

# POLYU Academy <sup>FOR</sup> Interdisciplinary RESEARCH

RIAM • RIAIoT • RiFood • RI-IWEAR • RILS  
PRI • RISA • SCRI • RISE • RISports • RISUD  
RCMI • RCDSE • MHRC • RCRE • RCSV

Please don't miss our  
**Distinguished Lecture Series in Fall 2022!**  
Stay tuned for more details!

**PAIR Newsletter**  
**ISSUE 3 - September 2022**



## Contents

### 04 Chief Editor's Corner

#### Knowledge Transfer

- 05 Eight PAIR projects awarded PolyU President's Awards for Outstanding Achievement in Knowledge Transfer
- 06 World's first optical fibre sensing system for railway monitoring
- 07 Urban positioning: 3D mapping-aided GNSS using dual-frequency pseudorange measurements from smartphones
- 08 PolyU-developed space instruments contributed to Nation's first lunar sampling mission
- 09 Applying simultaneous defocus technology to raise the standard of myopia control and address global problem of myopia

#### Feature Stories

- 10 Escalating interdisciplinary research for advanced sports science and technology
- 14 A dialogue with Dr Wong Ka-hing, Director of the Research Institute for Future Food
- 18 There is no health without mental health



Chief Editor: Prof. Chen Qingyan  
 Editor: Ms Linda Gudeman  
 Assistant Editors: Ms Florence Chan, Ms Sara Cheuk, Ms Mavis Fan and Ms Sherri Cheng

#### PolyU Academy for Interdisciplinary Research

Telephone: (852) 3400 3036  
 Email: info.pair@polyu.edu.hk  
 Website: www.polyu.edu.hk/pair/  
 Address: HJ201, 2/F, Stanley Ho Building  
 The Hong Kong Polytechnic University  
 Hung Hom, Kowloon, Hong Kong

#### PAIR Newsletter – Issue 3 – September 2022

PAIR Newsletter is published regularly by the PolyU Academy for Interdisciplinary Research and distributed by email and posted to PolyU research staff, students and alumni as well as related research institutes/ centres, researchers, supporters, donors and friends.

Current circulation (printed and online): 100,000  
 © The Hong Kong Polytechnic University. All Right Reserved.

### Research Achievements

- 22 Weyl semiconductor enables high-performance topological transistors
- 23 Super-fast large-area economical marine reclamations for housing and infrastructural developments
- 24 New water filter to safeguard clean water

### People

- 25 PAIR young scholars on the rise
- 28 PAIR scholars listed among National Top 20 by Research.com
- 29 PAIR members receive InnoStars Award
- RILS management committee member receives JSCE International Collaboration Award
- 30 PAIR scholar awarded RGC Senior Research Fellow 2022/23
- PRI member honoured with PolyU Young Innovative Researcher Award (YIRA) 2022

### News & Events

- 31 International Conference on Intelligent Wearable Systems (ICIWS 2022) successfully held
- 32 PAIR is officially inaugurated on 16 July 2022
- 34 PAIR shines at PolyU InnoTech Open Day
- 35 PolyU holds media luncheon and laboratory visit for local press
- RISUD key study on PM2.5 air pollution awarded RGC Theme-based Research Scheme funding
- 36 PAIR constituent research units make remarkable achievements
- 37 EcoMat, a new international academic journal, presents cutting-edge advanced materials for green energy and the environment







PolyU Academy for  
Interdisciplinary Research  
香港理工大學高等研究院

**PolyU Academy for Interdisciplinary Research**

*Director*

**Prof. Chen Qingyan**

*Global STEM Scholar and*

*Chair Professor of Building Thermal Science*



**Research Institute for Advanced Manufacturing**

*Director*

**Ir Prof. Man Hau-chung**

*Cheng Yick-chi Chair Professor in Manufacturing Engineering and  
Chair Professor of Materials Engineering*



**RILS** 土地及空間研究院  
Research Institute for Land and Space

**Research Institute for Land and Space**

*Director*

**Prof. Ding Xiaoli**

*Chair Professor of Geomatics*



**Otto Poon Charitable Foundation Research Institute  
for Smart Energy**

*Director*

**Ir Prof. Wang Shengwei**

*Otto Poon Charitable Foundation Professor in Smart Building and  
Chair Professor of Building Energy and Automation*



**Research Centre for Deep Space Explorations**

*Director*

**Ir Prof. Yung Kai-leung**

*Sir Sze-yuen Chung Professor in Precision Engineering and  
Chair Professor of Precision Engineering*



**Research Institute for Artificial Intelligence of Things**

*Director*

**Prof. Cao Jiannong**

*Otto Poon Charitable Foundation Professor in Data Science and  
Chair Professor of Distributed and Mobile Computing*



**Photonics Research Institute**

*Director*

**Prof. Lu Chao**

*Chair Professor of Fiber Optics*



**Research Institute for Sports Science and Technology**

*Director*

**Ir Prof. Zhang Ming**

*Chair Professor of Biomechanics*



**Mental Health Research Centre**  
精神健康研究中心

**Mental Health Research Centre**

*Director*

**Prof. David Man Wai-kwong**

*Professor, Department of Rehabilitation Sciences*



**Research Institute for Future Food**

*Director*

**Dr Wong Ka-hing**

*Associate Professor, Department of Applied Biology and  
Chemical Technology*



**Research Institute for Smart Ageing**

*Director*

**Ir Prof. Zheng Yongping**

*Henry G. Leong Professor in Biomedical Engineering and  
Chair Professor of Biomedical Engineering*



**RESEARCH INSTITUTE  
FOR SUSTAINABLE URBAN DEVELOPMENT**  
可持續城市發展研究院

**Research Institute for Sustainable Urban Development**

*Director*

**Prof. Li Xiangdong**

*Ko Jan Ming Professor in Sustainable Urban Development and  
Chair Professor of Environmental Science and Technology*



**RESEARCH CENTRE FOR  
RESOURCES ENGINEERING TOWARDS CARBON NEUTRALITY**  
碳中和資源工程研究中心

**Research Centre for Resources Engineering  
towards Carbon Neutrality**

*Director*

**Ir Prof. Poon Chi-sun**

*Michael Anson Professor in Civil Engineering and  
Chair Professor of Sustainable Construction Materials*



**Research Institute for Intelligent Wearable Systems**

*Director*

**Prof. Tao Xiaoming**

*Vincent and Lily Woo Professor in Textile Technology and  
Chair Professor of Textile Technology*



**Otto Poon Charitable Foundation  
Smart Cities Research Institute**  
潘樂陶慈善基金智慧城市研究院

**Otto Poon Charitable Foundation Smart Cities  
Research Institute**

*Director*

**Prof. John Shi Wen-zhong**

*Otto Poon Charitable Foundation Professor in Urban Informatics  
and Chair Professor of Geographical Information Science and  
Remote Sensing*



**Research Centre for  
Chinese Medicine Innovation**  
中醫藥創新研究中心

**Research Centre for Chinese Medicine Innovation**

*Director*

**Prof. Wong Man-sau**

*Professor, Department of Applied Biology and Chemical Technology*



**Research Centre for SHARP Vision**

*Director*

**Prof. To Chi-ho**

*Henry G. Leong Professor in Elderly Vision Health and  
Chair Professor of Experimental Optometry*

## Chief Editor's Corner

As we release our third issue of Newsletter, it marks the second year of the Academy's journey since its establishment in year 2021, as well as the 85th Anniversary of PolyU. Over the past year, PAIR has expanded rapidly. With the joint effort from PolyU scholars, young researchers and administrators, as well as our staunch industry and academic partners around the world, the Research Institutes (RIs) and Research Centres (RCs) of PAIR have altogether generated significant volume of research outputs—bringing us deeper insights into major societal challenges, e.g., ageing, food security, renewable energy and most importantly, innovative and sustainable solutions towards the betterment of mankind.

With HK\$145 million internal support to the Research Institutes (RIs) and Research Centres (RCs) in 2021/2022 academic year and the strengths and concerted effort from PolyU faculty members, researchers and students, our RIs and RCs have altogether generated 615 affiliated publications; garnered over HK\$429 million external research funding and donations; conducted 47 technology transfer activities; and attracted 81 awards and prizes at territory, regional and international level. In this Issue, we have included PAIR research projects which have received the PolyU President's Award for Outstanding Achievement in Knowledge Transfer. After all, I believe, it is really our love for knowledge and care for mankind that can make these happen.

In June 2022, it is of our great pleasure to announce the establishment of the Research Institute for Sports Science and Technology (RISports). In this Issue, we are glad to have the Director of RISports to share on the Institute's ambition and latest research. Another highlight would be the development of new assessment and intervention for mental health and well-being promotion. We are glad to have the Director of Mental Health Research Centre to share the latest research findings, ongoing projects and innovative solutions for holistic mental health. Speaking of health, it has much intricate association with the food we produce and eat daily. In this Issue, the Director of RiFood will share in more details the Institute's current projects, extensive partnerships and way forward. Another highlight in this Issue would be the new section on "People", in which we will share some of the latest remarkable achievements of PAIR scholars and members and their recognition in local, regional and international award schemes.

Through PAIR Newsletter, we hope to inform our colleagues, partners, students, alumni, friends and the public about exciting things and latest updates here at PAIR, as well as awards and honours received by our researchers which we all as mankind are proud for. We truly hope that our sharing here will inspire you with fresher awareness, perspectives, and understanding of current world challenges, and perhaps, new innovations to the challenges. Thank you very much for staying tuned to us. Hope you all enjoy reading our third issue of Newsletter.



Prof. Chen Qingyan  
Director of PolyU Academy for Interdisciplinary Research



## Knowledge Transfer

### Eight PAIR projects awarded PolyU President's Awards for Outstanding Achievement in Knowledge Transfer

The President's Awards for Outstanding Achievement in Knowledge Transfer (KT) recognise outstanding KT accomplishments of PolyU researchers who have made a significant impact on society. Eight innovative projects led by PAIR researchers have recently received the Award in the "industry" category. Awards in this category are given to research projects which generate products, methodologies, systems and/ or solutions that significantly enhance technologies and the capacity and competitiveness of industries.

Project Name	PAIR's Constituent Research Unit	Project Leader(s)
Advanced Topographic Mapping and Geomorphological Analysis Technologies Contributing to Landing Site Selection in Space Exploration Missions	Research Centre for Deep Space Explorations (RCDSE)	Prof. Wu Bo, Associate Director of RCDSE
3D Mapping Aided GNSS for Effective Positioning and Navigation in Urban Areas	Research Institute for Artificial Intelligence of Things (RIIoT) and Research Institute for Land and Space (RILS)	Dr Hsu Li-ta, Member of RIIoT and RILS
Scolioscan: 3D Ultrasound Imaging System for Radiation-free Scoliosis Assessment	Research Institute for Smart Ageing (RISA)	Ir Prof. Zheng Yong-ping, Director of RISA
Nu-Torque™: Breakthrough in Yarn Manufacturing Technology for Better Textile Properties	Research Institute for Intelligent Wearable Systems (RI-IWEAR)	Prof. Tao Xiao-ming, Director of RI-IWEAR; Prof. Xu Bin-gang, Professor in the School of Fashion and Textiles; and Dr Hua Tao, Professor in the School of Fashion and Textiles
Smart Life-cycle Optimisation and Diagnostic Technologies for Buildings Energy Saving	Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE)	Ir Prof. Wang Shengwei, Director of RISE; Prof. Xiao Fu, Associate Director of RISE; Dr Li Hangxin, Research Assistant Professor in the Department of Building Environment and Energy Engineering; and Dr Shan Kui, Research Assistant Professor in the Department of Building Environment and Energy Engineering
Predictive Maintenance Railway Monitoring System Based on Optical Fibre Sensing	Photonics Research Institute (PRI) and Research Centre for Deep Space Explorations (RCDSE)	Prof. Tam Hwa-yaw, Associate Director of PRI; Ir Dr Lee Kang-ken, Professor of Practice (Transportation), Department of Electrical Engineering; Dr Michael Shun-yee Liu, Senior Scientific Officer in the Department of Electrical Engineering; Dr Stephen L.H. Cho, Research Fellow in the Department of Electrical Engineering; and Mr David H.Y. Ay, Project Associate in the Department of Electrical Engineering
Myopic Defocus Technology for Myopia Control in Children	Research Centre for SHARP Vision (RCSV)	Prof. To Chi-ho, Director of RCSV; Prof. Carly Lam, Professor in the School of Optometry; and Dr Dennis Tse, Associate Professor in the School of Optometry



## Knowledge Transfer

### World's first optical fibre sensing system for railway monitoring

A team led by Prof. Tam Hwa-yaw, Associate Director of the Photonics Research Institute (PRI), has developed the world's first integrated optical fiber-based railway monitoring system. The system enables railways operators in Hong Kong and Singapore to switch from costly and unreliable scheduled maintenance to a condition-based, predictive approach. Five Smart Railway Systems (SRS) and two Train Track Condition Monitoring (TTCM) systems have been adopted by railway operators in Hong Kong and Singapore, respectively, to monitor the condition of trains and tracks continuously, ensuring that the railway lines are in good operating condition.

Condition-based maintenance is a real-time monitoring strategy that is much more cost-effective and efficient than traditional scheduled maintenance because it “does only what is needed, not what is scheduled”.

This innovative approach comprises an optical fibre sensing network installed on rail tracks to monitor the health of trains traveling on the tracks. Another sensing network is installed on in-service trains to continuously monitor the condition of the tracks, overhead lines, and train structures. An important feature of this approach is that the two sub-systems countercheck each other to safeguard the proper functioning of the sub-systems and ensure the reliability of the measured data. All sensors in the two sub-systems use laser light and are resistant to electromagnetic interference, thus providing much higher-quality data than traditional sensors.



Computer user interface for the track-based train condition monitoring system

Recipient of the 2014 Berthold Leibinger Innovationpreis Prize

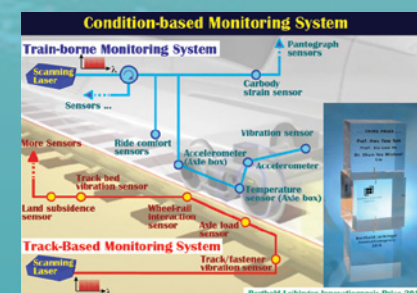


Computer user interface for the train-based track condition monitoring system

The system incorporates the use of big data analytics and machine-learning techniques to produce a large amount of high-quality measurement data from the critical components of trains and tracks, thus providing useful information about their condition. The team has been working closely with railway operators for over 15 years to develop the Health Index (HI) of trains and tracks. HI uses traffic light colours to indicate whether the condition of trains and tracks is good, deteriorating or bad. This allows the operators to easily identify the condition of various critical components and accurately predict the arrival times of trains.

The SRS systems are being used by the Mass Transit Railway Corporation (MTR) to monitor trains running along five metro lines. Meanwhile, the TTCM systems were installed and are operating on the two oldest metro lines in Singapore. These systems help reduce the cost of maintenance and enhance the safety and reliability of the railway lines.

The invention received the 2014 Berthold Leibinger Innovationpreis Prize, a prestigious award presented by the Federal Minister of Education and Research in Germany.



### Urban positioning: 3D mapping-aided GNSS using dual-frequency pseudorange measurements from smartphones

Location-based services, such as food and grocery delivery and taxi-hiring applications based on the geographical location of smartphones, are often used in our everyday lives. To date, dual-frequency global navigation satellite system (GNSS) positioning have been supported by an increasing number of smartphone models (Figure 1). However, there are times when the accurate location cannot be determined due to the limited smartphone GNSS performance. Dr Hsu Li-ta, Member of the Research Institute for Land and Space, Associate Head of the Department of Aeronautical and Aviation Engineering at PolyU, and his research team have been working on using a digital 3D mapping database to aid GNSS positioning in smartphones. Their research outcome is particularly important for urban smartphones users, who account for about 56% of the global population, according to the United Nations. They incorporated modernised GNSS civilised signals, including American GPS L5, European Galileo E5 and Chinese BeiDou B2a, in their 3D mapping-aided (3DMA) GNSS positioning algorithm. Their dual-frequency 3DMA GNSS algorithm can robustly achieve less than 5-meters of positioning in the urban canyons in Hong Kong (Figure 2). The result finding was published in NAVIGATION (<https://doi.org/10.1002/navi.448>) and Dr Hsu was invited by the Institute of Navigation in the United States to present the research work.

Figure 1. The number of smartphone model that supported dual-frequency GNSS over the years.

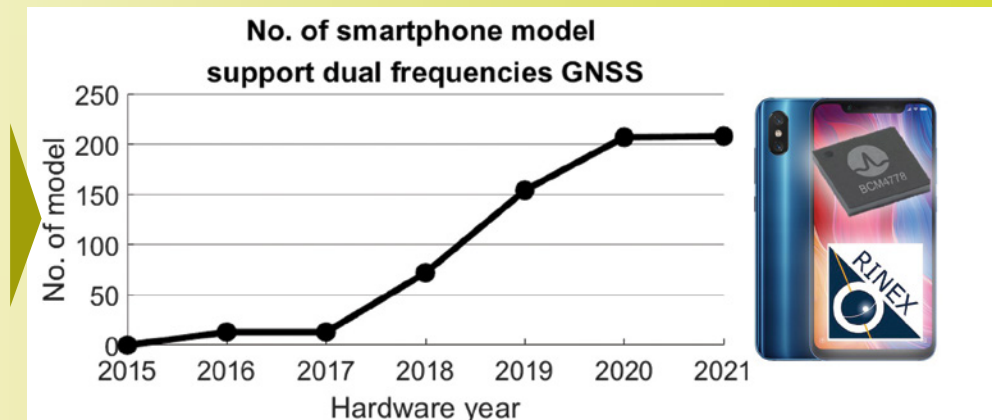
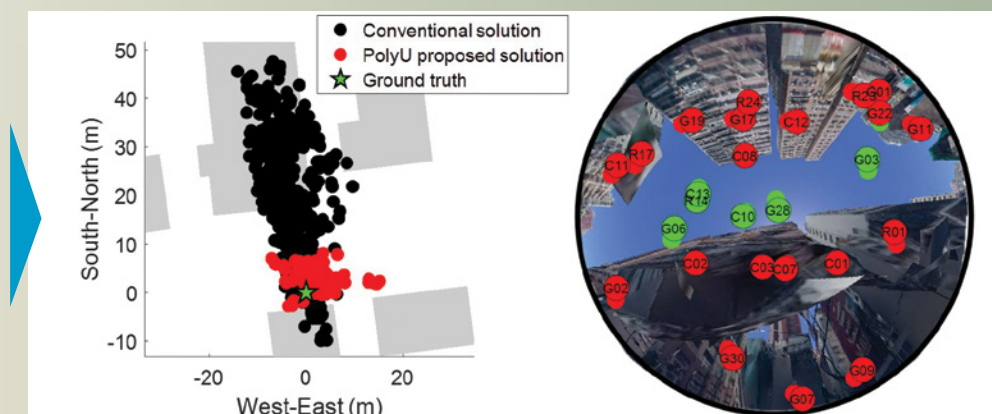
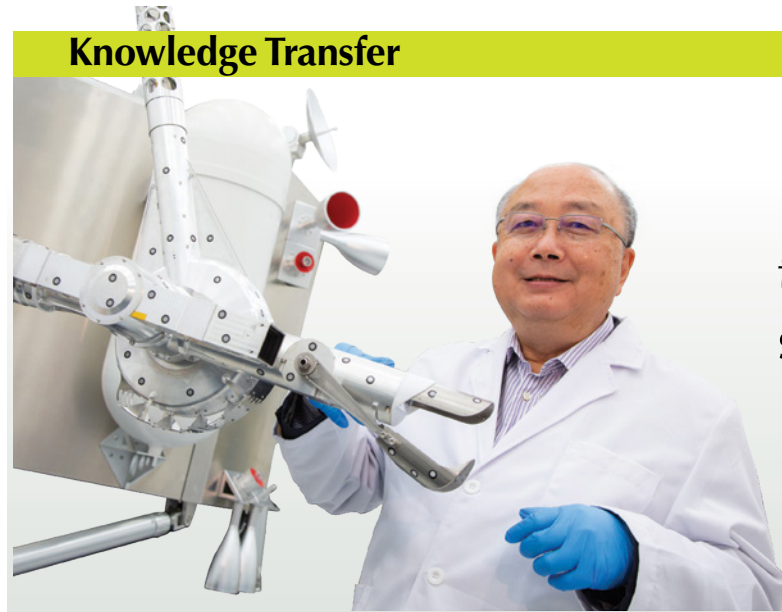


Figure 2. (Left) The positioning performance of the PolyU proposed positioning comparing to a conventional solution. (Right) The skyplot indicating many GNSS signals are blocked by buildings.





## Knowledge Transfer



### PolyU-developed space instruments contributed to Nation's first lunar sampling mission

In contribution to China's Chang'e 5 mission, a research team led by Ir Prof. Yung Kai-leung—Director of the Research Centre for Deep Space Explorations (RCDSE), Associate Head of the Department of Industrial and Systems Engineering, and Sir Sze-yuen Chung Professor in Precision Engineering at PolyU—developed and manufactured the “Surface Sampling and Packing System”. The System successfully acquired samples of rocks and soils from the lunar surface via robotic means, marking a new breakthrough in the Nation's space exploration project, as China became the third nation in the world to bring back lunar samples.

Chang'e 5 is China's first mission to collect lunar samples and the world's first lunar-sample return mission since the previous exploration in the year 1976. PolyU is the only tertiary institution in Hong Kong that possesses international deep space qualification experience and contributed to the Chang'e 5 mission.

The development of the System was technically complex and required very high levels of precision, accuracy and reliability. Prof. Yung's team overcame significant technical challenges in devising a system that could withstand the extreme space environment during different stages of the lunar mission. These challenges included the high daytime surface temperature and high-vacuum environment on the Moon, the impact and shock (e.g., solar winds and cosmic rays) on the equipment, and very strict weight limits for all devices used in the lunar mission. After six years of continuous effort and numerous trials, the team came up with a system of more than 400 components, made from materials including titanium alloy, aluminum alloy and stainless steel.

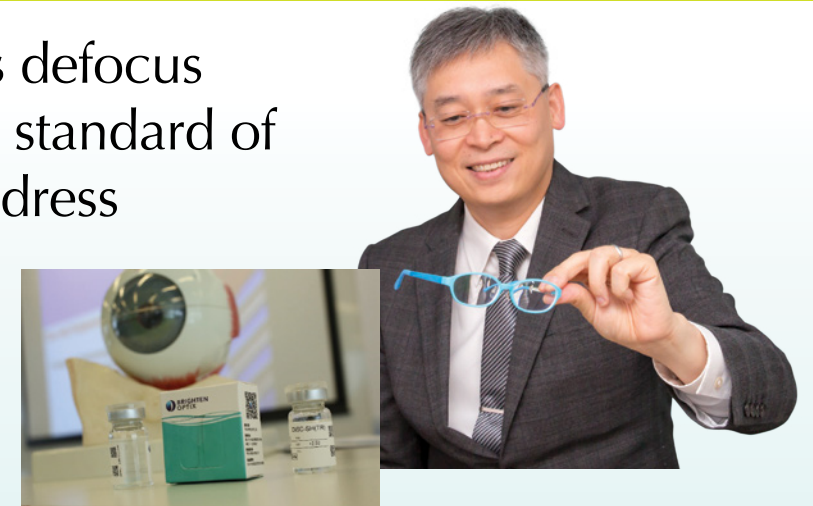
Chang'e 5 collected lunar samples through two means: a robotic arm for collection of lunar surface samples and a drilling machine for collection of underground samples. After Chang'e 5 landed on the near side of the Moon, the System's samplers acquired 1.5 kg of surface materials from the Moon and sealed them in a container. The robotic arm then lifted the container and placed it into an ascender. The ascender blasted off into lunar orbit, rendezvoused and docked with the orbiter, and transferred the sample container to the return vehicle that travelled back to Earth.

Lunar samples collected during the Chang'e 5 mission will help scientists understand some of the Moon's mysteries. The samples collected were the youngest-ever lunar samples brought back to the Earth, since Chang'e 5 landed in a region of the Moon much younger than those previously visited.

The System was awarded the “Scientific Technology Progress Award (Second Prize)” by the China Aerospace Science and Technology Corporation (CASC) and received an appreciation letter from The China Academy of Space Technology (CAST) for the University's contribution to space instrumentation. In addition, Prof Yung was individually bestowed with the “Scientific Technology Progress Award (Second Prize)” by CASC.



### Applying simultaneous defocus technology to raise the standard of myopia control and address global problem of myopia



Myopia, also known as short-sightedness, is a common vision condition in which people have difficulty seeing distant objects but can see nearby objects clearly. The condition occurs when the eyeball is too long. Thus, light entering the eye is focused in front of the retina, resulting in blurry vision.

Myopia affects between 70% and 90% of school-age children in Hong Kong and around 30% of people worldwide. It can develop into a potentially sight-threatening condition, affecting 10% of patients. By 2050, there will be five billion people with myopia (49.8% of the world population) and one billion people with high myopia (9.8% of the world population). Myopia affects the health and quality of life of individuals. The increasing prevalence of this condition calls for efforts to better control it.

Led by Prof. To Chi-ho, Director of the Research Centre for SHARP Vision (RCSV), RCSV members Prof. Carly Lam and Dr Dennis Tse have designed novel spectacle lenses and contact lenses—including the Defocus Incorporated Multiple Segments (DIMS) spectacle lens and Defocus Incorporated Soft Contact (DISC) lens for control of myopia progression in schoolchildren. The DISC lens has been found to be highly effective, slowing myopia progression by approximately 60%. If left untreated in childhood, such progression could lead to severe visual impairment and blindness later in life.

These lenses have contributed to evidence-based clinical practice in myopia control for children and received high marks from clinicians. The work of this RCSV team has been extended to over 25 research institutes. The patented and licensed lenses are now commercially available in Hong Kong and beyond.

The DISC lens and DIMS spectacle lens have attracted numerous international awards. The DISC lens was awarded the Gold Medal and a special grand prize at the 39th International Exhibition of Inventions in Geneva in 2011 while the DIMS spectacle lens won the champion grand prize at the 46th International Exhibition of Inventions in Geneva in 2018; and the 2020 SILMO d'Or Award (Vision) at the prestigious SILMO Optical Fair, one of the world's top optical fairs. The team also won the PolyU President's Awards for Outstanding Achievement in Knowledge Transfer: Industry 2021 (Team Award) in recognition of their impactful leadership and commitments to the research in applying the simultaneous defocus technology to advance the standard of myopia control and address a global problem.





## Feature Stories



# Escalating interdisciplinary research for advanced sports science and technology

The “unprecedented” success of Hong Kong athletes at the 2020 Summer Olympics in Tokyo has attracted unparalleled backing and attention from the community and expedited local sports development. The government and institutions in Hong Kong are now investing more resources in the sports sector for the nurturing of sports talents, elites, and related professionals. As one of the top 100 tertiary institutions worldwide, The Hong Kong Polytechnic University (PolyU) keeps abreast of regional and international developments and applies knowledge for timely, innovative, and practical solutions to pressing current and future needs. The field of sports science is no exception.

At a meet-and-greet session with national team Olympians at PolyU on 5 December 2021, Dr Lam Tai-fai, Chairman of the PolyU Council, pledged to support sports development with R&D in sports science and academic programmes. Within a year, PolyU has delivered on its pledge with the establishment of the Research Institute for Sports Science and Technology (RISports) on 1 June 2022.

Sports science and technology is an interdisciplinary area that integrates science, engineering, and design technology to solve sports-related problems. This area plays a vital role in athletes’ performance enhancement, public health promotion, injury prevention and recovery facilitation. Emerging technological solutions and innovation in the field of sports include carbon-fibre racing shoes, “sharkskin” swimsuits and carbon-fibre prostheses for amputee athletes.

Here at PolyU, we have the range of critical expertise needed for a world-class sports engineering platform, including musculoskeletal biomechanics, sports rehabilitation, health science, engineering and design, as well as textile and clothing. As such, the objective of RISports is to draw PolyU experts together and to collaborate with industry leaders and researchers to

provide novel scientific and engineering solutions to the sports world.

“Our research will be directed towards sports-related products, services, and solutions tailored to different groups of people (e.g. elite athletes, the general population, persons with special needs); innovative sportswear, equipment, and solutions for a better sports experience; training and rehabilitation efficacy enhancements; and promotion of sports engagement and sports safety. With our research in four thematic areas—(1) Sports Biomechanics and Human-Product Interaction, (2) Sports Product Design, Materials and Manufacturing, (3) Sports Measurement, Feedbacks and Instrumentation, and (4) Sports Training and Rehabilitation—we hope to create a new level of sports experience and promote a high-quality and healthy lifestyle for all. Sports science and technology can make sports more interesting, rewarding and safer,” explained Ir Prof. Zhang Ming, Director of RISports and Head of the Department of Biomedical Engineering at PolyU.

In fact, sports fans, athletes, and coaches have always been looking for ways to enhance their sports experience

and performance. However, some sports products, technologies and interventions are empirically driven without scientific proof or true enhancement of sports performance, and are thus less sustainable and impactful in the market and for society.

The research deliverables from RISports are distinctive in that they stress science-driven and evidence-based solutions for advancing sports technology. Prof. Zhang continued, “We have a truly dedicated interdisciplinary research team covering advanced, smart and sustainable materials; manufacturing technique and process; engineering (e.g. process, design, product, software, system); and human performance and related biomedical measurements and instrumentation.” By combining in-depth knowledge of sports and exercise performance, innovative ideas and advanced solutions, the Institute aims to help challenge the status quo of existing technologies and the limits of human performance. Our translational research is both consumer-centric and athlete-centric, and we will collaborate with sports institutes, sporting goods companies, government bodies and non-government organisations in and beyond Hong Kong.

“**Sports science and technology is an interdisciplinary area that integrates science, engineering and design technology to solve sports-related problems. This area plays a vital role in athletes’ performance enhancement, public health promotion, injury prevention and recovery facilitation.**”



“**Sports are for all people. Sports technology is no longer a privilege for professional athletes.**”

Sports are for all people. Sports technology is no longer a privilege for professional athletes. By making exercise equipment more suitable for seniors and people with disabilities and by designing systems that are more attractive to children, sports technology addresses major concerns of public health and the ageing population and enables all people to engage in sports. When it comes to sports training and rehabilitation, multiple disciplines come into play and make significant contributions. For example, biomedical engineers study injury mechanisms and thus facilitate early detection of musculoskeletal fatigue and strategies for injury prevention, while rehabilitation science helps develop a smart system for self-evaluation and individualised solutions for safe sports participation in indoor and outdoor settings. Mind-body exercises, such as Tai Chi or Qigong, are used as rehabilitation and therapeutic interventions.

By leveraging PolyU’s strengths in rehabilitation science and engineering, RISports is working with the respective experts and scholars on sports technologies for persons with disabilities and special needs, including prostheses for amputees and orthotic devices for body function enhancement and musculoskeletal rehabilitation.

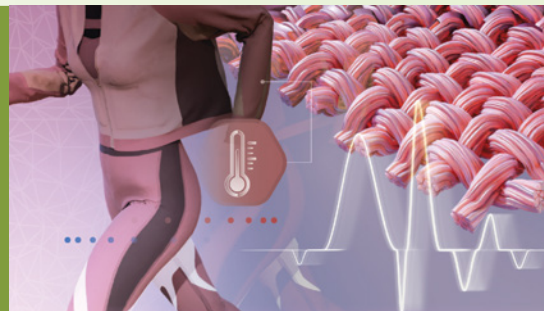




## Feature Stories

### Responding to sports development in Hong Kong and Mainland: professionalising sports as a discipline & bringing new opportunities to sports industry and research

“*There is a strong need for more research and development in sports science and technology; and to make sports and exercises interesting, rewarding and safe.*”



“I believe, aside from athletes’ achievements in the Tokyo Olympics in 2020, the ever-growing consumer needs and expectations for sports experience as well as competitions within the sports product industry have contributed to emerging interests and investments in research and innovation, as well as the design and manufacturing of sports products by the Hong Kong government and industry,” Prof. Zhang added.

Nowadays, particularly in modernised and ageing

societies, people are paying more attention to health and wellness. There is a strong need for further research and development in sports science and technology; and to make sports and exercises interesting, rewarding and safe. This type of research institute has been lacking in Hong Kong. RISports members have been actively collaborating with athletes and coaches and applying cutting-edge technologies to enhance athletes’ competitive performance.

“*The newly established Culture, Sports and Tourism Bureau (CSTB) marks the HKSAR government’s establishment of a sports sector to support local elite sports, maintain Hong Kong as a centre for major international sports events, and promote sports in the community through enhanced professionalism in sports and development of the sports industry.*”

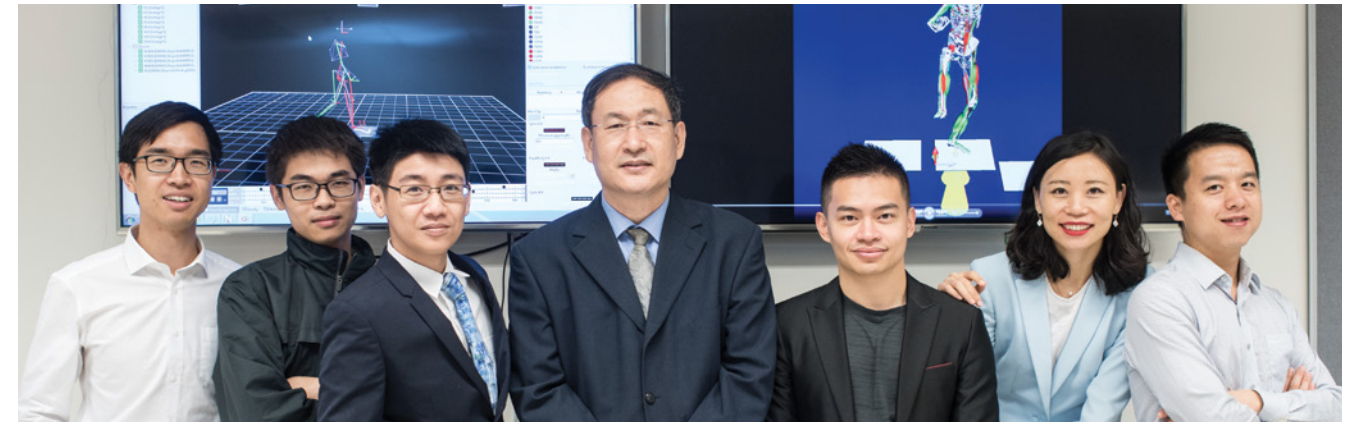
Cultivating sports talents is important for successful sports development. PolyU has a proud tradition of supporting elite student-athletes in achieving both sports and academic aspirations through the Outstanding Sportsmen Recommendation Scheme (OSRS). RISports will work in line with university policies and nurture young researchers, research students and undergraduates with interdisciplinary knowledge and experience in sports science and technology.

The newly established Culture, Sports and Tourism Bureau (CSTB) marks the HKSAR government’s establishment of a sports sector to support local elite sports, maintain Hong Kong as a centre for major international sports events, and promote sports in the community through enhanced professionalism in sports and development of the sports industry. China also announced the National Plan on sports and

fitness in the 14th Five-Year Plan (2021–2025). The nation aims to raise the percentage of the population who engage in regular physical activity to 38.5% and increase the scale of sports industry to generate an annual revenue of RMB 5 trillion by year 2025. These developments will definitely provide more opportunities for RISports, in particular, to attain its objective of encouraging the general public to participate in sports passionately and to exercise happily and safely.



### 25 years’ experience in sports science research: trends, significance and way forward



The demand for biomedical engineering (BME) expertise is continually increasing. We are now in an era with rapid emergence of new innovative technologies, and citizens and governments are devoting more attention to human health and ageing issues. BME bridges engineering technology and health/ medical care, and therefore should play an increasingly important role in the sports industry.

During the current pandemic, the unprecedented challenges to public health and the associated social disruptions may stimulate people to develop solutions for prevention, diagnosis treatment and rehabilitation.

Prof. Zhang’s research focuses on the biomechanics of the musculoskeletal system and body support design, and applies to the fields of sports science, orthopaedics and rehabilitation engineering. “In the past 25 years, my team

has been mainly working on the development of a biomechanical platform integrating experimental study with computational simulation for the understanding of the human musculoskeletal system and its support effects. Our computational simulation, using both a musculoskeletal model and a finite element model, can give a clear picture of the biomechanical performance of the foot and ankle and provide useful information for surgical intervention and shoe and orthosis design. This is a useful platform for understanding load transfer inside the body. Ultimately, our research on the body-support interface during sports and exercises can provide fundamental knowledge in body biomechanics to the field of sports science and technology,” said Prof. Zhang.



Associate Directors of RISports:



Prof. Fan Jin Tu



Prof. Amy Fu



Prof. Lilly Li



Prof. Wen Chih Yung



## Feature Stories



# A dialogue with Dr Wong Ka-hing, Director of the Research Institute for Future Food

**D**emographic shifts, digital technologies and consumers' demand for healthier food options and greater transparency in food production have driven new development in the food industry. To date, we have seen the rapid emergence and popularity of artificial food, diets, new farming methods and a digitalised food supply chain. What will be served on our dinner plates in coming decades? How will these foods be produced? How can we better prepare farmers, fishermen and food manufacturers for new methods of food production? What can be done to ensure healthy and sustainable food for all?

Accelerating the development of a future-oriented food system, PolyU proudly announces the establishment of the brand-new Research Institute for Future Food (RiFood). The new Institute, which marks the upgrade of the University's Food Safety and Technology Research Centre (FSTRC), will continue to build on the University's 10-year commitment to food science research, with fresh perspectives, new insights and interdisciplinary collaborations.

In this Issue, we invited Dr Wong Ka-hing, Director of RiFood, to describe the Institute's ambition, recent research and collaborative activities.

## From FSTRC to RiFood: building on achievements towards excellence in food research

**The Food Safety and Technology Research Centre (FSTRC) was established in August 2011 and has achieved impressive technological breakthroughs. Would you please share with us some of the Centre's major achievements? What has driven the establishment of the brand-new RiFood?**

A number of large-scale food safety incidents about 15 years ago drove PolyU to establish the Food Safety and Technology Research Centre (FSTRC) in the year 2011. During its 10-year tenure, FSTRC secured over HK\$160M in support from the industry and government of Hong Kong and Mainland China; published over 350 top journal articles; filed 30 Chinese and US patents; and received 20 national/international research awards.

Building on the Centre's success, the University invested HK\$30M to set up the Research Institute for Future Food (RiFood) in May 2021. RiFood is the first and only institute dedicated to food-related research among the universities in Hong Kong. At present, our research team consists of more than 50 academic staff members from 15 departments in 6 faculties and schools, bringing a wide spectrum of expertise to RiFood research. Since the Institute's first year of operation, we have received HK\$20M in funding support, published 29 journal articles and filed one patent. Our vision is to be a world-leading research institute that advances and transfers knowledge by research, public education and professional service to address the key challenges in food science and human health, for the benefit of humankind. At RiFood, interdisciplinary research, partnership and collaborations between experts from different disciplines will enable even more synergies.



*“Our vision is to be a world-leading research institute that advances and transfers knowledge by research, public education and professional service to address the key challenges in food science and human health, for the benefit of humankind.”*

## Expanded research to address food-human-environment complex

**What are the research foci of RiFood? Would you please tell us more about some of the rigorous research currently underway?**

The research scope of RiFood has expanded to address bigger global challenges related to food quality and quantity. In brief, RiFood has three main research directions: (1) Food Sustainability, (2) Smart Technology and Functional Food Development and (3) Nutrition and Human Health. These research directions address the interactions among the environment, food and humans.

First of all, “Food Sustainability” refers to food production which satisfies the food security needs of human society and preserves the environment for future generations. In this direction, we have been studying ways to improve food production systems—with the ultimate goal of developing efficient production methods for safe and high-quality food. For example, our project on precision hydroponics (a technique for growing plants in mineral nutrient solutions without using soil as a medium) seeks to provide nutrients (e.g. calcium, iron, iodine) that are lacking in the local diet. Aside from that, we also work on food waste upcycling and the detection and modelling of emerging food contaminants and animal diseases, as well as policies for the food supply chain.



Second, “Smart Technology and Functional Food Development” refers to the development of new food technologies and products. Research activities under this direction revolve around (a) new analytical/ metabolomics platforms for food authentication and understanding of traditional tonic food; (b) novel active ingredients for the development of functional food/ nutraceuticals; and (c) advanced technologies for future food industry such as nanotechnology, 3D printing and artificial intelligence etc. We have an investigative project on the conversion of agri-food waste into new sustainable materials (filaments) which would be used for 3D printing. We are also collaborating with the Research Institute for Artificial Intelligence of Things (RIAIoT) on the use of AI and high-resolution images for the classification of food freshness and quality.

Lastly, “Nutrition and Human Health” seeks to understand the effects of diet on human health. These include (a) nutrition for healthy ageing and early life; (b) the protective role of micronutrients against diseases, including COVID; and (c) the role and function of gut microbiota for human health. We are now initiating a number of longitudinal cohort studies under this research direction.



## Feature Stories

### Interdisciplinary, cross-sectoral and cross-border partnerships towards a better food system

*As a research institute dedicated to interdisciplinary solutions to food-related issues, would you please share with us some of RiFood's interdisciplinary, cross-sectoral and cross-border collaborations for attaining these solutions?*

Food research is interdisciplinary in nature, and RiFood actively pursues collaboration and strategic partnerships with universities, industry, and the government. In terms of academic partnership, we have been collaborating extensively with local academic institutions, such as The University of Hong Kong, Hong Kong Baptist University, and The Education University of Hong Kong; as well as international institutions, such as Vrije Universiteit Amsterdam, the University of Bologna, and Krida Wacana Christian University.

In terms of industrial partnership, we can look back on two landmarks in the year 2021. The first of these is the “PolyU-Yakult Joint Research Laboratory for Probiotics and Prebiotics in Human Health”—a new laboratory formed jointly by RiFood and Hong Kong Yakult Co Ltd. The Laboratory is dedicated to cutting-edge (pre-)clinical research in probiotics and prebiotics for the prevention and/or treatment of gut and brain diseases and eczema. We received a HK\$2M donation from Hong Kong Yakult Co Ltd as a starting research fund. Supported by Danone Nutricia Early Life Nutrition (Hong Kong) Ltd, the second landmark is a recent collaborative research study, “Hong Kong Microbiome and Nutritional Pathway”, which looks at the associations between early life nutrition and gut microbiome development among Caesarean-born Chinese babies.

In terms of public-academic partnership, locally, RiFood is collaborating with the Agriculture Fisheries and Conservation Department in Hong Kong to provide a mariculture training programme to interested parties and to conduct research at the first open water mariculture facility, located at Tung Long Island. We have trained 63 participants in the first year of the programme.

RiFood's impact also goes beyond Hong Kong. Contributing to the development of the Greater Bay Area (GBA), we joined hands with the Guangdong Academy of Sciences

*“Our members have been actively contributing to government advisory committees on local and regional levels.”*

and University of Macau to establish the Guangdong-Hong Kong-Macau Joint Lab on Microbiota and Fish Health. This laboratory aims to identify and house 1,000 beneficial bacteria species, which will be used for further product development—with the goal of enhanced aquaculture productivity.

You may have seen our members addressing food-related topics in the press and on different media platforms. Our members have been actively contributing to government advisory committees on local and regional levels. These include the Advisory Committee on Agriculture and Fisheries in Agriculture, Fisheries and Conservation Department (AFCD), HKSAR; the Expert Committee on Food Safety at the Centre for Food Safety (CFS), Food and Environmental Hygiene Department (FEHD), HKSAR; the Hong Kong Council for Testing and Certification (HKCTC); and the Expert Committee on GBA Food Quality and Standard in the Guangdong Administration for Market Regulation in supporting the establishment of food safety standards.

### RiFood as a central food research incubator

*We are excited to learn about some special equipment and facilities at RiFood that have made the Institute's advanced research possible. Would you please share with us in this regard?*

We possess a number of research platforms to facilitate our research. The Simulator of the Human Intestinal Microbial Ecosystem (SHIME®) is an instrument that carries out long-term experiments on human gut microbiota for identification of beneficial and harmful foods and probiotics. Our Sensory Evaluation Laboratory enables us to do objective testing of human preferences in regard to the appearance, fragrance and taste of foods. The Suga Research Laboratory for Sustainable Urban Green Agriculture was designed for experiments related to hydroponics and other types of indoor farming techniques. Finally, our laboratory for Infant and Child Nutrition, located in the Hong Kong Science Park, contains advanced equipment for analysis of breast milk and food items.

We also provide opportunities for research students in RiFood. We welcome undergraduates to get in touch with us and join our team and projects to learn what food research is like.

### Nanotechnology for healthy ageing and cancer treatment

*Your research has been recognised by a number of regional and international awards. Would you please tell us more about your efforts as well as their significance and scale of impact?*

Over the years, I have published over 100 top journal papers, conference abstracts/proceedings, and book chapters; generated 9 China/US patents; and received over HK\$50 million in funding support from government and the food industry in both Hong Kong and Mainland China. My current interest is the preparation of novel selenium nanosystems with different mushroom polysaccharide-protein (PSP) complexes for health promotion and biomedical applications (e.g. anti-osteoporosis, anti-cancer, and immunomodulation). Selenium is an essential trace mineral for human health with a recommended daily allowance of 55 µg/day. There is substantial evidence that selenium deficiency is detrimental to bone microarchitecture and associated with osteoporosis—suggesting its role in bone metabolism.

In our research programme, we have successfully prepared novel selenium nanoparticles, “Cs4-SeNPs”, using mushrooms. Our recent study involving oral administration of Cs4-SeNPs in mouse models has demonstrated the nanoparticles' effectiveness in promoting bone formation, attenuating bone resorption, and improving bone microarchitecture. This patented nanotechnology has gained wide recognition with a number of national and international awards, such as the Second-Class Award in Technological Innovation at the Ministry of Education's Higher Education Outstanding Scientific Research Output Awards (Science and Technology) 2020, and has been licensed to the local health food industry for commercialisation.

Selenium nanoparticles have also been found to possess remarkable anti-tumor efficacy. Our study discovered that SeNPs functionalised with mushroom PSP have an anti-proliferation effect on triple-negative breast cancer (TNBC)—a subtype of breast cancer which accounts for

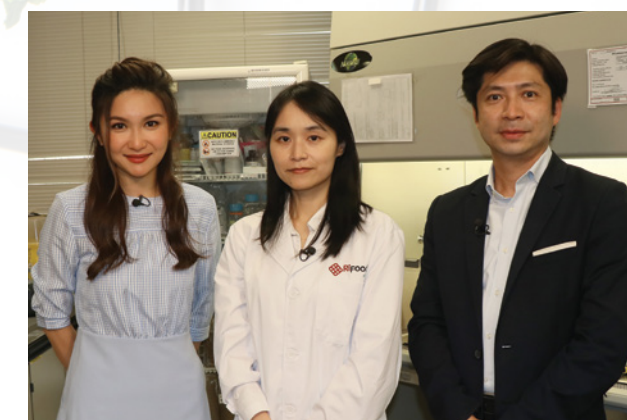
10–15% of all breast cancers. Our long-term goal is to develop a safe and evidence-based cancer-targeted nano-drug for human TNBC treatment, thereby improving the quality of life for TNBC patients in Hong Kong.

*“Healthy life can be something simple—the key is to find the right balance and build self-discipline.”*

### Promoting health in society while staying healthy as a food scientist

*With your determination to develop novel functional foods for disease prevention/ treatment, how has your profession as a food scientist impacted your values and lifestyle?*

I have always been conscious of my health despite a busy work schedule. I pay attention to a balanced diet—I have been eating three meals at set times every day and having a big bowl of vegetable salad every morning for many years. Aside from that, I very much value spending time with my family. I play football and go hiking with my family on a weekly basis. This is also a precious opportunity to have parent-child quality time and stay close to nature. Having sufficient rest is crucial. I do remind my daughter to go to bed by 10:00pm. Of course, mental health is important, too. As we remain positive and take things easy, our immunity improves as well. If we are able to be consistent with these habits, we can enjoy healthy living. A healthy life can be something simple—the key is to find the right balance and build self-discipline.





## Feature Stories

# There is no health without mental health



According to the World Health Organization, there is “no health without mental health”. Mental health—a state of well-being in which a person realises his/ her potential, effectively copes with life stresses, works productively, and contributes meaningfully to the community—has gained increasing awareness in academia and society in recent decades. Mental health research helps inform strategic direction and interventions for the promotion of mental health. To this end, higher education institutions around the world have joined together to establish new research units.

At PolyU, the Mental Health Research Centre (MHRC), a constituent unit under PolyU Academy of Interdisciplinary Research (PAIR), was established on 1 October 2021. MHRC is dedicated to translational research that will inform new practice models and changes in mental health policies.

## A strategic research centre for comprehensive mental health promotion

The aim of MHRC is to provide a broad evidence base for enhancements to mental health research practice, psychosocial and cultural impacts, and policy change and development in all aspects of mental health. According to Prof. David Man, Director of MHRC, “at the heart of MHRC’s work is our focus on both quality and impact. We have been taking wide-ranging actions to achieve our aim. These actions include research and development (e.g. cross-disciplinary and inter-sectoral mental health studies and collaboration with other research institutes and research centres under PAIR in interdisciplinary and knowledge exchange projects); professional exchange (e.g. organising conferences, symposia, seminars and international

*“The aim of MHRC is to provide a broad evidence base for enhancements to mental health research practice, psychosocial and cultural impacts, and policy change and development in all aspects of mental health.”*

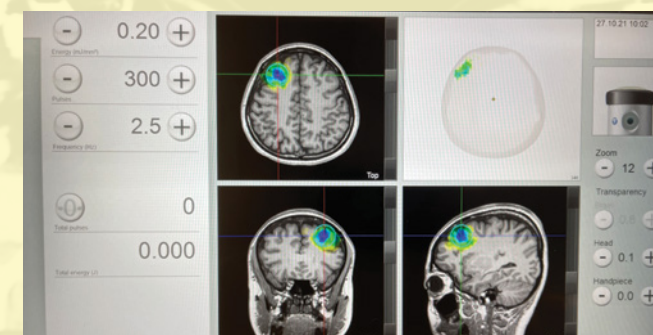


visiting programmes); partner engagement (e.g. establishing an alliance with members in the academic, governmental and charitable sectors); and research support (e.g. developing large grant application projects and providing funding support to accelerate research outcomes and deliverables).”

MHRC’s research falls into five key areas: (1) Basic and Translational Neuroscience of Mental Health; (2) Neuroimaging Studies and Innovative Cognitive

Rehabilitation of Mental Disorders; (3) Behavioural and Psychiatric Rehabilitation; (4) Psychosocial and Cultural Aspects of Mental Health; and (5) Service Use and Social Policy of Mental Health. The Centre has established internal seed funding to support the work of PolyU researchers in these areas. The five research areas are interlinked and reinforce each other. They are also structured in a way that allows ample room for local, regional and international partnerships and collaborations with other researches, institutions and centres. This approach facilitates and maximises the translational and interdisciplinary nature of the Centre. Prof. Man further explained, “as such, MHRC welcomes researchers by bringing together two to three research areas to answer new questions, conduct pilot studies and submit large grant applications. Ultimately, as we target mental health’s technical know-how, intervention models and policy-making, we hope MHRC’s research strength and diversity can help bring society towards comprehensive health promotion.”

Since the year 2021, MHRC has started several external projects funded by the public and charitable sectors. In addition to Prof. Man, Prof. Hector Tsang Wing-hong, Associate Director of MHRC, and Dr Sonata Yau Suk-yu, Member of MHRC, have been awarded funding from the government and charitable foundations for their individual projects on novel mental health interventions for different populations in the community. These projects include 3P (Prevention, Protection, and Promotion) intervention for individuals with COVID-19 by Prof. Man; mindfulness-based Qigong intervention for COVID-19 survivors and caregivers and an integrative mental health-exercise-diet wellness programme for teachers by Prof. Tsang; and the use of Chinese herbal medicine for persons with depression by Dr Yau.



## Responding to mental health challenges under the global pandemic: novel solutions

*“MHRC members have consistently been innovative, timely and responsive to community needs. During the global pandemic, the team have integrated digital technologies into their mental health promotion projects.”*

In Hong Kong, 61% of adults suffer from poor mental well-being (MindHK, 2020), with one in every seven people developing a common mental disorder in their lifetime. Mental health problems are becoming increasingly prevalent. According to the Mental Health Review Report, between 2011 and 2016, the number of psychiatric patients increased by 17%, reaching over 220,000 affected persons (Food and Health Bureau, 2019). More importantly, COVID-19 has affected the mental health of many people. It was found that 42% of anxiety and 50% of depression in 2020 could be attributed to the social and psychological impacts of the COVID-19 pandemic. Prof. David Shum, Member of MHRC, found that over 10% of Hong Kong residents exhibited PTSD symptoms one year after the onset of the pandemic. The elderly are still suffering from the negative impacts of the pandemic, although the fourth wave has gradually subsided after persisting for a while. In another study by MHRC, Prof. Hector Tsang found that over-concentration on anti-pandemic issues would cause persistent anxiety and might trigger emotional problems; but social psychological and behaviour therapies could significantly relieve the symptoms of depression and anxiety that emerged during the pandemic. After all, being in a constant state of stress and not managing it can adversely impact our mood and daily lives and lead to mental health problems in the long run.





## Feature Stories

MHRC members have consistently been innovative, timely and responsive to community needs. During the global pandemic, the team have integrated digital technologies into their mental health promotion projects. For example, Prof. Hector Tsang has started a project titled “Development of a digital platform (Electronic Mental Evaluation, Resources and Information Toolkit; e-MERIT) for pandemic support of the mental health of vulnerable groups”, which aims to provide timely support in the mental health context for the betterment of local vulnerable communities. Moreover, Prof. Tsang was featured on two RTHK TV programmes to promote a healthy lifestyle during the COVID-19 pandemic. One programme was “Healthpedia”, in which he introduced mind-body exercises such as Eight Brocades and “Rehab 8 Forms”. The other programme was “Anti-Pandemic News Express”, in which he provided tips on achieving work-life balance while working from home.



Apart from digital technologies, MHRC members have also been integrating Chinese culture, philosophies and approaches in order to generate new therapies. For instance, Dr Sonata Yau has been exploring the use of Chinese herbal medicine for depression. In her research project, “Advancing application of the active compounds of Chinese Herbal Medicine formulas in counteracting depression: Investigation of the synergistic activation on PACAP-mediated rapid and lasting antidepressant effects”, she focuses on the clinical application of Yueju, a Chinese multiherbal medicine formulated 800 years ago to treat symptoms associated with mood disorders. By examining the mechanistic action of Yueju’s extracted active ingredients, Dr Yau will bring us insights into the synergetic effects of these ingredients on antidepressant treatment targets. This effort will facilitate the modernisation of Yueju-based antidepressant formulas with an optimal therapeutic dosage for treating depression patients.

## Dedication to mental health research: looking back and ahead

Prof. Man was one of the few people in the early 1980s who promoted cognitive rehabilitation in Hong Kong. Prof. Barbara Ann Wilson, founder of the Oliver Zangwill Centre for Neuropsychological Rehabilitation in Ely, Cambridgeshire, and a renowned scholar in the field of neuropsychology, mentored Prof. Man when he was studying in the UK and later in the US. Prof. Man recalled, “Prof. Wilson has influenced me greatly. My specialties are in memory research and innovative cognitive rehabilitation for ultimate community reintegration.” In the course of his career, Prof. Man has developed two patented projects, an expert system in memory rehabilitation, Empowerment Questionnaires (EQ) for persons with brain injury and family caretakers, an online Chinese version of the Rivermead Behavioural Memory Test, a Chinese version of the Cambridge Prospective Memory Test, a



Chinese IADL scale and three licensed virtual-reality-based software programmes. Recently, Prof. Man’s research has focused on use of tele-rehabilitation, virtual reality systems, artificial intelligence and computer-assisted platforms for persons with acquired brain injury, mild cognitive impairment and schizophrenia. His team has developed a mobile app for older adults and persons with early dementia as well as a virtual-reality-based screening test for persons with mild cognitive dementia.

Over the years, Prof. Man has developed ways to manage his full and stressful work schedule and ensure his continued capacity for long-term pursuits. “I think good time management and priority setting are crucial to achieving a good state of well-being in my busy work at PolyU—research, teaching, management and community work. From my experience, I have learnt the difference between urgency and importance; and urgent work is not always important. I always aim for efficiency rather than just effectiveness; and quality rather than quantity of outcome.”

**“My church and religious life count a lot in balancing my body and mind so that I achieve tranquillity and direction in life. To me, work-life balance is not a slogan but a reality.”**

Prof. Man believes that too much busyness can be emotionally taxing and lead to physical and emotional burn-out—making us less effective in the tasks we are trying to accomplish. “I am cognisant of that and will clearly say ‘no’ to busyness if that happens. Personal and periodic retreat helps my body and soul strike a balance. My church and religious life (being a devoted Christian) count a lot in balancing my body and mind so that I achieve tranquillity and direction in life. To me, work-life balance is not a slogan but a reality. I have joined several social groups including two men’s groups which offer me great support during emotional darkness and distress. I also have work-leisure balance and enjoy activities like hiking, playing badminton, cycling, travelling, watching films, listening to music, reading books and shopping,” Prof. Man explained.

“I truly believe that work productivity is related to self-worth and a sense of mastery and achievement. This is good for my mood, too. I share with others that I do not just do the work I like, but make myself like or enjoy work I am doing/asked to do. Above all, my family life and time with family during busy days have always been indispensable—their support nourishes and energises me, giving my life great meaning during busy day-to-day work and more than 30 years of service at PolyU,” Prof. Man further explained.

Healthy competition is essential for one’s relentless efforts. “I work hard not because of the work requirement or monetary reward; rather, I am intrinsically motivated to aim for a higher level of accomplishment,” said Prof. Man. An open and humble attitude, a willingness to learn, and the ability to dream and think big are drivers of his innovative work.

During Prof. Man’s career of more than 30 years, many aspects of his work have changed. In the early part of his career, Prof. Man really enjoyed teaching and meeting students. Later, mid-career, he enjoyed working with different types of people, exploring various parts of the world during his research work and fully actualising his talents. Currently, he greatly enjoys mentoring younger staff, building relationships with others and serving the larger community in various advisory and consultant roles. To Prof. Man, these key work appointments or roles, on their own, serve a transient function and bear little long-term meaning. However, the opportunities that come with these positions—supporting students and staff as they grow and develop, improving educational programmes, helping patients recover more fully, bringing better service to a wider population, and maintaining high professional standards—are far more important and meaningful.

**“Supporting students and staff as they grow and develop, improving educational programmes, helping patients recover more fully, bringing better service to a wider population, and maintaining high professional standards — [these] are far more important and meaningful.”**





## Research Achievements

# Weyl semiconductor enables high-performance topological transistors

**F**ield-effect transistors—which use an electric field to control the current in semiconductors—are the building blocks of integrated circuits. State-of-the-art silicon transistors are mainly based on the charge transport mechanism, which results in unavoidable phonon scattering and high heat dissipation. As transistor density increases, high power consumption in electronic chips may compromise circuit performance and reliability. Researchers have investigated the spin and valley of electrons as information carriers for low-loss transport. However, these spin/valley transistors cannot meet the requirements for high-performance, low-power transistors due to their relatively small ON/OFF ratio (101 to 103) and low drive current.

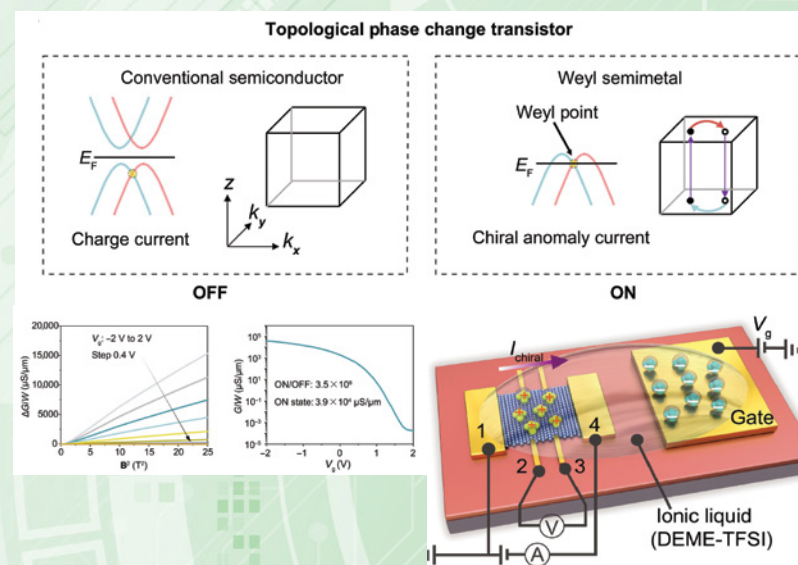
Aiming to overcome these constraints, Prof. Chai Yang, Core Member of the Research Institute for Intelligent Wearable Systems (RI-IWEAR), led his team in the successful development of Topological Phase Change Transistors (TPCTs) based on Tellurium (Te)—a Weyl semiconductor. The team's technological breakthrough was recently published in *Science Advances*.

The Te Weyl semiconductors have a band gap similar to a conventional semiconductor, but with Weyl points in the vicinity of valence/conduction bands. The Te channel can therefore be switched between these two topological phases by electrostatic modulation with

high double-layer capacitance. The Fermi level of the Weyl semiconductor can be positioned within the band gap or close to the Weyl point at different gate voltages. As the Fermi level of Te moves into the band gap, the Te channel is turned to the OFF state with the conventional semiconductor phase, exhibiting very low conductance and resulting in low static power consumption. When the Fermi level approaches the Weyl point, the Te channel is switched to the ON state with the Weyl topological phase, exhibiting an ultrahigh ON-state conductance with low-loss topological current.

To verify this operating mechanism, the team performed different control experiments (on angle-dependent negative magnetoresistance, the planar Hall effect, and nonlocal transport). These experiments strongly supported the observation of topological current.

The research team developed TPCTs using Te flakes with a thickness of approximately 10 nanometers as the channel material. TPCTs with the Te Weyl semiconductor exhibited high performance with operating voltage less than 2 V. The ON/OFF ratio was as high as 108, and the ON-state conductance reached 39 mS/μm. Therefore, this new type of transistor opens the way for field-effect transistors with low-power consumption.



# Super-fast large-area economical marine reclamations for housing and infrastructural developments

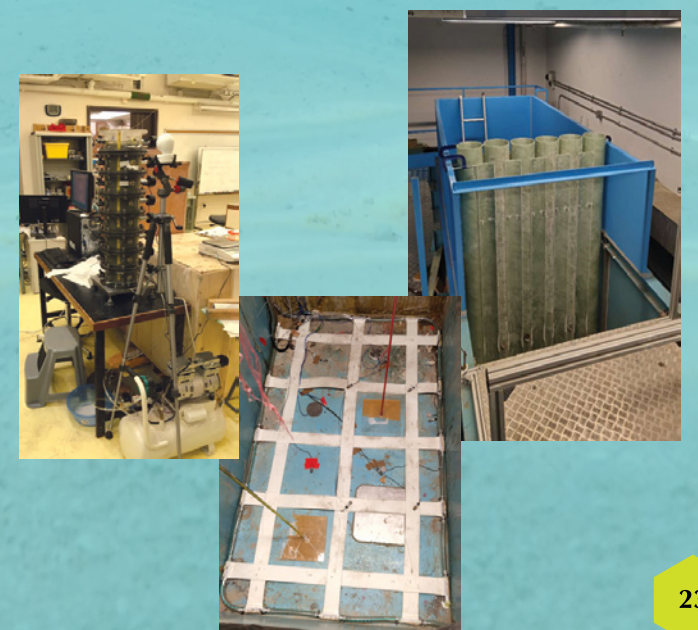
**H**ong Kong has a long history of marine reclamation and related technological applications. As part of the Hong Kong-Zhuhai-Macau Link Project, two artificial islands were reclaimed using sandfill and vertical drains with sandfill surcharge surrounded by 120 steel pipe piles (22 m in diameter and 50.5 m in length). In the reclamation of Hong Kong Airport Runway 1 and Runway 2, the project was accomplished by dredging and removing all Hong Kong Marine Deposits (HKMD), which had caused marine environmental problems. For the new Third Runway, all HKMD were kept in situ and surrounded by seawalls constructed on deep cement mixed (DCM) soil foundations. Imported sandfills (or crushed stones) were used to fill the reclaimed area. Vertical drains with preloading were used to improve the HKMD. However, there is a severe shortage of sand for marine reclamation projects in Hong Kong. The cost of crushed stones is high and production of crushed stones takes time. Therefore, it is imperative that an alternative reclamation method be identified—one that is economical, efficient and sustainable for Hong Kong.

Led by Ir Prof. Yin Jian-hua, Management Committee Member of the Research Institute for Land and Space (RILS) and Chair Professor of Soil Mechanics at the Department of Civil and Environmental Engineering (CEE), the research team has developed and implemented an innovative technique using horizontal band drains alongside a vacuum preloading method. This approach may facilitate the reuse of dredged sediment as fill material in future reclamation projects in Hong Kong.

Systematic research efforts, from experimental testing and theoretical modelling to engineering application, are underway. Specifically, three physical model tests are now being conducted to simulate the whole process of implementing the new soft soil improvement method, including the dredging process, self-weight consolidation process and fast consolidation process by vacuum preloading with prefabricated band drains. Preliminary

test results have clearly demonstrated that the new method is capable of reducing water content and increasing soil strength in an efficient and economical way. For example, in a large-scale plane strain physical model, the average water content of dredged sediment decreased from 220% to 76%, while the shear strength of sediment increased from almost zero to 27 kPa at the bottom of the physical model within 100 days of applying vacuum pressure.

To facilitate theoretical modelling, a new simplified Hypothesis B method was proposed. The new method has been verified by engineers as being accurate and easy to use. It can be used to predict the settlement of HKMD or other soft soils in layers and installed with/ without drains subjected to staged loading-unloading-reloading and even vacuum loading. Moreover, a prototype field trial is ongoing in a testing pit (base size of 12 m x 8 m and depth of 3.5 m) in Tung Chung in collaboration with the Civil Engineering and Development Department of the HKSAR government, AECOM and Build King-Samsung C&T Joint Venture to prove the practicality and constructability of the technique in the field. To follow up on these efforts, a combined mechanical-chemical method, which incorporates binder stabilisation using industrial wastes and vacuum preloading with prefabricated band drains at the same time, will be evaluated as a potential sustainable approach to marine reclamation.





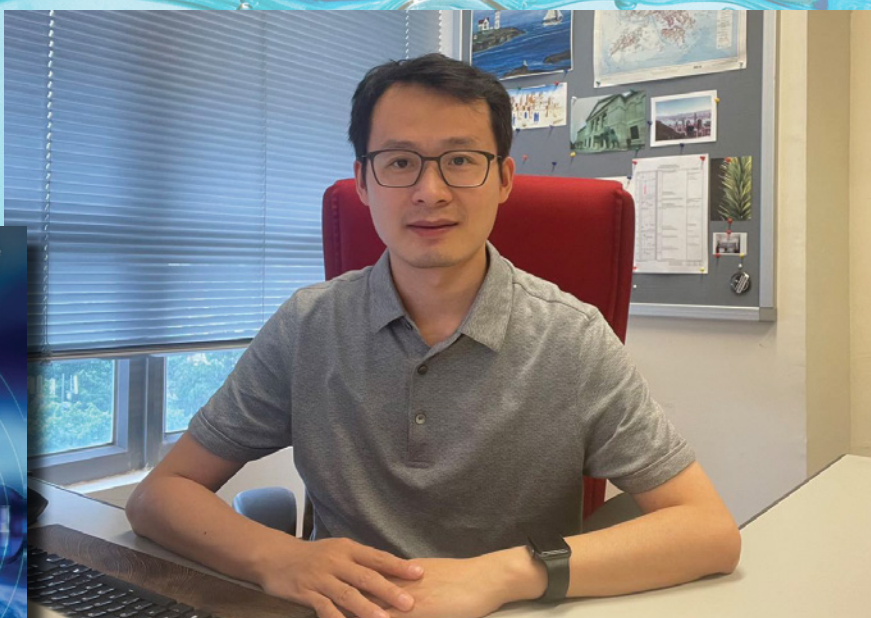
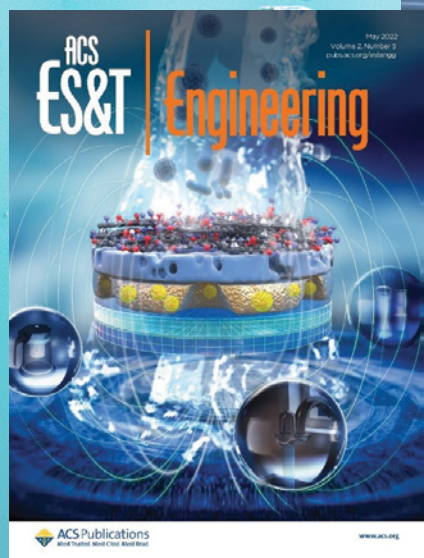
## Research Achievements

### New water filter to safeguard clean water

**W**ater purification ensures clean drinking water for humans. Dr Jiang Yi, Member of the Research Institute for Sustainable Urban Development (RISUD) and Assistant Professor in the Department of Civil and Environmental Engineering at PolyU, and his team have developed a new water filter which can significantly advance water purification technologies.

Their filters are devised from a new nanomaterial, graphene oxide (GO), a two-dimensional nanoscale sheet primarily made of carbon. GO nanosheets can be assembled into a membrane or filter. They have attracted growing attention from researchers due to their outstanding separation performance. However, the instability of the GO membrane, which arises from water-induced effects like swelling and poor interfacial adhesion to the substrate, has largely limited its separation performance and long-term applications.

To address this issue, Dr Jiang's team developed a new "magnetically ultra-stabilised GO-based membrane filter". They first decorated the GO nanosheets with in-situ formed magnetite nanoparticles, making the 2D materials magnetic. The team then used these materials to obtain a filter through a simple filtration method. They found that the filter could be ultra-stabilised above a permanent magnet. This marks the creation of a membrane filtration setup that remains intact under harsh ultrasonic destabilisation and turbulent hydrodynamic conditions. The membrane filter not only exhibits separation performance comparable to that of commercial ultrafiltration membranes, but also effectively inactivates waterborne pathogens (e.g., *E. coli*), thus achieving a suitable technology for many water purification applications.



The research work on the graphene oxide filter ultra-stabilised in a magnetic field was featured on the supplementary cover of the journal *ACS ES&T Engineering* (2022, 2, 5, 769–779).

## People

### PAIR young scholars on the rise

**P**AIR is committed to empowering young talents to apply their academic expertise, explore new disciplines and strive for interdisciplinary breakthroughs. We provide a platform to attract outstanding PhD graduates and young researchers from global top academic institutions to join the PAIR family as Research Assistant Professors (RAPs). RAPs shall conduct research in one or more research institute(s)/ centre(s) promoting the University's interdisciplinary research culture and excellence.

Since our establishment, we have attracted 38 RAPs to join 12 research institutes and research centres to conduct interdisciplinary research spanning a wide range of areas. They include:

PAIR's Constituent Research Unit	Name of RAP	
Research Institute for Advanced Manufacturing (RIAM)	Dr Wong Chi-ho	
Research Institute for Artificial Intelligence of Things (RIAIoT)	Dr Anwer Shahnawaz Dr Lei Chun-fong Dr Weng Duo-jie Dr Eric Xiao Bo	Dr Jiang Shan Dr Wang Fei Dr Wei Junqiu Dr Yang Yu
Research Institute for Future Food (RiFood)	Dr Dong Xiaoli Dr Iris Yu Ka-ming	Dr Yang Ruosong
Research Institute for Intelligent Wearable Systems (RI-IWEAR)	Dr Fang Bo	Dr Fu Jimin
Research Institute for Land and Space (RILS)	Dr Wang Yu	Dr Wang Cunteng
Photonics Research Institute (PRI)	Dr Zhang Yangxi	
Research Institute for Smart Ageing (RISA)	Dr Fong Manson	Dr Timothy Lee
Otto Poon Charitable Foundation Smart Cities Research Institute (SCRI)	Dr Zhang Anshu	Dr Zhang Min
Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE)	Dr Li Hangxin Dr Yuvraj Sahni Dr Wang Minghao Dr Miao Zhang	Dr Liu Kuan Dr Shan Kui Dr Yu Xiaoliang
Research Centre for Chinese Medicine Innovation (RCMI)	Dr Christina Poon	
Research Centre for Deep Space Explorations (RCDSE)	Dr Michael Chan Chun-wa	
Research Centre for SHARP Vision (RCSV)	Dr Choi Kai-yip Dr Elie de Lestrangé-Angineur Dr Samantha Shan Dr Ellen Tan	Dr Rachel Chun Dr Jeffrey Leung Dr William Tai Dr Xu Linchuan



## People

Here are some of the motivational quotes and mottos of our RAPs:

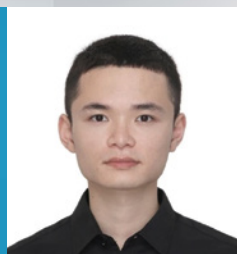
***“Never lose faith in yourself.”***

Dr Wong Chi Ho, Research Assistant Professor,  
Research Institute for Advanced Manufacturing



***“We are what we repeatedly do. Excellence, then, is not an act, but a habit.”***

Dr Jiang Shan, Research Assistant Professor,  
Research Institute for Artificial Intelligence of Things



***“Stay humble and kind!”***

Dr Iris Yu Ka-ming, Research Assistant Professor,  
Research Institute for Future Food



***“Every great work of art starts with an act of imagination.”***

Dr Fang Bo, Research Assistant Professor,  
Research Institute for Intelligent Wearable Systems



***“Keep the general goal in sight and take the daily tasks in hand.”***

Dr Fu Jimin, Research Assistant Professor,  
Research Institute for Intelligent Wearable Systems



***“Willing to learn and progress.”***

Dr Wang Yu, Research Assistant Professor,  
Research Institute for Land and Space



***“Find your way and find your research.”***

Dr Wang Cunteng, Research Assistant Professor,  
Research Institute for Land and Space



***“I am just curious.”***

Dr Zhang Yangxi, Research Assistant Professor,  
Photonics Research Institute



***“Don’t choose to hold on because there is hope; held on, and so there is hope.”***

Dr Timothy Lee, Research Assistant Professor,  
Research Institute for Smart Ageing



***“Among mysteries of science lies the key to victory.”***

Dr Zhang Anshu, Research Assistant Professor,  
Otto Poon Charitable Foundation Smart Cities Research Institute



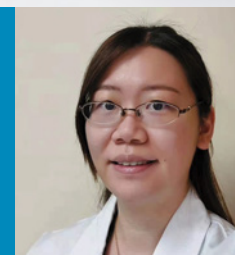
***“Do research that is useful to practice!”***

Dr Shan Kui, Research Assistant Professor,  
Otto Poon Charitable Foundation Research Institute for Smart Energy



***“Research is thinking what nobody else has thought and creating new knowledge for improving people’s health. There is always a solution.”***

Dr Christina Poon, Research Assistant Professor,  
Research Centre for Chinese Medicine Innovation



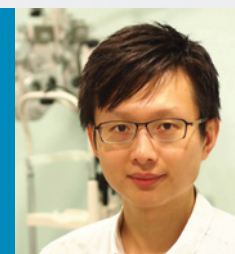
***“Luck is what happens when preparation meets opportunity.”***

Dr Michael Chan Chun-wa, Research Assistant Professor,  
Research Centre for Deep Space Explorations



***“No matter how hard or how impossible it is, never lose sight of your goal.”***

Dr Jeffrey Leung, Research Assistant Professor,  
Research Centre for SHARP Vision





## People

### PAIR scholars listed among National Top 20 by Research.com

According to the 2022 Top Scientists Rankings by the international academic website *Research.com*, 11 scholars in nine research institutes and research centres of PAIR rank among China's top 20 in their respective academic and research fields. It is another recognition of PolyU's teaching and research excellence.

Research Area	World	National	Scholar	RI/RC	H-index	Citations	Publications
Business and Management	47	2	Prof. Albert P.C. Chan	RILS, RISUD	79	22,363	332
	61	4	Prof. Li Heng	RIAIoT, RI-WEAR, RILS, RISUD	76	18,077	235
	83	6	Prof. Lai Kee-hung	RiFood, RISUD	72	22,974	181
	115	7	Prof. Eric W.T. Ngai	RIAIoT, RISUD	67	23,420	163
Engineering and Technology	79	6	Prof. Li Heng	RIAIoT, RI-WEAR, RILS, RISUD	86	24,839	509
	273	19	Prof. Wang Shengwei	RISE, RISUD	71	15,473	281
Environmental Sciences	229	11	Prof. Lee Shuncheng	RISUD	86	23,787	248
	250	14	Prof. Li Xiangdong	RISUD	85	28,963	219
	284	15	Prof. Daniel C.W. Tsang	RiFood, RILS, RISUD, RCRE	83	22,171	465
Mechanical and Aerospace Engineering	213	15	Prof. Yang Hongxing	RISE, RISUD	57	12,807	173
Psychology	2,630	13	Prof. David Shum	RI-WEAR, RISA, MHRC	56	10,946	270

Prof. Albert P.C. Chan Prof. Lai Kee-hung Prof. Wang Shengwei Prof. Li Xiangdong Prof. Yang Hongxing



Prof. Li Heng Prof. Eric W.T. Ngai Prof. Lee Shuncheng Prof. Daniel C.W. Tsang Prof. David Shum

### PAIR members receive InnoStars Award

Prof. Chi-ho To, Director of the Research Centre for SHARP Vision (RCSV) and Member of the Research Centre for Chinese Medicine Innovation (RCMI), and Mr Ling Kar-kan, SBS, Member of the Research Institute for Land and Space and Research Institute for Smart Ageing (RISA) and Director of the Jockey Club Design Institute of Social Innovation (JCDISI), received the InnoStars Award 2021 from Our Hong Kong Foundation (OHKF) on 29 July 2022.

OHKF presented the Award to nine outstanding individuals for their trailblazing creativity and innovation. Mr John Lee, HKSAR Chief Executive; Prof. Sun Dong, Secretary for Innovation, Technology and Industry; and Prof. Lo Chung-mau, Secretary for Health Professor Lo Chung-mau attended the Award.

The nine awardees were chosen by a vetting committee and judging panel comprising 18 notable technology and business leaders. The awardees were chosen for innovating their ways to excellence in science and technology, business model, social innovation, or culture and creativity. The InnoStars Award serves to inspire creativity and innovation, promote entrepreneurship, foster economic diversification, and showcase the innovative talent of Hong Kong people.



### RILS management committee member received JSCE International Collaboration Award

Prof. Dai Jian-guo, Management Committee Member of the Research Institute for Land and Space (RILS), Member of the Research Institute for Sustainable Urban Development (RISUD) and the Research Centre for Resources Engineering towards Carbon Neutrality (RCRE), as well as Professor of the Department of Civil and Environmental Engineering at PolyU, received the FY2021 JSCE International Outstanding Collaboration Award from the Japan Society of Civil Engineers (JSCE).

The Award recognises Prof. Dai's continuous efforts and significant contribution to the development of concrete science and technology, his leadership and achievements in fostering relationships among civil engineering researchers, as well as his commitment to strengthening the friendship between Japan and China through technical and cultural exchanges.





## People

### PAIR scholars awarded RGC Senior Research Fellow 2022/23

Three PolyU scholars were selected for the Research Grants Council's (RGC) Senior Research Fellow Scheme (SRFS) 2022/23 and awarded a total of HK\$23 million funding to facilitate and advance their research.

Two of the three winners are PAIR researchers. They are Prof. Sun Defeng, Leading Member of the Research Institute for Artificial Intelligence of Things (RIAIoT), and Prof. Li Gang, Management Committee Member of the Photonics Research Institute (PRI), Associate Director of the Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE), as well as Member of the Research Institute for Intelligent Wearable Systems (RI-IWEAR) and the Research Institute for Sustainable Urban Development (RISUD).

The Scheme provides ten grants to exceptional scholars from any of the academic disciplines at UGC-funded universities in each round of the annual exercise. Nominees are assessed in accordance with various criteria including leadership quality and vision in the chosen area of research, the merit of the research proposal, and the support provided by the university.



### PRI Member honoured with PolyU Young Innovative Researcher Award (YIRA) 2022

Dr Tommy Wei Mingchen, Member of the Photonics Research Institute (PRI), was selected as one of six recipients of the PolyU Young Innovative Researcher Award (YIRA) 2022. YIRA recognises PolyU researchers under the age of 35 who have demonstrated novel approaches, contributed to technology advancement, and propelled transformational innovation into solutions that address problems in society with a vision for positive change. There were 59 submissions across 22 departments in this inaugural round. In celebration of the excellence of young researchers, Dr Wei received the award and showcased his achievements to the public at PolyU InnoTech Open Day on 16 July.



## News & Events

### International Conference on Intelligent Wearable Systems (ICIWS 2022) successfully held

A three-day International Conference on Intelligent Wearable Systems (ICIWS 2022), hosted by the Research Institute for Intelligent Wearable Systems (RI-IWEAR) of The Hong Kong Polytechnic University (PolyU), was completed successfully on 29 June 2022 in hybrid mode. Twenty-nine guest speakers from global top universities provided valuable insights on four themes: Materials, Devices and Processing; Sensors, Actuators and Bioelectronics; Energy Harvesting and Storage; and Emerging Applications. The Conference attracted over 1,778 online registrants from 21 countries and regions and recorded a total of 110,000+ views from broadcast channels, for example, YouTube, Bilibili, Weibo and WeChat.

At the Opening Ceremony, Prof. Christopher Chao, Vice President (Research and Innovation) of PolyU, highlighted the rapid growth of the field of intelligent wearable systems and its emergence as an interdisciplinary area involving multiple academic subjects and technologies. RI-IWEAR, one of the constituent research units under PAIR, is determined to advance scientific knowledge in this field and enable successful technological development of fibrous materials, electronic devices and wearable systems that exhibit high performance, cost-effectiveness, flexibility, intelligence and scalability in production.

Prof. Chen Qingyan, Director of PolyU Academy for Interdisciplinary Research (PAIR), introduced the Academy to the audience. PAIR is a central research hub dedicated to providing interdisciplinary solutions to major social challenges in the areas of "Good Health & Well-being", "Sustainable Cities" and "Advanced Technologies".

The three-day Conference received very positive feedback. The first day was chaired by Prof. Chen; Prof. Tao Xiaoming, Director of RI-IWEAR; Prof. Fan Zhiyong, Professor of The Hong Kong University of Science and Technology; and Prof. Yan Feng, Associate Director of RI-IWEAR. Ten speakers from the US, the UK, Singapore, Mainland China, and Hong Kong shared on the theme of Materials, Devices and Processing.

On the second day, in sessions on sensors, actuators & bioelectronics as well as energy harvesting & storage, ten experts from the US, Japan, Mainland China, and Hong Kong shared their research findings with the audience.

On the last day of the Conference, nine speakers presented their work in a session on energy harvesting & storage and emerging applications. The top three recipients of the Outstanding Study Award were announced in recognition of excellence among PhD students. The winners received their awards from Dr Huang Bolong, Prof. Li Gang, and Prof. Raymond Wong Wai-yeung, Dean of the Faculty of Science; and shared their award-winning research with the audience.

To bring the Conference to a successful conclusion, Prof. Tao gave closing remarks and thanked all the online and onsite participants for their support.





## News &amp; Events

## PAIR is officially inaugurated on 16 July 2022

The Hong Kong Polytechnic University (PolyU) celebrated the inauguration of the PolyU Academy for Interdisciplinary Research (PAIR) at the Opening Ceremony of PolyU InnoTech Open Day on 16 July 2022. The Academy was jointly inaugurated by officiating guests, **Prof. Sun Dong**, Secretary for Innovation, Technology and Industry of the HKSAR Government; **Ms Rebecca Pun**, Commissioner for Innovation and Technology of the HKSAR Government; **Dr Lam Tai-fai**, PolyU Council Chairman; **Prof. Teng Jin-guang**, President of PolyU; **Prof. Wong Wing-tak**, Deputy President and Provost of PolyU; **Prof. Christopher Chao**, Vice President (Research and Innovation) of PolyU; **Prof. Tao Xiaoming**, Acting Director of PAIR; and leaders of PAIR's 16 constituent research units.

At the ceremony, Prof. Christopher Chao highlighted the contributory role of PolyU towards achieving the United Nations (UN) sustainable development goals: "Interdisciplinary research provides solutions to many complex global challenges. We need to leverage PolyU's research competitiveness to conduct interdisciplinary research, in which we draw experts from different fields of study to overcome disciplinary barriers for the advancement of knowledge and generation of practical solutions."

PAIR envisions becoming the largest interdisciplinary research platform in the Greater Bay Area for interdisciplinary solutions to major societal challenges through advanced research, partnership with world-renowned scholars, and knowledge transfer activities.

Comprising 16 research institutes and centres with over 400 experienced PolyU senior researchers from all over the world, PAIR focuses on research in frontier areas with the major objectives of boosting new technologies and innovation, expediting infrastructural connectivity, furthering ecological conservation, and developing a high-quality life circle.





## News &amp; Events

## PAIR shines at PolyU InnoTech Open Day

As one of the key contributors to the PolyU InnoTech Open Day on 16 July 2022, the PolyU Academy for Interdisciplinary Research (PAIR) provided various types of activities that shared the University's latest research and applications with industry representatives, academics, and the general public. The Academy collaborated with the Research and Innovation Office of PolyU to organise eight research and innovation sessions. The featured topics were related to life science, smart cities, neurohealth, future society, energy technology for carbon neutrality, healthy food and lifestyle management, future manufacturing, artificial intelligence of things, and intelligent wearable systems.

Exhibition and display booths were set up to showcase research outputs and award-winning solutions by PAIR researchers. These included a “surface sampling and packing system” and “planetary remote sensing and mapping technologies” from the Research Centre for Deep Space Explorations (RCDSE); “Scolioscan” – a radiation-free 3D ultrasound system for scoliosis assessment from the Research Institute for Smart Ageing; and the DISC soft contact lens and DIMS spectacle lens from the Research Centre for SHARP Vision.



## PolyU holds media luncheon and laboratory visit for local press

Prof. Teng Jin-Guang, President of The Hong Kong Polytechnic University (PolyU), together with other PolyU Senior Management Executives met with local media representatives at a luncheon on 5 July 2022.

At the meeting, Prof. Teng shared the latest international ranking and recent developments of the University. He also announced the establishment of the PolyU Academy for Interdisciplinary Research (PAIR) to foster interdisciplinary research, partnership with world-renowned scholars, and transfer of technologies to stakeholders. As the largest research platform of its kind in Hong Kong and the Greater Bay Area (GBA), PAIR will work closely with industries and the community to ensure the practical significance of its research.

Prof. Christopher Chao, Vice President (Research and Innovation), said that new disciplines may emerge from interdisciplinary research, just as biomedical engineering was the product of biology, medicine and engineering.

“Comprising 16 research institutes and centres with over 400 PolyU senior researchers from all over the world, PAIR focuses on research in frontier areas”, explained Prof. Chen Qingyan, Director of PAIR. “The Academy will make impactful contributions to the development of Hong Kong and the Greater Bay Area into an international innovation and technology hub”.

The luncheon was followed by a guided tour of PAIR units, including the Main Office of PAIR as well as the research facilities at the Research Institute for Advanced Manufacturing (RIAM), the Research Institute for Artificial Intelligence of Things (RIAIoT) and the Research Institute for Smart Ageing (RISA).





## News & Events

### RISUD key study on PM2.5 air pollution awarded RGC Theme-based Research Scheme funding



A key research study on fine particulate air pollution and health led by Prof. Li Xiangdong—Director of the Research Institute for Sustainable Urban Development, Dean of the Faculty of Construction and Environment, Chair Professor of Environmental Science and Technology, and Ko Jan Ming Professor in Sustainable Urban Development—was awarded funding of HK\$44.5 million under the Theme-based Research Scheme 2022/23 (Twelfth Round) of the Research Grants Council (RGC).

The project “Unravelling the Black Box Between Air Pollution and Public Health for Transformative Air Quality Management” seeks to identify the toxic components and emission sources that contribute to the acute toxicity of fine particulate matter (PM2.5), which is associated with chronic obstructive pulmonary disease and ischemic heart disease.

The study will make evidence-based recommendations on efficacious, practical and cost-effective approaches to managing air quality and public health in Hong Kong and around the world. The project may lead to a revision of the Air Quality Health Index algorithm and associated health advice, and an evaluation of and enhancement to the Air Quality Objectives in Hong Kong. The findings will be shared with national and international bodies to influence future policy-making on air quality in different parts of the world.

Prof. Li will lead an interdisciplinary team of researchers from PolyU and other universities as well as advisors of the World Health Organization. The team will organise regular workshops for experts and stakeholders on important health issues associated with PM2.5.

The research team will leverage the latest advances in environmental toxicology and molecular epidemiology to overcome scientific challenges in identifying the toxic components and emission sources of PM2.5. Through an existing PM2.5 global monitoring network, the team will select and focus on multiple cities with distinct natural and socioeconomic conditions. They will investigate different carbon emission reduction strategies towards carbon neutrality and the health benefits associated with the control of air pollution and climate change.

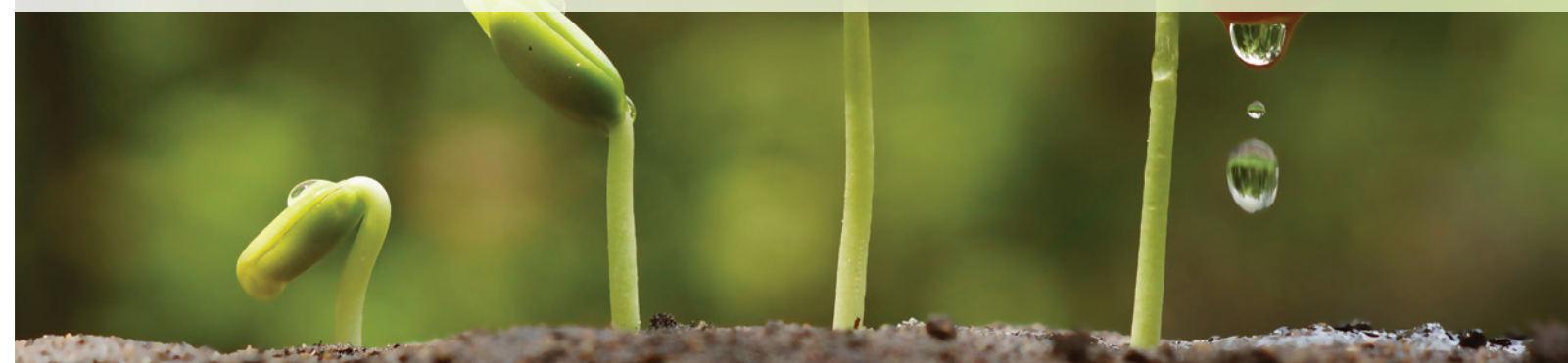
In the long term, the results of the research will help to inform future studies on the chronic effects of PM2.5 on health and the identification of ways to reduce associated health risks.

The project is one of eight outstanding research proposals that were awarded in the latest round of the RGC funding scheme.

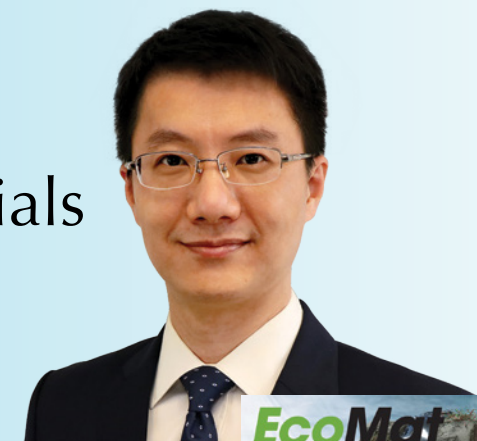


### PAIR constituent research units make remarkable achievements

In the 2021/22 academic year, constituent research units under the umbrella of PAIR received a total amount of HK\$429 million from donations and external research grants. On the other hand, 159 impactful research projects totaling HK\$145 million were supported by PAIR's internal fund allocated to research institutes and research centres by the University. The constituent research units published 615 affiliated publications, conducted 47 technology transfer activities, and attracted 81 awards and prizes at territory, regional and international level.



### EcoMat, a new international academic journal, presents cutting-edge advanced materials for green energy and the environment



EcoMat is an open-access journal jointly published by The Hong Kong Polytechnic University and John Wiley & Sons Inc. Prof. Zheng Zijian, Associate Director of the Research Institute for Intelligent Wearable Systems, is the Editor-in-Chief of the Journal.

EcoMat focuses on cutting-edge advanced materials for green energy and the environment. It encompasses a wide range of topics relevant to the development of eco-friendly and sustainable energy. These include, but are not limited to, the following topics: wind, water, and solar energy harvesting & conversion; batteries and supercapacitors; energy systems and networks; thermoelectrics; fuel cells; carbon capture and storage; piezo- and triboelectrics; water and air pollution control & cleaning; artificial photosynthesis; and hydrogen generation & storage. The Journal welcomes innovative interdisciplinary research to address the complexity of energy issues with high impact. EcoMat achieved its first impact factor of 12.213 in Clarivate's Journal Citation Reports 2022.

