruments for countryside medical care and community medical care.

Zhuang, Yiqi Ph.D.
Professor

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Research Interests

Design of radio-frequency and short-range communication integrated circuits especially for the applications in RFID, GPS and Bioelectronics.
Characterization methodology of micro-nano-electronic devices and materials.
Single-chip integration of digital, analogy, RF and power circuits.

Appendix I

217th ECS Meeting - Vancouver, Canada

April 25 - April 30, 2010

Program Information- E3 Integrated Optoelectronics 5

Electronics and Photonics/Dielectric Science and Technology

Monday, April 26, 2010

Plaza B, 2nd Floor, Hyatt

Minimally-invasive Imaging Technologies

Co-Chairs: David Armstrong and Haishan Zeng

Time	Abs#	Title and Authors
08:15		*Introductory Remarks (5 Minutes)*
08:20	1032	The Impact of Optoelectronics on Health, Communications and Entertainment *W. S. Ishak (Corning Incorporated)*
09:00	1033	Gastrointestinal Imaging Technologies: Can We Turn the Gut Inside Out? *L. W. Liu (University Health Network)*
09:30	1034	Endoscopic Ultrasound: Imaging and Beyond *F. Tse (McMaster University Medical Centre)*
10:00		*Intermission (30 Minutes)*
10:30	1035	In Vivo Characterization of Lung Cancers Using Endoscopic Raman Spectroscopy: A Pilot Study *M. A. Short, S. Lam, A. McWilliams and H. Zeng (British Columbia Cancer Research Centre)*
11:00	1036	Time-Resolved Fluorescence Spectra of Upper GI Tract: An Ex-Vivo Study *M. L. LePalud (McMaster University), F. Tse (McMaster University Medical Centre), J. Jo (Texas A&M University), M. Krishnamoorthy, R. Leung, D. Cappon, Z. Nie and Q. Fang (McMaster University)*
11:20	1037	Fluorescence Excitation Emission Matrix Spectroscopy for Endogenous Skin Fluorescence Characterization *J. Zhao (BC Cancer Research Centre), F. Feng, M. Tsai (University of British Columbia), H. Zeng (British Columbia Cancer Research Centre), D. McLean (University of British Columbia), E. Ruvolo, N. Kollias (Johnson & Johnson Consumer and Personal Products WW) and H. Lui (University of British Columbia)*
11:40	1038	In Vivo Near-Infrared Auto-Fluorescence Imaging of Pigmented Skin Lesions: Methods and Preliminary Clinical Results *S. Wang (British Columbia Cancer Research Centre), S. Siow (University of British Columbia), J. Zhao (BC Cancer Research Centre), H. Lui (The Skin Care Center), D. McLean (University of British Columbia), Q. He (Northwest University) and H. Zeng (British Columbia Cancer Research Centre)*

In-vivo micro-endoscopy

Co-Chairs: Daniel Cote and Frances Tse

Time	Abs#	Title and Authors
13:30	1039	Optical Molecular Imaging for Translational Surgery *D. Farkas (Cedars-Sinai Medical Center)*
14:00	1040	Confocal Laser Endomicroscopy in Gastroenterology: Initial Clinical Experiences and Comments *D. Armstrong (McMaster University)*
14:30	1041	In Vivo Optical Imaging in Neuroscience: Video Rate Microscopy and Miniature Probes *D. Côté (CRULRG - Universite Laval)*
15:00	1042	Combining Multiphoton Microscopy with Optical Coherence Tomography Using Femtosecond Lasers *S. Tang (University of British Columbia)*
15:30		*Intermission (30 Minutes)*

Advanced spectroscopy and imaging

Co-Chairs: Daniel Farkas and Christopher D. Salthouse

Time	Abs#	Title and Authors
16:00	1043	New Exciting Transdisciplinary Frontiers: Femtobiology and Femtomedicine *Q. Lu (University of Waterloo)*
16:30	1044	Single-Wall Carbon Nanotubes Assisted Photothermal Cancer Therapy: Animal Study with a Murine Model of Squamous Cell Carcinoma *N. Huang (BC Cancer Research Centre), H. Wang (BC Cancer Research Center), J. Zhao (BC Cancer Research Centre), H. Lui (University of British Columbia), M. Korbelik (BC Cancer Research Centre) and H. Zeng (British Columbia Cancer Research Centre)*

Tuesday, April 27, 2010

Plaza B, 2nd Floor, Hyatt

Integrated Optoelectronics Technology and Applications

Co-Chairs: Qiyin Fang & Haiying Zhang

Time	Abs#	Title and Authors
08:30	1045	Mobile Micro- and Nano-Instruments: Small, Cheap and under Wireless Control *V. Karanassios (University of Waterloo)*
09:00	1046	Microfluidics for Integrated Optoelectronics *P. R. Selvaganapathy (McMaster Unversity)*
09:30	1047	Photonic-Integrated Microcytometers: Design, Simulation, Fabrication and Characterization *C. Xu, B. Watts, T. Kowpak, S. Zhu (McMaster University) and Z. Zhang (Institute for Microstructural Science)*
10:00		*Intermission (30 Minutes)*

10:30	1048	Ultraviolet Optical Flow Cell for Point-of-Use Water Disinfection *E. B. Stokes, J. Oliver, A. Giles, C. Monroe, C. Cilip, H. McEntyre (The University of North Carolina at Charlotte), J. Pagan and P. Batoni (Dot Metrics Technologies)*
11:00	1049	Wide Field Catadioptric System Design for Endoscopic Auto-Fluorescence Imaging *R. Wang, J. Deen and Q. Fang (McMaster University)*
11:30	1050	Applications of Flexible Conformable Ultrasound Arrays for Real-Time Imaging During Neurosurgery *W. Grundfest, M. Culjat, R. Singh (UCLA) and E. Brown (UCSB)*
12:00	1051	Magnetically Driven Scanning Microlens for Out-of-Plane In Vivo Medical Imaging *H. Mansoor (The University of British Columbia), H. Zeng (British Columbia Cancer Research Centre) and M. Chiao (The University of British Columbia)*

Miniaturized Optoelectronics Technology and Applications

Co-Chairs: Chang-Qing Xu & Yiqi Zhuang

Time	Abs#	Title and Authors
13:30	1052	Applying Biophotonics in Molecular Medicine *F. Chuang, T. Huser and D. Matthews (NSF Center for Biophotonics / UC Davis)*
14:00	1053	Miniaturized Multifunction Electronic Medical Solution *H. Zhang (Institute of Microelectronics of Chinese Academy of Sciences)*
14:30	1054	Planar Fluorescence Imaging *C. D. Salthouse (University of Massachusetts, Amherst)*
15:00	1055	High-Speed Ultra-Sensitive Biomedical CMOS Imagers *D. Palubiak and M. J. Deen (McMaster University)*
15:20	1056	A Novel CMOS Image Sensor Using Time-Domain Single-Photon Counting *M. M. El-Desouki, D. Palubiak, M. Deen and Q. Fang (McMaster University)*
15:40		*Intermission (20 Minutes)*

Spectroscopy and imaging for in-vivo applications

Co-Chairs: Frank Chuang and Warren Grundfest

Time	Abs#	Title and Authors
16:00	1057	Using Fluorescence Lifetime Imaging Microscopy to Monitor Photofrin Uptake, Redistribution, and Intracellular Microenvironment *S. Yeh, T. Collins, R. Leung (McMaster University), J. Jo, K. Diamond (Texas A&M University) and Q. Fang (McMaster University)*
16:20	1058	In Vivo Micro-Raman Spectroscopy of the Skin with Reflectance Confocal Imaging Guidance *H. Wang, N. Huang (BC Cancer Research Center), J. Zhao (BC Cancer Research Centre), H. Lui (The Skin Care Center), M. Korbelik (BC Cancer Research Center) and H. Zeng (British Columbia Cancer Research Centre)*
16:40	1059	New Multimodal Multiphoton Imaging and Spectroscopy Apparatus for Dermatology *A. Lee (BC Cancer Research Centre), H. Wang (BC Cancer Research Center), Y. Yu, J. Zhao (BC Cancer Research Centre), S. Tang (University of British Columbia), H. Lui (The Skin Care Center), D. McLean (University of British Columbia) and H. Zeng (British Columbia Cancer Research Centre)*

Optoelectronic Components and Applications I

Co-Chairs: Boon Ooi and Edward Stokes

Time	Abs#	Title and Authors
17:00	1060	Low-Electrical-Interference MEMS Mirror Array for Wavelength-Selective Switches *T. Sakata, M. Usui, S. Uchiyama, N. Shimoyama, J. Kodate, H. Ishii, T. Matsuura, F. Shimokawa and Y. Sato (NTT)*

17:30	1061	Broadband InAs/InP Quantum Dash Lasers *B. S. Ooi (King Abdullah University of Science and Technology), C. Tan, C. Chen and J. Hwang (Lehigh University)*

Wednesday, April 28, 2010

Plaza B, 2nd Floor, Hyatt

Optical Detectors and Imagers I

Co-Chairs: M Jamal Deen and Joe C. Campbell

Time	Abs#	Title and Authors
08:30	1062	Photodiodes with Monolithically Integrated RF Circuits *Y. Fu, H. Pan and J. Campbell (University of Virginia)*
09:00	1063	Photodetectors and Receivers for 100 GbE Applications *H. Bach (Fraunhofer Heinrich-Hertz-Institute)*
09:30	1064	Photocurrent Modeling of Resonant Tunneling Quantum Dot Infrared Photodetectors *M. A. Naser, M. J. Deen and D. Thompson (McMaster University)*
10:00		*Intermission (30 Minutes)*

Optical Detectors and Imagers II

Co-Chairs: Heinz-Gunter Bach and Paul Barton

Time	Abs#	Title and Authors
10:30	1065	Fabrication of Silicon Photomultipliers for the Readout of Scintillation Radiation Detectors *P. Barton and D. Wehe (University of Michigan)*
11:00	1066	Random Telegraph Signal Noise in CMOS Imagers and Its Impact on Image Quality *S. Majumder, M. M. El-Desouki, O. Marinov and M. J. Deen (McMaster University)*
11:20	1067	Electrochemically Prepared Photo-Sensitive Metal-Insulator-Semiconductor Devices with Stepped Insulating Layer *K. Stella, D. Kovacs (Universität Duisburg-Essen), W. Brezna, J. Smoliner (TU Wien) and D. Diesing (Universität Duisburg-Essen)*
11:40	1068	Ultravilet to Visible Detection by Silicon Nanostructures *S. Hu, C. Li and T. Li (National Taiwan Normal University)*

Fabrication of Optoelectronics Components

Co-Chairs: Lluis Marsal and El-Hang Lee

Time	Abs#	Title and Authors
13:30	1069	Polymer and Silicon Optical Wires and Devices for VLSI Photonic Circuit Application *E. Lee (Inha University)*
14:00	1070	Analysis of InAs Self-Assembled Quantum Wires in an $In_xGa_yAl_{1-x-y}As$ Matrix Grown Lattice Matched to InP *D. Thompson, K. Cui and G. Botton (McMaster University)*
14:30	1071	Fabrication and Electrical Characterization of Conducting Polymer Nanopillars by Current Sensing Atomic Force Microcopy *L. F. Marsal, A. Santos, R. Palacios, P. Formentin, J. Ferré-Borrull and J. Pallarès (University Rovira i Virgili)*
15:00	1072	Fabrication of Magneto-Optical Microstructure by Using Femtosecond Laser Direct Writing *Y. Li, B. Liu, Y. Li, W. Shi, J. Tian and Q. Sun (Nankai University)*
15:30	1073	Formation of Optically Transparent, Electrically Conductive Ga-Doped ZnO Fine Patterns by Wet-

		Chemical Etching Technique *N. Yamamoto, S. Osone, H. Makino, T. Yamada and T. Yamamoto (Kochi University of Technology)*
15:50		*Intermission (10 Minutes)*

Optoelectronic Components and Applications II

Co-Chairs: Hiromu Ishii and Mohamed Naser

Time	Abs#	Title and Authors
16:00	1074	Photoluminescence of GaN/Quantum Dots/GaN Wafer Bonded Structure *Y. Li and E. B. Stokes (The University of North Carolina at Charlotte)*
16:30	1075	Beam Propagation in Nano-Waveguide and Its Applications *Y. Li, L. Zhao, J. Qi, J. Xu and Q. Sun (Nankai University)*
17:00	1076	Experimental Study on Low-Frequency Noise in Optical Coupling Devices *Y. Zhuang, J. Bao and D. Lei (Xidian University)*
17:30	1077	Effect of Rear Surface Texture on Laser Irradiation Induced Group-III Interdiffusion in InAs/InAlGaAs Quantum Dash Structure *Y. Ding, H. Sun, C. Tan, V. Hongpinyo (Lehigh University), C. Dimas (Masdar Institute of Science and Technology), Y. Ding (Lehigh University) and B. S. Ooi (King Abdullah University of Science and Technology)*
18:00	1078	Enhancing the Performance of Photovoltaic Cells by Using Gold Nanoparticles and Periodic Arrays of Nanoholes on Gold Films *P. Wang, M. Rahman and A. Brolo (University of Victoria)*
18:20		Concluding Remarks (10 Minutes)