Keynote Session Tutorial
Advancing Frontiers in BioMaterials and NanoMedicine

Thursday, June 1 11:00

Key Introduction Founder of the E-MRS, General Secretary Of the E-MRS Professor Dr. Paul SIFFERT

paul.siffert@european-mrs.com

Inviting the Nobel Laureate in Physiology or Medicine 2021 Professor Dr. David Julius

WELCOME

11:10 ***Honorary lecture Nobel Laureate in Medicine 2021***
PROFESSOR DR. DAVÍD JULIUS

Frontiers in Neurosensorics, discovers of receptors for temperature and touch

Professor Dr. David Julius
The Nobel Prize in Physiology or Medicine 2021
Born: 4 November 1955, New York, NY, USA
Affiliation at the time of the award:
University of California, San Francisco, CA, USA
Prize motivation: "for their discoveries of receptors for temperature and touch"
Prize share: ½

Our ability to sense heat, cold and touch is essential for survival and underpins our interaction with the world around us. In the late 1990s, David Julius investigated how temperature is translated into nerve impulses. He utilized capsaicin, a compound from chili peppers that induces a burning sensation, and DNA fragments, genes, which are active in heat-sensing neurons. One single gene was able to make cells capsaicin sensitive. Further experiments revealed that the gene encoded a heat-sensing receptor on the neurons. The Nobel Laureate in Physiology or Medicine 2021 Prof. Dr. David Julius "Frontiers in Neurosensorics"
Body's different types of receptors for different kinds of temperature and touch: sensory transduction molecules, mechanosensory neurons.
The Nobel Prize in Physiology or Medicine 2021 David Julius and Ardem Papapoutian are awarded "for their discovers of receptors for temperature and touch". American two neuroscientists identified the molecular receptors for sensing temperature and mechanical, studying responses on spicy chili peppers and cool menthol for their investigations.
Key mechanisms of how people sense heat, cold, touch and their own bodily movement are established.
www.nobelprize.org/prizes/physiology or medicine/2021
https://www.nobelprize.org/uploads/2021/10/press-medicineprize2021.pdf

Thursday, June 1 12:00 -- 13:00 Lunch

Keynote Session Biomaterials and Nanomedicine

The EMRS Invited Scientific Organizer General Supervisor Prof. Dr. Peilin Chen

Keynote Lecture

Peilin Chen

Professor/Research Fellow,
Chief Executive Officer of the thematic center for Biomedical Applications,
Research Center for Applied Sciences,
Academia Sinica, Taipei, Taiwan
E-mail: peilin@gate.sinica.edu.tw
https://rcas.sinica.edu.tw/faculty/peilin.html

Thursday, June 1 13:00

Abstract ID number 00147

Validation of Nanomedicine in Animal Models by Real-time Two-Photon Imaging

Abstract:

In the past decade, we witness rapid development in optical microscopy, where new biological structures and processes are discovered with an unprecedented spatiotemporal resolution. In the past few years, our group has been working on the applications of real-time intravital imaging, including the cell-cell interaction in hearts, brains, and tumors as well as the nanoparticle distributions in living animals, which allows us to track individual nanoparticles in animal models to validate the working principle of nanoparticle-base therapy. In this lecture, I am going to discuss the applications of real-time intravital imaging to reveal cell-nanoparticle interactions in animal models. Through these studies, we would like to answer the following questions 1) how do the nanocarriers reach the solid tumors and how do they pass through the cancer microenvironment in living animals, 2) how do the nanocarriers interact with circulating cells such as immune cells and circulating tumor cells in the bloodstream, 3) how do the nanoparticles penetrate into solid tumors, 4) how do the physiochemical properties influence the efficiency of nanocarriers to reach the solid tumors and 5) how do the nanocarriers translocate inside the cells to reach the targeted organelles. Through these studies, we should be able to optimize the surface modifications of nanocarriers for efficient delivery in various applications.

[1] San-Shan Huang, et al. “Immune cell shuttle for precise delivery of nanotherapeutics for heart disease and cancer” Science Advances, 2021, **7**, eabf2400.

[2] Hung-Lin Chen, et al, "Galectin-7 downregulation in lesional keratinocytes contributes to enhanced IL-17A signaling and skin pathology in psoriasis" 2021, J. Clin. Invest. **131**, e130704

[3] Chiung Wen Kuo, Di-Yen Chuch, Peilin Chen*, "Real-Time in vivo Imaging of Subpopulations of Circulating Tumor Cells Using Antibody Conjugated Quantum Dots" J. Nanobiotech, 2019, **17**, 26

[4] Tony WH Tang , et. al.,"Loss of Gut Microbiota Alters Immune System Composition and Cripples Post-Infarction Cardiac Repair" Circulation, 2019, **139**, 647

[5] Cheng YY, Gregorich Z, Prajnamitra RP, Lundy DJ, Ma TY, Huang YH, Lee YC, Ruan SC, Lin JH, Lin PJ, Kuo CW, Chen P, Yan YT, Tian R, Kamp TJ, Hsieh PC*. "Metabolic changes associated with cardiomyocyte dedifferentiation enable adult mammalian cardiac regeneration." Circulation, 2022, **146**, 1990.

Biography:
Peilin Chen received his Bachelor's degree in Chemistry from National Taiwan University in 1990 and obtained his Ph.D. degree in Chemistry from the University of California, Irvine in 1998. He worked as a postdoctoral fellow in the Chemistry department of the University of California, Berkeley between 1999 and 2001. Prof. Chen joined Research Center for Applied Sciences, Academia Sinica, Taiwan as an Assistant Research Fellow in 2001. He was promoted to Associate Research Fellow and Research Fellow in 2005 and 2010, respectively. He served as the deputy director of the Research Center for Applied Sciences between 2010 and 2012 and the Chief Executive Officer of the thematic center for Biomedical Applications in 2023. Prof. Chen was a visiting Professor atRIKEN and Kyoto University. Prof. Chen received several prestigious awards in Taiwan including the Research Award for Junior Research Investigators in Academia Sinica, the Ta-You Wu Memorial Award of the National Research Council and the Career Development Award in Academia Sinica and the Investigator Award of Academia Sinica. Prof. Chen has authored or co-authored more than 140 papers in refereed journals and conference proceedings, he has delivered more than 70 invited talks at international meetings and conferences. He organized more than 10 international symposia.

Keynote presentation

EMRS Invited keynote presenters

Yongdoo Choi
Principal Research Scientist,
Head, Division of Technology Convergence,
Director, Office of Technology Transfer,
National Cancer Center, Goyang, Republic of Korea
E-mail: ydchoi@ncc.re.kr
https://www.ncc.re.kr/main.ncc?uri=uniResearch&in_dept_nm=RCT1

Thursday, June 1 13:30

Abstract ID number 01837

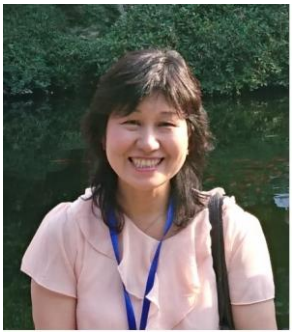
Indocyanine Green-loaded Activatable Theranostic nanogels for Image-guided Photodynamic Therapy and Enhanced Immunotherapy of Rapidly Growing Cancers

Abstract:

Herein, we developed a indocyanine green(ICG)-loaded activatable theranostic nanogels (ICG/Dex-Ce6) for fluorescence image-guided precise photodyanmic therapy (PDT) and enhanced immunotherapy of rapidly growing tumors. Quenched near-infrared fluorescence (NIRF) of ICG and chlorin e6 as well as singlet oxygen generation of ICG/Dex-Ce6 could be turned on inside cancer cells. In vivo NIRF imaging study showed high tumor-to-back groud ratio (7.31 ± 1.40) in ICG/Dex-Ce6-treated mice. Combined photodynamic and anti-PD-1 antibody therapy in the ICG/Dex-Ce6-treated group showed complete regression of tumors while single treatment of anti-PD-1 antibody (αPD-1) and ICG/Dex-Ce6+PDT showed tumor size of 54.2% and 55.3% as compared with control group, respectively. In vivo histopathological evaluation of major organs analysis of blood chemistry indicated no side effects in the ICG/Dex-Ce6+PDT+αPD-1 regimen. Investigation of tumor-draining lymph node showed the combination of ICG/Dex-Ce6, PDT, and anti-PD-1 synergistically enhances anti-tumor efficacy by increasing T cell immune resepone. In addition, growth of seconday tumors in rechallenge group was completely inhibited over 90 days, owing to the excellent long-term immune memory protection effect induced by ICG/Dex-Ce6-based PDT plus αPD1 treatment.

Biography:
Dr. Yongdoo Choi received his Bachelor degree in Polymer Engineering from Chonnam National University in 1996 and obtained his Ph.D. degree in Material Science from Gwangju Institute of Science and Technology, Korea in 2003. He worked as a postdoctoral fellow in the Radiology department of Massachusetts General Hospital, Boston between 2003 and 2006. He joined National Cancer Center (NCC), Korea as a Senior Research Scientist in 2007. He is now a principal research scientist and Head of Division of Technology Convergence at NCC Korea. He is also president of the Korean Photodynamic Association. He is serving as a deputy editor of *Quantitative Imaging in Medicine and surgery*, Associate editor of *Frontiers in Bioengineering and Biotechnology*, *Frontiers in Materials*, *Frontiers in Molecular Biosciences*, Editorial Advisory Board of *Bioconjugate Chemistry*, etc. His laboratory focuses on the development of novel molecular imaging agents for image-guided surgery, activatable photodynamic therapy agents, and theranostic nanomedicines.

Keynote presentation



Yuko Ichiyanagi
Professor,
Department of Physics,
Graduate School of Engineering Science,
Yokohama National University, Yokohama, Japan
E-mail: yuko@ynu.ac.jp
http://yukolab.ynu.ac.jp/

Thursday, June 1 14:00
Abstract ID number 00684

Magnetic Nanoparticles for Theranostics

Aabstract:
The emergence of magnetic nanoparticles has been discussed for biomedical applications. Previously, we obtained monodispersive magnetic nanoparticles (MNPs) by an original wet chemical method, and examined their magnetic, structural and thermal properties. Then we developed our magnetic nanoparticles to biological functions by conjugating functional groups. These functional MNPs were further introduced into cells. In addition, cancer cell selective MNPs were developed. Based on these techniques, we proposed a therapeutic method of magnetic hyperthermia. Several kinds of ferrite NPs were prepared and AC magnetic measurements were performed in order to analyze heating effect of MNPs for hyperthermia treatment. The relationship between imaginary part of magnetic susceptibility χ" and increase in temperature in the AC field was estimated. Thus, particles with large heat dissipation potential were optimized. Then, we carried out in vitro experiment using cultured human breast cancer cells, and a significant hyperthermia effect was observed. After the in vitro experiments, the mechanism underlying cancer cell death induced by magnetic hyperthermia was investigated, and it was found that magnetic hyperthermia treatment induced apoptosis in cancer cells leading to cell death. Imaging methods are one of the effective tools for diagnostics. We examined the magnetic properties and relaxation phenomena such as MR relaxation rates for our magnetic nanoparticles for various particle sizes and composition. Very interestingly, some MNPs showed very pronounced hyperthermia effect, but at the same time the significant MR contrast effect was observed. Furthermore, mass spectrometric imaging, magnetic particle imaging (MPI) and CT (X-ray tomography) imaging are in progress. Our hybrid functional particles have potential to assist these methods, our magnetic nanoparticles are expected to contribute to theranostics in future.

[1] S. Taira, Y. Ichiyanagi, M. Setou et al. eJ. Surf. Sci. Nanotech., **5** (2007) 23.
[2] T. Kondo, Y. Ichiyanagi, et al. J. Appl. Phys. **117** (2015) 17D157
[3] D. Shigeoka, Y. Ichiyanagi, et al. IEEE Trans. Magn.**54** (2018) 6100707
[4] H. Katayanagi, Y. Ichiyanagi, et al. Chem. Nano. Mat. 202200014, (2022) 1-7,
[5] M. Kang, Y. Ichiyanagi, H. Matsui, et al. "Nano Letters, 10.1021/acs.nanolett.2c02691 (2022)

Biography:
Yuko Ichiyanagi obtained her Ph.D. degree in Physics from Yokohama National University in 1996. After working as a technical staff in the computer lab, she worked as an Assistant Professor, Lecturer and Associate Professor, before becoming a Professor in 2019 at Yokohama National University. She worked concurrently Researcher of PRESTO at Japan Science and Technology Agency between 2007 and 2011. She is currently a Professor at both Yokohama National University (Applied Physics) and Osaka University (Thermodynamics) on a cross-appointment system. She also has experience working for a company and designing circuits. She was invited and chaired at international conference frequently. Now she has published more than 110 papers and books, and has been serving as an international advisory committee member of some reputed conferences. She just organized International Conference on Fine Particle Magnetism 2022 (ICFPM2022) in Yokohama. She is a member of editorial boad of IEEE Magnetics Letters since 2018, and a guest editor of Frontiers in Thermal Engineering since 2022.

Keynote presentation

Min-Ho Lee

Professor/Director,
School of Integrative Engineering/Biomedical Engineering
Convergence Research Institute for Biomedical Optics,
Chung-Ang University, Seoul, Korea
E-mail: mhlee7@cau.ac.kr

Thursday, June 1 14:30
Abstract ID number 00780

Concurrent and sensitive detection of duplex in opto-electrochemical platform

Abstract

We have developed an duplex biosensing platform for detecting biomarkers in which conductive nanomaterials combined with electrode were used. The electrodes have been successfully modified with highly designed nanomaterials or graphene heterostructures. The developed sensor displayed higher sensitivity and good selectivity as well as showed a good correlation with commercially available standard methods. For the multiple and sensitive detection of oncomiRs for diagnostics, a synergetic amplification strategy was introduced by combining a MXene-based electrochemical signal amplification and a duplex-specific nuclease (DSN)-based amplification system for rapid, attomolar and concurrent quantification of multiple microRNAs on a single platform in total plasma. In addition, for the high sensitivity platform for the detection of low level miRNAs, new, synergetic method was developed using a relay-race amplification using 3-way junction method and concentration method using DSN and magnetic nanoparticles. Recent progress towards the simultaneous multiple detection of Orf genes and S genes of coronavirus (SARS-Cov-2) using 4-way junction method have displayed selective quantification, displaying higher sensitivity when compared with qRT-PCR results.

In addition, some of the interesting optical method will be introduced in this talk regarding acoustic energy based multiple detection of some biomarkers.

[1] M. Mohammadniaei, et al., "Relay-race RNA/barcode gold nanoflower hybrid for wide and sensitive detection of microRNA in total patient serum", 2019, Biosensors and Bioelectronics, **141**, 111468
[2] L. Kashefi-Kheyrabadi, et al. "A MoS2@ Ti3C2Tx MXene hybrid-based electrochemical aptasensor (MEA) for sensitive and rapid detection of Thyroxine", 2021, Bioelectrochemistry, **137**, 107674
[3] HU Kim, et al. “Concurrent and Selective Determination of Dopamine and Serotonin with Flexible WS2/Graphene/Polyimide Electrode Using Cold Plasma” Small, 2021, **45**, 2102757.
[4] L. Kashefi-Kheyrabadi, et al, "Rapid, multiplexed, and nucleic acid amplification-free detection of SARS-CoV-2 RNA using an electrochemical biosensor" 2021, Biosensors and Bioelectronics. **195**, 113649.

Biography:

Min-Ho Lee received his Bachelor's degree in Mechanical D&P Engineering from Seoul National University in 1999 and obtained his M.S degree in Mechanical Engineering from the University of Minnesota, Minneapolis in 2002. He received his Ph.D. degree in Bioengineering from Rice University, Houston in 2005. He worked as a Team Leader and a managerial researcher in the Korea Electronics Technology Institute between 2006 and 2017. Prof. Lee joined School of Integrative Engineering, Biomedical Engineering, Chung-Ang University, Seoul as an Associate Professor in 2017. He was promoted to Professor in 2022. He is now the director of the Research Center for Convergence Research Institute for Biomedical Optics. Prof. Lee has authored or co-authored more than 100 papers in journals and conference proceedings, he has delivered more than 50 invited talks at international meetings and conferences. He organized more than 10 international symposia.

Keynote presentation

Jiashing Yu
Professor
Department of Chemical Engineering
National Taiwan University
Taipei, Taiwan
E-mail: jiayu@ntu.edu.tw
http://www.che.ntu.edu.tw/che/?p=448&lang=en

Thursday, June 1 15:00
Abstract ID number 00769

From Waste to Biomedical Resources: Applications of Keratin to Tissue Regeneration, Nanomedicine and Hemostasis Agent

Abstract
The excellent bioactivity and physiochemical properties of protein extracts have recently led to the popularity of utilizing keratins as biomaterials. Similar to other naturally derived biomaterials, keratins have the potential to form a defined, three-dimensional microstructure that supports cell infiltration, proliferation, and cell-guided tissue formation. We have optimized the processing method and developed various formation of keratin-based materials in to 2D and 3D forms such as coatings, thin films, hydrogel and scaffold. The natural abundance, intrinsic biocompatibility, and mechanical durability of keratins have shown promise in the field of biomaterials in diverse biomedical applications. In addition to tissue engineering applications, we also demonstrated the catalytic effects of using keratin as NO-donor to enhance the therapeutics efficacy in nanomedicine for treating cancer. Last but not least, we demonstrated that keratin could promote the activation of platelet and fibrin polymerization and has potential to act as a hemostasis reagent. Keratins are promising biomaterials due to their unique chemistry afforded by their high Sulphur content, excellent bioactivity, ability to self-assemble and intrinsic cell adhesion motifs. Such advantages have led to further exploration of keratin biomaterial in the field of wound healing, tissue engineering, drug delivery systems and regenerative medicine.

Biography:
Dr. Yu received her B.S. in Chemical Engineering in 2003 from National Taiwan University, Taiwan, R.O.C and Ph.D. in 2008 from UC Berkeley/UC San Francisco Joint Graduate Group in Bioengineering. Dr. Yu worked as a postdoctoral researcher at UCSF Medical School and Cardiovascular Research Institute from 2008-2010. She relocated back to her alma mater in 2010 and was an Assistant Professor from 2010-2015 and Associate Professor from 2015-2019. Dr Yu is promoted to full Professor from Aug. 2019

Dr. Yu's group focus on customized and functional modification of biomaterials including surface modification of biomaterials to enhance cell and extracellular matrix (ECM) interaction. Antibody and peptides conjugated nanoparticles as biosensors and drug delivery vehicles for cancer therapy, cell encapsulation and 3D culture of hASCs (human adipose-derived stem cell) in alginate-based microspheres and various porous scaffold and hydrogel for stem cells differentiation. The group has representative publications in *Biomaterials*, *Tissue Engineering*, *ACS Applied Materials and Interfaces*, *Journal of Materials Chemistry B and Biomaterials Sciences* etc.

Selected Awards and Fellowships of Dr. Yu include: Young Investigator Award 2012. ISOMRM International Symposium of Materials on Regenerative Medicine. Young Investigator Award, Certificate of Excellence, 2014 World Congress on Preventive and Regenerative Medicine (WCPRM). Recipient, Best Advisor Award (2016), National Taiwan University. Recipient, International Lectureship of the 97th Annual Meeting of The Chemical Society of Japan (March 2017). Recipient, Outstanding Achievement and Contribution. Asia Pacific Society for Materials Research 2017 (July 2017). Young Investigator Award 2017.3th ISOMRM International Symposium of Materials on Regenerative Medicine

Invited presentation

Si-Han Wu
Associate Professor
Graduate Institute of Nanomedicine and Medical Engineering,
Taipei Medical University
Taipei, Taiwan
E-mail: smilehanwu@tmu.edu.tw
https://tmu.pure.elsevier.com/en/persons/si-han-wu

Thursday, June 1 15:30
Abstract ID number 00564

Development of Bacteria-Targeted Mesoporous Silica Nanotherapeutics for Wound Healing

Abstract:
The increasing number of deaths caused by wound infections highlights the need for new treatment approaches. We aim to create mesoporous silica nanoparticles (MSNs) that effectively eliminate infectious microorganisms in epidermal and dermal tissues, thus improving wound healing outcomes. The exterior surface of the MSNs was functionalized with bacteria-targeting mannose moiety. Additionally, sulfonic groups were modified on the interior surface to increase the loading and stability of vancomycin, with a loading capacity of 9.47 wt%. The resulting Vam@MSN-man dispersed well in biological media such as PBS. In vitro cell biocompatibility and targeting of MSNs modified with divergent surface functionalization were systemically investigated. The hydrophobic porphyrin-derived photosensitizer 4N-POR-Si was also incorporated into the Vam@MSN-man, allowing two-photon imaging and photodynamic therapy (TPE-PDT). The results suggest that these hybrid MSNs can promote various cellular and molecular processes that benefit the wound microenvironment.

Biography:
Si-Han Wu received his Master's and Ph. D. in Chemistry from National Taiwan University in 2008 and 2013, respectively. After a post-doc at the Research Center for Applied Sciences of Academia Sinica, he joined Taipei Medical University as an assistant professor and became an associate professor in 2021. His research interests are in hybrid nanomaterials, focusing on the build-up of mesoporous, hollow, and multiple-compartmentalized silica nanomedicine. His current research aims to clarify the relationship between synthetic identity and physiological responses, focusing on (I) developing clinically translatable silica-based nanomedicine to eradicate hypoxic tumor cells and (II) constructing bacteria-targeting porous silica nanohybrids as antibacterial, antioxidant, and anti-inflammatory carriers for sepsis management.

Thursday, June 1 16:00-16:30 p.m. Coffee Break

Keynote presentation

Daisuke Miyosh
Professor,
Faculty of Frontiers of Innovative Research
in Science and Technology (FIRST),
Konan University,
Kobe, Japan
E-mail: miyoshi@konan-u.ac.jp
http://www.pi.konan-u.ac.jp/miyoshi/

Thursday , June 1 16:30
Abstract ID number 01578

Regulation of liquid-liquid phase separation induced by G-quadruplex nucleic acids

Liquid–liquid phase separation (LLPS) of nucleic acids has been attracting attention as a novel phenomenon in living cells. It is now evident that LLPS involving nucleic acids participates in the regulation of the central dogma at various levels, such as replication, transcription, processing, and translation. Dysfunction of LLPS is linked to the onset of neurodegenerative diseases as well as viral infection and cancer. It is considered that LLPS of different molecular compositions has common assembly and disassembly mechanisms. Fundamental properties of RNAs and DNAs for inducing LLPS is becoming clearer. RNA secondary structure-dependent LLPS has also been reported. Especially, G-quadruplex (G4) formed by guanine-rich sequences have been reported to induce LLPS in a structure-specific manner. Fragile X mental retardation protein (FMRP), SERPINE1 mRNA-binding protein 1 (SERBP1), and Histone H1 all induce LLPS with G4. The repetitive GGGGCC and GGC sequences are considered to play a role in onset mechanism of neurodegenerative diseases, such as amyotrophic lateral sclerosis (ALS) and frontotemporal dementia (FTD), and fragile X syndrome (FXS) and fragile X- associated tremor/ataxia syndrome (FXTAS), respectively. These G-rich sequences form G4s and induce aberrant RNA foci and sequestration of various RBPs. Although the characteristics the nucleic acid sequences inducing LLPS is becoming clearer, regulating of droplets have not yet been developed. In this study, we constructed an LLPS model system using G4-forming oligonucleotides and an cationic peptide derived from FMRP. The RNAs, which are derived from neurodegenerative diseases and cancer-related mRNAs, underwent LLPS with the peptide. We found for the first time that the sequence-specific redissolution of droplets is possible with complementary strands of the target RNAs, which undergo LLPS. Notably, the hybridization energy of the target G4-forming RNA and its complementary strand can control the degree of redissolution. These results will be useful to design a new modality for neurodegenerative diseases as well as cancers by use of oligonucleotides targeting G4 RNAs that undergo LLPS.

Biography:

Daisuke Miyoshi received his Bachelor degree in Chemistry from Konan University, Japan in 1995 and obtained his Ph.D. degree in Science from the same University in 2003. He worked as a postdoctoral fellow in the chemistry department of University of Illinois at Urbana-Champaing between 2003 and 2004. He joined Frontier Institute for Biomolecular Engineering Research (FIBER), Konan University, Japan as an Assistant Professor in 2004. He was promoted to an Associate Professor and a Professor in 2009 and 2014, respectively in the current department. His research interests include non-canonical nucleic acid structures (G-quadruplex, I-motif, triplex, junction, hairpin loop, etc.), small molecules targeting nuleic acids and their applications especially molecularly-targeted photodynamic therapy, molecular crowding, and liquid-liquid phase separation.

Keynote presentation

Koichi Kato
Professor,
Graduate School of Biomedical and Health Sciences,
Hiroshima University, Hiroshima Japan
Institute for Nanodevices,
Hiroshima University, Higashi-Hiroshima, Japan
E-mail: kokato@hiroshima-u.ac.jp
https://biomaterials-hu.wixsite.com/bmt-hu

Thursday, June 1 17:00
Abstract ID number 00763

Bioinspired Surfaces Designed for Stem Cell Expansion

Aabstract:

Somatic stem cells, such as mesenchymal stem cells (MSCs), are known to reside within a biological niche where various biomacromolecules serve to maintain the stem cell functions. Inspired by such a stem cell niche, we have been involved in designing materials surfaces on which stem cells rapidly and selectively proliferate in response to surface-tethered growth factors, while maintaining their undifferentiated state. The technology that permits the efficient expansion of stem cells will be useful in the future clinical applications of stem cells in regenerative medicine.

In the series of our studies, growth factors such as epidermal growth factor (EGF) and basic fibroblast growth factor (bFGF) were tethered to the surface of solid substrates. In the most typical strategy for surface tethering, growth factors were genetically modified to carry a hexahistidine peptide and chelated to the Ni(II)-bound glass surfaces. These surfaces were evaluated for their abilities to facilitate the efficient expansion of MSCs derived from bone marrow and neural stem cells (NSCs) derived from the fetal brain and induced pluripotent stem cells.

It was shown that the bFGF-tethered surface could capture MSCs, accelerating their proliferation rate. Interestingly, in situ refolding of partially denatured bFGF on the surface was found to enhance the promotive effect, indicating that the efficiency of the effect was highly depend on the structural integrity and hence biological activities of bFGF after surface tethering.

On the other hand, the part of an NSC population obtained from the brain of fetal rats was shown to express EGF receptor by flow cytometry and these cell were selectively captured on the EGF-tethering surface. The captured cells then proliferated much faster than NSCs obtained from conventional neurosphere culture, while continuously expressing intermediate filament nestin, a marker for NSCs. In the case of NSC of human origin, bFGF receptor is prominent instead of EGF receptor, therefore bFGF-tethered surface was tested. Similar to the case with rat NSCs, the stem cells of human origin selectively proliferated on the surface as well.

All these results described above demonstrate the feasibility of our bioinspired surface design for the efficient expansion of stem cells promising for use in regenerative medicine.

Biography:

Koichi Kato received his Bachelor's and Master's degrees in Agriculture from Kyoto University in 1988 and 1990, respectively, and obtained his Ph.D. degree in Polymer Chemistry from Kyoto University in 1996. He worked as JSPS postdoctoral research fellow at Research Center for Biomedical Engineering, Kyoto University in 1996 and then joined Department of Chemical Science and Engineering, Faculty of Engineering, Kobe University as Assistant Professor in 1996. From 1998 to 2000, he worked at Institute For Polymer Chemistry, Albert-Ludwigs-Universität Freiburg and Freiburg Materials Research Center as a research fellow supported by Alexander von Humboldt Foundation, Germany. In 2001, Prof. Kato was appointed as Associate Professor at Institute for Frontier Medical Sciences, Kyoto University. In 2011, he was moved to Graduate School of Biomedical and Health Sciences, Hiroshima University as Professo. From 2016 to 2020, he served as Dean of the School of Dentistry. Currently, Prof. Kato is additionally appointed as Vice Director of Research Institute for Nanodevices, Hiroshima University. He also served as Visiting Professor at Airlangga University in 2016 and Brawijaya University in 2022, Indonesia. Prof. Kato received several prestigious awards in Japan including the Award for Encouragement of Research in Polymer Science, The Society of Polymer Science and the Award for Young Investigator of Japanese Society for Biomaterials. Prof. Kato has more than 100 papers in refereed journals, conference proceedings, and book chapters.

Invited presentation

Jau-Ye Shiu
Assistant professor,
Graduate Institute of Biomedical Science,
China Medical University, Taiwan
E-mail: jyshiu@mail.cmu.edu.tw
http://webap.cmu.edu.tw/TchEportfolio/index_2/jyshiu

Thursday, June 1 17:30

Abstract ID number 01072

Using Real-time and High throughput Force-sensing Biochip Reveal Cellular Herterogeneity Under Drug Treatment

Aabstract:
Tumor heterogeneity caused drug resistant and reduced the treatment effect. Developing the functional assay to reveal the states of cell, here we uses cellular traction force to establish breast cancer (Herceptin) and lung cancer (Gefitinib) drug resistance dynamics mechanical fingerprint database and explores the molecular mechanism. We have developed an real-time and high throughput cellular force sensing platform, measuring and collecting the mechanical fingerprinting of breast cancer and lung cancer under drug treatment. Breast cancer and lung cancer drug- resistance cell lines all present clear dynamics mechanical fingerprint characteristics, only sensitive cells are applied peripheral force, anti-drug cell dynamics evenly distributed in individual cells. Since the mechanical has very distinct force distribution, we then consider how mechanotransduction play a role for drug-resistant cell. After blocking Integrin beta1, the mechanical fingerprint of resistant cell bocome a sensitive-like cell, we have successfully identified intrinsic anti-drug cells, and have simultaneously established multiple types of tumors and organoids. Measuring the tissue section by force sensing bio-chip shown the metastasis tumor can also be identified by their unique mechanical fingerprint.

Biography:
Dr. Shiu received his Ph.D. degree in Material Science and Engineering from National Chiao Tung University, Taiwan in 2009. During his PhD, his search project focused on the fabrication of 2D&3D polymeric nanostructures and integrated into microfluidic systems where applied the applications on i) using nanochannel to separate different scales of DNA molecules and single DNA analysis. ii) using switchable superhydrophobic surface to address proteins and cell on micro arrays and use it to enhance cell adhesion and transfection efficiency.
After receiving his Ph.D., he joined the group of Prof. Viola Vogel in ETH Zurich Switzerland as a postdoctoral fellow, he have developed a force sensing platform to measure cell-generated forces, this platform not only increase the spatial resolution at which traction forces can be mapped, but enable new biological discoveries associated with this mechanotransduction process This platform further understand how cell-generated forces are transmitted from transmembrane receptors all the way to the cell nucleus via their specific link to a specific subset of actin fibers that form the actin cap between normal and disease-associated cell. Dr. Shiu join department of Graduate Institute of Biomedical Science in China Medical University as assistant professor and focus on cancer related research. Dr. Shiu develop a new approach to quantitatively assay cellular force generation in a real-time and high-throughout at the single-cell level using machinal biomarker to identify drug resistant cancer cells.

keynote-and-invited-presenters-sesion-tutorial-biodiagnotics

Tutorial Frontiers in BioDiagnostics

Friday, June 2 09:00-12:00

Keynote Session BioDiagnostics

Chairs, Leaders of Discussions:

Prof./Research Fellow Peilin Chen, Research Center for Applied Sciences, Academia Sinica, Taiwan peilin@gate.sinica.edu.tw

Prof. Dr. Benoit Pichon, IPCMS, University of Strasbourg, France, Benoit.Pichon@ipcms.unistra.fr

Dr. Aaron Elbourne, RMIT University Melbourne, aaron.elbourne@rmit.edu.au

Keynote presentation

Peilin Chen

Professor/Research Fellow,
Chief Executive Officer of the thematic center for Biomedical Applications,
Research Center for Applied Sciences,
Academia Sinica, Taipei, Taiwan
E-mail: peilin@gate.sinica.edu.tw
https://rcas.sinica.edu.tw/faculty/peilin.html

Friday, June 2 9:00

Abstract ID : number 00201

Probing Circulating Tumor Cells in Animal Model
Quantum Dots and Real-time Intravital Imaging

C. Kuo, P. Chen.
Academia Sinica - Taipei (Taiwan, republic of china).

The detection of circulating tumor cells (CTCs) is very important for cancer diagnosis. CTCs can travel from primary tumors through circulation to form secondary tumor colonies via bloodstream extravasation. The number of CTCs has been used as an indicator of cancer progression. However, the population of CTCs is very heterogeneous. It is very challenging to identify CTC subpopulations with high metastatic potential, such as cancer stem cells (CSCs), which are very important for cancer diagnostic management.

We report a study of real-time CTC and CSC imaging in the bloodstreams of living animals using multi-photon microscopy and antibody-conjugated quantum dots. We have developed a cancer model for noninvasive imaging wherein pancreatic cancer cells expressing fluorescent proteins were subcutaneously injected into the earlobes of mice to form solid tumors. When the cancer cells broke from the solid tumor, CTCs with fluorescent proteins in the bloodstream at different stages of development could be monitored noninvasively in real-time. The number of CTCs observed in the blood vessels could be correlated to the tumor size in the first month and reached a maximum value of approximately 100 CTCs/min after five weeks of tumor inoculation. To observe CTC subpopulations, conjugated quantum dots were used. It was found that CD24+ CTCs can move along the walls of blood vessels and migrate to peripheral tissues. The accumulation of CD24+ cells on the sides of solid tumors was observed, which may provide valuable insight for designing new drugs to target cancer subpopulations with high metastatic potential. We also demonstrated that our system is capable of imaging a minor population of cancer stem cells, CD133+ CTCs, which are found in 0.7% of pancreatic cancer cells and 1-3% of solid tumors in patients.

With the help of quantum dots, circulating tumor cells with higher metastatic potential, such as CD 24+ and CD 133+ CTCs, have been identified in living animals. Using our approach, it is possible to investigate the detailed metastatic mechanism, such as the extravasation of tumor cells to the blood vessels. In addition, the number of observed CTCs in the bloodstream could be correlated with the stage of the tumor.

[6] San-Shan Huang, et al. “Immune cell shuttle for precise delivery of nanotherapeutics for heart disease and cancer” Science Advances, 2021, 7, eabf2400.
[7] Hung-Lin Chen, et al, "Galectin-7 downregulation in lesional keratinocytes contributes to enhanced IL-17A signaling and skin pathology in psoriasis" 2021, J. Clin. Invest. 131, e130704
[8] Chiung Wen Kuo, Di-Yen Chuch, Peilin Chen*, "Real-Time in vivo Imaging of Subpopulations of Circulating Tumor Cells Using Antibody Conjugated Quantum Dots" J. Nanobiotech, 2019, 17, 26
[9] Tony WH Tang , et. al.,"Loss of Gut Microbiota Alters Immune System Composition and Cripples Post-Infarction Cardiac Repair" Circulation, 2019, 139, 647
[10] Cheng YY, Gregorich Z, Prajnamitra RP, Lundy DJ, Ma TY, Huang YH, Lee YC, Ruan SC, Lin JH, Lin PJ, Kuo CW, Chen P, Yan YT, Tian R, Kamp TJ, Hsieh PC*. "Metabolic changes associated with cardiomyocyte dedifferentiation enable adult mammalian cardiac regeneration." Circulation, 2022, 146, 1990.

Biography:
Peilin Chen received his Bachelor’s degree in Chemistry from National Taiwan University in 1990 and obtained his Ph.D. degree in Chemistry from the University of California, Irvine in 1998. He worked as a postdoctoral fellow in the Chemistry department of the University of California, Berkeley between 1999 and 2001. Prof. Chen joined Research

Center for Applied Sciences, Academia Sinica, Taiwan as an Assistant Research Fellow in 2001. He was promoted to Associate Research Fellow and Research Fellow in 2005 and 2010, respectively. He served as the deputy director of the Research Center for Applied Sciences between 2010 and 2012 and the Chief Executive Officer of the thematic center for Biomedical Applications in 2023. Prof. Chen was a visiting Professor atRIKEN and Kyoto University. Prof. Chen received several prestigious awards in Taiwan including the Research Award for Junior Research Investigators in Academia Sinica, the Ta-You Wu Memorial Award of the National Research Council and the Career Development Award in Academia Sinica and the Investigator Award of Academia Sinica. Prof. Chen has authored or co-authored more than 140 papers in refereed journals and conference proceedings, he has delivered more than 70 invited talks at international meetings and conferences. He organized more than 10 international symposia.

Young investigator

Chuing Wen Kuo Assistant Ph.D student Academia Sinica, Taipei, Taiwan

Keynote presentation

Benoît Pichon

Professor, Inorganic Materials Chemistry (DCMI)
IPCMS ("Institute of Physics and Chemistry of Materials Strasbourg (IPCMS), UMR 7504 CNRS - University of Strasbourg") is an internationally recognized research and training center in materials and nanoscience.
Benoit.Pichon@ipcms.unistra.fr

Friday, June 2 09:30

Abstract ID number 00176

Investigation of high refractive index non plasmonic nanoparticle assemblies supported onto a metal thin film as a promising platform for SPR biosensor

B. Pichon [1], M. Dolci [1], P. Berling [1], F. Boulmedais [2], G. Barbillon [3]
[1]Institut De Physique Et Chimie Des Matériaux De Strasbourg - Strasbourg (France), [2]Institut Charles Sadron - Strasbourg (France), [3]Epf - Saclay (France).

SPR biosensor has become increasingly popular in research fields related to medicine, biology and ecology. Such a success is ascribed to quantitative analysis for dosage control and toxicity risk management as well as excellent reutilization performance and outstanding reproducibility. We report on the design a robust SPR biosensor which consists in an assembly of high refractive index non plasmonic nanoparticles supported onto a gold thin film. The nano architecture was build-up by performing three-step Copper Catalyze Alkyne-Azido (CuAAC) cycloaddition reaction, a highly specific and reliable reaction to perform which belongs to “click” chemistry. We show that the presence of nanoparticles result in the significant enhancement of sensitivity for detection of biomolecules. Furthermore, the fine tuning of the nanoparticle assembly structure allowed taking advantage of the interplay between the largest nanoparticle density and the largest number of receptors available at the nanoparticle surface. The surface functionalization was also finely addressed in order to enhance specific interactions and to reduce limit of detection. We show that such a platform is highly efficient to design label-free biosensors with high performance specificity, sensitivity and limit of detection.

Références

[1] Dolci et al. J. Mater. Chem. C 6, (2018), 9102

[2] Dolci et al. Appl. Surf. Sci. 527 (2020) 146773
[3] Berling et al. Sensors & Diagnostics, 1, (2022), 1069

Biography:

Benoit P. Pichon is full professor from the University of Strasbourg (France). He held his doctorate in Material chemistry from the University of Montpellier (France) in 2004. He started his research on organization processes of inorganic materials such as silica and pursued as a post-doc fellow on calcium carbonate directed by molecular self-assemblies. In 2006, he joined the university of Strasbourg as assistant professor where he focused on the design of magnetic nanoparticles in the Institut de Physique et Chimie des Matériaux de Strasbourg. He combines different metal oxides phases in order to produce rare earth free nanoparticles as permanent magnets. He is particularly interested in the study of their properties as a function of their composition and structure as well as the dimensionality of their assemblies. He obtained his habilitation to supervise research and became associate professor in 2014. B. Pichon has published more than 90 papers in the field of material science (h index of 33, > 3 400 citations), he has contributed to 60 international conferences, given 20 invited lectures. He has been awarded by the Prime d'Excellence Scientifique (2011-2015, 2015-2021, 2021-2025) and by the Prix les Espoirs de l'Université de Strasbourg in 2015. Since 2016, he is honorary member of the Institut Universitaire de France.

Young investigator

Mathias Dolci Dr, Eindhoven University of Technology
Postdoc, Department Biomedical Engineering, Group Molecular Biosensing for Med. Diagnostics Email m.dolci@tue.nl

Biography:

Mathias Dolci studied material physics at the University of Strasbourg (France), where he obtained his MSc degree in 2014. In 2018, he received his PhD from the University of Strasbourg, where he studied the assemblies of iron oxide nanoparticles onto gold thin film for biosensor applications. After a postdoctoral position at the University of Lille (France), he moved to Eindhoven University of Technology (TU/e, The Netherlands). He is currently postdoc in the research group Molecular Biosensing at the department of Biomolecular Engineering.

Young investigator

Pier Andrea Berling PhD Student Institute of Physics and Chemistry of Materials Strasbourg (IPCMS) Fr.

Friday, June 2 10:00-10:30 p.m. Coffee Break

Invited presentation

Stefan-Marian Iordache
PhD
Institute for Research and Development in Optoelectronics
INOE2000 · Optospintronics
Măgurele, România
inoe@inoe.ro

Friday, June 2 10:30

Abstract ID number 02660

Development of an Ag@Au core/shell system as label-free SERS investigation tool for malignant/non-malignant cells assessment

I. Bioinspired and biointegrated materials as new frontiers nanomaterials (11th edition)

S.M. Iordache 1, A.M. Iordache 1, C.N. Zoita 1, I.C. Vasiliu 1, M. Elisa 1, I. Chilibon 1, C. Rizea 2, A. Mazlum 2, C.E.A. Grigorescu 1.

1National Institute Of Research And Development For Optoelectronics-Inoe 2000 - Magurele (Romania), 2Roxy Veterinary S.r.l - Magurele (Romania).

Breast cancer and skin cancer frequency in human and other mammal populations has worryingly increased lately. There is an acute necessity for new diagnostic tools aimed at reducing mortality. Screening of tissues and bodily fluids with surface enhanced Raman scattering SERS may represent a strategic target for real time monitoring in surgery and other diagnostic applications. We aim at developing a support system for monitoring the surgery process, and assessing of tumor margins, in real-time, with novel Au-Ag alloy - surfaced surgery instruments. In this respect, we synthesized via green chemistry a novel core@shell Ag/Au material from non-toxic precursors. The size of the core@shell particles was below 200 nm, with a shell thickness of approximatively 22 nm. The effect of the spin-plasmonic structures on the SERS effect is investigated through label free SERS measurements on traces of body fluids and submicron fragments of animal tissue. The enhancement factor is compared with that resulted from SERS experiments on twin samples deposited on Au and Ag nanostructured surfaces.

Keywords:Ag,Au, Ramanspectroscopy, electrochemistry, label-free SERS support.
Acknowledgements: This work was carried out through the Core Program with the National Research Development and Innovation Plan 2022-2027, carried out with the support of MCID, project no. PN 23 05, and 18PFE/30.12.2021.

Biography:
Scientific Researcher 2008 - 2017, Senior Researcher III. 2017
National Institute for Research and Development in Optoelectronics - INOE 2000 okt. 2018 r. – present time, RomaniaMagurele, Romania University of Bucharest, Faculty of Physics, 3Nano-SAE Research Centre :
- Post Doc, Biosensor Development 2014 – 2015
- Doctor, Biophysics and Medical Physics2008 – 2011
- Master of Science, Biophysics and Medical Physics2006 - 2008
- Bachelor of Science, Biophysics and Medical Physics2001 – 2005

Friday, June 2 11:00

Abstract ID number 00330

Keynote presentation Professor **Dipak Kumar Goswami**

Indian Institute of the Technology Kharagpur, Faculty of Sciences (FoS) Organicc Electronics Group (India).

dipak@phy.iitkgp.ac.in

xdipak@gmail.com

Organic Electronics group is working on fabrication of highly efficient organic field-effect transistors (OFETs) and different sensors based on OFETs. The group has fabricated few highly efficient devices with exceptional ambient stability. Such devices showed tremendous promises to be used for flexible and stretchable applications. Few devices have been demonstrated for highly sensitive gas sensors with fastest responses. The group is currently working on fabrication of OFETs for flexible and stretchable applications. We are also interested in bio-medical application of OFETs.

I addition, group is involved in understanding the basic physics at surfaces and the interfaces of different organic layers used on the devices.

We are open for active collaborations with other groups interested in working in the fields of synthesis of active materials with different functionality.

Riya Sadhukhan, Area of Research: Biosensors for healthcare applications

Shiv Prakash Verma, Area of Research: Flexible and Stretchable Electronics

Sovanlal Mondal, Area of Research: Organic Electronic Devices

Rajdeep Banerjee, Area of Research: Flexible electronic devices

www.iitkgp.ac.in/department/PH/faculty/ph-dipak

Friday, June 2 11:00

Abstract ID number 00330

Air-Stable Bio-Protonic Devices with Ion Channels for Electronic Control of Hydrogen Ion Flow through Phospholipid Membranes

R. Sadhukhan, S. Verma, S. Mondal, R. Banerjee, D. Goswami.
Indian Institute Of Technology Kharagpur - Kharagpur (India).

Life is based on communication. All individual cells interact with each other because they all receive messages from the outside world that direct their activity and functions. The cell membrane receives information and sends it to the appropriate part of the cell. Most cellular communication is mediated by proteins and ion channels located in cell membranes. Ion channels regulate the flow of ions, typically Na+, K+, Ca2+, Cl-, and small molecules, across the cell membrane. Proton transport is critically important for neuronal function, even though protons are not directly involved in action potentials. One significant example is the oxidative phosphorylation in mitochondria, which uses proton gradients to convert energy from the oxidation of glucose into ATP, the currency of biological energy. Other examples include the activity of the antibiotic Gramicidin and light-activated H+ pumping by archaeal bacteriorhodopsins, bioluminescence activation from H+ dinoflagellates, and others.

Connecting to biological systems that rely primarily on ionic currents is difficult for man-made electronic platforms that use electronic currents to carry charges. We fabricated a two-terminal device with a gelatin-SLB(supported lipid bilayer)-gelatin structure that resembles the proton channel structure found in cell membranes. Al and Au were used to make the electrodes. Gelatin absorbs water molecules and self-ionizes to produce protons (H+). The quantity of protons increases along with the increase in relative humidity. As the relative humidity around the device increases, the I-V curves demonstrate that the flow of H+ through the ion channels increases.

Biography:

[7] 16 Mar 2018 – Present: Professor Indian Institute of Technology Kharagpur, Department of Physics, Kharagpur, India
[6] 13 Dec 2013 – 16 Mar 2018: Associate Professor Indian Institute of Technology Kharagpur, Department of Physics,Kharagpur,India
[5] 28 July 2012- 12 Dec 2013: Associate Professor Indian Institute of Technology Guwahati (IITG), Department of Physics,Guwahati,India
[4] July 2007 – July 2012: Assistant Professor Indian Institute of Technology Guwahati (IITG), Department of Physics,Guwahati,India
[3] June 2006 – May 2007: Post-Doctoral Research Fellow (with Prof. Helmut Dosch). Max Planck Institute for MetalsResearch,Stuttgart,Germany.
[2] May 2004 – March 2006: Post-Doctoral Research Fellow (with Prof. Michael. Bedzyk). Northwestern University, Materials Scienceand Engineering Department,USA.
[1] 10 April – 10 June, 2003: Visiting Scientist (with Prof. Jorg Zegenhagen).European Synchrotron Radiation Facility (ESRF) at beamline ID32 and surface characterization laboratory, Grenoble, France

Invited presentation

Aaron Elbourne
ARC DECRA Fellow / Senior Researcher / Senior Lecturer - School of Science, RMIT University
RMIT University Melbourne City Campus
2017-01-02 to present | Postdoctoral Research Fellow School of Science (Chemistry) aaron.elbourne@rmit.edu.au

Abstract ID number 00293

Behaviour of citrate-capped gold nanoparticles at biomembranes – atomic insight at supported lipid bilayer and liposome interfaces.

A. Elbourne, R. Kariuki, R. Penman, S.J. Bryant, G. Bryant, C.E. Conn, A.J. Chritofferson.
Rmit University - Melbourne (Australia).

Introduction: Nanomaterials - materials with nanoscale dimensions - are widely investigated, especially in many biological settings. This is due to their potential use as advanced nano-medicines and diagnostic technologies, antimicrobials, as cellular probes, and in cellular-imaging, among other applications. The commonality between all applications is that they utilise the nanosized features of the material, specifically their departure from traditional bulk-like properties. In general, nanoparticle-based biotechnologies must interact with, and often cross, a cellular membrane to be useful; however, the dynamics of these interaction is still poorly characterised.
Aim: Combine advanced experimental and computation studies to study the interaction of ultra-small gold nanoparticles (AuNP) at a synthetic bio-membrane to see determine the dynamic interaction of model systems at bio-membranes.
Methods: A combination of atomic force microscopy, light and energy scattering, and molecular dynamics simulations were used to study the fundamental behaviour of the AuNPs at the bio-membrane-liquid interface. The systems of interest are models consisting of supported lipid bilayers (SLBs) (see Figure 1.) and free-floating liposomes. These act as archetypal bio-membranes. Liquid-phase, ripple-phase, and gel-phase biomembranes were used to systematically asses interactions.
Results: We investigated the behaviour - dynamics, adsorption, translocation, and physical interactions – of a variety of AuNPs at the biomembrane interface. The techniques listed above are beginning to provide localised, nanoscale information on the dynamics and mechanisms governing the interactions of AuNPs and biomembranes.
Conclusion: The precise mechanism by which AuNPs adsorb to the bio-membrane is beginning to be elucidated, revealing several interesting behaviours: 1) initial adsorption, 2) nanoparticle incorporation and/or translocation, 3) particle-induced phase change, and 4) translocations of the particles. These interactions are of broad scientific and medical interest because nanomaterials have recently become a viable method for manipulating matter at the cellular level, particularly for therapeutic and diagnostic applications.

Biography:
Doctor of Philosophy (Chemistry) 2017, Bachelor of Teaching 2011/ Bachelor of Science (Hons) 2012
ARC DECRA Research Fellow, RMIT University.
Aaron has published 72 refereed articles in high-impact, international journals and three book chapters. This research has had 2,136 citations and a H-index of 24. The impact of his research has been recognised by numerous early career researcher awards and $3 million in grant funding.
Beyond his research, Aaron is dedicated to mentoring, including 17 PhD, two masters, and five honours students and fellow Early Career Researchers.

Young investigator

Rashad Kariuki PhD Student, RMIT University
Nanotechnology computational chemistry physical chemistry