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PAIR Newsletter
INAUGURAL ISSUE
March 2022

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Interdisciplinary
RESEARCH

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RILS • PRI • RISA • SCRI • RISE • RISUD
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Chief Editor: Prof. Chen Qingyan

Editor: Ms Linda Gudeman

Assistant Editors: Ms Florence Chan, Ms Sara Cheuk
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

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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
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Research Institute for Artificial Intelligence of Things
Director
Prof. Cao Jiannong
Otto Poon Charitable Foundation Professor in Data Science and
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Professor Jin-Guang Teng

Interdisciplinary Research to Address Societal Challenges



The world is facing many major challenges. Climate change caused by greenhouse gas emissions can have devastating impacts on the planet. The population is ageing, and that trend is projected to accelerate in the coming decades. The COVID-19 pandemic has not only tested the resilience of the healthcare system and the economic model of the world, but has probably also perpetually changed how we work and live. Solutions to these and many other challenges can no longer be found within isolated disciplines but call for interdisciplinary efforts.

The Hong Kong Polytechnic University (PolyU) is committed to contributing to the development of solutions to these challenges. It has therefore established the PolyU Academy for Interdisciplinary Research (PAIR) to steer interdisciplinary research, bringing together resources and expertise from different disciplines to deliver solutions that address key societal issues. The constituent units of PAIR currently include ten Research Institutes (RIs) and five Research Centres (RCs), whose research teams are drawn from the most distinguished scholars at PolyU. It is expected that a small number of additional constituent units will be established to expand the scope of PAIR in due time.

Researchers at PAIR will engage in both basic research and applied/translational research, with the ultimate aim being the development of world-leading innovations that address societal challenges. To this end, PAIR will also promote and facilitate the establishment of close partnerships with industries and the community, ensuring the real-world significance and impact of its research. These close partnerships are also very important for PAIR to generate a substantial level of research funding from industries and the community to achieve a sustainable financial model. Indeed, two of PAIR's research institutes, focusing on smart cities and smart energy respectively, have obtained major donations from the Otto Poon Charitable Foundation to fund their activities for the first few years. We are immensely grateful for the generosity of Dr Otto Poon, a distinguished local industry leader and alumnus of PolyU, and hope that many others will support PAIR either financially or in other ways.

PAIR will also play an important role in developing and supporting research collaboration activities between us and universities/research organisations in Mainland China and around the globe. In particular, a Fellowship programme is being planned to host outstanding scholars from around the world to spend short periods at PAIR for exchanges and collaborations.

It is with great pleasure that I share the above thoughts with you via the inaugural issue of the PAIR Newsletter. Through PAIR, we are pursuing an interdisciplinary collaborative research model that is unique in Hong Kong and uncommon elsewhere. You are invited to stay connected and travel this exciting but uncharted journey with us via the Newsletter and through other means.



Professor Christopher Chao

Interdisciplinary research enables effective solutions to global challenges



PolyU has a long history of striving for research excellence and responding to global challenges with practical innovation. Our commitment to interdisciplinary research and impactful innovations for tackling real-world issues is leading to a more sustainable tomorrow. The strategic missions of PAIR are to develop breakthrough ideas, foster sustainability, lift economic outcomes, and improve living conditions for the benefit of humankind.

The expansion of interdisciplinary research over the past decade has brought about a fundamental change in the basic concepts and practices of a scientific discipline or even our worldview. Regardless of the research domain, the effective integration of diverse scientific disciplines—incorporating perspectives from academia, industry and governmental organisations—and the rapid translation of research discoveries into practice are essential for realising the potential of the next era of research. One of our major objectives is to increase the synergies that underpin the University's research development and open new horizons with innovative solutions that address global challenges. For this purpose, we seek to enhance the collaboration among PAIR, the Research and Innovation Office, the Graduate School, and other major research facilities, including the State Key Laboratories and the Hong Kong Branches of Chinese National Engineering Research Centres.

New disciplines may also emerge from the extensive research currently being performed by our devoted scientists in this interdisciplinary environment. Their research may have a wide-ranging positive impact, expanding knowledge and improving the quality of life. Key focus areas for the constituent research units of PAIR include advanced manufacturing, artificial intelligence of things, high-capacity optical communication, smart cities, smart buildings, renewable energy, sustainable infrastructure, carbon neutrality, satellite remote sensing, space robotics technology, fabric-sensing technologies, food sustainability, COVID-19 related issues, health screening and diagnosis, physical wellness, neuroscience, maintenance of sharp vision, and many more. The findings of our interdisciplinary researchers can be used to address related global concerns and enhance the well-being of society in terms of health, education, social relationships, environment, and sustainability.

The year 2022 is PolyU's 85th anniversary, and a series of celebrations is in progress. Research achievements are an important part of this milestone. To keep up with cutting-edge technologies and research outcomes that improve people's lives, please stay tuned for the latest news about PAIR.

Professor Chen Qingyan

I am delighted to introduce the first issue of the PAIR Newsletter!

The United Nations (UN) developed a 2030 Agenda that initiated 17 Sustainable Development Goals (SDGs). It aims at taking actions to end global poverty, provide food and clean water, minimise climate change, solve energy crises, reduce gender inequality, protect the planet, develop economy, and promote peace among many others. Some of the goals that humankind wants to achieve today are too new and too big to be addressed with the traditional disciplinary boundaries. Interdisciplinary study allows for synthesis of ideas and the synthesis of characteristics from many disciplines. PolyU wants to help achieve the goals through interdisciplinary research. As the result, the University recently established PAIR that consists of ten RIs and five RCs.



Our RIs and RCs are integrating knowledge across advanced manufacturing, artificial intelligence of things, future food, intelligence wearable systems, land and space, photonics, smart ageing, smart cities, smart energy, sustainable urban development, deep space exploration, mental health, Chinese medicine innovation, resources engineering towards carbon neutrality and sharp vision. PAIR is thus an interdisciplinary hub enabling individual researchers to work cross disciplines to discover new knowledge. PAIR also transfers knowledge to our stakeholders and collaborates with our international peers. Our effort covers most of SDGs propelled by the UN. We emphasise on applied research that will provide solutions to the grand problems related to the SDGs. At the same time, our effort can undoubtedly enrich academic research and provide new perspectives and holistic understanding on topics studied in traditional disciplines. The outputs will create significant societal impact by bring direct benefits to Hong Kong and beyond.

The PAIR Newsletters are to inform our colleagues, students, alumni, peers, stakeholders, friends, as well as the public exciting things happening at PAIR, such as research highlights, knowledge transfer, feature stories, as well as news and events. In this first issue, we have the great pleasure to introduce some fruitful research results and knowledge transfer projects from several RIs and RCs. We are also very proud to announce some awards and honours received by our researchers. You may also learn more about our RIs and RCs from the feature stories. In this issue, we selected three from the Research Institute for Intelligence Wearable Systems (RI-IWEAR), the Photonics Research Institute (PRI), and the Research Centre for Deep Space Explorations (RCDSE). Their stories are really interesting.

I hope you enjoy reading the newsletters.

Smart city platform won prestigious innovation prizes and technology transfer opportunities

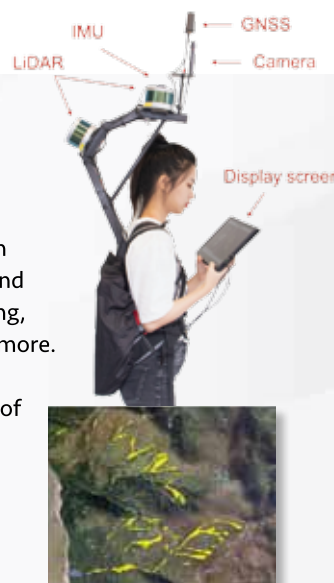
A team led by Prof. Shi Wenzhong, Director of the Otto Poon Charitable Foundation Smart Cities Research Institute (SCRI), developed a comprehensive Smart City Platform for Spatial Data Infrastructure (SDI). Incorporating the patented technologies of 3D city modelling, AI-based urban object cognition, spatial big data analytics and visualisation, the Platform can be used to acquire and process massive multi-source data to create a high-precision and realistic smart city data infrastructure.

To construct 3D city models, a lightweight mobile mapping backpack was developed. The backpack allows the real world to be mapped with cutting-edge spatial data capture methods and millimetre-level accuracy. The 3D city models and multi-source open data are then integrated on a comprehensive SDI. The SDI incorporates building information modelling (BIM) technology to create a digital replica of above-ground and underground urban space.

The platform incorporates multiple artificial intelligence technologies to recognize buildings, roads, hazards, and other urban objects from remote sensing imagery. The platform also implements methods developed by the team for predicting the spatiotemporal risk of COVID-19 symptom onset. Combined with urban simulation

functions, the platform provides an open-source, technology-neutral and low-cost solution for urban planning, transportation, public health, and more.

The platform has achieved a series of recognitions and opportunities for technology transfer. The platform and its COVID-19 prediction sub-platform won a Gold Medal in the Special Edition 2021 Inventions Geneva Evaluation Days - Virtual Event, and received one of the 2021 Smart 50 Awards (U.S.). The sub-platform for AI-based landslide mapping has been used by the Civil Engineering and Development Department (CEDD) of the HKSAR Government and has enabled an eightfold acceleration of CEDD's landslide mapping. By using the technologies on the platform, the team has also secured three Innovation and Technology Fund (ITF) projects, including the construction of a COVID-19 risk prediction platform for public sector users supported by the Food and Health Bureau of the HKSAR Government, and a public trial of logistics planning for Modular Integrated Construction (MiC), in collaboration with the Construction Industry Council.



Smart monitoring system for urban tree management

Led by Sr Prof. Charles Wong Man-sing, Member of the Research Institute for Land and Space (RILS), Member of the Otto Poon Charitable Foundation Smart Cities Research Institute (SCRI), Member of the Research Institute for Sustainable Urban Development (RISUD), Associate Dean of the Faculty of Construction and Environment, and Professor in the Department of Land Surveying and Geo-Informatics at PolyU, a team of researchers invented the Smart Monitoring System for Urban Tree Management. This monitoring system employs smart sensing technology to measure tree tilt and displacement. The locations of trees and information about their surrounding environment can be identified using the GIS-based platform for quantifiable analysis of the trees' root plate movement. The monitoring system is also equipped with AI algorithms and Spatial Big Data analytics, which can evaluate the leaning trend and the potential risk factors correlated with tree failure. Because the system enables large-scale monitoring of tree stability, timely and appropriate mitigation measures can be taken. The system won the gold medal at the 2021 Inventions Geneva Evaluation Days - Virtual Event, and is now being operated by the Tree Management Office of the Development Bureau of the Hong Kong Special Administrative Region.



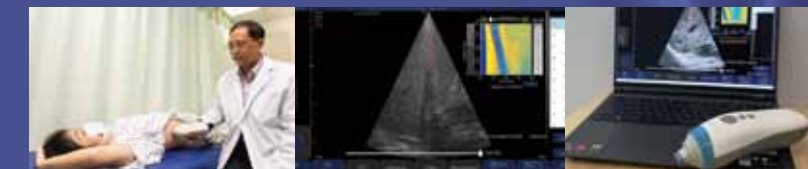
RISA professor invents Liverscan: a portable non-invasive system for liver fibrosis assessment

Alcohol abuse and hepatic tissue scarring due to long-term inflammation may cause liver fibrosis. In severe cases, liver fibrosis may develop into serious problems such as liver cirrhosis and cancer. Transient elastography (TE) diagnostic technology has recently emerged as a non-invasive method to assess liver fibrosis by measuring the stiffness of the liver, but it has the disadvantages of high cost and insufficient accuracy. In view of these challenges, Ir Prof. Zheng Yongping, Director of the Research Institute for Smart Ageing (RISA), Henry G. Leong Professor in Biomedical Engineering and Chair Professor of Biomedical Engineering in the Department of Biomedical Engineering at PolyU, has led a research team in developing Liverscan, a palm-sized wireless device that combines TE with a real-time ultrasound image-guided system, substantially reducing the cost and greatly enhancing the accuracy of measurement through the real-time imaging. Its lightweight, portable design allows medical staff to detect liver fibrosis in patients anytime, anywhere.

Liverscan combines two complex technologies in a palm-sized probe. The operator needs only to

install a program on a tablet computer to start using the instrument. Liverscan is easy to use and comes at a fraction of the cost of other TE machines. Essentially, Liverscan makes liver fibrosis assessment more widely available to the public by lowering the price, improving the measurement accuracy and taking the procedure to more people in the community. Liverscan won a silver medal at the Special Edition 2021 Inventions Geneva Evaluation Days - Virtual Event, an online version of the prestigious International Exhibition of Inventions of Geneva.

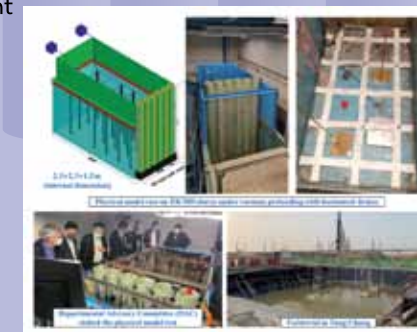
This technique has been licensed to a local startup company that has been supported by Hong Kong Science Park IncuBio program and PolyU's TLF scheme. Clinical trials are now being conducted on Liverscan, with local release planned for 2023 and a full-scale worldwide launch in 2026.



RILS research team partners with government and industry practitioners to implement a new land reclamation technique in a prototype field test

Led by Ir Prof Jian-hua Yin from the Department of Civil and Environmental Engineering, a research team of the Research Institute for Land and Space (RILS) has developed and implemented an innovative reclamation technique. This approach uses horizontal band drains together with a vacuum preloading method to facilitate the possible reuse of dredged sediment as fill material in future reclamation projects. A laboratory-scale physical model test has been successfully conducted at PolyU to demonstrate the principles and effectiveness of the use of horizontal band drains with the vacuum preloading method to consolidate the local dredged sediment. This model test has been supported by a Research Impact

Fund (HK\$9,876,600), titled "Study of Super-fast Large-area Economical Marine Reclamations for Housing and Infrastructural Developments in the Guangdong-Hong Kong-Macau Greater Bay Area", from the Research Grants Council. To prove the practicality and constructability of this technique in the field, a prototype field trial is ongoing in a testing pit (base size of 12m x 8m, depth of 3.5m) in Tung Chung in collaboration with the Civil Engineering and Development Department, AECOM, and Build King-Samsung C&T Joint Venture. The outcomes of the field trial will serve as a vital reference for sustainable marine reclamation in Hong Kong and will enable significant academic advancement in solving soft ground problems.



Therapeutic music-with-movement programme for elderly with cognitive impairment

In Hong Kong, around 100,000 people are living with dementia, a figure that will increase exponentially in the foreseeable future. Alarming, about 60% of long-term care residents are living with dementia, nearly all of whom experience anxiety, depression, or other behavioural and psychological symptoms that place heavy demands on the healthcare system and jeopardize their quality of life. Music-with-movement is an evidence-based psychosocial intervention that has been demonstrated to improve health outcomes (cognition, mood, and agitation level) in older adults with cognitive impairment in a variety of settings.

Funded by the Innovation and Technology Fund for Better Living and the Ho Cheung Shuk Yuen Charitable Foundation, an interactive music-with-movement system was developed by a team at the Research Institute for Smart Ageing (RISA) to improve the lives of older adults with dementia and their caregivers. This project is the first music intervention of its kind to leverage cloud computing, motion sensors, and augmented reality technology. An intelligent cloud-based platform was created to track older adults' health conditions and engagement levels as measured through sensors embedded in specially designed musical instruments. The elderly are motivated to participate in the music-with-movement intervention by adopting augmented reality technology. A total of 70 sets of portable systems have been developed, and the project has entered the implementation phase. At least 50 institutes and 1,000 older adults will participate in the intervention. Trained facilitators, mostly staff at elderly care institutions, will lead the music activities at least once per week, for up to 12 weeks. To date, the system is being used by four community service centres, and more than 30 institutes have been enrolled. Recruitment will be extended to residential care homes for the elderly once the pandemic is under control.



Lithium batteries made pliable with metallic fabrics

Flexible and wearable electronics – from smartwatches to flexible displays, health monitoring garments and even robotics – are increasingly commonplace in our daily lives. However, the lithium-ion batteries available on the market for powering these products are rigid and bulky, causing discomfort to users.

An interdisciplinary research team led by Prof. Zheng Zijian from the Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE) and the Institute of Textiles and Clothing at PolyU has successfully developed revolutionary flexible lithium batteries to address this problem. Under the supervision of Prof. Zheng, they have created highly conductive metallic fabrics to replace the metallic foil used in conventional batteries. The team has successfully coated various common textiles with a thin layer of metal, and the coating technology has been patented and named 'Polymer-Assisted Metal Deposition' (PAMD).



As textiles are light in weight, flexible and durable, with a large specific surface area, the team's textile-based batteries exhibit excellent mechanical flexibility and high energy density. When compared to conventional batteries, the newly developed batteries are very stable under deformation and have proved to be penetration- and impact-resistant. Importantly, the battery fabrication process is fully compatible with conventional textile manufacturing processes as well as battery production lines.

Based on their great success in developing these highly conductive textiles and flexible batteries, the research team won four prizes at the 43rd and 47th International Exhibitions of Inventions of Geneva.

In June 2021, Prof. Zheng and Dr Miya Ng, a postdoctoral fellow on the research team, co-founded a spin-off company, the EightOSix Technology Company Limited. The company is focusing on commercialization of the wearable Li batteries, which could be fully integrated into wearable electronics, providing comfort and safety to users and making the product design process easier. Within half a year from the company's founding, they were awarded funding by the PolyU Microfund 2021, IDEATION programme and Incu-Tech programme of HKSTP.

Ultrasound system provides radiation-free scoliosis examination

Scoliosis examination using X-ray imaging is the gold standard in clinic, and schoolchildren need to have regular follow-up visits for the progression of scoliosis before reaching their bone maturity. Even though the radiation dose of modern X-ray systems is low, it is still a concern. Therefore, the medical community has been actively seeking ways to provide accurate radiation-free examinations. Ir Prof. Zheng Yongping, Director of the Research Institute for Smart Ageing (RISA), Henry G. Leong Professor in Biomedical Engineering, Chair Professor of Biomedical Engineering at PolyU, has carried out an inspiring scientific research project: the invention of a radiation-free 3D ultrasound evaluation system for scoliosis assessment.

In collaboration with local medical doctors, a study has been conducted with 952 scoliosis patients to understand the curves measured using X-ray and this new ultrasound system. The results showed that the angles measured by the two methods overall have a good correlation, and the agreement is particularly good at the thoracic region and for mild curves smaller than 30 degrees. Another study involved 442 schoolchildren who were enrolled in the Department of Health's Scoliosis Screening Service. The results demonstrated that 42.5% of the schoolchildren were able to avoid unnecessary X-ray exposure, if this new ultrasound system was used during referring process, i.e. whether the angle reached 20 degrees.

Results of different studies conducted by Ir Prof. Zheng's and other teams have demonstrated that 3D ultrasound imaging can be used in screening, progress monitoring and treatment outcome measure for scoliosis in schoolchildren without the hazard of radiation. Ir Prof. Zheng pointed out that the newly developed ultrasound evaluation system is portable, making it easy to carry out for screening in schools, suitable for clinics with limited space in Hong Kong, and can even be used for follow-up with children at home. The system has been commercialized by a local start-up company and installed for clinical use in around 20 cities in Europe, Australia, and China.

Ir Prof. Zheng's team also stated that his team will continue to improve the technology. "The first step is to make measurements more automated, in order to speed up the detection results and reduce the burden on doctors; the second is to create a three-dimensional model of the spine through the three-dimensional ultrasound data we have obtained, so as to have a deeper understanding of scoliosis; the final step will be to add artificial intelligence and use algorithms to assist doctors in determining the development trend of spinal problems."

This novel technology can also be used for examining other conditions of spine, such as low back pain, spine sagittal deformity, for subjects with different ages, including elder people. Related research works are ongoing in Ir Prof. Zheng's team.



Interdisciplinary collaboration is the key to solving the greatest challenges in the world

Universities have traditionally been places where scholars and students work on individual research topics. However, this approach cannot meet the needs of today. Nowadays, cross-fertilisation and cross-functional cooperation are probably the most critical drivers of success. The Hong Kong Polytechnic University's (PolyU's) focus on research in recent years has brought tangible results, whether in recruitment of quality researchers, international recognition of the University's research achievements, or the continued development of interdisciplinary research that maximises cross-field benefits and synergy among different disciplines.

"PAIR has therefore been established to facilitate interdisciplinary research, transfer technologies to stakeholders, inspire innovations in technology applications, and collaborate with top institutions worldwide."

PolyU echoes the language of interdisciplinary research and is determined to bring scholars and students together in novel combinations to develop ambitious projects that respond to global challenges, for the greater good of society. The PolyU Academy for Interdisciplinary Research (PAIR) has therefore been established to facilitate interdisciplinary research, transfer technologies to stakeholders, inspire innovations in technology applications, and collaborate with top institutions worldwide. PAIR members are expanding knowledge and solving challenging problems through basic and applied interdisciplinary research that integrates disciplines not only from the sciences, but also from the arts. PAIR will deliver success by breaking structural and cultural barriers.

PAIR is where ambitious ideas flourish and collaboration occurs

Professor Chen Qingyan, Director of PAIR and Chair Professor of Building Thermal Science, Department of Building Environment and Energy Engineering, PolyU, says he has set two challenging goals for leading this new research and innovation hub. He aims to build it into a world-class research organisation in the areas in which PolyU has significant strategic advantages or interests. He also seeks to make PolyU research translational and widely applicable with a positive impact on society.

In his mind, five effective strategies are essential for realising these goals. First, Professor Chen highlights the importance of managing and funding research to harness expertise and research capacities across multiple disciplines. He suggests developing innovative interdisciplinary research projects that can apply for large research grants from Hong Kong, Mainland China and international sources. Internal funding from the Research Institutes (RIs) or Research Centres (RCs) under PAIR can act as seed funds. He adds that interdisciplinary collaboration will ignite more ambitious ideas for innovation from different researchers.

Enhancing research collaboration with first-class universities worldwide is essential, according to Professor Chen. Partnering with a breadth of disciplinary expertise and representation from different levels of academia and research bodies will enable PolyU researchers to identify the concerns that occupy the leading minds and to advance pre-competitive research. "They will be more likely to envisage future global developments and thus remain ahead of the curve," he says.

Professor Chen considers strengthening ties and developing research collaboration with industry players to be another important goal. He welcomes the establishment of more university-industry research centres where PolyU researchers can apply their findings to the development of services and products in response to identified needs. They will be able to generate knowledge that transforms and benefits society.

As the Director of PAIR, Professor Chen is eager to nurture an entrepreneurial spirit among PolyU academics. "It's important that they can emerge as successful entrepreneurs who effectively communicate, promote, focus, learn and strategise, in addition to driving technology innovations," Professor Chen remarks. He will work with the Knowledge Transfer and Entrepreneurship Office to enhance PolyU's entrepreneurial environment and develop an entrepreneurial culture.

Finally, Professor Chen believes the University should more intentionally promote its excellent research capabilities and achievements to the public. He considers it vital to enhance the visibility and reputation of the University as a world leader in its strategic focus areas and as an agent of change.

Research Institutes and Research Centres are catalysts in identifying answers to society's most challenging questions

PAIR has been the home to mission-driven RIs and RCs since its inception. At present, PAIR hosts ten RIs and five RCs with a wide portfolio that encompasses health care and medication, infrastructure and sustainability, manufacturing and automation, science, technology and space exploration. These RIs and RCs combine to underscore interdisciplinary

research as one of the most productive and inspiring of human pursuits, producing solutions to profound societal issues, ensuring sustainable environment, and enhancing the quality of life. The new discoveries, technologies, and innovations that arise from interdisciplinary research can inspire young minds and increase the understanding of our place in space and time. PAIR and its RIs and RCs will challenge current thinking and offer new solutions that contribute to the knowledge-based economies of Hong Kong, the Greater Bay Area and beyond.

"PAIR and its RIs and RCs will challenge current thinking and offer new solutions that contribute to the knowledge-based economies of Hong Kong, the Greater Bay Area and beyond."

Going the extra mile together

The RIs and RCs under PAIR are progressing along the right trajectory. "It is our priority to actively support the newly established RIs and RCs," Professor Chen adds. "PAIR will offer assistance in recruiting researchers, preparing proposals, managing funding, and providing promotional and administrative support." Professor Chen also plans to bring together researchers from different RIs and RCs in venues such as research salons and informal gatherings, setting the stage for fruitful dialogues, intellectual exchanges, inspirations and breakthroughs. He says, "Exciting discovery is always possible in a research domain linking two or more RIs and RCs." He also wants RIs and RCs to share talents and knowledge, empowering each other to address new opportunities.

"If the RIs and RCs are the organs, their people are the lifeblood."

Professor Chen considers Postdoctoral Researchers and Research Assistant Professors to be the core players in building up the University's research capabilities. He likens the University to a human body: "If the RIs and RCs are the organs, their people are the lifeblood." An accomplished academic himself, Professor Chen urges researchers to develop perseverance and go the extra mile. He hopes that PAIR will be part of the University's success story.

PolyU will extend its research priorities and create a shared interdisciplinary vision

Prior to joining PolyU, Professor Chen spent a quarter of a century at two of the most innovative universities in the world: the Massachusetts Institute of Technology (MIT) and Purdue University. "At MIT and Purdue, I immersed myself in interdisciplinary research to spark inspiration, drive discovery and attain impressive results," Professor Chen recalls. "These universities have had establishments like PAIR for years, and a full-fledged technology transfer ecosystem is evident — from basic research to applied research to industry applications. They give birth to many new start-ups and enterprises." PolyU's recent developments, in his view, give it the potential to emulate these two pioneers in creating a robust eco-system that will translate basic research into results that matter. He believes that PolyU's state-of-the-art laboratories and the many top-notch researchers who excel in translational research are ready to share their extraordinary vision.

Comprising faculty members from various disciplines, PAIR serves as an innovation hub dedicated to the development of knowledge and technology. PAIR looks forward to working with external partners across the educational and industrial sectors in delivering further collaborative projects that will improve people's lives.



Professor
Chen Qingyan

Top IWEAR scientist in Asia heads new research institute

“RI-IWEAR will make significant contributions to knowledge advancement, creation of new technologies, cultivation of IWEAR professionals, and development of new technology industries in Hong Kong and beyond.”

In May 2021, the very first research hub in Asia for interdisciplinary research in intelligent wearable technology was established, namely, the Research Institute for Intelligent Wearable Systems (RI-IWEAR), under the PolyU Academy for Interdisciplinary Research (PAIR) of The Hong Kong Polytechnic University. Professor Tao Xiaoming, Vincent and Lily Woo Professor in Textile Technology of the Institute of Textiles and Clothing of PolyU, was appointed as its Director. Professor Tao seeks to brand RI-IWEAR as the leading research institute in intelligent wearable systems via an impactful interdisciplinary research programme, global academic and industrial collaboration, knowledge and technology transfer, and human resource enhancement. “RI-IWEAR will make significant contributions to knowledge advancement, creation of new technologies, cultivation of IWEAR professionals, and development of new technology industries in Hong Kong and beyond,” said Professor Tao.

A paradigm shift in apparel and electronic products

In fact, the membership of RI-IWEAR reflects the IWEAR team’s long history of interdisciplinary collaboration among multiple disciplines, including physics, chemistry, materials, textiles and clothing, design, electronics, mechanical engineering, computing, and occupational health and safety. Such an interdisciplinary environment of RI-IWEAR enables synergies and collaborations among researchers in this emerging disruptive technology that demands a huge paradigm shift in the areas of apparel and electronic products as well as the way of life. Human-centric wearables have high levels of intelligence, with many additional functions that enhance our everyday lives on top of their conventional features. Wearable technology finds abundant applications in online healthcare, online education, sports, the Internet of Things (IoT), smart cities, personal protection, virtual and augmented reality (VR/AR), and even entertainment. Intelligent wearable technology would enable textiles to listen, see, smell, feel and more in the near future.

The benchmarking pioneer in Asia

Compared with other universities in Asia, RI-IWEAR displays many competitive advantages. PolyU has an international reputation for leadership in smart textile integrated wearable systems. Its strong research team has excellent track records in publication, funding applications and knowledge transfer. All the interdisciplinary research areas are unique, with well-established collaboration achievements in cutting-edge technologies. Moreover, the Institute’s work covers all aspects of intelligent wearable systems, including scalable technologies for

flexible biosensors, in-sensing and near-sensing devices, microelectronic textile fabrics, evaluation platforms for IWEAR devices and systems, sensing morphing mannequins, photo-biomodulation devices, iontronic devices and actuators, in-sensor computing devices, and stretchable skin-mounted electronic devices.

The birth of a convenient COVID-19 detector

Since the establishment of RI-IWEAR, numerous research findings have impacted society at large. One of these is a portable platform for detection of SARS-CoV-2 immunoglobulin G (IgG) based on organic electrochemical transistors (OECTs), led by Professor Yan Feng, Associate Director of RI-IWEAR and Professor of the Department of Applied Physics (AP), Faculty of Applied Science and Textiles (FAST) of PolyU. Currently highly sensitive antibody detections are conducted in the hospital and laboratory with large instruments, which are costly and time consuming. On the other hand, existing rapid diagnose methods have low sensitivity and are difficult to quantify the level of antibody. Professor Yan’s research could make COVID-19 antibody testing accurate, fast, non-invasive, with a portable device, which is urgently needed for large-scale antibody testing. To enable faster detection, voltage pulses are applied to the gate electrode of the OECT to accelerate binding between the antibody and antigen. Optimization of the ion concentrations and pH values of test solutions allows the specific detection of SARS-CoV-2 IgG within just a few minutes. These portable sensors, which can be remotely controlled by a mobile phone, show promise for use in the diagnosis and prognosis of COVID-19. The antibody detection platform is convenient, fast and accurate, and it is helpful in the protracted battle with COVID-19. The research finding was published in the top journal *Science Advances* in 2021.

New development of transferring metal gate field-effect transistors

Another impactful development is new process of fabricating metal gate field-effect transistors (TMGFETs), led by Dr Chai Yang, the Assistant Dean of the Faculty of Applied Science and Textiles of PolyU. The rapid development of edge devices highly demands low-power electronics for effective data acquisition and intelligent

information processing. The power consumption of an individual device is proportional to the square of the voltage. To reduce the operation voltage of electron devices, Dr Yang Chai’s research team demonstrates a new type of transistor with sub-1V operation voltage. In this process, metal gate electrodes are transferred to a 2D metal-oxide semiconductor (MOS₂), which eliminates the use of the vacuum and high-temperature process typically used for preparing FETs. The research team has also designed a self-assembled layer to optimize the TMG/MoS₂ interface. According to the experimental results and density functional theory calculation, an increase in the contact distance can reduce Fermi level pinning and the metal-induced gap state. The TMGFETs exhibit a subthreshold slope approaching the thermal limit, a high ON/OFF ratio, and a low gate leakage current. Furthermore, the double-gate configuration enables logic functions with a small footprint. These studies have shown that TMGFETs are promising candidates for low-power electronic applications with a simple fabrication method. The results were also published in *Science Advances* in late 2021.

Future research directions of wearable technology

The sustainability of a research institute requires ambition and perseverance in solving real-world problems; innovative concepts generated by a paradigm shift; and extraordinary creativity that leads to technology breakthroughs. RI-IWEAR aims to roll out new projects continually along these lines. First of all, the research institute is continuing to develop intelligent wearable systems for monitoring of physical, physiological, and psychological conditions and posture for people with specific needs, such as sportsmen, elderly people, young children and pregnant women. New research activities have started with energy. One of them has just commenced in the end of 2021 to work on high-efficiency, eco-friendly antiviral materials, discovered and invented by the team, for personal protective equipment and hygiene products. Researchers are performing extensive experiments on laser-printed graphene for detection, prevention and sterilization of COVID-19. Other new major funded research projects include skin-mounted flexible electronic technologies, electronic textile interaction systems, water-saving technologies of irrigation for agriculture.

Active engagement in interdisciplinary research

Although the R&D pathway is lengthy, RI-IWEAR is not operating alone. It is among nine other research institutes and five other research centres under the umbrella of PAIR. RI-IWEAR is one of the very first PAIR institutes to collaborate with its sister institutes. Key members of RI-IWEAR have collaborated with the Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE), the Research Institute for Artificial Intelligence of Things

“Research is exciting! I like to inspire more and more energetic young researchers to generate new ideas and extend technology frontiers to the next level!”

Application

Evolution

Fibre

(RIAIoT), the Research Institute for Smart Ageing (RISA), and the Photonic Research Institute (PRI) with joint memberships. Professor Tao foresees additional joint projects with the Faculty of Health and Social Sciences.

RI-IWEAR places an emphasis of the real applications of intelligent wearable systems. The team of RI-IWEAR has a very good working relationship with soft-goods industries. The Institute participates in the Semiconductor and Nanotechnology Association of Hong Kong, and has started to develop an industrial consortium to promote collaboration among various industries in the fields of microelectronics, textile, apparel, sports, health, IoT, etc.

Nurturing the new stars of IWEAR

Professor Tao believes that cultivating young researchers is as important as pursuing technology breakthroughs. She is very glad to be working in PolyU, which places a high value on research and development (R&D). She intends to inspire more young researchers to collaborate with various parties, think outside the box, step out of their comfort zones, maintain high spirits, and pursue their dreams.

In order to nurture leading young researchers, Professor Tao strategizes with them on funding applications and research directions. She has deliberately appointed two young scholars, Professor Yan Feng, Professor of the Department of AP in FAST, and Professor Zijian Zhen, Professor of the Institute of Textiles and Clothing in FAST of PolyU, as the Associate Directors of RI-IWEAR in order to nurture their directorship abilities. Professor Yan was acknowledged by Clarivate Analytics as one of the “2021 Highly Cited Researchers” and ranked in the top 2% of the most-cited scientists in the world in the “updated science-wide author databases of standardised citation indicators” compiled by Stanford University in November 2021.

Professor Tao affirms: “Research is exciting! I like to inspire more and more energetic young researchers to generate new ideas and extend technology frontiers to the next level!”



Professor
Tao Xiaoming



Dr Chai Yang



Professor
Yan Feng



Professor
Zijian Zhen

A dialogue with Professor Lu Chao, Director of the Photonics Research Institute (PRI)

“Through collaboration with industries locally and in the Greater Bay Area (GBA), we aim to have more of our research outputs be used in different application areas in the form of commercialisation and spinoffs.”

What is the strategic plan of PRI in the next 3 years?

In the coming three years, we plan to establish PRI as one of the major research centres in the region and worldwide. To achieve this, we will create an environment where people working in the areas of materials, devices, systems, and applications can collaborate on high-impact research. Through seminars, workshops and other means of interaction among people inside and outside the institute, we will identify and fund several interdisciplinary research projects. Moreover, we will actively search for talent internationally in the above areas. Through collaboration with industries locally and in the Greater Bay Area (GBA), we aim to have more of our research outputs be used in different application areas in the form of commercialisation and spinoffs.

Compared with other universities in mainland China or other Asian countries, what are the competitive edges of PRI research at PolyU?

One particular advantage we have is a good mix of faculty members working on fundamental research and those working on applications of photonic technology. This allows us not only to carry out high-impact research but also to foster strong collaboration with industries globally. In addition, the research facilities we have built up over the last 20 years are among the best in the region.

Are there any possibilities for PRI to conduct interdisciplinary research with other research institutes and/or research centres? If so, what is one of your initiatives?

Yes, of course. Photonics has many potential applications, and a number of our members are also involved in other research institutes; for instance, we are currently carrying out some preliminary studies with the Research Institute for Land and Space on water leak detection. In addition, we certainly are actively looking for other opportunities for collaboration. We will use our seminars as a platform for initiating discussions with other research institutes and centres under PAIR.



Professor
Lu Chao

The PolyU-Huawei Joint Laboratory for Optical Interconnection Networks and Advanced Computing Systems was established in 2016. What has been memorable about your collaboration with Huawei over the last five years?

Our collaboration with Huawei dates to 2007. Over the years, we have had many fruitful application projects. The collaboration has facilitated not only the development of technology by Huawei, but also high-impact research publications based on the challenging problems given to us by Huawei. With the joint laboratory, I am very happy to see that many more people from PolyU are involved in joint research projects with Huawei.

“Photonics is a major branch of science, and it continues to evolve and play a major role in 21st-century technological advancement.”

Photonics is the physical science of light waves. Many people may not be familiar with this advanced field of knowledge and its technology applications. Would you please elaborate on the contributions of photonics to humankind?

Photonics is a major branch of science, and it continues to evolve and play a major role in 21st-century technological advancement. Among the 114 Nobel Prizes in Physics awarded since 1901, 47 have been directly or indirectly related to optics. Furthermore, Photonics underpins various industries such as IT and communications that are valued in the trillions of dollars. Other important uses of photonics are in sensing, energy, nanotechnology, imaging, advanced manufacturing and biomedical applications. One good example is optical communication, which was proposed by Nobel laureate Dr Charles Kao in 1966. Nowadays, internet services such as Google, YouTube, Facebook, WhatsApp and WeChat are integrated into our daily lives. To access them, we have to rely on the broadband infrastructure provided by optical fibre communication networks. Huge amounts of data from our Facebook or WeChat accounts, or Google or Baidu maps are stored in data centres. The connections among servers and switches in data centres are also based on optical fibre technology. Further examples include LED lighting and display, CCD on cameras and phones, and LIDAR for self-driving cars.



Indeed, PolyU researchers have made many innovative applications of photonic technologies. For instance, systems developed by PolyU have been used to monitor the condition of trains and tracks in railway systems in Hong Kong and Singapore. Moreover, PolyU has developed lift and escalator monitoring systems with the Electrical and Mechanical Services Department (EMSD) of Hong Kong. Highly sensitive gas-sensing systems have also been developed by PolyU for many different applications, and numerous other applications in biomedical and energy areas are being pursued.

“With the Photonics Research Centre, we are provided with the opportunity to be better integrated with the research activities of the GBA and other provinces in mainland China.”

Knowing that there is a Photonics Research Centre (PRC) at the Shenzhen Research Institute of PolyU, could you please describe the differences between the roles and responsibilities of the PRI in Hong Kong and those of the PRC in Shenzhen?

The PRC at the Shenzhen Research Institute and the PRI at PolyU Hong Kong complement each other well. With PRC, we are provided with the opportunity to be better integrated with the research activities of the GBA and other provinces in mainland China. For example, many of the members have participated in the Ministry of Science and Technology (MOST) national key research program through PRC as PCs, PIs and members of projects. We have also had the chance to be involved in many large projects of the National Natural Science Foundation of China

(NSFC). In addition, as a key international manufacturing hub, Shenzhen gives us access to a very large pool of engineering talent in optics design, electronic design and software programming. Thus, we have many opportunities to implement prototypes for potential commercialisation of our research output.

“For young researchers, finding something interesting to do is always an important aspect of your research life.”

What do you enjoy about photonics? What would you say to young people who are going into photonics research?

I studied electronics for both my undergraduate and postgraduate degrees, but I have always been fascinated by a wide range of interesting aspects of physics. Photonics is a good combination of electronics and physics, and even after working in the area for many years, I find many interesting things to understand and to explore. For young researchers, finding something interesting to do is always an important aspect of your research life. With so many different potential applications, I am sure a young researcher can find something to interest him/ her.

A healthy work-life balance is important. How do you prioritise your time?

I am still striving to achieve a healthy work-life balance. There is always more interesting work to do than the amount of time you have. The excellent location of PolyU does allow us to relax when we have time. A good walk along the Victoria Harbour after work can always make you more relaxed.

The exploration journey from homemade gadget to high-precision space instrument

"I believe there is no room for trial and error when it comes to rockets and other astronomical endeavours."

From dental forceps to Space Holinser Forceps

When Ir Prof. Yung Kai-leung, Director of the Research Centre for Deep Space Explorations (RCDSE), joined The Hong Kong Polytechnic University (PolyU) in 1986, he was already a seasoned researcher who was ready to take up new challenges. He participated in the development of space instruments with industry partners as early as 25 years ago. At PolyU, he stepped into the area of space engineering and adapted the dental forceps of his partner to create the Space Holinser Forceps used by astronauts for precision soldering in 1995 in the then-MIR space station, Russia; developed the Mars Rock Corer for the Beagle 2 lander transported by the Mars Express Mission of the European Space Agency (ESA) in 2003; developed the Planetary Surface Soil Preparation System for the 2011 Sino-Russian Phobos Grunt Mission; designed and co-developed a microsatellite platform on Kaituo-1B, one of our nation's 21 satellites, within one launch in 2015; and, of course, the Camera Pointing System (CPS) for the Chang'e-3 mission that landed on the front face of the Moon in 2013, and Chang'e-4 on the far side of the Moon in 2019.

The low-cost microsatellite platform allows easier access to space for research institutes, SMEs or even tertiary institutions and opens up new prospects in space exploration for local younger generations. The success of the Chang'e-3 and Chang'e-4 missions gave Professor Yung and PolyU's scientific research team the opportunity to participate in the national lunar exploration project of the Chang'e 5 mission, in the development of the Lunar Surface Sampling and Packaging System. One of the

mission's tasks was to acquire and bring back to Earth about two kilograms of lunar regolith. The team has successfully developed the system prototype and flight units for the high-temperature samplers, together with two near-field cameras for vision guidance and a sample packaging system that will carry the samples back to Earth.

From the Moon to the red planet and beyond

Apart from participating in several lunar exploration projects, Professor Yung has contributed to the design of the Mars Landing Surveillance Camera (Mars Camera) for the nation's first-ever Mars soft landing mission, Tianwen-1. The camera was made to capture images of the red planet after landing and to monitor the deployment of the Zhurong Mars rover. The Tianwen-1 spacecraft arrived in Mars' orbit in February 2021 and landed on the surface of Mars in May 2021. The spacecraft, which comprises an orbiter, a lander and the Zhurong rover, completed its orbiting, landing and roving in a single mission, the first such attempt in human history. The mission has since returned large amounts of scientific data from the red planet and information about the landing region on Utopia Planitia.

Moreover, based on the track records of ESA's Mars Rock Corer and the Russian Phobos Grunt SOPSYS projects, the research team has recently cooperated with the Swedish Institute of Space Physics on the Jupiter Ice-Moon exploration (JUICE) mission, which is expected to be launched in 2023. With this wealth of experience, Professor Yung expects many opportunities for cooperation with foreign universities and institutions in the future.

Interdisciplinary team devoted to planetary resources research

RCDSE focuses on planetary resources research with respect to exploration, exploitation and utilization. An interdisciplinary team has been formed as the core, with the addition of other collaborators to perform impactful real-world research that often requires the synergy of different disciplines.

The design and manufacture of functional space mechanisms and payloads is the ultimate engineering challenge. These payloads must be able to sustain many unforeseen challenges during voyages through the hostile space environment, as well as being lightweight and absolutely reliable. They must operate reliably under severe conditions such as high vacuum, extreme temperatures, microgravity, cosmic dust, and cosmic rays. Professor Yung is composed, focused, and precise, propelling engineering technology to new heights, and has made far-reaching contributions to space research. He is a model for scientific researchers.

In fact, the sustainability of a research centre relies heavily on its ongoing research areas and new ideas. Currently, the scientists and researchers of RCDSE are working on Chang'e 5's lunar regolith sample analysis for lunar resources exploitation, Chang'e 6's sample return mission, Chang'e 7's water ice detection and in-situ sample analysis from the south polar region of the Moon, and future asteroid exploration missions.

No room for trial and error

Professor Yung believes there is no room for trial and error when it comes to rockets and other astronomical endeavours. Scientists and engineers must overcome numerous difficulties, and the slightest mistake is enough to negate all previous efforts. Therefore, when he was selected by the Space Agency to participate in the lunar exploration project, Professor Yung felt honoured and excited. At the same time, he set out with a trembling heart. In the development process, any error will require re-running of the whole process and long delays. "If you make a mistake, you have already lost, and the mission cannot wait for you at all," he explained.

"When I consider facing challenges in research as a way of life that I enjoy, then there are no stresses or frustrations."

Being a scientist can be stressful at times; being a scientist in space missions can be traumatic and involve tremendous frustration. One might wonder how an academic, engineer, scientist and researcher, such as Professor Yung, manages the stress and frustration of a busy work schedule. "When I consider facing challenges in research as a way of life that I enjoy, then there are no stresses or frustrations", he said.

Dreams of a space scientist

Professor Yung's dream is to use his knowledge to further the nation's scientific and technological advancement, as well as to invent things that bring benefits to humanity. With his dedication, this is certainly a dream that is coming true. Professor Yung's long-standing commitment to research and his outstanding achievements have earned him numerous accolades. These include PolyU President's Awards for Outstanding Performance/Achievement in 1999 and 2014. He was also awarded the Bronze Bauhinia Star by the Hong Kong Special Administrative Region Government in 2015 in recognition of his contributions to scientific research, particularly in machine design, automatic control systems and space technology.

"My dream is to use my knowledge to further the nation's scientific and technological advancement, as well as to invent things that bring benefits to humanity."

While Professor Yung very much enjoys working on his dream research projects at PolyU, he also likes teaching young people. To students who aspire to excellence in research, the veteran space scientist says: "Besides having strong skills for basic research, the ability to communicate is important. Scientists not only need to have an innovative mind; they also need to communicate their ideas with others clearly, as new inventions are the result of close teamwork."

Professor Yung is devoted to research. He loves teaching and spending time with students. PolyU encourages students to become "practical dreamers" while he is a true believer of such. Professor Yung has cultivated many scientific researchers from the University. He often reminds young people not to simply have "ideas", nor to be satisfied and proud just because their ideas are good. These concepts must be realized in order to be valuable. He encourages young researchers to aim high, to dare to innovate and explore, and to have perseverance and a fighting spirit in order to realize their dreams.

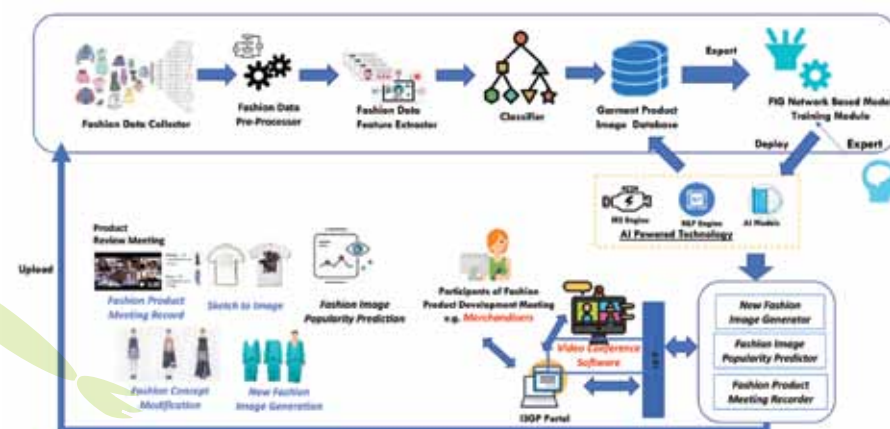


Advance in AI-powered technologies boosts the fashion design industry to the next level

Generative Adversarial Networks (GAN) are a recent advance in AI-powered technologies used to generate previously non-existent objects, and they provide an opportunity for the design of fashion by AI. However, the fashion industry has not been at the forefront in leveraging AI technology.

The Intelligent Inspiration Image Generation Platform (I3GP) for fashion design was developed by Prof. Eric W. T. Ngai, Associate Director of the Research Institute for Artificial Intelligence of Things (RIAIoT) and Professor and Associate Head of the Department of Management and Marketing at PolyU. The aim of I3GP is to support virtual interactive discussions among internal and external participants in fashion product development (e.g. fashion merchandisers, fashion product designers and buyers) through AI-powered fashion image generation (FIG) technology via video conferencing or face-to-face meetings, by integrating proposed FIG network-based models with natural language processing (NLP) and computer vision technologies.

The platform allows the internal and external participants in fashion product development to demonstrate their ideas during meetings and to collaborate through instantaneous modifications. Furthermore, during a virtual discussion, meeting notes can be recorded automatically with the relevant images to improve traceability. I3GP can also generate numerous new fashion design images that users can modify according to specific parameters (e.g. pattern, collar type and season) and employ for prediction of design popularity. Users can also automatically record meeting notes with the relevant images during virtual discussions to support fashion product development.



Advanced fourier-transform electron paramagnetic resonance spectrometer for molecular and nano functional materials research

Fourier-transform electron paramagnetic resonance (FT-EPR) spectroscopy can be used to determine the local and microenvironment of paramagnetic spin-active nuclei, and more importantly the electronic communication between these entities within small distances. It is becoming a highly important characterization technique for emerging molecular and nano functional materials in various research areas, such as catalysis, battery electrodes, molecular machines, protein-protein recognition, methodology of electron-electron distance measurements, hydrogen storage, transparent conductors, and quantum computing, to name but a few. As a result, there is a huge demand for the establishment of a modern FT-EPR facility in Hong Kong.



Image courtesy of BRUKER

Prof. Raymond Wong Wai-yeung, Associate Director of the Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE), Member of the Research Institute for Intelligent Wearable Systems (RI-IWEAR), Dean of the Faculty of Applied Science and Textiles and Chair Professor of Chemical Technology at PolyU, and his research team received a Research Equipment Grant of over HK\$7 million from the Research Grant Committee (RGC) Collaborative Research Fund (CRF) 2021/2022 to support the development of such a project.

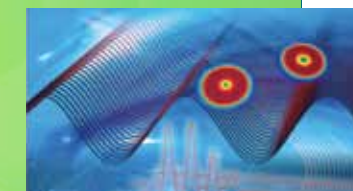


Image courtesy of BRUKER

The overarching objectives of this project are to address this immediate need, i.e., to establish the first FT-EPR facility that will expand characterization capabilities for emerging molecular and nano functional materials, and to eventually promote multidisciplinary research in Hong Kong through collaborations with leading experts in these fields. A customized FT-EPR facility that combines all useful techniques does not yet exist in Hong Kong or even in Mainland China. Setting up this unique facility will substantially broaden the range of materials that can be studied and will give Hong Kong the advantage in research on, and development of, emerging molecular and nano functional materials. In this way, we will acquire an advanced FT-EPR system with customized experimental features that will further the efforts of the Hong Kong scientific community in high-impact research. We also envision that the industry in Hong Kong will be a major beneficiary of this facility, where many of their long-standing puzzles can be solved.

Discovery of novel anticancer drugs targeting LIF pathway and based on traditional Chinese heat-clearing and detoxication medicines

The world's growing oncology burden has severely strained healthcare systems and has affected our quality of life. Dr Chen Sibao of the Research Centre for Chinese Medicine Innovation (RCMI) has addressed this matter. Predicated on his previous research which confirmed the significance of the leukaemia inhibitory factor (LIF) signaling pathway in the occurrence and development of tumours, Dr Chen's new research aims to establish a technology platform for *in vitro* and *in vivo* efficacy studies of antitumor drugs based on the LIF signaling pathway, and to provide a scientific basis for the research and development of new antitumour drugs derived from ten plant species used for heat clearing and detoxication in traditional Chinese medicine.

Postmenopausal osteoporosis: discovery of natural antiosteoporotic lead compounds from microbial transformation

Around 200 million people worldwide suffer from osteoporosis. The adverse effects, low medication tolerance and high cost of the existing treatments have limited their long-term use. In view of these concerns, Prof. Wong Man-sau, Dr Daniel Mok and Dr Xiao Huihui of the Research Centre for Chinese Medicine Innovation (RCMI), as well as Dr Amber Chiou, Associate Director of the Research Institute for Future Food (RiFood), and Dr Chan Chi On of the Department of Applied Biology and Chemical Technology (ABCT) at PolyU, have collaborated with Increasepharm to develop safe, efficient and stable lead compounds from the lignan of *Sambucus Williamsii* Hance (SWH). This folk herbal medicine has been used to treat bone and joint diseases for thousands of years, and the newly developed compounds will be utilized in the treatment of postmenopausal osteoporosis.

Higher probability of occurrence of hotter and shorter heat waves followed by heavy rainfall

According to long-term meteorological observations provided by the Hong Kong Observatory, there is a significantly increasing trend in the number of very hot days, especially in recent years. The year 2021 was the warmest on record in Hong Kong, with 11 months that were warmer than usual. Meanwhile, the annual number of heavy rain days is also increasing, with hourly rainfall records being broken several times over the last few decades. According to the newly released Hong Kong Climate Action Plan 2050, the Government is calling for urgent action to combat extreme heat and severe rainstorms because these events have been increasing in frequency and intensity under climate change, posing serious threats to human health, socioeconomic development, urban infrastructure and ecosystems in Hong Kong.



Dr Wang Shuo

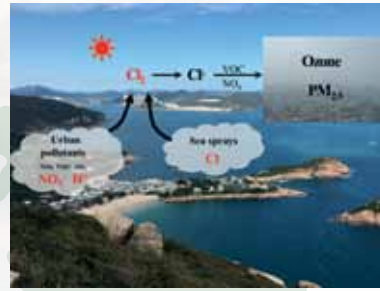
Dr Wang Shuo, Member of the Research Institute for Land and Space (RILS) and Assistant Professor, Department of Land Surveying and Geo-Informatics at PolyU, and his research teammates have looked into the issue. Dr Wang's research explored the unexpected occurrences of heat waves followed by heavy rainfall. Such compound extreme events could exacerbate the damage caused by the combination of different types of extreme events. The research revealed the way in which a heat wave may evolve into heavy rainfall, leading

to consecutive heat waves and heavy rainfall events. These consecutive events are projected to occur more frequently under a warming climate based on gridded observations, reanalysis datasets, and model simulations. Dr Wang's research findings revealed that out of every four heat wave events in China during the period of 1981–2005, one of the events was followed by heavy rainfall within seven days, and Hong Kong was one of the hotspots detected across Southeast China. Furthermore, shorter and hotter heat waves were more likely to be followed by heavy rainfall. This tendency underscores the need for early warning and disaster preparedness for the occurrence of subsequent rainstorms when a short-duration but high-intensity heat wave has been observed. The research findings have significant implications for Hong Kong as the emerging climate-related disasters have been receiving increasing attention from the public.

The research results have been published in *Geophysical Research Letters*. (<https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2021GL094831>)

RISUD and RILS researchers discovered a smog-aggravating chemical in Hong Kong's air

Ozone (O_3) is an air pollutant that causes eye irritation and respiratory diseases. Despite improvement of overall air quality in Hong Kong in recent years, high concentrations of ozone remain a serious problem in the city. Ozone at ground level is produced by chemical reactions involving volatile organic compounds (VOCs) and oxides of nitrogen (NO_x) in the presence of sunlight. The production of ozone is initiated and sustained by radicals – highly reactive oxidants; the conventional radicals are OH, HO_2 and RO_2 (collectively called ROx radicals).



In a field study at a coastal site in Hong Kong, a team of researchers from the Research Institute for Sustainable Urban Development (RISUD) and the Research Institute for Land and Space (RILS) discovered unprecedented concentrations of molecular chlorine (Cl_2) during the autumn when ozone pollution reaches its annual peak. Cl_2 was previously known to destroy 'good ozone' at high altitudes over the Antarctic, thus allowing cancer-causing ultra-violet sunrays to reach the Earth's surface. In polluted areas, however, Cl_2 can be a 'new' radical source of ozone that harms human health and vegetation. In collaboration with international scientists, the field study team found that the high Cl_2 concentrations are caused by the interaction of man-made pollutants (NO_x and acidic chemicals) with natural sea-spray particles. This pollution pathway is important not only for Hong Kong but also for other coastal cities and for other pollutants like $PM_{2.5}$. The team's findings can be used to adjust or refine measures that reduce ozone pollution.

The study results were published recently in *Nature Communications*. The first author is Dr Peng Xiang, who was a PhD student at the time of this study, and the corresponding author is Prof. Wang Tao, Member of RISUD and RILS and Chair Professor in the Department of Civil and Environmental Engineering (CEE). Other contributing authors include Ir Prof. Guo Hai, Prof. Lee Shuncheng, and additional PhD students and researchers from CEE, personnel from the Hong Kong Environmental Protection Department, and scientists from the US, France, Spain, Sweden, Germany and Mainland China. The study was supported by funding from the Hong Kong Research Grants Council, the Agence Nationale de la Recherche, the Swedish Research Council, and the European Research Council.

Sustainable marine infrastructure enabled by the innovative use of seawater sea-sand concrete and fibre-reinforced polymer composites

Fibre-reinforced polymer (FRP) composites are increasingly gaining acceptance as replacements for steel in conventional reinforced concrete structures in aggressive environments because of their excellent corrosion resistance. The use of FRP composites in concrete structures also opens a new avenue for concrete production with the direct use of locally available seawater and sea-sand in coastal/marine construction. In 2018, a project team led by Prof. Teng Jin-Guang was awarded a grant of over HK\$52.4 million, including matching funding from local participating universities, to develop sustainable marine infrastructure enabled by the innovative use of seawater sea-sand concrete (SSC) and FRP composites. In 2020, Prof. Yu Tao took over the role of Project Coordinator from Prof. Teng, who assumed his duty as the President of PolyU in July 2019 and now serves as the Advisory Project Coordinator of the project.



FRP reinforcement bars, seawater, and sea-sand

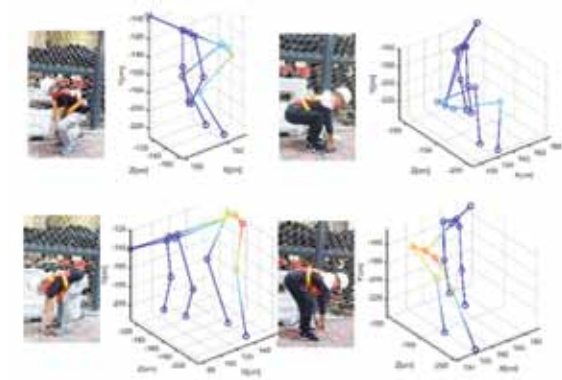
Since January 2019, the project team has made significant progress and achieved several breakthroughs. The team has clarified the effects of seawater on the properties of SSC and successfully developed ultra-high-performance SSC with a compressive strength of more than 180 MPa. Various innovative forms of FRP-SSC structural members, including beams, columns and slabs, have been proposed and investigated in experimental and theoretical studies. Optical fiber-based humidity, pH and chloride sensors have been successfully developed for monitoring the environment inside FRP-SSC structures. Molecular dynamics simulations have been carried out to elucidate the material structures of SSC and the fundamental deterioration mechanisms of FRP, while a numerical simulation framework is being developed to enable real-time unification of the thermo-physics of materials and the mechanics of FRP-SSC structures. Furthermore, accelerated exposure tests and field exposure tests on FRP, SSC and FRP-SSC structural members have commenced. Partial results of the project have become available through publications in international SCI journals.

A novel non-intrusive method to measure construction workers' physical fatigue



Professor Li Heng

The construction industry around the world has unsatisfactory occupational health and safety records. One of the critical reasons is attributed to high physical demands and hostile working environments. Many countries, including Hong Kong, tackle longstanding problems deriving from physical fatigue. Workers' fatigue may cause work-related injuries and accidents on construction sites. Traditionally, fatigue monitoring in the construction domain relies on self-reporting or subjective questionnaires. These methods require the manual collection of responses and are impractical for continuous fatigue monitoring.



To promote a sustainable workforce, it is crucial to monitor physical fatigue levels amongst construction workers in order to mitigate them. Prof. Li Heng, Associate Director of Research Institute for Intelligence of Things (RIIoT) and Chair Professor of Construction Informatics of PolyU, and his team have developed a novel non-intrusive method to monitor whole-body physical fatigue by combining computer vision technology and smart insoles. A computer vision-based 3D motion capture algorithm was developed to model the motion of various body parts using an RGB camera. A fatigue assessment model was developed using the 3D model data from the developed motion capture algorithm and biomechanical analysis.

The experiment showed that the proposed physical fatigue assessment method could automatically provide joint-level physical fatigue assessments. Then, a series of experiments demonstrated the potential of the method in assessing the physical fatigue level of different construction task conditions such as site layout and the work-rest schedules. Furthermore, smart insoles capable of measuring the support reaction forces acting on feet were applied for monitoring purposes. By fusing the two types of data, biomechanical models will be developed and employed to estimate worker physical fatigue levels. Field experiments validated the feasibility of the method.

RISA's study of effects of environment-related experiences on well-being of older people in Hong Kong's "Double Ageing" context

"Ageing in place" has become an essential social policy in Hong Kong. Central to ageing in place is the Person-Environment (P-E) fit. This fit indicates the degree to which the experiences of living are conducive to people's development of capabilities for proactively using environmental resources for a good life. There are two types of environment-related experiences. Socio-spatial experiences are developed when older people engage in physical and social activities, including experiences on the micro, meso and macro levels of the environment. Psychological experiences include residential satisfaction and place attachment. Both types of experiences contribute to well-being. However, evidence of wide applicability of the P-E fit concept, particularly to densely populated urban environments in the Asia-Pacific region, is limited.



A questionnaire survey identified 28 items in the built environment that are conducive to the development of place attachment and well-being. These 28 items fall under four dimensions, i.e., housing and estate (F1), walkability (F2), living convenience (F3) and social environment (F4). All four environmental dimensions promote emotional well-being (W1) through residential satisfaction (M1). The dimensions of housing and estate, living convenience and social environment are predictors of emotional, social (W2) and psychological (W3) well-being through place attachment (M2). This means that for older people living in densely populated urban environments in Hong Kong, place attachment acts as a more robust mechanism than residential satisfaction, underlying the association between interactions with the environmental and multifaceted well-being. Micro-level environmental factors are essential to achieving the best aging in place outcome.

The study identified the socio-spatial and psychological experiences perceived to be important by Hong Kong's older people; assessed the effects of socio-spatial and psychological experiences on well-being; and identified key planning strategies and environmental policies for improving those experiences of ageing in place that are suitable for densely populated Asian cities. The study also contributed to existing P-E fit by articulating the environmental factors essential to developing a well-being-oriented community life. Empirically identified paths connecting environment-related experiences and well-being will provide evidence-based solutions for improving the planning and design of age-friendly communities in Hong Kong and other modern mega cities in Asia.

Biochar-enhanced construction materials for sustainable waste management and long-term decarbonisation

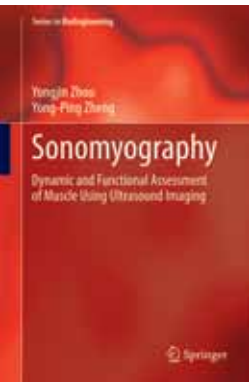
Using innovative designs and science-informed manufacturing technologies, Prof. Dan Tsang of the Research Centre for Resources Engineering towards Carbon Neutrality (RCRE) has developed cutting-edge biochar-enhanced construction materials for sustainable waste management and long-term decarbonisation, which will be agenda-setting and impactful for scalable applications in the local construction industry and throughout the Greater Bay Area. The pioneering products will include biochar partition block and biochar porous paver. The lightweight partition block helps to reduce noise and remove pollutants, while the porous paver is highly permeable as a sustainable drainage element. It has been forecast that the industrial-scale adoption of such technologies will significantly contribute to landfill diversion of yard waste and reduction of carbon emissions.

Biochar is widely recognised as a carbon-negative material and a key component of the decarbonisation technology deployed for achieving carbon neutrality. Conversion of biomass waste (e.g., yard waste) into innovative biochar-enhanced construction materials can foster a circular economy of waste valorisation and low-carbon construction and help to achieve the waste reduction targets in the Government’s Waste Blueprint for Hong Kong 2035.



Sonomyography: dynamic and functional assessment of muscle using ultrasound imaging

Sonomyography (SMG) refers the technique using ultrasound imaging for dynamic and functional assessment of muscle, and the term is first coined by Ir Prof. Zheng Yongping, Director of Research Institute for Smart Ageing (RISA), and his research team in 2006. Traditionally functional assessment of muscle is commonly achieved using electromyography (EMG), which is the electrical signal collected from skin surface and generated during muscle contraction. However, surface EMG is inherently difficult to differentiate activities of overlapping or neighboring muscles, as electrical signals collected on the skin surface are combined with the signals from all nearby muscles. SMG uses real-time ultrasound imaging to analyze the architectural changes of muscle during its contraction to obtain SMG signals, which can be real-time changes of muscle thickness, cross-sectional area, muscle fiber length or orientation, etc. Inherently, different muscle groups can be differentiated in the ultrasound images, thus their SMG signals as well. Furthermore, SMG provides biomechanical information of muscle, which is complementary with EMG’s electrical information of muscle. SMG has wide applications in muscle functional assessment and control area, including prosthesis control and game control. It can be used for the assessment of sarcopenia, i.e. muscle loss among elder people as well as intervention outcome for sarcopenia, such as exercises or physiotherapy.



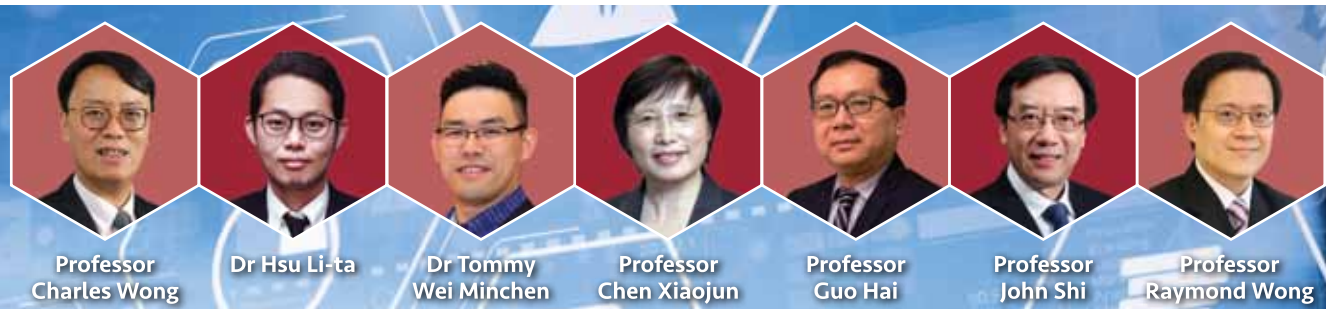
The book recently published by Springer titled “Sonomyography: Dynamic and Functional Assessment of Muscle Using Ultrasound Imaging” is co-authored by Ir Prof. Zheng and his former Postdoctoral Fellow Dr Zhou Yongjin. It summarized the research, development, and application of SMG since 2006 up to now. It also highlighted the future trend in this area, with device being ultra-small and wearable, data collection speed ultra-fast for a wider application in ageing, sports, rehabilitation, scientific research, etc.

RCDSE study found impact remnants on the Moon that may be sources of water

A study led by the National Space Science Centre of the Chinese Academy of Sciences and joined by Prof. Wu Bo, Associate Director of the Research Centre for Deep Space Explorations (RCDSE) and Associate Head of the Department of Land Surveying and Geo-informatics at PolyU, has found carbonaceous chondrite remnants from an impactor in a young lunar crater formed within the past million years, the first-ever discovery of such fragments by in-situ investigation on the far side of the Moon. Prof. Wu suggests that carbonaceous chondrite-like meteorites may be the source of 10% to 20% of the water on the present Moon.

Prof. Wu’s role in the research was to use innovative 3D mapping technology to create a detailed 3D topographic model of the two-metre-sized crater from lunar surface images acquired by the Yutu-2 rover of the Chang’e-4 mission. The 3D morphology of the crater is critical for determining whether or not the crater resulted from a meteorite impact. Hyperspectral images in the visible and near-infrared range (0.45–0.945 μm) with a spatial resolution less than 1mm per pixel highlight the presence of glassy material with a high concentration (47%) of carbonaceous chondrites. The research team identified this material as remnants of the original impactor, which was not completely vaporized by the impact.

The results were published in the scientific journal *Nature Astronomy* (<https://doi.org/10.1038/s41550-021-01530-w>).



Seven interdisciplinary research projects led by members of PAIR’s research institutes and research centres received funds and grants from the Research Grant Committee

The Research Grant Committee (RGC) announced the funding results of the Research Impact Fund (RIF) in 2021/22, Collaborative Research Fund (CRF) in 2021/22 and Second Round One-off CRF COVID-19 and Novel Infectious Diseases (NID) Research Exercise earlier this year. Five interdisciplinary research projects conducted by PAIR’s constituent research units received over HK\$36 million grant in total.

Research project	Project Coordinator	RI / RC involved	Amount awarded
RGC RIF 2021/22			
Deeper Understanding of Color Matching Mechanism for Developing High-quality Lighting and Imaging Systems	Dr Tommy Wei Minchen	PRI and RISUD	\$5,700,000
Reliable Multiagent Collaborative Global Navigation Satellite System Positioning for Intelligent Transportation Systems	Dr Hsu Li-ta	RIIoT and RISUD	\$3,100,000
RGC CRF 2021/22 Research Equipment Grant			
High performance deep learning clusters for big data analytics	Prof. Chen Xiaojun	RIIoT, SCRI and RCSV	\$3,099,659
Advanced Fourier-transform Electron Paramagnetic Resonance Spectrometer for Molecular and Nano Functional Materials Research	Prof. Raymond Wong Wai-yeung	RISE and RI-IWEAR	\$7,964,914
RGC CRF 2021/22 Research Project Grant			
Study of Carbon Sequestration in Hong Kong’s Vegetation: from Present to Future Prediction under Climate Change	Prof. Charles Wong Man-sing	RILS and RISUD	\$4,949,639
Second Round One-off CRF COVID-19 and NID Research Exercise in 2021/22			
Is the Usual Social Distance Sufficient to Avoid Airborne Infection of Expiratory Droplets in Indoor Environments?	Prof. Guo Hai	RILS and RISUD	\$4,703,090
Spatiotemporal Prediction and Real-time Early Warning of COVID-19 Onset Risk	Prof. John Shi Wenzhong	SCRI	\$6,964,000

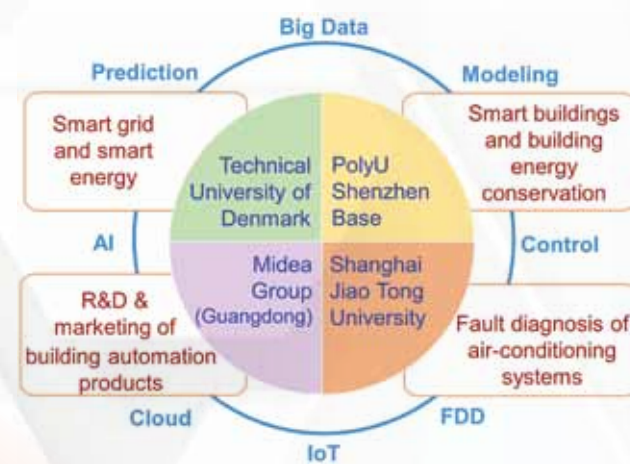
Two scholars at PAIR received the Global STEM Professorship

Prof. Chen Qingyan, Director of PolyU Academy for Interdisciplinary Research (PAIR) and Chair Professor of Building Thermal Science, and Prof. Weng Qihao, Associate Director of Research Institute for Land and Space (RILS), Chair Professor and Global STEM Scholar of the Department of Land Surveying and Geo-Informatics, were recently awarded the prestigious “Global STEM Professorship” by the Government of the Hong Kong Special Administrative Region.

The objective of the “Global STEM Professorship” scheme is to strengthen support to Hong Kong universities to attract world-renowned innovation and technology scholars to work in Hong Kong. This would aid the universities to scale new heights in teaching and research activities and to expand the innovation and technology talent pool of Hong Kong. In the long run, the scheme is expected to build up the universities’ capacities in commercialising and applying their research discoveries, to encourage technology and knowledge transfer to serve the community and spearhead innovation and technology development in Hong Kong.

Smart building energy management research funded by Ministry of Science and Technology of China

Prof. Linda Xiao Fu, Associate Director of Otto Poon Charitable Foundation Research Institute of Smart Energy (RISE), Associate Dean of Faculty of Construction and Environment and Professor of Department of Building Environment and Energy Engineering of PolyU, was awarded RMB4,120,000 from Ministry of Science and Technology of China (MOST) – 2021 National Key R&D Programs to conduct research on smart energy management technologies for complex building energy systems in high-density cities from 1st July 2021 to 30th June 2024. The total budget of the project is RMB6,120,000. Prof. Xiao leads an international multidisciplinary team consisting of experts from Technical University of Denmark, Shanghai Jiao Tong University and Midea Group in this project.



Buildings are responsible for over 1/3 energy use and carbon emissions in the world. With the rapid urbanization, the development of high-density cities encounters major energy and environmental challenges. To cope with the challenges, buildings are integrated with increasingly complex energy systems to improve building energy efficiency and use more renewable energy. The existing physics-based domain knowledge about buildings and building energy systems face big challenges in dealing with big system, big data, uncertainties, coupled dynamics and interactions as well as occupant behaviour. Meanwhile, the mature IT and IoT infrastructure and advanced cloud, big data and AI

technologies and facilitates in modern cities enable the development and implementation of smart management of building and district energy systems.

This project aims to develop innovative data-driven knowledge discovery, prediction, modeling, control and fault diagnosis technologies by leveraging advanced big data and AI for managing building and district energy systems, to improve their energy efficiency, flexibility, reliability and sustainability. This project will demonstrate and test the technologies to be developed in a number of buildings and districts in Hong Kong, Foshan, Shanghai and Copenhagen.

Associate Director of RILS conferred as Fellow of the American Association of Geographers and elected into The Academy of Europe (Academia Europaea)

Prof. Weng Qihao, Associate Director of RILS, Chair Professor and Global STEM Scholar of the Department of Land Surveying and Geo-Informatics at PolyU, conferred as Fellow of the American Association of Geographers (AAG) for his significant contributions to advancing geography. Prof. Weng and his colleagues developed a methodology for estimating temperatures with satellite-derived measures of vegetation that is now applied widely throughout a wide range of fields. He has helped lead the field of remote sensing at the AAG and beyond.



Prof. Weng were also elected Foreign Member of The Academy of Europe (Academia Europaea) in its 2021 class recently, an European institution that aims to promote European research, advise governments and international organisations in scientific matters, and further interdisciplinary and international research. Members of the Academy are nominated and elected only by their peers. Prof. Weng has made significant contributions to the advancement of knowledge in the fields of remote sensing, GIScience, urban climatology, urban ecology, sustainability science and geospatial AI.

Research team in SCRI received special recognition in the 2021 RICS Awards Hong Kong

The Otto Poon Charitable Foundation Smart Cities Research Institute (SCRI) - 3D Mobile Mapping System Research Team has been highly commended by the judging panel in the Research Team of the Year category in the 2021 Royal Institution of Chartered Surveyors (RICS) Awards Hong Kong!



The RICS Award showcase the most inspirational initiatives and developments in land, real estate, construction and infrastructure. They recognise outstanding achievement, teamwork and companies. The 2021's entrants have been responsible for some of the biggest projects Hong Kong has seen to date – including delivering for clients during COVID, fostering better workplaces for occupants, creating diverse workplaces, boosting the sustainability of projects through the use of technology and working to fight against the impacts of climate change.

Apart from the 13 winners, the research team in SCRI was one of the highly commended teams who judges felt deserved special recognition. They developed a lightweight and reliable 3D mobile mapping system (mobile mapping backpack), which can easily measure cities and obtain 3D maps with centimetre-level accuracy. It can be used to build spatial data infrastructure and can thus support smart city applications in many fields. The system adopts advanced technologies such as Simultaneous Localisation and Mapping (SLAM), which is not restricted by the signal receiving area of the Global Navigation Satellite System (GNSS). It can carry out continuous data collection in different complex indoor and outdoor environments and is particularly suitable for high-density and complex urban environments, such as those in Hong Kong.

Ninety-five PAIR members recognised as top two percent scientists worldwide



Stanford University has recently released an update of the list that represents the top 2% of the most-cited scientists in various disciplines. The report was prepared by a team of experts led by Prof. John Ioannidis, the eminent Professor at the Stanford University.

PolyU RiFood establishes the world's first collaborative research laboratory with Yakult officially

PolyU Research Institute for Future Food (RiFood) received a generous donation of HK\$2 million from Hong Kong Yakult Co. Ltd. (Yakult) to establish the "PolyU-Yakult Joint Research Laboratory for Probiotics and Prebiotics in Human Health". Interviewed by the media on 19 October 2021, Dr K.H. Wong, Director of RiFood and Dr William Tai, Director of PolyU-Yakult Joint Lab, revealed that they aim to pursue impactful and cutting-edge research in Food Science and Human Health. By establishing PolyU-Yakult Joint Lab, the team will focus on the development of new probiotics and prebiotics for the prevention and therapy of different diseases, to facilitate scientific exchange between Hong Kong and the world.



PolyU receives staunch support from the Otto Poon Charitable Foundation for the establishment of the Smart Cities Research Institute and the Research Institute for Smart Energy

Thanks to a generous donation from the Otto Poon Charitable Foundation (the Foundation), The Hong Kong Polytechnic University (PolyU) has established two research institutes in support of the University's research endeavours in the areas of smart cities and sustainable energy. The two research institutes are named the Otto Poon Charitable Foundation Smart Cities Research Institute (SCRI) and the Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE) in appreciation of the Foundation's significant contributions. Officiated by Dr David Chung, Under Secretary for Innovation and Technology of the HKSAR Government, the naming ceremony was held on 8 October 2021. It was attended by Ir Dr Otto Poon Lok-to, Founder of the Otto Poon Charitable Foundation, Dr Lam Tai-fai, PolyU's Council Chairman, Professor Jin-Guang Teng, PolyU's President and others. Established in 2020, SCRI and RISE will bring together PolyU experts from diversified fields to develop impactful interdisciplinary research.

SCRI aims at being a global centre of excellence in urban informatics and a living smart cities laboratory for Hong Kong and the Guangdong-Hong Kong-Macao Greater Bay Area in order to promote smart cities development in Hong Kong and in the country. Its research focus areas include Smart Mobility, Smart Living, Smart Environment, Smart People, Smart Government, and Smart Economy. SCRI is collaborating with some of the world's top universities including the University of Cambridge and University College London, as well as major industrial players to develop innovative solutions. SCRI's innovations have received worldwide recognition and won two Gold Medals at 2021 Inventions Geneva Evaluation Days and two prizes in the 2021 Smart 50 Awards.

RISE strives to pursue translational research on innovative solutions for energy-related problems. Its five research focus areas include District Energy Systems and Smart Grid, Smart Buildings and Smart Energy Systems, Advanced Energy Storage Technologies, Advanced and Renewable Energy Conversion Technologies, and Advanced Energy Materials. RISE's world-class research has been recognised in various global research rankings. According to a recent report by Stanford University, 16 RISE members have been listed among the top 2% of scientists in relevant research fields globally, with three members ranking in the top 25 places.



Four PAIR academics recognised amongst the world's most highly cited researchers in 2021



Four academics from PAIR have been acknowledged in the "2021 Highly Cited Researchers" list by Clarivate Analytics. The list identifies the most influential scholars around the world for their exceptional research performance, determined by the publication of multiple highly cited papers that rank in the top 1% by citations in each respective field. Approximately 6,600 researchers across the globe were named Highly Cited Researchers in 2021.

The inclusion of our academics in the list is a testament to PolyU and PAIR's pursuit of research excellence and our impact on society.

The four PAIR researchers featured in the list, and the fields in which they have been recognised, are as follows:

Name	Research Field	RI/RCs involved
Prof. Daniel TSANG	Engineering & Environment and Ecology	RIFood, RILS, RISUD and RCRE
Prof. GUO Song	Computer Science	RIIoT and RISUD
Prof. LI Gang	Cross-Field	RI-IWEAR, PRI, RISE and RISUD
Prof. YAN Feng	Cross-Field	RI-IWEAR, PRI, RISE and RISUD

Inauguration Ceremony of Research Centre for Resources Engineering towards Carbon Neutrality



The PolyU Academy for Interdisciplinary Research (PAIR) was proud to celebrate the inauguration of the Research Centre for Resources Engineering towards Carbon Neutrality (RCRE) on 14 January 2022 on the PolyU campus. Over 100 guests from the Hong Kong Government, PolyU, the industry and the Centre's research partners attended physically or online and witnessed this new page.

Speaking at the inaugural ceremony, Prof. Jin-Guang Teng, President of PolyU, stated that PolyU now has the largest research team and facilities among all the universities in Hong Kong focusing on resources engineering towards carbon neutrality, and has established a strong track record and recognised reputation in the waste management research community. PolyU will advance further with the establishment of RCRE for the good of the society.



Under PAIR's leadership, RCRE will become the effective platform aligning people of similar interests to work together in the very important interdisciplinary research field of how to make good use of resource engineering to achieve carbon neutrality. "Our campus is working hard on achieving the goal of carbon neutrality before 2050. RCRE fits very well into this arena and its research work will add great value to helping not only PolyU but the whole community to achieve this target that can benefit our society in a meaningful way," PolyU's Vice President (Research and Innovation) Prof. Christopher Chao said at the same occasion.

Attending the ceremony online, Mr Wong Kam-sing, Secretary for the Environment of the HKSAR, commended PolyU for its contribution and efforts to pool its interdisciplinary talents and facilities to advance the development of decarbonisation technologies and related policy study.

The ceremony also featured a fruitful scientific exchange by different PolyU and overseas researchers who presented on a kaleidoscope of topics. Poster presentations on current projects conducted by PolyU researchers were also staged and attracted the attention of all the attending guests at the spot.

RCSV member appointed as Asia Pacific Council of Optometry President

Prof. Carly Lam, Member of Research Centre for SHARP Vision (RCSV) and Professor of School of Optometry at PolyU, was appointed as the President of Asia Pacific Council of Optometry (APCO) Executive Committee recently. She has served in APCO and World Council of Optometry (WCO) in various roles for more than 10 years.



Prof. Lam has a long-standing research interest in myopia control and prevention, children's vision, binocular vision and amblyopia training. She is currently a Member of the College of Optometrists (UK) and a Fellow of the American Academy of Optometrists. She is also the honorary advisor of The Hong Kong Society of Professional Optometrists and the Honorary Member of The Association of Private Practice Optometrists. Prof. Lam has served in the regulatory bodies of Optometry in Hong Kong as a member of the Supplementary Medical Professions Council and a member of the Optometrists Board of Hong Kong.