The 17th IEEE International Conference on Nano/Micro Engineered & Molecular Systems

VIRTUAL IEEE-NEMS

2022 TECHNICAL PROGRAM

https://ieee-nems.org/2022/

April 14-17, 2022

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VIRTUAL IEEE-NEMS 2022

The 17th IEEE International Conference on Nano/Micro Engineered & Molecular Systems

April 14-17, 2022

On behalf of

the IEEE Nanotechnology Council

& the conference organizing committee

WELCOME

Welcome all of you to the 17th IEEE International Conference on Nano/Micro Engineered & Molecular Systems (IEEE-NEMS 2022) as held on-line from April 14-17, 2022. The IEEE-NEMS is a premier conference series sponsored by the IEEE Nanotechnology Council focusing on the promotion of advanced research areas related to MEMS, nanotechnology, and molecular technology. Prior conferences were held in Xiamen (China, 2021), San Diego (USA, 2020), Thailand (2019), Singapore (2018), Los Angeles (USA, 2017), Matsushima Bay and Sendai (Japan, 2016), Xi'an (China, 2015), Hawaii (USA, 2014), Suzhou (China, 2013), Kyoto (Japan, 2012), Kaohsiung (Taiwan, 2011), Xiamen (China, 2010), Shenzhen (China, 2009), Hainan Island (China, 2008), Bangkok (Thailand, 2007), and Zhuhai (China, 2006). The IEEE-NEMS Conference typically attracts over 600 attendees with participants from more than 20 countries and regions worldwide. Due to Covid-19 pandemic, the IEEE-NEMS conference operates virtually this year. The conference has managed to invite leading scientists to give 5 plenary talks, 9 keynote talks, 24 invited session presentations, and 12 regular session presentations covering topics from reviews to future perspectives of NEMS fundamentals and applications.

Before we kick-off IEEE-NEMS 2022, we want to express our appreciation to every attendee who contributes your works. Without your brilliant ideas and elegant works, the conference cannot be successful. We also want to thank our conference organizers, technical program committee members, our sponsors, and the great organization committee members. We hope all of you enjoy this virtual conference.

Welcome to IEEE-NEMS 2022!

Eric Pei-Yu Chiou, General Chair
University of California at Los Angeles

Thomas Kin Fong Lei, Program Chair
Chang Gung University

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PLENARY & KEYNOTE HIGHLIGHTS

Plenary Speakers

Akihiro Kusumi
Okinawa Institute of Science and Technology Graduate University

Burn J. Lin
National Tsing Hua University

Robert S. Langer
Massachusetts Institute of Technology

Yi Cui
Stanford University

Ming C. Wu
University of California, Berkeley

Keynote Speakers

Dino Di Carlo
University of California, Los Angeles

Hiroshi Toshiyoshi
The University of Tokyo

Katsuo Kurabayashi
University of Michigan, Ann Arbor

Jeff Wang
John Hopkins University

Michael Teitell
University of California, Los Angeles

Vincent C. Lee
National University of Singapore

Dean Ho
National University of Singapore

John X.J. Zhang
Dartmouth Engineering

Rahul Shendure
Carbon Built

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RM 001	RM 002	RM 003	RM 004	RM 005	RM 006	RM 007
https://reurl.cc/mGmYLM	https://reurl.cc/Kpa9Ag	https://reurl.cc/zMd5W6	https://reurl.cc/g0qYzX	https://reurl.cc/bkOmnM	https://reurl.cc/Np7xpp	https://reurl.cc/RjZkj9

April 14 [Thursday] (UTC+8)							
Time (UTC+8)	**RM 001**						
08:55-09:00	**Opening Ceremony**						
09:00-09:45	EDOM Plenary Lecture 1: **Akihiro Kusumi**, Okinawa Institute of Science and Technology Graduate University ***Metastable Nano-liquid Signaling Platforms on the Cell Membrane as Revealed by Single Molecular Imaging***					Chair: Tim Yeh	
09:45-10:30	EDOM Plenary Lecture 2: **Burn J. Lin,** National Tsing Hua University ***Lithography Advances to Shrink IC by a Million Times***					Chair: Thomas Lei	
10:30-10:40	***Break (10 min)***						
10:40-11:10	**RM 001**		**RM 002**		**RM 003**		
	Keynote Lecture 1 **Dino Di Carlo**, University of California, Los Angeles ***Lab on a Particle Technology to Scale Biological Research 1000-fold*** Chair: Eric Chiou		Keynote Lecture 2 **Hiroshi Toshiyoshi**, The University of Tokyo ***Silicon Oxide Electret as a Power Generation Material*** Chair: Wibool Piyawattanametha		Keynote Lecture 3 **Katsuo Kurabayashi**, University of Michigan, Ann Arbor ***Plasmo-Opto-Electro-Fluidic Biosensors for Critical Care Medicine*** Chair: Aaron Ohta		
11:10-12:40	**RM 001**	**RM 002**	**RM 003**	**RM 004**	**RM 005**	**RM 006**	**RM 007**
	Invited Session T1.1	Invited Session T1.2	Invited Session T1.3	Invited Session T1.4	Invited Session T1.5	Invited Session T1.6	Invited Session T1.7
	Novel Micro/Nano Systems for Bio and Energy Applications Chair: Sung-Yong Park	**Advanced Nanofluidic Systems for Single Molecule Detection** Chair: Wei-Lun Hsu	**Functional Materials and NEMS/MEMS** Chair: Akio Higo	**Advanced Fabrication Technologies for Nano/Micro Systems** Chair: Yoshikazu Hirai	**Emerging Micro- and Nano-scale Sensing and Manipulation Techniques** Chair: Tim Yeh	**MEMS/NEMS Based Microfluidic and Medical Devices** Chair: Sang-Seok Lee	**Wearable / Stretchable Sensors and Liquid-Metal Systems** Chair: Aaron Ohta
12:40-12:50	***Break (10 min)***						
12:50-14:20	Invited Session T2.1 **Smart Mechatronics for Energy Harvesting** Chair: Daisuke Yamane	Regular Session T2.2 **Micro/Nano Fluidics** **Paper ID: 103, 110, 118, 119, 133, 134** Chair: Yu-Jui (Ray) Fan	Regular Session T2.3 **Micro/Nano Electro-Mechanical Systems I** **Paper ID: 114, 127, 128, 130, 138, 145** Chair: Cheng-Hsin Chuang	Regular Session T2.4 **Molecular Sensors, Actuators, & Systems I** **Paper ID: 115, 120, 121, 122, 135, 136** Chair: Pin-Chuan Chen	Regular Session T2.5 **Nanobiology / Nanomedicine** **Paper ID: 107, 108, 165, 166, 171, 174** Chair: Chi-Shuo Chen	Regular Session T2.6 **Nanomaterial Based Devices and Systems I** **Paper ID: 109, 126, 131, 141** Chair: Hsieh-Fu Tsai	

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April 15 [Friday] (UTC+8)							
Time (UTC+8)	RM 001						
09:00-09:45	Hygeia Touch Plenary Lecture 3: **Robert S. Langer**, Massachusetts Institute of Technology ***Microtechnologies and Nanotechnologies in Drug Delivery*** Chair: Chao-Min Cheng						
09:45-10:30	EDOM Plenary Lecture 4: **Yi Cui**, Stanford University ***Reinventing Batteries through Nanoscience*** Chair: Keng-Hui Lin						
10:30-10:40	***Break (10 min)***						
10:40-11:10	**RM 001**		**RM 002**		**RM 003**		
	Keynote Lecture 4 **Jeff Wang**, John Hopkins University ***Droplet Microfluidics Enables Rapid Diagnostics and Antimicrobial Susceptibility Testing*** Chair: Cecil Chen		Keynote Lecture 5 **Michael Teitell**, University of California, Los Angeles ***Mitochondrial Transfer and Cell Fate Transitions*** Chair: Dean Ho		Keynote Lecture 6 **Chengkuo Lee**, National University of Singapore ***Artificial Intelligence Enabled Sensing Technologies and Applications in Metaverse*** Chair: Tak Sing Wong		
11:10-12:40	**RM 001**	**RM 002**	**RM 003**	**RM 004**	**RM 005**	**RM 006**	**RM 007**
	Regular Session F1.1 **CM Ho Best Paper Competition Paper ID: 124, 125, 158, 160** Chairs: Pak Kin Wong, Aaron Ohta	Invited Session F1.2 **Nano-constructs for Biosensing and Cellular Engineering** Chair: Aram Chung	Invited Session F1.3 **Microneedles** Chair: Zhihong Li	Invited Session F1.4 **The Impact of Inter-disciplinary Science** Chair: Tzu-En Lin	Invited Session F1.5 **Advanced Nanotool for NEMS** Chair: Koji Sugano	Invited Session F1.6 **Applications and Experimental Techniques for Economical Microfluidic Devices** Chair: Wei-Hsin Tien	Invited Session F1.7 **Advanced Bioelectronics and Biointerfaces** Chair: Huiliang Wang
12:40-12:50	***Break (10 min)***						
12:50-14:20	Regular Session F2.1 **Best Conference Paper Competition Paper ID: 104, 132, 139, 140** Chairs: Pak Kin Wong, Aaron Ohta	Invited Session F2.2 **Microfluidic Platforms for Cell Manipulation and Biomarker Detection** Chair: Ting-Hsuan Chen	Invited Session F2.3 **Wearable and Implantable NanoEnergy and NanoSystem (NENS)** Chair: Chengkuo Lee	Invited Session F2.4 **Translational Advances in Micro-, Nano- and Digital Medicine** Chair: Edward Kai-Hua Chow, Agata Blasiak	Regular Session F2.5 **Micro/Nano Electro-Mechanical Systems II Paper ID: 147, 149, 150, 151, 154, 159** Chair: Cheng-Hsin Chuang		

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April 16 [Saturday] (UTC+8)							
Time (UTC+8)	RM 001						
09:00-09:45	EDOM Plenary Lecture 5: **Ming C. Wu**, University of California, Berkeley ***Optoelectronic Tweezers – A New Optofluidic Platform for Single Cell Biology*** Chair: Eric Chiou						
09:45-10:15	**RM 001**		**RM 002**		**RM 003**		
	Keynote Lecture 7 **Dean Ho**, National University of Singapore ***Big Data versus Small Data: Optimizing N-of-1 Interventional Healthcare*** Chair: Edward Chow		Keynote Lecture 8 **John X.J. Zhang**, Dartmouth Engineering ***Nanotechnology in Bioenergy Harvesting and Sensing for Medical Implants*** Chair: Mark Cheng		Keynote Lecture 9 **Rahul Shendure**, Carbon Built ***CarbonBuilt – Taking Low Carbon Concrete from University Bench to Commercial Production*** Chair: Eric Chiou		
10:15-10:30	***Break (15 min)***						
10:30-12:00	**RM 001**	**RM 002**	**RM 003**	**RM 004**	**RM 005**	**RM 006**	**RM 007**
	Invited Session S1.1 **NEMS Emerging Applications** Chair: Mark Cheng	Invited Session S1.2 **Micro-/nano-Structure-Enabled Sensors** Chair: Faheng Zang	Invited Session S1.3 **Advanced Micro/Nano Photonics Technology** Chair: Guo-En Chang	Invited Session S1.4 **Biomaterials and Biosensors in Biomedical Application** Chair: Yu-Jui (Ray) Fan	Invited Session S1.5 **Micro/Nano Biosensing Technologies: From Diseases Diagnostics to Health Monitoring** Chair: Tak-Sing Wong	Invited Session S1.6 **NEMS for Human Sensing** Chair: Hiroyuki Kudo	Invited Session S1.7 **Engineering-Based Micro-physiological System (MPS): From Fundamentals to Commercial Applications** Chair: Ryuji Yokokawa
12:00-12:10	***Break (10 min)***						
12:10-13:40	Regular Session S2.1 **Best Student Paper Competition** **Paper ID: 113, 123, 137, 148, 173** Chairs: Pak Kin Wong, Aaron Ohta	Invited Session S2.2 **Microstructure Engineering and Applications** Chair: Chia-Wen Tsao	Regular Session S2.3 **Molecular Sensors, Actuators, & Systems II** **Paper ID: 143, 152, 156, 167, 170** Chair: Sanket Goel	Regular Session S2.4 **Micro/Nano Fluidics and Fabrication** **Paper ID: 142, 153, 169, 161, 162, 164** Chair: Yu-Jui (Ray) Fan	Regular Session S2.5 **Nanomaterial Based Devices and Systems II** **Paper ID: 146, 163, 168** Chair: Chi-Shuo Chen		

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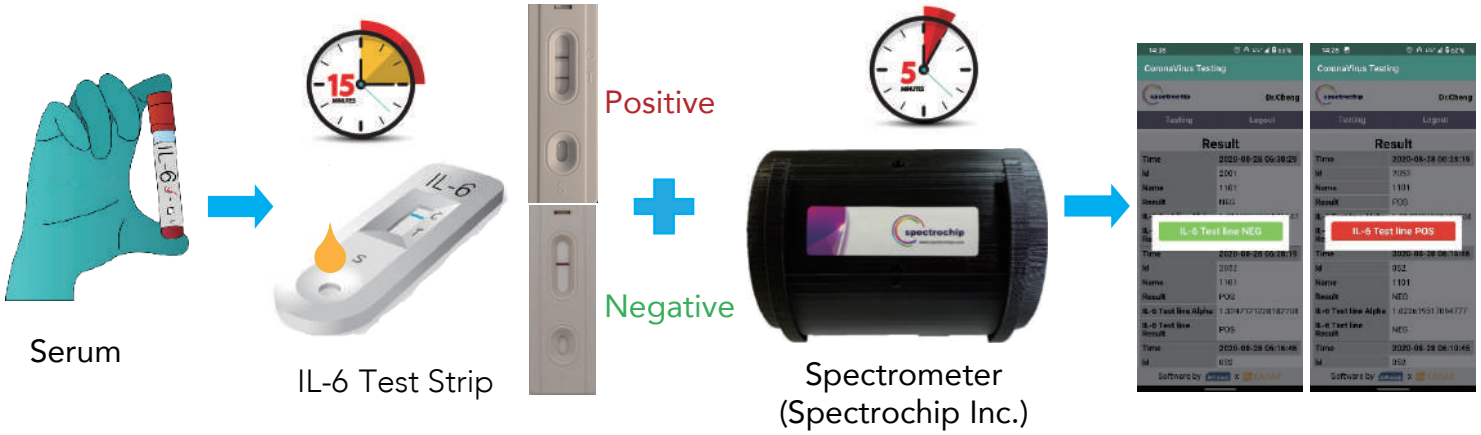
Interleukin 6 (IL-6) Rapid Test System (RUO)



Serum | IL-6 Test Strip | Spectrometer (Spectrochip Inc.)

The system consists of IL-6 test strip and a miniature spectrometer. The purpose is to assist clinicians to detect the IL-6 concentration in serum or plasma of patients with infectious symptoms, and to assist doctors to give patients the most appropriate care in a short period of time. This system can be used for qualitative evaluation with rapid test strip or quantitative evaluation with spectrometer. Currently, it is only for laboratory/research use. The system has also been tested for serum IL-6 analysis of patients with confirmed COVID-19.

Sperm Motility Rapid Test System (RUO)

Sperm | Motility Test Paper | Spectrometer (Spectrochip Inc.) | Quantitative Concentration

The system consists of motility test paper and a miniature spectrometer. The purpose is to provide users to monitoring the semen quality (i.e., for follow-up treatment, ligation, pregnancy) through measuring the number of swimming (motile) sperm cells per ml in the semen sample (human/animal). The system can be used for qualitative evaluation with test paper or quantitative evaluation with spectrometer.

HygeiaTouch Self Sampling Kit for Women

HygeiaTouch Self Sampling Kit for Women is clinical verified (self collected vs physician collected) for the sampling of vaginal cell material without the aid of a vaginal speculum. The collected specimen is suitable for microbial studies, including human papillomavirus (HPV) testing, and other genomic studies such as common vaginal pathogens through polymerase chain reaction (PCR) in a professional laboratory.

HygeiaTouch®
健康新體驗

Hygeia Touch Inc.
www.hygeiatouch.com
Email: elainelien@hygeiatouch.com

TECHNICAL PROGRAM INDEX

Plenary Sessions

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PL2	Lithography Advances to Shrink IC by a Million Times PL Speaker: Burn J. Lin, National Tsing Hua University Chair: Thomas Lei | Time: 09:45-10:30 (TWN), April 14, 2022 (RM 001)
PL3	Microtechnologies and Nanotechnologies in Drug Delivery PL Speaker: Robert S. Langer, Massachusetts Institute of Technology Chair: Chao-Min Cheng | Time: 09:00-09:45 (TWN), April 15, 2022 (RM 001)
PL4	Reinventing Batteries through Nanoscience PL Speaker: Yi Cui, Stanford University Chair: Keng-Hui Lin | Time: 09:45-10:30 (TWN), April 15, 2022 (RM 001)
PL5	Optoelectronic Tweezers – A New Optofluidic Platform for Single Cell Biology PL Speaker: Ming C. Wu, University of California, Berkeley Chair: Eric Chiou | Time: 09:00-09:45 (TWN), April 16, 2022 (RM 001)

Keynote Sessions

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KN4	Droplet Microfluidics Enables Rapid Diagnostics and Antimicrobial Susceptibility Testing KN Speaker: Jeff Wang, John Hopkins University Chair: Cecil Chen | Time: 10:40-11:10 (TWN), April 15, 2022 (RM 001)
KN5	Mitochondrial Transfer and Cell Fate Transitions KN Speaker: Michael Teitell, University of California, Los Angeles Chair: Dean Ho | Time: 10:40-11:10 (TWN), April 15, 2022 (RM 002)
KN6	Artificial Intelligence Enabled Sensing Technologies and Applications in Metaverse KN Speaker: Vincent C. Lee, National University of Singapore Chair: Tak Sing Wong | Time: 10:40-11:10 (TWN), April 15, 2022 (RM 003)
KN7	Big Data versus Small Data: Optimizing N-of-1 Interventional Healthcare KN Speaker: Dean Ho, National University of Singapore Chair: Edward Chow | Time: 09:45-10:30 (TWN), April 16, 2022 (RM 001)
KN8	Nanotechnology in Bioenergy Harvesting and Sensing for Medical Implants KN Speaker: John X.J. Zhang, Dartmouth Engineering Chair: Mark Cheng | Time: 09:45-10:30 (TWN), April 16, 2022 (RM 002)
KN9	CarbonBuilt – Taking Low Carbon Concrete from University Bench to Commercial Production KN Speaker: Rahul Shendure, Carbon Built Chair: Eric Chiou | Time: 09:45-10:30 (TWN), April 16, 2022 (RM 003)

Invited Sessions

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IS T1.3	Functional Materials and NEMS/MEMS Chair: Akio Higo Time: 11:10-12:40 (TWN), April 14, 2022 (RM 003)	IS T1.4	Advanced Fabrication Technologies for Nano/Micro Systems Chair: Yoshikazu Hirai Time: 11:10-12:40 (TWN), April 14, 2022 (RM 004)
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IS T1.7	Wearable / Stretchable Sensors and Liquid-Metal Systems Chair: Aaron Ohta Time: 11:10-12:40 (TWN), April 14, 2022 (RM 007)	IS T2.1	Smart Mechatronics for Energy Harvesting Chair: Daisuke Yamane Time: 12:50-14:20 (TWN), April 14, 2022 (RM 001)
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IS S1.3	Advanced Micro/Nano Photonics Technology Chair: Guo-En Chang Time: 10:30-12:00 (TWN), April 16, 2022 (RM 003)	IS S1.4	Biomaterials and Biosensors in Biomedical Application Chair: Yu-Jui (Ray) Fan Time: 10:30-12:00 (TWN), April 16, 2022 (RM 004)

IS S1.5	**Micro/Nano Biosensing Technologies: From Diseases Diagnostics to Health Monitoring** Chair: Tak-Sing Wong Time: 10:30-12:00 (TWN), April 16, 2022 (RM 005)	IS S1.6	**NEMS for Human Sensing** Chair: Hiroyuki Kudo Time: 10:30-12:00 (TWN), April 16, 2022 (RM 006)
IS S1.7	**Engineering-Based Micro-physiological System (MPS): From Fundamentals to Commercial Applications** Chair: Ryuji Yokokawa Time: 10:30-12:00 (TWN), April 16, 2022 (RM 007)	IS S2.2	**Microstructure Engineering and Applications** Chair: Chia-Wen Tsao Time: 12:10-13:40 (TWN), April 16, 2022 (RM 002)

Regular Sessions

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RS T2.4	**Molecular Sensors, Actuators, & Systems I** Chair: Pin-Chuan Chen Time: 12:50-14:20 (TWN), April 14, 2022 (RM 004)	RS T2.5	**Nanobiology / Nanomedicine** Chair: Chi-Shuo Chen Time: 12:50-14:20 (TWN), April 14, 2022 (RM 005)
RS T2.6	**Nanomaterial Based Devices and Systems I** Chair: Hsieh-Fu Tsai Time: 12:50-14:20 (TWN), April 14, 2022 (RM 006)	RS F1.1	**CM Ho Best Paper Competition** Chairs: Pak Kin Wong and Aaron Ohta Time: 11:10-12:40 (TWN), April 15, 2022 (RM 001)
RS F2.1	**Best Conference Paper Competition** Chair: Pak Kin Wong and Aaron Ohta Time: 12:50-14:20 (TWN), April 15, 2022 (RM 001)	RS F2.5	**Micro/Nano Electro-Mechanical Systems II** Chair: Cheng-Hsin Chuang Time: 12:50-14:20 (TWN), April 15, 2022 (RM 004)
RS S2.1	**Best Student Paper Competition** Chair: Pak Kin Wong and Aaron Ohta Time: 12:10-13:40 (TWN), April 16, 2022 (RM 001)	RS S2.3	**Molecular Sensors, Actuators, & Systems II** Chair: Sanket Goel Time: 12:10-13:40 (TWN), April 16, 2022 (RM 003)
RS S2.4	**Micro/Nano Fluidics and Fabrication** Chair: Yu-Jui (Ray) Fan Time: 12:10-13:40 (TWN), April 16, 2022 (RM 004)	RS S2.5	**Nanomaterial Based Devices and Systems II** Chair: Chi-Shuo Chen Time: 12:10-13:40 (TWN), April 16, 2022 (RM 005)

Metastable Nano-liquid Signaling Platforms on the Cell Membrane as Revealed by Single Molecular Imaging

EDOM PL1: 09:00 – 09:45
Friday, April 14, 2022
Location: RM 001

Akihiro Kusumi

Okinawa Institute of Science and Technology
Graduate University

Abstract

Signaling is one of the most important functions of the cellular plasma membrane (PM). A variety of extracellular signaling molecules bind to their specific receptors in the PM, and the engaged receptors in turn trigger various cytoplasmic signaling cascades. These signaling pathways are intertwined and affect each other, in a process called crosstalk, which enables the cells to fine tune the overall signal. The crosstalk of different receptor signaling pathways has been examined quite extensively, but the platform responsible for signal integration has never been discovered. Here, using single-molecule imaging, we found a nanometer-scale (50-80 nm) liquid-like protein assembly on the PM cytoplasmic surface (at a density of ~2-μm apart from each other on average, with a lifetime of ~10 s), working as the signal transduction and integration platform for receptors, including GPI-anchored receptors (GPI-ARs), receptor-type tyrosine kinases (RTKs), and GPCRs. The platform consists of integrin, talin, RIAM, VASP, and zyxin, and is thus termed iTRVZ. These molecules are known as focal-adhesion constituents, but iTRVZ is distinct from focal adhesions, because iTRVZ exists on both the apical and basal PMs and lack vinculin. The iTRVZ formation is driven by specific protein-protein interactions, liquid-liquid phase separation, and interactions with actin filaments and raft domains via PI(4,5)P2. iTRVZ integrates and amplifies the GPI-AR and RTK signals in a strongly non-linear fashion, and thus works as an AND gate and noise filter. These findings greatly advance our understanding of the mechanism for crosstalk between signaling pathways.

Short Bio

Akihiro Kusumi somehow developed his love of time-resolved fluorescence measurements under the microscope (1984) and single-molecule imaging (1989). Like molecules in the plasma membrane, I underwent hop diffusion from Kyoto (Asst. Prof. 1984), Tokyo (Assoc. Prof. 1988), Nagoya (Prof. 1997), Kyoto again (Prof. 2005), and then to Okinawa (Prof. 2016), and sometimes became trapped in smaller domains within a compartment, carrying out projects called "Membrane Organizers", "Membrane Mechanisms", and "Hierarchical Meso-Scale Domains", supported by Japan Science and Technology agency and the Ministry of Education of the Japanese government.

My H-index is 64, as of October 17, 2019 (the H-index and the number of citations for each paper is based on the analysis by Google Scholar). In the following, he summarizes his previous scientific contributions related to the present proposal by Prof. Subczynski.

Lithography Advances to Shrink IC by a Million Times

EDOM PL2: 09:45 – 10:30
Thursday, April 14, 2022
Location: RM 001

Burn J. Lin

National Tsing Hua University

Abstract

The minimum feature size of semiconductors has shrunken from 5μm to 5 nm in 21 generations since the 80s. In terms of area, the IC circuits have shrunken 1 million times. Improvement of the imaging lens enables a feature size reduction to 11% while the imaging wavelength has reduced from 436 to 193 nm enabling feature size reduction to 44%. With just these improvements, the minimum half pitch can only shrink to 114 nm. Many other innovations are needed to reach the 5 nm minimum feature size. In this presentation, the techniques and tools to reach this phenomenal $\lambda/20$ feature size are presented.

Short Bio

Dr. Burn J. Lin is the Dean of the College of Semiconductor Research at National Tsing Hua University. He holds Distinguished Research Chairs at the National Tsing Hua University, National Yang Ming Chiao Tung University, and National Taiwan University. From 2011 to 2015 he was a Vice President and the Sole Distinguished Fellow at TSMC, Ltd., which he joined in 2000 as a Senior Director. Earlier he held various technical and managerial positions at IBM in the US, after joining in 1970. He has been extending the limit of optical lithography for half a century.

Dr. Lin is a member of the US National Academy of Engineering, Academician of Academia Sinica, ITRI laureate, IEEE and SPIE Fellows, Distinguished alumni of Ohio State University and National Taiwan University.

Microtechnologies and Nanotechnologies in Drug Delivery

Hygeia Touch PL3: 09:00 – 09:45
Thursday, April 15, 2022
Location: RM 001

Robert S. Langer

Massachusetts Institute of Technology

Abstract

There are numerous new technologies being developed that may impact the future of medicine. For example, new drug delivery technologies including microparticles, nanoparticles and nanotechnology promise to create new treatments for cancer, heart disease and other illnesses. Nanotechnology may also be useful in delivering DNA and siRNA as well. An important example--the development of nanoparticles for delivering the COVID-19 mRNA vaccine will be discussed. Approaches involving polymers, microchips, and lipids will be examined.

Short Bio

Robert S. Langer is one of 12 Institute Professors at MIT; being an Institute Professor is the highest honor that can be awarded to a faculty member. Dr. Langer has written more than 1,500 articles. He also has over 1,400 issued and pending patents worldwide. Dr. Langer's patents have been licensed or sublicensed to over 400 pharmaceutical, chemical, biotechnology and medical device companies. He is the most cited engineer in history (h-index 299 with over 361,000 citations according to Google Scholar).

Reinventing Batteries through Nanoscience

Yi Cui

Stanford University

EDOM PL4: 09:45 – 10:30
Friday, April 15, 2022
Location: RM 001

Abstract

The fast growth of portable power sources for transportation and grid-scale stationary storage presents great opportunities for new battery chemistries. The invention of lithium ion batteries has been recognized with Nobel Prize in 2019. How to increase energy density, reduce cost, speed up charging, extend life, enhance safety and reuse/recycle are critical challenges. Here I will present how we utilize nanoscience to reinvent batteries and address many of challenges by understanding the materials and interfaces through new tools and providing new materials guiding principles. The topics to be discussed include: 1) A breakthrough tool of cryogenic electron microscopy, leading to atomic scale resolution of fragile battery materials and interfaces. 2) Materials design to enable high capacity materials: Si and Li metal anodes and S cathodes. 3) Interfacial design with polymer and inorganic coating to enhance cycling efficiency of battery electrodes. 4) New electrolyte design. 5) New battery chemistry for grid scale storage.

Short Bio

At Stanford University, Yi Cui is the director of the Precourt Institute for Energy, co-director of the StorageX Initiative, Fortinet Founders Professor Engineering in the Department of Materials Science and Engineering. He is currently a Somorjai Miller Visiting Professor at University of California, Berkeley. A cleantech pioneer and entrepreneur, Cui earned his bachelor's degree in chemistry in 1998 from the University of Science & Technology of China and his PhD in chemistry from Harvard University in 2002. He was a Miller Postdoctoral Fellow at the University of California, Berkeley from 2002 to 2005 before joining the Stanford faculty. He has founded five companies to commercialize the energy and environment technologies from his lab: Amprius, 4C Air, EEnotech, EnerVenue and LifeLab Design Inc. Cui has published more than 500 studies and is one of the world's most cited scientists. He is an elected fellow of the American Association for the Advancement of Science, the Materials Research Society, the Electrochemical Society and the Royal Society of Chemistry. He is an executive editor of Nano Letters and co-director of the Battery 500 Consortium, co-director of Bay Area Photovoltaic Consortium. His selected awards include Global Energy Prize (2021), DoE Lawrence Award (2021), Materials Research Society Medal (2020), Electro Chemical Society Battery Technology Award (2019), Nano Today Award (2019), Blavatnik National Laureate (2017), and the Sloan Research Fellowship (2010).

Optoelectronic Tweezers – A New Optofluidic Platform for Single Cell Biology

EDOM PL5: 09:00 – 09:45
Saturday, April 16, 2022
Location: RM 001

Ming C. Wu

University of California, Berkeley

Abstract

Recent success stories of treating cancer with immunotherapy has generated tremendous excitement in the last few years. The remarkable treatment of former President Jimmy Carter's cancer was widely publicized. Immunotherapy uses the antibodies produced by white blood cells, or the cells themselves, to boost the immune response of patients to fight cancer cells. The discovery and production of such "biological drugs" require efficient screening and analysis of a large number of individual white blood cells. In this talk, I will discuss an optofluidic technology developed at Berkeley several years ago called "optoelectronic tweezers" (OET). OET enables cloning of single cells in sub-nanoliter compartments in a microfluidic chip. Antibodies produced by individual cells can be measured in hours, significantly shorter than the 3-month long traditional workflow. The fully automated OET instruments are now helping pharmaceutical industries speed up drug discovery and production process.

Short Bio

Ming Wu is Nortel Distinguished Professor of Electrical Engineering and Computer Sciences at UC Berkeley. He received his Ph.D. from the same department in 1988 and joined the faculty in 2004 after doing research at AT&T Bell Labs and UCLA. Professor Wu is best known for his work on Optical MEMS and optoelectronic tweezers (OET). He received the 2016 William Streifer Scientific Achievement Award from IEEE Photonics Society, 2017 C.E.K. Mees Medal from Optica (formerly Optical Society), and 2020 Robert Bosch Micro and Nano Electro Mechanical Systems Award from IEEE Electron Device Society. He co-founded Berkeley Lights Inc. (NASDAQ: BLI) in 2011 to bring optoelectronic tweezers to market. OET-based instruments are now widely used by biopharma companies for antibody discovery, cell line development, and synthetic biology.

Lab on a Particle Technology to Scale Biological Research 1000-Fold

KN1: 10:40 – 11:10
Thursday, April 14, 2022
Location: RM 001

Dino Di Carlo

University of California, Los Angeles

Abstract

The ultimate limits of measurement in biology are the "quantum" units that convey information, e.g. single nucleic acids, proteins, and cells. Microfluidics has emerged as a powerful tool to compartmentalize single cells and molecules into sub-nanoliter droplets as individual bioreactors to enable sensitive detection and analysis down to this quantum limit. However, the current systems for these quantum assays have not been widely adopted, partly due to the requirement of specialized instruments and microfluidic chips to generate uniform droplets and perform adequate manipulations. I will discuss the platforms we are developing to fractionate volumes in simplified, instrument-free ways using 3D-shaped microparticles. These "lab on a particle" platforms enable sorting cells based on secreted products for the discovery of antibodies, the development of cell lines producing recombinant products, and the selection of functional cells for cell therapies. Each cell and its secreted products can be analyzed and sorted using widely available flow cytometers operating at up to a 1000 cells per second, promising to democratize single-cell technologies.

Short Bio

Dino Di Carlo received his B.S. in Bioengineering from the University of California, Berkeley in 2002 and received a Ph.D. in Bioengineering from the University of California, Berkeley and San Francisco in 2006. From 2006-2008 he conducted postdoctoral studies in the Center for Engineering in Medicine at Harvard Medical School. He has been on the faculty in the Department of Bioengineering at UCLA since 2008 and now as Professor of Bioengineering serves as the Vice Chair of the Department and Deputy Director of an NSF Engineering Research Center focused on diagnostics for underserved populations. In 2019 he was named the Armond and Elena Hairapetian Chair Professor in Engineering and Medicine at UCLA. His research pioneered the use of inertial fluid dynamic effects for the control, separation, and analysis of cells in microfluidic devices. His recent work extends into numerous other fields of biomedicine and biotechnology including lab-on-a-particle technologies, directed evolution of cells, rapid diagnostics, mechanomedicine, next generation biomaterials, and phenotypic drug screening. He has also been a leader in technology entrepreneurship: He co-founded several companies that are commercializing UCLA intellectual property developed in his lab including CytoVale, Vortex Biosciences, Tempo Therapeutics, Forcyte, Ferrologix, Hana Diagnostics, and Partillion Bioscience. He has served as Scientific Advisor for companies including Omega Biosystems, Acoustic Bio and Cue Health (NASDAQ:HLTH). Among other honors he received the Presidential Early Career Award for Scientists and Engineers (PECASE) and was elected a Fellow of the American Institute for Medical and Biological Engineering in 2016, was elected a Fellow of the Royal Society of Chemistry (FRSC) in 2014, was awarded the National Science Foundation (NSF) Faculty Early Career Development award and the U.S. Office of Naval Research (ONR) Young Investigator Award, the Packard Fellowship and Defense Advanced Research Projects Agency (DARPA) Young Faculty Award, and received the National Institutes of Health (NIH) Director's New Innovator Award and Coulter Translational Research Award.

Silicon Oxide Electret as a Power Generation Material

KN2: 10:40 – 11:10
Thursday, April 14, 2022
Location: RM 002

Hiroshi Toshiyoshi

The University of Tokyo

Abstract

Besides being used as a mechanical material, silicon can be turned into an electret or permanent electrical charge when oxidized with impurity. We discuss on a process to include silicon oxide electret in a MEMS (microelectromechanical systems) vibrational energy harvester that delivers more than 1 mW power from environmental vibrations of less than 1 G (= 9.8 m/s2) in a low frequency range (~ 100 Hz).

Short Bio

Hiroshi Toshiyoshi received the B.S., M.E. and Ph.D. degrees in electrical engineering from The University of Tokyo, Tokyo, Japan, in 1991, 1993 and 1996, respectively. He joined the Institute of Industrial Science, The University of Tokyo in 1996 as a Lecturer. From 1999 to 2001, he was a Visiting Assistant Professor at the University of California, Los Angeles, CA, USA. In 2002, he became an Associate Professor with the Institute of Industrial Science (IIS), The University of Tokyo. From 2002 to 2007, he was a Codirector of LIMMS/CNRS-IIS UMI-2820, an international joint laboratory of the Centre National de la Recherche Scientifique, Paris, France. Since 2009, he has been a Professor with the IIS, The University of Tokyo. His research interests include optical MEMS, power MEMS, and CMOS-MEMS.

Plasmo-Opto-Electro-Fluidic Biosensors for Critical Care Medicine

KN3: 10:40 – 11:10
Thursday, April 14, 2022
Location: RM 003

Katsuo Kurabayashi

University of Michigan, Ann Arbor

Abstract

Biomarker-guided precision medicine holds the promise to target treatment to the specific pathologic processes occurring in an individual patient, thus increasing the efficacy of care and decreasing the use of harmful, unhelpful interventions. However, many acute inflammatory life-threatening illnesses caused by severe infection, trauma, surgery, immunotherapy, or organ transplantation remain left behind in the field of precision medicine owing to the lack of appropriate diagnostic tools. While testing and therapeutic plans for cancers and other chronic diseases are formulated over days to weeks, a life-saving treatment for critically ill patients must be delivered in minutes to hours, requiring fast, sensitive, and accurate diagnostic technologies near the patient. To address this unmet need, my research group at University of Michigan is currently developing advanced blood biomarker analysis platforms incorporating microfluidic systems, biologically functionalized plasmonic nanostructures, and two-dimensional atomically layered semiconducting transition metal dichalcogenide (TMDC) photoconductive nanosheet channels into a hand-held module. The near-infrared (NIR) operation of our biosensors allows colloidal nanoparticle-based colorimetric measurement of target protein biomarkers with a minimum effect of the photo absorption by constituents (e.g. blood cells, platelets, fat globules, and metabolites) in the background biofluid. This eliminates the need for sample purification steps, which has been the critical bottleneck challenging point-of-care testing (POCT). It also facilitates ultrasensitive biomarker detection of levels as low as approximately 100 fg/mL with dynamic detection ranges of 106 in less than 15 minutes. The limit of detection value is more than 100 times lower than that of the current non-POCT gold standard method; enzyme-linked immunosorbent assay (ELISA). Simultaneously achieving speed, sensitivity, selectivity, and battery-powered portability, our biosensor platforms manifest the potential to broadly advance critical care strategies for treating systemic inflammatory disorders at the point of care. This talk provides an overview of our plasmo-opto-electro-fluidic (POEF) biosensor technology and discusses its translation to near-patient monitoring of cytokine release syndrome (CRS)/neurotoxicity and management of sepsis through our collaborative research between University of Michigan College of Engineering and Medical School.

Short Bio

Katsuo Kurabayashi is Professor of Mechanical Engineering and Electrical Engineering and Computer Science at the University of Michigan, Ann Arbor. He received his BS in Precision Engineering from the University of Tokyo in 1992, and his MS and PhD in Materials Science and Engineering from Stanford University, CA, in 1994 and 1998, respectively. His current research focuses on optofluidics, nanoplasmonic and biomolecular biosensing, and BioMEMS/microsystems for immunoassay, clinical diagnosis, single-cell study, and analytical chemistry. He authored and co-authored more than 175 peer-reviewed papers and holds 11 U.S. patents. He received the 2001 NSF Early Faculty Career Development (CAREER) Award, and the Robert Caddell Memorial Award in 2005, the Pi Tau Sigma Outstanding Professor Award in 2007, the University of Michigan Mechanical Engineering Outstanding Achievement Award in 2013, the Ted Kennedy Award in 2015, and the Wise-Najafi Prize for Engineering Excellence in the Miniature World in 2019 from the College of Engineering at the University of Michigan. He is a Fellow of RSC and ASME.

Droplet Microfluidics Enables Rapid Diagnostics and Antimicrobial Susceptibility Testing

KN4: 10:40 – 11:10
Friday, April 15, 2022
Location: RM 001

Jeff Wang

John Hopkins University

Abstract

The talk describes droplet microfluidic-based platforms for pathogen detection and antimicrobial susceptibility testing (AST). I will first introduce droplet magnetofluidics, a technology that eliminates the need for large, complex instrumentation and fluidics typically associated with clinical laboratory nucleic acid amplification testing. Droplet magnetofluidics facilitates facile extraction and purification of nucleic acid targets from clinical samples and concentrates them into a small volume for amplification detection. The assay miniaturization helps maximize the thermocycling speed and minimize reagent consumption, thereby enabling a molecular test with a short turnaround time of 15 minutes and a low assay cost of ~$2. The magnetofluidic diagnostic platforms have demonstrated clinically relevant sensitivity and specificity for Hepatitis C viral infections, sexually transmitted diseases, and, recently, COVID-19. Meanwhile, I will also present a microfluidic single-cell biosensing platform that employs droplet microfluidics to enable pathogen detection without performing nucleic acid amplification via hybridization detection of 16S rRNA from single bacterial cells captured in picolitre droplets. In-droplet quantitative measurements of genetic contents from single bacterial cells also provide a surrogate for accelerating AST. When applied to urinary tract infections, the droplet-based single-cell platform achieved both pathogen identification and AST from urine samples in 30 minutes, as opposed to 2-3 days by conventional culture-based methods.

Short Bio

Jeff T.H. Wang is Louis M. Sardella Professor in Mechanical Engineering at JHU, where he has served on the faculty since 2002. He earned his doctorate in mechanical engineering from UCLA in 2002. His research focuses on the development of new technologies for molecular analysis and biomedical research via advances in micro- and nano-scale sciences. He has contributed to developments in single-molecule fluorescence spectroscopy, microfluidics, and nano-biosensors for genetic and epigenetic biomarker-based diagnostics of cancer, infectious disease, and an array of other diseases. Dr. Wang is an inventor of 25 patents and has authored 170 research articles and delivered 130 invited talks. He received the NSF CAREER Award in 2006, CSR Jorge Heller Award in 2007, ASGR Excellence in Research Award in 2007, the JALA Ten Award in 2011. He is a Fellow of the American Institute for Medical and Biological Engineering (AIMBE), American Society of Mechanical Engineering (ASME), Institute of Electrical and Electronics Engineers (IEEE), and Royal Society of Chemistry (ROC).

Mitochondrial Transfer and Cell Fate Transitions

KN5: 10:40 – 11:10
Friday, April 15, 2022
Location: RM 002

Michael Teitell

University of California, Los Angeles

Abstract

The ability to generate primary cell lines with desired, compatible nDNA-mtDNA sequences is difficult to achieve due to the necessity of controlled mitochondrial transfer. We deploy a massively parallel transfer platform to deliver isolated healthy mitochondria from peripheral blood mononuclear cells into mtDNA-depleted (rho-0) primary fibroblasts. The resulting stable isolated mitochondrial replacement (SIMR) fibroblast (SIMR) lines have restored respiration, but retain a rho0-like metabolome and transcriptome. Reprogramming of SIMR fibroblasts to pluripotency followed by differentiation to mesenchymal stem cells (MSCs) progressively resets the metabolome and transcriptome profiles to that of reprogrammed and MSC-differentiated control fibroblasts. Despite having non-native mtDNA sequences, the SIMR lines were able to produce adipocytes, osteocytes, and chondrocytes by directed differentiation. Finally, preliminary work has successfully generated SIMR fibroblasts with specific detrimental mtDNA sequences that show impaired respiration and may aid in the modeling of mitochondrial disorders. We show using SIMR fibroblasts that fate transition is necessary to fully reset rho-0 cell metabolism following mitochondrial transfer, enabling streamlined studies of novel mtDNA-nDNA combinations.

Short Bio

Dr. Michael Teitell holds the Latta Endowed Chair in Pathology and is a Professor in the Departments of Pathology, Pediatrics, and Bioengineering at UCLA. He is the Director of the UCLA Jonsson Comprehensive Cancer Center and President of the Jonsson Cancer Center Foundation. He directs the National Cancer Institute funded UCLA Tumor Immunology Training Program. Dr. Teitell's laboratory studies overlapping areas with emerging roles in cancer and mitochondrial disease. These areas include: (1) development and oncogenesis in germinal center B lymphocytes; (2) metabolism and epigenetic regulation in stem cell biology; (3) mitochondrial biology and transplantation; and (4) the development and applications of biotechnology to basic and translational problems in human disease. Dr. Teitell is Board certified in anatomic, clinical and pediatric pathology and is a recipient of the Stohlman Memorial Scholar Award from the Leukemia Society of America, the Margaret E. Early Medical Research Trust Award, the FOCIS/Millenium Pharmaceuticals Award for Genomics Research, and he was elected to the American Society of Clinical Investigators and the Association of American Physicians.

Artificial Intelligence Enabled Sensing Technologies and Applications in Metaverse

KN6: 10:40 – 11:10
Friday, April 15, 2022
Location: RM 003

Chengkuo Lee

National University of Singapore

Abstract

Wireless and portable electronics are undergoing explosive development in the 5G and Internet of Things (IoT) platform. Flexible and wearable electronics will further drive the future direction of the next generation electronics. Among the enabling devices of future electronics in 5G/IoT applications, the flexible and wearable sensors play the indispensable roles. When sensors integrated with the artificial intelligence (AI) technology to enable the analysis function, such AI-assisted systems achieve a higher level of intelligence for a wide range of smart home applications including advanced identity recognition, human-machine interfaces, and personalized healthcare. In this talk, sensory information from gloves, socks, mats and toilet are analyzed by deep learning approaches and wide range of applications are provided.

Short Bio

Dr. Chengkuo Lee received his Ph.D. degree in precision engineering from The University of Tokyo, Tokyo, Japan, in 1996. Currently, he is the director of Center for Intelligent Sensors and MEMS at National University of Singapore, Singapore. He cofounded Asia Pacific Microsystems, Inc. (APM) in 2001, where he was Vice President of R&D from 2001 to 2005. From 2006 to 2009, he was a Senior Member of the Technical Staff at the Institute of Microelectronics (IME), A-STAR, Singapore. His research interests include MEMS, NEMS and flexible devices for IoT, energy harvesting, metamaterials and biomedical applications. He has trained 30 PhD students graduated from ECE Dept., NUS. He has co-authored 410+ journal articles and 360+ conference papers. He holds 10 US patents. His google scholar citation is more than 19000+. He is the associate-editor-in-chief of Trans. Nanotechnology (IEEE), and editor-in-chief of Intern. J. Optomechatronics (Taylor & Francis). He is in the Executive Editor Board of J Micromechanics and Microeng. (IOP, UK). He is the Associate editor of J. MEMS (IEEE) and Internet of Things (Elsevier). He is also the Editor of next journals: Scientific Reports (Springer Nature), Bioelectronic Medicine (BMC, Springer Nature), CHIP (Elsevier), J. Optical Microsystems (SPIE), Journal of Sensors (Hindawi), Sensors (MDPI), and Micromachines (MDPI). He serves on steering committee and technical program committee for various conferences such as Transducers 2015, IEEE MEMS 2015, IEEE NEMS 2015, IEEE SENSORS 2018, IEEE MEMS 2019, Transducers 2019, IEEE MEMS 2020, and Transducers 2021, etc. He has also chaired many conferences including IEEE NEMS'18, OMN '16 and '14, ISMM'14, and Bio4Apps'13 etc.

Big Data versus Small Data: Optimizing N-of-1 Interventional Healthcare

KN7: 09:45 – 10:15
Saturday, April 16, 2022
Location: RM 001

Dean Ho

National University of Singapore

Abstract

Drug discovery and development are different segments of the therapy roadmap that need to be seamlessly integrated. Discovering promising candidates represents the first of many steps needed to optimally harness a drug's potential, particularly due to the fact that monotherapies may yield improved but sub-optimal clinical outcomes compared to standard care. As such, these candidates often need to be delivered in combination with other therapies, and the methodologies used to design these combinations vary widely. Importantly, traditional and truly optimised drug development can be the difference between no efficacy and life-saving outcomes. In the quest for truly optimised drug development - whether novel or repurposed - multiple challenges need to be overcome. The right drugs and corresponding doses need to be identified, which will have a profound impact on the drugs that ultimately comprise that combination. Using traditional approaches, this can be an insurmountable barrier given the very large drug and dose parameter space that is created. In addition, a one-size-fits-all approach serves as a barrier to truly individualised, or N-of-1 treatment, as even effective drugs given at incorrect dosages can result in little to no efficacy. Furthermore, these doses may need to be modulated dynamically during the course treatment, since the patient response to treatment can also be dynamic. This talk will address our recent clinical development studies at WisDM and N.1 to dynamically tailor patient-specific treatment outcomes, reduce healthcare costs, and increase accessibility to practice-changing and optimised medicine.

Short Bio

Professor Dean Ho is currently Provost's Chair Professor, Director of The N.1 Institute for Health (N.1), Director of The Institute for Digital Medicine (WisDM) and Head of the Department of Biomedical Engineering at the National University of Singapore.

Prof. Ho and collaborators successfully developed and validated CURATE, a powerful digital medicine platform that has optimized human treatment for broad indications ranging from oncology to infectious diseases.

Prof. Ho is a Fellow of the US National Academy of Inventors (NAI), the American Association for the Advancement of Science (AAAS), American Institute for Medical and Biological Engineering (AIMBE), and the Royal Society of Chemistry. He was also recently named to the HIMSS Future50 Class of 2021 for his internationally-recognised leadership in digital health. His discoveries have been featured on CNN, The Economist, National Geographic, Forbes, Washington Post, NPR and other international news outlets. Prof. Ho is also a Subgroup Lead in the World Health Organization (WHO)-ITU AI for Health Working Group for Regulatory Considerations.

Prof. Ho is a recipient of the Tech Heroes from Crisis Pathfinder Award from the Singapore Computer Society, NSF CAREER Award, Wallace H. Coulter Foundation Translational Research Award, and V Foundation for Cancer Research Scholar Award, among others. He has also served as the President of the Board of Directors of the Society for Laboratory Automation and Screening (SLAS), a 26,000+ member global drug development organization.

IEEE-NEMS KEYNOTE

Nanotechnology in Bioenergy Harvesting and Sensing for Medical Implants

KN8: 09:45 – 10:15
Saturday, April 16, 2022
Location: RM 002

John X.J. Zhang

Dartmouth Engineering

Abstract

As the complexity of implantable devices is increasing, the size and power requirements of implantable devices has shrunk by more than double over the past few decades. However, the functionality or lifespan of the devices is often found to be limited due to shortage of power. With more than 50% of the device size being occupied by the battery alone, longevity of such implantable devices has garnered huge concern over the years. Fueled by the demand of additional biosensors coupled to such devices, implantable energy harvesters, capable of harvesting the body's mechanical, chemical, or thermal energy over a long period of time, have gained tremendous popularity. Amongst these technologies, implantable piezoelectric thin film devices provide a promising method recently to generate continuous supply of power. Realization of such implantable power sources can shift the burden from commonly used lithium-ion batteries by utilizing physiological resources. In this talk, we will review recent developments with focus on piezoelectric polymer-based nanotechnology for implantable cardiac energy harvesting and sensing.

Short Bio

Dr. John X.J. Zhang is a Professor at Thayer School of Engineering at Dartmouth College, and an Investigator in the Dartmouth-Hitchcock Medical Center. He served as NSF program director during 2020-2021 global pandemics, helping launched the research initiatives related to predictive intelligence for pandemic prevention. He received his Ph.D. in Electrical Engineering from Stanford University, California in 2004, and was a Research Scientist in Systems Biology at the Massachusetts Institute of Technology (MIT) before joining the faculty at University of Texas at Austin in 2005. Dr. Zhang is a Fellow of American Institute for Medical and Biological Engineering (AIMBE) and a Fellow of Royal Society of Chemistry (FRSC). Dr. Zhang is also a graduate of Stanford LEAD executive program at Graduate School of Business.

His research takes multi-disciplinary approaches, utilizing engineering expertise in bionanotechnology, microfluidics, functional materials design, and micro-nanofabrication of biochips for synergizing sensing, imaging, and biomarker screening on-chip to facilitate studies of biomedical complexity and early diagnostics towards precision healthcare. He has received numerous recognitions including NSF CAREER award, NIH Director's Transformative award, DARPA Young Faculty Award, Wallace Coulter Foundation Early Career Award, Facebook SARA award, Sony Faculty Innovation Award, and Agilent University Research Award.

Dr. Zhang has published over 300 peer-reviewed papers and proceedings, presented over 80 invited seminars worldwide, and has 8 US and over 30 international patents issued. His research discoveries and patents were licensed to two companies with successful commercialization. Dr. Zhang has mentored over 30 Ph.D. students and post-doctoral scholars and published a textbook Molecular Sensors and Nanodevices in Biomedical Engineering.

CarbonBuilt - Taking Low Carbon Concrete from University Bench to Commercial Production

KN9: 09:45 – 10:15
Saturday, April 16, 2022
Location: RM 003

Rahul Shendure

Carbon Built

Abstract

CarbonBuilt's mission is to enable concrete manufacturing to drive large-scale greenhouse gas reductions through the cost-effective utilization of CO and other industrial waste. CarbonBuilt's Reversa™ process transforms carbon dioxide (CO) taken directly from industrial processes, biomass boilers, or emerging direct air capture solutions into a low carbon, but otherwise "no compromise", precast concrete product. Reversa's breakthrough use of low cost and low carbon materials enables this capital and energy efficient curing process to deliver an 80%+ reduction in concrete's carbon footprint along with a 30%+ financial return. CarbonBuilt's core technology was developed at UCLA's Institute for Carbon Management. In 2021, the UCLA CarbonBuilt team was awarded the grand prize in the NRG COSIA Carbon XPRIZE.

Short Bio

Rahul Shendure is the CEO of CarbonBuilt, a low carbon concrete technology company. Rahul has spent almost all of his 26+ year career focused on reducing humankind's environmental impact. Concurrently, Rahul serves as Board Chair of Oscilla Power, a pioneering ocean energy technology company he co-founded in 2009, and as a Director of the Composite Recycling Technology Center, a non-profit commercializing products from carbon fiber scrap. He is active early-stage investor with a portfolio consisting of more than 40 companies, 80% of which are focused on climate solutions. Previously, Rahul served as co-founder, CEO and Board Chair of Bellwether Bio, a cancer diagnostics company acquired by Guardant Health in 2019. Earlier, Rahul was the Vice President of Product Marketing and first business hire at Amyris, a pioneering industrial biotechnology company, and led product management at Ballard Power Systems, a pioneering hydrogen fuel cell company. He started his career with engineering and operational assignments at General Electric. Rahul has a BS in Chemical Engineering from MIT and an MBA from Harvard.

Novel Micro/Nano Systems for Bio and Energy Applications

IS T1.1: 11:10-12:40
Thursday, April 14, 2022
Location: RM 001

Session Chair: **Sung-Yong Park**
San Diego State University

Description

This session will present the recent studies involved with nanomaterials and micro/nano systems for energy- and bio-related applications.

T1.1.1 Selective artificial neural network by targeted delivery of neuronal cells using magnetically controlled microrobots, Hongsoo Choi, Department of Robotics Engineering, Daegu Gyeongbuk Institute of Science and Technology (DGIST), Daegu, Korea.

T1.1.2 Novel computational design of high refractive index nanocomposites and effective refractive index tuning based on nanoparticle morphology effect, Jong Eun Ryu, Department of Mechanical and Aerospace Engineering, North Carolina State University, Raleigh, NC, USA

T1.1.3 A novel microsensor embedded coronary artery stent to continuously monitor in-stent restenosis, Moataz Elsisy[1], Robert Herbert[2], Woon-Hong Yeo[2,3,4], Mohamed Ibrahim[1], Youngjae Chun[1,5,6*],
[1]Department of Industrial Engineering, University of Pittsburgh, PA 15261, USA
[2]George W. Woodruff School of Mechanical Engineering, Institute for Electronics and Nanotechnology, Georgia Institute of Technology, Atlanta, GA 30332, USA
[3]Wallace H. Coulter Department of Biomedical Engineering, Georgia Institute of Technology and Emory University School of Medicine, Atlanta, GA 30322, USA
[4]Parker H. Petit Institute for Bioengineering and Biosciences, Institute for Materials, Neural Engineering Center, Institute for Robotics and Intelligent Machines, Georgia Institute of Technology, Atlanta, GA 30332, USA
[5]McGowan Center for Regenerative Medicine, University of Pittsburgh Medical Center, PA 15213, USA,
[6]Department of Bioengineering, University of Pittsburgh, PA 15261, USA

T1.1.4 Microfluidics for Environmental application: Monitoring harmful microorganisms and biofilm formation in microfluidic chips, Sungwoo Bae, Department of Civil and Environmental Engineering, National University of Singapore, Singapore

T1.1.5 An optofluidic solar indoor lighting for green and sustainable buildings, Sung-Yong (Sean) Park, Department of Mechanical Engineering, San Diego State University, San Diego, CA, USA

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Advanced Nanofluidic Systems for Single Molecule Detection

IS T1.2: 11:10-12:40
Thursday, April 14, 2022
Location: RM 002

Session Chair: **Wei-Lun Hsu**
The University of Tokyo

Description

Understanding intricate and coupled electrokinetic and electrochemical phenomena in nanospace is of crucial importance for single molecule detection toward next generation of medical diagnostic applications. In this session, we invite five exceptional talks on nanofluidics for biosensing research from young and inspiring scientists in Japan, P. R. China and Taiwan (R. O. C.), covering the cutting-edge topics of nanofluidic protein separation, femtoliter-droplet mass spectrometry, nanopore-confined electrochemical sensing, digital nanopore virus detection and nonlinear electrokinetics in nanopores. This session will enable us to merge novel ideas for the exploration of a pathway forward for the advancement of current nanobiosensor technology.

T1.2.1 Digestion and Separation of pL Protein Sample Utilizing Nanofluidics, Kyojiro Morikawa, Institute of NanoEngineering and MicroSystems (iNEMS), Department of Power Mechanical Engineering National Tsing Hua University, Hsinchu, Taiwan, Collaborative Research Organization for Micro and Nano Multifunctional Devices (NMfD), The University of Tokyo, Tokyo, Japan

T1.2.2 Femtoliter-Droplet Shooter by Gas/Liquid Nanofluidics for an Interface of Mass Spectrometry, Yutaka Kazoe Department of System Design Engineering, Faculty of Science and Technology, Keio University, Kanagawa, Japan

T1.2.3 Glass Nanopore Confined Electrochemical Sensing at Single Entity Level, Ru-Jia Yu, Yi-Lun Ying, Yi-Tao Long, State Key Laboratory of Analytical Chemistry for Life Science, School of Chemistry and Chemical Engineering, Nanjing University, Nanjing, P. R. China Chemistry and Biomedicine Innovation Center, Nanjing University, Nanjing, P. R. China

T1.2.4 Nanopore Sensing for Single-Virus Detections to Digital Infection Diagnosis, Makusu Tsutsui the Institute of Scientific and Industrial Research, Osaka University, 8-1 Mihogaoka, Ibaraki, Osaka, Japan

T1.2.5 Transport-Induced-Charge Electrokinetics in Nanopores, Wei-Lun Hsu, Zhixuan Wang, Haoyu Wang,

Hirofumi Daiguji, Department of Mechanical Engineering, The University of Tokyo, Tokyo, Japan

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Functional Materials and NEMS / MEMS

IS T1.3: 11:10-12:40
Thursday, April 14, 2022
Location: RM 003

Session Chair: **Akio Higo**
The University of Tokyo

Description

This invited session shows the functional materials and NEMS/MEMS for future integration of materials and devices. We selected in simulation field, nano-material field, NEMS/MEMS field, Bio-related device field, and compound semiconductor field. We discuss the material characteristics and future integration of the functional materials to NEMS/MEMS and colloidal quantum dots solar cell devices.

T1.3.1 Beyond Nanomaterials: The Science of Subnanometer Particles, Takane Imaoka**,** Laboratory for Chemistry and Life Science, Institute of Innovative Research, Tokyo Institute of Technology, Japan., School of Materials and Chemical Technology, Tokyo Institute of Technology, Japan

T1.3.2 Molecular Analyses of Transport Phenomena of Reactant/Product Materials in Polymer Electrolyte Fuel Cell, Takashi Tokumasu[1], Takuya Mabuchi[2] [1]Institute of Fluid Science, Tohoku University, Sendai, Japan [2]Frontier Research Institute for Interdisciplinary Science, Tohoku University, Sendai, Japan

T1.3.3 Bio-sensor Using Electrochemical Impedance Spectroscopy, Ichiro Yamashita**,** Graduate School of Medicine, Osaka University**,** 8-1 MihogaOka Suita, Osaka, Japan

T1.3.4 Photoelectric conversion using Infrared absorbing colloidal nanocrystals, Haibin Wang[1], Takaya Kubo[2], and Hiroshi Segawa[1, 2]
[1]Graduate School Arts & Sciences, The University of Tokyo, Tokyo, Japan.
[2]Research Center for Advanced Science and Technology, The University of Tokyo, Tokyo, Japan

T1.3.4 Tailor-made CMOS-MEMS as tools for nanomaterials, Yoshio Mita, *Senior Member,* Department of Electrical Engineering and Information Systems (EEIS), the University of Tokyo, Japan, Platform Device Research Division, Systems Design Lab., School of Engineering, the University of Tokyo, Japan

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Advanced Fabrication Technologies for Nano/Micro Systems

IS T1.4: 11:10-12:40
Thursday, April 14, 2022
Location: RM 004

Session Chair: **Yoshikazu Hirai**
Kyoto University

Description

Current micro-nano fabrication technology has reached integration levels at which high-performance MEMS devices and sensitive sensors can be fabricated. The scope of this invited session covers new design, fabrication technology, characterization, and applications of devices and systems in micro- and nano-scales. This session is organized five energetic researchers in Japan and highlights recent advances in the field of fabrication technologies and the state of the art in Nano/Micro System applications.

T1.4.1 Femtosecond Laser Direct Writing of Metal/Metal Oxide Composite Patterns for Sensor Applications, Mizue Mizoshiri, Nagaoka University of Technology, Japan

T1.4.2 Rapid Prototyping of Microstructure Using Grayscale Lithography, Kentaro Totsu, Micro System Integration Center, Tohoku University, Japan

T1.4.3 Development of Ultra-thin Glass and Its Application to Micro/Nanofluidics, Yo Tanaka, Laboratory for Integrated Biodevice, Center for Biosystems Dynamics Research (BDR), RIKEN, Japan

T1.4.4 Z-axis Controllable Multi-Electrode-Layer Electrorotation Device Utilizing Levitation Effect, Yuki Okamoto, Sensing System Research Center, National Institute of Advanced Industrial Science and Technology, Japan

T1.4.5 Alkali Metal Vapor Cells Fabricated with Three-Dimensional Microstructuring Technique for Miniature Atomic Clocks, Yoshikazu Hirai, Department of Mechanical Engineering and Science, Kyoto University, Japan

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Emerging Micro- and Nano-scale Sensing and Manipulation Techniques

IS T1.5: 11:10-12:40
Thursday, April 14, 2022
Location: RM 005

Session Chair: **Tim Yeh**
University of Texas at Austin

Description

This session will focus on exciting emerging microscale and nanoscale technologies for molecular, cellular and tissue level studies. The topics range from novel photonic sensors, microfluidic systems for tissue culture, nanopore measurements, and membrane receptor trajectory acquisition and analysis. Both early-stage conceptual investigation and translational work will be presented.

T1.5.1 Assessing metastatic potential and classifying cancer cells using deep learning-based EGFR trajectory analysis, Yen-Liang Liu, Master Program for Biomedical Engineering, China Medical University, Taichung City, Taiwan

T1.5.2 Using the next-generation sequencing platform for massively parallel selection of fluorescent nanomaterials, Tim Yeh, Biomedical Engineering Department, University of Texas at Austin, TX, USA

T1.5.3 Resistive pulse nanopore sensing for single-molecule and single-particle analysis, MinJun Kim, Mechanical Engineering Department, Southern Methodist University, TX, USA

T1.5.4 Microfluidic chip-based method for cell spheroids culture, Chia-Hsien Hsu, Institute of Biomedical Engineering and Nanomedicine, National Health Research Institutes, Taiwan

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MEMS/NEMS Based Microfluidic and Medical Devices

IS T1.6: 11:10-12:40
Thursday, April 14, 2022
Location: RM 006

Session Chair: **Sang-Seok Lee**
Tottori University

Description

In this session, we focus on MEMS/NEMS based devices for medical and health care applications. This session consists of 5 invited talks such as 3 talks for microfluidics, 2 talks for medical devices. The cutting-edge research achievement will be presented in the session.

T1.6.1 Robust Processing of Multi-Step Reactions in Drops, Hee-Sun Han, Chemistry Department, University of Illinois at Urbana-Champaign, IL, USA, Center for Biophysics and Quantitative Biology, Urbana, IL, USA, Institute for Genomic Biology, Urbana, IL, USA

T1.6.2 Nanoparticle Polymer Composites for Microfluidics and BioMEMS, Bonnie L. Gray, Engineering Science, Faculty of Applied Sciences, Simon Fraser University, Burnaby, BC, Canada

T1.6.3 Minimally Invasive Medical Devices Utilizing Non-planar Photofabrication Techniques, Tadao Matsunaga, Faculty of Engineering, Tottori University, Tottori, Japan

T1.6.4 Point-of-Care Finger-Actuated Microfluidic Devices, Je-Kyun Park, Department of Bio and Brain Engineering, Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea; KAIST Institute for the NanoCentury, Daejeon, Korea; KAIST Institute for Health Science and Technology, Daejeon, Korea

T1.6.5 Development of Ingestible Thermometer Charged by Gastric Acid Battery as a Next-Generation Healthcare Device, Shinya Yoshida, Graduate School of Engineering, Tohoku University, Sendai, Miyagi, Japan

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Wearable / Stretchable Sensors and Liquid-Metal Systems

IS T1.7: 11:10-12:40
Thursday, April 14, 2022
Location: RM 007

Session Chair: **Aaron Ohta**
University of Hawaii at Manoa

Description

This session covers topics in wearable and/or stretchable sensors and systems, such as electrodes for ECG measurements and wearable sweat analysis systems. This session also includes systems and sensors that use room-temperature liquid metals as functional materials. This covers stretchable materials, thermal management systems, reconfigurable circuits, actuators, and thin-film coatings.

T1.7.1 Fabrication of metal microneedle array electrodes based on Bi-In-Sn alloys for ECG detection, Soonmin Seo, College of BioNano Technology, Gachon University, Gyeonggi, Korea

T1.7.2 3D-Printed Epidermal Microfluidic Systems for the Collection and Analysis of Sweat, Tyler Ray,

Department of Mechanical Engineering, University of Hawai'i at Mānoa, Honolulu, HI, USA; Department of Cell and Molecular Biology, John A. Burns School of Medicine, University of Hawai'i at Mānoa, Honolulu, HI, USA

T1.7.3 Polymerized Liquid Metal Networks for Stretchable RF Conductors, Alexander Watson, Engineering Management, Systems and Technology Department, University of Dayton, Dayton OH, USA

T1.7.4 Progress in Liquid-Metal Actuation and Applications, Wayne A. Shiroma, Aaron T. Ohta, Department of Electrical and Computer Engineering, University of Hawaii at Manoa, HI, USA

T1.7.5 Liquid-Metal Systems and Applications, Arif Rahman, Department of Electrical and Computer Engineering, University of Hawaii at Manoa, HI, USA. Department of Computer Science and Engineering, Hawaii Pacific University, HI, USA

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Smart Mechatronics for Energy Harvesting

IS T2.1: 12:50-14:20
Thursday, April 14, 2022
Location: RM 001

Session Chair: **Daisuke Yamane**
Ritsumeikan University

Description

Energy harvesting is one of the key technologies for realizing self-powered, maintenance-free, and autonomous wireless network systems for the coming next-generation Internet of Things era. The technological advancement of energy harvesting devices/systems can be achieved by the development of both mechanical and electrical aspects. This is because one characteristic affects the other, and the performance of energy harvesting devices/systems is related to the performance of both. With this background, this session will focus on state-of-the-art mechatronics technologies for energy harvesting and will cover a wide range of topics including materials, mechanics, electronics, fabrication processes, and applications.

T2.1.1 Development of Vibrational Energy Harvester Based on Smart Mechatronics, Shimpei Ono, Central Research Institute of Electric Power Industry, Kanagawa, Japan

T2.1.2 Smart electret composed of polar organic molecules for vibrational energy generators, Yuya Tanaka, Center for Frontier Science, Chiba University, Japan

T2.1.3 Smart mechatronics for electrostatic MEMS vibration energy harvesters, Daisuke Yamane, Department of Mechanical Engineering, Ritsumeikan University, Shiga, Japan

T2.1.4 Smart energy extraction from energy harvesters using timing-based asynchronous digital circuits, Takeaki Yajima, Department of Electrical Engineering and Computer Science, Kyushu University, Fukuoka, Japan

T2.1.5 Smart mechatronics based on piezoelectric polymer energy harvesting, Takashi Nakajima, Department of Applied Physics, Faculty of Science, Tokyo University of Science, Tokyo, Japan

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Nano-constructs for Biosensing and Cellular Engineering

IS F1.2: 11:10-12:40
Friday, April 15, 2022
Location: RM 002

Session Chair: **Aram Chung**
Korea University

Description

This session introduces novel nanoparticles and nanodevices for biosensing and cellular engineering applications.

F1.2.1 Metal-organic framework nanoparticle-embedded functional platform to guide neural stem cell differentiation, Tae-Hyung Kim, School of Integrative Engineering, Chung-Ang University, Seoul, Korea

F1.2.2 Nanoparticles for Intracellular Glucose Monitoring, Yun Jung Heo, Department of Mechanical Engineering, Kyung Hee University, Gyeonggido, Korea

F1.2.3 Dielectrophoretic underwater capture and detection of ultra-low concentrated nanoparticles, Yong-Sang Ryu, Brain Science Institute, Korea Institute of Science and Technology (KIST), Seoul, 02792, Republic of Korea, KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul, 02841, Korea

F1.2.4 Plasmonic Nanostructures for Sensitive Molecular Sensing and High-Spatial Imaging, Inhee Choi, Department of Life Science, University of Seoul, Seoul, Korea

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Microneedles

IS F1.3: 11:10-12:40
Friday, April 15, 2022
Location: RM 003

Session Chair: **Zhihong Li**
Peking University

Description

Microneedles are able to penetrate into the tissue and offer great chances in various biomedical applications including transdermal drug delivery, stable bio-signal monitoring, sampling and bio-sensing. Owing to the micro-scale feature size, microneedles have advantages of minimal invasiveness, painlessness, high biosafety and simple operation. Our invited speakers will share their excellent research on materials, fabrication technologies and applications on various microneedles.

F1.3.1 Minimally invasive bioelectronics, Xi Xie, Sun Yat-sen University, China

F1.3.2 Microneedles for applications of biomedical engineering, Jingquan Liu, Shanghai Jiaotong University, China

F1.3.3 Silk microneedle patch capable of on-demand multidrug delivery to the brain for glioblastoma treatment, Tiger Hu Tao, SIMIT CAS, China

F1.3.4 Polycrystalline diamond-based microelectrodes for neurotransmitter sensing, Wen Li, Michigan State University, USA

F1.3.5 Microneedle based Nanoelectroporation for localized gene delivery in vivo, Lingqian Chang, Beihang University, China

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The Impact of Interdisciplinary Science

IS F1.4: 11:10-12:40
Friday, April 15, 2022
Location: RM 004

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

Description

The session is dedicated to providing a forum to discuss the latest developments in all areas of science and engineering, especially in fields of chemistry, chemical engineering, biomedical engineering.

F1.4.1 Triboelectric field-enabled switching structures in cholesteric liquid crystals for self-powered applications of information security and vision correction, 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, Hsinchu, Taiwan

F1.4.2 Microfluidic Analytical Systems for Disease Diagnosis, Chien-Fu Chen, Institute of Applied Mechanics at National Taiwan University, Taiwan

F1.4.3 The application of fungal polysaccharides on anti-cancer, Tung-Yi Lin, Institute of Traditional Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan, Program in Molecule Medicine, National Yang Ming Chiao Tung University, Taipei, Taiwan, Biomedical Industry Ph.D. Program, National Yang Ming Chiao Tung University, Taipei, Taiwan

F1.4.4 Single-molecule Analytical Platform for Nanoscience and Chemical/Biological Applications, Peng Zhang, Water Desalination and Reuse Center, Biological and Environmental Science and Engineering Division, King Abdullah University of Science and Technology, 23955, Thuwal, Saudi Arabia

F1.4.5 AI-Based Scanning Electrochemical Microscopy Image Fusion using Novel Soft Ultramicroelectrode, Tzu-En Lin, Dept of Electronics and Computer Engineering, Int. of Biomedical Engineering, National Yang Ming Chiao Tung University, Taiwan

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Advanced Nanotool for NEMS

IS F1.5: 11:10-12:40
Friday, April 15, 2022
Location: RM 005

Session Chair: Koji Sugano
Kobe University

Description

Nanotechnology researches have been developed on the foundations of nanotechnological tools such as electron microscopy, atomic force microscopy (AFM), and various other observation and analytical technologies. These are still developing and are expected to lead to novel nanotechnologies. The electron microscopy is used for not only observation but also manipulation of biomolecules. Its combination with MEMS enables novel characterization of nanoscale physics. The plasmonic nanostructures will also open up novel technologies for analyzing biomolecules. The novel AFM provides the capability of nanoscale resolution visualization and interaction measurements in liquids. In this

session, recent research activities on advanced nanotools are presented.

F1.5.1 Molecular Mixed Reality Using Nano Resolution Virtual Cathode Display, Takayuki Hoshino, Department of Mechanical Science and Engineering, Hirosaki University at Hirosaki, Japan

F1.5.2 MEMS Probes in Electron Microscope for Nanotribology], Tadashi Ishida, Department of Mechanical Engineering, Tokyo Institute of Technology, Kanagawa, Japan

F1.5.3 Manipulation and Detection of a Single DNA Oligomer using a Gold Nanoparticle Dimer, Koji Sugano, Department of Mechanical Engineering, Graduate School of Engineering, Kobe University, Japan

F1.5.4 Atomic-Scale Imaging of Surface and Interfacial Structures in Liquids by Frequency Modulation Atomic Force Microscopy, Naritaka Kobayashi, Department of Electronic Systems Engineering, School of Engineering, The University of Shiga Prefecture, Japan

F1.5.5 Development of Nanoendoscopy-AFM for Visualizing Intracellular Nanostructures of Living Cells, Keisuke Miyazawa, Faculty of Frontier Engineering, Kanazawa University, Ishikawa, Japan, Nano Life Science Institute (WPI-NanoLSI), Kanazawa University, Ishikawa, Japan

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Applications and Experimental Techniques for Economical Microfluidic Devices

IS F1.6: 11:10-12:40
Friday, April 15, 2022
Location: RM 006

Session Chair: **Wei-Hsin Tien**
National Taiwan University of Science and Technology

Description

As more microfluidic devices get commercialized and the market size grows, the need to reduce the fabrication and development cost of the microfluidic products also become important. In this invited session, five research works will be presented for applications and experimental techniques for cost-effective microfluidic devices. These studies range from novel applications in medical training, chemical sensing clinical diagnostic tools to instrumentation and experimental methods for design and build evaluations.

F1.6.1 Application of Advanced Manufacturing to Enhance the Quality of Clinical Neurosurgeon Training – Creation of Lifelike Brain Simulator, Yu-Wen, Yang, Pin-Chuan, Chen, Department of Mechanical Engineering, National Taiwan University of Science and Technology, 106 Taipei, Taiwan; Department of Neurological Surgery, Tri-Service General Hospital and National Defense Medical Center, 114 Taipei, Taiwan

F1.6.2 Development of a micro xuan-paper-based analytical device for chemical sensing, Noel A.S. Alvarado, Jose Lizama, Hsiu-Yang Tseng, Mechanical Engineering Department, National Taiwan University of Science and Technology, Taiwan

F1.6.3 A printed-circuit-board-based biosensing platform for point-of-care diagnostics, Yong-Ming Ye, Noel A.S. Alvarado, Hsiu-Yang Tseng, Mechanical Engineering Department, National Taiwan University of Science and Technologyy, Taiwan

F1.6.4 Post-processing schemes for temperature sensitive particles for thermal and flow visualization in microscopic flows, Wei-Hsin Tien, Shang-Yu Wu, Mechanical Engineering Department, National Taiwan University of Science and Technology, Taiwan

F1.6.5 Particle streak velocimetry and its applications in flow visualization of acoustofluidics Mumtaz Hussain Qureshi, Wei-Hsin Tien, Mechanical Engineering Department, National Taiwan University of Science and Technology, Taiwan

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Advanced Bioelectronics and Biointerfaces

IS F1.7: 11:10-12:40
Friday, April 15, 2022
Location: RM 007

Session Chair: **Huiliang Wang**
University of Texas at Austin

Description

Bioelectronics and Biointerfaces is a rapidly growing field that utilizes advanced materials and electronic systems to bidirectionally interface with biological systems. Such bioelectronic systems can be applied not only for deeper understanding of basic brain functions but also for enhanced diagnostics, monitoring and therapeutics in human disease. In this session, we will have five invited speakers to discuss about the design of advanced nanomaterials, organic materials, device fabrication strategies for improved bio-interfacing capability.

F1.7.1 Multifunctional Integrated Nanoelectronics for the Brain, Hui Fang, Thayer School of Engineering, Dartmouth College, Hanover, NH, USA

F1.7.2 Seeing the Sound: Wireless Neural Interfaces for In Vivo Neuromodulation, Guosong Hong**,** Department of Materials Science and Engineering, Stanford University, CA, USA., Wu Tsai Neurosciences Institute, Stanford University, CA, USA

F1.7.3 Smart Textiles for Personalized Health Care, Jun Chen, Bioengineering Department, University of California at Los Angeles, CA, USA

F1.7.4 Skin-Interfaced Wearable Biosensors, Wei Gao, *Senior member,* Andrew and Peggy Cherng Department of Medical Engineering, California Institute of Technology, Pasadena, CA 91125, USA

F1.7.5 Design of Advanced Wearable EEG Electrodes for Brain-Computer Interface, Huiliang Wang**,** Department of Biomedical Engineering, University of Texas at Austin, Austin, TX 78712, USA

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Microfluidic Platforms for Cell Manipulation and Biomarker Detection

IS F2.2: 12:50-14:20
Friday, April 15, 2022
Location: RM 002

Session Chair: **Ting-Hsuan Chen**
City University of Hong Kong

Description

Leveraging the microfluidics enables unprecedented accessibility for research in the small scale. In this invited session, we provide a venue for discussing an array of micro/nano devices with factors ranging from fluidic, optic, and nanomaterials for investigation of biological research such as cell manipulation and biomarker detection. It is anticipated to bring inspiration propelling research with new perspectives.

F2.2.1 A Novel Photo-Responsive Surfactant for Droplet Microfluidics, Guangyao Cheng[1], To Ngai[2], Yi-Ping Ho[1]
[1]Department of Biomedical Engineering, The Chinese University of Hong Kong, Hong Kong
[2]Department of Chemistry, The Chinese University of Hong Kong, Hong Kong

F2.2.2 Predicting Cell Cycle of Live Cells in Detachable Microfluidics with Mask Regional Convolutional Neural Networks, Hsieh-Fu Tsai, Department of Biomedical Engineering, Chang Gung University, Taiwan

F2.2.3 The microfluidic system integrating surface-enhanced Raman spectroscopy for antimicrobial susceptibility testing, Nien-Tsu Huang, Department of Electrical Engineering & Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University, Taiwan

F2.2.4 Efficient fabrication of monodisperse hepatocyte spheroids and encapsulation in hybrid hydrogel with controllable extracellular matrix effect, Hon Fai Chan, Institute for Tissue Engineering and Regenerative Medicine & School of Biomedical Sciences, The Chinese University of Hong Kong, Hong Kong

F2.2.5 Microfluidic Particle Dam for Direct Visualization of SARS-CoV-2 Antibody Levels in COVID-19 Vaccinees, Ting-Hsuan Chen, Department of Biomedical Engineering, City University of Hong Kong, Hong Kong

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Wearable and Implantable NanoEnergy and NanoSystem (NENS)

IS F2.3: 12:50-14:20
Friday, April 15, 2022
Location: RM 003

Session Chair: **Chengkuo Lee**
National University of Singapore

Description

Wearable, flexible and implantable electronics have been developed as self-powered and self-sustained nanosystems with diversified applications, such as human motions sensing, environmental monitoring, healthcare monitoring, therapy, rehabilitation, human-machine interfaces, and factory automation. The future development of NanoEnergy and NanoSystems (NENS) will change the research landscape of wearable and implantable electronics. This invited session presents you the leading works in this area.

F2.3.1 Self-powered Medical Devices and Electrical Stimulation Therapy, Zhou LI, Beijing Institute of Nanoenergy and Nanosystems, University of Chinese Academy of Sciences, Beijing, China

F2.3.2 Optical Transduction Mechanism Towards Self-Powered Soft Pressure and Strain Sensors, Inkyu Park, Korea Advanced Institute of Science and Technology (KAIST), Korea

F2.3.3 Advanced Multimaterial Fibers: Structure-Enabled Self-Powered Functionalities, Lei Wei, Nanyang Technological University, Singapore

F2.3.4 Self-driven Nanomaterials, Devices and Systems for Healthcare and Environmental Applications, Zong-Hong Lin, National Tsing Hua University, Hsinchu, Taiwan

F2.3.5 From triboelectric nanogenerators and electronic skins to actively-perceiving soft robots and autonomous flexible applications, Ying-Chih Lai, National Chung Hsing University, Taiwan

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Translational Advances in Micro-, Nano- and Digital Medicine

IS F2.4: 12:50-14:20
Friday, April 15, 2022
Location: RM 004

Session Chairs: **Edward Kai-Hua Chow**
Agata Blasiak
National University of Singapore

Description

Innovations in biomedical engineering have led to unprecedented translational advances in a range of clinical applications, from cancer treatment to diabetes management. These innovation presented here encompass the development of micro-, nano- and digital medicine to address the most pressing medical problems of our time.

F2.4.1 Immuno-modulatory Therapeutic Delivery Systems, Dang Thuy Tram, Nanyang Technological University, Singapore

F2.4.2 Development of microneedle-based skin patch for transdermal glucose sensing, Xu Chenjie, City University of Hong Kong, Hong Kong

F2.4.3 CURATE.AI – small data, AI-derived platform for optimizing personalized healthcare, Agata Blasiak, National University of Singapore, Singapore

F2.4.4 Turning tumors from cold to hot using RIG-I agonists delivered by extracellular vesicles, Minh Le, National University of Singapore, Singapore

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NEMS Emerging Applications

IS S1.1: 10:30-12:00
Saturday, April 16, 2022
Location: RM 001

Session Chair: **Mark Cheng**
The University of Alabama

Description

Micro/nano microsystems have found many applications in recent years. In this section, the invited speakers will discuss on-going research in their research group, including label-free detection (called SHRED) for water-in-oil droplet systems, to 3D printed microfluidic microfluidic, and to microplastic detection based on computer vision and machine learning. The section will also cover quantum computer connectors using electrodeposited superconductor and parity-time symmetric wireless sensing for biomedical device.

S1.1.1 Chemical Detection in Droplets using the Stagnant-Cap Hydrodynamic Retardation Effect Detector (SHRED), Amar S. Basu**,** Electrical and Computer Engineering and Biomedical Engineering Wayne State University, Detroit MI, USA

S1.1.2 Monolithically 3D-Printed Microfluidics with Wirelessly-Driven Boundary Layer Pump, Joe Fujiou Lo, Mechanical Engineering Department, University of Michigan at Dearborn, MI, USA

S1.1.3 Microfluidic for In-line Microplastic Detection, Mark Cheng**,** Professor, Electrical and Computer Engineering**,** The University of Alabama, Tuscaloosa, AL, USA

S1.1.4 Electrodeposited Superconductor Thin Films for the Fabrication of Quantum Computer Connectors, Qiang Huang**,** Department of Chemical and Biological Engineering, University of Alabama, Tuscaloosa, AL, USA

S1.1.5 Higher-Order PT-Symmetric Telemetry for Wireless Microsensors, Pai-Yen Chen, Department of Electrical and Computer Engineering, University of Illinois at Chicago, IL, USA

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Micro-/nano-structure-enabled Sensors

IS S1.2: 10:30-12:00
Saturday, April 16, 2022
Location: RM 002

Session Chair: **Faheng Zang**
Shanghai Jiao Tong University

Description

Micro- and nano-scale structures and fabrication technology are increasingly used in creation of high-performance and multi-functional sensor platforms for health. These micro-/nano-structures-integrated sensors require minimal amount analyte, benefit from the high-surface-area sensing probes and exhibit ultra-high sensitivity. Researchers around the global are invited to this session to discuss micro-/nano-structures and advanced fabrication technologies. The topics include microneedles, CNT-modified electrochemical sensors, nanostructured receptors and transducers, 3D nanofabrication, and nanostructured-Si microcantilevers, as well as their applications in sensing.

S1.2.1 Microneedle fabrication and applications, Bo Cui, Department of Electrical & Computer Engineering, University of Waterloo, Waterloo, Ontario, Canada

S1.2.2 Electrochemical sensing of biomolecules using carbon nanotube nanocomposites modified electrodes, Xiaoxue Xu[1], Wei Zheng[2]
[1]School of Biomedical Engineering, Faculty of Engineering and Information Technology, University of Technology Sydney, Ultimo, 2007, NSW, Australia
[2.]Institute of Corrosion Science and Surface Technology, College of Materials Science and Chemical Engineering, Harbin Engineering University, Harbin 150001, China

S1.2.3 Versatile biosensing enabled by nanostructured transducers and receptors, Faheng Zang, Department of Micro/Nano Electronics, Shanghai Jiao Tong University, Shanghai, China

S1.2.4 3-D Nanofabrication and Nanostructure Fine-tuning via Helium Ion Microscope, Huan Hu, ZJU-UIUC Institute, International Campus, Zhejiang University, Haining, Zhejiang Province, China., State Key laboratory of Fluidic Power & Mechanical Systems, Zhejiang University, Hangzhou, China

S1.2.5 Nanostructured-Silicon Microcantilever Resonators for Multifunctional Sensing Applications, Jiushuai Xu, Institute of Semiconductor Technology (IHT), TU Braunschweig, Braunschweig, Germany, Laboratory for Emerging Nanometrology (LENA), TU Braunschweig, Braunschweig, Germany

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Advanced Micro/Nano Photonics Technology

IS S1.3: 10:30-12:00
Saturday, April 16, 2022
Location: RM 003

Session Chair: **Guo-En Chang**
National Chung Cheng University

Description

Micro-nano photonics have long being important technologies for miniaturizing optical systems and enabling various applications including communications, computing, and sensing. This invited section provides a forum for researchers to discuss the cutting-edge research in micro/nano photonics technologies for a wide range of applications.

S1.3.1 Bio-Intelligent Lasers for Healthcare Applications, Yu-Cheng Chen, School of Electrical and Electronics Engineering, School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore

S1.3.2 Nanostructured Inorganic Semiconductors for Advanced Optoelectronics, Munho Kim, School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore

S1.3.3 Integrated on-chip nanolasers based on solution-processed perovskite quantum dots, Ya-Lun Ho, University of Tokyo, Japan

S1.3.4 Plasmonic-enhanced Terahertz Tomography, Shang-Hua Yang, Department of Electrical Engineering, National Tsing Hua University, Taiwan

S1.3.5 Fabrication of Photodetectors Based on Low-Dimensional Materials, Wei-Chen Tu, Department of Electrical Engineering, National Cheng Kung University, Tainan, Taiwan

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Biomaterials and Biosensors in Biomedical Application

IS S1.4: 10:30-12:00
Saturday, April 16, 2022
Location: RM 004

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

Description

In recent years, a great deal of focus has been aimed to engineer biomaterial-based cues, both at the micro/nano scales, and biosensors with applied perspectives for target

applications in different bio- and non-bio sectors of the modern world. The key scientific advancements in biomedical area, have presented next generation concepts related to biomaterials. Use of properly designed and structured materials, allows for the development well-defined sensing prototype that supports a series of directed events. For these reasons, we are pleased to launch the invited session and the issue is focused on "biomaterials and biosensors in biomedical application".

S1.4.1 The effect of cyclic mechanical stretch on the 3D culture model of lung cancer cells, Yi-Chiung Hsu, Department of Biomedical Sciences and Engineering, National Central University, Taiwan.

S1.4.2 Surface Properties of Nanoparticles Influencing its distribution in eye, Ching-Li Tseng Graduate Institute of Biomedical Materials & Tissue Engineering, Taipei Medical University, Taipei, Taiwan

S1.4.3 Phase-Dependent MoS2 Nanoflowers as Light-Activated Antibacterial Agents, Tsung-Rong Kuo, Graduate Institute of Nanomedicine and Medical Engineering, College of Biomedical Engineering, Taipei Medical University, Taipei, Taiwan

S1.4.4 Phototherapeutic performances of functional biomaterials, Er-Yuan Chuang, Graduate Institute of Biomedical Materials & Tissue Engineering, Taipei Medical University, Taiwan

S1.4.5 Biosensing platforms with nanostructure surface plasmon resonance for nuclear acid sensing and immunosensing, Yu-Jui Fan, Member, School of Biomedical Engineering, Taipei Medical University, Taiwan

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Micro/Nano Biosensing Technologies: From Diseases Diagnostics to Health Monitoring

IS S1.5: 10:30-12:00
Saturday, April 16, 2022
Location: RM 005

Session Chair: **Tak-Sing Wong**
The Pennsylvania State University

Description

Detection and diagnosis of critical diseases such as cancer and infectious diseases rely on the ability to detect biological signatures at the cellular and molecular levels. Advancements in micro- and nanotechnologies allow us to detect, monitor, and quantify these biological signatures with unprecedented sensitivity and speed. In this session, we will sample through some of the state-of-the-art biosensing technologies using advanced micro/nanotechnologies ranging from single cell biosensors for cancer study to protein-based biosensors for COVID-19 diagnostics to advanced non-invasive health monitoring.

S1.5.1 Ultrasensitive Biomolecular Detection Enabled by Pitcher-Plant-Inspired Slippery Surfaces, Tak-Sing Wong, Department of Mechanical Engineering and the Materials Research Institute, The Pennsylvania State University, PA, USA., Convergence Center for Living Multifunctional Material Systems, The Pennsylvania State University, PA, USA

S1.5.2 Targeting Bladder Cancer Heterogeneity by Single Cell Biosensors, Pak Kin Wong, Department of Biomedical Engineering, Mechanical Engineering and Surgery, The Pennsylvania State University

S1.5.3 Modifying Paper's Wicking Properties for Microfluidic Paper-Based Sensors, Hideaki Tsutsui, Departments of Mechanical Engineering and Bioengineering, Stem Cell Center, University of California Riverside, USA

S1.5.4 Magneto-Immunoassays for Rapid, High Sensitivity Quantification of Protein Biomarkers, Peter B. Lillehoj, Department of Mechanical Engineering, Rice University, Houston, TX, USA., Department of Bioengineering, Rice University, Houston, TX, USA

S1.5.5 Plenty of Room Under the Skin: A Wearable's Perspective, Sheng Xu, Department of Nanoengineering, University of California, San Diego, USA

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NEMS for Human Sensing

IS S1.6: 10:30-12:00
Saturday, April 16, 2022
Location: RM 006

Session Chair: **Hiroyuki Kudo**
Meiji University

Description

In this session, highly active Japanese researchers will introduce the latest research status from fundamentals to applications of human sensing, which is accelerating toward a post-pandemic. We focused on non-invasive and minimally invasive biomonitoring for human sensing.

S1.6.1 Bioelectrical Interfaces for Enzyme-Free Biosensors, Toshiya Sakata, Department of Materials Engineering, School of Engineering, The University of Tokyo, Tokyo, Japan

S1.6.2 Minimally Invasive Microperfusion System for Measurement of Subepidermal Biological Substances, Noriko Tsuruka, Graduate School of Engineering, Tohoku University, Miyagi, Japan

S1.6.3 Sensing Your Mind by Wearable Devices: a Challenge of Neuroengineering for Human Well-being, Yumie Ono, Health Science and Medical Engineering Laboratory, Meiji University, Kawasaki, Japan, Department of Electronics and Bioinformatics, School of Science and Technology, Meiji University, Kawasaki, Japan

S1.6.4 Conformal Printings for Stress-Free Human Monitoring: Sensor Elements Blended with the Environment, Ken-ichi Nomura, Sensing System Research Center, National Institute of Advanced Industrial Science and Technology, Tsukuba, Japan

S1.6.5 Non-invasive Biosensing Systems for Personal Health Recording, Hiroyuki Kudo, Department of Electronics and Bioinformatics, School of Science and Technology, Meiji University, Kawasaki, Kanagawa, Japan

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Engineering-Based Microphysiological System (MPS): From Fundamentals to Commercial Applications

IS S1.7: 10:30-12:00
Saturday, April 16, 2022
Location: RM 007

Session Chair: **Ryuji Yokokawa**
Kyoto University

Description

Microphysiological system (MPS) is recognized as a microfluidic chip that replicate patho/physiologically relevant cell culture environment toward the evaluation of numerus candidate drugs. Focus of engineering-based researchers in MPS are widely ranging from fundamental academic research to commercial applications: To develop a novel assay platform for understanding biological questions, to develop a prototype for commercialization and to implement industrial use by bridging end users in a regulatory context. Speakers in this session will introduce recent activities of MPS in Japan.

S1.7.1 Microphysiological Systems (MPS) Based-on Microfluidic Devices for Commercialization, Hiroshi Kimura[1,2]
[1]Department of Mechanical Engineering, School of Engineering, Tokai University, Kanagawa, Japan
[2]Micro/Nano Technology Center, Tokai University, Kanagawa, Japan

S1.7.2 Reverse Bioengineering of Living Systems for Drug Discovery, Ken-ichiro Kamei, Institute for Integrated Cell-Material Sciences (WPI-iCeMS), Kyoto University, Kyoto, Japan

S1.7.3 Co-culturing of Epithelial and Endothelial Tissues in Microfluidic Devices Toward SARS-CoV-2 Analysis, Kazuya Fujimoto, Department of Micro Engineering, Kyoto University, Japan

S1.7.4 A Triculture Model of the Blood-Brain Barrier for Assessing the Effect of Cell-Cell Interactions on Barrier Integrity, Kennedy Omondi Okeyo[1,2], Ryutaro Tamai[2], and Taiji Adachi[1,2]
[1]Institute for Frontier Life and Medical Sciences, Kyoto University, Kyoto, Japan
[2]Department of Micro Engineering, Kyoto University, Kyoto, Japan

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Microstructure Engineering and Applications

IS S2.2: 12:10-13:40
Saturday, April 16, 2022
Location: RM 002

Session Chair: **Chia-Wen Tsao**
Engineering, National Central University

Description

Micro- or nano-structure engineering enables broad rang applications. In this invited section, we demonstrate various microstructure engineering techniques to create microchannel, liquid lens or liquid metal coil. And their application towards to biological, optical or energy engineering.

S2.2.1 Miniature Power Generation System Integrated with a Liquid Metal Coil Array, Shih-Jui Chen, Department of Mechanical Engineering, National Central University, Taiwan

S2.2.2 Laser Nanotexturing by Micro Liquid Lenses and Material Melting, Yuan-Jen Chang, Department of Mechanical Engineering, National Yunlin University of Science and Technology, Taiwan

S2.2.3 The Study of the Microfluidics Flow Controlled Modes in the Runner of the Platform, Yao-Tsung Lin, Department of Mechanical Engineering, Chien Hsin University of Science and Technology, Taiwan

S2.2.4 Rheotaxis and Unsteady Migration of Unicellular Alga Flowing in a Microchannel, Cheng-Hsi Chuang, Department of Mechanical and Mechatronic Engineering, National Taiwan Ocean University, Keelung, Taiwan

S2.2.5 Using Stereolithography 3D printing to Manufacture Three-Dimensional Paper-Based Microfluidic Devices for Efficient Chemical Mixing and Biodetection, Pin-Chuan Chen, Department of Mechanical Engineering National Taiwan University of Science and Technology, Taiwan.

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Micro/Nano Fluidics

RS T2.2: 12:50-14:20
Thursday, April 14, 2022
Location: RM 002

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

T2.2.1 Microfluidic Paper-Based Colorimetric System for Simultaneous Multi-Time Nitrite Detection in Foods, Zong-Xiao Cai, Ya-Ju Chuang and junan kuo, National Formosa University, National Taiwan University Hospital Yunlin Branch

T2.2.2 Alginate Hydrogel Microcapsules Produced by Coaxial Electrohydrodynamic Method, Zixuan Song, Zhihai Wang, Xi Chen, Jingang Gui and Yaohong Wang, Beijing University of Technology, Beijing Children's Hospital, Tianjin University

T2.2.3 Exploring the Change of Ion Current Under the Crowded Condition of Macromolecules Based on Nanopores, Hongluan Li, Xun Yao, Wei Xu, Haiyan Wang and Jingjie Sha, School of Mechanical Engineering, Southeast University

T2.2.4 Screening of Short Single- and Double-stranded DNA Molecules Using Silicon Nitride Nanopores, Chaochao Wang, Zengdao Gu, Yin Zhang and Jingjie Sha, School of Mechanical Engineering, Southeast University

T2.2.5 Quantitative Hematocrit Measurement on a Paper Microfluidic Chip Pretreated by Sodium Chloride, Zhiqing Xiao, Zitao Feng, Yuqian Yang, Zejingqiu Chen, Lexin Sun, Rongkai Xu, Ruoqi Zeng and Weijin Guo, Shantou University

T2.2.6 Reversal of Nanopore Ion Selectivity Due to Transport-Induced-Charge Phenomena, Haoyu Wang, Zhixuan Wang, Hirofumi Daiguji and Wei-Lun Hsu, The University of Tokyo

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Micro/Nano Electro-Mechanical Systems I

RS T2.3: 12:50-14:20
Thursday, April 14, 2022
Location: RM 003

Session Chair: **Cheng-Hsin Chuang**
National Sun Yat-sen University

T2.3.1 High-sensitive Flexible Temperature Sensor with PEDOT: PSS Composites and PI Substrate for Human Body Monitoring, Zhengfang Zhu, Yi Su, Jing Chen, Lin Li, Lei Wang and Hui Li, Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences

T2.3.2 Ultrathin Si NEMS Resonators for Gas Sensing with Ultrahigh Sensitivity, Wei Yu, Amit Banerjee, Yoshikazu Hirai, Jun Hirotani and Toshiyuki Tsuchiya, Kyoto University, Kyoto University

T2.3.3 A Fully 3D Printed Accelerometer for Movement Monitoring Applications, Guandong Liu, Zhejiang University

T2.3.4 Diaphragms Functionalized with Nanogranular Tunneling Resistors for Pressure Sensing in Cardiovascular Implants, Ann-Kathrin Klein, Claus J. Burkhardt, Alexander Kaya and Andreas Dietzel, Technische Universität Braunschweig, Institute of Microtechnology, NMI Natural and Medical Sciences Institute at the University of Tübingen, NanoScale Systems, Nanoss GmbH

T2.3.5 An Impedance Flow Cytometer Chip with Tunable Impedance Responses for High Sensitive Cellular Biomarker Detection, Mu Chen, Southeast University

T2.3.6 Self-Powered Triboelectric Pressure Sensors Without Environmental and User Effect by Spike-Based Communication, Chankyu Han, Jungrak Choi and Inkyu Park, Korea Advanced Institute of Science and Technology

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Molecular Sensors, Actuators & Systems I

RS T2.4: 12:50-14:20
Thursday, April 14, 2022
Location: RM 004

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

T2.4.1 A PVDF/PET Flexible Piezoelectric Actuator Array Based on Row/Column Addressing Scheme, Dengfei Yang, Shuo Ding and Fangyi Ma, Advanced Institute of Information Technology, Peking University, National University of Singapore, Shaoxing Vocational & Technical College

T2.4.2 Dual-Mode Arduino-Based Cmos-Mems Magnetic Sensor System with Self-Calibration for Smart Building'S Energy Monitoring, Hadi Tavakkoli, Izhar, Mingzheng Duan, Xu Zhao, Reshmi Waikho, Lung-Jieh Yang and Yi-Kuen Lee, Department of Mechanical and Aerospace Engineering, The Hong Kong University of Science and Technology, Department of Mechanical and Electro-Mechanical Engineering, Tamkang University

T2.4.3 Scaling Analysis and Identification of Critical Dimensions of CMOS Compatible Micro Search-Coil Magnetometers for Internet of Things Application, Hadi Tavakkoli, Xu Zhao, Izhar, Mingzheng Duan and Yi-Kuen Lee, The Department of Mechanical and Aerospace Engineering, The Hong Kong University of Science and Technology, College of Civil Engineering & Mechanics, Xiangtan University, China

T2.4.4 Analysis of Single BSA Protein Molecules Using MoS2 Nanopores, Chaoming Gu, Zhoubin Yu, Xiaojie Li, Xin Zhu, Zhen Cao, Zhi Ye, Chuanhong Jin and Yang Liu, Zhejiang University

T2.4.5 Detection of Molecules Based on Enhanced Backscattering Effect in Microsphere Lens, Pengcheng Zhang, Guoqiang Gu, Zitong Yu, Xi Chen, Xiaoqin Huo, Lin Zeng, Yuye Wang, Yi Zhang and Hui Yang, SIAT Shenzhen

T2.4.6 Development of Oxygen Sensor in Humid Hydrogen Background based on Metal Oxide and Machine Learning Algorithm, Yeongjae Kwon, Kichul Lee, Mingu Kang and Inkyu Park, Korea Advanced Institute of Science and Technology

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Nanobiology / Nanomedicine

RS T2.5: 12:50-14:20
Thursday, April 14, 2022
Location: RM 005

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

T2.5.1 Preliminary Experiment Results on Dog Breath Analysis Using the MEMS Micropreconcentrator, Sang-Seok Lee, Junya Maeda, Tomoaki Kageyama, Yusuke Murahata, Tadao Matsunaga and Yoshiharu Okamoto, Tottori University

T2.5.2 A Microfluidic System for Methylated BRCA1 Detection from Cell-Free DNA By Utlizing a Novel Aptamer-Based Assay, Chih-Hung Wang, Yu-Jen Cheng, Keng-Fu Hsu and Gwo-Bin Lee, Department of Power Mechanical Engineering, National Tsing Hua University, Department of Obstetrics Gynecology, National Cheng Kung University

T2.5.3 Real-time Tracking of Living Cell Proliferation with Nano Mechanical Biomarkers, Yuxuan Xue, Mukun Zhang, Xinyu Liu, Ye Ma and Ning Xi, The University of Hong Kong

T2.5.4 Dynamic Mechanical Response of Adenovirus Infected Living Single Cell and UVC Irradiation Disinfection Effects, Yuxuan Xue, Mukun Zhang, Xinyu Liu, Ye Ma and Ning Xi, The University of Hong Kong

T2.5.5 Development of a Microfluidic Device Integrated with a Membrane Emulating Air-blood Barrier for Lung-on-a-chip Applications, Gulsim Kulsharova, Perizat Kanabekova and Bereke Dauletkanov, Nazarbayev University

T2.5.6 High Frequency Ti3C2Tx NEMS Resonators, Bo Xu, Jiankai Zhu, Fei Xiao, Na Liu, Yachun Liang, Hujie Wan, Xu Xiao and Zenghui Wang, University of Electronic Science and Technology of China

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Nanomaterial Based Devices and Systems I

RS T2.6: 12:50-14:20
Thursday, April 14, 2022
Location: RM 006

Session Chair: **Hsieh-Fu Tsai**
Chang Gung University

T2.6.1 Size-Based Sorting of Extracellular Vesicles Via Optically-Induced Dielectrophoresis on A Microfluidic Chip, Wei-Jen Soong, Yi-Sin Chen and Gwo-Bin Lee, National Tsing Hua University

T2.6.2 Fast Synthesis of Gold Nanotriangles Using Glass Microfluidic Device, Mao Hamamoto and Hiromasa Yagyu, Kanto Gakuin University

T2.6.3 Self-powered Vibration Detector for the Intelligent Vibration Control System Based on Triboelectric Nanogenerator, Ruixue Sun, Zeyu Liu, Fenqiang Liu, Yonghao Zhang, Honghui Zhang, Lei Xie and Changrong Liaoy, Chongqing University

T2.6.4 Simultaneous Generation and Delivery of Neutral Polymeric Aerosol by Electro-Hydrodynamic Nebuliser, Trung-Hieu Vu, Jarred W. Fastier-Wooller, Tuan-Hung Nguyen, Canh-Dung Tran, Dzung Viet Dao and Van Thanh Dau, School of Engineering And Built Environment, Griffith University,

Queensland, Australia, Departmen of Aerospace Engineering, University of Ulsan, Ulsan, Republic of Korea, School of Electrical Engineering And Robotics, Queenslan University of Technology, Brisbane, Queensland, Australia, University of Engineering And Technology, Vietnam National University, Hanoi, Vietnam, School of Engineering And Built Environment, Griffith University, Australia, Centre of Catalysis And Clean Energy, Griffith University, Australia

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CM Ho Best Paper Competition

RS F1.1 11:10-12:40
Friday, April 15, 2022
Location: RM 001

Session Chair: **Pak Kin Wong**
Pennsylvania State University
Session Chair: **Aaron Ohta**
University of Hawaii

F1.1.1 Robotic Printed Combinatorial Droplet (RoboDrop) for Antibiotic Combination Screening, Fangchi Shao, Hui Li, Kuangwen Hsieh, Pengfei Zhang and Tza-Huei Wang, Johns Hopkins University

F1.1.2 Detection of Nanoparticles in A Minute Sample Using the Vibration Induced Flow, Kanji Kaneko, Mamiko Tsugane, Taku Sato, Takeshi Hayakawa, Yosuke Hasegawa and Hiroaki Suzuki, Chuo University, The University of Tokyo

F1.1.3 Facile Wettability-Patterned Flexible Surface for Multifunctional Microdroplet Array Manipulation, Hao Chen, Dachao Li and Xiaoping Li, Tianjin University

F1.1.4 Dielectrophoresis-Based Blood Plasma Extraction Using Two-Layer Conducting-Pdms Microelecrodes, Junwang Liu, Penghui Shen, Duli Yu and Xiaoxing Xing, Beijing University of Chemical Technology

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Best Conference Paper Competition

RS F2.1 12:50-14:20
Friday, April 15, 2022
Location: RM 001

Session Chair: **Pak Kin Wong**
Pennsylvania State University
Session Chair: **Aaron Ohta**
University of Hawaii

F2.1.1 Nanowell-based Nano/Micropolarizer Array Biochip for Super-Resolution Imaging, Hsin-Yi Hsieh, Chung-Hao Lin, Po-Chou Chen, Wei-Ko Wang and Chin-Chuan Hsieh, VisEra Technologies Company Limited

F2.1.2 The Influence of Substrate Microstructures on the Fluorescent Intensity Profile, Size, Roundness, and Coffee Ring Ratio of Protein Microarray Spots, Weijin Guo, Lluisa Vilaplana, Jonas Hansson, M.-Pilar Marco and Wouter van der Wijngaart, Shantou University, Institute for Advanced Chemistry of Catalonia (IQAC-CSIC), KTH Royal Institute of Technology

F2.1.3 Data Analysis Platform for Nanobubble Characterization of Solid-state Nanopores, Soumyadeep Paul, Yuichiro Hanada, Bluest Lan, Hirofumi Daiguji, Kuo-Ching Liang and Wei-Lun Hsu, The University of Tokyo, National Taiwan University, Keio University

F2.1.4 Aluminum Oxide-Coated Particle Differentiation Employing Supervised Machine Learning and Impedance Cytometry, Brandon Ashley, Jianye Sui, Mehdi Javanmard and Umer Hassan, Rutgers, the State University of New Jersey

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Micro/Nano Electro-Mechanical Systems II

RS F2.5 12:50-14:20
Friday, April 15, 2022
Location: RM 004

Session Chair: Cheng-Hsin Chuang
National Sun Yat-sen University

F2.5.1 Fuzzy sliding-mode control of the electrostatically tuned quasi-zero stiffness MEMS accelerometer, Ziyi Ye, Zhipeng Ma, Yixuan Guo, Yiming Jin, ZTF, Xudong Zheng and Zhonghe Jin, Zhejiang University

F2.5.2 A Novel Piezoresistive Transducer for Bulk Mode Mems Resonator, Yupeng Tian, Haoshen Zhu and Quan Xue, South China University of Technology

F2.5.3 Design and Simulation of a Resettable MEMS Safety and Arming Device, Xiaoyu Kong, Yun Cao, Hengbo Zhu, Haotian Liu, Weirong Nie and Zhanwen Xi, Nanjing University of Science and Technology

F2.5.4 A Linear Model for Multiple Degree-Of-Freedom Weakly Coupled Resonators Based Accelerometers, Boyi Zhu, Jiayue Lou, Li Tang and Zhipeng Ma, Zhejiang University

F2.5.5 Temperature Drift Compensation of a Tuned Low Stiffness Mems Accelerometer Based on Double-Sided Parallel Plates, Tengfei Zhang, Zhipeng Ma, Yiming Jin, Ziyi Ye, Xudong Zheng and Zhonghe Jin, Zhejiang University

F2.5.6 Demonstration of Production of Pull-In Cancellation Voltage Generated by Electret-Based Vibrational Energy Harvester and Cockcroft-Walton Voltage Multiplier, Hiroaki Honma, Shota Harada and Hiroshi Toshiyoshi, The University of Tokyo

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Best Student Paper Competition

RS S2.1 12:10-13:40
Saturday, April 16, 2022
Location: RM 001

Session Chair: **Pak Kin Wong**
Pennsylvania State University
Session Chair: **Aaron Ohta**
University of Hawaii

S2.1.1 Highly Sensitive Flexible Capacitive Pressure Sensor Based on Bionic Hybrid Microstructures, Lin Li, Jing Chen, Zhengfang Zhu, Zebang Luo, Nian Zhou, Yuewu Tan, Lei Wang and Hui Li, Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences

S2.1.2 Design Analysis of Capacitive Micromachined Ultrasonic Transducers, Kendalle Howard, Lucrecia Ramirez, Byoung Hee You and In-Hyouk Song, Texas State University, Lone Star College

S2.1.3 Synthesis and Immobilization of Silver Nanoparticles on Filter Paper and Surgical Masks for Antimicrobial Applications, Hammad Arshad, Saima Sadaf and Umer Hassan, School of Biochemistry & Biotechnology, University of the Punjab, Rutgers the State University of New Jersey

S2.1.4 2.5-dimensional insect-mimetic wing model for flapping wing nano air vehicles and design window search for manufacturable solutions using polymer micromachining, Vinay Shankar, Ryunosuke Matsuo, Minato Onishi and Daisuke Ishihara, Kyushu Institute of Technology

S2.1.5 Stem-FIT: a Microneedle-based Multi-parametric Sensor for In Situ Monitoring of Salicylic Acid and pH Levels in Live Plants, Nafize I. Hossain and Shawana Tabassum, The University of Texas at Tyler

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Molecular Sensors, Actuators, & Systems II

RS S2.3 12:10-13:40
Saturday, April 16, 2022
Location: RM 003

Session Chair: **Sanket Goel**
Birla Institute of Technology & Science
Pilani, Hyderabad Campus

S2.3.1 Enhanced Non-Enzymatic Microfluidic Biofuel Cells to Continuously Self-Power Bio-devices, Sanket Goel, Birla Institute of Technology & Science Pilani, Hyderabad Campus

S2.3.2 A Needle-Type Sensor Fabricated on a 32 Guage Needle for the Measurement of 1D Partial Pressure of Oxygen Distribution, Bokyung Seo, Jaeho Park and Inkyu Park, Korea Advanced Institute of Science and Technology

S2.3.3 Influence of Electrode Duty Factor on the Performance of Lamb-Wave AlN Resonators on SOI Substrate, Haichao Cao and Hao Ren, School of Information Science and Technology, ShanghaiTech University

S2.3.4 A Deep Learning Assisted Smartphone Platform for Screening of Alzheimer's Disease Using a Microfluidic Paper-based Analytical Device, Sixuan Duan, Tianyu Cai, Ziren Xiao, Xinheng Wang, Xi Yang, Jia Zhu and Pengfei Song, Xi'an Jiaotong - Liverpool University, Suzhou City University

S2.3.5 Impact of Aperture on the Performance of AlN Lamb Wave Resonators on SOI substrate, Zhihao Li, Yunping Niu and Hao Ren, ShanghaiTech University, School of Information Science and Technology

S2.3.6 Enhanced Dna Binding Detection on Dense Particle Packed Microreactor Array, Wenrui Zhang, Dachao Li and Xiaoping Li, Tianjin University

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Micro/Nano Fluidics and Fabrication

RS S2.4 12:10-13:40
Saturday, April 16, 2022
Location: RM 004

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

S2.4.1 Deep Learning Assisted Ultra-Accurate Smartphone Testing of Paper-Based ELISA Assays, Sixuan Duan, Tianyu Cai, Ziren Xiao, Jia Zhu, Xinheng Wang, Xi Yang and Pengfei Song, Xi'an Jiaotong - Liverpool University, Suzhou City University

S2.4.2 Transport-Induced-Charge Distribution Near the Entrance of an Ultrathin Nanopore, Zhixuan Wang, Wei-Lun Hsu and Hirofumi Daiguji, Zhejiang University

S2.4.3 Applying Hybrid Bonding Technique to Manufacture a Peristaltic Micropump with Extremely High Flow Rate, Tuan Ngoc Anh Vo, Pin-Chuan Chen and Yu-Hsiang Chen, Department of Mechanical Engineering, National Taiwan University of Science and Technology

S2.4.4 3D Alkali Vapor Cell with Vertical Sidewalls, Jin Zhang, Jianfeng Zhang and Jintang Shang, The Key Laboratory of MEMS of the Ministry of Education, Southeast University

S2.4.5 Facile Fabrication of Silk/Off-stoichiometry Thiol-ene (OSTE) Microneedle Patches, Yuqian Yang, Zhiqing Xiao, Lexin Sun, Zitao Feng, Zejinqiu Chen and Weijin Guo, Shantou University

S2.4.6 Fabrication of Solid Microneedle using Multi-slit Diffraction UV Lithography, Jun Ying Tan, Yuankai Li, Punit Prakash, Bala Natarajan and Jungkwun Kim, Kansas State University

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Nanomaterial Based Devices and Systems II

RS S2.5: 12:10-13:40
Saturday, April 16, 2022
Location: RM 005

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

S2.5.1 Wireless, Skin-mountable, Crack-Activated Pressure Sensor for Pressure Injury Prevention, Seokjoo Cho, Yong Suk Oh, Hyeonseok Han and Inkyu Park, Korea Advanced Institute of Science and Technology

S2.5.2 A Flexible Pressure Sensor with Wide Range Using Polyimide/Graphene Oxide/BaTiO3 Nanofibers as Dielectric Layer, Dezhi Wu, Xianshu Cheng, Yunheng Wu and Zhenjin Xu, Xiamen University

S2.5.3 Screen-Printed Electrochemical Immunosensor utilizing Polyaniline and Gold Nanoparticles for the detection of the bladder cancer cell membrane protein FGFR3, Ting-Hui Cheng, Institute of Medical Science and Technology, National Sun Yat-sen University

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