The 15th IEEE International Conference on Nano/Molecular Medicine and Engineering

VIRTUAL IEEE-NANOMED

2021 TECHNICAL PROGRAM

http://www.ieee-nanomed.org/2021/

November 15-17, 2021

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VIRTUAL IEEE-NANOMED 2021

The 15th IEEE International Conference on Nano/Molecular Medicine & Engineering

November 15-17, 2021

On behalf of

the IEEE Nanotechnology Council

& the conference organizing committee

WELCOME

Welcome all of you to the 15th IEEE International Conference on Nano/Molecular Medicine and Engineering (IEEE-NANOMED 2021) as held on-line from November 15-17, 2021. IEEE NANOMED is an annual conference organized by the IEEE Nanotechnology Council, to attract together scientists, engineers, and even for medical doctors, etc. Due to Covid-19 pandemic, this is the second year to operate the IEEE-NANOMED conference virtually.

This conference has managed to invite leading scientists to give 3 plenary talks, 3 keynote talks, 21 invited session presentations, and 6 regular session presentations for the topic reviews and future perspectives of NANOMED fundamentals and applications. We will invite some presentations to publish their research works in special issue of IEEE Open Journal of Nanotechnology. We hope the Journal special issue can inspire more people to present their excellent research results in Nano/Molecular Medicine and Engineering fields.

Before we kick-off IEEE-NANOMED 2021, we want to express our appreciativeness to every attendance who contributed your works. Without your brilliant ideas and elegant works, the conference cannot be attractive. We also want to thank our conference organizers, technical program committee members, our sponsors, and the great organizing committee members. We hope all of you can enjoy this virtual conference.

Your Conference General Chair,

Kin Fong Lei
Chang Gung University, Taoyuan, Taiwan

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VIRTUAL IEEE-NANOMED 2021

IEEE-NANOMED Sessions are all in *UTC+8:00 (Morning in Asia and Evening in America)*

Microsoft TEAMS Meeting links:

RM 001	RM 002	RM 003	RM 004	RM 005
https://reurl.cc/35Rj4R	https://reurl.cc/n5yEqn	https://reurl.cc/0xQ24k	https://reurl.cc/Rb8jYn	https://reurl.cc/0xQxbb

November 15 [Monday] (UTC+8)					
Time (UTC+8)	**RM 001**				
08:30-08:35	**Opening Ceremony**				
08:35-09:20	Plenary Lecture 1: **Shin-Ru Shih**, Chang Gung University (Chair: Kin Fong Lei) ***Basic and Clinical Research of SARS-CoV-2: Laboratory Diagnosis, Vaccine and Antiviral Developments***				
09:20-9:50	Keynote Lecture 1: **Elena A. Rozhkova**, Argonne National Laboratory (Chair: Anderson Shum) ***Merging Nanotechnology & Synthetic Biology toward Directed Evolution of Energy Materials***				
9:50-10:00	***Break (10 min)***				
10:00-11:30	**RM 001**	**RM 002**	**RM 003**	**RM 004**	**RM 005**
	Invited Session M1.1 **Biosensors & Nanomedicine** Chair: Chien-Fu Chen	Invited Session M2.1 **Artificial Intelligence Implementations in Biomedical Imaging** Chair: Hsieh-Fu Tsai	Invited Session M3.1 **Electrical Device in Biomedical Applications** Chair: Bor-Ran Li	Invited Session M4.1 **Printing Technology in Nano-Bio-Medicine** Chair: Ji Tae Kim	Regular Session M5.1 **Nano and Molecular Technologies in Medical Theranostics** #2, #12, #23, #29, #30, #31 Chair: Pin-Chuan Chen
11:30-11:40	***Break (10 min)***				
11:40-13:10	**RM 001**	**RM 002**	**RM 003**	**RM 004**	**RM 005**
	Invited Session M1.2 **Flexible Nanostructured Devices for Sensing and Actuation** Chair: Inkyu Park	Invited Session M2.2 **Cell Mechanics from Research to Applications** Chair: Changjin Huang	Invited Session M3.2 **Nano/Micro-Technology for Biomedical Applications** Chair: Yi-Chiung Hsu	Invited Session M4.2 **Engineering Microfluidic Platforms for Bio/Chemical Applications** Chair: Sammer UL Hassan	Regular Session M5.2 **Bio/Nano Sensing** #6, #13, #14, #16, #32, #33, #41 Chair: Pin-Chuan Chen

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Microsoft TEAMS Meeting links:

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https://reurl.cc/35Rj4R	https://reurl.cc/n5yEqn	https://reurl.cc/0xQ24k	https://reurl.cc/Rb8jYn	https://reurl.cc/0xQxbb

November 16 [Tuesday] (UTC+8)					
Time (UTC+8)	**RM 001**				
08:35-09:20	Plenary Lecture 2: **Xuanhe Zhao**, Massachusetts Institute of Technology (Chair: Anderson Shum) ***Merging Human-Machine Intelligence with Soft Materials Technology***				
09:20-09:50	Keynote Lecture 2: **Jin-Woo Kim**, University of Arkansas (Chair: Pak Kin Wong) ***Multifunctional Bio-Hybrid Nanoscale Materials: Design and Assembly***				
09:50-10:00	***Break (10 min)***				
10:00-11:30	**RM 001**	**RM 002**	**RM 003**	**RM 004**	**RM 005**
	Invited Session T1.1 **Advanced Manufacturing Solutions in Material/Device Design** Chair: Hui Ying Yang	Invited Session T2.1 **New Generation of Wearable / Implanted Devices - Leveraging Self-power Technology** Chair: Vincent Lee	Invited Session T3.1 **Nanomaterials and Nanodevices for Healthcare Applications** Chair: Zong-Hong Lin	Regular Session T4.1 **Biochip and Bio-MEMS** #1, #4, #11, #15, #17, #21 Chair: Kin Fong Lei	Regular Session T5.1 **Best Paper Competition** #20, #22, #27, #28 Chairs: Nalinikanth Kotagiri and Jangho Kim
11:30-11:40	***Break (10 min)***				
11:40-13:10	**RM 001**	**RM 002**	**RM 003**	**RM 004**	**RM 005**
	Invited Session T1.2 **Micro/Nano Technology for Biosensing** Chair: Megan Ho	Invited Session T2.2 **Novel Materials for Bio and Robotic Applications** Chair: King Lai	Invited Session T3.2 **Nanomedicine in Ophthalmology** Chair: Joseph Chan	Invited Session T4.2 **Microfluidics, Analytical Chemistry, and Biosensing** Chair: Pin-Chuan Chen	Invited Session T5.2 **Biomedical Applications for Fluidics, Hydrogels and Devices** Chair: Michinao Hashimoto

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November 17 [Wednesday] (UTC+8)				
Time (UTC+8)	RM 001			
08:35-09:20	Plenary Lecture 3: **Xingyu Jiang**, Southern University of Science and Technology (Chair: Anderson Shum) ***Liquid Metal/Polymer-based Flexible Devices for Biomedical Applications***			
09:20-09:50	Keynote Lecture 3: **Ken-Tye Yong**, The University of Sydney (Chair: Kin Fong Lei) ***Triboelectric Nanogenators for Biomedical Engineering and Nanomedicine Applications***			
09:50-10:00	***Break (10 min)***			
10:00-11:30	**RM 001**	**RM 002**	**RM 003**	**RM 004**
	Invited Session W1.1 **Microfluidics for Diagnostics** Chair: Cecil Chen	Invited Session W2.1 **Nano/Molecular Medicine & Engineering** Chair: Tzu-En Lin	Regular Session W3.1 **Biological Interface Cells at the Nanoscale I** #7, #9, #10, #18, #34, #35 Chair: Raymond Lam	Regular Session W4.1 **Biological Interface Cells at the Nanoscale II** #25, #42, #43, #45, #46 Chair: Chi-Shuo Chen
11:30-11:40	***Break (10 min)***			
11:40-13:10	**RM 001**	**RM 002**	**RM 003**	
	Invited Session W1.2 **Advanced Plasmonic Platform for Biosensors** Chair: Ray Yu-Jui Fan	Invited Session W2.2 **Advances in Microswimmers for Biomedical Applications** Chair: Alan Tsang	Invited Session W3.2 **Sensing Single Cell Properties in Microfluidics** Chair: Raymond Lam	

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TECHNICAL PROGRAM INDEX

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KN3	**Triboelectric Nanogenators for Biomedical Engineering and Nanomedicine Applications** KN Speaker: Ken-Tye Yong, The University of Sydney Session Chair: Kin Fong Lei, Chang Gung University | Time: 09:20-09:50 (TWN), Nov 17, 2021 (RM 001)

Invited Sessions

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IS T1.1	**Advanced Manufacturing Solutions in Material/Device Design** Session Chair: Hui Ying Yang, Singapore University of Technology and Design Time: 10:00-11:30 (TWN), Nov 16, 2021 (RM 001)	IS T2.1	**New Generation of Wearable / Implanted Devices - Leveraging Self-power Technology** Session Chair: Vincent Lee, National University of Singapore Time: 10:00-11:30 (TWN), Nov 16, 2021 (RM 002)

IS T3.1	Nanomaterials and Nanodevices for Healthcare Applications Session Chair: Zong-Hong Lin, National Tsing Hua University Time: 10:00-11:30 (TWN), Nov 16, 2021 (RM 003)	IS T1.2	Micro/Nano Technology for Biosensing Session Chair: Megan Ho, The Chinese University of Hong Kong Time: 11:40-13:10 (TWN), Nov 16, 2021 (RM 001)
IS T2.2	Novel Materials for Bio and Robotic Applications Session Chair: King Lai, City University of Hong Kong Time: 11:40-13:10 (TWN), Nov 16, 2021 (RM 002)	IS T3.2	Nanomedicine in Ophthalmology Session Chair: Joseph Chan, The University of Hong Kong Time: 11:40-13:10 (TWN), Nov 16, 2021 (RM 003)
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IS W3.2	Sensing Single Cell Properties in Microfluidics Session Chair: Raymond Lam, City University of Hong Kong Time: 11:40-13:10 (TWN), Nov 17, 2021 (RM 003)		

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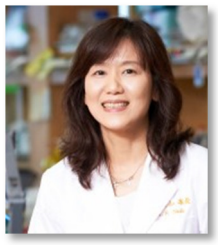
RS W3.1	Biological Interface Cells at the Nanoscale I Session Chair: Raymond Lam, City University of Hong Kong Time: 10:00-11:30 (TWN), Nov 17, 2021 (RM 003)	RS W4.1	Biological Interface Cells at the Nanoscale II Session Chair: Chi-Shuo Chen, National Tsing Hua University Time: 10:00-11:30 (TWN), Nov 17, 2021 (RM 004)

Basic and Clinical Research of SARS-CoV-2: Laboratory Diagnosis, Vaccine and Antiviral Developments



PL1: 08:35 – 09:20
Monday, November 15, 2021
Location: RM 001

Shin-Ru Shih

Chang Gung University, Taiwan
srshih@mail.cgu.edu.tw

Abstract

As the COVID-19 pandemic continues, the causative virus, SARS-CoV-2 continues to evolve. SARS-CoV-2 is the strain of coronavirus, a kind of RNA virus which has been known to mutate frequently. This talk will discuss viral genetic diversity and its impact on virus stability and antigenicity. First, investigation of the genomic variation of SARS-CoV-2 isolates in Taiwan and comparison of their evolutionary trajectories with the global strains will be presented. Like other isolates from different countries, D614G change in viral spike (S) protein becomes dominant. We developed a flexible electrochemical impedance spectroscopy-based biosensor to measure the interaction between spike protein and ACE2 receptor and found that the spike protein of the S-G614 variant had better binding ability with ACE2 receptor than that of the S-D614 variant after storage at –20°C up to 30 days. Stability and infectivity are related to each other, and higher stability of S-G614 than that of S-D614 may contribute to fast viral spread of the S-G614 variant.

Short Bio

Shin-Ru Shih got her bachelor degree in Medical Technology and master degree in Biochemistry from National Taiwan University and her Ph.D. in Biochemistry and Molecular Biology from Rutgers University, New Jersey, USA. She established a Molecular Virology Laboratory at Chang Gung University in 1996 and was appointed Medical Director in Clinical Virology Laboratory, Chang Gung Memorial Hospital in 1998. She also started the Research Center for Emerging Viral Infections at Chang Gung University in 2009, and took the lead as center director since then. Her team have been studying various aspects of emerging RNA viruses, including identification of viral pathogens during outbreaks, mechanistic studies of pathogenesis, and development of vaccines and antiviral agents.

Merging Human-Machine Intelligence with Soft Materials Technology

PL2: 08:35 – 09:20
Tuesday, November 16, 2021
Location: RM 001

Xuanhe Zhao

Massachusetts Institute of Technology, USA
zhaox@mit.edu

Abstract

Whereas human tissues and organs are mostly soft, wet and bioactive; machines are commonly hard, dry and biologically inert. Merging humans, machines and their intelligence is of imminent importance in addressing grand societal challenges in health, sustainability, security, education and joy of living. However, interfacing humans and machines is extremely challenging due to their fundamentally contradictory properties. At MIT Zhao Lab, we exploit *soft materials technology* to form long-term, high-efficacy, multi-modal interfaces and convergence between humans and machines. In this talk, I will first discuss the mechanics and general principles to design extreme properties including tough, resilient, adhesive, strong, fatigue-resistant and conductive for soft materials. Then I will discuss a set of soft materials technology platforms, including i). bioadhesives for instant strong adhesion of diverse wet dynamic tissues and machines; ii). bioelectronics for long-term multi-modal neural interfaces; iii). biorobots for teleoperated and autonomous navigations and operations in previously inaccessible lesions such as in cerebral and coronary arteries. I will conclude the talk with a perspective on future human-machine convergence enabled by soft materials technology.

Short Bio

Xuanhe Zhao is Professor of Mechanical Engineering at MIT. The mission of Zhao Lab is to advance science and technology on the interfaces between humans and machines for addressing grand societal challenges in health and sustainability with integrated expertise in mechanics, materials and biotechnology. A major focus of Zhao Lab's current research is the study and development of soft materials and systems. Dr. Zhao is the recipient of the NSF CAREER Award, ONR Young Investigator Award, SES Young Investigator Medal, ASME Hughes Young Investigator Award, Adhesion Society's Young Scientist Award, Materials Today Rising Star Award, and Web of Science Highly Cited Researcher. He held the Hunt Faculty Scholar at Duke University, and the d'Arbeloff Career Development Chair and Noyce Career Development Professorship at MIT.

Liquid Metal/Polymer-Based Flexible Devices for Biomedical Applications

PL3: 08:35 – 09:20
Wednesday, November 17, 2021
Location: RM 001

Xingyu Jiang

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Abstract

Conductive inks made from lipid metals-polymer composites (MPC) can be printed into patterned circuits on flexible materials. Such flexible devices have excellent conductivity, flexibility, stretchability, biocompatibility, and conformability. These properties can dramatically expand the capability of electronics in a variety of biomedical applications, such as biomedical sensing, tissue engineering, regenerative medicine and gene therapy. Epidermal liquid metal-based electronics, such as blood oxygen sensor and sweat detection device, allow real-time digital feedback of health information. Meanwhile, implantable medical implements can be used to treat cardiovascular disease, such as small-diameter artificial blood vessels for promoting endothelialization, degradable temporary cardiac pacing lead for correcting abnormal heart rate and implantable stent with electroporation for gene delivery. I will also discuss the idea of an "electronic blood vessel" in particular and a related concept of "electronic vascularized tissues/organs" in general.

Short Bio

Xingyu Jiang is a Chair Professor at the Southern University of Science and Technology, Shenzhen, China. He obtained his B.S. at the University of Chicago in 1999 and his Ph.D. at Harvard University in 2004. In 2005, he began to start his own lab at the National Center for Nanoscience and Technology (an affiliate of the Chinese Academy of Sciences). In 2018, he was appointed the Head and Chair Professor at the Department of Biomedical Engineering of the Southern University of Science and Technology. He has published more than 300 peer-reviewed papers. His research has been recognized by many awards and supported by a number of prestigious funding, including "Hundred Talents Plan" of the Chinese Academy of Sciences, the National Science Foundation of China's Distinguished Young Scholars Award, the Scopus Young Researcher Gold Award, and the Human Frontier Science Program Young Investigator Award. He is a Fellow of the Royal Society of Chemistry (UK) and the American Institute of Medical and Biological Engineering.

IEEE-NANOMED KEYNOTE

Merging Nanotechnology & Synthetic Biology toward Directed Evolution of Energy Materials

KN1: 09:20 – 09:50
Monday, November 15, 2021
Location: RM 001

Elena A. Rozhkova

Argonne National Laboratory
rozhkova@anl.gov

Abstract

The interface between nanomaterials and biological systems, the living and synthetic worlds, has evolved into a new science, nanobiotechnology, which deals with the design of materials for a variety of applications, from the environmentally friendly energy sources to neural modulation through optogenetics. The evolution of a new function, which goes far beyond the individual original inorganic particles and biological molecules, requires a powerful combination of chemical synthesis, fabrication, synthetic biology, and self-assembly into hybrid hierarchical structures.
In our work, we use microbial rhodopsins, transmembrane protein channels that are capable of light-guided translocation of ions across the lipid membrane. We have demonstrated that by combining these light-gated biological entities with inorganic nanoparticles, it is possible to perform the "artificial photosynthesis" function, e.g. H2 production, CO2 reduction and cell-like ATP synthesis.
Optogenetics, an advanced high-precision technique of modulating excitable cells such as neurons using light, harnesses similar microbial opsins. However, this method also relies on implantable fiber optics to deliver photons into the brain. We developed radioluminescent nanoparticles, which absorb X-ray energy and convert it into optical luminescence. When these nanoparticles are introduced into an animal brain, they serve as an in situ source of photons for high-fidelity modulation of a light-gated channelrhodopsin in neurons, thus offering a new wireless optogentic approach.

Short Bio

Dr. Rozhkova earned her Ph.D. in Chemistry at the Moscow State Institute for Fine Chemical Technology. She worked in Japan as a Japan Society for Promotion of Science (JSPS) postdoctoral fellow at the Institute of Multidisciplinary Research for Advanced Materials, Tohoku University. After moving to the US in 2003, she became a research staff member at the Chemistry Department of Princeton University, and later she moved to Chicago. Since joining the Center for Nanoscale Materials at Argonne National Laboratory in 2007, Elena has been focusing on a general theme of Nano-Bio Interfaces, one of the most exciting interdisciplinary research fields of our time. Success in this area can lead to the solution of emerging problems of civilization, for example, to provide alternative sustainable energy, to advance medical technologies in the diagnosis and treatment of incurable diseases. Rozhkova is a recipient of JSPS fellowship (2000), Brain Research Foundation Fay/Frank Women's Council Award (2007), the U. of Chicago Argonne LLC Board of Governors Distinguished Performance Award and a medal (2013), Prof. M. J. Nanjan Fourth Endowment Lecture Award "For outstanding contributions in the field of nano-biotechnology" (2018). She was named an IEEE Nanotechnology Council Distinguished Lecturer 2021.

IEEE-NANOMED KEYNOTE

Multifunctional Bio-Hybrid nanoscale Materials: Design and Assembly

KN2: 09:20 – 09:50
Tuesday, November 16, 2021
Location: RM 001

Jin-Woo Kim

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Abstract

Advances in nanotechnology have yielded nanomaterials, both hard and soft nanomaterials, with a variety of shapes, sizes and compositions, and their unique physicochemical properties, stemming from their size, shape and composition, have offered enormous promise to advance diverse fields, ranging from optoelectronics and nanophotonics to molecular/nano sensing, biosecurity and bio/nano medicine. Recently, great interest has been focused on their promising attributes for manipulating into multifunctional hybrid nanostructured materials with tailored size, shape and function. These hybrid nanomaterials would yield advanced properties that have multifaceted applications in various fields, including biomedical applications to offer an enabling approach to customize nanoagents to the individual patients. Despite recent progress, however, there still is plenty of room for improvement and many untapped possibilities for innovative strategies to be developed. This lecture will discuss our recent advances in the design and fabrication of multifunctional bio-hybrid nanocomposites for advanced materials particularly in bio/nano medicine. It will also discuss ***the fundamental challenges to*** as well as future directions of ***the*** controlled assembly of bio-hybrid soft nanocomposites with specific shape and function, particularly the need of a "holistic" approach in their development by considering not only the impediments regarding chemistry and controls in NP assembly but also the incomplete but growing understanding of biology and the interactions between nanomaterials and biological components in a complex biological system.
This work was supported in part by the National Science Foundation (OIA-1457888 and ECCS-1810014), the National Institute of Health (1R21HG010055), and the Arkansas Biosciences Institute.

Short Bio

Jin-Woo Kim is a Director of Bio/Nano Technology Group and a Professor of Biological Engineering, Biomedical Engineering and Materials Science & Engineering at University of Arkansas. He is an Adjunct Professor of Electrical Engineering at Pohang University of Science & Technology (POSTECH). He received his first B.S. in Chemical Technology (currently Chemical & Biological Engineering) from Seoul National University, the second B.S. in Microbiology from University of Iowa, the M.S. in Biology from University of Wisconsin, and the Ph.D. in Biological Engineering from Texas A&M University. He was a Visiting Professor of the School of Engineering and Applied Sciences at Harvard University and the Center for Functional Nanomaterials at Brookhaven National Laboratory. His research focus is in the area of *Bio/Nano Technology*, *i.e.*, *biologically inspired nanotechnology*, which spans interdisciplinary fields of biological engineering, biomedical engineering, biology, chemistry, and nanotechnology. Learning from biological systems in nature, his research aims to develop more effective and efficient routes to "panoscale" (*i.e.*, 'any' scale) system integration of multifunctional hierarchical structures for biomimetic advanced materials and devices. He has published over 125 peer-reviewed articles, over 240 presentations with over 85 invited presentations, and 5 patents granted/pending. He received several teaching and research awards, holds guest editorships and editorial board memberships for several journals, including co-Editor-in-Chief of *IEEE Open Journal of Nanotechnology* and Senior Editor of *IEEE Transactions on Nanotechnology*, and has been ad-hoc reviewers for leading journals, including *Science, PNAS,* and *Nature Nanotechnology*. He held leadership positions for international societies, including Vice Presidents for Publications (2017-2019) and for Conferences (2020-2022) of IEEE Nanotechnology Council, is a steering committee chair of IEEE-NANOMED, and has served as organizing committees for several international conferences, including general chairs (2015 and 2019), general co-chairs (2011, 2017, 2020, and 2021) and program chair (2010) of IEEE-NANOMED, general chair (2023) and general co-chair (2019) of IEEE-NANO, general chair (2020) of IEEE-NEMS, *etc*. He is a Fellow of the American Institute of Medical & Biological Engineering (AIMBE) and IEEE Nanotechnology Distinguished Lecturer (2017-2018).

Triboelectric Nanogenators for Biomedical Engineering and Nanomedicine Applications

KN3: 09:20 – 09:50
Wednesday, November 17, 2021
Location: RM 001

Ken-Tye Yong

The University of Sydney, Australia
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Abstract

During the last decade, TENG-based devices have been employed in biomedical applications such as monitoring physiological and pathological signals from the body. These TENG-based devices can be engineered to serve as a platform for challenges in powering miniaturized sensitive diagnostic tools, drug delivery therapy systems, and guided phototherapy devices. The triboelectric phenomenon basically occurs when two different materials come into contact and opposite charges create on these surfaces are known as triboelectric charges. These charges on the dielectric surfaces will induce electric potential which can be harvested for powering various miniaturized electronic biodevices. For example, TENG devices are often prepared with two organic thin films such as PTEE and PDMS where the individual film is connected to an electrode for power harvesting. In addition, nanomaterials can be integrated into the film's surface to enhance the power output yield. The advantages of being lightweight, small size, and low cost allows TENG-based device to be applied for powering implantable/non-implantable biodevices, an essential characteristic for tailoring specific needs in biomedical engineering and nanomedicine applications. In this talk, we will highlight the use of TENG-based devices with different morphologies, compositions, and models for biomedical engineering and nanomedicine applications (e.g. drug delivery, biosensing, photothermal therapy, gene delivery, etc). Also, we will discuss some important factors to be considered when designing TENG-based devices for in vitro and in vivo applications and the future trend of using such systems in the biophotonic and nanomedicine field. Certainly, the biocompatibility of TENG-devices will be one of the main challenges to be overcome soon if we would like/want to pursue in vivo biophotonic or nanomedicine technologies with implantable TENG-based devices. The biocompatibility assessment of TENG devices will be discussed. This talk is intended to promote the awareness of past and present developments of TENG-based devices in biomedical fields, the challenges of TENG-based devices, and the approaches to engineer new types of TENG, whereby encouraging researchers to think about exciting and promising biophotonic and nanomedicine applications with TENG in the near future.

Short Bio

Ken-Tye Yong is a Professor at the School of Biomedical Engineering, University of Sydney. He earned his BS, ME, and Ph.D. from the State University of New York at Buffalo, USA. He is a Fellow of the Royal Society of New South Wales, Optical Society of America, and Royal Society of Chemistry. He is the recipient of the 2017 Beilby Medal and Prize, 2018 Rosenhain Medal and Prize, and 2018 IEEE Distinguished Lecturer Award. His research interests include nanomaterials for nanomedicine and plasmonic sensing. He has published 250 journal articles, 7 book chapters, and 50 conference papers.

Biosensors & Nanomedicine

IS M1.1: 10:00-11:30
Monday, November 15, 2021
Location: RM 001

Session Chair: **Chien-Fu Chen**
Institute of Applied Mechanics, National Taiwan University, Taipei, Taiwan

Description

This invited session covers topics related to the biosensors and biomaterials for targeting the global heathy issues adopting various nano/microtechnologies, analytical platforms, and biological technologies.

M1.1.1 Towards Electrochemical and Optical Sensors for the Determination of COVID-19, Arunas Ramanavicius, State Research Institute Center for Physical and Technological Sciences, Vilnius, Lithuania

M1.1.2 Biomedical Applications of Organic Color Centers, Mijin Kim, Molecular Pharmacology Program, Sloan Kettering Institute, New York, USA

M1.1.3 Paralleled Droplet Digital Nucleic Acid Amplifications for Pathogen Quantification, Hao Yuan, School of Life Science and Engineering, Southwest Jiaotong University, Chengdu, China

M1.1.4 MXene -Based Microneedles for Biosensing and Electrostimulation, Tzu-En (Linna) Lin, Institute of Biomedical Engineering, College of Electrical and Computer Engineering, National Yang Ming Chiao Tung University, Hsinchu, Taiwan

M1.1.5 'Microwebs': Synthetic Structures Imitating 'Neutrophil Extracellular Traps (NETs)', Yang Song, School of Materials Science & Engineering, Shanghai Jiao Tong University, Shanghai, China

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Artificial Intelligence Implementations in Biomedical Imaging

IS M2.1: 10:00-11:30
Monday, November 15, 2021
Location: RM 002

Session Chair: **Hsieh-Fu Tsai**
Technology Development & Innovation Center, Okinawa Institute of Science and Technology Graduate University, Japan

Description

Recent advances in machine learning techniques together with parallel acceleration have contributed to success in artificial intelligence for improving and accelerating biomedical imaging analysis that outperform conventional computer vision analysis. Leveraging artificial intelligence methods for statistical prediction and pattern recognition also present novel interest for application in high throughput image analysis and medical diagnostics. This session focuses on the latest development of artificial intelligence implementation in biomedical imaging.

M2.1.1 Segmentation of Cancer Stem Cell using CGAN, Tomoyasu Sugiyama, Tokyo University of Technology, Japan

M2.1.2 MR Radiomics in Predicting Response of Vestibular Schwannoma after Gamma Knife Radiosurgery, Chia-Feng Lu, National Yang Ming Chiao Tung University, Taiwan

M2.1.3 Automatic Brain Image Segmentation Using Fast Data Density Functional Theory, Chien-Chang Chen, National Central University, Taiwan

M2.1.4 3DeeCellTracker: a Deep Learning-based Method for Tracking Cells in 3D Time Lapse Images, Chentao Wen; Kotaro Kimura, Nagoya City University, Japan

M2.1.5 DeepPhenotype: Single-shot Segmentation and Cell Cycle Prediction of Single Cells in Phase Contrast Microscopy, Paul Hsieh-Fu Tsai; Tomoya Noma, Amy Q. Shen, Okinawa Institute of Science and Technology Graduate University, Japan

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Electrical Device in Biomedical Applications

IS M3.1: 10:00 -11:30
Monday, November 15, 2021
Location: RM 003

Session Chair: **Bor-Ran Li**
Institute of Biomedical Engineering, College of Electrical and Computer Engineering, National Yang Ming Chiao Tung University, Taiwan

Description

Bioelectronics comprise the development and study of electronic devices that operate as transducers between the signals and functions of biology, and those of conventional electronic processing systems. Bioelectronic devices can be

used to regulate the physiology of cells, tissues, and organs in a chemically-specific manner. In addition, they can also be applied to living systems to selectively sense, record, and monitor different signals and physiological states, as well as convert relevant parameters into electronic readout for further processing and decision makings.

M3.1.1 Realtime 2D Imaging of Fluorographene and ALD-based Sensing Membrane for Directly Cell Culture and Acidification Monitor, Chia-Ming Yang, Institute of Electro-Optical Engineering, Chang Gung University, Taiwan

M3.1.2 Rapid and Sensitive Pathogen Detection by Isothermal Amplification Using Janus Particles Enabled Rotational Diffusometry, Han-Sheng Chuang, Department of Biomedical Engineering, National Cheng Kung University, Taiwan

M3.1.3 Smart Materials for Future Healthcare and Enabling Technology Applications, Po-Kang Yang, Department of Biomedical Sciences and Engineering, National Central University, Taiwan

M3.1.4 New Insights into the Phase Transformation of Graphene Oxide: Biomedical Interfaces, Guan-Yu Chen, Institute of Biomedical Engineering, College of Electrical and Computer Engineering, National Yang Ming Chiao Tung University, Taiwan

M3.1.5 Electric-double-layer (EDL) BioFETs for Disease Diagnosis and Cellular Response Monitoring, Yu-Lin Wang, Institute of Nanoengineering and Microsystems, National Tsing Hua University, Hsinchu, 300 Taiwan

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Printing Technology in Nano-Bio-Medicine

IS M4.1: 10:00-11:30
Monday, November 15, 2021
Location: RM 004

Session Chair: **Ji Tae Kim**
The University of Hong Kong, Hong Kong SAR

Description

Advances in micro/nanoprinting technology are currently making tremendous contributions to diverse fields from healthcare monitoring to organ transplantation. In this invited session, the latest developments on various printing techniques such as inkjet printing, microfluidic dispensing, 3D printing, and so on, and the prospect of their practical applications to diagnosis and therapeutics will be discussed. The meeting will cover a broad range of materials, manufacturing/transfer techniques, and device fabrications related to medicine.

M4.1.1 Hydrodynamic Confinements: An Enabling Bioanalytical Technology for Tumor Profiling, Govind Kaigala, IBM Research Europe – Zurich, Switzerland

M4.1.2 Bioprinted Human Tissues for Advanced Therapeutics, Jinah Jang, POSTECH, Korea

M4.1.3 3D-printed Organ Phantoms for Micro-robotics and Minimally-invasive Surgery, Tian Qiu, University of Stuttgart, Germany

M4.1.4 3D-printed Bio-medical Structural Electronics, Woo Soo Kim, Simon Fraser University, Canada

M4.1.5 3D Printing of Self-Assembled Dipeptides, Ji Tae Kim, The University of Hong Kong, Hong Kong SAR

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Flexible Nanostructured Devices for Sensing and Actuation

IS M1.2: 11:40-13:10
Monday, November 15, 2021
Location: RM 001

Session Chair: **Inkyu Park**
Department of Mechanical Engineering, KAIST, Republic of Korea

Description

In this invited technical session, we discuss recent advancement of flexible sensing and actuation devices based on functional micro/nano-structures. The micro/nano-structures provide unique material and structural characteristics, and therefore facilitate excellent functionalities and superior performances in various applications. Furthermore, by the combination of micro/nano-structures and flexible/stretchable/wearable platforms, we can realize unprecedented performances in sensors and actuators, which can be utilized in numerous fields such as robotics, metaverse, healthcare, and biomedical technologies. Top young researchers in this field will give invited talks with the following topics:

M1.2.1 Haptic Biomaterials for Two-Way Communication with Physiological Systems, Darren Lipomi, University of California at San Diego, USA

M1.2.2 Biomedical Electrophysiology Sensing Robot Applications using 3D Printed Dry

Electrodes, Woo Soo Kim, Simon Fraser University, Canada

M1.2.3 Electronic Suture for Wireless In-vivo Strain Sensing, Jaehong Lee, Daegu Gyeongbuk Institute of Science & Technology, Korea

M1.2.4 Flexible and Stretchable Wearable Sensors via Engineering Microcracks/Microstructure in Polymer Nanocomposites, Shuying Wu, Macquarie University, Australia

M1.2.5 Soft Nanocomposite Sensors for Human Motion Detection and Healthcare, Morteza Amjadi, Harriot-Watt University, UK

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Cell Mechanics from Research to Applications

IS M2.2: 11:40-13:10
Monday, November 15, 2021
Location: RM 002

Session Chair: **Changjin Huang**
School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore

Description

Understanding the mechanical behavior of biological systems paves the way for the development of more effective diagnostics and therapeutics and advanced biomimetic systems. This invited session focuses on the latest findings on cell mechanics from fundamental research to biomimetic and bioinspired biomedical applications.

M2.2.1 Strain Rate-Dependent Mechanical Response of Single Cell-Cell Junctions, Ruiguo Yang, Department of Mechanical and Materials Engineering, University of Nebraska-Lincoln, USA

M2.2.2 Nano-topography Engineering in Cells, Wenting Zhao, School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore

M2.2.3 Mechanics of Nanoscale Lipid Vesicles, Changjin Huang, School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore

M2.2.4 Crafting of Extracellular Matrix Mimicry for Transformative Craniofacial Therapies, Tugba Ozdemir, Nanoscience and Nanoengineering Department, South Dakota School of Mines and Technology, USA

M2.2.5 Coupled Monitoring and Modulating Neuromuscular Systems, Pingqiang Cai, School of Medicine, Chemistry and Biomedicine Innovation Center, Nanjing University, China

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Nano/Micro-Technology for Biomedical Applications

IS M3.2: 11:40-13:10
Monday, November 15, 2021
Location: RM 003

Session Chair: **Yi-Chiung Hsu**
Department of Biomedical Sciences and Engineering, National Central University, Taiwan

Description

Nano/Micro-Technology has long been recognized as an emerging strategy for therapy and/or diagnosis of disease. In this session, 3 novel drug nano/micro-carriers for treatment of cancer, nerve recovery, or acnes, as well as 2 advanced nanotechnologies for bio-detections are presented.

M3.2.1 Preparation of Multi-function Nanomaterials in Application to Malignant Tumor Treatment, Chian-Hui Lai, Graduate Institute of Biomedical Engineering, National Chung Hsing University, Taiwan

M3.2.2 Development of Magnetic Sample Measurement System for Magnetic Particle Content in Single Living Cell, Tzong-Rong Ger, Department of Biomedical Engineering, Chung Yuan Christian University, Taiwan

M3.2.3 Electromagnetized-Field-Mediated Adaptable Conductive Microporous Hydrogels for Directing Nerve Repair and Brain Function Recovery, Ru-Siou Hsu, Department of Chemistry, Stanford, USA

M3.2.4 Development of Multifunctional Nano-Emulsion for Acne Vulgaris, Kuang-Hung Hsiao[1], Chun-Ming Huang[1,2], Yu-Hsiang Lee[1,3,]
[1]Department of Biomedical Sciences and Engineering, National Central University, Taiwan
[2]Department of Dermatology, University of California, San Diego, CA, USA
[3]Department of Chemical and Materials Engineering, National Central University, Taiwan

M3.2.5 Continuous Polymerase Chain Reaction Microfluidics Integrating with Gold-capped Nanoslit Sensing Chip for Epstein-Barr Virus Detection, Han-Yun Hsieh, Institute of Applied Mechanics, Department of Engineering, National Taiwan University, Taiwan

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Engineering Microfluidic Platforms for Bio/Chemical Applications

IS M4.2: 11:40-13:10
Monday, November 15, 2021
Location: RM 004

Session Chair: **Sammer UL Hassan**
The University of Hong Kong, Hong Kong SAR

Description

Microfluidics, especially droplet-based microfluidics, has become an enabling technology to perform bio/chemical assays in microsystems. This session aims to present leading scientists working in the fields of microfluidics and droplet-based microfluidics from multidisciplinary backgrounds. The invited speakers will share the cutting-edge technologies and discuss their latest and novel applications. We hope to promote these exciting developments and encourage discoveries across the disciplines to enhance and strengthen the potential of technologies in revolutionizing the fields of point-of-care diagnostics, precision medicine, and biomedical device development.

M4.2.1 Picoinjection Aided Digital Reaction Unlocking Assay for Nucleic Acid Quantification, Shuhuai Yao, Department of Mechanical and Aerospace Engineering, The Hong Kong University of Science and Technology, Hong Kong SAR

M4.2.2 Novel Microfluidic Technologies for Antimicrobial Susceptibility Testing, Kangning Ren, Han Sun, Zhengzhi Liu, Chiu-Wing Chan, Yisu Wang, Associate Professor, Department of Chemistry, Hong Kong Baptist University, Hong Kong SAR

M4.2.3 Silicon-based Micro/nanofluidic Devices for Cell and Biomolecular Separation and Detection, Levent YOBAS, Department of Electronic and Computer Engineering, Department of Chemical and Biological Engineering, Hong Kong University of Science & Technology, Hong Kong SAR

M4.2.4 Mechanical Properties of Eutopic Endometrial Cells as a Biomarker for Endometriosis, Mohamed Abdelgawad, Mechanical Engineering Department/College of Engineering, American University of Sharjah, UAE

M4.2.5 Pump-free Production of Nanoscale Liposomes using a 3D Printed Reactor-In-A-Centrifuge (RIAC), Dario Carugo[1], Yongqing He[1], Domenico Andrea Cristaldi[2], Gareth LuTheryn[1,2]

[1]Department of Pharmaceutics, UCL School of Pharmacy, University College London, UK
[2]Department of Mechanical Engineering, University of Southampton, UK

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Advanced Manufacturing Solutions in Material/Device Design

IS T1.1 10:00 -11:30
Tuesday, November 16, 2021
Location: RM 001

Session Chair: **Hui Ying Yang**
Singapore University of Technology and Design, Singapore

Description

Advanced manufacturing solutions bring both challenges and opportunities to the new industrial era. There are the demands in establishing the new technology and process in the development of new generation of materials/devices. Materials science is inherently a very exciting research field and often provide supports to the functional devices. In addition materials-related R&D research are also highly influenced by the application demands and needs from other technologies. This invited session aims to bring together advanced manufacturing solutions in material/device design and provide insights on advanced synthesis, applications and modeling fields.

T1.1.1 High-precision Acoustic Cell Sorting for Biomedical Applications, Ye Ai, Singapore University of Technology and Design, Singapore

T1.1.2 Rare Earth Doped Nanoparticles as Dual Modal Imaging Probes, Mei Chee Tan, Singapore University of Technology and Design, Singapore

T1.1.3 Physics and Modelling of Charge Injection in 2D Material Contact Heterostructures, Yee Sin Ang, Singapore University of Technology and Design, Singapore

T1.1.4 Towards an Inhuman Approach to Disease Modeling: Tumor-on-a-chip Platforms for Machine Intelligence, Javier G. Fernandez, Singapore University of Technology and Design, Singapore

T1.1.5 Direct Fabrication and Tailoring of Soft Robot Bodies, Pablo Valdivia y Alvarado, Singapore University of Technology and Design, Singapore

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New Generation of Wearable / Implanted Devices - Leveraging Self-power Technology

IS T2.1: 10:00 -11:30
Tuesday, November 16, 2021
Location: RM 002

Session Chair: **Vincent Lee**
National University of Singapore, Singapore

Description

In this invited technical session, 5 invited speakers will report recent advances in the implanted devices for applications ranging from retina implants, pacemakers, and peripheral nerves modulations. With the aid of energy harvesting technology and self-powered sensors, various wearable devices and implanted devices are realized in the fashion of self-sustained systems. Moving into the 5G/IoT era, AI-enabled wearable technology will fundamentally change the technology in the healthcare and smart homes.

T2.1.1 Optoelectronic Biointerface Devices for Measuring and Controlling Biological Function, Jun Ohta, Nara Institute of Science and Technology, Japan

T2.1.2 Peripheral Neuromodulation using Triboelectric Nanogenerator, Sanghoon Lee, DGIST, Korea

T2.1.3 Self-powered Pacemaker Supplied by Piezoelectric Energy Harvester, Bin Yang, Shanghai Jiaotong University, Shanghai, China

T2.1.4 Bipolar-charged Rotary Electret Energy Harvester, Kai Tao, Department of Microsystem Engineering, Northwestern Polytechnical University, Xi'an, Shaanxi, China

T2.1.5 Progress in the Wearable Sensors and Bioelectronic Medicine, Chengkuo Lee, Center for Intelligent Sensors and MEMS, National University of Singapore, Singapore

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Nanomaterials and Nanodevices for Healthcare Applications

IS T3.1: 10:00 -11:30
Tuesday, November 16, 2021
Location: RM 003

Session Chair: **Zong-Hong Lin**
Institute of Biomedical Engineering, Department of Power Mechanical Engineering, and Frontier Research Center on Fundamental and Applied Sciences of Matters, National Tsing Hua University, Taiwan

Description

Nanomaterials and nanodevices with various advantages in comparison to conventional ones have triggered increasing research efforts from both industry and academia. Many intelligent or medical nanomaterials and nanodevices have shown their capabilities to continually analyze different activities and help to predict diseases before serious conditions happen. For examples, active/self-powered sensors with no external input power, are mini-sized and lightweight. The development of these smart nanomaterials and nanodevices have pushed their feasible applications in a wide range of fields. This session will attempt to cover the recent achievements of nanomaterials and nanodevices for healthcare applications, which include nanoisozymes, physical/chemical sensors, biosensors, microfluidics for medical & biological applications, and self-powered sensors/systems.

T3.1.1 Versatile and Advantageous Use of Spontaneously Generated Triboelectric Signals, Dongwhi Choi, Department of Mechanical Engineering, Kyung Hee University, Korea

T3.1.2 Human Body-Based Self-Powered Wearable Electronics for Promoting Wound Healing Driven by Biomechanical Motions, Hulin Zhang, College of Information and Computer, Taiyuan University of Technology, China

T3.1.3 Flexible Self-powered Motion/pressure Sensors and Their Wearable Applications, Fang Yi, School of Materials Science and Engineering, Sun Yat-sen University, China

T3.1.4 Design of Wearable Triboelectric Nanogenerator for Self-Powered Healthcare and Biomedical Sensing, Yannan Xie, Institute of Advanced Materials, Nanjing University of Posts and Telecommunications, China

T3.1.5 Towards Continuous Health Monitoring Platforms by Noninvasive enzyme-free biosensors and Triboelectric Nanogenerator based Self-powered systems, Min-Hsin Yeh, Department of Chemical Engineering, National Taiwan University of Science and Technology, Taiwan

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Micro/Nano Technology for Biosensing

IS T1.2: 11:40 -13:10
Tuesday, November 16, 2021
Location: RM 001

Session Chair: **Megan Ho**
Department of Biomedical Engineering
The Chinese University of Hong Kong,
Hong Kong SAR

Description

The COVID-19 pandemic has raised remarkable social awareness on the importance of effective and timely diagnosis to help minimize the risk of contracting and spreading disease-causing pathogens. The advancement of biosensing platforms, built on a concerted effort of micro- and nano-technology, has enabled reliable diagnostics to remedy global health burden. This session is aimed to showcase the recent advances on biosensing ranging from fundamental studies, platform development to translational research.

T1.2.1 Intelligent Digital Microfluidics, Ya Tang Yang, Department of Electrical Engineering, National Tsing-Hua University, Taiwan

T1.2.2 Automatic Mitochondria Detection in Label-Free Live Cell Images Using Deep Learning, Chan-Min Hsu; An-Chi Wei, Department of Electrical Engineering, National Taiwan University, Taiwan

T1.2.3 Modulation of Membrane Deformation by Shear through Microfluidics for Biomedical Applications, Megan Yi-Ping Ho, Department of Biomedical Engineering, The Chinese University of Hong Kong, Hong Kong SAR

T1.2.4 Targeted Sub-Attomole Cancer Biomarker Detection based on Phase Singularity 2D Nanomaterial-Enhanced Plasmonic Biosensor, Shuwen Zeng, French National Centre for Scientific Research (CNRS), France

T1.2.5 Novel DNA Biosensor System for Measuring Disease Relevant Enzyme Activities and Drug Screening, Cinzia Teasauro, VPCIR Biosciences, Denmark; Birgitta R. Knudsen, Department of Molecular Biology, Aarhus University, Denmark

Novel Materials for Bio and Robotic Applications

IS T2.2: 11:40 -13:10
Tuesday, November 16, 2021
Location: RM 002

Session Chair: **King Lai**
Centre for Robotics and Automation,
Department of Biomedical Engineering,
City University of Hong Kong,
Hong Kong SAR

Description

Novel materials have been widely studied and leaded to next-generation micro and nanoscale devices and systems. In this session, we will discuss the stat-of-the-art system with various applications of colloidal quantum dots, graphene, aptamer in biosensing, cellular, photonic and robotic area. To further realize the practical use of these smart and novel materials as functional devices, various way to study and characterize different types of these system has to be developed.

T2.2.1 Rapid Detection Using Aptameric Graphene Field-Effect Transistor Biosensors, Guangfu Wu, Department of Biomedical Engineering and Institute of Materials Science, University of Connecticut, USA

T2.2.2 Macrophage Modulates the Functions of MSCs in the Presence of Polyethylene Particles, Qi Gao, Department of Orthopedic Surgery, Stanford University, USA

T2.2.3 Mechanical Modeling of Cell Adhesion, Yuqiang Fang, School of Mechanical and Aerospace Engineering, Jilin University, China

T2.2.4 3D-printed Light-driven Micro Robots, Runhuai Yang, School of Biomedical Engineering, Anhui Medical University, China

T2.2.5 Multi-band Infrared Focal Plane Arrays with Colloidal Quantum Dots, Xin Tang, School of Optics and Photonics, Beijing Institute of Technology, Beijing, China

T2.2.6 Polyurethane Yarn-based Sensor for Human Motion Monitoring, Xiaoting Li; King Wai Chiu Lai, Centre for Robotics and Automation, Department of Biomedical Engineering, City University of Hong Kong, Hong Kong SAR

Nanomedicine in Ophthalmology

IS T3.2: 11:40 -13:10
Tuesday, November 16, 2021
Location: RM 003

Session Chair: **Joseph Y. K. Chan**
Department of Ophthalmology,
The University of Hong Kong,
Hong Kong SAR

Description

Brief session synopsis: The advance in both diagnosis and treatment on eye diseases require the significant input from nanobiomedicine research. In this session, the speakers will share their latest innovations on the novel design of nano-drug delivery systems for improving the current treatment strategies of various retinal diseases, as well as the exploration of the use of microRNA as a therapeutic option to treat glaucoma, the leading cause of irreversible blindness. In addition, the latest biomedical MRI imaging technique will be introduced to better understand the waste clearance mechanisms of the visual system in health and disease in vivo.

T3.2.1 Light-triggered Drug Release for the Treatment of Retinoblastoma, Weiping Wang, Department of Pharmacology and Pharmacy, The University of Hong Kong, Hong Kong SAR

T3.2.2 Development of Injectable Nanocomposites for Intravitreal Drug Delivery, Victoria R Kearns, Department of Eye and Vision Science, Institute of Life Course and Medical Sciences, University of Liverpool, UK

T3.2.3 Biomaterial Engineering for Controlled Release and Targeted Delivery in the Eye, Laurence Lau, Department of Chemical and Biological Engineering, The Hong Kong University of Science and Technology, Hong Kong SAR

T3.2.4 Dynamic Contrast-enhanced Imaging of Cerebrospinal Fluid in the Optic Nerve, Kevin C. Chan, Departments of Ophthalmology and Radiology, New York University Grossman School of Medicine; Department of Biomedical Engineering, New York University Tandon School of Engineering, New York, New York, USA

T3.2.5 Adeno-associated Virus-mediated Delivery of MicroRNA-19a Enhances Axon Regeneration and Survival in Retinal Ganglion Cells, Heather Mak, Department of Ophthalmology, The University of Hong Kong, Hong Kong SAR

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Microfluidics, Analytical Chemistry, and Biosensing

IS T4.2: 11:40 -13:10
Tuesday, November 16, 2021
Location: RM 004

Session Chair: **Pin-Chuan Chen**
National Taiwan University of Science and Technology,
Taiwan

Description

This session is a multidisciplinary and applications-oriented, which presents the results of original research or development across all of microfluidics fields of interest, particularly in the fields of analytical chemistry and biosensing.

T4.2.1 Rapidly and Simultaneously Quantifying Multiple Biomarkers of L-tyrosine Hydroxylase (TH) Deficiency by Using Paper Microfluidic Devices and Smartphone-Based Analysis System, Pin-Chuan Chen, National Taiwan University of Science and Technology, Taipei, Taiwan

T4.2.2 Low-Cost Biosensors Development for Medical Applications and Environmental Monitoring, Yi-Kuang Yen, Department of Mechanical Engineering, National Taipei University of Technology, Taipei, Taiwan

T4.2.3 A Self-Powered Glucose Biosensor Operated Underwater to Monitor Physiological Status of Free-Swimming Fish, Shih-hao Huang; Department of Mechanical and Mechatronic Engineering, National Taiwan Ocean University, Keelung, Taiwan

T4.2.4 Microfluidic Technology for Single-cell Manipulation and Culture, Chia-Hsien Hsu, Institute of Biomedical Engineering and Nanomedicine, National Health Research Institutes, Taiwan

T4.2.5 Modular Downstream Two Phase Processing Micro-Reactors, Ya-Yu Chiang, Department of Mechanical Engineering, National Chung Hsing University, Taichung, Taiwan

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Biomedical Applications for Fluidics, Hydrogels and Devices

IS T5.2: 11:40 -13:10
Tuesday, November 16, 2021
Location: RM 005

Session Chair: **Michinao Hashimoto**
Pillar of Engineering Product Development,
Singapore University of Technology and Design,
Singapore

Description

This session discusses recent progresses in fluidics, hydrogels and devices in biomedical applications. Relevant technologies in materials development, device fabrication and sample manipulations in micro-to-nano scales. Biomedical applications such as disease diagnostics, drug screening and development, controlled drug delivery and personalized medicine are highlighted.

T5.2.1 Intelligent Magnetic Digital Microfluidic System, Yi Zhang, School of Electronic Science and Engineering, University of Electronic Science and Technology of China, China

T5.2.2 Hydrogel Drop-Screen for High-Throughput Cell Functional Heterogeneity Analysis toward Precision Medicine, Chia-Hing Chen, Department of Biomedical Engineering, City University of Hong Kong, Hong Kong SAR

T5.2.3 Alginate Hydrogel Microparticles as Controlled Release Carrier of Adeno-associated Virus for Gene Therapy, Hiroaki Onoe, Department of Mechanical Engineering, Faculty of Science and Technology, Keio University, Japan

T5.2.4 Protease-responsive Delivery of an Anti-inflammatory Drug in a Chemically-induced Mouse Model of Subcutaneous Inflammation, Tram T. Dang et al., School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore 637459, Singapore

T5.2.5 IceMicroneedles for Intradermal Delivery of Vaccines, Chenjie Xu, Department of Biomedical Engineering, City University of Hong Kong, Hong Kong SAR

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Microfluidics for Diagnostics

IS W1.1: 10:00 -11:30
Wednesday, November 17, 2021
Location: RM 001

Session Chair: **Cecil Chen**
Department of Biomedical Engineering,
City University of Hong Kong,
Hong Kong SAR

Description

Microfluidics has been an enabling technology that miniaturizes and automates the diagnostics and therapeutics on a miniaturized platform. Recent success of microfluidics for theranostics has allowed increased sensitivity while maintaining suitability for point-of-care testing for conducting large-scale surveying without increasing medical burden. In this invited session, we provide a venue for discussing an array of microfluidic devices ranging from fluidics, optic, and nanomaterials for investigation of biomedical applications, such as detection of biomarkers and monitoring of treatment efficacy. It is anticipated to bring inspiration propelling researches with new perspectives in this field.

W1.1.1 Label-free Biosensor of Phagocytosis for Diagnosing Bacterial Infections, Bee Luan Khoo, Department of Biomedical Engineering, City University of Hong Kong, Hong Kong SAR

W1.1.2 Microengineering Paper's Wicking Properties for Rapid Flow and Automation in Microfluidic Paper-Based Microfluidic Devices, Hideaki Tsutsui, Departments of Mechanical Engineering and Bioengineering, Stem Cell Center, University of California Riverside, USA

W1.1.3 Leukemia-on-a-Chip: Dissecting the Leukemia Niche-associated Mechanisms of Chemotherapy Resistance, Weiqiang Chen, Departments of Biomedical Engineering, Mechanical and Aerospace Engineering, New York University, New York, NY, USA

W1.1.4 Microfluidic Magneto-Immunoassay for Rapid, High Sensitivity Protein Quantification, Peter B. Lillehoj, Departments of Mechanical Engineering and Bioengineering, Rice University, USA

W1.1.5 Microfluidic Particle Dam for Quantification of Soluble Analytes via Visual Inspection, Ting-Hsuan Chen, Department of Biomedical Engineering, City University of Hong Kong, Hong Kong SAR

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Nano/Molecular Medicine & Engineering

IS W2.1: 10:00 -11:30
Wednesday, November 17, 2021
Location: RM 002

Session Chair: **Tzu-En Lin**
National Yang Ming Chiao Tung University, Taiwan

Description

The session is dedicated to providing a forum to discuss the latest developments in all areas of Nano/Molecular Medicine & Engineering.

W2.1.1 Marginative Delivery-Mediated Extracellular Leakiness by Biomimetic Nanomedicine, Shang-Hsiu Hu, National Tsing Hua University, Taiwan

W2.1.2 Au-doped Cu/Fe@polymer Nanoreactor with Fenton Reaction/Photodynamic Effects for Synergetic Cancer Therapy, Jiashing Yu, National Taiwan University, Taiwan

W2.1.3 Comprehensive Study of Ion Concentration Polarization in Microfluidics and its Application, Yu-Jui Fan, Taipei Medical University, Taiwan

W2.1.4 Extrusion 3D Printing a Cell-culture Chip for Drug Screening, Yi-Chen Ethan Li, Feng Chia University, Taiwan

W2.1.5 Electrochemical Detection and Cleaning of the Contaminated Contact Lens by using Scanning Electrochemical Microscopy with Soft Microelectrode, Tzu-En (Linna) Lin, National Yang Ming Chiao Tung University, Taiwan

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Advanced Plasmonic Platform for Biosensors

IS W1.2: 11:40 -13:10
Wednesday, November 17, 2021
Location: RM 001

Session Chair: **Yu-Jui (Ray) Fan**
Taipei Medical University, Taiwan

Description

The strong enhancement and localization of electromagnetic field in plasmonic systems have found applications in many areas especially in bio-applications. in this session, we focus on the use of plasmonic phenomena in biosensors. With such recent developments, there is the prospect of improving sensitivity and lowering the limit of detection in order to overcome the limitations inherent in ultrasensitive detection of chemical and biological analytes, especially at single molecule levels.

W1.2.1 Plasmonic Gold Nanoisland Film as a Substrate for Bacterial Theranostics, Tsung-Rong Kuo, Taipei Medical University, Taiwan

W1.2.2 Optimized Performances of the NanoBioAnalytical Platform for Extracellular Vesicles Detection, Wilfrid Boireau, University of Burgundy - Franche-Comté, France

W1.2.3 In situ Au-glycopolymer Nanohybridization for SERS-based Biosensing and Single-cell Immunity, Chih-Chia Huang, National Cheng Kung University, Taiwan

W1.2.4 Time-Lapse LSPR Detection of Hydrogen Peroxide Secreted from Living Cells Using Plasmonic Gel Films, Yih-Fan Chen, National Yang Ming Chiao Tung University, Taiwan

W1.2.5 Continuous Polymerase Chain Reaction Microfluidics Integrated with a Gold-capped Nanoslit Sensing Chip for Epstein-Barr Virus Detection, Yu-Jui (Ray) Fan, Taipei Medical University, Taiwan

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Advances in Microswimmers for Biomedical Applications

IS W2.2: 11:40 -13:10
Wednesday, November 17, 2021
Location: RM 002

Session Chair: **Alan Cheng Hou Tsang**
The University of Hong Kong, Hong Kong SAR

Description

This invited session covers the recent progress in the development of microswimmers for biomedical applications, such as targeted navigation and targeted drug delivery. The session includes invited talks covering both theoretical and experimental aspects of microswimmers, from biological microswimmers to artificial microswimmers and from individual motion to swarm dynamics.

W2.2.1 Collective Cargo Transport by Schooling Micro-swimmers, Arnold Mathijssen, University of Pennsylvania, USA

W2.2.2 Macrotransport Theory for Chemotactic Microorganisms and Diffusiophoretic Colloids in Hydrodynamic Flows, Henry C. W. Chu, University of Florida, USA

W2.2.3 Magnetic Microswarm: Design, Targeted Delivery and in vivo Applications, Li Zhang, The Chinese University of Hong Kong, Hong Kong SAR

W2.2.4 Nanoswarm from Exchange Interaction for Antimicrobial Application, Jinyao Tang, The University of Hong Kong, Hong Kong SAR

W2.2.5 Smart Artificial Microswimmers via Reinforcement Learning, Alan Cheng Hou Tsang, The University of Hong Kong, Hong Kong SAR

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Sensing Single Cell Properties in Microfluidics

IS W3.2: 11:40 -13:10
Wednesday, November 17, 2021
Location: RM 003

Session Chair: **Raymond H. W. Lam**
Department of Biomedical Engineering,
City University of Hong Kong,
Hong Kong SAR

Description

This session concludes some recently developed microfluidic strategies for characterizing single-cell properties in different aspects, e.g. drug uptake/resistance, elasticity, zeta potential, cell adhesion strength. Some of these works can offer high-throughput sensing.

W3.2.1 High Throughput, Multiplex Single-cell Chemical Transcriptome Profiling for Drug Deep Screening based on Drug Oligonucleotide-hashing and Droplet Pairing, Zida Li, Department of Biomedical Engineering, School of Medicine, Shenzhen University, China

W3.2.2 Formation of Bacteria and Cancer Cell Pearl Chain under Dielectrophoresis, Marcos, School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore

W3.2.3 How Rigid is the Flagellar Filament of the Bacterium Bacillus Subtilis? Xinhui Shen, School of Mechanical and Aerospace Engineering, Nanyang Technological University, Singapore

W3.2.4 Revealing Cell Elasticity Clues using a Microfluidic Cytometer in Two-cell Entosis, Jifeng Ren, School of Biomedical Engineering, Capital Medical University, Beijing, China

W3.2.5 High-throughput Electrokinetic Sensing for Biophysical Properties of Floating Single Cells, Raymond H. W. Lam, Department of Biomedical Engineering, City University of Hong Kong, Hong Kong SAR

Nano and Molecular Technologies in Medical Theranostics

RS M5.1: 10:00-11:30
Monday, November 15, 2021
Location: RM 005

Session Chair: **Pin-Chuan Chen**
National Taiwan University of Science and Technology, Taiwan

M5.1.1 Droplet-based Single-virus Analysis to Probe the Genetic Diversity at Whole-genome Level, Lang Nan and Ho Cheung Shum, The University of Hong Kong

M5.1.2 Terbium-doped Mesoporous Silica Nanoparticles for Bioimaging Purposes, Nurgul Daniyeva, Kamila Zhumanova, Moon Sung Kang, Anara Molkenova, Ki Su Kim, Dong-Wook Han and Timur Atabaev, Nazarbayev University; Nazarbayev University; Pusan National University.

M5.1.3 Automated Circulating Cell-free DNA Isolation Using a Movable-layer System with Dextran-enhanced Sedimentation, Hung Phi Hoang, Islam Seder, Ana Isabel Ferrer Ramírez and Sung-Jin Kim, Konkuk University

M5.1.4 Magnetic Nanoparticles-Incorporated Temperature Responsive Hydrogel for Externally Controlled Implantable Drug Delivery Devices, Mohammad Mohtasim Hamid Pial, Asahi Tomitaka and Nezih Pala, Florida International University

M5.1.5 Search Space Analysis for In Vivo Computation for Smart Tumor Targeting, Lisa Zhang, Khulood Al Balushi, Zheng Gong, Shaolong Shi, Zimei Wu and Yifan Chen, University of Waikato; University of Electronic Science and Technology of China; University of Auckland

M5.1.6 High Throughput Screening of Fluorogenic RNA Aptamers Using Droplet-based Microfluidics for Live Cellular RNA Imaging, Aditi Dey Poonam, Andrew Brian Kinghorn, Wei Guo, Julian Alexander Tanner and Ho Cheung Shum, The University of Hong Kong

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Bio/Nano Sensing

RS M5.2: 11:40-13:10
Monday, November 15, 2021
Location: RM 005

Session Chair: **Pin-Chuan Chen**
National Taiwan University of Science and Technology, Taiwan

M5.2.1 Multi-parameter based Characterization of Biosamples using a Broadband Microstrip Patch based RF Sensor, Annesha Mazumder, Azeemuddin Syed, Prabhakar Bhimalapuram and Tapan Kumar Sau, International Institute of Information Technology Hyderabad

M5.2.2 Self-powered Triboelectric Sensor Based on Molecularly Imprinted Polymers for Noninvasive Lactate Monitoring in Human Sweat, Pawisa Kanokpaka, Bung-Chen Wang, Wei-Song Hung and Min-Hsin Yeh, National Taiwan University of Science and Technology

M5.2.3 The Development of Point-of-Care Plasmonic-based Biosensor for Early Detection of COVID-19 Virus, Rabail Sidhu, Mansoor Ali Khan and Rongkun Zheng, National University of Sciences and Technology (NUST); The University of Sydney

M5.2.4 Fuzzy-Inspired Biosensing Strategy for Double-Feature Tumor Classification, Zheng Gong, Honorine Niyigena Ingabire, Chenghui Liu, Michael J. Cree and Yifan Chen, The University of Waikato; University of Electronic Science and Technology of China

M5.2.5 An Electrodeposited Copper(Ⅱ) Oxide Nanostructured Electrode for Photoelectrochemical Sensor, Hui-Ling Liu, Leung-Sze Tsui, Yan-Qi Liang and Chia-Ming Yang, Chang Gung University

M5.2.6 Wearable Piezoelectric BioMEMS-based Sensor for SAR-COV-2 (COVID-19) Virus Droplets Detection, Abdullah Mansoor Ali Khan and Ahmed Rasheed, National University of Sciences and Technology

M5.2.7 Gold Nanoparticles Assisted Single Step Sensing of Cobalt with MWCNT Coated Flexible Carbon Cloth, Abhishesh Pal, Satish Kumar Dubey and Sanket Goel, BITS Pilani Hyderabad Campus

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Biochip and Bio-MEMS

RS T4.1 10:00 -11:30
Tuesday, November 16, 2021
Location: RM 004

Session Chair: **Kin Fong Lei**
Chang Gung University, Taiwan

T4.1.1 Effect of Low Conductivity Background Solution on Long-term Optically Induced Dielectrophoresis (ODEP)-based Cell Manipulation in a Microfluidic System, Po-Yu Chu and Min-Hsien Wu, Chang Gung University

T4.1.2 Periodic Decrease Stepwise Waveform Generator, Md Ahasan Ahamed and Sung-Jin Kim, Konkuk University

T4.1.3 A Programmable Microfluidic Droplet Platform for Nucleic Acid Amplification and Detection, Jingxuan Tian, Aditi Dey Poonam and Ho Cheung Shum, Advanced Biomedical Instrumentation Centre; The University of Hong Kong

T4.1.4 Dual Applications of Integrated ITO Electrodes in Barrier on a Chip Platform, Sihan Liu, Sammer Ul Hassan, Jaewon Park and Ho Cheung Shum, the University of Hong Kong; Southern University of Science and Technology

T4.1.5 Using Microfluidic-based Pancreatic Spheroid to Evaluate the Efficacy of Biological Effectiveness of Boron Neutron Capture Therapy, Lin-Yen Yu, Megha Jhunjhunwala and Chi-Shuo Chen, National Tsing Hua University

T4.1.6 The Effect of Conjugating Estrone, the Concentration of PEG, and Flowrate Ratio on the Size of Liposomes Prepared in a Herringbone Micromixer, Mohamed Agam, Vinod Paul, Mohamed Abdelgawad and Ghaleb Husseini, American University of Sharjah

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Best Paper Competition

RS T5.1: 10:00 -11:30
Tuesday, November 16, 2021
Location: RM 005

Session Chairs: **Nalinikanth Kotagiri,**
University of Cincinnati, USA;
Jangho Kim,
Chonnam National University, Korea

T5.1.1 Tracking of Magnetic Micromotors in Confined Channels Through Scattering Tissue, Azaam Aziz, Dmitriy Karnaushenko, Nektarios Koukourakis, Jürgen W. Czarske, Oliver G. Schmidt and Mariana Medina-Sánchez, Leibniz-Institut für Festkörper- und Werkstoffforschung (IFW) Dresden; Chair of Measurement and Sensor System Technique, School of Engineering, TU Dresden

T5.1.2 A Molecular Biosensor for Probing Long Noncoding RNA Dynamics During Collective Cancer Invasion, Ninghao Zhu and Pak Kin Wong, The Pennsylvania State University

T5.1.3 Immune Tug of War: A Microfluidic Transwell Device for Probing Heterogeneity in Immune-Tumor Interactions, Yue Yan, David J. DeGraff and Pak Kin Wong, The Pennsylvania State University

T5.1.4 A Reconfigurable Microfluidic Building Block Platform for High-Throughput Nonhormonal Contraceptive Screening, Jyong-Huei Lee, Carl van der Linden, Francisco J. Diaz and Pak Kin Wong, The Pennsylvania State University

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Biological Interface Cells at the Nanoscale I

RS W3.1: 10:00 -11:30
Wednesday, November 17, 2021
Location: RM 003

Session Chair: **Raymond Lam**
City University of Hong Kong,
Hong Kong SAR

W3.1.1 Cell Tracking in Crowded Environment using Semantic Segmentation with U-Net, Chinmay Burgul and sambeeta Das, University of Delaware

W3.1.2 Assimilation of Polarization Drives Collective Cell Migration Asymmetrically, Megha Jhunjhunwala, Rong-Shing Chang and Chi-Shuo Chen, National Tsing Hua University

W3.1.3 Smart Tumour Targeting by Reinforcement Learning, Lei Liu, Yue Sun, Shaolong Shi and Yifan Chen, University of Electronic Science and Technology of China

W3.1.4 The Broadcast of Cellular Mechano-signaling: Physical Contacts with Microglia Alter the Rheological Properties of Glioma Spheroid, Ping-Chen Kuo, Chih-Tung Liu, Megha Jhunjhunwala, Rong-Shing Chang and Chi-Shuo Chen, National Tsing Hua

University

W3.1.5 Heat and Pressure-Assisted Multiscale Nanotopographic Patches for Soft and Hard Tissue Regeneration, Woochan Kim, Yonghyun Gwon, Sunho Park and Jangho Kim, Chonnam National University

W3.1.6 Eggshell Membrane-incorporated Bioactive Nanotopographical Scaffolds for Enhanced Bone Regeneration, Yonghyun Gwon, Woochan Kim, Sunho Park and Jangho Kim, Chonnam National University

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Biological Interface Cells at the Nanoscale II

RS W4.1: 10:00 -11:30
Wednesday, November 17, 2021
Location: RM 004

Session Chair: **Chi-Shuo Chen**
National Tsing Hua University, Taiwan

W4.1.1 Confinement-Dependent Diffusiophoretic Transport of Nanoparticles in Collagen Hydrogels, Viet Sang Doan, SungGyu Chun, Jie Feng and Sangwoo Shin, University at Buffalo, The State University of New York; University at Buffalo

W4.1.2 Flexible Anti-Pathogenic Patch Covered in Vertically Aligned Nanospike Arrays for Controlling Stem Cells Behaviors, Sunho Park, Woochan Kim, Yonghyun Gwon and Jangho Kim, Chonnam National University

W4.1.3 Low Fluid Shear Stress Regulates Osteogenic Differentiation of Human Mesenchymal Stem Cells through Notch1-Dll4 Signaling, Yuwen Zhao, Kagya Amoako and Shue Wang, University of New Haven

W4.1.4 Preparation and Characterization of Nanopatterned Polycaprolactone/Cellulose Nanocrystal Composite Membranes for Cardiovascular Tissue Engineering, Joseph Batta-Mpouma, Gurshagan Kandhola, Patrick Kuczwara, Woochan Kim, Hanna K. Jensen, Jangho Kim, Morten O. Jensen and Jin-Woo Kim, University of Arkansas; Chonnam National University; University of Arkansas for Medical Sciences

W4.1.5 Enhanced Localized Surface Plasmon Resonance of Gold Nanoparticles on Cellulose Nanocrystals, Jaspreet Kaur, Gurshagan Kandhola, Joseph Batta-Mpouma, Jingyi Chen, Joshua Sakon and Jin-Woo Kim, University of Arkansas