

BISC

Monday, 19 April

[BISC Satellite in Taiwan] 9:15-11:00
Biomedical Application I
 Chair: Kung-Bin Sung
National Taiwan University

BISC-Opening 9:15
Opening Remarks

BISC Satellite in Taiwan-01 9:30 *Invited*

Imaging and Molecular defects in Transcription Syndromes

Jean-Marc Egly
French Academy of Sciences

BISC Satellite in Taiwan-02 10:00 *Invited*

Image-based high content analysis on discovering anti-cancer drug targeting cancer stemness niche

Huei-Wen Chen
National Taiwan University

The tumorous microenvironment (TME) and intra-tumorous heterogeneity may fuel the cancer cell plasticity and evolution. We established a lung cancer stem cells (CSCs) and cancer-associated fibroblasts (CAFs) co-cultured system, a niche-based model to mimic the TME of patients and developed the image-based high-throughput drug screening with phenotypical parameters and stemness markers.

BISC Satellite in Taiwan-03 10:30 *Invited*

CT Radiomics of lung cancer

Yeun-Chung Chang
Department of Medical Imaging, NTUH

Lung cancer is the leading cause of cancer-related mortality worldwide with only an average five-year survival rate of around 19%. To provide adequate therapy for lung cancer, TNM staging has been widely used for supporting treatment management.

[BISC Satellite in Taiwan] 11:15-12:45
Optical Coherence Tomography

Chair: Chia-Lung Hsieh
Academia Sinica

BISC Satellite in Taiwan-04 11:15 *Invited*

Deep learning empowered cellular-resolution optical coherence tomography

Sheng-Lung Huang
National Taiwan University

Cellular-resolution optical coherence tomography (OCT) could help unveil living organisms' functions and facilitate clinical disease/cancer diagnosis in the early stage. The cell size, orientation, and morphology are critical indicators to discriminate between normal and cancer cells.

BISC Satellite in Taiwan-05 11:45 *Invited*

OCT/OCTA-guided laser ablation for tumor treatment

Meng-Tsan Tsai, Hao-Wei Huang, Wen-Ju Chen, Tai-Ang Wang, Feng-Yu Chang
Chang Gung University

Laser ablation has come an alternative solution for tumor treatment, and it can be used to remove or shrink tumor tissue. In the previous reports, the pulsed lasers are the most common laser as the light source of laser treatment due to the controllable thermal damage, but it is difficult to use continuous-wave (CW) lasers for tissue ablation because of unpredictable laser damage and thermal effect.

BISC Satellite in Taiwan-06 12:15 *Invited*

A pilot study of developing a small footprint imaging platform with optical coherence tomography (OCT) and OCT angiography for mouse brain imaging in vivo

Hsiang-Chieh Lee¹, Ting-Hao Chen¹, Yi-Chun Wu¹, Chih-Chang Li¹, Yu-Wei Chang¹, Ming-An Chen¹, Ting-Yen Tsai¹, Chuan-Bor Chueh¹, Meng-Tsan Tsai², Yoshiaki Yasuno³, Ming-Kai Pan¹
¹National Taiwan University, ²Chang Gung University, ³University of Tsukuba

Various technologies have been applied to investigate the mechanism of cerebral autoregulation with the mouse brain model, including neurovascular coupling where the changes in the blood oxygenation and blood volume, for example, represent the response to the changes in neural activity.

[BISC Satellite in Taiwan] 14:00-16:00
Biomedical Application II

Chairs: Meng-Tsan Tsai
Chang Gung University
 Shi-Wei Chu
National Taiwan University

BISC Satellite in Taiwan-07 14:00 *Invited*

Noninvasive quantification of neonatal bilirubin and hemoglobin levels using a handheld diffuse reflectance spectroscopy system

Sheng-Hao Tseng, Shih-Yu Tzeng, Nan-Yu Cheng, Jun-Yen Guo, Ming-Chen Fang
National Cheng Kung University

The prevalence rates of neonatal jaundice and anemia could reach 80% and 25%, respectively. We have developed a handheld diffuse reflectance spectroscopy system to noninvasively, accurately determine the bilirubin and hemoglobin levels of neonates.

BISC Satellite in Taiwan-08 14:30 *Invited*

New treatment opportunities for drug resistance in non-small cell lung cancer

S-Ja Tseng
National Taiwan University

Therapeutic outcomes in treating non-small cell lung cancer (NSCLC) are compromised by the emergence of drug resistance in response to epidermal growth factor receptor (EGFR)-tyrosine kinase inhibitor (TKI) targeted therapy. Clinical virotherapy has been successfully approved for use in cancer treatment by the US Food and Drug Administration (FDA), however a number of improvements are still sought to more broadly develop virotherapy.

BISC Satellite in Taiwan-09 15:00 *Invited*

Morphological Biomarker of Osteoarthritis Knees by Deep Learning

Gary Han Chang
National Taiwan University

MRI-based morphology of femorotibial joints has shown great promise in prediction of osteoarthritis risk and progression, albeit detailed segmentation of femorotibial joints in large volume remains to be difficult. In this work, we developed a morphological biomarker which reflect the changes in bone and cartilage shapes from knee MRI images using deep learning (DL).

BISC Satellite in Taiwan-10 15:30 *Invited*

Tracking molecular dynamics during spermatocyte divisions in the nematode *Caenorhabditis elegans*

Jui-Ching Wu, Shang-Yang Chen, Yu-Hao Chen
National Taiwan University

Spermatocytes exhibit a distinct type of cell division during which the duplicated genome undergoes two consecutive separations without pausing. Such repetition requires rearrangement of the division machineries in between the two separation events. Nonetheless, the mechanistic regulation underlining spermatocyte divisions has been poorly explored.

[BISC Satellite in Taiwan] 16:15-18:15
Medical/Biological Imaging Instrumentation and Techniques

Chairs: Sheng-Lung Huang
National Taiwan University
 Hsiang-Chieh Lee
National Taiwan University

BISC Satellite in Taiwan-11 16:15 *Invited*

Toward quantitative dosage analysis of transcranial photobiomodulation with near-infrared light

Kung-Bin Sung¹, Tzu-Chia Kao¹, Li-Da Huang², Wen-Wei Su¹

¹National Taiwan University, ²The University of Texas at Austin

Transcranial photobiomodulation (tPBM) using near-infrared light has been demonstrated to produce neuroprotective and neuroenhancing effects of the brain non-invasively. We develop enabling techniques to quantify the photon energy delivered to the gray matter to facilitate both research and practical use of tPBM. Results revealed up to one order of magnitude variations in the delivery efficiency due to variations in optical properties and head structure.

BISC Satellite in Taiwan-12 16:45 *Invited*

High-speed dynamic cell imaging by scattering-based interference optical microscopy

Chia-Lung Hsieh
Academia Sinica

Label-free optical microscopy provides the opportunity to observe biological cells in their native forms, but the imaging sensitivity, spatiotemporal resolution, and molecular specificity are usually compromised especially compared to the fluorescence-based approaches.

BISC Satellite in Taiwan-13 17:15 *Invited*

Study of violin spruce woods with aid of two-photon hyperspectral imaging

Szu-Yu Chen, Po-Lin Chen, Hwan-Ching Tai, Jia-Wei Xu
National Central University

Violin-family instruments commonly use spruce as tonewood for the top plate. The acoustic quality is critically affected by the wood properties which have been shown different between modern and old ones due to chemical treatment and aging. In this research, a two-photon hyperspectral system was introduced to reveal the microscopic differences within spruce wood samples in both spatial and spectral domains.

BISC Satellite in Taiwan-14 17:45 *Invited*

High-speed volumetric imaging for brain

Shi-Wei Chu
National Taiwan University

Since the days of Cajal, optical microscopy has been a vital tool for physiology, and neuroscientists have accumulated significant amount of information on structures and functions of isolated neurons. However, to understand the emergent properties of a brain, functional observation of complicated neuronal networks is necessary, leading to the request of volumetric imaging with high speed, deep penetration, and sub-cellular resolution.

BISC

Tuesday, 20 April

[BISC-1] 15:30-17:15
Bioimaging with New Technologies
 Chair: Yoshihisa Aizu
Muroran Institute of Technology

BISC-1-01 15:30 *Invited*

Photoacoustic imaging as a bridge from medical imaging to bioimaging
 Miya Ishihara
National Defense Medical College, Japan
 Photoacoustic imaging is a technology that can add quantitative depth information to optical imaging. The scope of photoacoustic imaging includes clinical, preclinical, and biological applications. We have developed three systems that adapt to each application. In my talk, I will introduce each system.

BISC-1-02 16:00 *Invited*

Fluorescence imaging to understand the molecular mechanism of DNA damage-triggered cellular reprogramming in plants
 Yosuke Tamada¹, Akihiro Imai², Nan Gu¹
¹*Utsunomiya University*, ²*Hiroshima Institute of Technology*
 We recently discovered that massive but transient DNA damage can trigger cellular reprogramming of differentiated cells to stem cells. In the talk, we will introduce our recent progress and fluorescent imaging techniques enabling above discovery.

BISC-1-03 16:30

Focus-Shift using Rotating Planar Mirrors for Light Sheet Microscopy
 Kenneth Li
Optonomous Technologies Inc.
 This paper presents a focus-shift system capable of scanning a sample volume using simple rotating planar mirrors without distortions or chromatic aberrations. In synchronism with advanced scanning illumination techniques such as light sheet and lattice light sheet technologies, 3-dimensional images can be acquired at high speed without having to use electrically tunable lenses (ETL) with aberrations or translation of heavy lenses and fixture at low speed.

BISC-1-04 16:45

Physiological modulation of a biological cell by using direct electron beam exposure
 Asahi Tanaka, Wataru Inami, Yoshimasa Kawata
Shizuoka University
 We have developed stimulation method for a living biological cell by using direct electron beam exposure. This method is expected to generate reactive oxygen species in a live cell, which modulate physiological functions.

BISC-1-05 17:00

Deep ultraviolet based serial block-face imaging for 3-dimensional morphological assessment of the rodent brains
 Deepa Kasaragod, Meina Zhu, Hidenori Aizawa
Hiroshima University
 We present a deep ultraviolet (DUV) light microscope capable of serial block-face imaging of the whole rodent brain. The capability of the 3D-DUV microscope for quantitative volumetric analysis of the small substructures of habenula is shown. It is expected that large scale wide-field high resolution analysis of the smaller regions would allow for elucidating the functional changes linked with the morphological changes in brain under pathological conditions.

Wednesday, 21 April

[BISC-2] 9:00-10:00
Infrared and THz Imaging
 Chair: Yasuhiro Awatsuji
Kyoto Institute of Technology

BISC-2-01 9:00 *Invited*

Application of infrared laser to living cells for manipulation of gene expression, and *in vivo* temperature measurement method
 Takumi Tomoi¹, Joe Sakamoto¹, Suguru Ohe², Yosuke Tamada², Yasuhiro Kamei¹
¹*National Institute of Basic Biology*, ²*School of Engineering, Utsunomiya University*
 Combination of infrared laser heating through a microscope optics and heat shock response of cells achieves single-cell gene induction *in vivo*. We will introduce a live-cell manipulation technique and show representative data in living animals and plants. Further, we will discuss a local heating property *in vivo* through a temperature imaging technique using a fluorescent thermometer.

BISC-2-02 9:30

Estimating the dielectric parameters of water and gel using reflectance and transmission at 1.85 to 2.07 THz
 Zoltan Vilagosh¹, Negin Foroughimehr¹, Alireza Lajevardipour¹, Dominique Appadoo², Saulius Juodkazis^{3,4}, Andrew Wood¹
¹*Australian Centre for Electromagnetic Bioeffects Research, Swinburne University of Technology, Hawthorn, Australia*, ²*Australian Synchrotron, THz Far Infrared Beamline, Clayton, Australia*, ³*Optical Sciences Centre and ARC Training Centre in Surface Engineering for Advanced Materials (SEAM), Swinburne University of Technology, Hawthorn, Australia*, ⁴*World Research Hub Initiative (WRHI), School of Materials and Chemical Technology, Ookayama, Meguro-ku, Tokyo 152-8550, Japan*
 A novel method of estimating the dielectric properties of water based substances in the 2.0 THz region involves using an ATR apparatus in a way that converts the apparatus to a reflection/transmission mode. It is best suited for 2.0 THz and above with a diamond crystal as the refractive index of diamond (2.40) and water (1.95 at 2.0 THz) are in the optimal ratio for excellent contrast.

BISC-2-03 9:45

Ceramic-based metamaterial for THz sensing applications
 Mathieu Poulin, Maksim Skorobogatyy
Ecole Polytechnique de Montreal, Engineering Physics Department
 We theoretically predict existence of Spoof Zenneck waves supported by a subwavelength corrugated surface in the terahertz spectral range, which corresponds to an alternative to plasmon-polariton for THz sensing application.

[BISC-3] 11:00-12:00
Optogenetics
 Chair: Yosuke Tamada
Utsunomiya University

BISC-3-01 11:00 *Invited*

Holographic optical probing of the computing properties of single neurons
 Vincent Daria
The Australian National University, Australia
 In this talk, I will summarize our efforts to probe the integrative and non-linear properties of dendrites of cortical pyramidal neurons using holographic structured illumination.

BISC-3-02 11:30 *Invited*

Optical control of cellular signaling pathways using animal opsins
 Hisao Tsukamoto
Kobe University
 Optical control of cellular responses is useful to understand biological functions. Animal opsins, light-sensitive G protein-coupled receptors (GPCRs), can be used as control tools to drive a wide variety of intracellular signaling pathways in a light-dependent manner. Here, I characterize molecular properties of invertebrate opsins as "ON-OFF" switch of GPCR signalings.

[BISC-4] 13:30-15:00
Digital Holography
 Chair: Yusuke Ogura
Osaka University

BISC-4-01 13:30

High-speed planar lightwave circuit digital holographic microscope using a thin film heater for biological samples
 Hideaki Gomi¹, Kazutaka Nakama¹, Shutaro Kodama¹, Katsunari Okamoto², Eriko Watanabe¹
¹*The university of Electro-Communications*, ²*Okamoto Laboratory*
 We developed a high-speed planar lightwave circuit digital holographic microscope (PLC-DHM) that used a thin film heater for thermo-optical phase shifter. Microscopic moving images of biological samples such as volvox and daphnia was obtained.

BISC-4-02 13:45

Lensless digital holographic microscope for label-free imaging
 Manoj Kumar¹, Osamu Matoba¹, Mitsuhiro Morita¹, Yasuhiro Awatsuji²
¹*Kobe University*, ²*Kyoto Institute of Technology*
 A new configuration of lensless digital holographic microscope based on a wedge plate is demonstrated. The system is simple in geometry, compact in size and highly stable in temporal phase measurements leading to the accurate investigations of minute membrane fluctuations of the biological cells.

BISC-4-03 14:00

Simultaneous three-dimensional tracking of a mother colony and a daughter colony of a moving *Volvox* by parallel phase-shifting digital holographic microscopy
 Junya Inamoto¹, Shuhei Genko¹, Tomoyoshi Inoue¹, Kenzo Nishio¹, Osamu Matoba², Toshihiro Kubota³, Yasuhiro Awatsuji¹
¹*Kyoto Institute of Technology*, ²*Kobe University*, ³*Kubota Holography Laboratory Corporation*
 We present simultaneous three-dimensional trajectories of a mother colony and a daughter colony of a *Volvox* dynamically moving in water. The trajectories were achieved at 1000 frames/s by a parallel phase-shifting digital holographic microscope.

BISC-4-04 14:15

Shape measurement of a droplet using phase-shifting burst digital holography
 Takumi Ujije, Yuta Ozawa, Yoshio Hayasaki
Utsunomiya Univ.
 Phase-shifting digital holography with burst-imaging method is developed for measuring a shape of the dynamic object. In this research, a drying process of a liquid droplet on a glass substrate were observed.

BISC-4-05 14:30

Numerical Evaluations for Multiplicative Algebraic Reconstruction Technique
 Tomohiro Aoyagi, Kouichi Ohtsubo
Toyo University
 Multiplicative algebraic reconstruction techniques (MART) is one of POCS for solving a system of simultaneous equation. We applied the MART to image reconstruction problems and evaluate the image quality in computer simulations.

BISC-4-06 14:45

Image reconstruction of objects through diffusers with different diffusion angles
 Takumi Tsukada, Taichi Nishijima, Wataru Watanabe
Ritsumeikan University
 When objects are located in scattering media such as biomedical tissues, one must consider image reconstruction of objects between two scatterers or diffusers. In this paper, we capture speckle images through a 4-f imaging system; then we reconstruct objects through two diffusers by deep learning.

[BISC-5] 16:00-17:30
Deep Imaging
 Chair: Wataru Watanabe
Ritsumeikan University

BISC-5-01 16:00 *Invited*

towards fluorescence imaging deep in scattering media
 Sylvain Gigan
Sorbonne University
 non-invasive linear fluorescence imaging deep in scattering media remains very challenging, due to the difficulty use fluorescence as a guide star. I will discuss several computational approaches, using either functional activity of neurons, or dynamic excitation through wavefront shaping, to achieve this goal.

BISC-5-02 16:30 *Invited*

3D imaging through Fourier lightfield microscopy
 Emilio Sanchez-Ortiga, Hui Yun, Gabriele Scrofanì, Manuel Martínez-Corral, Genaro Saavedra
3D Imaging and Display Laboratory, University of Valencia
 Lightfield microscopy has been recently introduced in single-shot 3D bioimaging. In this contribution we review the state-of-the-art of a novel architecture in lightfield imaging: Fourier lightfield microscopy. We present this new paradigm, showing its state-of-the-art and describing some challenges that it should face in the near future.

Program

BISC

Wednesday, 21 April

BISC-5-03 17:00 *Invited*

Deep tissue imaging by optical coherence tomography / microscopy at Optical Window III

Norihiko Nishizawa, Masahito Yamanaka
Nagoya University, Japan

High resolution optical coherence tomography and microscopy using fiber laser based super continuum were demonstrated at 1.7 μ m range. Precise structures of mouse brain were observed successfully at depth of up to 1.9 mm.

[BISC-6] 9:00-10:15
Nano and Structured Light

Chair: Osamu Matoba
Kobe University

BISC-6-01 9:00 *Invited*

***In vivo* fluorescence imaging of transplanted stem cells by quantum dots for regenerative medicine**

Hiroshi Yukawa^{1,2}
¹*Nagoya University*, ²*National Institutes for Quantum and Radiological Science and Technology*

Quantum dots (QDs) have excellent fluorescence properties in comparison to traditional fluorescence probes. In this presentation, the applications of QDs such as stem cell labeling and *in vivo* imaging of transplanted stem cells is reported.

BISC-6-02 9:30 *Invited*

Multicolor tracking of single biomolecules with metallic nanoparticles at microsecond time resolution

Jun Ando
RIKEN

We developed a multicolor dark-field imaging system using silver and silver-gold alloy nanoparticles together with gold nanoparticles, and revealed fast motions of phospholipids in supported membranes and kinesins along microtubules at 100 μ s time resolution.

BISC-6-03 10:00

Fluorescence tags using FRET networks and DNA structural change

Yusuke Ogura, Keita Hayashi,
Suguru Shimomura, Jun Tanida
Osaka University

We present a method for constructing fluorescence tags using Förster resonance energy transfer networks and DNA nanostructures which can change in response to molecular input. Simulation results demonstrate the capability of the method.

[BISC-7] 11:00-12:00
Computational and Multimodal Imaging

Chair: Yuan Luo
National Taiwan University

BISC-7-01 11:00 *Invited*

First Photon-detection Ghost imaging for weak light imaging

Yasuhiro Mizutani, Shoma Kataoka,
Tutomu Uenohara, Yasuhiro Takaya
Osaka University

We propose a novel imaging method using the Ghost Imaging (GI) in a photon limited imaging by using the First Photon-detection Time (FPT). The GI with FPT (FPGI) was able to obtain high quality image than a conventional imaging method using same photon number. Furthermore, to improve the detection time, we modified machine learning to reduce the measurement number in the view point of noise influence.

BISC-7-02 11:30

Simultaneous light-field fluorescence and TIE-based phase imaging

SUDHEESH K RAJPUT¹, RYO SHINKE¹,
Xiangyu Quan¹, Yasuhiro Awatsujii²,
OSAMU MATOBA¹

¹*Kobe University*, ²*Kyoto Institute of Technology*
We propose a simultaneous imaging of fluorescence and phase information. Here, the fluorescence imaging can be performed by the concept of light field and phase information is obtained by solving the transport of intensity equation.

BISC-7-03 11:45

Integrated optical imaging system composed of optical time-of-flight and optical coherence tomography

Juan Manuel Franco Sanchez¹,
Yuki Shimamoto¹, Shunya Masaki¹,
Joel Cervantes², Quang Duc Pham³,
Keiichiro Kagawa⁴, Hajime Nagahara⁵,
Yoshio Hayasaki¹
¹*Utsunomiya University Center for Optical Research & Education (CORE), Utsunomiya University, Japan*, ²*University Center of Exact Sciences and Engineering, Guadalajara University, Mexico*, ³*National Center for Technological Progress, Vietnam*, ⁴*Research Institute of Electronics, Shizuoka University, Japan*, ⁵*Institute for Dataability Science, Osaka University, Japan*

In this research, an optical time-of-flight and an optical coherence tomography were integrated, because both methods have a measurable range that overlaps in the submillimeter range. The integrated optical imaging system has the maximum measurable range of several ten centimeters and the axial resolution of several micrometers, and also get inside observation ability derived from the feature of the optical coherence tomography.

Thursday, 22 April

[BISC-8] 13:30-15:00

Visualization and Processing

Chair: Izumi Nishidate
Tokyo University of Agriculture and Technology

BISC-8-01 13:30 *Invited*

Red blood cell flow dynamics at bifurcations of the brain capillaries

KAZUTO MASAMOTO, Ruka Sakuraba,
Tomoya Niizawa
The University of Electro-Communications, Japan

Two-photon microscopy was used to concurrently image blood plasma and single blood cells expressing fluorescent proteins in the anesthetized rat cortex, and revealed that viscosity determines a direction of the cell's flow at the capillary bifurcations.

BISC-8-02 14:00

Imaging microplastics consumed by water organisms using a full-Stokes polarization camera

Nobuaki Endo, Nathan Hagen, Shuhei Shibata,
Yukitoshi Otani
Utsunomiya University

Waterborne microplastics can be difficult to detect in situ. We report on a method of visualizing microplastics using their inherent birefringence. By using a full-Stokes polarization camera for measurement, the microplastics can be visualized and quantified in real-time. In addition, we show that the camera is able to visualize PET microplastics consumed by brine shrimps in vivo.

BISC-8-03 14:15

Bio-optic gas visualization system (Sniff-cam) for human volatiles

Kenta Iitani, Koji Toma, Takahiro Arakawa,
Kohji Mitsubayashi
Tokyo Medical and Dental University

A bio-optic gas-imaging system (sniff-cam) with enzyme immobilized mesh demonstrates a spatiotemporal gas-imaging for human volatiles. The bio-fluorometric sniff-cam for ethanol was constructed with alcohol dehydrogenase (ADH) immobilized mesh and the NADH imaging unit, thus imaging human ethanol in the gas phase not only exhaled air but also transcutaneous vapor after drinking.

BISC-8-04 14:30

Finger region extraction using color of skin for hand-waving finger vein authentication

Hiroyuki Suzuki¹, Narissa Dittthapakdijanya²,
Takashi Komuro³, Keiichiro Kagawa⁴,
Kazuya Nakano⁵, Takashi Obi²
¹*Gunma University*, ²*Tokyo Institute of Technology*, ³*Saitama University*, ⁴*Shizuoka University*, ⁵*University of Miyazaki*

We propose a finger region extraction method that takes color images with both of a near infra-red LED and identifies the finger region based on the skin color information.

BISC-8-05 14:45

Processing Bone Fracture Image before and after Surgery using GPU

Luis Cadena¹, Franklin Cadena²,
Alberto Albuja¹, Patricio Castillo³,
Gustavo Cadena⁴

¹*Universidad de las Fuerzas Armadas ESPE*, ²*College Juan Suarez Chacon*, ³*Universidad Técnica Particular de Loja UUTPL*, ⁴*Universidad Central del Ecuador*

A fracture is the solution of continuity of bone tissue in any bone of the body occurs as a result of excessive stress that exceeds bone resistance, ie is the consequence of a single or multiple overload and occurs in milliseconds. This work presents an improved methodology for processing bone fracture images before and after surgery using segmentation and graphic accelerator cards to help the medical specialist in the analysis and evaluation of the images.

[BISC-P]
Poster Session

BISC-P-01

Quantitatively characterizing the microstructural features of collagen fiber bundles with or without tenocytes by Mueller imaging polarimeter

Chenle Cao¹, Jiazhi Wang¹, Guodong Zhou¹,
Jianhui Li¹, Ke Liu¹, Lihui Liu¹, Li Li², Yanqiu Li¹
¹*Key Laboratory of Photoelectron Imaging Technology and System of Ministry of Education, School of Optics and Photonics, Beijing Institute of Technology*, ²*Chinese People's Liberation Army General Hospital, The 8th Medical Center*

We apply the Mueller imaging polarimeter for quantitative detection of rabbit transplanted tendon samples, the results indicate that the retardance and the orientation angle parameters can distinguish rabbit tendon tissues with or without tenocytes.

BISC

Poster

BISC-P-02

Study on the cellular-level polarization characteristics of pathological sections with different preparation state by Mueller matrix polarimeter
Jiazhi Wang¹, Chenle Cao¹, Guodong Zhou¹, Li Li², Ke Liu¹, Jianfeng Wang¹, Yanqiu Li¹
¹Beijing Institute of Technology, ²Chinese People's Liberation Army General Hospital, The 8th Medical Center

The paper studied the polarization characteristics of pathological sections with different preparation states (undewaxed, dewaxed or H-E stained), which provides the basis for the best selection of the slice preparation state during polarization diagnosis.

BISC-P-03

Investigation of noncontact fast-scanning internal-temperature measurement using a thermopile-infrared point detector

Masaki Hisaka
Osaka Electro-Communication University
A noncontact method using an infrared point detector to measure a thermal object's internal temperature was developed. We introduced the 2D fast-scanning system to reduce a thermal filament image's capturing time inside a miniature bulb.

BISC-P-04

Comparison of hepatocellular carcinoma and healthy liver tissues utilizing the optical polarized system

Vi Thao Nguyen^{1,2}, Truc Thanh Nguyen^{1,2}, Hai Thanh Le^{3,2}, Hung Quoc Phan⁴, Hien Thi Thu Pham^{1,2}
¹School of Biomedical Engineering, International University, HCMC, Vietnam, ²Vietnam National University HCMC, Vietnam, ³Faculty of Mechanical Engineering, HCMC University of Technology, HCMC, Vietnam, ⁴Mechanical Engineering Department, National United University, Miaoli 36063, Taiwan
Hepatocellular carcinoma (HCC) is the most frequent type of liver cancer. This study was applied an optical polarization system using the Stokes-Mueller matrix to differentiate the HCC tissues with normal ones, based on optical characteristics of cancerous and normal tissues with polarized light. It paves the way for non-invasive, real-time identification of HCC and early detection of liver cancer.

BISC-P-05

Two-Step Curve Fitting Combined with a Two-Layered Tissue Model to Quantify Intrinsic Fluorescence of Cervical Mucosal Tissue in Vivo

Guo-Sheng Lin¹, Chong Ian Mok¹, Kung-Bin Sung^{1,2,3}
¹Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University, ²National Taiwan University, Department of Electrical Engineering, ³National Taiwan University, Molecular Imaging Center
Fluorescence spectroscopy (FS) has been used to characterize tissue fluorophores in vivo for the diagnosis of precancers in the uterine cervix. In this study, a two-step curve fitting process is established to extract the intrinsic fluorescence intensity and spectrum of fluorophores including NADH and FAD in the epithelium and collagen crosslinks in the stroma.

BISC-P-06

Non-invasive quantification of the photon fluence rate in the prefrontal cortex for transcranial photobiomodulation (TPBM)

Yu-Peng Hsieh¹, Tzu-Chia Kao², Kung-Bin Sung²
¹Department of Electrical Engineering, National Taiwan University, ²Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University

Transcranial photobiomodulation (TPBM) has been applied to improve cognition in chronic traumatic brain injury, whereas TPBM-induced enhancement of the brain is dose-dependent. We perform Monte Carlo simulations and propose a machine-learning based model that predicts the fraction of the energy of photons delivered to the gray matter (GM) based on the diffuse reflectance exiting the scalp surface and demographic variables such as gender and age.

BISC-P-07

Enhancing Diagnosis of Gingivitis by Quantifying Gingival Tissue Functional Parameters with Diffuse Reflectance Spectroscopy

Chieh Yeh¹, I-Wen Huang², Yuan-Hsun Tsai², Po-Chi Hu², Tzu-Chia Liu¹, Guan-Hua Lai¹, Sheng-Hao Tseng¹, Yu-Chen Kuan³
¹Department of Photonics, National Cheng Kung University, ²Metal Industries Research and Development Centre, ³Division of Periodontics, Department of Dentistry

Early gingivitis is difficult to assess by visual observation. We found that the tissue chromophore values derived from our diffuse reflectance spectroscopy system had a greater advantage over the conventional 2-wavelength reflectance ratio method.

BISC-P-08

High-speed and wide-field endoscopic optical coherence tomography imaging of the oral mucosa with a micromotor imaging catheter and polarization diversity detection

Ting-Yen Tsai¹, Chuan-Bor Chueh¹, Ting-Hao Chen¹, Meng-Shan Wu¹, Meng-Tsan Tsai^{2,3}, Hsiang-Chieh Lee^{1,4,5}
¹Graduate Institute of Photonics and Optoelectronics, National Taiwan University, ²Department of Electrical Engineering, Chang Gung University, ³Department of Neurosurgery, Chang Gung Memorial Hospital, ⁴Department of Electrical Engineering, National Taiwan University, ⁵Molecular Imaging Center, National Taiwan University

Due to the complex geometry of the oral cavity, it is challenging to perform wide-field optical coherence tomography (OCT) imaging of different regions of the oral mucosa, particularly in patients with opening difficulty due to submucosa fibrosis. In addition to changes in the tissue architectures, angiogenesis has been demonstrated to play an important role in the progression of oral neoplasm.

BISC-P-09

Graphics processing unit (GPU) accelerated microvascular imaging framework with optical coherence tomography (OCT) and OCT angiography techniques

Yu-Ling Chen¹, Ting-Hao Chen¹, Ting-Yen Tsai¹, Chuan-Bor Chueh¹, Yi-Chun Wu¹, Meng-Tsan Tsai^{2,3}, Cheng-Kuang Lee⁴, Hsiang-Chieh Lee^{1,5,6}
¹Graduate Institute of Photonics and Optoelectronics, National Taiwan University, ²Department of Electrical Engineering, Chang Gung University, ³Department of Neurosurgery, Chang Gung Memorial Hospital, ⁴NVIDIA AI Technology Center (NVAITC), NVIDIA, ⁵Department of Electrical Engineering, National Taiwan University, ⁶Molecular Imaging Center, National Taiwan University

Recently, the functional extension of optical coherence tomography (OCT) with OCT angiography (OCTA) allows volumetric imaging of the subsurface microvasculature without requiring exogenous contrast agents like conventional angiography techniques. However, performing OCTA requires intensive computation to extract the changes of OCT signal due to moving red blood cells in the microvascular network.

BISC-P-10

Quantitative absorption imaging of single nanoparticles by widefield interferometric photothermal microscopy

Yu-Chien Huang^{1,2}, Te-Hsin Chen¹, Jz-Yuan Juo¹, Shi-Wei Chu², Chia-Lung Hsieh¹
¹Academia Sinica, ²National Taiwan University

We demonstrate widefield interferometric photothermal microscopy to detect the local refractive index changes of single nanoparticles induced by the dissipated heat due to light absorption (known as the thermal lens effect). The sensitivity of our system is sufficient for visualizing very small single gold nanoparticles, as small as 5 nm. We establish a model to explain the generation mechanism of the photothermal signal.

BISC-P-11

Label-free imaging of cell nucleus dynamics by coherence brightfield (COBRI) microscopy

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Academia Sinica

We use coherent brightfield (COBRI) microscopy, a highly sensitive scattering-based interference microscopy, to capture the dynamic linear scattering signal of chromatin in live cells. A strategy of reconstructing the chromatin organization from the dynamic COBRI imaging is demonstrated. Using our methods, we investigate the processes of chromatin (de) condensation induced by chemical drugs at the unprecedented spatial and temporal resolutions.

BISC-P-12

Mueller matrix calculation using Electric field Monte Carlo simulation

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Understanding the propagating of light in biological tissues have long been an important issue. For this purpose, modeling scattering of light from laser radiation into turbid media has been studied. One of the common modeling tools is Monte Carlo simulation, and Mueller matrix method is a commonly used technique to study birefringence and depolarization properties of biological samples.

BISC-P-13

Multi-depth high resolution imaging with SAX microscopy

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We show multi-depth imaging in SAX microscope using tunable focusing lens without moving samples or microscope objective. Imaging properties of our system are experimentally measured using fluorescent beads.

BISC-P-14

Monitoring of pH by using stimulus responsive hydrogel and Fiber Bragg grating for bioreactor application
Monitoring of pH by using stimulus responsive hydrogel and Fiber Bragg grating for bioreactor application

Aruna N
Lakireddy Bali Reddy College of Engineering
In this paper a pH monitoring system is demonstrated by utilizing wavelength modulated fiber optic techniques. A stimulus responsive hydrogel which exhibits a volume change with the change of pH is utilized to render a strain on FBG.

BISC-P-15

Carcinogenic chromium (VI) sensing using swelling characteristics of hydrogel on Fiber Bragg grating

Aruna N
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The present article proposes carcinogenic Chromium (VI) metal ion sensor by a hydrogel coated etched FBG. Hydrogel synthesized from the blends of ATAC which is stimulus responsive to chromium ions suffers a volume change in different Cr solutions.

BISC

Poster

BISC-P-16

Development of a miniature imaging head combing wide-angle camera and optical coherence tomography for the semiautonomous laparoscope surgery procedure

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Serving as minimally invasive surgery, robotic surgery has become a promising treatment approach toward various diseases, such as Urology, Gastroenterology, or Gynecology. Although robotic surgery exhibits several advantages of decreasing the incision size and shorter patient stay, it still imposes extensive labor loading to the surgeons. Therefore, recently, semiautonomous laparoscope surgery has been emerged to improve the surgery precision further.

BISC-P-17

Quantification of Cardiac dynamics of zebrafish Larvae Using lightsheet fluorescence microscopy

Yu-Hsuan Huang, Po-Sheng Hu
 National Yang Ming Chiao Tung University
 Pathological disorder such as acute cardiovascular disease remains one of the major causes of death worldwide. Zebrafish has become an exquisite animal model for investigating many aspects of humanoid heart organ like structural morphogenesis, dynamic function and pathogenesis which allow screening efficiency of medicine.

BISC-P-18

Investigation of position and size for lymphedema with Infrared thermal imaging technology

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The purpose is to utilize infrared-ray thermal imaging system to detect thermal temperature of the target, and the appearance of image by the digital image processing. The image of the infrared-ray thermal imager could get the related position and size of the lymphedema. The experiment measured the noncontact measurement of infrared images in the knee, calf belly and ankle of the patient's lower limb edema to observe the magnitude of its edema.

BISC-P-19

Quantification of the variation of skin properties induced by facial masks using diffuse reflectance spectroscopy

Yin-Yu Chen, Shih-Yu Tzeng, Yun-Yo Yen, Sheng-Hao Tseng
 National Cheng Kung University

Facial masks are known to moisturize skin to maintain proper skin health. The global sheet face mask market size was valued at USD 257.9 million in 2018. Nevertheless, there are few academic literatures to discuss the effect of facial mask on skin. In this study, we compare the commercially available instrument with our DRS system by measuring the skin after applying facial masks.

BISC-P-20

Digital micro-mirror device based multi-focal confocal microscopy

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¹Institute of Nano Engineering and Microsystems, National Tsing Hua University, ²Institute of Medical Device and Imaging, National Taiwan University

For acquiring optically sectioned images of volumetric samples from multiple depths without axial scanning, a confocal system which is able to obtain multi-plane images with a Digital Micro-Mirror Device (DMD) has been proposed. The focal points of the laser beam can be arbitrarily positioned to any multiple planes in the three dimensional object space by switching multiplexed binary hologram encoded in the DMD by Lee hologram.

BISC-P-21

Volume Holographic Beam Shaper for Super Gaussian Beams

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A volume holographic optical element is designed and fabricated using photopolymer (PQ-PMMA) for super Gaussian beam. A Lee hologram and Digital Micro Mirror Device (DMD) are used for modulating the laser beam to a uniform one all over its beam diameter. The efficiency and uniformity of super Gaussian beams generated through volume holographic optical component is experimentally demonstrated with optimized parameters.

BISC-P-22

Fast isotropic quantitative differential phase contrast microscopy using radially asymmetric color pupil

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Differential phase contrast microscopy based on twelve-axis measurements of half-circle pupil acquires isotropic phase information but suffers with poor imaging speed. We proposed a new method by modulating illumination pattern to realize isotropic PTF within three-axis measurements.

BISC-P-23

Moiré lens based long axial scanning telecentric imaging system

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We present a telecentric design to obtain constant magnification with long axial scanning range in an optical sectioning microscope. A Moiré lens is included and utilized for this purpose. The design principles of our system are explained through mathematical expression and simulation results are provided for different conditions.

BISC-P-24

3D Archimedean spiral Metasurface for Enhances Broadband Optical Chirality

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Metasurfaces comprising 3D chiral structures have shown great potential in chiroptical applications such as chiral optical components and sensing. So far, the main challenges lie in the nanofabrication and the limited operational bandwidth. Here, we present an effective nanofabrication method to create a 3D chiral metasurface with far- and near-field broadband chiroptical properties.

BISC-P-25

Investigation of laser-induced thermal effect with laser speckle contrast imaging

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The laser treatment is an ideal option to conduct a surgical resection since it enables to provide higher accuracy and to cause less damage when targeting invariant tissue areas. Compared to traditional mechanical or chemical treatment modalities, it can shrink or destroy cancer cells using a narrow, focused light beam without harming normal tissue nearby.

BISC-P-26

Characterization of vitiligo with optical coherence tomography

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Optical coherence tomography (OCT) can noninvasively reconstruct the three-dimensional microstructure of skin and OCT has been commonly used for clinical studies. Additionally, the functional imaging abilities have been intensively investigated in the past few years such as angiography, spectroscopy, polarization, elasticity, etc. The previous reports have demonstrated that OCT can be a powerful tool for diagnoses of skin disorders.

BISC-P-27

Airy light sheet microscope for *in-vivo* imaging of *C. elegans*

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The feature of rapid divergence of conventional Gaussian beam restricts the field of view in light sheet microscopy. Comparison with Gaussian beam, the Airy beams provides many advantages in light sheet microscopy such as larger field of view (FOV), longer penetration path, and self-reconstruction.

BISC-P-28

Deep neural networks enabled isotropic quantitative differential phase contrast microscopy

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We utilized U-net model for mapping from 1-axis phase reconstruction to 12- axis one. The results show that the deep neural network we proposed achieved expecting performance. The final testing loss value of our model after 1000 epochs of training achieved 6.7e-5 after normalized. The peak signal to noise ratio improvement is from 26dB to 30dB.