

# Faculty of Science

## Dayong Jing Student Fellowship

### IBMD Research Projects Available – 2024 Summer Round

- Quantum nanoparticles for biological imaging
- Single nanoparticle optical trapping and cooling in physiological environments
- Absolute temperature measurement of mitochondria in live cells
- Integrating the upconversion nanomaterials with nanofibers for enhance biosensing and photodynamic therapies
- Developing electrokinetically active ultrasensitive methods for cancer diagnostics
- Instrument-free electrophoretic separation and detection of complex biomarkers using low-cost textile threads
- Tracking SARS-CoV-2 virus spike within lung cells
- Oligo-based biosensors for quantification of cancer-associated microRNAs
- Recombinant CLIC Proteins as Cell Protective Agents
- Integrated Multi-Organelle Interactome Mapping: Unveiling Cellular Dynamics
- Intracellular viscosity measurements by upconversion nanoparticle tracking correlated with Brillouin imaging
- Intracellular temperature and viscosity measurement
- Rapid test of SPINT1 biomarker for diagnosis of pregnancy with risk of stillbirth
- Point-of-care testing of Preeclampsia
- Single nanoparticle tracking within confined nanopores
- Studying Non-Spherical Particle Dynamics for Advanced Bioparticle Sorting in Microfluidics
- Small Extracellular Vesicles Encapsulating miRNA-16-5p as a Novel Therapeutic for PD-L1 Inhibitor-Dependent Immunotherapy in Pleural Mesothelioma
- The role of exosomal circular RNA as novel biomarker for brain metastasis in non-small cell lung cancer and its inhibition as a treatment option
- The development of hybrid luminescent probes for biomedical applications.

# Faculty of Science

## Dayong Jing Student Fellowship

### IBMD Project Supervisors

#### **Professor Jiajia Zhou**

Prof Zhou currently holds an Australian Research Council Future Fellowship and National Health and Medical Research Council Investigator Grant. She has won a number of major awards including the 2022 David Syme Research Award, 2019 Sturges Prize, and 2018 Nanomaterials Young Investigator Award. In 2016, she joined UTS Institute for Biomedical Materials and Devices where she has worked on making nanoparticles even smaller while retaining their useful optical properties. This removes an obstacle to further improvements in resolution and sensitivity in areas such as security inks, display technologies, quantum biotechnology, bioimaging and sensing. She has also worked on applying these technologies in rapid COVID-19 antigen tests, and protein and pathogen detection for the food industry.

#### **Dr Gungun Lin**

Gungun Lin is an ARC DECRA fellow and Senior Lecturer at the School of Mathematical and Physical Sciences, UTS. He is a core member of the Institute for Biomedical Materials and Devices (IBMD), where his research program focuses on functional micro- and nanomaterials and microelectromechanical system (MEMS) technologies for biomedical applications. Gungun's research expertise spans materials physics and chemistry, micro- and nanofabrication, micro and nanotechnology, and analytical chemistry. He received his Master of Science Degree from the University of Ulm in Germany and his PhD degree with the highest honor (Summa Cum Laude) from Chemnitz University of Technology in Germany.

#### **Dr Martin (Mohammad) Sadraeian**

Dr Sadraeian is a Postdoctoral Researcher and a core member of IBMD. Dr Sadraeian completed his PhD in Biomolecular Physics with key contributions on Anti-HIV immunoconjugates. He has conducted projects on anti-viral photo-immunotherapy and virus photoinactivation. Dr Sadraeian is already working on photo-diagnostics for detection of miRNA and viral RNA. The major interest of the Sadraeian's project is the biomolecule manipulation, including the designing and production of novel synthetic RNA and DNA molecules, and conjugating them with antibodies and upconverting nanoparticles (UCNP). The final products will be biosensors for photo-diagnostics of cancer or virus infection.

#### **Dr Jawairia (Jia) Khan**

Dr Khan is a material scientist and core member of the Institute for Biomedical Materials and Devices (IBMD). She was awarded her PhD degree in Analytical Chemistry from University of Wollongong, Australia in 2021. Dr Khan's research focuses on developing low-cost fiber-based microfluidics for point-of-care analysis including electrophoretic separations and in-situ on-fiber analyte detection. A current focus involves the use of these fiber-based microfluidics in developing next generation lab-on-fiber devices for liquid biopsy and biosensing using upconversion nanoprobles, with the ultimate goal to integrate the system into wearable sensors. Her research expertise spans materials and devices, fabrication techniques, nanotechnology, analytical chemistry and characterization.

## IBMD Project Supervisors

### **A/Prof Irina Kabakova**

A/Prof Irina Kabakova is an Associate Head of School MaPS (Education and Students) and an Optical Physicist working in the field of Advanced Microscopy/Spectroscopy. She runs a Brillouin Microscopy Lab at UTS. Brillouin Microscopy unites optics and acoustics and looks at mechanical properties of materials at the microscale. The beauty of this technology is that mechanical parameters of the materials are read out by using only a focused beam of light, making it into a versatile and safe technique for use with biological materials such as tissues and cells. In Brillouin Imaging Lab, we explore how pathological processes in cells and tissues represent themselves in changes in tissue's elasticity. These findings are key to understanding the disease progression at the microscale as well providing means for early disease diagnostics.

### **Dr Le (Leo) Zhang**

Dr Zhang serves as a Postdoctoral Research Fellow at UTS and plays a pivotal role as a core member of the UTS Institute for Biomedical Materials and Devices (IBMD). He completed his PhD in Biomedical and Microbiology at UTS in 2021, under the guidance of Distinguished Professor Dayong Jin. Emerging as an international leader in antimicrobial resistance (AMR), his primary focus lies in exploring the mechanisms behind bacterial evolution of antibiotic resistance through a variety of interdisciplinary approaches. These methods include single-molecule microscopy, whole-genome sequencing, and global transcription analysis. Dr Zhang's groundbreaking work involves the integration of photonics and advanced materials into molecular biology, significantly contributing to the understanding of AMR. His research has yielded 19 journal publications, featuring in prestigious outlets such as Nature Methods, eLife, and Analytical Chemistry.

### **Prof Stella Valenzuela**

Prof Stella Valenzuela undertook her PhD studies in cell and molecular biology [identifying novel genes - CLIC1 and MIC-1 - from activated macrophage cells] at the Centre for Immunology (CFI), St Vincent's Hospital Sydney, obtaining her PhD from the University of NSW. Prior to this she had worked in the commercial sector, in the biotechnology companies Australian Monoclonal Development Pty Ltd and Cellabs Pty Ltd in research and development of monoclonal antibody technologies for research and diagnostic purposes. Following her PhD studies she was a Research Scientist at the CFI [functional studies of intracellular ion channel proteins - CLICs], later moving to the University of NSW to take up a position as an NHMRC Research Fellow [knockout mouse studies of S100 inflammatory proteins]. She later joined the University of Technology (UTS), Key Centre for Health Technologies [cellular responses to mobile phone frequencies]. She is currently the Director for the ARC Research Hub for Integrated Device for End-User Analysis at Low Levels (IDEAL Hub) at UTS. Previously she has served as both Head of School and Associate Head of School (Research) in the School of Life Sciences, UTS. Prof Valenzuela is a member of the Institute for Biomedical Materials and Devices and the Centre for Health Technologies and previously also a member of the Institute of Nanoscale Technologies, UTS. She has been instrumental in establishing Bionanotechnology research at UTS and is currently working with her industry partner Surgical Diagnostics Pty Ltd, within the IDEAL HUB, an ARC Industry transformation hub, developing devices that use ion channel proteins and tethered membrane technologies.

### **Dr Libing Fu**

Dr Fu is a Postdoctoral Research Associate IBMD. In 2018, Dr Fu received her PhD in upconversion nanoparticle-based drug delivery supervised by Deputy Dean of Research and Innovation, Prof Roger Chung at Macquarie University Centre for Motor Neuron Disease Research. In 2014, Dr Fu acquired a full overseas scholarship from the China Scholarship Council and Macquarie University. From 2021-2023, Dr Fu joined IBMD to lead the lateral flow assay program. Her research focuses on signal-on DNA biosensors, lateral flow assay, rare-earth-doped nanoparticle-based brain drug delivery, super-resolution microscopy imaging, cell culture, and microinjection & bioimaging of zebrafish.

## IBMD Project Supervisors

### **Dr. Qi Wen**

Dr. Wen works across the disciplines of physics, chemistry, materials science, and nanoengineering, at the forefront of nanotechnology and interfacial physics. In materials science, she is establishing new methods for fine-tuning the size, shape, and surface properties of nanochannels and investigating their many unique ion transport and electrochemistry properties. Particularly, she aims to integrate these new functionalities into nanofluidic devices. She is transforming fundamental knowledge in physical sciences into useful separation and energy conversion applications, such as ion sieving, desalination, and artificial photosynthesis. She has developed technology for ultrahigh efficiency mass/energy transportation and advanced manipulation that will enable ultra-fast, sensitive single molecule tracking, and advance basic molecular mechanobiology research and multi-modal chemical and electrical controlled mass transport. At the beginning of 2023, she joined ARC Laureate Fellow Prof. Dayong Jin's group at UTS. She extended her research interests to include controlled synthesis of upconversion nanoparticles with desirable size, shape, surface, and composition, as well as optical system design, single nanoparticle tracking and sensing, and nanofluidic system fabrication.

### **Dr Sareh Zhand**

Dr. Sareh Zhand is a highly accomplished researcher with a PhD in Microbiology from Shahid Beheshti University in Iran, where she focused on oncolytic virotherapy for colorectal cancer. She has held several academic positions at the University of Technology Sydney (UTS), including post-doctoral research associate and research assistant roles, contributing significantly to biomedical engineering and microfluidics. Her research expertise spans cancer diagnosis, particularly through the use of small extracellular vesicles, with notable publications on pleural mesothelioma biomarkers and immune cell engineering. Dr. Zhand has received several prestigious awards for her oral and poster presentations, and she has secured a substantial iCARE Discovery Grant for research on mesothelioma. Additionally, she has mentored multiple early-career researchers, reflecting her commitment to advancing the field and nurturing future talent.

### **Dr Guochen Bao**

Dr Guochen Bao is an Emerging Leadership 1 Fellow of the Australia National Health and Medical Research Council (NHMRC EL1), a Chancellor's Research Fellow (CRF) at University of Technology Sydney (UTS), with expertise in organic synthesis, analytical chemistry, spectroscopy, hybrid nanomaterials, nanophotonics characterisations, and biomedical engineering. Currently, Dr Bao leads the research focusing on developing hybrid materials, with desired functions, and optical and nanophotonic properties, and integrating these new functionalities into molecular/nano-probes and functional devices for ultrasensitive bioassay, biomedical imaging, and precise therapy. Details please find at <https://profiles.uts.edu.au/Guochen.Bao>