OSA Optics and Photonics Congress
OSA Biophotonics Congress: Optics in the Life Sciences

14–17 April 2019
Loews Ventana Canyon Resort
Tucson, Arizona, USA

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Thank you to all the Committee Members for contributing many hours to maintain the high technical quality standards of OSA meetings.

General Information

Registration

Grand Ballroom Foyer, Loews Ventana Canyon

Sunday, 14 April	12:00–18:00
Monday, 15 April	07:00–18:00
Tuesday, 16 April	07:00–17:30
Wednesday, 17 April	07:30–18:00

Online Access to Technical Digest

Full Technical Attendees have both EARLY and FREE continuous online access to the Congress Technical Digest and Post Deadline papers through OSA Publishing's Digital Library. The presented papers can be downloaded individually or by downloading .zip files, (.zip files are available for 60 days).

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Poster Presentation PDFs

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3. Scan the QR code

Schedule

Search for conference presentations by day, topic, speaker or program type. Plan your schedule by setting bookmarks on programs of interest.

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IMPORTANT: You will need to log in with your registration email and password to access the technical papers. Access is limited to Full Conference attendees only.

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Special Events

Hot Topic Discussions
Monday, 15 April, 13:00-13:45
Location: Patio

Join your colleagues for informal discussions on a selection of current hot topics. Round tables will be set on the back patio and a different topic will be featured at each table. Topics to be discussed include, Deep Learning for Quantitative Imaging Analysis, Artificial Intelligence in Optics and Photonics and Implicit Bias. You can also bring your own topic and host a table.

Please note that lunch will not be provided. We recommend that you visit the hotel's Visita Barista or Bill's Grill for lunch and then come on over with it.

Student & Early Career Professional Development & Networking Lunch and Learn
Monday, 15 April, 12:30–14:00
Location: Salon G

This program will provide a unique opportunity for students and early career professionals, who are close to finishing or who have recently finished their doctorate degree, to interact with experienced researchers. Key industry and academic leaders in the community will be matched to each student based on the student's preference or similarity of research interests. Students interested in all career paths — from those seeking an academic position, to those wishing to start a technology business, to those interested government/public service, to those looking to translate their benchwork skills to product development — are encouraged to apply. Students will have an opportunity to discuss their ongoing research and career plans with their mentors, while mentors will discuss their professional journeys and provide useful tips to those who attend.

This workshop is complimentary for OSA Members and space is limited. Not all who apply will be able to attend due to space limitations and priority will be given to those who have most recently graduated or are close to graduation.

Hosted By: OSA Foundation

Congress Reception
Monday, 15 April, 18:30–20:00
Location: Coyote Corral at Loews Ventana Canyon

Join your fellow attendees for the Congress Reception. Enjoy western fare while dancing the night away at the Coyote Corral. Directional signs will guide you to this special location. One reception ticket is included in the Full Technical Registration Fee. Guest tickets may be purchased for US $50.

Emerging Biomedical Applications of Nonlinear Optics
Tuesday, 16 April, 12:30–14:00
Location: Salon G

Join the OSA Nonlinear Optics Technical Group for this special event exploring potential applications for nonlinear optics within the field of biomedical optics. Our speakers will give short five-minute talks on their research, which is at the intersection of nonlinear optics and biomedical engineering, followed by a moderated question and answer session. This technical group event will also provide an opportunity for you to network with others who share an interest in this area. RSVP is required, please visit the registration desk to learn if space is available.

Hosted By: OSA Nonlinear Optics Technical Group

Joint Poster Sessions
Tuesday, 16 April 16:00–17:30
Location: Grand Ballroom Foyer

The Congress will feature a joint poster sessions with over 50 poster presentations. Posters are an integral part of the technical program and offer a unique networking opportunity, where presenters can discuss their results one-to-one with interested parties.

Presenters can display their posters starting Monday afternoon. This will allow additional time for attendees to view the posters before the formal session with the presenters. All poster need to removed by the Wednesday morning coffee break.

A Celebration of the Nobel Prize Winning Work of Arthur Ashkin
Tuesday, 16 April, 17:30–19:30
Location: Salon F

Attendees are invited to join the OSA Optical Trapping and Manipulation in Molecular and Cellular Biology Technical group as they celebrate the pioneering work of Dr. Arthur Ashkin. The event will bring together members of the optical trapping community to recognize Dr. Ashkin for receiving the 2018 Nobel Prize in Physics and to discuss his work in this area. Dr. Gabe Spalding of Illinois Wesleyan University will give a brief presentation reflecting on Ashkin's work, which will be followed by a networking reception bringing together researchers who share an interest in optical trapping and manipulation.

Hosted By: OSA Optical Trapping and Manipulation in Molecular and Cellular Biology Technical Group

Plenary Speakers

Valentina Emiliani, *Vision Institute Paris, France*

Toward Circuit Optogenetics

Valentina will present how recent joint progress in light delivering approaches, opsins engineering and laser sources development have brought the field of optogenetics into a new phase that we can name 'circuit optogenetics', where neural circuits can be optically interrogated with milli-second temporal precision and single-cell resolution.

Biography: Valentina Emiliani joined the Max Born Institute after having obtained her PhD in Physics in Rome in 1998. She investigate carrier transport in quantum wire by near field optical microscopy (SNOM). In 2002, she moved at the European Laboratory for Nonlinear Spectroscopy to lead a research group focused on the investigation of light propagation in disordered structure by SNOM. In 2002, she moved to Paris at the Institute Jacques Monod in Paris. Her interest was to study the role of mechanical forces on the establishment of cell polarity by optical tweezers. In 2005, she was awarded with the European Young Investigator grant and formed the "Wave front engineering microscopy" group at Paris Descartes University, pioneering the use of wave front shaping for neuroscience. Valentina became research director in 2011 and Director of the Neurophotonics laboratory in 2014.

In 2018, she moved her group at the Vision Institute in Paris where she has also taken the head of the photonics department. In 2015 she obtained the Prix "Coups d'élan pour la recherche française" from the Bettencourt-Shueller foundation and in 2017 the Axa chair "Investigation of visual circuits by optical wave front shaping ".

Aydogan Ozcan, *California NanoSystems Institute UCLA, USA*

Deep Learning-enabled Computational Microscopy and Sensing

Deep learning is a class of machine learning techniques that uses multi-layered artificial neural networks for automated analysis of signals or data. The name comes from the general structure of deep neural networks, which consist of several layers of artificial neurons, each performing a nonlinear operation, stacked over each other. Beyond its mainstream applications such as the recognition and labeling of specific features in images, deep learning holds numerous opportunities for revolutionizing image formation, reconstruction and sensing fields. In this presentation, Aydogan will provide an overview of some of our recent work on the use of deep neural networks in advancing computational microscopy and sensing systems, also covering their biomedical applications.

Biography: Aydogan Ozcan is the Chancellor's Professor at UCLA and an HHMI Professor with the Howard Hughes Medical Institute, leading the Bio- and Nano-Photonics Laboratory at UCLA and is also the Associate Director of the California NanoSystems Institute. Ozcan holds 38 issued patents and >20 pending patent applications and is the author of one book and the co-author of >500 peer-reviewed publications in major scientific journals and conferences.

Ozcan is the founder and a member of the Board of Directors of Lucendi Inc. and Holomic/Cellmic LLC, which was named a Technology Pioneer by The World Economic Forum in 2015. Ozcan is a Fellow of the International Photonics Society (SPIE), The Optical Society (OSA), the American Institute for Medical and Biological Engineering (AIMBE), the Institute of Electrical and Electronics Engineers (IEEE), the Royal Society of Chemistry (RSC), and the Guggenheim Foundation, and has received major awards including the Presidential Early Career Award for Scientists and Engineers, International Commission for Optics Prize, Biophotonics Technology Innovator Award, Rahmi M. Koc Science Medal, International Photonics Society Early Career Achievement Award, Army Young Investigator Award, NSF CAREER Award, NIH Director's New Innovator Award, Navy Young Investigator Award, IEEE Photonics Society Young Investigator Award and Distinguished Lecturer Award, National Geographic Emerging Explorer Award, National Academy of Engineering The Grainger Foundation Frontiers of Engineering Award and MIT's TR35 Award for his seminal contributions to computational imaging, sensing and diagnostics.

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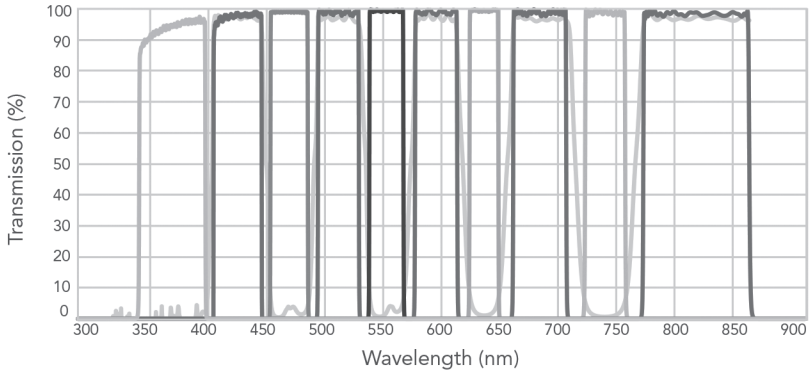

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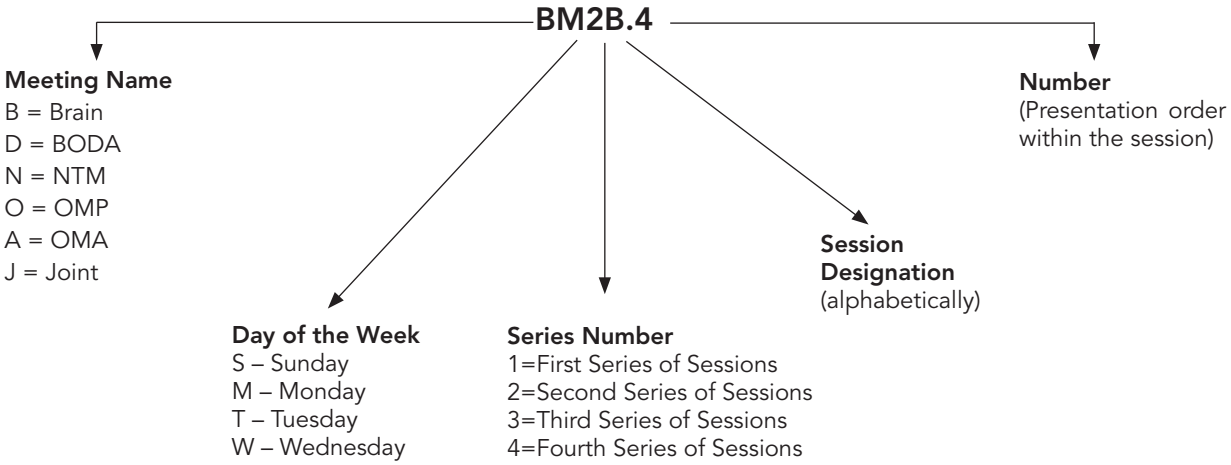
Explanation of Session Codes



The first letter of the code designates the meeting. The second element denotes the day of the week. The third element indicates the session series in that day (for instance, 1 would denote the first sessions in that day). Each day begins with the letter A in the fourth element and continues alphabetically through the parallel session. The lettering then restarts with each new series. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.).

For example, a presentation coded BM2B.4 indicates that this paper is being presented as part of the BRAIN meeting on Monday (M) in the second series of sessions (2), and is the second parallel session (B) in that series and the fourth paper (4) presented in that session.

Invited papers are noted with Invited

Plenaries are noted with Plenary

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Agenda of Sessions — Sunday, 14 April

	Salon J	Salon K & L
	BODA	NTM
12:00–18:00	**Registration,** *Grand Ballroom Foyer*	
13:00–15:00	**DS1A • Clinical Applications I**	**NS1B • Light Field and Interferometric Techniques**
15:00–15:30	**Coffee Break,** *Grand Ballroom Foyer*	
15:30–17:30	**DS2A • Clinical Applications II**	**NS2B • New Technologies**

Monday, 15 April

	Salon K & L	Salon I	Salon F	Salon J	Salon D
	BRAIN	BODA	NTM	OMP	OMA
07:00–18:00	**Registration,** *Grand Ballroom Foyer*				
08:30–10:00	**JM1A • Plenary Session,** *Salon B*				
10:00–10:30	**Coffee Break with Exhibitors,** *Grand Ballroom Foyer*				
10:30–12:30	**BM2A • Mapping Large Networks**	**DM2B • Endoscopy**	**NM2C • Nonlinear Micrsoscopy: Clinical Applications**	**OM2D • Imaging & the Immune System**	**AM2E • Biophysics I**
12:30–14:00	**Lunch Break On Your Own**				
12:30–14:00	**Student & Early Career Professional Development & Networking Lunch and Learn,** *Salon G* (Separate registration required)				
13:00–13:45	**Hot Topic Discussions,** *Patio*				
14:00–16:00	**BM3A • Precise Stimulation**	**DM3B • Tissue Oxygenation and Blood Flow**	**NM3C • Advances in Microscopy: Deep-Learning**	**OM3D • Monitoring Single Cells in Vivo**	**AM3E • Theory**
16:00–16:30	**Coffee Break with Exhibitors,** *Grand Ballroom Foyer*				
16:30–18:30	**BM4A • Functional Microscopy**	**DM4B • High-Speed, High-Throughput**	**NM4C • Tissue Microscopy: Applications to Tissue Mechanics and Disease**	**OM4D • Optical Imaging Tools for Surgery & Pathology**	**AM4E • Biophysics 2**
18:30–20:00	**Conference Reception,** *Coyote Corral at Loews Ventana Canyon*				

Key to Conference Abbreviations

BODA	Bio-Optics: Design and Application
BRAIN	Optics and the Brain
NTM	Novel Techniques in Microscopy
OMP	Optical Molecular Probes, Imaging and Drug Delivery
OMA	Optical Manipulation and Its Application

Agenda of Sessions — Tuesday, 16 April

	Salon K & L	Salon I	Salon F	Salon J	Salon D
	BRAIN	BODA	NTM	OMP	OMA
07:00–17:30	**Registration,** *Grand Ballroom Foyer*				
08:00–10:00	**BT1A • New Indicators**	**DT1B • Optical Imaging Technologies I**	**NT1C • Nonlinear Microscopy: Techniques, Technologies, and Applications I**	**OT1D • Improving Therapy with Light**	**AT1E • Nanothermodynamic**
10:00–10:30	**Coffee Break with Exhibitors,** *Grand Ballroom Foyer*				
10:30–12:30	**BT2A • Vascular Imaging**	**DT2B • Optical Imaging Techologies II**	**NT2C • Tissue Microscopy: Photoacoustic and Endoscopic Technologies**	**OT2D • Endogenous Optical Contrast Imaging**	**AT2E • Biological Applications**
12:30–14:00	**Lunch Break On Your Own**				
12:30–14:00	**Emerging Biomedical Applications of Nonlinear Optics,** *Salon G* (Advanced RSVP required)				
14:00–16:00	**BT3A • Behaving Brains**	**DT3B • Cellular Applications**	**NT3C • Tissue Microscopy: Tissue Structure and Dynamics**	**OT3D • Probes & Analytics for Multispectral Imaging**	**AT3E • Enhancing Techniques**
16:00–17:30	**JT4A • Poster Session and Coffee Break with Exhibitors,** *Grand Ballroom Foyer*				
17:30–19:30	**A Celebration of the Nobel Prize Winning Work of Arthur Ashkin,** *Salon F*				

Key to Conference Abbreviations

BODA	Bio-Optics: Design and Application
BRAIN	Optics and the Brain
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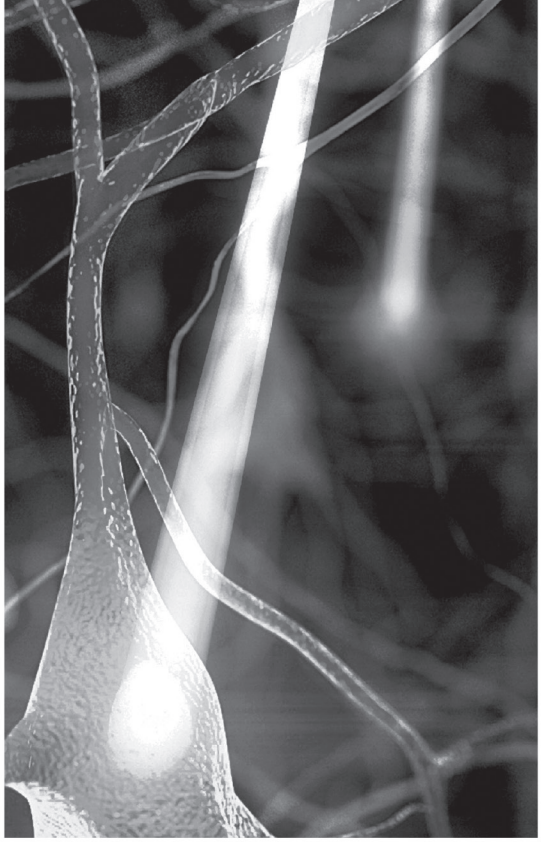
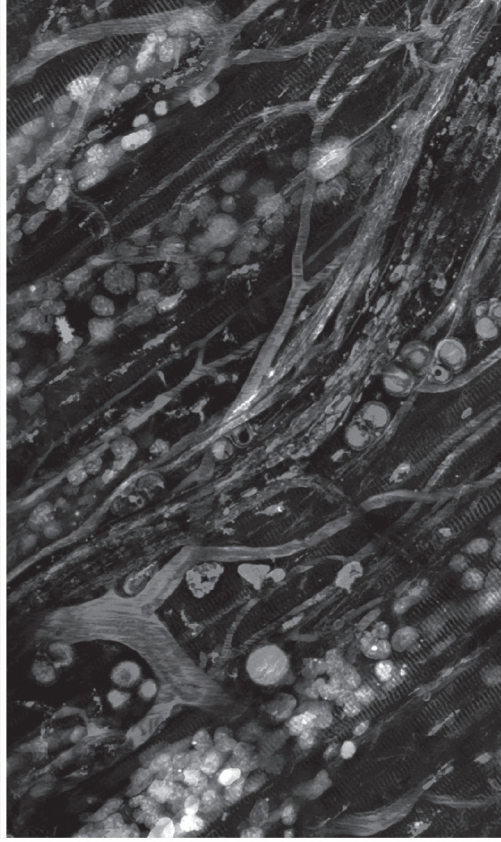
Agenda of Sessions — Wednesday, 17 April

	Salon K & L	Salon I	Salon F	Salon J	Salon D
	BRAIN	BODA	NTM	OMP	OMA
07:30–18:00	**Registration,** *Grand Ballroom Foyer*				
08:00–10:00	**BW1A • Human Brain Technology**	**DW1B • Sensing Applications**	**NW1C • Nonlinear Microscopy: Techniques, Technologies, and Applications II**	**OW1D • Quantitative Molecular Imaging using Dual Probel Strategies**	**AW1E • Materials**
10:00–10:30	**Coffee Break with Exhibitors,** *Grand Ballroom Foyer*				
10:30–11:30	**Selected Highlights and Future Directions for Optics in the Brain**	**DW2B • Micro/Nano Optics**	**NW2C • Superresolution Imaging**	**OW2D • Novel Optical Imaging Tools & Techniques**	**AW2E • Optothermal Manipulation**
11:45–12:30	**Postdeadline Papers** (See the Update Sheet for complete information)				
12:30–14:00	**Lunch Break On Your Own**				
14:00–16:00	**BW4A • Human Brain Applications**		**JW4C • Light Sheet Techniques (BODA and NTM)**	**OW4D • High Resolution Microscopy Techniques**	**AW4E • Nanotrapping**
16:00–16:30	**Coffee Break with Exhibitors,** *Grand Ballroom Foyer*				
16:30–18:30	**JW5B • Optical Windows into the Brain (BRAIN and BODA)**		**NW5C • Light Sheet Techniques**	**OW5D • Fluoresence Lifetime Imaging and Photoacoustic Imaging**	**AW5E • Soft Matter**

Key to Conference Abbreviations

BODA	Bio-Optics: Design and Application
BRAIN	Optics and the Brain
NTM	Novel Techniques in Microscopy
OMP	Optical Molecular Probes, Imaging and Drug Delivery
OMA	Optical Manipulation and Its Application

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Salon J

Bio-Optics: Design and Application

Salon K & L

Novel Techniques in Microscopy

12:00–18:00 Registration, *Grand Ballroom Foyer*

13:00–15:00
DS1A • Clinical Applications I
Presider: Jana Kainerstorfer; University of Arizona, USA

DS1A.1 • 13:00 Invited

Visualizing and Delivering Immunotherapeutics Through the Lymphatics, Eva M. Sevick-Muraca[1]; [1]*UT Health Science Center at Houston, USA.* The lymphatics provide access to regional lymph nodes where systemic immune responses are initiated. Optical imaging shows that immunotherapies can be delivered directly to the lymphatics for more effective response in cancer and autoimmune disorders.

DS1A.2 • 13:30

Angle-Restricted Fluorescent Optical Projection Tomography to Localize Micromets in Lymph Nodes, Veronica C. Torres[1], Chengyue Li[1], Lagnojita Sinha[1], Jovan G. Brankov[2], Kenneth M. Tichauer[1]; [1]*Biomedical Engineering, Illinois Inst. of Technology, USA;* [2]*Electrical and Computer Engineering, Illinois Inst. of Technology, USA.* Angle-constrained optical projection tomography and filtered backprojection reconstruction are sufficient to detect and localize the smallest clinically relevant metastases in excised porcine lymph nodes.

DS1A.3 • 13:45

Mid-infrared Spectroscopic Assessment of Cartilage Degeneration, Rubina S. Shaikh[1], Ervin Nippolainen[1], Vesa Virtanen[2], Lassi Rieppo[2], Julian Haas[3], Boris Mizaikoff[3], Viacheslav Artyushenko[4], Olga Bibikova[4], Isaac O. Afara[1], Simo Saarakkala[2], Juha Töyräs[1,5]; [1]*Univ. of Eastern Finland, Finland;* [2]*Research Unit of Medical Imaging, Physics and Technology, Faculty of Medicine, Univ. of Oulu, Finland;* [3]*Inst. of Analytical and Bioanalytical Chemistry, Ulm Univ., Germany;* [4]*Art photonics, GmbH, Germany;* [5]*School of Information Tech. and Electrical Engineering, The Univ. of Queensland, Australia.* We introduce classification models based on partial least squares discriminant-analysis (PLS-DA) for estimating cartilage integrity (assessed by OARSI grade) based on mid-infrared spectra of cartilage matrix. The best model achieved accuracy of 84%.

DS1A.4 • 14:00

Scanning Modulation for Speckle Reduction in Visible-light Optical Coherence Tomography of the Human Retina, Ian Rubinoff[1], Lisa Beckmann[1], Brian T. Soetikno[1], David Miller[1], Xian Zhang[1], Yuanbo Wang[2], Roman Kuranov[1,2], Hao F. Zhang[1,2]; [1]*Biomedical Engineering, Northwestern Univ., USA;* [2]*Opticent Health, USA.* We added rectangular modulation to traditional scan sequences using only a standard galvanometer scanner to reduce speckle in visible-light OCT images. This simple method increased contrast and revealed fine structures in the human retina.

DS1A.5 • 14:15

In-vivo Diffuse Reflectance for Bone Boundary Detection in Orthopedic Surgery, Stefan Andersson Engels[1], Katarzyna Komolibus[1], Konstantin Grygoriev[1], Ray Burke[1], Brian Wilson[2]; [1]*Tyndall National Inst., Ireland;* [2]*Univ. Health Network, Univ. of Toronto, Canada.* Real-time detection of tissue boundaries using diffuse reflectance could help prevent trauma in orthopedic surgery. The aim of this study is to differentiate between four different types of tissue based on results from in-vivo measurements.

DS1A.6 • 14:30

Development of handheld near-infrared spectroscopic medical imaging system, Manob Jyoti Saikia[1,2], Rajan Kanhirodan[1]; [1]*Indian Inst. of Science, USA;* [2]*Electrical, Computer and Biomedical Engineering, Univ. of Rhode Island, USA.* We present a handheld near-infrared spectroscopic imaging system. The system has a sensor pad and a controller for the high-speed 3D imaging of tissue wirelessly. Experimental results on a phantom prove working of the system.

DS1A.7 • 14:45

***In silico* Evaluation of Thermal Skin Damage Caused by Picosecond Laser Irradiation,** Yu Shimojo[1], Takahiro Nishimura[1], Hisanao Hazama[1], Nobuhiro Ito[2], Kunio Awazu[1,3]; [1]*Graduate School of Engineering, Osaka Univ., Japan;* [2]*Global Center for Medical Engineering and Informatics, Osaka Univ., Japan;* [3]*Graduate School of Frontier Biosciences, Osaka Univ., Japan.* An *in silico* method is proposed to evaluate thermal skin damage caused by picosecond laser irradiation. The results show the temperature rise and the thermal damage are noninferiority to a conventional nanosecond domain laser device.

13:00–15:00
NS1B • Light Field and Interferometric Techniques
Presider: Paco Robles; Georgia Institute of Tech., USA

NS1B.1 • 13:00 Invited

Fast, volumetric live-cell imaging using high-resolution light-field microscopy, Changliang Guo[1,2], Haoyu Li[3,4], Shu Jia[1,2]; [1]*Wallace H. Coulter Department of Biomedical Engineering, Georgia Inst. of Technology, USA;* [2]*Wallace H. Coulter Department of Biomedical Engineering, Emory Univ., USA;* [3]*Ultra-Precision Optoelectronic Instrument Engineering Center, Harbin Inst. of Technology, China;* [4]*Dept. of Biomedical Engineering, Stony Brook Univ. (SUNY), USA.* We report high-resolution LFM (HR-LFM) for live-cell imaging with a resolution of 300-700 nm in all three dimensions, an imaging depth of several micrometers, and a volume acquisition time of milliseconds.

NS1B.2 • 13:30

Artifact-free 3D Deconvolution for Light Field Microscopy, Zhi Lu[1], Jiamin Wu[1], Hui Qiao[1], Tao Yan[1], Zijing Zhou[1], Xu Zhang[1], Jingtao Fan[1], Qionghai Dai[1]; [1]*Tsinghua Univ., China.* We propose an artifact-free deconvolution method for light field microscopy by ptychographic iterations in phase space. Experiments on biological samples show the resolution enhancement with much less artifacts and computational cost.

NS1B.3 • 13:45

Fourier-Domain Light-Field Microscopy, Changliang Guo[1,2], Wenhao Liu[1,2], Shu Jia[1,2]; [1]*Wallace H. Coulter Dept. of Biomedical Engineering, Georgia Tech, USA;* [2]*Dept. of Biomedical Engineering, Emory Univ., USA.* We report a new type of light-field microscopy, allowing volumetric recording in the Fourier domain and rapid reconstruction using a wave-optics algorithm. We demonstrate the method by 3D particles tracking and imaging various biological samples.

NS1B.4 • 14:00

A Hyperspectral Microscope based on a Birefringent Ultrastable Common-Path Interferometer, Alessia Candeo[2], Bárbara Elza Nogueira de Faria[3], Gianluca Valentini[2], Andrea Bassi[2], Giulio Cerullo[2], Cristian Manzoni[1]; [1]*IFN-CNR, Italy;* [2]*Dipartimento di Fisica, Politecnico di Milano, Italy;* [3]*Departamento de Física, Universidade Federal de Minas Gerais, Brazil.* We describe a Fourier-transform hyperspectral microscope based on an ultrastable birefringent interferometer. The device has broad spectral coverage, high, short acquisition time. We present two setups, and examples in spectral imaging.

NS1B.5 • 14:15

Hyperspectral Microscope Based on a Birefringent Interferometer for Biomedical Imaging, Barbara Elza N. de Faria[1,2], Gladystone R. da Fonseca[1], Gianluca Valentini[2], Andrea Bassi[2], Giulio Cerullo[2], Cristian Manzoni[2], Ana M. de Paula[1]; [1]*UFMG, Brazil;* [2]*Politecnico di Milano, Italy.* We demonstrate a Fourier-transform hyperspectral microscope based on an ultrastable birefringent interferometer. As an application example, we obtained fluorescence image from a cancer tissue biopsy.

NS1B.6 • 14:30

Optical Diffraction Tomography Based on a Spatial Light Modulator for Biological Imaging, Ahmed Bassam S. Emam[1], Joowon Lim[1], Elizabeth Antoine[1], Demetri Psaltis[1]; [1]*EPFL, Switzerland.* Using a spatial light modulator instead of galvo-mirrors for scanning in tomographic systems, it is possible to obtain better image resolution while maintaining mechanical stability. Optimized computational algorithms can further enhance resolution.

NS1B.7 • 14:45

Depth-Extended High-Resolution Microscopy with Double-Ring Phase Modulation, Xuanwen Hua[1], Changliang Guo[1], Wenhao Liu[1], Shu Jia[1]; [1]*Biomedical Engineering, Georgia Tech., USA.* We report a depth-extended, high-resolution fluorescence microscopy with double-ring modulated Bessel beams. A 4-to-5-fold improved depth-of-focus and an axially-uniform PSF has been achieved for diffraction-limited, depth-extended cell imaging.

15:00–15:30 Coffee Break, *Grand Ballroom Foyer*

Salon J

Bio-Optics: Design and Application

15:30–17:30
DS2A • Clinical Applications II
Presider: Xingde Li; Johns Hopkins University, USA

DS2A.1 • 15:30 Invited

Monitoring and Guidance of Ablation Therapy with Optics, Christine P. Hendon[1]; [1]*Columbia University, USA.* I will highlight optical imaging and spectroscopy to monitor and guide radiofrequency ablation treatment of cardiac arrhythmias, which will directly interrogate the tissue for characterization for real time feedback to improve ablation therapy.

DS2A.2 • 16:00 Invited

Comparison of Frozen Sections and Nonlinear Imaging for Evaluation of Mohs Surgical Margins, Michael G. Giacomelli[1], Lucas C. Cahill[3], Tadayuki Yoshitake[3], Beverly Faulkner-Jones[2], Daihung Do[4], James Fujimoto[3]; [1]*Univ. of Rochester, USA;* [2]*Pathology, Beth Israel Deaconess Medical Center, USA;* [3]*EECS, Massachusetts Inst. of Technology, USA;* [4]*Dermatology, Beth Israel Deaconess Medical Center, USA.* We present the results of a study comparing two photon microscopy to conventional frozen sections for evaluating Mohs surgical margins during surgery for basal cell carcinoma.

DS2A.3 • 16:30

Light Sheet Microscopy of Human Skin In Vivo, Christopher D. Nguyen[1], Cheng Gong[1], Nachiket Kulkarni[1], Wenbin Zhu[1], Clara Curiel-Lewandrowski[1], Dongkyun Kang[1]; [1]*Univ. of Arizona, USA.* We demonstrated light sheet microscopy of human skin in vivo. Light sheet microscopy images of human forearm skin (image width = 3 mm) display microscopic features similar in appearance to reflectance confocal microscopy.

DS2A.4 • 16:45

Design of Epifluorescence Cervical Cancer Patch to Screen across Large Field-of-View, John Gawedzinski[1], Tomasz Tkaczyk[1]; [1]*Rice University, USA.* High-resolution endomicroscopy techniques are limited in field-of-view by the fiber optic probe size. We present a prototype for screening cervical tissue across a 25 mm field-of-view using a high-resolution image guide and image-stitching algorithm.

DS2A.5 • 17:00

A handheld confocal microscope with MEMS-based flat-field scanning for fluorescence-guided surgery, Linpeng Wei[1], Chengbo Yin[1], Sanjeewa Abeytunge[2], Gary Peterson[2], Michael Mandella[4], Milind Rajadhyaksha[2], Nader Sanai[3], Jonathan T. Liu[1]; [1]*Univ. of Washington, USA;* [2]*Memorial Sloan Kettering Cancer Center, USA;* [3]*Barrow Neurological Inst., USA;* [4]*Michigan State Univ., USA.* We developed a handheld line-scanned dual-axis confocal microscope for real-time optical biopsy. The device utilizes a MEMS-based scanning method for field-flattening, and provides high-speed (16 Hz) fluorescence imaging with sub-nuclear resolution.

DS2A.6 • 17:15

Automated Preprocessing of Near Infrared Spectroscopic Data, Jari E. Torniainen[1,2], Isaac O. Afara[1,2], Mithilesh Prakash[1,2], Jaakko K. Sarin[1,2], Lauri Stenroth[1], Juha Töyräs[1,2]; [1]*Dept. of Applied Physics, Univ. of Eastern Finland, Finland;* [2]*Diagnostic Imaging Center, Kuopio Univ. Hospital, Finland.* Preprocessing is important for near infrared spectroscopy applications as it reduces noise and improves prediction accuracy of models. We present a toolbox for automatically combining different preprocessing strategies for spectral data.

Salon K & L

Novel Techniques in Microscopy

15:30–17:30
NS2B • New Technologies
Presider: Conor Evans; Massachusetts General Hospital, USA

NS2B.1 • 15:30 Invited

Multiplexed quantitative imaging of cell´s molecular machinery with super-resolution microscopy, Melike Lakadamyali[1]; [1]*Univ. of Pennsylvania, USA.* Super-resolution microscopy has become an enabling technology to visualize subcellular structures and multi-protein complexes with near molecular level spatial resolution. However, major challenges remain in making these tools more useful for biological applications. In this talk I will highlight how we are overcoming some of these major technical challenges. I will talk about a novel method we developed to extend super resolution microscopy to image many colors in one shot in a high throughput manner taking advantage of frequency multiplexing. I will further highlight tools we have developed that enable us to count the copy number of proteins within molecular complexes using super-resolution microscopy.

NS2B.2 • 16:00

Measuring Rotational Dynamics with High Accuracy and Precision Using a Tri-spot Point Spread Function, Oumeng Zhang[1], Matthew D. Lew[1]; [1]*Washington Univ. in St. Louis, USA.* Fluorescence microscopy is limited to measuring even-order moments of dipole orientation, thereby causing bias when estimating molecular rotational dynamics. We designed a Tri-spot PSF that measures rotational constraint accurately and precisely.

NS2B.3 • 16:15

Single-shot 3D fluorescence microscopy with Fourier DiffuserCam, Fanglin L. Liu[1], Vaishnavi Madhavan[2], Nick Antipa[1], Grace Kuo[1], Saul Kato[2], Laura Waller[1]; [1]*Univ. of California, Berkeley, USA;* [2]*Univ. of California, San Francisco, USA.* We propose a single-shot 3D fluorescence microscope that achieves large FOV and good resolution across a wide axial range by inserting a diffuser into the Fourier plane of the objective. We show 3D results of a freely-moving C. elegans at 25 fps.

NS2B.4 • 16:30 Invited

Out-of-Phase Imaging after Optical Modulation for Micro- and Macro-scale Multiplexed Fluorescence Imaging Against Autofluorescence and Ambient Light, Ludovic Jullien[1], Ruikang Zhang[1], Raja Chouket[1], Jerome Querard[1], Marie-Aude Plamont[1], Zsolt Kelemen[2], Agathe Espagne[1], Alison Tebo[1], Arnaud Gautier[1], Lionel Gissot[2], Jean-Denis Faure[2], Vincent Croquette[3], Thomas Le Saux[1]; [1]*Chemistry, Ecole Normale Superieure, France;* [2]*Institut Jean-Pierre Bourgin, INRA, France;* [3]*Physics, Ecole Normale Superieure, France.* In micro- and macro-scale fluorescence imaging, Speed Out-of-Phase Imaging after Optical Modulation (Speed OPIOM) is shown to be highly efficient for multiplexed fluorescence imaging in the presence of autofluorescence and ambient light.

NS2B.5 • 17:00

Femto-Seq: A New Nonlinear Microcopy Approach for Elucidating Chromatin Structure at the Single Gene Level., Max Kushner[1], Juan Wang[1], Abdullah Ozer[1], Judhajeet Ray[1], Hening Lin[1], John Lis[1], Warren Zipfel[1]; [1]*Cornell University, USA.* Femto-Seq is a new nonlinear optical methodology that provides a means to determine the chromatin environment at the base-pair level at and around any site in the nucleus that can be identified by imaging.

Salon K & L	Salon I	Salon F
Optics and the Brain	Bio-Optics: Design and Application	Novel Techniques in Microscopy

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

07:00–18:00 Registration, *Grand Ballroom Foyer*

08:30–10:00
JM1A • Plenary Session, *Salon B*

JM1A.1 • 08:30 Plenary
Toward Circuit Optogenetics, Valentina Emiliani[1]; [1]*Vision Inst. Paris, France*. Valentina will present how recent joint progress in light delivering approaches, opsins engineering and laser sources development have brought the field of optogenetics into a new phase that we can name 'circuit optogenetics', where neural circuits can be optically interrogated with milli-second temporal precision and single-cell resolution.

JM1A.2 • 09:00 Plenary
Deep Learning-enabled Computational Microscopy and Sensing, Aydogan Ozcan[1]; [1]*Univ. of California Los Angeles, USA.* In this presentation, I will provide an overview of some of our recent work on the use of deep neural networks in advancing computational microscopy and sensing systems, also covering their biomedical applications.

10:00–10:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

10:30–12:30
BM2A • Mapping Large Networks
Presider: Pablo Blinder; Tel Aviv University, Israel

BM2A.1 • 10:30 Invited
High-Throughput Electrophysiological, Behavioral, or Social Event Triggered Imaging of Mouse Mesoscale Brain Activity, Timothy Murphy[1]; [1]*Univ. of British Columbia, Canada*. New systems for imaging mesoscale functional circuits in awake mice using genetically encoded sensors such as GCAMP6. Automated homecage mesoscale imaging, chronic single unit activity assessment, and social interaction imaging will be discussed.

BM2A.2 • 11:00 Invited
Multi-area two-photon imaging for investigating long-range cortical networks, Jerry Chen[1]; [1]*Boston University, USA*. Investigating how different cortical areas communicate with each other is critical for understanding brain function. We will describe new imaging technologies and their applications for simultaneous imaging of neuronal populations across multiple cortical areas.

BM2A.3 • 11:30
Chromatic serial multiphoton microscopy for high-content multiscale analysis of large brain volumes, Lamiae Abdeladim[1], Katie Matho[1,2], Solène Clavreul[2], Pierre Mahou[1], Jean-Marc Sintes[1], Xavier Solinas[1], Ignacio Arganda-Carreras[3], Anatole Chessel[1], Steve Turney[4], Jeff Lichtman[4], Alexis-Pierre Bemelmans[5], Karine Loulier[2], Willy Supatto[1], Jean Livet[2], Emmanuel Beaurepaire[1]; [1]*Ecole polytechnique, Lab for Optics and Biosciences, CNRS, Inserm, France;* [2]*Sorbonne Université, Inserm, CNRS, Institut de la Vision, France;* [3]*Ikerbasque, Spain;* [4]*Harvard Univ., USA;* [5]*MIRCen, CEA, CNRS, France*. Large-scale microscopy techniques are transforming brain imaging but lack efficient multi-contrast modalities. Our work combines two-photon wavelength-mixing and serial tomography microscopy to overcome this limitation.

10:30–12:30
DM2B • Endoscopy
Presider: Jennifer Barton; University of Arizona, USA

DM2B.1 • 10:30 Invited
Nano-optic endoscope: A new approach to endoscopic imaging, Hamid Pahlevaninezhad[1]; [1]*Harvard Medical School, USA*. This work establishes a new class of endoscopic optical imaging catheters, termed nano-optic endoscopes, that uses metalenses with ability to modify the phase of light at sub-wavelength level enabling high-resolution imaging at extended depth-of-focus.

DM2B.2 • 11:00 Invited
Updates on Fiber-optic Nonlinear Endomicroscopy, Xingde Li[1]; [1]*Johns Hopkins Univ., USA*. We will present recent key technological developments of nonlinear endomicroscopy for improving imaging frame rate and SNR. Representative applications, including brain imaging on freely-walking rodents and assessment of preterm-birth risk, will also be discussed.

DM2B.3 • 11:30
High-Resolution Endomicroscopy with a Spectrally Encoded Miniature Objective, Hamin Jeon[1], Michal Pawlowski[1], Tomasz Tkaczyk[1]; [1]*Rice University, USA*. Fiber bundle consists of limited number of cores, which leads to limited spatial sampling. We present a custom-fabricated, spectrally encoded, miniature endomicroscopic objective that can be coupled to a fiber bundle to overcome its sampling limit.

10:30–12:30
NM2C • Nonlinear Microscopy: Clinical Applications
Presider: Connor Evans; Massachusetts General Hospital, USA

NM2C.1 • 10:30 Invited
Recent Advances in Multiphoton Microscopy for Clinical Skin Imaging, Mihaela Balu[1], Griffin Lentsch[1], Anand Ganesan[2], Ronald Harris[2], Janellen Smith[2], Kenneth Linden[2], Patrick Lee[2], Karsten Koenig[3,4], Christopher Zachary[2], Kristen Kelly[2], Bruce Tromberg[1]; [1]*Beckman Laser Inst., Univ. of California, Irvine, USA;* [2]*Dermatology Dept., Univ. of California, Irvine, USA;* [3]*Dept. of Biophotonics and Laser Technology, Saarland Univ., Germany;* [4]*JenLab, GmbH, Germany.* This presentation will discuss recent advances in multiphoton microscopy (MPM) as a tool for in-vivo imaging of human skin to evaluate MPM's potential to enhance the diagnostic accuracy of skin diseases and guide effective treatment.

NM2C.2 • 11:00 Invited
Pharmacokinetic Tomography of Cutaneous Drug Delivery with Advanced Fluorescence Microscopy, Kin F. Chan[1], Maiko Hermsmeier[1], Sinyoung Jeong[2], Sam Osseiran[2,3], Alexander Fast[2], Xin Chen[1], Akira Yamamoto[1], Conor L. Evans[2]; [1]*BioPharmX, Inc., USA;* [2]*Wellman Center for Photomedicine, Harvard Medical School, USA;* [3]*Harvard-MIT Division of Health Sciences and Technology, USA.* Cutaneous pharmacokinetics of active ingredients with two-photon excited fluorescence lifetime imaging enabled single-daily dose drug visualization and distribution with higher sensitivity and specificity.

NM2C.3 • 11:30
In Vivo Label-free Multiphoton Microscopy for Monitoring Delayed Skin Wound Healing, Jake D. Jones[1], Hallie E. Ramser[1], Alan E. Woessner[1], Kyle P. Quinn[1]; [1]*Univ. of Arkansas, USA.* Using an optical redox ratio of FAD/(NADH+FAD) autofluorescence and fluorescence lifetime imaging, we demonstrate differences in skin wound metabolism between aged and young mice through longitudinal monitoring over 10 days.

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

07:00–18:00 Registration, *Grand Ballroom Foyer*

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10:00–10:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

10:30–12:00
OM2D • Imaging & the Immune System
Presider: Tomasz Zal; Univ. of Texas M. D. Anderson Ctr. USA

OM2D.1 • 10:30 Invited
Intravital optical imaging and spectroscopy to monitor tumor therapeutic and immune response, Gregory M. Palmer[1]; [1]*Duke University., USA*. Functional intravital spectroscopy and imaging provides a means of monitoring the longitudinal time course of therapy. We demonstrate the ability to monitor tumor therapeutic response using portable sensors suitable for monitoring awake animals

OM2D.2 • 11:00 Invited
Macrophage-mediated Drug Delivery for the Treatment of Gliomas, Steen Madsen[1], Stephanie Molina[1], Henry Hirschberg[2]; [1]*Univ. of Nevada, Las Vegas, USA;* [2]*Univ. of California, Irvine, USA. In vitro* studies demonstrated the efficacy of macrophage-delivered chemotherapeutics. Macrophages are resistant to chemotherapeutics and release drugs in cell suspensions. Applications in light-based therapeutics will be discussed.

OM2D.3 • 11:30 Invited
Detecting inflammatory responses in live animal models with near-infrared ROS probes, Haiying Zhou[3], Walter Akers[2], Steven Brody[3], Matthew Wood[3], Mikhail Y. Berezin[3,1]; [1]*Chemistry, Washington Univ., USA;* [2]*St. Jude Children's Research Hospital, USA;* [3]*Washington Univ. School of Medicine, USA.* Near-infrared contrast agents and optical methods are useful in detection of reactive oxygen species in vivo in the small animal models of acute lung injury, angiogenesis and peripheral neuropathies

10:30–12:30
AM2E • Biophysics 1
Presider: Frank Cichos; Univ. Leipzig, Germany

AM2E.1 • 10:30 Invited
Determination of twisting of kinesin molecules during stepping, Basudev Roy[1], Avin Ramaiya[2], Erik Schaffer[2]; [1]*Indian Inst. of Technology, Madras, India;* [2]*Univ. of Tuebingen, Germany.* Kinesin molecules "walk" on microtubules with 8 nm steps. We find that it simultaneously twists during motility, probed by attaching birefringent microspheres of liquid crystalline material RM257 (Merck) under optical micro protractor.

AM2E.2 • 11:00 Invited
Ultrafast Force-Clamp Spectroscopy: Dissecting Rapid Interactions Between Biomolecules, Marco Capitanio[1,2]; [1]*University of Florence, Italy;* [2]*LENS, Italy.* Ultrafast force-clamp spectroscopy is a constant-force laser trap technique with microsecond and sub-nanometer resolution. We present applications to protein-DNA interaction, molecular motors and mechanosensitive proteins at the single molecule level

AM2E.3 • 11:30
Single Amyloid Fibrils Studied in a Thermophoretic Trap, Martin Fränzl[1], Tobias Thalheim[1], Juliane Adler[1], Daniel Huster[1], Frank Cichos[1]; [1]*Leipzig Univ., Germany.* The aggregation of proteins into amyloid fibrils is fundamental for the understanding of neurodegenerative disorders. Here, we demonstrate a method for the investigation of growth and breakup of single $A\beta_{40}$ amyloid fibrils in a thermophoretic trap.

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

BM2A • Mapping Large Networks—Continued

BM2A.4 • 11:45
Excitatory and inhibitory circuits differentially regulate local and distant cerebral hemodynamics, Joonhyuk Lee[1], Annie R. Bice[1], Zachary Rosenthal[1], Jin-Moo Lee[1], Adam Q. Bauer[1]; [1]*Washington Univ. School of Medicine, USA.* Optogenetic photostimulation of excitatory or inhibitory circuits differentially regulated local cerebral blood volume and flow in awake, transgenic mice. Each neural subclass also uniquely influenced distant cortical hemodynamic activity.

BM2A.5 • 12:00
Anesthesia affects forepaw motor output and movement complexity during light-based motor mapping, Trevor R. Voss[1], Annie R. Bice[1], Jin-Moo Lee[1], Adam Q. Bauer[1]; [1]*Washington Univ. School of Medicine, USA.* We used automated light-based optogenetic mapping in Thy1-ChR2 mice to map forepaw motor movements under titrated levels of ketamine anesthesia. Anesthesia dose affected the amplitude, direction, and complexity of photostimulus-evoked movement types.

BM2A.6 • 12:15
Patterns of Intrinsic Neural and Hemodynamic Activity Recover Uniquely Following Stroke, Byungchan Kim[1], Zachary Rosenthal[1], Joseph Culver[1], Jin-Moo Lee[1], Adam Q. Bauer[1]; [1]*Washington Univ. in St. Louis, USA.* Longitudinal functional imaging of intrinsic and stimulus-evoked neural and hemodynamic activity was performed in mice pre- and post-stroke. Hemodynamic connectivity is restored by 8 weeks while neural activity patterns are permanently affected.

DM2B • Endoscopy—Continued

DM2B.4 • 11:45
A Clinically Compatible Handheld Fluorescence Lifetime Imaging (FLIM) Endoscope for Label-Free Metabolic Imaging of Oral Cancer, Oscar R. Benavides[1], Michael Serafino[1], Jesus Rico-Jimenez[1], Shuna Cheng[1], Javier Jo[1]; [1]*Texas A&M BME, USA.* A compact and robust handheld FLIM endoscope has been developed for label-free metabolic imaging of oral cancer. Its performance has been optimized for noninvasive and fast in situ clinical metabolic imaging of the oral mucosa.

DM2B.5 • 12:00
Ultrathin Lensless Fiber Endoscope with in Situ Calibration for 3D Imaging, Juergen W. Czarske[1], Elias Scharf[1], Robert Kuschmierz[1]; [1]*Technische Universität Dresden, Germany.* We present a holographic endoscope with tiny footprint. A novel non-invasive in situ calibration of a coherent fiber bundle in combination with a galvanometer scanner enables fast, minimally invasive 3D measurements.

DM2B.6 • 12:15
Model and evaluation of face forward illumination for multimodal endoscopic probes, David Vega[1], Jennifer K. Barton[1]; [1]*University of Arizona, USA.* Multimodal probes with microscopy capabilities can obtain high-resolution images of tissue without additional probes. Initial results of modeling and evaluation of the optical performance predict the possible feasibility of the multimodal system.

NM2C • Nonlinear Microscopy: Clinical Applications—Continued

NM2C.4 • 11:45
Utilization of second harmonic generation imaging for tissue classification of serous tubal intraepithelial carcinoma, Eric Rentchler[1], Kristal L. Gant[2], Manish Patankar[2], Paul Campagnola[1]; [1]*Dept. of Biomedical Engineering, The Univ. of Wisconsin-Madison, USA;* [2]*Dept. of Obstetrics and Gynecology, The Univ. of Wisconsin-Madison, USA.* Second harmonic generation imaging is used to image human fallopian tube histological tissue slices. The resulting images were used to classify distal, serous tubal intraepithelial carcinoma, and high grade serous carcinoma.

NM2C.5 • 12:00 Invited
Stimulated Raman imaging of vibrational tags: pushing new frontiers of light microscopy, Wei Min[1]; [1]*Columbia Univ., USA.* While the label-free imaging has been the prevailing strategy in Raman microscopy, recent development and applications of vibrational tags, particularly when coupled with stimulated Raman Scattering (SRS) microscopy, have enabled new and exciting capabilities for bio-imaging.

12:30–14:00 Lunch Break On Your Own

12:30–14:00 Student & Early Career Professional Development & Networking Lunch and Learn, *Salon G*
(Separate registration required)

13:00–13:45 Hot Topic Discussions, *Patio*

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

AM2E • Biophysics 1—Continued

AM2E.4 • 11:45
Withdrawn

AM2E.5 • 12:00 Invited
Dual-beam laser traps – the other optical trap Arthur Ashkin invented, Gheorghe Cojoc[1], Paul Müller[1], Mirjam Schürmann[1], Kyoohyun Kim[1], Jochen Guck[1,2]; [1]*Center for Molecular and Cellular Bioengineering (CMCB), Technische Universität Dresden, Germany;* [2]*Max Planck Inst. for the Science of Light, Germany.* While optical tweezers are quite ubiquitous, dual-beam laser traps are much less known, despite them predating optical tweezers by almost two decades. I will review their history and provide an overview of current applications

12:30–14:00 Lunch Break On Your Own

12:30–14:00 Student & Early Career Professional Development & Networking Lunch and Learn, *Salon G*
(Separate registration required)

13:00–13:45 Hot Topic Discussions, *Patio*

Salon K & L

Optics and the Brain

Salon I

Bio-Optics: Design and Application

Salon F

Novel Techniques in Microscopy

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

14:00–16:00
BM3A • Precise Stimulation
Presider: Alipasha Vaziri; The Rockefeller University, USA

BM3A.1 • 14:00 Invited

Fast 3D imaging and photostimulation by 3D acousto-optical microscopy revealed spatiotemporally orchestrated clusters in the visual cortex, Gergely Szalay[1], Zoltán Szadai[1], Linda Judák[1], Pál Maák[3], Katalin Ócsai[2], Máté Veress[3], Tamás Tompa[1], Balázs Chiovini[1], Gergely Katona[1,2], Balazs Rozsa[1,2]; *[1]Inst. Exp. Medicine, Hungarian Acad Sci, Hungary; [2]PPCU, Hungary; [3]Dept. of Atomic Physics, BME, Hungary.* Fast 3D imaging and simultaneous holographic simulation by 3D acoustooptical (AO) microscopy shows visual information being represented in spatiotemporally orchestrated clusters of neuronal assemblies in the visual cortex and changing due to learning

BM3A.2 • 14:30

Precise optical probing of perceptual detection, Gilad M. Lerman[1], Jonathan V. Gill[1,2], Dmitry Rinberg[1,2], Shy Shoham[1,3]; *[1]NYU Neuroscience Inst., New York Univ. Langone Health, USA; [2]Center for Neural Science, New York Univ., USA; [3]Tech4Health Inst., New York Univ. Langone Health, USA.* We developed and used holographic two-photon optogenetic stimulation to probe the detection of evoked neuronal activity at cellular and single action potential resolution, with millisecond precision, while ruling out detection of indirect effects.

BM3A.3 • 14:45

High-efficiency Holographic Stimulation of Blue Light-sensitive Excitatory Opsins *In Vivo*, Angelo Forli[2], Yoav Printz[1], Ofer Yizhar[1], Tommaso Fellin[2]; *[1]Department of Neurobiology, Weizmann Inst. of Science, Israel; [2]Department of Neuroscience and Brain Technologies, Istituto Italiano di Tecnologia, Italy.* We performed two-photon holographic stimulation of blue light-sensitive excitatory opsins using high- and low-repetition rate lasers and we demonstrate high-efficiency neural stimulation with few mW average power *per* cell in the intact mouse cortex.

BM3A.4 • 15:00

Holographic display for optical retinal prosthesis: design and validation, Shani Rosen[1], Shy Shoham[2]; *[1]Technion Israel Inst. of Technology, Israel; [2]NYU Langone Health, Tech4Health Inst., USA.* We study and design an optimized holographic display for optical retinal prosthesis and provide evidence for the ability of normally sighted individuals aided by the device to perform high-acuity demanding visual tasks.

BM3A.5 • 15:15

Holographic Display and Volumetric Light Sculpting by Dynamic Synthesis of 4d Light Fields, Nicolas C. Pegard[1,2], Laura Waller[1], Hillel Adesnik[2]; *[1]Electrical Engineering and Computer Science, Univ. of California, Berkeley, USA; [2]Molecular and Cell Biology, Univ. of California, Berkeley, USA.* We synthesize custom light fields by simultaneously modulating light in the spatial and angular domain. Experimental results show new applications for high-resolution 3D displays and high-speed sculpted illumination with enhanced depth selectivity.

14:00–16:00
DM3B • Tissue Oxygenation and Blood Flow
Presider: Brian Applegate; Texas A&M University, USA

DM3B.1 • 14:00 Invited

Oxygen Sensing Tools from the Bench to the Beside, Conor L. Evans[1]; *[1]Massachusetts General Hospital, USA.*Low tissue oxygenation can lead to a host of problems making the detection and quantification of tissue oxygen concentration important. We have developed tissue pO2 sensing technologies for application for wounds and tissue monitoring.

DM3B.2 • 14:30 Invited

Blood Flow Regulation and Neurovascular Coupling in the Healthy and Diseased Brain, Jana M. Kainerstorfer[1]; *[1]Carnegie Mellon University, USA.* Intracranial pressure influences blood flow regulation and neuro-vascular coupling, which are impaired in traumatic brain injury. We are developed non-invasive ways of measuring intracranial pressure by using near-infrared spectroscopy in order to guide treatment.

DM3B.3 • 15:00

Improving accuracy of visible-light OCT oximetry in rodents and humans, Hao F. Zhang[1], Brian T. Soetikno[1], Lisa Beckmann[1], Xian Zhang[1], Ian Rubinoff[1], Roman Kuranov[1]; *[1]Northwestern Univ., USA.* We developed a combined cross-correlation and graph-search segmentation techniques, to reliably extract the backscattered light spectrum so that we can improve the accuracy of retinal oximetry using visible-light OCT.

DM3B.4 • 15:15

Optical Speckle Image Correlation Velocimetry (OSICV) - A New Quantitative Blood Flow Imaging Tool, Abdul. M. Safi[1], Muhammad Mohsin Qureshi[2], Yan Liu[3], Euiheon Chung[2]; *[1]Electrical Engineering, Univ. of South Florida, USA; [2]BMSE, Gwnagju Inst. of Science and Technology, Korea (the Republic of); [3]Electrical Engineering, Caltech, USA.* We developed a speckle based imaging technique that can provide absolute blood flow velocity noninvasively. We demonstrated that this technique can provide the flow speed and direction in an *in vivo* mouse mesentery vessel.

14:00–16:00
NM3C • Advances in Microscopy: Deep-Learning
Presider: Kyle Quinn; University of Arkansas, USA

NM3C.1 • 14:00 Invited

Deep-Learning Stimulated Raman Scattering Microscopy, Ji-Xin Cheng[1]; *[1]Boston Univ., USA.* We present a stimulated Raman scattering imaging system which acquires a Raman spectrum within 20 µs. A U-Net deep learning network is applied to maintain the sensitivity at high speeds, enabling high-throughput label-free spectroscopic imaging of cells and tissues.

NM3C.2 • 14:30 Invited

DeepLFM: Deep Learning-based 3D Reconstruction for Light Field Microscopy, Xiaoxu Li[1], Hui Qiao[1], Jiamin Wu[1], Zhi Lu[1], Tao Yan[1], Ruxin Zhang[1], Xu Zhang[1], Qionghai Dai[1]; *[1]Tsinghua Univ., China.* We propose a high-resolution 3D reconstruction method for light field microscopy via deep learning. Experimental results on K562 cells verify its superior performance, which exhibit less artifacts especially near the native object plane.

NM3C.3 • 15:00

Deep Learning Based Tomographic Phase Microscopy with Blind Structured Illumination, Chang Qiao[1], Hui Qiao[1], Jiamin Wu[1], Xiaoxu Li[1], Jingtao Fan[1], Qionghai Dai[1]; *[1]Department of Automation, Tsinghua Univ., China.* Deep learning based tomographic phase microscopy with blind structured illumination is a unique imaging mechanism combining simplified optical design with deep neural network. The simulation results show DeepTomo has high spatiotemporal resolution.

NM3C.4 • 15:15

Fluorescent Lifetime Imaging improved via Deep Learning, Jason T. Smith[2], Nathan Un[2], Ruoyang Yao[2], Nattawut Sinsuebphon[2,3], Alena Rudkouskaya[1], Joseph Mazurkiewicz[1], Margarida Barroso[1], Pingkun Yan[2], Xavier Intes[2]; *[1]Albany Medical College, USA; [2]Rensselaer Polytechnic Inst., USA; [3]Medical Imaging System Tech. Research Team, National Science and Tech. Development Agency, Thailand.* We present a novel workflow based on Deep Learning trained on synthetic data to quantify fluorescence lifetime imaging of experimental data across multiple microscopic and macroscopic applications with unprecedented accuracy and computational speed.

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

14:00–16:00
OM3D • Monitoring Single Cells In Vivo
Presider: Brian Pogue; Dartmouth, USA

OM3D.1 • 14:00 Invited
Intravital Imaging of Bone Remodeling and Cross Talk with Hematpoietic Stem Cell Activity, Charles P. Lin[1,2], Allison Yeh[1,2], Joel Spencer[3], Constantina Christodoulou[4], Fernando Camargo[4]; [1]*Massachusetts General Hospital, USA;* [2]*Harvard Medical School, USA;* [3]*School of Engineering, Univ. of California Merced, USA;* [4]*Harvard Stem Cell Inst., USA.* Bone is a living tissue. We show here that bone remodeling is important not only for maintenance of the skeleton, but also for the biology of hematopoietic stem cells residing within the bone marrow.

OM3D.2 • 14:30 Invited
Polyscopic Imaging of Window Chamber Mouse Models, Arthur F. Gmitro[1]; [1]*Biomedical Engineering, Univ. of Arizona, USA.* Window chambers implanted into mice provide a means to visualize molecular, cellular, and physiologic processes in vivo. Imaging via optical, nuclear, ultrasound, and MRI can be used to provide a comprehensive understanding of disease.

OM3D.3 • 15:00 Invited
Shedding Diffuse Light on Circulating Tumor Cell Mediated Metastasis, Mark Niedre[1]; [1]*Northeastern University, USA.* We recently developed new technology to detect rare, fluorescently-labeled circulating tumor cells (CTC) and clusters with diffuse light. We discuss the use of this technology in studying CTC dissemination in small animal cancer metastasis models.

14:00–16:00
AM3E • Theory
Presider: Agnese Callegari; Bilkent University, Turkey

AM3E.1 • 14:00 Invited
Self Field, Radiated Energy, and Radiated Linear Momentum of an Accelerated Point Charge, Masud Mansuripur[1]; [1]*Univ. of Arizona, USA.* Working within the framework of the classical theory of electrodynamics, we derive an exact mathematical solution to the problem of self-field (or radiation reaction) of an accelerated point-charge traveling in free space.

AM3E.2 • 14:30
Theoretical Limits of Nanoparticle Optical Manipulation, Jeffrey E. Melzer[1], Euan McLeod[1]; [1]*Univ. of Arizona, USA.* Efficient translation of nanoparticles using optical tweezers (OT) is critical in OT-based methods such as micro- and nano-assembly. We investigate the limits of OT nanoparticle manipulation, achieving record lateral translation speeds of ~0.17 mm/s.

AM3E.3 • 14:45
Theoretical study of particle escaping from moving standing wave, Guanghui Wang[1], Yao Chang[1]; [1]*Nanjing Univ., China.* In term of escaping rate and trapping time, we give a general and systematic investigation on the dynamic properties of trapped nanoparticles in the moving standing wave theoretically and numerically.

AM3E.4 • 15:00
Accurate Dipole Modeling of Forces on a Metallic Nanoparticle With a Larger Radius Than Skin Depth, Weilin Liu[1], Euan McLeod[1]; [1]*Univeristy of Arizona, USA.* Light scattered by and optical forces on metal nanoparticles are widely calculated using a dipole model. Often, an effective volume based on the skin depth is used. We show that this effective volume reduces accuracy.

AM3E.5 • 15:15
Angular momenta and negative azimuthal forces induced on a particle via guided light in ultrathin optical fibers, Viet Giang Truong[1], Ivan Toful[1], Fam Le Kien[1], Mihail I. Petrov[2], Sile Nic Chormaic[1]; [1]*LMI Unit, Okinawa Inst. of Science & Tech., Japan;* [2]*Meta Lab, ITMO Univ., Russian Federation.* We calculate forces acting on a Mie particle in the evanescent field of a microfiber. Theoretical and experimental observations indicate that quasicircularly polarized light guided in the fiber can exert a negative azimuthal force on particles.

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

BM3A • Precise Stimulation—Continued

BM3A.6 • 15:30
Pulsed Infrared Light Evokes Astrocytic Calcium Signaling in a Label-Free Format, Wilson R. Adams[1], Ana I. Borrachero-Conejo[2], Manqing Wang[3], Emanuela Saracino[4], Tamara Posati[2], Roberto Zamboni[4], Marco Caprini[5], Grazia Paola Nicchia[6], E Duco Jansen[1,7], Valentina Benfenati[4], Anita Mahadevan-Jansen[1,7]; [1]*Dept. of Biomedical Engineering, Vanderbilt Univ., USA;* [2]*Istituto per lo studio dei materiali nanostrutturati, CNR-ISMN, Italy;* [3]*Bioengineering College, Chongqing Univ., China;* [4]*Istituto per lo Sintesi Organica e la Fotoreattività, CNR-ISOF, Italy;* [5]*Dept. of Biotechnology and Pharmacology, Univ. of Bologna, Italy;* [6]*Dept. of Bioscience, Biotechnology, and Biopharmacology, Univ. of Bari, Italy;* [7]*Dept. of Neurosurgery, Vanderbilt Univ. Medical Center, USA.* To begin understanding how pulsed infrared light modulates brain tissues *in vivo*, we explored its effects on isolated cortical astrocytes *in vitro*. Pulsed IR light may be a useful tool to study glial physiology.

BM3A.7 • 15:45
Multiline Orthogonal Scanning Temporal Focusing (mosTF) microscopy for reducing scattering in high-speed in vivo brain imaging, Yi Xue[1], Josiah R. Boivin[1], Elly Nedivi[1], Peter So[1]; [1]*Massachusetts Inst. of Technology, USA.* Temporal focusing microscopy is used for in vivo brain imaging but influenced by tissue scattering. We developed Multiline Orthogonal Scanning Temporal Focusing microscopy that reduces scattering by reassignment of scattered emission photons.

DM3B • Tissue Oxygenation and Blood Flow—Continued

DM3B.5 • 15:30
Early Detection of Pressure Injury using Noninvasive Diffuse Correlation Spectroscopy, Alec Lafontant[1], Michael T. Neidrauer[1], Michael Weingarten[1], Rose Ann DiMaria-Ghalili[1], Guy Fried[2], Peter Lewin[1], Leonid Zubkov[1]; [1]*Drexel Univ., USA;* [2]*Magee Rehabilitation Hospital, USA.* Diffuse correlation spectroscopy was used to measure blood flow index (BFI) in rehabilitation patients with spinal cord injuries. Significant differences in BFI were found between patients who developed pressure injuries and those who did not.

DM3B.6 • 15:45
Assessment of *in vivo* Diabetic Wounds using Optical Metabolic Imaging, Mahsa Ranji[1]; [1]*Univ. of Wisconsin-Milwaukee, USA.* Diabetes is known to cause delayed wound healing, and extremity diabetic ulcers may end with lower limb amputations and mortalities. Optical imaging shows that diabetes alters wounds mitochondrial redox state due to higher oxidative stress.

NM3C • Advances in Microscopy: Deep-Learning—Continued

NM3C.5 • 15:30 Invited
3D histology with deep learning fluorescence microscopy, Nicholas J. Durr[1], Faisal Mahmood[1], Bihe Hu[2], Katherine N. Elfer[2], Daniel Borders[1], J. Quincy Brown[2]; [1]*Biomedical Engineering, Johns Hopkins Univ., USA;* [2]*Biomedical Engineering, Tulane Univ., USA.* We present unsupervised adversarial image translation to reconstruct 3D H&E images from fluorescence microscopy of tissues labeled with DRAQ5 and Eosin. This approach enables accurate H&E estimation, enhanced resolution, and spectral unmixing.

16:00–16:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

OM3D • Monitoring Single Cells In Vivo—Continued

OM3D.4 • 15:30
Labeling Circulating Tumor Cells with a Folate Receptor Targeted Probe for Diffuse *in-vivo* Flow Cytometry, Roshani A. Patil[1], Srinivasarao Madduri[2], Philip Low[2], Mark Niedre[1]; [1]*Northeastern Univ., USA;* [2]*Chemical Engineering, Purdue Univ., USA.* Diffuse *in-vivo* Flow Cytometry is a new method to enumerate fluorescently-labeled circulating tumor cells *in-vivo*. Herein, we investigated the use of a folate receptor-targeted fluorescence probe EC17 for labeling of target cells in the bloodstream.

OM3D.5 • 15:45
Novel mitochondria penetrating peptide for live-cell long-term tracking of mitochondria, Tinghan Zhao[1], Sweety Singh[1], Yuanwei Zhang[1], Kevin D. Belfield[1]; [1]*New Jersey Inst. of Technology, USA.* A novel mitochondria penetrating peptide (MPP) that can permeate the mitochondrial membrane for long-term tracking of mitochondria is reported. In-vitro studies indicate persistence of the MPP probe, low cytotoxicity, and high bio-compatibility.

AM3E • Theory—Continued

AM3E.6 • 15:30 Invited
Optical trapping of hybrid nanostructures: a theoretical description, Maria A. Iati[1]; [1]*CNR-Istituto Processi Chimico-Fisici, Italy.* Hybrid nanostructures have unique optical properties. We present an approach to model optical trapping of hybrid systems in the T-matrix formalism. We show results on plasmonic mesocapsules, core-shell nanostructures, and nanomaterials with gain.

16:00–16:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

Salon K & L	Salon I	Salon F
Optics and the Brain	Bio-Optics: Design and Application	Novel Techniques in Microscopy

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

16:30–18:30
BM4A • Functional Microscopy
Presider: Timothy Murphy; University of British Columbia, Canada

BM4A.1 • 16:30 Invited
Pysight: a fully asynchronous, photon-counting-based solution for fast multi-photon volumetric imaging, Pablo Blinder[1,2]; [1]*Neurobiology, Biochemistry and Biophysics School, Tel Aviv Univ., Israel;* [2]*Sagol School for Neuroscience, Tel Aviv Univ., Israel.* We present PySight, a solution for multidimensional volumetric imaging. PySights integrates an ultrafast varifocal lens, time-correlated single photon counting hardware, with open-source code; making it an easy-to-implement add-on to existing setups.

BM4A.2 • 17:00 Invited
Full-Field Interferometric Imaging of Action Potentials, Daniel Palanker[1], Kevin Boyle[1], Tong Ling[1], Felix Alfonso[1], Tiffany Huang[1]; [1]*Stanford Univ., USA.* High-speed quantitative phase microscopy enables full-field imaging of cellular deformations during action potential. In spiking HEK cells, displacements of up to 3nm (0.9mrad) have been observed, and they match the time course electrical recordings.

BM4A.3 • 17:30 Invited
Imaging neuronal responses through all cortical layers and subplate of visual cortex in awake mice with optimized three-photon microscopy, Murat Yildirim[1], Hiroki Sugihara[1], Mriganka Sur[1], Peter So[1]; [1]*Massachusetts Inst. of Technology, USA.* In visual cortex, information is processed in multiple layers. However, responses of neurons in deeper layers have been unclear. Here, we design of a custom-made three-photon microscope to image a vertical column of the cerebral cortex in awake mice

16:30–18:30
DM4B • High-Speed, High-Throughput
Presider: Kristen Maitland; Texas A&M University, USA

DM4B.1 • 16:30 Invited
Compressed Ultrafast Microscopy: Redefining the Speed Limit of Bioimaging, Gao Liang[1]; [1]*Univ. of Illinois Urbana-Champaign, USA.* We present the world's fast FLIM imager which is capable of imaging fluorescence lifetimes at 100 fps.

DM4B.2 • 17:00 Invited
Hybrid Adaptive Optics: An Approach for Imaging Faster and Deeper, Steven Adie[1]; [1]*Cornell University, USA.* We combine hardware adaptive optics (AO) and computational AO on an optical coherence microscopy platform. By imaging with deliberately introduced astigmatism, we demonstrate increased volumetric throughput and suppression of multiple scattering.

DM4B.3 • 17:30
Low-cost, High-speed Near-infrared Confocal Microscope, Cheng Gong[1], Nachiket Kulkarni[1], Wenbin Zhu[1], Christopher D. Nguyen[1], Clara Curiel-Lewandrowski[2], Dongkyun Kang[1,2]; [1]*College of Optical Sciences, Univ. of Arizona, USA;* [2]*Cancer Center, Univ. of Arizona, USA.* We developed a low-cost, high-speed near infrared confocal microscope. Material cost was approximately $5k. *In vivo* confocal images of human skin acquired at 203 frame/sec clearly visualized cellular features, including keratinocytes and melanocytes.

DM4B.4 • 17:45
High-speed Optical Diffraction Tomography for High Throughput Cell Imaging Applications, Yanping He[1], Renjie Zhou[1]; [1]*The Chinese Univ. of Hong Kong, Hong Kong.* We propose a high-speed optical diffraction tomography technique to achieve >100 tomograms/second imaging speed. Digital micromirror devices and a fast camera are used for high speed illumination angle scanning and image acquisition.

16:30–18:30
NM4C • Tissue Microscopy: Applications to Tissue Mechanics and Disease
Presider: Kyle Quinn; University of Arkansas, USA

NM4C.1 • 16:30 Invited
Peri-cellular stiffness distribution in 3D type 1 collagen systems is dependent upon both cell contractility and remodeling, Mark Keating[1], Micah Lim[1], Qingda Hu[1], Elliot Botvinick[1]; [1]*Biomedical Engineering, Univ. of California Irvine, USA.* While there are empirical relationships between bulk tissue stiffness and cell state, correlations with pericellular stiffness are less established. Active-microrheology reveals a heterogenous landscape we argue must be considered in mechanobiology.

NM4C.2 • 17:00
Microlaser-based contractility sensing in single cardiomyocytes and whole hearts, Marcel Schubert[1], Lewis Woolfson[1], Isla R. Barnard[1], Andrew Morton[1], Becky Casement[1], Gavin Robertson[2], Gareth B. Miles[3], Samantha J. Pitt[2], Carl S. Tucker[4], Malte C. Gather[1]; [1]*School of Physics and Astronomy, Univ. of St Andrews, UK;* [2]*School of Medicine, Univ. of St Andrews, UK;* [3]*School of Psychology & Neuroscience, Univ. of St Andrews, UK;* [4]*The Queens's Medical Research Inst., Univ. of Edinburgh, UK.* Microscopic whispering gallery mode lasers detect minute changes in cellular refractive index inside individual cardiac cells and in live zebrafish. We show that these signals encode cardiac contractility that can be used for intravital sensing.

NM4C.3 • 17:15
Investigation of Collagen Chirality with Double Stokes-Mueller Polarimetry, Ahmad Golaraei[1,2], Lukas Kontenis[3], Kamdin Mirsanaye[1], Yeji Ro[1], Margarete Akens[2], Brian Wilson[2], Virginijus Barzda[1]; [1]*Univ. of Toronto, Canada;* [2]*Princess Margaret Cancer Centre, Canada;* [3]*Light Conversion, Lithuania.* Chirality of collagen in biological tissues is imaged using double Stokes-Mueller polarimetric microscopy. The phase difference between chiral and non-chiral susceptibility components is revealed by full polarimetry measurements.

NM4C.4 • 17:30
Role of Collagen Fiber Alignment and Morphology on Ovarian Cancer Cell Migration Using Image-based Scaffolds, Samuel F. Alkmin[1], Rebecca Brodziski[1], Haleigh Simon[1], Daniel Hinton[2], Randall Goldsmith[2], Manish Patankar[3], Paul Campagnola[1]; [1]*Univ. of Wisconsin - Madison, USA;* [2]*Univ. of Wisconsin - Madison, USA;* [3]*Department of Obstetrics and Gynecology, Univ. of Wisconsin - Madison, USA.* Multiphoton excited photochemistry is used to create image-based scaffolds of ovarian tumors, investigating the role of collagen remodeling on cell migration. Results show that overall alignment and fiber properties govern the migration dynamics.

NM4C.5 • 17:45
High Sensitivity Label-Free Imaging with Doppler Raman Microspectroscopy, David Smith[1], Jeffrey J. Field[1], David Winters[2], Scott Domingue[2], Jesse Wilson[1], Daniel Kane[3], Randy Bartels[1]; [1]*Colorado State Univ., USA;* [2]*KM Labs, USA;* [3]*Mesa Photonics, USA.* We present Doppler Raman, a novel detection technique for coherent Raman scattering microscopy that offers improved sensitivity and readily detects low frequency modes from $10cm^{-1}$ to $1500cm^{-1}$ for use in studying label-free biological systems.

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

16:30–18:30
OM4D • Optical Imaging Tools for Surgery & Pathology
Presider: Summer Gibbs; Oregon Health and Science Univ., USA

OM4D.1 • 16:30 Invited
Near-Infrared Fluorescence Lymphatic Imaging in the Clinical Setting, John C. Rasmussen[1]; [1]*Univ. of Texas Health Science Center, USA.* Near-infrared fluorescence imaging provides a unique opportunity to assess the lymphatics in health and disease. Herein is described the development, translation, and use of this imaging modality for clinical assessment and surgical recovery.

OM4D.2 • 17:00 Invited
Intra-Operative Molecular Imaging, David Vera[1]; [1]*Univ. of California San Diego, USA.* I will describe the design and testing of a fluorescent-labeled radiopharmaceutical for sentinel lymph node mapping during robotic surgery for prostate, bladder, and endometrial cancers. Fluorescence imaging during surgery will be presented.

OM4D.3 • 17:30
Molecular Chemical Imaging of Critical Anatomical Structures *in vivo*, Aaron G. Smith[1], Arash Samiei[2], John Lyne[2], Christopher Post[2], Shona Stewart[1], Heather Gomer[1], Jihang Wang[1], Jeffrey Cohen[2], Patrick Treado[1]; [1]*ChemImage Corporation, USA;* [2]*Allegheny Health Network, USA.* Improved patient outcomes highlight the need to avoid errors in surgery. Molecular Chemical Imaging (MCI) aids in identifying critical structures without reagents and *in vivo* results are presented for a range of surgical applications.

OM4D.4 • 17:45 Invited
Nondestructive 3D pathology with open-top light-sheet (OTLS) microscopy for precision medicine, Jonathan T. Liu[1]; [1]*Univ. of Washington, USA.* We have developed an "open-top" light-sheet microscopy platform for rapid slide-free 3D pathology of surgical and biopsy specimens. Ongoing studies aim to show that this nondestructive approach improves prognostication and treatment stratification.

16:30–18:30
AM4E • Biophysics 2
Presider: Agnese Callegari; Bilkent University, Turkey

AM4E.1 • 16:30 Invited
Optical induction of hydrodynamic flows in cells and embryos, Moritz Kreysing[1]; [1]*Max Planck Inst. for Cell Biology & Genetics Dresden, Germany.* We show that optically-induced thermo-viscous flows can move the cytoplasm of cells and developing embryos. This enabled i) probe-free active micro-rheology and ii) testing of reaction-transport systems in-vivo. We provide an outlook on future applications.

AM4E.2 • 17:00
Experimental Investigation of Active Brownian Dynamics in 3D Optical Potentials Using Light-Sheet Microscopy, Jalpa Soni[1], Omar E. Olarte[2,3], Pablo Loza-Alvarez[2], Giovanni Volpe[1]; [1]*Univ. of Gothenburg, Sweden;* [2]*ICFO - Institut de Ciencies Fotoniques, The Barcelona Inst. for Science and Technology, Spain;* [3]*Vicerrectoria de Investigacion, Universidad ECCI, Colombia.* Abstract: We study the diffusion dynamics of active Brownian particles in 3D optical potentials, by tracking chemotactic Janus particles in H_2O_2 solution using a customised light sheet microscope with fast volumetric imaging capabilities

AM4E.3 • 17:15
Creating an automated micromanipulator with a microfluidics and optical tweezers approach to study replicative ageing, Niek Welkenhuysen[2,1], Martin Mojica-Benavides[3], Caroline B. Adiels[3], Giovanni Volpe[3], Marija Cvijovic[2,1]; [1]*Chalmers Univ. of Technology, Sweden;* [2]*Univ. of Gothenburg, Sweden;* [3]*Univ. of Gothenburg, Sweden.* We designed a microfluidics systems combined with optical tweezers to create an automated micro-manipulator. With this setup we studied the replicative lifespan in yeast to elucidate mechanisms which contribute to ageing of biological cells.

AM4E.4 • 17:30 Invited
Building single molecules atom-by-atom in optical tweezers, Kang-Kuen Ni[1]; [1]*Harvard University, USA.* We use optical tweezers to isolate single atoms and then induce a reaction between them with a pulse of light to build single molecules. We aim to harness their quantum resources for future applications in simulations and computations.

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

BM4A • Functional Microscopy—Continued

BM4A.4 • 18:00 Invited
3-Photon Calcium Imaging of Deep Cortical Layers for Functional Connectomics, Kevin Takasaki[1], Josh Larkin[1], Reza Abbasi-Asl[1], Dan Denman[1], Dan Millman[1], Saskia de Vries[1], Marc Takeno[1], Nuno da Costa[1], Clay Reid[1], Jack Waters[1]; [1]*Allen Inst. for Brain Science, USA.* 2-photon image quality degrades in volume-labeled tissue due to high background fluorescence. We apply 3-photon imaging to measuring functional responses in deep layers of primary visual cortex in pan-excitatory transgenic mice expressing GCaMP6s.

DM4B • High-Speed, High-Throughput—Continued

DM4B.5 • 18:00
Rapid Volumetric Multiphoton Imaging with the Combination of an Ultrasound Lens and a Resonant Mirror, Chia-Wei Hsu[1]; [1]*NCTU APL, Taiwan.* An ultrasound lens and a resonant mirror were integrated into a multiphoton microscopy that is rapidly and precisely controlled by an embedded field programmable gate array to acquire volumetric image at 30 volumes per second.

DM4B.6 • 18:15
Beam Shaping in Life Sciences, Anna Moehl[1], Sven Wickenhagen[1], Ulrike Fuchs[1], Steffen Schneider[2]; [1]*Asphericon GmbH, Germany;* [2]*asphericon, Inc., USA.* The work presented deals with two concepts to generate a homogeneous intensity distribution out of a Gaussian beam which can be used to improve the illumination for microscopy as well as efficiency of stitched images.

NM4C • Tissue Microscopy: Applications to Tissue Mechanics and Disease—Continued

NM4C.6 • 18:00 Invited
Mapping the Micromechanics of the Extracellular Matrix, Seemantini Nadkarni[1]; [1]*Harvard Univ., USA.* Abstract not provided.

18:30–20:00 Conference Reception, *Coyote Corral at Loews Ventana Canyon*

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

OM4D • Optical Imaging Tools for Surgery & Pathology—Continued

OM4D.5 • 18:15
Monitoring the effect on anti-aging treatment using Raman spectroscopy with paraffin-embedded skin samples, Soogeun Kim[1], Ayoung Bang[1], Samjin Choi[1]; [1]*Dept. of Biomedical Engineering, College of Medicine, Kyung Hee Univ., Korea (the Republic of).* In this study, we show that Raman spectroscopy can present quantitative information about the effect on anti-aging treatment carried out by FDA-approved radiofrequency device, by using paraffin-embedded skin samples.

AM4E • Biophysics 2—Continued

AM4E.5 • 18:00 Invited
Optical trapping in zebrafish for Neuroscience, Itia Favre-Bulle[1], Gilles Vanwalleghem[1], Alexander Stilgoe[1], Ethan Scott[1], Halina Rubinsztein-Dunlop[1]; [1]*Univ. of Queensland, Australia.* This study will present how we used optical trapping technique in the zebrafish inner ear to manipulate ear stones and simulate acceleration and sound, and how we simultaneously image the whole brain activity.

18:30–20:00 Conference Reception, *Coyote Corral at Loews Ventana Canyon*

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

07:00–17:30 Registration, *Grand Ballroom Foyer*

08:00–10:00
BT1A • New Indicators
Presider: Emily Gibson; University of Colorado at Boulder, USA

BT1A.1 • 08:00 Invited

Genetically-encoded red and near-infrared neural activity indicators, Robert E. Campbell[1,2]; [1]*Chemistry, Univ. of Alberta, Canada;* [2]*Chemistry, The Univ. of Tokyo, Japan.* In this seminar I will describe our most recent efforts to design and engineer new red and near-infrared indicators to enable new opportunities for multicolour and deep tissue in vivo imaging of neural activity.

BT1A.2 • 08:30 Invited

High-performance calcium sensors for imaging activity in neuronal populations and microcompartments, Dana Hod[1,2]; [1]*Neurosciences, Lerner Research Inst., Cleveland Clinic Foundation, USA;* [2]*School of Medicine, Case Western Reserve Univ., USA.* Calcium imaging is commonly used for recording neuronal activity in various animal models. We present the development of the green calcium sensors jGCaMP7, and their application for recording activity from neuronal populations and microcompartments.

BT1A.3 • 09:00 Invited

A Genetically Encoded Autonomous Bioluminescent Voltage Indicator, Prasanna Srinivasan[1], Craig Montell[2], Luke Theogarajan[1]; [1]*ECE, UCSB, USA;* [2]*MCDB, UCSB, USA.* We report a genetically encode bioluminescent voltage indicator overcoming some of the current limitations, such as low sensitivity and photobleaching. In-vitro results from our sensor shows a 10X change in bioluminescence due to membrane potential.

08:00–10:00
DT1B • Optical Imaging Technologies I
Presider: Paco Robles; Georgia Institute of Tech., USA

DT1B.1 • 08:00 Invited

Miniaturized multimodal fiber-optic imaging probes, Jiawen Li[1,2], Erik Schartner[1,2], Juliette Delhove[1,3], Bryden Quirk[1,2], Rodney Kirk[1,2], Stefan Musolino[1,2], Alexandra McCarron[1,3], Patricia Cmielewski[1,3], Caroline Boudoux[4], Martin Donnelley[1,3], David Parsons[1,3], Heike Ebendorff-Heidepriem[1,2], Robert McLaughlin[1,2]; [1]*Univ. of Adelaide, Australia;* [2]*Australian Research Council Centre of Excellence for Nanoscale BioPhotonics, Australia;* [3]*Women's and Children's Hospital, Australia;* [4]*Dept. of Engineering Physics, Polytechnique Montréal, Canada.* We describe multimodal probes acquiring fluorescence and optical coherence tomography signals through a single fiber. We demonstrate their use in imaging genetically-modified cells in tissue, and how to perform simultaneous imaging and fiber sensing.

DT1B.2 • 08:30

Multimodal multiphoton microscopy driven by a fiber-based two-color ultrafast source, Hsiang-Yu Chung[1,2], Qing-di Cheng[3], Robin Schubert[3,4], Markus Perbandt[3,4], Christian Betzel[3,4], Rüdiger Greinert[5], Franz Kärtner[1,2], Guoqing Chang[1,6]; [1]*Center for Free-Electron Laser Science, DESY, Germany;* [2]*Physics, Universität Hamburg, Germany;* [3]*Univ. of Hamburg, Lab. for Structural Biology of Infection and Inflammation, DESY, Germany;* [4]*The Hamburg Centre for Ultrafast Imaging, Universität Hamburg, Germany;* [5]*Skin Cancer Center Buxtehude, Germany;* [6]*Beijing National Lab. for Condensed Matter Physics, Inst. of Physics, Chinese Academy of Sciences, China.* We demonstrate fiber-based two-color sources that produce femtosecond pulses in two biomedical transmission windows (800 and 1300 nm). This powerful source enables multiphoton microscopy for both virtual skin biopsy and protein nano-crystal scoring.

DT1B.3 • 08:45

Fluorescence and Multiphoton Imaging of a Mouse Model of Spontaneous Ovarian Cancer, Travis W. Sawyer[1], Jennifer W. Koevary[2], Photini F. Rice[2], Jennifer K. Barton[1,2]; [1]*Optical Sciences, Univ. of Arizona, USA;* [2]*Biomedical Engineering, Univ. of Arizona, USA.* Ovarian cancer is the deadliest gynecologic cancer, but can be addressed with early detection. We investigate fluorescence and multiphoton imaging for imaging ovarian cancer, finding that tissue changes can be detected through quantitative analysis.

DT1B.4 • 09:00

Fourier Light-Field Microscopy: An Integral Model and Experimental Verification, Wenhao Liu[1], Changliang Guo[1], Xuanwen Hua[1], Shu Jia[1]; [1]*Georgia Tech., USA.* We demonstrate theoretically and experimentally Fourier light-field microscopy, a new imaging scheme for volumetric bioimaging. The experimental results agree well with the theoretical model.

DT1B.5 • 09:15

Enhanced Structued-illumination Depth Camera for 3D Modeling of Small Animals, Xiaohua Feng[1], Gao Liang[1]; [1]*Univ. of Illinois at Urbana Champaign, USA.* We present a structured-illumination depth camera with improved depth sensing range and accuracy by recursive decomposition of binary codes. We validated the proposed method numerically and demonstrated it experimentally by imaging a phantom animal.

08:00–10:00
NT1C • Nonlinear Microscopy: Techniques, Technologies, and Applications I
Presider: Marie-Claire Schanne-Klein; LOB - Ecole Polytechnique, CNRS, Inserm, France

NT1C.1 • 08:00 Invited

TruResolution: An Automated Spherical Aberration Correction for Deep Multiphoton Microscopy, Carlo A. Alonzo[1]; [1]*Scientific Solutions Group, Olympus Corporation of the Americas, USA.* Deep imaging in a multiphoton microscope is improved by automated spherical aberration correction. Image brightness and resolution are increased by tailoring optical corrections to the depth and refractive index profile of the specimen.

NT1C.2 • 08:30

High-speed Multicolor Coherent Raman Imaging Enabled by a Novel Fiber Optical Parametric Oscillator, Tim Hellwig[1,3], Maximilian Brinkmann[1,3], Alexander Fast[2], Conor L. Evans[2], Carsten Fallnich[1,3]; [1]*Inst. of Applied Physics, Univ. of Münster, Germany;* [2]*Wellman Centre for Photomedicine, Massachusetts General Hospital, Harvard Medical School, USA;* [3]*Refined Laser Systems - Exist-FT 03EFLNW192, Univ. of Münster, Germany.* We present high-speed multicolor coherent Raman imaging enabled by a robust fiber optical parametric oscillator tunable in 5 ms per arbitrary wavelength step without the need for a mechanical delay.

NT1C.3 • 08:45

Broadband Hyperspectral Stimulated Raman Scattering Microscopy with a Parabolic Fiber Amplifier Source, Benjamin Figueroa[1], Walter Fu[2], Tai Nguyen[3], Kseniya Shin[1], Bryce Manifold[1], Frank Wise[2], Dan Fu[1]; [1]*Univ. of Washington - Seattle, USA;* [2]*Cornell Univ., USA;* [3]*Univ. of Southern California, USA.* We have developed a broadband light source that extends the spectral coverage and spectral resolution of our current hyperspectral simulated Raman scattering (SRS) microscope. We discuss potential applications enabled by the broadband SRS microscope.

NT1C.4 • 09:00 Invited

TRAFIX: Imaging at depth with temporal focusing and single-pixel detection, Adrià Escobet-Montalban[1], Mingzhou Chen[1], Philip Wijesinghe[1], Kishan Dholakia[1]; [1]*Univ. of St Andrews, UK.* We describe a new strategy for wide field multiphoton imaging through turbulent media by projecting orthonormal patterns using temporal focusing and recording fluorescent signals with single-pixel detection.

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

07:00–17:30 Registration, *Grand Ballroom Foyer*

08:00–10:00
OT1D • Improving Therapy with Light
Presider: Summer Gibbs; Oregon Health and Science Univ., USA

OT1D.1 • 08:00 Invited
Vitamin B_{12} derivatives for light activated chemotherapy, Jennifer Shell[1], Liberty N. Gendron[2], Dillon C. Zites[3], Ethan LaRochelle[1], Brian W. Pogue[1], Thomas Shell[3]; [1]*Dartmouth College, USA;* [2]*Biology, Saint Anselm College, USA;* [3]*Chemistry and Biochemistry, Norwich Univ., USA.* The alkylcobalamin platform provides a method to release drugs via tunable light activation. We have shown that drugs attached to cobalamin are tumor selective and demonstrated light dependent release of drugs from the B_{12} platform.

OT1D.2 • 08:30 Invited
Functional Imaging and Treatment of Tumors Using New Fluorescent Proteins, Marina Shirmanova[1], Maria M. Lukina[1], Diana V. Yuzhakova[1], Irina N. Druzhkova[1], Alena I. Gavrina[1], Konstantin A. Lukyanov[2], Vsevolod V. Belousov[2], Elena V. Zagaynova[1]; [1]*Privolzhskiy Research Medical Univ., Russian Federation;* [2]*Shemyakin-Ovchinnikov Inst. of Bioorganic Chemistry RAS, Russian Federation.* Fluorescent proteins in combination with fluorescence imaging technologies offer unique opportunities to explore cancer. We developed methodologies for monitoring of different functional processes in tumor models and for tumor treatment.

OT1D.3 • 09:00 Invited
Targeting Drug-Resistant Cancer Stem Cells Using Photodynamic Fluorescent Probes, Bryan Q. Spring[1]; [1]*Northeastern Univ., USA.* This presentation will show that photodynamic therapy (PDT) is effective against patient-derived cancer stem cell cultures. Moreover, sub-lethal PDT results in re-sensitization of cancer cell phenotypes with induced drug-resistance to chemotherapy.

08:00–10:00
AT1E • Nanothermodynamics
Presider: Agnese Callegari; Bilkent University, Turkey

AT1E.1 • 08:00 Invited
Microparticle transport across optical potentials: noisy ratchets and cavitation bubbles, Pedro A. Quinto-Su[1], Magda Sanchez[1], Roberto de J. León-Montiel[1]; [1]*ICN-UNAM, Mexico.* We demonstrate microparticle transport across optical potentials created with holographic optical tweezers: slow directed motion in symmetric ratchet systems with dynamical noise and fast random hopping with absorbing beads and cavitation bubbles.

AT1E.2 • 08:30 Invited
Optical Ratchets: Controlling Transport Far from Equilibrium, Alejandro V. Arzola[1], Karen Volke-Sepulveda[1], Petr Jakl[2], Berenice García Rodríguez[1], Hugo Harleston Aguirre[1], Pavel Zemanek[2], Francisco Sevilla[1]; [1]*Instituto De Fisica, UNAM, Mexico;* [2]*Inst. of Scientific Instruments of the CAS, Czechia.* Motion rectification of colloidal particles by means of the out-of-equilibrium ratchet mechanism is shown in fully-reconfigurable optical lattices. We explore different lattice geometries and mechanisms to drive the system far from equillibrium.

AT1E.3 • 09:00
Statistics of Brownian particles held in non-harmonic potentials in an active bath, Aykut Argun[1], Giovanni Volpe[1]; [1]*Goteborgs Universitet, Sweden.* We study non-equilibrium fluctuations of magnetic colloidal particles in bacterial suspensions held in non-harmonic optical potentials, where articles are placed at a water-air interface.

AT1E.4 • 09:15
Light-driven Assembly and Optical Manipulation of Active Colloidal Molecules, Falko Schmidt[1], Benno Liebchen[2], Hartmut Loewen[2], Giovanni Volpe[1]; [1]*Gothenburg Univ., Sweden;* [2]*Heinrich-Heine-Universität Düsseldorf, Institut für Theoretische Physik II: Weiche Materie, Germany.* We provide a new route for active self-assembly, where *activity occurs as an emergent phenomenon* only when individual building blocks bind together, in a way which we *manipulate using laser light.*

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

BT1A • New Indicators—Continued

BT1A.4 • 09:30 Invited

High-resolution imaging of neuromodulator dynamics with genetically encoded indicators, Lin Tian[1]; [1]*Univ. of California Davis, USA*. In this talk, I will discuss our recent progress into develop and apply a new suite of genetically encoded indicators to enable ultrafast neuronal imaging of dopamine dynamics in vivo.

DT1B • Optical Imaging Technologies I—Continued

DT1B.6 • 09:30

Smartphone light sheet fluorescence microscopy for molecular diagnostics, Hoang Nguyen[1], Wei-Chuan Shih[1]; [1]*Univ. of Houston, USA*. A new design of smartphone light sheet microscopy based on inkjet-printed DotLens is presented. Its ultimate simplicity, yet high quality imaging capabilities would find applications in point-of-care diagnostics and low-resources scenarios.

DT1B.7 • 09:45

Remote Detection of Photoacoustic Signals using Time Varying Speckle Patterns, Matan Benyamin[1,2], Hadar Genish[2], Ran Califa[2], Nissan Ozana[1,2], Ariel Schwarz[2], zeev zalevsky[1,2]; [1]*Faculty of Engineering and the Nanotechnology center, Bar Ilan Univ., Israel;* [2]*ContinUse Biometrics, Israel*. A novel method for noncontact detection of photoacoustic signals is experimentally demonstrated. The approach is based on time varying speckle pattern analysis and suggests a more robust alternative for previously suggested solutions

NT1C • Nonlinear Microscopy: Techniques, Technologies, and Applications I—Continued

NT1C.5 • 09:30 Invited

Label-free, optical, morpho-functional cancer biomarkers, Irene Georgakoudi[1]; [1]*Tufts University, USA*. Label-free two photon imaging of human epithelia provides information regarding functional (metabolic) and morphological tissue metrics that characterize both bulk and heterogeneity aspects of the corresponding features. In combination, they provide accurate diagnosis of (pre)cancers.

10:00–10:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

OT1D • Improving Therapy with Light—Continued

OT1D.4 • 09:30
Characterization of Radiation-Induced Reoxygenation in Head and Neck Tumor Xenografts Using Diffuse Reflectance Spectroscopy, Sina Dadgar[1], Joel Joel Rodriguez Troncoso[1], Austin Dotson[1], Narasimhan Rajaram[1]; [1]*Univ. of Arkansas, USA.* Diffuse reflectance spectroscopy of radiation-induced reoxygenation in human head and neck tumors indicate a higher level of reoxygenation in radiation-resistant tumors, thus providing a potential biomarker for identifying treatment resistance.

OT1D.5 • 09:45
Oxygen Loaded Nanodroplets as a Theranostic for High Risk Pregnancies Using Multimodal Ultrasound and Photoacoustic Imaging, Megan E. Escott[1], Dylan Lawrence[1], Jason Cook[2], Carolyn Bayer[1]; [1]*Tulane Univ., USA;* [2]*NanoHybrids, Inc., USA.* In this work, we demonstrate the potential of targeted, oxygen-loaded nanodroplets as a theranostic for placental ischemia using multimodal ultrasound and photoacoustic imaging.

AT1E • Nanothermodynamics—Continued

AT1E.5 • 09:30 Invited
Transport and heat exchange of colloids under time-delayed feedback control, Sabine H. Klapp[1], Sarah A. Loos[1]; [1]*Technische Universität Berlin, Germany.* We discuss transport properties and stochastic thermodynamics of a colloidal model system under time-delayed feedback control. It is shown that time delay alone generates a finite heat exchange and oscillatory dynamics with marked thermodynamic signatures.

10:00–10:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

10:30–12:30
BT2A • Vascular Imaging
Presider: Patrick Drew; Pennsylvania State Univ., USA

BT2A.1 • 10:30 Invited
Improving Stroke Outcome – OCT Reveals a New Therapeutic Target, David A. Boas[1]; [1]*Boston University, USA.* Red blood cells intermittently stall in cerebral microvessels because of leukocyte adhesion. This stalling is exacerbated in the penumbra of a stroke. We show pharmaceutical reversal of this stalling resulting in improved stroke outcomes.

BT2A.2 • 11:00
Visible-Light Optical Coherence Tomography Investigaetion into Vasculature Changes Following Microprism Implantation, Lisa Beckmann[1], Xian Zhang[1], Hao F. Zhang[1]; [1]*Northwestern Univ., USA.* A chronically implanted microprism in the rodent cortex enables cross-sectional imaging of all cortical layers. We determined the time course of recovery from this surgical implantation using visible-light optical coherence tomography angiography.

BT2A.3 • 11:15 Invited
Neuronal activity and neuroenergetics with and without cerebral blood flow, Anna Devor[1]; [1]*Univ. of California San Diego, USA.* Two-photon phosphorescence lifetime microscopy allows measurement of intravascular and tissue partial pressure of O2 with unprecedented spatial resolution. It is used to estimate Cerebral Metabolic Rate of O2 and capillary flux of red blood cells.

BT2A.4 • 11:45
Comparison of convolutional neural and fully convolutional networks for segmentation of 3D in vivo multiphoton microscopy images of brain vasculature, Mohammad Haft-Javaherian[1], Chris B. Schaffer[1], Nozomi Nishimura[1], Mert R. Sabuncu[1]; [1]*Cornell University, USA.* We optimized DeepVess, a convolutional neural network, to segment multiphoton microscopy images of brain blood vessels that outperformed the state-of-the-art machine learning methods and a trained human annotator.

BT2A.5 • 12:00
Differentiating Hemorrhagic and Ischemic Stroke Using Spectral Contrast Optical Coherence Tomography Angiography, Lisa Beckmann[1], Xian Zhang[1], Roman Kuranov[1,2], Hao F. Zhang[1]; [1]*Northwestern Univ., USA;* [2]*Opticent Health, USA.* Traditional optical coherence tomography angiography (OCTA) only visualizes blood vessels where flow exceeds a minimum velocity. Here we show that spectral contrast OCTA within the visible-light spectral range can visualize vessels with no flow.

BT2A.6 • 12:15
A Deep Learning Approach to 3D Segmentation of Brain Vasculature, Waleed Tahir[1], David A. Boas[1], Sreekanth Kera[1], Xiaojun Cheng[1], Jiabei Zhu[1], Lei Tian[1]; [1]*Boston Univ., USA.*The segmentation of blood-vessels is an important preprocessing step for the quantitative analysis of brain vasculature. We approach the segmentation task for two-photon brain angiograms using a fully convolutional 3D deep neural network.

10:30–12:30
DT2B • Optical Imaging Technologies II
Presider: Maciej Wojtkowski; Uniwersytet Mikolaja Kopernika, Poland

DT2B.1 • 10:30 Invited
From 1 to 1000: Insights from a Global Photonics Company, Anjul Loiacono[1]; [1]*Thorlabs Inc., USA.* Design for commercialization is one of several challenges encountered when translating a benchtop-built technology to selling thousands worldwide. I will present the Thorlabs› perspective on things to consider to obtain commercial success.

DT2B.2 • 11:00 Invited
Quantitative phase imaging with epi-mode illumination in thick scattering samples., Paco Robles[1]; [1]*Georgia Inst. of Technology, USA.* Quantitative phase imaging yield insight into subcellular structures with nanometer sensitivity *but it is limited to relatively thin samples.* Here we overcome this barrier to enable the same rich *quantitative* insight tomographically in thick samples.

DT2B.3 • 11:30
Speckle-free and cross-talk-free imaging in Fourier domain full-field optical coherence tomography, Patrycjusz Stremplewski[1], Egidijus Auksorius[1], Pawel Wnuk[1], Lukasz Kozon[1], Piotr Garstecki[1], Maciej Wojtkowski[1]; [1]*Inst. of Physical Chemistry, Poland.* We report on a system that is able to significantly reduce cross-talk and speckle noise in Fourier domain full-field optical coherence tomography. It is achieved by fast phase modulation of a laser wavefront and angular compounding.

DT2B.4 • 11:45
Arthroscopic Delivery of OCT Using Low-Cost OCT System for Assessment of Porcine Articular Cartilage Thickness, Evan T. Jelly[1], Adam Wax[1]; [1]*Duke University, USA.* We present a method for non-invasive optical measurements of porcine articular cartilage thickness using a low-cost OCT engine and a handheld rigid borescope. Validation was performed on excised porcine femorotibial joint cartilage.

DT2B.5 • 12:00
Scanning laser terahertz near-field reflection microscope for biological analysis, Kosuke Okada[1], Kazunori Serita[1], Zirui Zang[1,3], Hironaru Murakami[1], Iwao Kawayama[1], Quentin Cassar[2], Amel Al-Ibadi[2], Gaëtan MacGrogan[4], Thomas Zimmer[2], Jean-Paul Guillet[2], Patrick Mounaix[2], Masayoshi Tonouchi[1]; [1]*Osaka Univ., Japan;* [2]*Univ. of Bordeaux, France;* [3]*Univ. of Rochester, USA;* [4]*Bergonié Inst., France.* We developed a scanning laser terahertz near-field reflection microscope and succeeded in getting high-spatial resolution terahertz images of breast cancer tissue. These images will help us to accurately detect canceration dynamics and tumor margins.

DT2B.6 • 12:15
Fiber Selection for Broadband, Ultrashort Pulse Propagation, Kelli Kiekens[1], Orkhongua Batjargal[1], David Vega[1], Yi-Hsin Ou[1], Khanh Kieu[1], Jennifer K. Barton[1]; [1]*Univ. of Arizona, USA.* Propagation of broadband, ultrashort pulses through a few meters of standard silica fiber can severely distort and broaden the pulse due to dispersion and nonlinearity. Choice of fiber and dispersion compensation can reduce these effects.

10:30–12:30
NT2C • Tissue Microscopy: Photoacoustic and Endoscopic Technologies
Presider: Daniel Elson; Imperial College London, UK

NT2C.1 • 10:30 Invited
Photoacoustic imaging beyond the acoustic diffraction limit, Emmanuel Bossy[1]; [1]*Université Grenoble-Alpes, France.* The resolution of conventional photoacoustic imaging (PAI) is limited at depth by the acoustic diffraction limit. This presentation will illustrate how super-resolution techniques initially developed for optical imaging can be adapted to achieve super-resolution PAI.

NT2C.2 • 11:00
Optical resolution photoacoustic microscopy and fluorescence imaging with a multimode fiber, Antonio Miguel Caravaca Aguirre[1], Emmanuel Bossy[1]; [1]*Universite Grenoble Alpes (UGA), France.* We present a dual modality ultra-thin imaging system based on a optical mul- timode fiber and a optical fiber hydrophone that combines optical resolution photoacoustic and fluorescence microscopy

NT2C.3 • 11:15
3D Endoscopic Imaging Using a GRIN Lens Array, Changliang Guo[1,2], Shu Jia[1,2]; [1]*Wallace H. Coulter Dept. of Biomedical Engineering, Georgia Inst. of Technology, USA;* [2]*Wallace H. Coulter Dept. of Biomedical Engineering, Emory Univ., USA.* A volumetric endoscopy system is demonstrated allowing 3D reconstruction of volumetric information using deconvolution algorithms. This system has a great potential for clinical applications for recording and revealing 3D structures of specimens.

NT2C.4 • 11:30
Wavefront shaping for achieving high NA GRIN-lens-based endoscopic imaging, You Zhou[1], Guoxun Zhang[1], Jiamin Wu[1], Myunghwan Choi[2], Qionghai Dai[1]; [1]*Tsinghua Univ., China;* [2]*Sungkyunkwan Univ., Korea (the Republic of).* We propose a wavefront shaping method to improve the spatial resolution and light collection efficiency of a GRIN-lens-based endoscopic system. The genetic algorithm is used for the search of an optimized phase modulation pattern.

NT2C.5 • 11:45
Compact Multiphoton Endoscopy for Translation into Clinical Applications, Shuo Tang[1], Lin Huang[1]; [1]*Univ. of British Columbia, Canada.* MPM endoscopy is developed using femtosecond fiber laser as source, SMF for delivering fs pulses, and miniature components for imaging head. The system is compact with all-fiber connection, suitable for translating MPM into clinical applications.

NT2C.6 • 12:00 Invited
Latest advances in tethered capsule endomicroscopy, Guillermo Tearney[1]; [1]*Harvard Medical School, USA.* Abstract not provided.

12:30–14:00 Lunch Break On Your Own

12:30–14:00 Emerging Biomedical Applications of Nonlinear Optics, *Salon G*
(Advanced RSVP required)

Tuesday, 16 April

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

10:30–12:30
OT2D • Endogenous Optical Contrast Imaging
Presider: Bryan Spring; Northeastern University, USA

OT2D.1 • 10:30 Invited
Label-free ultra-sensitive molecular detection for bioscience and translational medicine, Judith Su[1]; [1]*Univ. of Arizona, USA.* We present our latest work on ultra-sensitive biomolecular detection for medical diagnostics using frequency locked whispering gallery mode microtoroid resonators. In addition, we present new designs for enhanced sensing and alternative robust light coupling approaches .

OT2D.2 • 11:00 Invited
Endogenous and exogenous contrast mechanisms for detection of ovarian cancer, Jennifer K. Barton[1], Jennifer W. Koevary[1], Photini Rice[1], Travis W. Sawyer[1]; [1]*Univ. of Arizona, USA.* We show that multispectral fluorescence imaging, optical coherence tomography, and multispectral microscopy differentiates normal, cancer, and benign ovary and fallopian tube tissue in a mouse model and human tissue samples.

OT2D.3 • 11:30 Invited
High-Throughput Screening Raman Spectroscopy (HTS-RS) Platform for Label-Free Single Cell Analysis, Iwan Schie[1], Jan Rüger[1], Saif Abdullah Mondol[1], Anuradha Ramoji[1,2], Ute Neugebauer[1,2], Christoph Krafft[1], Jürgen Popp[1,3]; [1]*Inst. of Photonic Tech., Germany;* [2]*Univ. Hospital Jena, Germany;* [3]*Friedrich-Schiller Univ. Jena, Germany.* We present a HTS-RS platform for rapid and label-free macromolecular fingerprinting of tens of thousands eukaryotic cells. The proposed platform combines automated imaging microscopy with Raman spectroscopy to enable rapid label-free cell screening.

OT2D.4 • 12:00
Diagnosis of clinical pathogenic source and human tissue samples based on Raman spectroscopy and chemometrics, Geer Teng[1], Qianqian Wang[1], Jinglin Kong[2], Nouman Khan[1], Weiwei Liu[2], Xutai Cui[1], Kai Wei[1], Wenting Xiangli[1], Biqiang Hu[1]; [1]*Beijing Inst. of Tech., China;* [2]*Research Inst. of Chemical Defense, China.* Combined with chemometrics algorithms, Raman spectroscopy was used to identify clinical samples like bacteria and tumor. Based on proposed methods, the correct classification rate reached a high value, which improved the diagnostic accuracy.

OT2D.5 • 12:15
Role of Local Electric Field in Controlling Fluorescence Quantum Yield of Red Fluorescent Proteins, Mikhail Drobizhev[1], J. Nathan Scott[1], Patrik R. Callis[1], Rosana S. Molina[1], Thomas E. Hughes[1]; [1]*Montana State Univ., USA.* By measuring internal electric field components in a series of red fluorescent proteins we demonstrate that the fast nonradiative relaxation in the more red shifted variants is explained by the twisted intramolecular charge transfer.

10:30–12:30
AT2E • Biological Applications
Presider: Sile Nic Chormaic; Okinawa Inst. of Science & Tech., Japan

AT2E.1 • 10:30 Invited
Momentum and a new traceability path for optical power, Alexandra B. Artusio-Glimpse[1]; [1]*National Inst. of Standards & Technology, USA.* On May 20, 2019, SI units will depend on seven constants of nature. This redefinition has a powerful impact on optical metrology. I will discuss how we use radiation pressure to define the optical watt.

AT2E.2 • 11:00
FORMA: Force Reconstruction via Maximum-likelihood-estimator Analysis, Laura Pérez García[1,2], Jaime Donlucas Pérez[1], Giorgio Volpe[3], Alejandro V. Arzola[1], Giovanni Volpe[2]; [1]*Universidad Nacional Autónoma de México, Mexico;* [2]*Physics, Univ. of Gothenburg, Sweden;* [3]*Chemistry, Univ. College London, UK.* We propose an algorithm to retrieve the conservative and non-conservative components of a force field acting on a Brownian particle from the analysis of its displacements with important advantages over established techniques.

AT2E.3 • 11:15
Waveguides of Light through Red Blood Cells, Anna Bezryadina[1,2], Rekha Gautam[2], Yinxiao Xiang[2], Josh Lamstein[2], Yi Liang[2], Nicolas Perez[1], Tobias Hansson[3], Benjamin Wetzel[3], Roberto Morandotti[3], Zhigang Chen[2]; [1]*Physics and Astronomy, California State Univ. Northridge, USA;* [2]*Physics and Astronomy, San Francisco State Univ., USA;* [3]*Institut National de la Recherche Scientifique, Université du Québec, Canada.* We demonstrate nonlinear optical effects and self-trapping of a laser beam through red blood cell suspensions under different osmotic conditions. Formed waveguides can provide effective guidance for weaker light through scattered bio-soft-matter.

AT2E.4 • 11:30
Holographic optical tweezers assisted imaging spectroscopy, Mohsen Rakhshandehroo[1], Wei-Chuan Shih[1]; [1]*Univ. of Houston, USA.* Holographic optical tweezers (HOT) is an effective means for optical manipulation. Herein we demonstrate its integration with imaging Raman spectroscopy for biological and biomedical applications.

AT2E.5 • 11:45
Digital microscopy enhanced by deep learning, Saga Helgadottir[1], Aykut Argun[1], Giovanni Volpe[1]; [1]*Univ. of Gothenburg, Sweden.* We provide a fully automated deep learning algorithm, using convolutional neural networks, outperforming other traditional methods for high precision digital video microscopy of single and multiple particles with noise.

AT2E.6 • 12:00 Invited
Optoelectronic Tweezers – A New Optofluidic Platform for Single Cell Biology, Ming C. Wu[1]; [1]*Univ. of California Berkeley, USA.* Optoelectronic Tweezers use 2D light patterns to simultaneously trap, sort, confine, and culture tens of thousands of single cells through light-addressed dielectrophoresis. This talk will discuss their principle and successful commercialization for single-cell biology applications.

12:30–14:00 Lunch Break On Your Own

12:30–14:00 Emerging Biomedical Applications of Nonlinear Optics, *Salon G* (Advanced RSVP required)

Tuesday, 16 April

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

14:00–16:00
BT3A • Behaving Brains
Presider: Darcy Peterka; Columbia University, USA

BT3A.1 • 14:00 Invited
Developing new tools for image network dynamics in freely behaving animals, Daniel B. Aharoni[1]; [1]*UCLA, USA.* The Miniscope Project, an open-source collaborative effort, was created to accelerate innovation of miniature microscope technology and to increase global access to this technology.

BT3A.2 • 14:30 Invited
Three dimensional multiphoton microscopy in freely moving animals, Emily A. Gibson[3], Baris N. Ozbay[3], Gregory L. Futia[3], Ming Ma[1], Victor M. Bright[2], Juliet T. Gopinath[4], Ethan G. Hughes[1], Diego Restrepo[1]; [1]*Cell and Dev. Biology, Univ. of Colorado Denver, USA;* [2]*Mechanical Engineering, Univ. of Colorado Boulder, USA;* [3]*Bioengineering, Univ. of Colorado Denver, USA;* [4]*Electrical, Computer and Energy Engineering, Univ. of Colorado Boulder, USA.* We report a head-mounted fiber coupled two-photon microscope with electrowetting optics for three-dimensional imaging in freely moving animals.

BT3A.3 • 15:00 Invited
Imaging the behavior and neural activity of freely moving organisms with a gigapixel microscope, Roarke Horstmeyer[1], Mark Harfouche[1], Eva A. Naumann[1], Timothy Dunn[1]; [1]*Duke University, USA.* We present a micro-camera array microscope that images at cellular-level detail across hundreds of square centimeters. We demonstrate how this microscope can image the behavior and fluorescent neural activity of freely swimming zebrafish.

14:00–16:00
DT3B • Cellular Applications
Presider: Irene Georgakoudi; Tufts University, USA

DT3B.1 • 14:00 Invited
Discovering Biology with Broadband Coherent Raman Imaging, Marcus T. Cicerone[1], Wei-Wen Chen[1], Charles Camp[2], Ronit Sharon-Frilling[2]; [1]*Chemistry and Biochemistry, Georgia Inst. of Tech., USA;* [2]*National Inst. of Standards and Technology, USA.* I will discuss key aspects of spectroscopic coherent Raman imaging technique, and its use for characterizing complex biological systems and understanding their function.

DT3B.2 • 14:30
Changes in Macrophage Metabolism in Response to Pro-Inflammatory and Anti-Inflammatory Stimuli, Isabel S. Smokelin[1], Craig Mizzoni[1], Josh Erndt-Marino[1], Andrew Ford[1], David Kaplan[1], Irene Georgakoudi[1]; [1]*Tufts Univ., USA.* Changes in macrophage metabolism linked to inflammation may be detected using label-free two-photon excited fluorescence (TPEF) measurements, which suggest that distinct redox ratio changes occur in response to pro- and anti-inflammatory stimuli.

DT3B.3 • 14:45
White Blood Cell Classification Using Quantitative Phase Microscopy Based Deep Learning, Xin Shu[1], Sameera Sansare[3], Di Jin[2], Kai-Yu Tong[1], Rishikesh Pandey[3], Renjie Zhou[1]; [1]*The Chinese Univ. of Hong Kong , Hong Kong;* [2]*Massachusetts Inst. of Technology, USA;* [3]*Univ. of Connecticut School of Medicine, USA.* We have constructed a convolutional neural network for classifying white blood cells by using data from a quantitative phase microscope. Better than 90% classification accuracy is obtained in both training set and test set.

DT3B.4 • 15:00
3D Label Free Virtual Dyeing Method Based on Single-shot Polarizing Coupled Sheared Interferometer for Living Cells, Lu Zhang[1], Chunhui Zhao[1]; [1]*Xi'an Jiaotong Univ., China.* 3D label free virtual dyeing method is presented based on single-shot polarizing coupled sheared interferometer, which is prospected to diagnose living cells by their spatial morphology and without any invasive processing.

DT3B.5 • 15:15
Viability study for interrogating pancreatic cancer margins with targeted microbubbles and multiphoton microscopy, Benjamin Cromey[1], Katha Patel[2], Ryan Knox[1], Josef Vagner[3], Bhaskar Banerjee[2,4], Terry Matsunaga[2,4], Khanh Kieu[1]; [1]*College of Optical Sciences, Univ. of Arizona, USA;* [2]*College of Medicine, Univ. of Arizona, USA;* [3]*BIO5 Inst., Ligand Discovery Lab, Univ. of Arizona, USA;* [4]*Biomedical Engineering, Univ. of Arizona, USA.* We have demonstrated a method for determining which cells are cancerous in pancreatic cancer cells using multiphoton microscopy and targeted microbubbles. We continue this work to ensure it works for live and dead cells.

14:00–16:00
NT3C • Tissue Microscopy: Tissue Structure and Dynamics
Presider: J. Quincy Brown; Tulane University, USA

NT3C.1 • 14:00 Invited
Rapid Volumetric Mapping of Neural Dynamics Across the Mouse Brain by Optoacoustic Calcium Imaging, Daniel Razansky[1,2], Sven Gottschalk[1], Oleksiy Degtyaruk[1], Ben McLarney[1], Johannes Rebling[2], Magdalena Hutter[1], X Luis Dean-Ben[1,2], Shy Shoham[3]; [1]*Technical Univ. of Munich and Helmholtz Center Munich, Germany;* [2]*Univ. and ETH Zurich, Switzerland;* [3]*New York Univ., USA.* We report on a functional optoacoustic neuro-tomography approach for simultaneous imaging of hemodynamics and calcium fluxes in living mouse brain, effectively bridging the gap between functional microscopy and whole-brain macroscopic neuroimaging.

NT3C.2 • 14:30
Adaptive Hybrid Illumination Microscopy for Zebrafish Screening, Juergen W. Czarske[1], Nektarios Koukourakis[1]; [1]*Technische Universität Dresden, Germany.* We present adaptive hybrid-illumination microscopy for fast volumetric fluorescence measurement in zebrafish. Using an adaptive lens for axial scanning enables a 3D microscope without any mechanical movements.

NT3C.3 • 14:45
Dual-view Inverted Selective Plane Illumination Microscopy for Accurate 3D Digital Pathology on Large Specimens, Bihe Hu[1], Guang Li[1], J. Quincy Brown[1]; [1]*Tulane Univ., USA.* diSPIM is used to render 3D digital histological images on large specimens. By comparing dual-view deconvolved results with the corresponding single-view images, we demonstrate that dual-view imaging can provide higher image accuracy.

NT3C.4 • 15:00
Photoacoustic Shadow-casting Microscopy (PASM), Jorge Tordera Mora[1], Xiaohua Feng[1], Gao Liang[1]; [1]*Univ. of Illinois at Urbana-Champaign, USA.* Photoacoustic Shadow-casting Microscopy allows high-resolution imaging of biological samples with an unprecedented sensitivity. Given a desired SNR, PASM requires a much reduced excitation fluence, alleviating the photothermal damage to the specimen.

NT3C.5 • 15:15
Fast Polarization-Resolved Third Harmonic Generation Microscopy for the Characterization of Biomaterials, Joséphine M. Morizet[1], Guillaume Ducourthial[1], Willy Supatto[1], Arthur Boutillon[1], Renaud Legouis[2], Marie-Claire Schanne-Klein[1], Chiara Stringari[1], Emmanuel Beaurepaire[1]; [1]*Ecole Polytechnique, France;* [2]*I2BC, France.* We present a fast P-THG microscope where polarization states are switched between image lines using an EOM. We show that fast P-THG is ideally suited for characterizing materials anisotropy in dynamic biological environments.

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

14:00–16:00
OT3D • Probes & Analytics for Multispectral Imaging
Presider: Sergei Vinogradov; University of Pennsylvania, USA

OT3D.1 • 14:00 Invited
Machine Learning Methods for Spectral and Image Data, Thomas W. Bocklitz[1]; [1]*IPC, University Jena, Germany.* To utilize optical techniques for bio-medical applications, e.g. disease diagnostics, the data needs to be analyzed using machine learning. This translation requires automatic data pipelines presented in this contribution for selected application.

OT3D.2 • 14:30
Facilitating Hyperspectral Single Pixel Lifetime Imaging via deep-learning, Marien I. Ochoa[1], Ruoyang Yao[1], Pingkun Yan[1], Xavier Intes[1]; [1]*Rensselaer Polytechnic Inst., USA.* We report on NetFLICS, a deep-learning framework that enables inverse solver free image formation in Hyperspectral Single Pixel Lifetime Imaging at faster acquisition and processing times than conventional methods.

OT3D.3 • 14:45 Invited
Chemical imaging for Biomedicine, Lu Wei[1]; [1]*California Inst. of Technology, USA.* I present two chemical imaging strategies for bio-imaging. First, we devised a Bioorthogonal Chemical Imaging suited for probing small bio-molecules. Second, we developed a super-multiplex vibrational imaging, capable of resolving up to 24 colors.

OT3D.4 • 15:15 Invited
Luminescent silicon nanocrystals as bioimaging probes, Paola Ceroni[1]; [1]*Chemistry Ciamician, Univ. of Bologna, Italy.* Si nanocrystals exhibit bright and long-lived (microsecond) luminescence that can be tuned from the near-infrared into the visible by decreasing their size. These nanostructures have applications in bioimaging (time-gated luminescence microscopy).

14:00–16:00
AT3E • Enhancing Techniques
Presider: Frank Cichos; University Leipzig, Germany

AT3E.1 • 14:00 Invited
Trapping in a material world, Kishan Dholakia[1]; [1]*Univ. of St. Andrews, UK.* This paper will describes work using trapped materials, namely birefringent (vaterite) and upconverting particles. This includes measurement of temperature using upconverting particles and coupling of particles in vacuum through optical binding.

AT3E.2 • 14:30
Dynamics of optically trapped particles tuned by critical Casimir forces and torques, Alessandro Magazzù[1], Agnese Callegari[2], Juan Pablo Staforelli[3], Andrea Gambassi[4], Siegfried Dietrich[5,6], Giovanni Volpe[1]; [1]*Dept. of Physics, Univ. of Gothenburg, Sweden;* [2]*National Nanotechnology Research Center, Bilkent Univ., Turkey;* [3]*Center for Optics and Photonics, Universidad de Concepicón, Chile;* [4]*International School for Advanced Studies and INFN, Italy;* [5]*Max Planck Inst. for Intelligent Systems, Germany;* [6]*Univ. of Stuttgart, Germany.* We investigate the effects of critical Casimir forces and demixing, on the dynamics of a pair of optically trapped particles dispersed in the bulk of a critical binary mixure in proximity of its critical point.

AT3E.3 • 14:45
Spider Silk Self-assembly for Micro-fiber Formation Using Optical Tweezers and Microfluidics, Martin Mojica Benavides[1], Ana Herrera[4,5], Anna Rising[2,3], Frauke Graeter[4,5], Caroline B. Adiels[1]; [1]*Gothenburg Univ., Sweden;* [2] *Swedish Univ. of Agricultural Sciences, Sweden;* [3]*Karolinska Institute, Sweden;* [4]*Heidelberg Inst. for Theoretical Studies, Germany;* [5]*Heidelberg Univ., Germany.* Spider silk is a protein-based composition containing a flexible amorphous and a stiff crystalline phase. We present the use of microfluidics coupled with optical tweezers to study the required conditions for micro-fibers formation.

AT3E.4 • 15:00
Optical Forces and the First Kerker Condition, Nils Odebo Länk[1], Peter Johansson[1,2], Mikael Käll[1]; [1]*Chalmers Univ. of Technology, Sweden;* [2]*School of Science and Technology, Örebro Univ., Sweden.* We investigate, using transfer matrix and Mie calculations, to what extent the zero-backscattering Kerker condition affects the radiation pressure and thus the optical trap stability for silicon particles using realistic optical tweezing parameters.

AT3E.5 • 15:15
Dynamics of Optically Bound Clusters in Complex Optical Fields, Simon Hanna[1], Chaoyi Zhang[1]; [1]*University of Bristol, UK.* Computer simulations are used to explore the dynamical behavior of optically bound clusters of spherical nanoparticles in optical traps; optical binding lowers the system symmetry enabling a coupling with the angular momentum of the beam.

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

BT3A • Behaving Brains—Continued

BT3A.4 • 15:30 Invited

Miniature 3D Fluorescence Microscope Using Random Microlenses, Kyrollos Yanny[1,2], Nick Antipa[1], Ren Ng[1], Laura Waller[1]; [1]*UC Berkeley, USA;* [2]*UC San Francisco, USA.* We propose a single-shot 3D Miniscope, implemented by replacing the tube lens with random microlenses in the pupil. Compared to miniature light-field microscopes, we improve resolution and depth range in a more compact, lightweight package.

DT3B • Cellular Applications—Continued

DT3B.6 • 15:30

Speckle decorrelation for cell's dynamics, Paulina Niedzwiedziuk[1], Maciej Wojtkowski[1], Karol Karnowski[1]; [1]*Inst. of Physical Chemistry PAS, Poland.* Lung cancer cells were measured in scanning Optical Coherence Microscopy setup. Consecutive 2D speckled data was decorrelated to obtain flow information. We observed regions which are more active than others.

DT3B.7 • 15:45

Intracellular Semiconductor Nanodisk Lasers, Alasdair H. Fikouras[1], Marcel Schubert[1], Markus Karl[1], Jothi D. Kumar[1], Simon J. Powis[2], Andrea di Falco[1], Malte C. Gather[1]; [1]*School of Physics and Astronomy, Univ. of St. Andrews, UK;* [2]*School of Medicine, Univ. of St. Andrews, UK.* We report the application of semiconductor nanodisk lasers within living cells. Our lasers have volumes 1000-fold smaller than eukaryotic nuclei, ultralow pulse energy lasing thresholds (E_{th}≈0.13pJ), and provide excellent spectral stability.

NT3C • Tissue Microscopy: Tissue Structure and Dynamics—Continued

NT3C.6 • 15:30 Invited

In Vivo Multiphoton Microscopy of the Beating Mouse Heart in Health and Disease, David M. Small[1], Michael R. Lamont[1], Nathaniel H. Alan-Rahill[1], Nozomi Nishimura[1]; [1]*Cornell University, USA.* In vivo multiphoton microscopy of the beating mouse heart generates cell-resolved volumetric images parameterized by cardiorespiratory phase-space. We compare displacement and deformation profiles throughout the cardiac cycle before and after injury.

16:00–17:30 JT4A • Poster Session and Coffee Break with Exhibitors, *Grand Ballroom Foyer*

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

OT3D • Probes & Analytics for Multispectral Imaging—Continued

OT3D.5 • 15:45
Biosensors Based on Plasmonic Nanostructures for the Visible and Deep UV Range, Sofia M. Safaryan[1], Oksana Borzenkova[1], Pavel Kusov[1], Sergey Kosolobov[1], Yuri Kotelevtsev[1], Vladimir P. Drachev[2,1]; [1]*Skolkovo Inst. of Science and Technology, Russian Federation;* [2]*Univ. of North Texas, USA.* Protein assisted-, DNA hybridized- plasmonic nanostructures for the visible, fractal shell coreless for the extremely broad band VIS-IR and magnetic nanoparticles for the deep UV involved in our efforts on biosensing including cortisol probe.

AT3E • Enhancing Techniques—Continued

AT3E.6 • 15:30
Computational toolbox for optical tweezers in the geometrical optics regime, Agnese Callegari[1], Mite Mijalkov[1], Burak Gokoz[1], Giovanni Volpe[1,2]; [1]*Bilkent Univ., Turkey;* [2]*Gothenburg Univ., Sweden.* We provide a toolbox for the calculation of optical forces and torques on dielectric particles in the geometrical optics limit.

AT3E.7 • 15:45
Optical Tweezers as a tool to differentiate healthy / diabetic individuals via measuring elasticity of the erythrocyte cell membrane., Nahum Méndez Alba[1], José Luis Hernández Pozos[1]; [1]*Universidad Autónoma Metropolitana, Mexico.* Erythrocyte membrane elasticity is studied using a dual-optical tweezer to perform deformation of RBC. Results show that is possible to identify diabetic individuals compared to healthy ones in 90% of the cases studied.

16:00–17:30 JT4A • Poster Session and Coffee Break with Exhibitors, *Grand Ballroom Foyer*

16:00–17:30
JT4A • Poster Session

JT4A.1
Withdrawn

JT4A.2
Manipulate nanoparticles with a laser-induced microbubble, Yuwen Li[1], Chenglong Zhao[1]; [1]*Dept. of Electro-Optics and Photonics, Univ. of Dayton, USA.* A laser-induced microbubble refers to a bubble that is generated in a liquid solution by CW laser illumination to light absorptive materials. In this study, we use the gold nanoparticles to manipulate nanoparticles with laser-induced microbubbles.

JT4A.3
Precise Rhodamine B distribution mapping with E-TPF and F-TPF, Guozhong Hou[1], Zhiwei Dong[1], Sheng Zhang[1], Zhibin Zhang[1], Yuanqin Xia[1,2]; [1]*Harbin Inst. of Technology, China;* [2]*School of Electronic and Information Engineering, Hebei Univ. of Technology, China.* We propose a new method capable of precise Rhodamine B distribution mapping with two-photon fluorescence (TPF) microscopy. Both epi-detection TPF (E-TPF) and forward TPF (F-TPF) is used for TPF imaging.

JT4A.4
Visualizing the Colonization Dynamics of Pathogenic Bacteria Labelled by Upconverting Nanoparticles Inside the Gut, Gokhan Dumlupinar[1,2], Raminder Singh[3], Katarzyna Komolibus[1], Silvia Melgar[3], Stefan Andersson-Engels[1,2]; [1]*Biophotonics, Tyndall National Inst., Ireland;* [2]*Physics, Univ. College Cork, Ireland;* [3]*APC Microbiome Inst., Ireland.* This study intends to show the use of upconversion photoluminescence imaging to investigate the colonization and infection dynamics of a natural murine intestinal pathogen, *Citrobacter rodentium (C.rodentium)*, which induces inflammation in mice.

JT4A.5
Lifting Wavelet and KL Transform (LWKL) Based CT and MRI Image Fusion Scheme, Jayant Bhardwaj[1]; [1]*ECE, BhagwanParshuram Inst. of Technology, India.* The proposed method has proved an efficient methodology in the transform based image fusion schemes .The attractable properties of both Lifting wavelet and KL Transform (LWKL method) are employed.

JT4A.6
Optical Clearing Technology Accelerates Imaging Efficiency of Wide-field Large-volume Tomography, Hao Wu[1,2], Siqi Chen[1,2], Xiaoquan Yang[1,2], Jing Yuan[1,2], Hui Gong[1,2]; [1]*Collaborative Innovation Center for Biomedical Engineering, Wuhan National Laboratory for Optoelectronics-Huazhong Univ. of Science and Technology, China;* [2]*Britton Chance Center and MOE Key Laboratory for Biomedical Photonics, School of Engineering Sciences, Huazhong Univ. of Science and Technology, China.* We developed optical clearing technology to improve efficiency of wide-field large-volume tomography. During sectioning, solution clears sample's surface. It enables to image thicker layers for reducing time consuming in brain data acquisition.

JT4A.7
Simultaneous Axial Multiline Scanning Imaging by Remote Focusing, Rui Jin[1,2], Yalan Yu[1,2], Hui Gong[1,2], Jing Yuan[1,2]; [1]*Collaborative Innovation Center for Biomedical Engineering, Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China;* [2]*Britton Chance Center and MOE Key Laboratory for Biomedical Photonics, School of Engineering Sciences, Huazhong Univ. of Science and Technology, China.* We propose a simultaneous axial imaging in single detector by remotely reflecting different axial planes using a stepwise mirror. We demonstrated the system achieved imaging two axial planes of a mouse brain slice simultaneously.

JT4A.8
Tryptophan and Kynurenines in Neurodegenerative Disease, Laura Sordillo[1,2], Peter SORDILLO[2], Lin Zhang[2], Robert Alfano[2,1]; [1]*Electrical Engineering, CCNY, USA;* [2]*IUSL, CCNY, USA.* There is mounting evidence that there exists a connection between abnormal tryptophan and neurogenerative disease. Relationship between tryptophan and kynurenines in 48 normal and Alzheimer's disease human tissues was investigated using fluorescence.

JT4A.9
Label-Free Intravital Imaging of Cortical Myelin in Mouse Brain by Third-Harmonic Generation Microscopy, Michael Redlich[1,2], Hyungsik Lim[1,2]; [1]*Physics and Astronomy, CUNY Hunter College, USA;* [2]*Physics, CUNY Graduate Center, USA.* We demonstrate label-free intravital imaging of the myelinated fibers in the cerebral cortex of mouse by third-harmonic generation microscopy. Using an optical parametric oscillator as the excitation source, the depth of 250 μm is achieved.

JT4A.10
Improving *In Vivo* Multi-photon Microscopy Using Plug and Play Photon Counting, Hagai Har-Gil[1], Pablo Blinder[1]; [1]*Tel Aviv Univ., Israel.* Rapid imaging of neuronal activity under multi-photon microscopy represents a photon deprived application. We show how photon counting improves signal-to-noise ratio in these experiments.

JT4A.11
Label Free Imaging of Cortical Blood Vessels Using Third Harmonic Generation (THG) Microscopy, Nancy E. Ruiz-Uribe[1], Sung Ji Ahn[2,1], Chris B. Schaffer[1]; [1]*Biomedical Engineering, Cornell Univ., USA;* [2]*Feil Family Brain and Mind Inst., Weill Cornell Medical College, USA.* We measured flow speeds from cortical brain arterioles, venules, and capillaries in mice using third harmonic generation from red blood cells up to 1 mm deep and determined the effect of dextran in brain physiology.

JT4A.12
Human anti-NR1 autoantibodies induce synaptic pathology with functional relevant loss of postsynaptic NMDA receptors, Lars Schmidl[1], Luise Röpke[1], Mihai Ceanga[1], Jakob Kreye[2], Nina Wenke[2], Holger Haselmann[1], Harald Pruess[2], Christian Geis[1]; [1]*Hans-Berger Department of Neurology, Univ. Hospital Jena, Germany;* [2]*German Center for Neurodegenerative Diseases, Germany.* We investigated the pathogenic role of anti-N-Methyl-D-aspartate receptor (NMDAR) antibodies in neurons and in a mouse model of autoimmune encephalitis using LSM and super-resolution microscopy. We found a functional reduction of synaptic NMDARs.

JT4A.13
Raman Micro-spectroscopic Study on Brain Tissue Mapping, Rubina S. Shaikh[1], Marie-Christine Guiot[2,3], Kelvin Petrecca[2], Maxime Tchaya[4], Frederic Leblond[1,5]; [1]*LRO, CRCHUM, Université de Montréal, Canada;* [2]*Dept. of Neurology and Neurosurgery, Montreal Neurological Inst. and Hospital, McGill Univ., Canada;* [3]*Dept. of Pathology, McGill Univ., Canada;* [4]*WITec GmbH, Germany;* [5]*Dept. of Engineering Physics, Polytechnique Montreal, Canada.* In this study we develop high resolution Raman maps from the brain tissue based on k-means cluster analysis.

JT4A.14
Neurotransducers Based Voltage Sensitive Dye-Doped Microlasers, Maurizio Manzo[1], Omar Cavazos[1]; [1]*Engineering Technology, Univ. of North Texas, USA.* We demonstrate a novel neurotransducer for nerve cells electric potential detection that is based on voltage sensitive dye coupled to a microlaser. The neurotransducer exhibits a sensitivity of $\Delta\lambda/\Delta E$=-5*10^{-4}nm/(V/m) and a resolution of 34 V/m.

JT4A.15
Early Life Adversity Leads to Demyelination in the Anterior Cingulate Cortex, Alicja Gasecka[1], Pierre-Eric Lutz[3], Arnaud Tantit[3], Gustavo Turecki[3], Naguib Mechawar[3], Daniel Cote[2,1]; [1]*CERVO Brain Research Center, Canada;* [2]*Universite Laval, Canada;* [3]*Douglas Mental Health Univ. Inst., Canada.* We show morphological evidence from Raman microscopy that the myelination in the anterior cingulate cortex is affected in teens who died by suicide and had suffered child abuse.

JT4A.16
Automated Detection of Malaria Infected Red Blood Cells Using Spatial Coherence Microscope via Ensemble Model, Neeru Singla[1], Kavita Dubey[1], Vishal Srivastava[1]; [1]*Thapar Inst. of Engineering and Tech. Patiala, India.* Malaria Detection is important at the early stage, hence it will induce death. We implement an ensemble method for the early diagnosis of malaria infected cells with extracted morphological parameters using spatial coherence microscope.

JT4A.17
Dark-Field Quantitative Phase Imaging for Angular Scattering, Robert L. Draham[1], Kaitlin J. Dunn[1], Andrew J. Berger[1]; [1]*The Inst. of Optics, Univ. of Rochester, USA.* We constructed a microscope system that obtains angular scattering information using dark-field quantitative phase imaging. In this technique, unscattered light acts as a reference for interferometry. We tested the system using polystyrene beads.

JT4A.18
Can Cutaneous Tumors Be Imaged By Ex Vivo Reflective Confocal Microscopy Without Fluorescent Agents?, Radhika Srivastava[1], Catherine Reilly[1], Ann John[1], Babar Rao[1,2]; [1]*Rutgers RWJMS Dept. of Dermatology, USA;* [2]*Dept. of Dermatology, Weill Cornell Medical Center, USA.* Ex vivo reflectance confocal microscopy can be used to image freshly excised cutaneous tumors without the use of fluorescent agents. Prevailing features were described for each histopathological diagnosis.

JT4A.19
Assessing the Use of Digital Holographic Microscopy to Measure the Fractal Dimension of Colloidal Aggregates, Jerome Fung[2], Samantha Hoang[1]; [1]*Physics, Wellesley College, USA;* [2]*Physics & Astronomy, Ithaca College, USA.* We perform simulations to evaluate an experimental technique for measuring the fractal dimension of colloidal aggregates using digital holographic microscopy. We find that the technique is valid for fractal dimensions as low as D_f = 1.3.

JT4A.20
Withdrawn

JT4A.21
The gradient and frequency-wise analysis improves wide-field imaging in miniaturized one-photon microsocpy, Jeonghwan Son[1], Biagio Mandracchia[1], Michael D. Caponegro[2], Styliani-Anna Tsirka[2], Shu Jia[1]; [1]*The Wallace H. Coutler Dept. of Biomedical Engineering, Georgia Inst. of Technology and Emory Univ., USA;* [2]*Dept. of Pharmacological Sciences, Stony Brook Univ., USA.* The miniaturized one-photon epi-fluorescence microscopy (miniscopy) has emerged as a powerful tool for *in vivo* functional brain imaging. Here, we report a computational method to improve the image quality of miniscopy.

JT4A.22
Adapted polarizing microscopy technique for the determination of birefringence patterns in parchments, Julie Bouhy[1], Angel Martin Fernandez Alvarez[1], Catherine Charles[1], Olivier Deparis[1]; [1]*Univ. of Namur, Belgium.* We adapted a polarizing microscopy technique involving image processing in order to determine birefringence patterns in anisotropic biological tissues. The methodology is applied to the study of parchments' material degradation and internal strains.

JT4A • Poster Session—Continued

JT4A.23
Withdrawn

JT4A.24
Improving Space-Bandwidth Product with Quantitative Oblique Back-Illumination Microscopy, Patrick B. Ledwig[1]; *[1]Georgia Inst. of Technology, USA.* Quantitative oblique back-illumination microscopy (qOBM) uses back-scattered light as an Illumination source for phase contrast.We change illumination parameters, we probe the frequency domain, allowing us to improve resolution with multiple captures.

JT4A.25
Development of Relative Lifetime Imaging System for Intraoperative Parathyroid Identification, Peter Pellionisz[1], Harrison Cheng[1], Joe Pantoja[1], Warren Grundfest[1], Maie St. John[1]; *[1]Univ. of California Los Angeles, USA.* We implemented dynamic optical contrast imaging in a mobile system for intraoperative parathyroid differentiation from surrounding adipose tissue. Our promising in vivo results demonstrate feasibility of the system for surgical guidance.

JT4A.26
Application of single-pixel camera for imaging in turbid media, Julia I. Sudyka[1], Michal Hamkalo[1], Maciej Wojtkowski[1]; *[1]Inst. of Physical Chemistry, PAS, Poland.* We present imaging technique based on single-pixel camera concept. Method encompasses two-dimensional image acquisition with possible data compression and only singular photodiode needed. Our system may become important tool for modern microscopy.

JT4A.27
Characterization of memory effect in juvenile mouse skull for imaging through intact bone, Kayvan Forouhesh Tehrani[1], Nektarios Koukourakis[2], Juergen W. Czarske[2], Luke Mortensen[1]; *[1]Univ. of Georgia, USA; [2]TU Dresden, Germany.* Optical aberrations produced by mouse skull is a barrier for imaging of the brain. Here we present a characterization of murine skull optical aberrations and its memory effect, using a modeling method, and direct measurement.

JT4A.28
Phase Aberration Compensation for Resolution Enhancement in Digital Holographic Microscopy under Structured Illumination, Shaohui Li[1], Da Yin[1], Shaotong Feng[1], Jun Ma[2], Qingyu Ma[1], Caojin Yuan[1]; *[1]Nanjing Normal Univ., China; [2]Nanjing Univ. of Science and Tech., China.* The phase analysis method for quadratic phase of DHM system and the phase-shifting amount of the structured illumination is presented, which is based on the principle component analysis. The experimental results validate this method.

JT4A.29
Using Uric Acid for Singlet Oxygen Detection in a Laser Virus Inactivation Experiment, Aristides Marcano Olaizola[1], David Kingsley[2]; *[1]Delaware State Univ., USA; [2]Food Safety and Intervention Technologies Research Unit of the USDA ARS, Delaware State Univ., USA.* We demonstrate the generation of singlet oxygen in a laser virus inactivation experiment using a low power diode light at 405 nm by detecting photobleaching of the absorption peak of uric acid at 294 nm.

JT4A.30
Waveguide mid-infrared absorption spectroscopy of proteins in the spectral fingerprint region, Vinita Mittal[1], Milos Nedeljkovic[1], Ali Khokhar[1], Lewis Carpenter[1], Ganapathy Murugan[1], Harold Chong[2], Phil Bartlett[3], Goran Mashanovich[1], James Wilkinson[1]; *[1]ORC, Univ. of Southampton, UK; [2]ECS, Univ. of Southampton, UK; [3]School of Chemistry, Univ. of Southampton, UK.* Integration of paper fluidics with Ge-on-Si waveguides for evanescent-field sensing of liquid analytes is demonstrated. Mid-infrared absorption spectroscopy of BSA protein in water and of toluene is shown in the fingerprint region of 1900-1000 cm^{-1}.

JT4A.31
Effects of detailed structures on light scattering pattern for label free cells, Lu Zhang[2], Yunhao Xie[1]; *[2]Xi'an Jiaotong Univ., China.* The effects of cellular detailed structures of membrane, nucleus and sub-organelles on scattering are studied to provide a ground truth in predicting malignant disease in early stage by light method on label free cell level.

JT4A.32
Optical biosensor method to develop human blood types data base using NIR Photons technology, Ebraheem Sultan[1], Jasem Alostad[2], Hameed Ebraheem[1], Nizar Alkhateeb[1]; *[1]PAAET- College of Tech. Studies, Kuwait; [2]PAAET, Kuwait.* Free-space broadband frequency modulated near infrared photon transmission and backscattering mode technique has been used in this paper as an optical bio-sensor method to measure, identify and extract optical properties of different blood types.

JT4A.33
High-resolution Multispectral Fluorescence Lifetime Imaging Microscopy for Characterization of Atherosclerosis Plaque, Jeongmoo Han[1], Hyeong S. Nam[1], Min Woo Lee[1], Sunwon Kim[2,3], Joon Woo Song[3], Jin Won Kim[3], Yoo Hongki[1]; *[1]Biomedical Optics and photomedicine lab, Korea (the Republic of); [2]Dept. of Cardiology, Korea Univ. Ansan Hospital, Korea (the Republic of); [3]Cardiovascular Center, Korea Univ. Guro Hospital, Korea (the Republic of).* We developed a high resolution fluorescence lifetime imaging microscopy to assess atherosclerotic plaque. Various tissue components can be classified using multispectral fluorescence lifetimes and intensity ratio based on a histological study.

JT4A.34
A handheld MEMS-scanned *in vivo* optical-sectioning microscope for early detection and surgical guidance, Chengbo Yin[1], Linpeng Wei[1], Sanjeewa Abeytunge[3], Gary Peterson[3], Adam Glaser[1], Michael Mandella[2], Milind Rajadhyaksha[3], Jonathan T. Liu[1]; *[1]Univ. of Washington, USA; [2]Michigan State Univ., USA; [3]Memorial Sloan Kettering Cancer Center, USA.* A miniature line-scanned (LS) dual-axis confocal (DAC) microscope, with a 12-mm diameter distal tip, has been developed for high-speed (>15 Hz) microscopic imaging of tissue surfaces up to a depth of ~ 150 µm.

JT4A.35
Arthroscopic Near-Infrared Spectroscopic Prediction of Human Meniscus Properties, Juho P. Ala-Myllymäki[1], Tommi Paakkonen[2], Juha Töyräs[1,3], Isaac O. Afara[1]; *[1]Dept. of Applied Physics, Univ. of Eastern Finland, Finland; [2]Dept. of Medicine, Univ. of Eastern Finland, Finland; [3]School of Info. Tech. and Electrical Engineering, The Univ. of Queensland, Australia.* We investigate the potential of near-infrared spectroscopy for estimating the properties of human meniscus during arthroscopy. *In vitro* predictive models were developed and tested on *ex vivo* arthroscopic near-infrared spectroscopy measurements.

JT4A.36
Interaction of Femtosecond Pulsed Lasers with Fe^{2+} and Fe^{3+} Doped Calcium Phosphates for Bone Tissue Engineering, Emaan Alsubhe[1], Antonios Anastasiou[1], Chiranjeevi Maddi[1], Mostafa El-Raif[2], Peter V. Giannoudis[3], Animesh Jha[1]; *[1]School of Chemical and process engineering, Univ. of Leeds., UK; [2]Leeds Dental School, Univ. of Leeds, UK; [3]Faculty of Medicine and Health, Univ. of Leeds, UK.* In this work, we aim to investigate the effect of Fe^{2+}/Fe^{3+} doping on the laser sintering of calcium phosphate minerals for the fabrication of bone scaffolds. The laser-matter mechanisms and the biological response are discussed.

JT4A.37
Mid-infrared and Near infrared spectroscopic analysis of mechanically and enzymatically damaged cartilage, Ervin Nippolainen[1], Rubina S. Shaikh[1], Vesa Virtanen[2], Lassi Rieppo[2], Isaac O. Afara[1], Simo Saarakkala[2], Juha Töyräs[1,3]; *[1]Univ. of Eastern Finland, Finland; [2]Univ. of Oulu, Finland; [3]Univ. of Queensland, Australia.* In this study, we demonstrate the potential of mid-infrared (MIR) and near infrared (NIR) spectroscopies to reveal and differentiate between superficial changes in articular cartilage (AC) after mechanical or enzymatic degradation.

JT4A.38
Withdrawn

JT4A.39
Use of the PV[O]H Algorithm as a Noninvasive Imaging Modality for Spinal Cord Injury In Vivo in a Rat Model, Seth Fiilioe[2], Kyle K. Bishop[1], Alexander V. Jannini[1], Jon Kim[1], Richard McDonough[2], Steven Ortiz[2], Jerry Goodisman[2], Julie Hasenwinkel[1], Joseph Chaiken[2]; *[1]Syracuse Biomaterials Inst., Syracuse Univ., USA; [2]Dept. of Chemistry, Syracuse Univ., USA.* PV[O]H involves simultaneously measuring elastic scattering and inelastic emission as a near infrared laser is scanned across tissue. Contrast for imaging derives from correlated variations in local turbidity and Raman/fluorescence emission.

JT4A.40
Noninvasive In Vivo Quantitative Emission Spectroscopy of Optically Thin or Dilute Two-Phase Samples: Bacterial Cultures, Steven Ortiz[1], Richard McDonough[1], Paul Dent[1], Jerry Goodisman[1], Joseph Chaiken[1]; *[1]Dept. of Chemistry, Syracuse Univ., USA.* We demonstrate measuring bacterial density and the chemical state of bacterial culture medium without physical sampling allowing continuous monitoring while avoiding potential contamination. This cannot be accomplished using OD 600 measurements.

JT4A.41
Supervised Learning: How Training Detects Microvasculature in Photoacoustic Images, Ravi Chowdhary[1], Junjie Yao[1]; *[1]Biomedical Engineering, Duke Univ., USA.* Vessel segmentation algorithms in photoacoustic images suffer from discontinued vessels. We developed a supervised learning algorithm that determines vessels and non-vessels. Our results indicated our algorithm can determine more microvasculature.

JT4A.42
Interaction and Internalization of Photodithazine in *C.Albicans* Microbial Wall for Enhancement Photodymanic Therapy, Raphael A. Caface[1], Francisco Eduardo G. Guimarães[1]; *[1]USP, Brazil.* Serial distribution of light by LED induce photodynamic action through photodithazine for photodynamic inactivation, light doses equal to 1 J/cm^2 were shown to be more efficient in the interaction and internalization in *c.albicans* cells.

JT4A.43
Study on Optimal Parameters of Photobiomodulation Therapy on the Excitation of Inflammatory Cells in Diabetes, Qianqian Chen[1], Jichun Yang[1], Huijuan Yin[1], Xiafei Shi[1], Wendong Jin[1], Yingxin Li[1]; *[1]Inst. of Biomedical Engineering, Chinese Academy of Medical Sciences, China.* We aimed to discover the optimal parameters of photobiomodulation therapy (PBM) on the proliferation of U937-induced inflammatory cells by MTT method in order to help its application in clinic treatment of diabetic foot ulcers.

JT4A.44
Analysis on the Three-dimensional Pathological Changes of PDT Treated Tumor, Wendong Jin[1], Huijuan Yin[1], Xiafei Shi[1], Qianqian Chen[1], Yingxin Li[1]; *[1]Inst. of Biomedical Engineering, Chinese Academy of Medical Sciences, China.* We are interested in knowing the three-dimensional pathological changes of PDT treated tumor so the whole scanning images of 230 HE-staining slides from a tumor in a mice at 3 days after PDT were analyzed.

JT4A.45
Fabrication of Multi-Layered Bone Scaffolds using Femtosecond Pulsed Lasers, Neelam Iqbal[1], Antonios Anastasiou[1], Chiranjeevi Maddi[1], Mostafa El-Raif[2], Peter V. Giannoudis[3], Animesh Jha[1]; *[1]School of Chemical and Processing Engineering, Univ. of Leeds, UK; [2]Division of Oral Biology, Leeds Dental School, UK; [3]Dept. of Trauma and Orthopaedic Surgery, Leeds General Infirmary, UK.* An IR femtosecond pulsed laser was used for micropatterning of biomineral containing chitosan membranes, aiming to enhance bone mineralization and angiogenesis. Materials have been characterized with XRD, SEM and spectroscopic techniques.

JT4A • Poster Session—Continued

JT4A.46
Characterization of Urease Enzyme Using Raman and FTIR Spectroscopy, Manish Chauhan[1], Chiranjeevi Maddi[1], Animesh Jha[1], Venkat Subramanian[1], Pietro Valdastri[1]; [1]*Univ. of Leeds, UK.* Urease is a commonly found enzyme in the natural biological environment like plants, soil, and animals. Its characteristic decomposition is spectroscopically investigated in acidic (chloride) environment for understanding nitrogen cycle.

JT4A.47
Polarimetric Information for Pre-Cancer Detection from Uterine Cervix Specimens, Meredith Kupinski[1,2]; [1]*Univ. of Arizona, USA;* [2]*LPICM, Ecole Polytechnique, France.* The detection performance of cervical intraepithelial neoplasia is reported from backscattering polarimetric measurements at visible wavelengths. The detection for non-linear and linear compressions of the full Mueller matrix is investigated.

JT4A.48
Light-sheet Imaging to Characterize Vascular Development in Murine Retina, Chih-Chiang Chang[1], Yichen Ding[2], Kyung In Baek[1], Xili Ding[1], Dong Wang[1], Song Li[1], René R. Sevag Packard[2], Tzung Hsiai[2]; [1]*Bioengineering, UCLA, USA;* [2]*Medicine, UCLA, USA.* Light-sheet fluorescence microscopy (LSFM) coupled with fluorescence-friendly tissue clearing technique enables the detailed analysis of 3-D vascular network in the murine retina.

JT4A.49
Surface plasmon polariton excitation in a metallic hybrid film for optical studies of a biological fluid, Sandra Gastélum-Acuña[1]; [1]*Dept. de Investigación en Física, CONACyT-Universidad de Sonora, Mexico.* We propose a metallic hybrid system in contact with biological fluid to study optically the fluid by using surface plasmon polariton spectroscopy. A thin film of Ag and other of Al forms the bimetallic layer.

JT4A.50
Optofluidic Platform for Bacteria Screening in Nanoliter Droplets, Jakub Boguslawski[1], Natalia Pacocha[1], Michal Horka[1], Maciej Wojtkowski[1], Piotr Garstecki[1]; [1]*Inst. of Physical Chemistry, Poland.* A microfluidic platform for an optical, label-free screening of bacteria growth in nanoliter droplets is demonstrated. We show that based on droplet's scattering properties we can perform a reliable binary readout.

JT4A.51
Improved Non-Contact Optical Monitoring of Blood Pulsation in IR using Laser Speckle Contrast Analysis, Hadar Genish[1], Matan Benyamin[2,1], Ariel Schwarz[3], Nissan Ozana[1], Zeev Zalevsky[2], Ran Califa[1]; [1]*ContinUcse Biometrics, Israel;* [2]*Bar Ilan Univ., Israel;* [3]*Jerusalem College of Engineering, Israel.* A non-contact optical method based on laser speckle contrast analysis in IR for monitoring of blood pulsation is compared to remote PPG. Suggested method show superiority at anatomic sites with week pulsation.

JT4A.52
Regularizing refractive index sensitivity for disordered plasmonic array, Jong Moon Lee[1], Ibrahim Misbah[1], Wei-Chuan Shih[1]; [1]*University of Houston, USA.* Plasmonic arrays fabricated by low-cost nanosphere lithography feature disorderliness and corresponding non-uniform index sensitivity. A calibration technique based on hyperspectral imaging has been implemented to regularize the sensitivity.

JT4A.53
Anisotropic 3D insulin granule transport in live cells with MFM, Xiaolei Wang[1], Hannah Yi[1], Itay Gdor[1], Matthew Daddysman[1], Ruxandra Nicolae[2], Theresa Haunold[1], Elizabeth White[1], Mark Hereld[3], Norbert Scherer[1]; [1]*Univ. of Chicago, USA;* [2]*Univ. of Chicago Laboratory Schools, USA;* [3]*Argonne National Laboratory, USA.* We quantitatively track single intracellular insulin granules in 3D with a custom-built multifocal microscope (MFM). The granules exhibit anisotropic dynamics. Our study has important implications for understanding cell function.

JT4A.54
Rapid Pathology of Lumpectomy Margins with Open-Top Light-Sheet (OTLS) Microscopy, Ye Chen[1], Weisi Xie[1], Adam Glaser[1], Nicholas Reder[2], Chenyi Mao[3], Suzanne Dintzis[2], Joshua C. Vaughan[3], Jonathan T. Liu[1,2]; [1]*Dept. of Mechanical Engineering, Univ. of Washington, USA;* [2]*Dept. of Pathology, Univ. of Washington, USA;* [3]*Dept. of Chemistry, Univ. of Washington, USA.* Rapid and comprehensive surface microscopy of freshly excised breast specimens has been achieved with an optimized open-top light-sheet (OTLS) microscopy system in conjunction with an improved fluorescent analogue of H&E staining.

JT4A.55
Microscopic Investigation and Modeling of Topically Applied Nanoparticles for Quantitative Molecular Imaging, Soyoung Kang[1], Xiaochun Xu[2], Eric Navarro[2], Yu Wang[1], Kenneth M. Tichauer[2], Jonathan T. Liu[1]; [1]*Univ. of Washington, USA;* [2]*Biomedical Engineering, Illinois Inst. of Technology, USA.* We present a mathematical model that simulates the behavior of targeted nanoparticles topically applied on tissue surfaces. This model is valuable for optimizing nanoparticle-based imaging methods and accurate quantification of biomarkers.

17:30–19:30 A Celebration of the Nobel Prize Winning Work of Arthur Ashkin, *Salon F*

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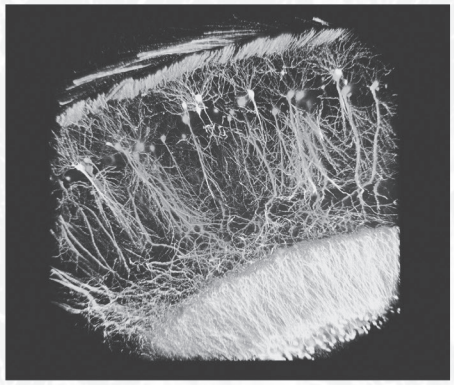

Two-photon Image of Neurons Expressing thy1-YFP in a Cleared Region of the Dentate Gyrus. (Courtesy of the 2017 Imaging Structure and Function in the Nervous System Course at Cold Spring Harbor Laboratory, Cold Spring Harbor, NY)

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07:30–18:00 Registration, *Grand Ballroom Foyer*

08:00–09:45
BW1A • Human Brain Technology
Presider: Gemma Bale; University College London, UK

BW1A.1 • 08:00 Invited
Acousto optics for cerebral blood flow monitoring, Michal Balberg[1]; [1]*Holon Institute of Tech., Israel.* Acousto-optic sensing, using ultrasound-modulated light in live tissue, enables non-invasive, continuous monitoring of blood flow in the brain. Preclinical and clinical data demonstrate agreement with other modalities for blood flow sensing and its benefits.

BW1A.2 • 08:30 Invited
Integrated CMOS TD-NIRS using 1.5D interposer technology, Sreenil Saha[1], Mohamad Sawan[1], Frederic Lesage[1,2]; [1]*Electrical Engineering, Ecole Polytechnique, Canada;* [2]*Research Center, Montreal Heart Inst., Canada.* We present the design of a standalone optical probe integrated with a Time-Gated Single Photon Detection module and Pulsed Light Emission unit. The miniaturized optode can be used in Near-Infrared Spectroscopy and functional brain imaging.

BW1A.3 • 09:00
Development of a Wearable fNIRS System Using Modular Electronic Optodes for Scalability, Bernhard Zimmermann[1,2], Davide Tamborini[2], Juliette Selb[1,2], Antonio Ortega Martinez[1], David A. Boas[1,2]; [1]*Biomedical Engineering, Boston Univ., USA;* [2]*Martinos Center/Radiology, MGH/Harvard Medical School, USA.* We have developed a low-cost, wearable, and scalable fNIRS system, based on chains of compact and fiber-less electronic optodes, each containing a dual-color LED, photodiode, amplifier, analog to digital converter, and FPGA for demodulation.

BW1A.4 • 09:15
Interrogation of sample dynamics using interferometric diffuse correlation spectroscopy, Mitchell B. Robinson[1,2], Stefan Carp[2], Davide Tamborini[2], David A. Boas[3,2], Maria Angela Franceschini[2]; [1]*Harvard-MIT HST, Massachusetts Inst. of Tech., USA;* [2]*A. Martinos Center for Biomedical Imaging, Massachusetts General Hospital, USA;* [3]*Biomedical Engineering, Boston Univ., USA.* Diffuse correlation spectroscopy (DCS) is a technique that has traditionally required low noise, single photo counting detectors. By utilizing an interferometric approach, we show that these hardware conditions can be relaxed.

08:00–10:00
DW1B • Sensing Applications
Presider: Chenglong Zhao; University of Dayton, USA

DW1B.1 • 08:00 Invited
Smartphone Nano Colorimetry, Wei-Chuan Shih[1]; [1]*University of Houston, USA.* Recent advances in inkjet-printed optics have created DotLens, which can be attached onto any smartphone camera akin to a contact lens, and enable smartphones to obtain images of nanoscale objects for colorimetric sensing.

DW1B.2 • 08:30
Glucose sensing by stamping surface-enhanced Raman spectroscopy (S-SERS), Chun-Jen Lin[1], Ibrahim Misbah[1], Wei-Chuan Shih[1]; [1]*University of Houston, USA.* We report glucose sensing 10 mM to 0.1 mM in water using stamping surface-enhanced Raman spectroscopy (S-SERS) technique with nanoporous gold disk (NPGD) plasmonic substrates, a reagent- and separation-free technique.

DW1B.3 • 08:45
Aptamer-based SERS detection and quantitation of small molecules and enzymes on plasmonic nanostructures, Suyan Qiu[1], Wei-Chuan Shih[1]; [1]*University of Houston, USA.* Sensitive and selective detection and quantitation of small molecules and enzymatic activities have been attempted using surface-enhanced Raman spectroscopy (SERS). Pre-immobilized aptamers and *in situ* assembled aptamer have been developed.

DW1B.4 • 09:00
Frequency-locked Optical Whispering Evanescent Resonators for Ultra-Sensitive Doping Detection in Urine, Erol Ozgur[1], Kara E. Roberts[1], Ekin O. Ozgur[1], Adley Gin[1], Jaden R. Bankhead[1], Zhikun Wang[1], Judith Su[1]; [1]*Univ. of Arizona, USA.* Frequency locking is an emergent method for interrogating the optical resonances by feedback control, with unprecedented precision. Here, we demonstrate ultrasensitive detection of doping agents in urine using frequency locked on-chip microcavities.

DW1B.5 • 09:15
Label-free Ultrasensitive Detection of Amyloid-β Using Lipid-Functionalized Microtoroid Optical Resonators for Early Diagnosis of Alzheimer's Disease, Adley Gin[1], Phuong Diem Nguyen[1], Erol Ozgur[1], Judith Su[1]; [1]*Univ. of Arizona, USA.* Amyloid-β is a biomarker of interest in early detection of Alzheimer's disease. Here we present microtoroid optical resonators functionalized with a lipid membrane for highly-sensitive, label-free detection of Amyloid-β proteins.

08:00–10:00
NW1C • Nonlinear Microscopy: Techniques, Technologies, and Applications II
Presider: Shuo Tang; Univ. of British Columbia, Canada

NW1C.6 • 08:00 Invited
Fast Polarization-Resolved SHG Microscopy to Monitor Dynamic Collagen Reorganization During Skin Stretching, Guillaume Ducourthial[1], Margaux Schmeltz[1], Jean-Sébastien Affagard[2], Xavier Solinas[1], Maeva Lopez-Poncelas[2], Christelle Bonod-Bidaud[4], Ruth Rubio-Amador[4], Florence Ruggiero[4], Jean-Marc Allain[2,3], Emmanuel Beaurepaire[1], Marie-Claire Schanne-Klein[1]; [1]*LOB, Ecole Polytechnique - CNRS - Inserm, France;* [2]*LMS, Ecole Polytechnique - CNRS, France;* [3]*INRIA - Université Paris-Saclay, France;* [4]*IGFL, ENS-Lyon - CNRS - Université de Lyon, France.* We have implemented a fast polarization-resolved SHG microscope to quantify the dynamic collagen reorganization in *ex vivo* murine skin dermis during stretching assays. It provides new multiscale data about biomechanics of connective tissues.

NW1C.2 • 08:30
Label-Free Imaging of Bipolar Cell Axons in Mouse Retina by Second-Harmonic Generation , Festa Bucinca[1,2]; [1]*Hunter College, USA;* [2]*Physics, The Graduate Center, CUNY, USA.* We present label-free imaging of retinal bipolar cell (RBC) axons by second-harmonic generation microscopy arising from uniformly polarized microtubules. The utility is shown for verifying the persistence of RBC axons in glaucoma.

NW1C.3 • 08:45
Hyperspectral Multiphoton Microscopy for In Vivo Visualization of Spectrally-overlapped Fluorescent Labels, Menansili A. Mejooli[1], Amanda Bares[1], Scott Leddon[2], Steven Tilley[1], Jingyuan Dong[1], Minsoo Kim[2], Deborah Fowell[2], Nozomi Nishimura[1], Chris B. Schaffer[1]; [1]*Cornell Univ., USA;* [2]*Microbiology and Immunology, Univ. of Rochester Medical Center, USA.* We constructed a hyperspectral multiphoton microscope (HMM) that enabled high spectral-resolution imaging deep into scattering samples and used this instrument for in vivo visualization of the behavior of multiple cell types after an injury.

NW1C.4 • 09:00
Understanding ECM Remodeling in Idiopathic Pulmonary Fibrosis Via Polarization Resolved SHG Microscopy, Darian James[1], Hsin-Yu B. Chang[1], Nathan K. Sandbo[2], Vikas Singh[3], Paul Campagnola[1]; [1]*Biomedical Engineering, Univ. of Wisconsin-Madison, USA;* [2]*Allergy, Pulmonary, and Critical Care Medicine, Univ. of Wisconsin-Madison, USA;* [3]*Biostatics and Informatics, Univ. of Wisconsin-Madison, USA.* We use polarization resolved SHG microscopy to study macromolecular/supramolecular collagen alterations in idiopathic pulmonary fibrosis. We found significant differences in collagen structure, these insights could lead to new diagnostic approaches.

NW1C.5 • 09:15
Temporal Focusing with Remote Axial Scanning via Dispersion with an Electrically Tunable Lens, Michael E. Durst[1], Anthony Turcios[1]; [1]*Middlebury College, USA.* We implement high-speed axial scanning in a two-photon temporal focusing microscope by dispersion tuning with an electrically tunable lens. We remotely shift the temporal focus 100 μm axially at 100 Hz.

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

07:30–18:00 Registration, *Grand Ballroom Foyer*

08:00–09:45
OW1D • Quantitative Molecular Imaging using Dual Probe Strategies
Presider: Kimberley Samkoe; Dartmouth Medical School, USA

OW1D.1 • 08:00 Invited
Quantitative Fluorescence Molecular Imaging through Kinetic Modeling and Paired Agent Methods, Kenneth M. Tichauer[1], Negar Sadeghipour[1], Xiaochun Xu[2]; [1]*Illinois Inst. of Technology, USA;* [2]*Dartmouth College, USA.* Physiology and pharmacokinetics signficantly influence uptake and retention of injected imaging agents. Paired-agent methods that employ co-injection of a control agent can account for these effects, allowing truly quantitative molecular imaging.

OW1D.2 • 08:30 Invited
Intracellular paired-agent imaging (iPAI) in live cells and tissues for monitoring drug-target interactions and signal cascade response, Kimberley Samkoe[1], Kenneth M. Tichauer[2], Summer L. Gibbs[3], Emily Schultz[3], Lei Wang[3]; [1]*Dartmouth Medical School, USA;* [2]*Illinois Inst. of Technology, USA;* [3]*Oregon Health and Science Univ., USA.* Fluorescent small molecule inhibitors and isotype control paired-agents administered simultaneously in living systems enable intracellular quantification of drug-target interactions and downstream phosphorylation events in individual patients.

OW1D.3 • 09:00
Staining and rinsing protocol in excised lymph node using paired-agent fluorescence imaging to detect micrometastases, Chengyue Li[1], Veronica C. Torres[1], Xiaochun Xu[1], Jovan G. Brankov[1], Kenneth M. Tichauer[1]; [1]*Illinois Inst. of Technology, USA.* Paired-agent fluorescence imaging could significantly improve the sensitivity of micrometastases detection for breast cancer sentinel lymph node biopsy and suggests that fewer than 1000 cells may be potentially observable in a whole human lymph node.

OW1D.5 • 09:15
Paired-agent imaging demonstrates improved diagnostic ability compared to single targeted agents for guiding head and neck squamous cell carcinoma resection, Cheng Wang[1]; [1]*Dartmouth college, USA.* Paired agent imaging demonstrates higher diagnostic ability and can more effectively predict EGFR expression than single agent imaging. It has the best potential in fluorescence-guided resection of head and neck cancer.

08:00–10:00
AW1E • Materials
Presider: Antonio Neves; Universidade Federal do ABC, Brazil

AW1E.1 • 08:00 Invited
Reversible Optogenetic Control of Growth Factor Signaling During Cell Differentiation and Vertebrate Embryonic Development, Kai Zhang[1], Vishnu Krishnamurthy[1], John Khamo[1], Payel Mondal[1], Savanna Sharum[1], Jing Yang[1]; [1]*Univ. of Illinois, USA.* To decipher the kinetic regulation of growth factor signaling outcomes, I will introduce our recently developed non-neuronal optogenetic strategy that enables reversible control of growth factor signaling during cell differentiation and embryonic development.

AW1E.2 • 08:30
Determination of surface binding properties using rotational optical tweezers, Rahul Vaipully[1], Dhanush Bhatt[1], Anand Dev Ranjan[1], Basudev Roy[1]; [1]*Indian Inst. of Technology, Madras, India.* We trap close to a surface to find that rotation rate vanishes at finite tweezers laser powers for some substrates. We suspect this to be due to binding between the substrate and the birefringent particle.

AW1E.3 • 08:45
Study of Single Airborne Particle Using Laser Spectroscopy and Universal Optical-trapping, Yongle Pan[1], Aimable Kalume[1], Zhiyong Gong[2], Chuji Wang[2], Joshua Santarpia[3]; [1]*US Army Research Laboratory, USA;* [2]*Mississippi State Univ., USA;* [3]*Sandia National Laboratories, USA.* A new universal optical-trapping technology was developed. Physical, chemical and biological properties of trapped-single airborne particles were studied via position-resolved temporal Raman, cavity ringdown spectra, and back-scattering patterns.

AW1E.4 • 09:00 Invited
Optical Trapping and Optomechanically-assisted Assembly of Non-Spherical Nanocontainers, Cornelia Denz[1], Alvaro Barroso[1], Robert Meissner[1], Neus Oliver[1]; [1]*Westfaelische Wilhelms Univ Munster, Germany.* We demonstrate using nonspherical nanocontainers as probes for force sensing and building blocks for complex assemblies. Employing holographic optical tweezers, arbitrary nanoarchitectures are optomechanically fabricated.

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

BW1A • Human Brain Technology—Continued

BW1A.5 • 09:30
Superconducting nanowire single-photon detectors for Diffuse Correlation Spectroscopy, Davide Tamborini[1], vikas Anant[2], Boris Korzh[3], Matthew D. Shaw[3], Stefan Carp[1], Maria Angela Franceschini[1]; [1]*Massachusetts General Hospital, USA;* [2]*Photon Spot Inc., USA;* [3]*Jet Propulsion Laboratory, California Inst. of Tech., USA.* We present the benefits of using superconducting nanowire single-photon detectors to improve the performance of diffuse correlation spectroscopy measurements, thanks to their high detection efficiency and precise timing response.

DW1B • Sensing Applications—Continued

DW1B.6 • 09:30
Multiplex sensing of lead and mercury in drinking water using smartphone nano-colorimetry, Hoang Nguyen[1], Wei-Chuan Shih[1]; [1]*University of Houston, USA.* We report smartphone nano-colorimetry (SNC) for mobile and multiplex detection and quantitation of lead and mercury ions in drinking water. The detection limit is below EPA action levels set for both metal ions.

DW1B.7 • 09:45
Optimized Reconstruction for Sparse and Small Targets in Lens-free Holographic Microscopy, Zhen Xiong[1], Jeffrey E. Melzer[1], Jacob Garan[1], Euan McLeod[1]; [1]*University of Arizona, USA.* Lens-free holographic microscopy offers sub-micron resolution over a field-of-view >20 mm^2, making it a suitable biomedical imaging and sensing platform. We devised a sparsity-promoting method, which enhances SNR by ~8 dB compared to typical methods.

NW1C • Nonlinear Microscopy: Techniques, Technologies, and Applications II—Continued

NW1C.1 • 09:30 Invited
Label-free Dynamic Lipid Membrane Potential Imaging, Orly B. Tarun[1], Sylvie Roke[1]; [1]*Ecole Polytechnique Federale de Lausanne, Switzerland.* Using high throughput wide field SH imaging we probe the orientational ordering of water in freestanding lipid membrane hydration shells, and determine real-time membrane potential maps (400 nm, ~100 ms). Applications to neurons are investigated.

10:00–10:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

OW1D • Quantitative Molecular Imaging using Dual Probe Strategies—Continued

OW1D.6 • 09:30
Raman-Encoded Molecular Imaging (REMI) with Topically Applied SERS Nanoparticles for Lumpectomy Guidance, Soyoung Kang[1], Yu Wang[1], Nicholas Reder[1], Sara Javid[1], Suzanne Dintzis[1], Jonathan T. Liu[1]; [1]*Univ. of Washington, USA*. We have developed a Raman-encoded molecular imaging technique capable of imaging targeted SERS nanoparticles topically applied on human breast specimens to quantitatively image a panel of disease biomarkers for intraoperative guidance of lumpectomy.

AW1E • Materials—Continued

AW1E.5 • 09:30 Invited
Single-molecule measurements on individual biomolecules held in an electrokinetic trap, Quan Wang[1]; [1]*Princeton University, USA*. Holding biomolecules in solution presents a significant challenge to optical tweezers but can be reliably achieved using feedback electrokinetic traps. I will describe our advances in measuring size, charge and smFRET of individually trapped biomolecules.

10:00–10:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

Salon K & L	Salon I	Salon F
Optics and the Brain	Bio-Optics: Design and Application	Novel Techniques in Microscopy

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

10:30-11:30
Selected Highlights and Future Directions for Optics in the Brain

The Optics and Brain Program Committee will choose several topics to showcase, pointing out exciting results from the other Topical Meetings relevant for neuroscience and discussing emerging ideas and opportunities.

10:30–11:30
DW2B • Micro/Nano Optics

Presider: Tomasz Tkaczyk; Rice University, USA

DW2B.1 • 10:30
Detection of membrane binding events using microtoroid optical resonators, Phuong Diem Nguyen[1], Adley Gin[1], Judith Su[1]; [1]*University of Arizona, USA.* Novel lipid coated microtoroid optical resonators was developed for membrane interaction. The proposed platform significantly enhanced the detection of cholera toxin in term of time and detection limit compared to fluorescent-based assay.

DW2B.2 • 10:45
Plasmonic Sensors on Invisible Substrates, Ibrahim Misbah[1], Wei-Chuan Shih[1]; [1]*University of Houston, USA.* Gold nanodisks array with minimal effect from the glass substrates have been fabricated using nanosphere lithography and HF undercutting. The undercut substrates have blue-shifted plasmonic resonance with higher bulk refractive index sensitivity.

DW2B.3 • 11:00
Gold-Silver Alloy Nanodisk Array for Smartphone Colorimetric Biosensing, Ibrahim Misbah[1], Wei-Chuan Shih[1]; [1]*University of Houston, USA.* Substrate-bound gold-silver alloy nanodisk array has in a pair of high and low energy LSPR modes. This high energy mode is applied for colorimetric detection of sub-nM and sub-monolayer surface binding using a smartphone.

DW2B.4 • 11:15
High-resolution air-clad imaging fibers, Harry A. Wood[1], Kerrianne Harrington[1], Jonathan Knight[1], Tim Birks[1], James M. Stone[1]; [1]*University of Bath, UK.* We describe an imaging fiber bundle that uses 11,000 doped silica cores in an air-filled cladding to image features as small as 3 μm at 1 μm wavelength.

10:30–11:30
NW2C • Superresolution Imaging

Presider: Virginijus Barzda; University of Toronto, Canada

NW2C.1 • 10:30
Super-Resolution using Nonlinear Fourier-Basis Spatial Frequency Projections, Keith Wernsing[1], Jeffrey Field[1], Jeff Squier[2], Randy Bartels[1]; [1]*Colorado State Univ., USA;* [2]*Colorado School of Mines , USA.* Multiphoton Spatial Frequency Modulated Imaging reconstructs super-resolved images by driving harmonics of 1D spatial frequency projections through a nonlinear sample interaction. Tomographic reconstruction extends the resolution enhancement to 2D.

NW2C.2 • 10:45
Single Pixel Fourier Computed Tomography, Patrick A. Stockton[1], Keith A. Wernsing[1], Jeffery Field[1], Randy Bartels[1], Jeff Squier[2]; [1]*Colorado State University, USA;* [2]*School of Mines, USA.* We introduce a new tomographic imaging technique called Fourier Computed Tomography (FCT). FCT aims to alleviate the anisotropic resolution generated by MP-SPIFI.

NW2C.3 • 11:00
Withdrawn

NW2C.4 • 11:15
Combining Total Internal Reflection Fluorescence Microscopy with Rapid Super-resolution Imaging, Min Guo[1], Panagiotis Chandris[1], John P. Giannini[1], Jiji Chen[1], Harshad D. Vishwasrao[1], Hari Shroff[1]; [1]*National Inst. of Health, USA.* We combined instant structured illumination microscopy and total internal reflection fluorescence microscopy (instant TIRF-SIM), enabling rapid super-resolution imaging (down to 115±13 nm) at acquisition speeds up to 100 Hz in living samples.

11:45–12:30 Postdeadline Papers (See the Update Sheet for complete information)

12:30–14:00 Lunch Break On Your Own

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

10:30–11:30
OW2D • Novel Optical Imaging Tools & Techniques
Presider: Kenneth Tichauer; Illinois Institute of Tech., USA

OW2D.1 • 10:30
Studies of collective emission from virus-templated chromophore antenna arrays, Irina Tsvetkova[1], Arathi Anil-Sushma[1], Bogdan Dragnea[1]; [1]*Indiana University, USA.* We report on the observation by time-resolved fluorescence spectroscopy of coherent relaxation of an array of chromophores bound to the surface of an icosahedral virus particle.

OW2D.2 • 10:45
Plasmonic Dark Modes for Enhanced Microcavity Biosensing, Cheng Li[1], Lei Chen[1,2], Euan McLeod[1], Judith Su[1]; [1]*University of Arizona, USA;* [2]*Beijing Univ. of Posts and Telecommunications, China.* Plasmonically enhanced microcavities exhibit local field enhancement but decreased quality (Q) factor compared to bare microcavities. We show that trimer gold nanostructures generate dark modes that greatly increase field enhancement and maintain Q.

OW2D.3 • 11:00
Photoacoustic Tomography for Longitudinal Monitoring of Targeted Contrast Agents, Kristie Huda[1], Chengxi Wu[1], Jaclyn Sider[1], Sergey Ermilov[2], Carolyn Bayer[1]; [1]*Tulane Univ., USA;* [2]*Photosound Technologies Inc, USA.* In this work, we characterized a prototype photoacoustic tomographic imaging system to monitor longitudinal placental accumulation of a folate conjugated contrast agent.

OW2D.4 • 11:15
Automated registration for optoacoustic tomography and MRI, Wuwei Ren[1,2], Hlynur Skulason[1], Felix Schlegel[1], Markus Rudin[1], Jan Klohs[1,3], Ruiqing Ni[1]; [1]*Inst. for Biomedical Engineering, ETH and University of Zurich, Switzerland;* [2]*Biomedical Optics Research Lab., Univ. Hospital Zurich, Switzerland;* [3]*Zurich Neuroscience Center, Univ. of Zurich, Switzerland.* Mapping optoacoustic tomography onto MRI data enables spatiotemporal resolution complementarity and accurate quantification. We have developed an automated registration toolbox. Both phantom and animal studies have shown robust registration results.

10:30–11:30
AW2E • Optothermal Manipulation
Presider: Antonio Neves; Universidade Federal do ABC, Brazil

AW2E.1 • 10:30 Invited
Optothermal manipulations of colloidal particles and living cells, Yuebing Zheng[1,2]; [1]*Dept. of Mechanical Engieering, The Univ. of Texas at Austin, USA;* [2]*Texas Materials Inst., The Univ. of Texas at Austin, USA.* We share our newly developed optothermal manipulation techniques, including bubble-pen lithography, opto-thermophoretic tweezers, opto-thermoelectric tweezers, optothermal assembly, and opto-thermoelectric printing.

AW2E.2 • 11:00
Holographic photothermal microbubble assisted imaging spectroscopy, Nareg Ohannesian[1], Ibrahim Misbah[1], Wei-Chuan Shih[1]; [1]*Univ. of Houston, USA.* We present holographic generation of photothermal microbubbles on high-density nanoporous gold array, which allows dynamic control of size and location, and can be used for assembling micro/nanoparticles readily measured by imaging spectroscopy.

AW2E.3 • 11:15
Optical manipulation with an optothermal surface bubble for ultrasensitive sensing, Chenglong Zhao[1]; [1]*University of Dayton, USA.* We report an optical manipulation method based on an optothermal surface bubble. Nanogap-rich structures that are fabricated with this method are used to detect chemical substance down to femtomolar concentrations.

11:45–12:30 Postdeadline Papers (See the Update Sheet for complete information)

12:30–14:00 Lunch Break On Your Own

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

14:00–16:00
BW4A • Human Brain Applications
Presider: Frederic Lesage; Ecole Polytechnique, Canada

BW4A.1 • 14:00 Invited
Illuminating Metabolism: Investigating Neonatal Brain Injury with Broadband Near-Infrared Spectroscopy, Gemma Bale[1]; [1]*University College London, UK.* Real-time assessment of brain metabolism is possible with broadband NIRS-measured changes in cytochrome-c-oxidase. Cerebral metabolic reactivity is related to the outcome of injury in neonatal hypoxic-ischaemic encephalopathy.

BW4A.2 • 14:30
fNIRS as a Quantitative tool to Asses and Predict Surgical Skills, Yuanyuan Gao[1], Pingkun Yan[1], Suvranu De[1], Xavier Intes[1]; [1]*RPI, USA.* We report on the application of fNIRs and derived metrics to assess and predict surgical skills within the framework of the Fundamentals of Laparoscopic Surgery.

BW4A.3 • 14:45
Homologous Connectivity Maps Can Discriminate Diseased from Healthy Brains, Dmitry Patashov[1], Dmitry Goldstein[1], Michal Balberg[1]; [1]*Holon Inst. of Technology, Israel.* NIRS based, resting state connectivity maps of symmetric brain regions are determined for healthy subjects and patients suffering major depression. Empirical filtering of the oxy-hemoglobin signals leads to a good discrimination between the groups.

BW4A.4 • 15:00
Critical Closing Pressure Measured in Stroke Patients with Diffuse Correlation Spectroscopy and Transcranial Doppler Ultrasound, Kuan Cheng Wu[2,1], Parisa Farzam[2], Faheem Sheriff[3], Maria Angela Franceschini[2], Mohammad Ali Aziz-Sultan[3]; [1]*Boston Univ., USA;* [2]*Massachusetts General Hospital, USA;* [3]*Brigham and Women's Hospital, USA.* Critical Closing Pressure (CrCP) is a non-invasive approach of estimating intracranial pressure. In 15 stroke patients, we found a strong correlation between CrCP derived from Diffuse Correlation Spectroscopy and from Transcranial Doppler Ultrasound.

BW4A.5 • 15:15
Comparison of Photon Energy Distributions in the Prefrontal Cortex between 810 nm and 1064 nm for Optimizing Photobiomodulation Effects, Kung-Bin Sung[1], Tzu-Chia Kao[1], Chao-Shun Zhan[1], Ting-Xuan Lin[1]; [1]*National Taiwan Univ., Taiwan.* Absorption and scattering coefficients of the skin, skull and gray matter are estimated from human forehead in vivo. Monte Carlo calculated photon fluence rate in the prefrontal cortex is higher with 1064 nm illumination.

BW4A.6 • 15:30
Comparison of brain tissue structures on histological slides and fluorescence microscopy images, Hussein Mehidine[1], Elise Akan[1], Arnault Tauziede-Espariat[2], Pascale Varlet[2], Bertrand Devaux[2], Darine Abi Haidar[1]; [1]*IMNC-CNRS-UMR8165, France;* [2]*Sainte-Anne hospital, France.* In neurosurgery, histological examination is the standard to evaluate tissue's nature, but it is time-consuming. Fluorescence and SHG imaging could be an intraoperative solution.

BW4A.7 • 15:45
Transmittance and Diattenuation Measurements Reveal Different Properties of Brain Tissue, Miriam Menzel[5,1], Markus Axer[5], Katrin Amunts[5,2], Hans De Raedt[3], Kristel Michielsen[4,1]; [1]*RWTH Aachen Univ., Germany;* [2]*Univ. of Düsseldorf, Germany;* [3]*Univ. of Groningen, Netherlands;* [4]*Forschungszentrum Jülich GmbH, Germany;* [5]*Inst. of Neuroscience and Medicine (INM-1), Forschungszentrum Jülich GmbH, Germany.* We explore the polarization-(in)dependent transmitted light intensity of histological brain sections. Using experimental and simulation studies, we demonstrate that it contains valuable information about nerve fiber architecture and tissue structure.

14:00–16:00
JW4C • Advanced Imaging Tools and Techniques (NTM and BODA)
Presider: Marie-Claire Schanne-Klein; Ecole Polytechnique, CNRS, France

JW4C.1 • 14:00
Quantification of Low Abundance White Cell Surface Molecules in Ovarian Cancer by Dark Field and Fluorescence Microscopy, Jawad Hoballah[1], German Gonzalez[2], Sinyoung Jeong[3], Hongzhou Ma[1], Jeffrey S. Brooker[1], Daniel Cramer[4], Petra B. Krauledat[2], Conor L. Evans[3], William P. Hansen[2]; [1]*Thorlabs, Inc., USA;* [2]*PNP Research Corp., USA;* [3]*Massachusetts General Hospital, USA;* [4]*Brigham and Women's Hospital, USA.* Darkfield microscopy demonstrated that MUC16 shed from ovarian cancer tumors is present on the surface of white cells, and when quantified in a patient for two years was predictive of the disease course.

JW4C.2 • 14:15
Multiplexed Intensity Diffraction Tomography (mIDT) for Dynamic, Label-Free Volumetric Biological Imaging, Alex C. Matlock[1], Ji Yi[2], Lei Tian[1]; [1]*Boston Univ., USA;* [2]*Medicine, Boston Univ., USA.* We present multiplexed Intensity Diffraction Tomography (mIDT) for live biological sample imaging. We achieve 100X imaging speed improvements using model-based multiplexed LED illuminations that maintain high-quality 3D object reconstructions.

JW4C.3 • 14:30
Microscopy with Ultraviolet Surface Excitation (MUSE) for Rapid Intraoperative Pathology of Breast Surgical Margins, Weisi Xie[1], Ye Chen[1], Yu Wang[1], Linpeng Wei[1], Chengbo Yin[1], Adam Glaser[1], Mark Fauver[1], Eric J. Seibel[1], Joshua C. Vaughan[2], Nicholas Reder[3], Jonathan T. Liu[1,3]; [1]*Dept. of Mechanical Engineering, Univ. of Washington, USA;* [2]*Dept. of Chemistry, Univ. of Washington, USA;* [3]*Dept. of Pathology, Univ. of Washington, USA.* Comprehensive pathology of fresh breast specimen surfaces has been achieved with a fluorescent analogue of H&E and a fully-automated MUSE system that incorporates 3D deconvolution to improve image quality.

JW4C.4 • 14:45
Pockels Cells Enable Wide-field Fluorescence Lifetime Imaging, Adam Bowman[1], Mark Kasevich[1]; [1]*Stanford University, USA.* We demonstrate Pockels cells (PCs) as wide-field imaging gates for nanosecond temporal resolution with high collection efficiency [1]. Wide-field fluorescence lifetime imaging microscopy (FLIM) and single molecule lifetime spectroscopy are shown.

JW4C.5 • 15:00
Development of a GPU-accelerated Constrained Reconstruction Algorithm for Compressed Fluorescence Lifetime Imaging Microscopy, Yayao Ma[1,2], Riwei Jin[1], Gao Liang[1,2]; [1]*Univ. of Illinois at Urbana-Champaign, USA;* [2]*Beckman Inst. for Advanced Science and Tech., USA.* We present a GPU-accelerated constrained reconstruction algorithm which improves image quality and reconstruction speed for compressed fluorescence lifetime microscopy.

JW4C.6 • 15:15
Computational Reconstruction of Angular Scattering Distributions Through an Individual Multimode Fiber, Haoran Zhang[1], Zachary Steelman[1], Adam Wax[1]; [1]*Duke University, USA.* We demonstrate the use of a transmission matrix approach to reconstruct angular scattering profiles measured through an individual multimode fiber, with an eye towards applications in tissue scattering and Mie theory-based analysis.

JW4C.7 • 15:30
Scattered Light Contrast Microscopy: Turning Diffusely Scattered Light into Contrast for Imaging, Jeremy D. Rogers[1]; [1]*University of Wisconsin-Madison, USA.* A reflectance mode scanning microscope is demonstrated that measures the scattered light distribution for each pixel in the microscope image. Data is analyzed to provide quantitative endogenous contrast of cells within thick tissue including retina.

JW4C.8 • 15:45
Automatic Correction of Pixel-dependent Noise: Towards the Ideal sCMOS Camera, Biagio Mandracchia[1], Xuanwen Hua[1], Changliang Guo[1], Shu Jia[1]; [1]*Georgia Inst. of Technology, USA.* sCMOS cameras are very appealing for fluorescence microscopy but they suffer from high readout noise. We propose a non-iterative, fast, unsupervised algorithm that erases sCMOS noise without losing the quantitative information of fluorescence signal.

16:00–16:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

14:00–16:00
OW4D • High Resolution Microscopy Techniques
Presider: Jesse Jokerst; University of California at San Diego

OW4D.1 • 14:00 Invited
Glia-neuron interaction in the light of in vivo two-photon imaging, Bruno Weber[1]; [1]*Universitat Zurich, Switzerland.* FRET sensors specific for energy substrates, such as lactate have been developed and successfully used in vivo. A major advantage of these FRET sensors is that they do not interfere with the intrinsic metabolite concentrations and pathways.

OW4D.2 • 14:30 Invited
Two-Photon Phosphorescence Lifetime Imaging Reveals Oxygen Role in Tumor Immune Surveillance, Tomasz Zal[1], Mateusz Rytelewski[1], Karine Haryutyunan[2], Felix Nwajei[1], Meenakshi Shanmugasundaram[1], Patrick Wspanialy[3], M. Anna Zal[1], Chao Hsien Chen[1], Joe Marszalek[4], Mirna E. Khatib[5], Shane Plunkett[5], Sergei A. Vinogradov[5], Marina Konopleva[2]; [1]*Dept. of Immunology, Univ. of Texas MD Anderson Cancer Center, USA;* [2]*Dept. of Leukemia, Univ. of Texas MD Anderson Cancer Center, USA;* [3]*Univ. of Guelph, Canada;* [4]*Ctr for Co-Clinical Translation, Univ. of Texas MD Anderson Cancer Center, USA;* [5]*Dept. of Biochemistry and Biophysics and of Chemistry, Univ. of Pennsylvania, USA.* Immune response to tumors can be enhanced by hyperoxygenation, but underlying mechanisms remain unclear. We explore this biological relationship in vivo using two-photon phosphorescence lifetime imaging method that is compatible with cell dynamics.

OW4D.3 • 15:00
Probing Membrane Dynamics Using Simultaneous Second Harmonic Generation and Two-Photon Excitation Fluorescence Spectroscopy, Lindsey N. Miller[1], Tessa R. Calhoun[1]; [1]*Univ. of Tennessee, Knoxville, USA.* Small molecule-membrane interactions were studied in bacteria using second harmonic generation and two-photon excitation fluorescence spectroscopy. Results suggest membrane kinetics are highly dependent on molecular size and membrane compositions.

OW4D.4 • 15:15
Long-Term Super-Resolution Imaging of Amyloid Structures Using Transient Binding of Thioflavin T, Kevin Spehar[1], Tianben Ding[1], Yuanzi Sun[2], Niraja Kedia[1], Jin Lu[1], George Nahass[1], Matthew D. Lew[1], Jan Bieschke[2,1]; [1]*Washington Univ. in St. Louis, USA;* [2]*Univ. College London, UK.* Amyloids are implicated in Alzheimer's disease but cannot be well resolved by standard light microscopy. We developed a tool to directly image native amyloid structures and dynamics at nanometer resolution over minutes to days.

OW4D.5 • 15:30
Primate brain tissue identification using a compact coherent Raman spectroscopy probe, Damon DePaoli[1,2], Nicolas Lapointe[2], Younès Messaddeq[1], Martin Parent[2], Daniel Côté[1,2]; [1]*Physics, Université Laval, Canada;* [2]*CERVO Brain Research Center, Canada.* We present an all-silica-fiber CARS spectroscopy system with tunable fiber-lasers, capable of creating HWNM spectra in milliseconds. Using this system, we have identified and resolved at high resolution segmented brain regions in primate tissue.

OW4D.6 • 15:45
Characterization of DHEA-induced PCOS-model by CARS Microscopy, Luca Fesus[2,3], Dóra Domokos[4], Violetta Lener[4], Tibor Jakabovics[4], Robert Szipocs[2,1], Attila Kolonics[1,4]; [1]*R&D Ultrafast Lasers Kft., Hungary;* [2]*Applied and Nonlinear Optics, Wigner RCP, Hungary;* [3]*Semmelweis Univ., Hungary;* [4]*Bio-Firmware Ltd., Hungary.* The efficiency of *Origanum majorana* and *Mentha piperita* essential oil co-treatment was studied on DHEA-induced PCOS-model by analysis of lipid content changes in cumulus oocytes complexes by CARS and Bodipy fluorescence microscopy.

14:00–15:30
AW4E • Nanotrapping
Presider: Peter Pauzauskie; University of Washington,USA

AW4E.2 • 14:00
Cold Brownian Motion (CBM) of Optically Trapped Alkali-Yttrium-Fluoride Nanostructures (Yb:MYF, M = K, Na, Li), Xiaojing Xia[1], R. Greg Felsted[1], Anupum Pant[1], Elena Dobretsova[1], Peter Pauzauskie[1,2]; [1]*Univ. of Washington, USA;* [2]*Physical & Computational Science Directorate, Pacific Northwest National Laboratory, USA.* Single-beam laser tweezers with a tunable NIR trapping wavelength are used to analyze cold Brownaing motion (CBM) dynamics of ytterbium-doped alkali yttrium fluoride (Yb:MYF, M= K, Na, Li) nanostructures.

AW4E.3 • 14:15
Beam Displacement due to Thermal Blooming in Optical Tweezers, Antonio A. Neves[1], Partha P. Patra[2], Qiwei Li[3], Alessandro Magazzù[4], Mikael Käll[2], Giovanni Volpe[4]; [1]*Universidade Federal do ABC, Brazil;* [2]*Chalmers Univ. of Tech., Sweden;* [3]*Hochschule Coburg, Germany;* [4]*Univ. of Gothenburg, Sweden.* Water near an optically trapped particle absorbs part of the laser energy resulting in changes for the refractive index and density. Particle position and optical potential description are affected by this photothermal effect.

AW4E.4 • 14:30
Manipulate and Immobilize Microparticles by Optoelectronic Tweezers and Ultraviolet Curing, Weizhen Li[1], Revanth Kailashnath[1], Yang Qian[1], John H. Marsh[1], Alasdair Clark[1], Steven L. Neale[1]; [1]*Univ. of Glasgow, UK.* Optoelectronic tweezers (OET) offers a flexible method to manipulate and assemble solder beads into desired patterns. Using an ultraviolet curable solution as a buffer, the assembled microstructures can be immobilized on the device.

AW4E.5 • 14:45
Optical Force Positioning and Aggregation of Nanoparticles, Maria G. Donato[1], Antonino Foti[1], Silvie Bernatova[2], Ota Samek[2], Pavel Zemanek[2], Raymond Gillibert[1], Pietro G. Gucciardi[1], Onofrio M. Marago[1]; [1]*CNR-IPCF, Italy;* [2]*ISI-CAS, Czechia.* Optical forces are used to position and aggregate nanoparticles. Plasmon-enhanced forces make hot-spots for protein detection at 10 nM. Optical forces on layered materials are used to push and aggregate nanostructures in specific patterns.

AW4E.6 • 15:00 Invited
Biosensing at the Quantum Noise Limited, Nicolas Mauranyapin[1,2], Lars Madsen[1,2], Michael Taylor[3], Warwick Bowen[1,2]; [1]*School of mathematics and physics, Univ. of Queensland, Australia;* [2]*Centre for Engineered Quantum Systems, Australia;* [3]*School of biomedical sciences, Univ. of Queensland, Australia.* Evanescent biosensors have unprecedented precision, but require optical intensities above damage thresholds. Here, quantum noise limited precision allows nanofibre sensing of a label free single molecule with orders-of-magnitude reduced intensity.

16:00–16:30 Coffee Break with Exhibitors, *Grand Ballroom Foyer*

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

16:30–18:30
JW5A • Optical Windows into the Brain (BRAIN and BODA)
Presider: Euiheon Chung; Gwangju Inst. of Science & Tech., South Korea

JW5A.1 • 16:30 Invited
Optical Clearing Skull Window for Cortical Neural and Vascular Imaging, Dan Zhu[1]; [1]*Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Tech., China*. Here I will report an optical clearing skull window without craniotomy, which not only promise to image cortical neuron at synaptic resolution, but also promise to long-term trace cortical vascular structure and function.

JW5A.2 • 17:00 Invited
The Eye as a Window Into The Brain: Retinal Imaging of Leukocyte Endothelial Interactions for Central Nervous System Inflammation Detection, Clemens Alt[1]; [1]*Wellman Center for Photomedicine, USA*. We discovered that transport of cerebrospinal fluid (CSF) extends into the retina. There, CSF pro-inflammatory mediators, secreted in the inflamed brain, cause leukocyte rolling that we quantify non-invasively in mouse models of CNS inflammation.

JW5A.3 • 17:30
Quantifying Changes in Fetal Brain Vasculature Due to Prenatal Cannabinoid Exposure Using Optical Coherence Tomography, Raksha Raghunathan[1], Chih-Hao Liu[1], Amur Kouka[1], Connie Yan[1], Noemi Bustamante[1], Manmohan Singh[1], Rajesh C. Miranda[2], Kirill V. Larin[1,3]; [1]*Univ. of Houston, USA;* [2]*TAMHSC College of Medicine, USA;* [3]*Tomsk State Univ., Russian Federation*. With several places legalizing marijuana, its effects on fetal brain development is unknown. Correlation mapping optical coherence tomography showed a rapid decrease in embryonic brain vascularization due to prenatal synthetic cannabinoid exposure.

JW5A.4 • 17:45
Fiber-based tissue identification during deep brain stimulation neurosurgery in primates, Damon DePaoli[1], Laurent Goetz[1], Dave Gagnon[1], Gabriel Maranon[1], Michel Prud'homme[2], Léo Cantin[2], Martin Parent[1], Daniel Côte[1]; [1]*Universite Laval, Canada;* [2]*Enfant-Jesus Hospital, Canada*. We have shown the ability to discriminate different tissue types, including blood vessels, in front of the chronic electrode during its implantation in deep brain stimulation neurosurgery in *in vivo* primates.

JW5A.5 • 18:00
Snapshot Compressive Volumetric Light-sheet Microscopy, Xukang Wang[1], Yang Liu[1], Xiaofei Han[1], Jinli Suo[1], Qionghai Dai[1]; [1]*Tsinghua Univ., China*. We proposed a snapshot compressive volumetric light-sheet microscopy method for high-speed three-dimensional imaging of zebrafish and cleared mouse brain.

JW5A.6 • 18:15
SUT: a Simple and Morphology-preserving Optical Clearing Agent for Mammal Organs, Jie Zhang[1], Zhiwei Wang[2], Guangpu Fan[3], Hui Zhao[4,5], Qi Tan[1], Yong Li[1], Wei Wang[4,5]; [1]*Shandong Provincial Hospital affiliated to Shandong Univ., China;* [2]*Beijing Friendship Hospital, Capital Medical Univ., China;* [3]*Peking Univ. People's Hospital, China;* [4]*Fuwai Hospital, China;* [5]*Chinese Academy of Medical Sciences & Peking Union Medical College, China*. We developed a new method, SUT (Scheme Update on tissue Transparency), an effective method to clear organs. Over the course of 4- 6 days we obtained transparent tissues from mice with little protein loss.

16:30–18:15
NW5C • Light Sheet Techniques
Presider: J. Quincy Brown; Tulane University, USA

NW5C.1 • 16:30 Invited
Multi-immersion open-top light-sheet microscopy, Adam Glaser[1], Jonathan T. Liu[1]; [1]*University of Washington, USA*. We present an easy-to-use multi-immersion open-top light-sheet microscope designed specifically for high-throughput imaging of tissues prepared with a variety of clearing protocols.

NW5C.2 • 17:00
Non-Iterative Aberration Correction with Phase-Sensitive Spatial Frequency Projection Light Sheet Microscopy, Jeffrey J. Field[1], Randy Bartels[1]; [1]*Colorado State University, USA*. We present a variant of light-sheet microscopy that encodes aberration phase in the temporal fluctuations of fluorescence intensity emitted from the specimen. Aberrations are recovered and removed to correct images in post-processing.

NW5C.3 • 17:15
Toward Single-Lens Epi-Fluorescent Light Sheet Microscopy with Single-Pixel Detection, Jeffrey J. Field[1], Randy Bartels[1]; [1]*Colorado State University, USA*. We report a method for epi-fluorescent light-sheet microscopy with a single-element detector. This method is based on spatial frequency projection imaging and utilizes PSF engineering to enhance the depth of field.

NW5C.4 • 17:30
2-Photon bessel beam lightsheet microscope with 3-axis isotropic resolution using an axicon lens, Francois Cote[1,2], Cleophace Akitegetse[1,2], Martin Levesque[1,3], Daniel C. Cote[1,2]; [1]*Cervo Brain Research Centre, Canada;* [2]*Centre d'optique, photonique et laser (COPL), Canada;* [3]*Dept. of psychiatry and neurosciences, Université Laval, Canada*. We propose a new 2-photon lightsheet microscope with 1cm length Bessel beam that allows to obtain a unique 2-um isotropic resolution in all three axis of a scanned volume.

NW5C.5 • 17:45
An approach of 3D reconstruction for images by Dual-view Inverted Selective Plane Illumination Microscopy (diSPIM), Guang Li[1], Bihe Hu[1], J. Quincy Brown[1]; [1]*Tulane University, USA*. A new approach of 3D reconstruction for images by dual-view inverted selective plane illumination microscopy (diSPIM) is presented. Via this way, restriction on memory size of data can be eliminated, and processing speed is faster.

NW5C.6 • 18:00
A multimodal light-sheet microscope that is compatible with all clearing techniques, Tonmoy Chakraborty[1], Kevin Dean[1], Hu Zhao[2], Reto Fiolka[1]; [1]*UT Southwestern, USA;* [2]*Texas A&M Univ., USA*. Combined with optical clearing protocols, light-sheet microscopy offers rapid and sensitive imaging of whole organs. We report a light sheet microscope with isotropic, submicron resolution that is compatible a refractive index range of 1.33-1.56.

Salon J

Optical Molecular Probes, Imaging and Drug Delivery

Salon D

Optical Manipulation and Its Application

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

16:30–18:15
OW5D • Fluorescence Lifetime Imaging and Photoacoustic Imaging
Presider: Mikhail Berezin; Washington Univ. School Medicine, USA

OW5D.1 • 16:30 Invited
Photoacoustic Spectroscopy for Molecular Imaging and Image-Guide Drug Delivery, Jesse Jokerst[1]; [1]*NanoEngineering, University of California, San Diego, USA.* Photoacoustic imaging combines the high temporal and spatial resolution of ultrasound with the good contrast and spectral nature of optics. Here, I will discuss photoacoustic imaging in nanomedicine and drug delivery.

OW5D.2 • 17:00 Invited
Molecular Contrast Optical Coherence Tomography with PLGA Encapsulated Methylene Blue, Brian E. Applegate[1]; [1]*Texas A&M University, USA.* We are developing molecular contrast for OCT based around pump-probe spectroscopy of methylene blue. Optical system development for improved imaging speed and development of a more efficient contrast agent will be discussed.

OW5D.3 • 17:30 Invited
Fluorescence Lifetime Techniques for Longitudinal Study of Bioengineered Tissues Properties, Laura Marcu[1]; [1]*University of California Davis, USA.* We present studies showing fiberoptic fluorescence lifetime as means to monitor recellularization processes in vascular constructs grown in bioreactors and to assess changes in bioengineered cartilage functional properties during matrix maturation.

OW5D.4 • 18:00
Multiplexed Fluorescence Lifetime *in vivo* FRET Imaging Using a Dark Quencher, Alena Rudkouskaya[1], Sez-Jade Chen[2], Nattawut Sinsuebphon[2], Joseph Mazurkiewicz[1], Marien Oshoa[2], Xavier Intes[2], Margarida Barroso[1]; [1]*Albany Medical College, USA;* [2]*Rensselaer Polytechnic Inst., USA.* We report characterization of multiplexed lifetime FRET imaging in biological samples by leveraging the dark quencher IRDye QC-1. It allows to quantify non-invasively ligand-target engagement of multiple receptors in live xenografted animals.

16:30–18:00
AW5E • Soft Matter
Presider: Onofrio Marago; CNR-IPCF, Italy

AW5E.1 • 16:30 Invited
Tunable soft-matter optofluidic waveguides assembled by light, Oto Brzobohaty[1], Lukas Chvatal[1], Alexandr Jonas[1], Martin Siler[1], Jan Kanka[1], Jan Jezek[1], Pavel Zemanek[1]; [1]*Inst. of Scientific Instruments of the CAS, v. v. i., Czechia.* We report on optomechanical properties of self-assembled colloidal optical waveguides created from wavelength-size dielectric particles held together by long-range optical binding forces. We demonstrate their non-linear optical properties.

AW5E.2 • 17:00
Optoelectronic tweezers with patterned photoconductive layer for selecting, moving, and storing particles and cells, Shuailong Zhang[1,2], Aaron R. Wheeler[1,2]; [1]*Inst. of Biomaterials and Biomedical Engineering, Univ. of Toronto, Canada;* [2]*Dept. of Chemistry, Univ. of Toronto, Canada.* Patterned optoelectronic tweezers is developed, in which the photoconductive layer is patterned, forming structures useful for repelling unwanted particles/cells, and also for keeping selected particles/cells in place.

AW5E.3 • 17:15
Multiple Nanoparticle Trapping With Low Laser Intensity, Using Gold Plasmonic Array , Theodoros Bouloumis[1], Xue Han[1], Domna Kotsifaki[1], Viet Giang Truong[1], Sile Nic Chormaic[1]; [1]*Okinawa Inst. of Science and Tech. Graduate Univ., Japan.* We used a patterned gold nanohole array for trapping multiple polystyrene nanoparticles (30 nm) at low laser intensity (0.51 mW/μm^2). A high trap stiffness was achieved (0.85 fN/(nm.mW) and experimental values were in agreement with simulations.

AW5E.5 • 17:30 Invited
DNA Origami Nanotools for Single-Molecule Biosensing and Superresolution Microscopy, Philip Tinnefeld[2], Qinshan Wei[3], Guillermo P. Acuna[4], Aydogan Ozcan[5], Carolin Vietz[1], Birka Lalkens[1], Kateryna Trofymchuk[2], Cindy M. Close[2], Hakan Inan[2], Sarah Ochmann[2], Lennart Grabenhorst[2], Viktorija Glembockyte[2]; [1]*TU Braunschweig, Germany;* [2]*Ludwig-Maximilians-Universitaet Muenchen, Germany;* [3]*North Carolina State Univ., USA;* [4]*Univ. of Fribourg, Switzerland;* [5]*Univ. of California, USA.* We have combined DNA nanotechnology with sensitive optical detection to create functional single-molecule devices such as nanorulers and self-assembled nanoantennas that enable new applications in single-molecule biosensing.

Key to Authors and Presiders

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