Track 7: Photonics for Biology and Medicine

Wuxi Room, 3F

October 25

13:30–15:30

M4G • Optical Cancer Imaging

Presider: Junle Qu, Shenzhen University, China

M4G.1 • 13:30 Invited

Multimodal Tissue Imaging Supported by Optical Clearing, Valery V. Tuchin[1,2]; [1]*Science Medical Center, Saratov State Univ., Russian Federation;* [2]*Laboratory of Laser Molecular Imaging and Machine Learning (LMIML), National Research Tomsk State Univ., Russian Federation.* The method of tissue optical clearing is discussed in the context of supporting of multimodality of optical imaging. Improved optical imaging and efficiency of laser treatment in the implementation of various theranostics approaches are demonstrated.

M4G.2 • 14:00 Invited

Recent Advances on Multifunctional Photosensitizers for Enhanced Photodynamic Therapy, Buhong Li[1]; [1]*Fujian Normal Univ., China.* Photodynamic therapy (PDT) utilizes photosen- sitizer together with irradiation light of specific wavelengths interacting with oxygen to generate cytotoxic reactive oxygen species. Future demands for ideal multifunctional photosen- sitizers, emphasizing clinical translation and PDT application will be discussed.

M4G.3 • 14:30

Deep Filtered Back Projection for Photoacoustic Image Reconstruction, Kang Shen[1], Chao Tian[1]; [1]*Univ. of Science and Technology of China, China.* We develop a filtered back projection based deep learning image reconstruction tech- nique for photoacoustic tomography (PAT), called DeepFBP. This algorithm is implemented by mapping the conventional filtered back-projection (FBP) algorithm into a deep neural network. The performance of the DeepFBP technique was evaluated using numerical simulation.

M4G.4 • 14:45

Proposal of a Hybrid Optical Double Ring Resonator for Cancer Biosensing, Sherine Shawky[1], Ahmed Abdelmalek[1], Ahmed Allam[1], Hossam Shalaby[1]; [1]*Egypt-Japan Univ. of Science and Te, Egypt.* A new design for a silicon-on-insulator (SOI) optical biosensor is proposed in the form of a hybrid double- ring resonator. The proposed device improves the sensitivity by 2.4 times compared with the traditional devices.

M4G.5 • 15:00

Large-Scale Optical Pulling of Cancer Cells With Counter- Propagating Beams in the Near-Infrared-II Window, Yuxuan Ren[1], Gwinky Yip[2], Yi Zhou[2], Kevin Tsia[2], Kenneth Kin-Yip Wong[2]; [1]*Fudan Univ., China;* [2]*The Univ. of Hong Kong, Hong Kong.* We demonstrate that the near-infrared light can pull biological cells with weak polarizability owing to the bio- photonic nanojet. Counter-propagating beams can exert backaction forces with opposite direction on the biological cells in large-scale.

M4G.6 • 15:15

Multi-Modality Synergistic Tumor Precision Treatment Based on Phototherapy, Siwen Li[1]; [1]*State Key Laboratory of Natural Medicines, Jiangsu Key Laboratory of Drug Screening, Depart- ment of Biomedical*

Engineering, School of Engineering, China pharmaceutical Univ., China. Phototherapy is a mild and precise treatment . Herein, we constructed multiple nanoplatforms to combine immunotherapy, gene therapy, chemotherapy with phototherapy to achieve synergistic treatment, resulting in appreciable tumor growth inhibition.

16:00–18:15

M5G • Optical Spectral Imaging Techniques

Presider: To Be Announced

M5G.1 • 16:00 Tutorial

Fluorescence Lifetime Imaging Microscopy and its Biomedi- cal Applications, Junle Qu[1], Liwei Liu[1], Danying Lin[1]; [1]*Shenzhen Univ., China.* In this talk, I will introduce the basic principle of fluorescence lifetime imaging microscopy (FLIM), review its recent progress, discuss the challenges for FLIM technology and present recent applications of FLIM in biomedicine.

M5G.2 • 16:45 Invited

High-Speed and High-Resolution Raman Imaging of Biologi- cal Molecules Using Line Illumination, Katsumasa Fujita[1,2]; [1]*Osaka Univ., Japan;* [2]*AIST, Japan.* We will present our recent progress on the development of Raman microscopy using line illumination to improve the image acquisition speed and the spatial resolution in vibrational imaging of biological samples.

M5G.3 • 17:15 Invited

Title to be Announced, David D. Sampson[1]; [1]*Univ. of Surrey, UK.* Abstract not available.

M5G.4 • 17:45

Hyperspectral Spatial Frequency Domain Imaging for Label- Free, Non-Contact, and Wide-Field Monitoring of Tissue Optical Properties and Chromophore Concentrations, Yanyu Zhao[1]; [1]*Beihang Univ., China.* Spatial Frequency Domain Imag- ing (SFDI) is an emerging technology that enables label-free, non-contact, and wide-field mapping of tissue optical proper- ties, which further allows for quantification of chromophore concentrations including oxy-hemoglobin, deoxy-hemoglobin, water and lipids.

M5G.5 • 18:00

A High-Q, Double-arc Microcapillary Biosensor for DNA De- tection With High Speed, low Sample Volume, Shuai Zhang[1], Yao Lu[1], Zhongwei Liang[1], Cheng Wan[2], Hongdan Wan[1]; [1]*Nan- jing Univ. of Posts & Telecomm, China;* [2]*Yikongenomics (Suzhou) Co., Ltd., China.* We demonstrate a label free DNA fiber sensor based on double-arc microcapillary (DAM) with high-Q WGM oscillation. The detection limit of the sensor is <100 pM, the volume of the detection sample is approximately nL

October 26

08:30–10:00

T1G • Novel Optical Imaging Techniques

Presider: To Be Announced

T1G.1 • 08:30 Invited

Polarization Sensitive Swept Source OCT to map Local- ized Birefringent Information Within Living Tissue,

Ruikang K. Wang[1], Peijun Tang[1]; [1]*Univ. of Washington, USA.* We will describe a novel method of tracing polarization states propa- gating within a birefringent tissue to map local optic axis and phase retardation, indicative of local birefringent information and thus collagen fiber organizations.

T1G.2 • 09:00 Invited

Multi-Dimensional Single Particle Tracking, Ning Fang[1]; [1]*Xiamen Univ., China.* We have developed a multi-dimensional single particle tracking (SPT) method for visualizing 3D rota- tional motions of anisotropic imaging probes in complex cel- lular environments. This allows us to reveal the detailed working mechanisms of molecular motors in live cells.

T1G.3 • 09:30 Invited

Live-Cell FRET Assay on the Stoichiometry and Regulation Network of Bcl-2 Family Complexes, Tongsheng Chen[1]; [1]*South China Normal Univ., China.* FRET analysis was used to quantify the protein–protein interactions among Bax, Bcl- xL, Bad and tBid in healthy and apoptotic cells. Bcl-xL binds preferentially to Bad, then to tBid and Bax in mitochondria, whilst Bcl-xL displays higher afnity to Bad or tBid than to itself.

10:30–12:15

T2G • Super-resolution Microscopy I

Presider: Tongsheng Chen, South China Normal University, China

T2G.1 • 10:30 Invited

Single-Molecule Localization Super-Resolution Microscopy and Its Applications, Leiting Pan[1]; [1]*Nankai Univ., China.* Based on single-molecule localization super-resolution microscopy, we revealed an ~80-nm spectrin tetramer length in native erythrocyte cytoskeleton, as well as elucidated e a novel, fast, reversible assembly of the vimentin cytoskeleton induced by hypotonic stress.

T2G.2 • 11:00 Invited

Organic Semiconducting Probes for Superresolution Imag- ing and in Vivo Imaging, Changfeng Wu[1]; [1]*Southern Univ of Science & Technology, China.* Highly fluorescent polymer dots was developed for biological imaging. The hydrophobic semi- conductor polymers tend to form small, stable and densely- packed Pdots, which exhibited large absorption cross section, high fluorescence quantum yields, and good biocompatibility for superresoluition imaging and in vivo imaging.

T2G.3 • 11:30 Invited

Super-Resolution Fluorescence Polarization Microscopy and its Biological Applications, Hao Zhang[1]; [1]*Southern Univ. of Science and Tech, China.* Fluorescent dipoles reflect the spatial orientation of the fluorophores. However, the Abbe's diffraction limit deteriorates the imaging accuracy of both position and orientation of the fluorescent dipoles. We developed several super-resolution tools to image the molecular orientation of fluorophores.

T2G.4 • 12:00

Deconvolution of Non-Diffracting Beam Based Confocal Two-Photon Microscopy, Canice C. Yiu[1,2], Hongsen He[1], Ryan K. Chan[1], Emmett Lam[1], Kenneth Kin-Yip Wong[1,2]; [1]*The Univ. of Hong Kong, Hong Kong;* [2]*Advanced Biomedical Instrumenta- tion Centre Limited, Hong Kong.* We demonstrated image qual- ity enhancement by deconvolution for non-diffracting beam confocal two-photon microscopy. Through a custom Bessel/Airy point spread

function (PSF) and Richardson-Lucy algorithm, we achieved ≥7 .0 dB increase in signal-to-background ratio (SBR).

13:30–15:30

T3F • Lightsheet Microscopy and Deep Imaging

Presider: Changfeng Wu, Southern University of Science & Technology, China

T3F.1 • 13:30 Invited

Deep-Learning Fluorescence Microscopy for Capturing Biological Dynamics at High Spatiotemporal Resolution, Peng Fei[1]; [1]*Huazhong Univ. of Sci and Tech, China.* Insufficient spatiotemporal performance is the major weakness of current 3D fluorescence microscopy. We report deep learning-enhanced fluorescence microscopy that can reconstruct dynamic signals at high spatiotemporal resolution.

T3F.2 • 14:00 Invited

Imaging Cleared Tissues Using Tiling Light Sheet Microscopy and a Strategy to Understand Intelligence, Liang Gao[1]; [1]*Westlake Univ., China.* We developed a tiling light sheet microscope for 3D multicolor imaging of cleared tissues, and we describe a solution to decode large scale neural network using tissue clearing techniques and tiling light sheet microscopy.

T3F.3 • 14:30 Invited

Break the Unbroken Limits Towards Super-Resolution Microscopy Using Photon Upconversion, Qiuqiang Zhan[1]; [1]*South China Normal Univ., China.* Photon upconver- sion offers an exciting opportunity for biological super-resolution imaging. By optically controlling the upconversion fluorescence properties, we discovered efficient optical depletion and nonlinear emission, enabling subcellular super-resolution microscopy by breaking the unbroken traditional limitations.

T3F.4 • 15:00 Invited

Three-Dimensional Super-Resolution Microscopy in Thicker Specimens Using Adaptive Optics, Martin J. Booth[1]; [1]*Univ. of Oxford, UK.* Adaptive optics facilitates super-resolution microscopy in thicker specimens by compensating aberrations arising from refractive index variations. We show imaging results from advanced super-resolution systems, including structured illumination, 4pi single molecule and 4pi isoSTED microscopes.