THE HONG KONG POLYTECHNIC UNIVERSITY
香港理工大學

ANNUAL REPORT ON ACTIVITIES AND ADVANCEMENT OF KNOWLEDGE TRANSFER

2022-23

31 JULY 2023

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1. EXECUTIVE SUMMARY

The year 2022 marked the 85th anniversary of The Hong Kong Polytechnic University (PolyU). Driven by the guiding principle that all PolyU's Intellectual Properties (IPs) of practical value should leave campus to create societal impact, PolyU has long been committed to transforming its innovations and technologies into practical solutions that deliver real-world benefits. In this way, PolyU addresses societal challenges and contributes to the advancement of Hong Kong, the nation, and the world.

Through the PolyU Academy for Interdisciplinary Research (PAIR), the largest interdisciplinary research and knowledge transfer (KT) platform of its kind in the Greater Bay Area (GBA), PolyU is transforming its mission-driven interdisciplinary research output into impactful solutions in key fields such as sustainable cities, advanced technologies, and health and well-being. PAIR also recently organised the first and largest conference in interdisciplinary research to forge closer collaborations among stakeholders around the world. As a new initiative to support Hong Kong's integration into national innovation and technology (I&T) development, PolyU has established the Policy Research Centre for Innovation and Technology (PReCIT). PReCIT is a University-level interdisciplinary policy research centre that brings experts and policymakers together to address societal challenges such as carbon neutral cities, I&T development in the GBA, and the Belt and Road Initiative in Southeast Asia.

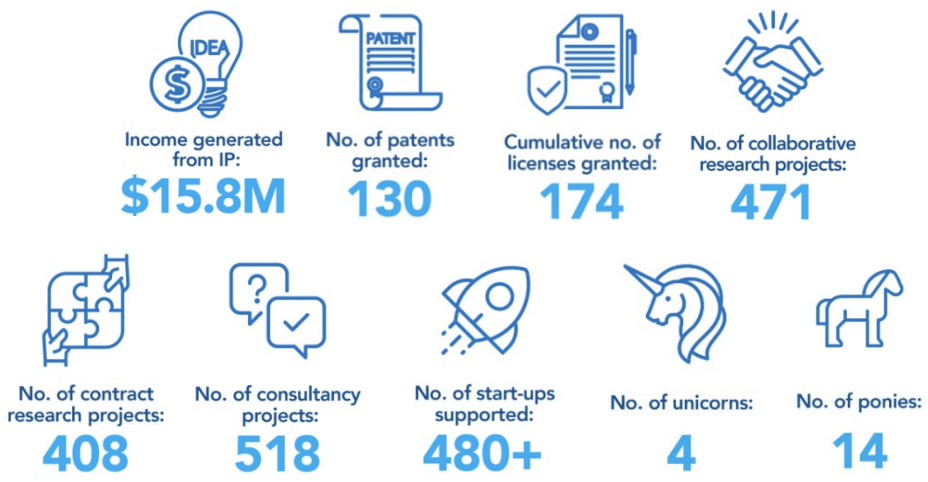
To enhance the ambience for KT and entrepreneurship, PolyU has strengthened its initiatives and policies. These include offering inventors a greater benefit-sharing percentage on IP commercialisation, allowing academic staff to take up executive roles in start-ups on a part-time basis under predetermined conditions, and introducing a trial license scheme for start-ups to pursue market validation of its IPs.

PolyU forms strategic partnerships with industry leaders and institutions to engage in R&D, and to subsequently work towards commercialisation. In 2022/23, the University has partnered with industry leaders such as Chinachem Group, China Harbour, China Resources, Hanson Robotics, and Sun Hung Kai Properties. These collaborations cover areas such as carbon neutrality, the green economy, improving the urban living environment, sustainability, artificial intelligence (AI) for well-being, green buildings, and smart energy. PolyU has also partnered with world-leading institutions to establish three research centres under the Hong Kong government's InnoHK initiative. These InnoHK research centres focus on AI in design, reliability and safety, and vision science. They have collaborated with more than 20 industry partners, including the Hong Kong Electronic Industries Association Limited, the Hong Kong Electronics Industry Council, the Hong Kong Applied Science and Technology Research Institute, and the MTR Corporation, undertaking impactful projects to address global challenges.

PolyU provides comprehensive support for researchers, students, and start-ups to pursue entrepreneurship at different stages. Its initiatives include a new undergraduate programme in Innovation and Entrepreneurship, proof-of-concept funding for ideation, Future Challenge competitions to address industry pain points, and the GBA Start-up Postdoc Programme (the first of its kind in Asia) to nurture technopreneurs. In 2022/23, PolyU launched a new Angel Fund scheme with two-tier funding support of HK$1 million and HK$3 million to bridge the funding gap and help high-potential technology start-ups grow, scale their businesses, and take their innovations to market.

The University's KT and entrepreneurship initiatives have resulted in a 42% increase in IP commercialisation income in 2022/23, and over 480 technology and social innovation start-ups. To date, the PolyU entrepreneurial ecosystem includes four unicorns (companies valued at US$1 billion or above) and 14 ponies (companies valued at US$10 million or above). This report presents five impact cases demonstrating how PolyU's KT and entrepreneurship initiatives have addressed two global health challenges (obesity and myopia), invented new colour management technologies with imaging and metaverse applications, improved workplace safety in the construction industry, and discovered biodegradable materials with antimicrobial abilities.

In summary, PolyU's achievements in KT and entrepreneurship are illustrated as follows:



2. ENHANCING INTERDISCIPLINARY RESEARCH AND INNOVATIONS FOR SOCIETAL IMPACT

2.1. PolyU Academy for Interdisciplinary Research (PAIR) – the Largest Interdisciplinary Research and KT Platform in the GBA

As the largest mission-driven interdisciplinary research and KT platform of its kind in the GBA, the PolyU Academy for Interdisciplinary Research (PAIR) is dedicated to providing world-leading interdisciplinary solutions to address significant societal challenges through advanced research and knowledge transfer activities. Officially inaugurated in July 2022, PAIR now comprises 16 research institutes and centres with over 400 experienced researchers from different disciplines from all over the world. PAIR focuses on three mission-driven research themes that are vital for the betterment of society and humankind: sustainable cities, advanced technologies, and health and well-being.

Focus research areas of PAIR:

Research Themes	Research Institutes / Centres under PAIR
Sustainable Cities	Research Institute for Land and Space (RILS) 土地及空間研究院
	Otto Poon Charitable Foundation Smart Cities Research Institute (SCRI) 潘樂陶慈善基金智慧城市研究院
	Otto Poon Charitable Foundation Research Institute for Smart Energy (RISE) 潘樂陶慈善基金智慧能源研究院
	Research Institute for Sustainable Urban Development (RISUD) 可持續城市發展研究院
	Research Centre for Resources Engineering towards Carbon Neutrality (RCRE) 碳中和資源工程研究中心
Advanced Technologies	Research Institute for Advanced Manufacturing (RIAM) 先進製造研究院
	Research Institute for Artificial Intelligence of Things (RIAIoT) 人工智能物聯網研究院
	Research Institute for Intelligent Wearable Systems (RI-IWEAR) 智能可穿戴系統研究院
	Photonics Research Institute (PRI) 光子技術研究院
	Research Centre for Deep Space Explorations (RCDSE) 深空探測研究中心

Health and Well-being	Research Institute for Future Food (RiFood) 未來食品研究院 Research Institute for Sports Science and Technology (RISports) 體育科技研究院 Mental Health Research Centre (MHRC) 精神健康研究中心 Research Institute forSmart Ageing (RISA) 智齡研究院 Research Centre for Chinese Medicine Innovation (RCMI) 中醫藥創新研究中心 Research Centre for SHARP Vision (RCSV) 視覺科學研究中心

PAIR Conference 2023 – First and largest interdisciplinary conference in Hong Kong

PAIR and its constituent research units have organised and/or co-organised a range of scholarly activities to facilitate knowledge exchange and foster collaboration. These have included the PAIR Distinguished Lecture Series, the PAIR Public Seminar Series, and the PAIR Salon. These activities have seen world-leading scholars such as Nobel Laureate Prof. Reinhard Genzel and Turing Award Laureate Prof. Joseph Sifakis share their impactful research, and industry experts from diverse sectors provide their business perspectives. In May 2023, PAIR also held the first and largest interdisciplinary conference in Hong Kong. With a theme of Research Excellence for Societal Impacts, the goal of the conference was to share interdisciplinary research and technologies, and forge closer collaboration and professional exchange among stakeholders from different fields around the world to stimulate growth in Hong Kong and beyond. Throughout 2022/23, PAIR's KT activities have attracted over 230,000 participants worldwide to engage in closer collaboration and exchange.

2.2. InnoHK Research Centres: Turning Innovations into Impacts

By harnessing its research competence in artificial intelligence, design, reliability, safety, and vision science, PolyU has partnered with world-leading institutions under the Hong Kong government's flagship InnoHK initiative to conduct impactful collaborative research that can address global challenges. These include:

Laboratory for Artificial Intelligence in Design (AiDLab) in partnership with Royal College of Art, UK

- the region's first research platform specialising in interdisciplinary AI and design innovations

AiDLab has established a new creative 'AI in design' cluster and is in a leading position internationally to conduct interdisciplinary research that drives innovation and sustainability. In December 2022, AiDLab's first spin-off company, Code-Create, launched the AI-based Interactive Design Assistant for Fashion (AiDA). This is a first-to-market technology that can generate unique fashion collections based on the creative inspirations of designers in about 10 seconds. AiDA uses advanced AI technologies that can produce original fashion designs in an accessible, speedy, and user-friendly manner with just a few simple clicks. A key component of the system is Mixi, an intelligent tool that enables accurate product search and auto tagging by recognising design elements, and accurately distinguishes more than 2,300 colours in fashion images. AiDA promotes not only speed and efficiency, but also inspiration and creativity by helping industry unleash the potential of AI for design. It is set to have a revolutionary impact on fashion design.

Centre for Advances in Reliability and Safety (CAiRS) in partnership with University of Maryland, College Park, USA
- using AI technologies to develop new customised management tools for product reliability and system safety

CAiRS aims to link up academic and industrial counterparts and use customised AI technologies to develop new approaches that can ensure product reliability and system safety. These technologies can be applied to diverse industries in Hong Kong including transportation, consumer products, telecommunications, public utilities, and infrastructure. Using the most advanced equipment, and with extensive industrial support from organisations such as the Hong Kong Electronic Industries Association Limited and the Hong Kong Electronics Industry Council, over 20 well-known local companies have signed agreements with CAiRS aiming to improve the reliability and safety of their products and systems. One example of such an agreement is the memorandum of understanding (MoU) signed in June 2023 between CAiRS and the MTR Corporation. The MoU focuses on three major areas: 1) anomaly detection; 2) knowledge transfer; and 3) prognostics and health management. The partnership will also lead to more opportunities to jointly develop advanced AI technology to strengthen MTR reliability and safety.

Centre for Eye and Vision Research (CEVR) in partnership with University of Waterloo, Canada
- tackling the world's biggest challenges in vision science

Over two billion people worldwide have impaired vision. At least one billion of these cases are either preventable or are unaddressed. The Centre for Eye and Vision Research (CEVR) was officially launched in June 2022 with a mission to develop groundbreaking technologies to prevent vision loss, preserve healthy vision in Hong Kong's aging population, and drive global research collaborations for innovations in vision health. CEVR is currently conducting 25 high potential research projects to address urgent needs and challenges in eye and vision health. For example, it has partnered with the Hong Kong Applied Science and Technology Research Institute (ASTRI) to treat patients of different ages who suffer from 'lazy eye' and other eye conditions. Lazy eye (amblyopia) is a common visual impairment that reduces vision in one eye. This impairs the ability of the two eyes to work together and leads to a loss of 3D vision. This breakthrough collaboration will involve developing novel treatments incorporating ASTRI's augmented reality (AR) technologies and CEVR's research on recovering neuroplasticity (capacity for change) in the visual cortex. The ultimate goal is to heal patients' eyes and give hope that they may recover their vision. CEVR and ASTRI will also jointly develop a comprehensive navigation system for people with impaired vision. This will remove mobility barriers and dramatically enhance their well-being.

2.3. Strategic Partnerships with Industry for Joint Research and Applications

Drawing on PolyU's interdisciplinary research excellence, the following University-Industry strategic partnerships have been formed for joint research, and to translate research outcomes into practical solutions and real-world benefits.

Partnership with Chinachem Group (Chinachem) for the sustainable future of the GBA

- This partnership leverages the combined strengths and experience of PolyU in interdisciplinary research with that of Chinachem in property and community development. It explores innovative solutions and technology applications for the sustainable development of the GBA. Under the partnership, collaborative projects will focus on reducing carbon emissions and energy consumption, exploring new types of intergenerational housing, and experimenting with blockchain technology to promote a green economy.

China Resources (CR) - PolyU Joint Research Institute for Carbon Neutral New Materials

- PolyU has partnered with China Resources to jointly engage in projects focusing on carbon neutrality and sustainability. The intended outcome of these projects is to develop new materials that can be extensively applied in industry. The partnership also aims to commercially transform and incubate start-up projects to promote talent development and support knowledge transfer.

China Harbour - PolyU Joint Research Centre for Land Development

- PolyU has joined hands with China Harbour Engineering Co. Ltd (CHEC) to establish the China Harbour-PolyU Joint Research Centre for Land Development. The goal of this partnership is to boost practical research on land development and improve the urban living environment.

Collaboration with Sun Hung Kai Properties (SHKP) to advance green building technologies

- This collaboration with SHKP focuses on three research projects on green applications, green building materials, and green construction processes. The goal of this partnership is to save energy, reduce carbon emissions, and increase efficiency.

Partnership with Hanson Robotics to establish Centre for Humanistic Artificial Intelligence and Robotics

- PolyU will collaborate with Hanson Robotics Limited to establish the Centre for Humanistic Artificial Intelligence and Robotics (CHAiR). The goal of this partnership is to enhance the contribution of AI and robotic technology to create social and commercial benefits.

2.4. Leading Policy Research for I&T Development

Establishment of Policy Research Centre for Innovation and Technology (PReCIT)

PolyU established the Policy Research Centre for Innovation and Technology (PReCIT) in November 2022 to dovetail with the National 14th Five Year Plan's support of Hong Kong developing into an international I&T hub. PReCIT is a university-level interdisciplinary policy research centre that focuses on formulating strategies to support Hong Kong's participation in pioneering national technology missions. It has a special focus on carbon neutral cities, I&T development in the GBA, and Belt and Road Initiative development.

Since its establishment, PReCIT has submitted recommendations for the 2022 Policy Address on how to foster I&T development, and has introduced the 'Green Deck' proposal for public consultation. PReCIT has also been commissioned by the Social Welfare Department to evaluate the effectiveness of its Strive and Rise Programme, and has organised a number of forums and seminars to facilitate policy planning and discussion. These events have covered a wide range of topics including:

- Planning, Land and Housing for Innovation and Technology Development in Hong Kong
- Integrating I&T into the GBA and the National System
- Funding Landscape from Research to Commercialisation
- University-Industry Collaboration on Chinese Medicine Innovations
- APEC Energy Forum 2022


Green Deck 綠報
紅隨口倡建綠化平台
創造土地 貢獻社會
綠化平台周全規劃 推動本地及大灣區經濟效益

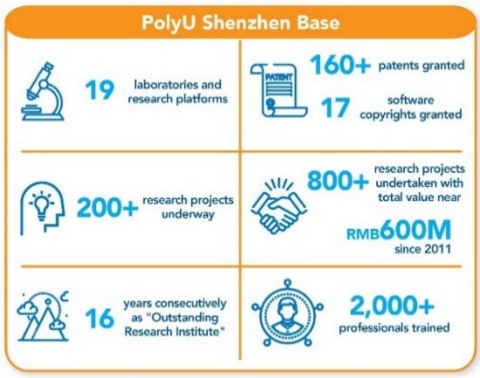
Singtao newspaper reporting on the Green Deck proposal

2.5. Expanding Impact to the GBA and the Mainland

PolyU established its Shenzhen Base to support innovative translational research and solutions for the development of the GBA and the nation.

Fostering talent and I&T development in the GBA via PolyU Shenzhen Base

PolyU Shenzhen Base currently has 19 laboratories and research platforms, including two State Key Laboratories and three municipal-level laboratories. Since 2011, PolyU Shenzhen Base has undertaken over 800 scientific research projects from different government agencies and industry with an overall value of nearly RMB 600 million. Over the years, the PolyU Shenzhen Base has been granted over 160 patents and 17 software copyrights. The PolyU Shenzhen Research Institute has been awarded the title of Outstanding Research Institute by the Science, Technology and Innovation Commission of Shenzhen Municipality for 16 consecutive years, starting from 2005.



PolyU promotes cross-border science and technology collaboration at Guangming Science City Forum

To promote I&T development and cross-border collaborations, PolyU supported the Shenzhen government in co-organising the inaugural Guangming Science City Forum in April 2023. Under the theme of 'Shenzhen - Hong Kong - Macao Forum for Coordinated Sci-Tech Innovation', PolyU facilitated in-depth discussions on how to strengthen scientific and technological cooperation throughout the region to advance technology, develop industry, and cultivate talent. The forum attracted over 3,000 distinguished guests, including Mr. John Lee, Chief Executive of the HKSAR; Prof. Witman Hung, JP, Hong Kong Deputy to the National People's Congress; Mr. Zheng Hongbo, member of the Standing Committee of the CPC Shenzhen Municipal Committee; and Prof. Yuk-shan Wong, GBS, JP, Chairman of the Research Grants Council. PolyU is committed to supporting the forum every year, aiming to establish a high-end exchange and innovation platform to contribute to the nation's I&T development.

New Mainland/GBA Joint Research Centre Funding Scheme

To support PolyU's research development in the Mainland, especially in the GBA region, the University introduced a new funding scheme in 2022 to establish joint research institutes, centres, and labs with mainland partners, including universities, major/strategic corporations and organisations. The collaboration with mainland universities may lead to joint/dual PhD programmes being established in selected strategic disciplines, while the partnership with industrial partners will focus on developing promising translational research work.

Translational research institutes in mainland cities

To further extend PolyU's impactful innovations to the Mainland, the University is establishing translational research institutes in several mainland cities. With support provided by the respective city governments, PolyU research teams will engage in applied research and knowledge transfer activities that can address the host city's industry and development needs. PolyU has already signed MoUs with Wuxi, Wenzhou, Jinjiang, and Hangzhou to establish translational research institutes. It is also pursuing more collaborations with other mainland cities.

3. FOSTERING KT AND ENTREPRENEURSHIP WITH TECHNOLOGY AND SOCIAL INNOVATIONS

To support knowledge transfer and entrepreneurship at all levels, PolyU has been implementing measures to advance innovation, commercialisation, and entrepreneurship.

3.1 Enhancing the Ambience to Advance KT and Entrepreneurship

Incentivising inventors to commercialise IP

To provide more incentives for inventors to commercialise their inventions, PolyU has enhanced its benefit-sharing arrangements to provide inventors with a greater percentage share of the benefits. It will also set up a central fund from its assigned share of income earned from commercialisation to further support translational research, prototyping, and subsequent commercialisation.

Enabling commercialisation of PolyU IPs

The University has also introduced the Trial License Scheme to help commercialise its research and innovations. The scheme enables start-ups to use PolyU IPs on a trial basis for market validation before formalising a licensing agreement.

Overall, the accumulative number of licenses granted to the University has increased to 174 in 2022/23 compared with 162 in 2021/22. Overall income from IP commercialisation has reached HK$15.8 million for 2022/23, an increase of around 42% compared with last year.

Fostering academic entrepreneurship

Having already allowed academic staff to hold majority shares in their start-ups, PolyU is now the first university in Hong Kong to allow academic staff to take up executive roles in their own start-ups on a part-time basis (other than as unpaid leave). These policies have encouraged more than 100 academic staff from 20 academic departments to pursue entrepreneurship by establishing start-ups. Some of these start-ups use innovative PolyU technologies. These include myopia control technologies to help retard myopia progression in children; a radiation-free scoliosis assessment system for safe and effective evaluation; 3D printable antimicrobial materials for infection control and antiviral consumer products; and decarbonisation technology for sustainable development in the construction industry. These start-ups have further expanded the impact of PolyU's advanced technologies on society.

Strengthening recognition for KT and entrepreneurship

In addition to the President's Award for Outstanding Achievements in Knowledge Transfer, PolyU has strengthened its recognition for outstanding PolyU alumni achievements in entrepreneurship. A new award category of Entrepreneurial Achievement has been added to the Outstanding PolyU Young Alumni Award. In 2022, two alumni were awarded the Outstanding PolyU Young Alumni Award in Entrepreneurial Achievement. They are Mr James O Hing-pong, Co-Founder of GoGoX, and Dr Bruce Wang Lei, Founder of EcoFlow Inc. Both start-ups are PolyU-nurtured unicorns.

3.2 Entrepreneurship Development: from Education to Acceleration

The University has been enhancing its entrepreneurship development framework to nurture start-ups at different stages of development – from education to ideation, pre-incubation, incubation, and acceleration for sustained growth.

PolyU entrepreneurship ecosystem snapshot

So far, PolyU has nurtured over 7,600 entrepreneurs and 480+ start-ups since its first entrepreneurship incubation programme launched in 2011. Of these, 250+ are tech start-ups while 230+ are start-ups engaged in social/design innovations. Within the PolyU entrepreneurial ecosystem and community, there are currently four unicorns (companies valued at US$1 billion or above) and 14 ponies (companies valued at US$10 million or above). Three PolyU-supported start-ups were also listed in Forbes Asia 100 to Watch 2022, which features fast-growing start-ups across the Asia-Pacific region that are addressing real-world challenges with fresh thinking, and innovative products and services.

Enriched curriculum to cultivate interdisciplinary I&T talent

PolyU continuously enhances its curriculum to nurture innovation and technology talent to meet the needs of society. In the 2022/23 academic year, PolyU has launched a new undergraduate programme called 'X + Innovation and Entrepreneurship'. The programme provides students from different disciplines with the essential knowledge and skills to thrive in the rapidly evolving I&T landscape. It also provides outreach opportunities in different start-up environments, such as internships and exchange trips to the GBA and overseas.

Besides credit-bearing courses, PolyU has also been working with ecosystem partners and collaborators that include the Home and Youth Affairs Bureau, the Youth Development Commission, and We Venture to provide comprehensive entrepreneurship training and support for students. This training and support includes workshops, seminars, mentorship support, legal advice, and networking opportunities to help students navigate their entrepreneurship journey and overcome challenges along the way. For example, 2022/23 has seen the launch of the Startup's Guide training series to provide essential knowledge in an extensive range of topics, including the following:

- Pitching with Impact
- Crowdfunding Strategy
- Fundraising Bootcamp
- Starting Your Business in China
- Navigating Contractual Matters
- Effective Digital Marketing
- Streamlining E-commerce Fulfillment for a Seamless Customer Experience

Ideation for generating innovations and solutions

Domain-based future challenges

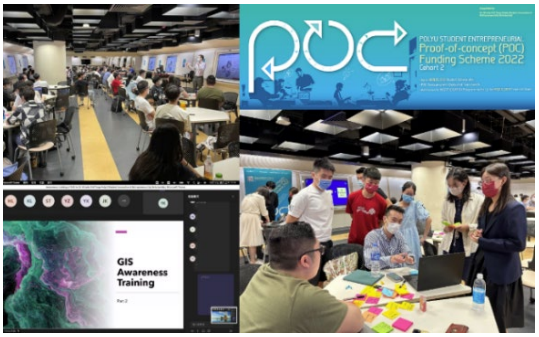
While students and researchers may have brilliant ideas and cutting-edge knowledge, they often lack the market insights and industry experience to translate their ideas into practical applications. To address this gap, PolyU has organised a series of domain-based Future Challenge competitions focusing on smart cities, health, digital technology, and sustainability to foster early engagement with industry. These competitions are based on industry pain points and provide a foundation for generating ideas and solutions. With industrial support from Chinachem Group, ESRI China (Hong Kong), Hong Kong Telecom, the

Federation of Hong Kong Industries, the Chinese Manufacturers' Association of Hong Kong, and Hang Seng Bank, among others, the Future Challenge competitions have attracted over 650 participants from diverse fields and industries who have created more than 85 projects. Winning projects have included turning waste textiles into sustainable high-density rechargeable batteries; developing eco-friendly antiviral/antimicrobial materials for personal protective equipment and hygiene products; and providing a one-stop solution to minimise food packaging waste and plastic pollution. In addition to cash prizes and entrepreneurship support from the University, several exceptional projects have also received pre-incubation funding support to help the teams move towards commercialisation and bring their innovative ideas to market.

GBA Sustainability Innovation Challenge

Having previously organised a Sustainability Future Challenge in Hong Kong, the University also organised the Greater Bay Area Sustainability Innovation Challenge in August 2022 to foster I&T development and cultivate talent in the GBA. More than 40 teams from 11 higher education institutions in the region submitted projects. The 16 winning teams included five from PolyU.

Proof-of-Concept (POC) Funding Scheme



The University has enhanced its POC Funding Scheme to strengthen its educational element through workshops and mentorship support. This year the scheme attracted 240 students, who created 92 projects – an increase of 70% compared with last year. Outstanding projects included detecting metal surface defects on billboards to avoid accidents and improve public safety; developing an air quality monitoring system to improve the health and well-being of communities; and creating a smart crane layout solution for Modular Integrated Construction (MiC) to minimise accidents and injuries. Through a series of design thinking workshops, Minimum Viable Product (MVP) training, and one-on-one mentoring sessions, students learned the fundamental skills they need to help turn their concepts into reality.

Student-led entrepreneurship organisations

PolyU has established two student-led organisations, the Google Developer Student Club (GDSC) and the Entrepreneurship Society (ES) to cultivate an innovative and entrepreneurial spirit among students. During the past year, GDSC has organised more than 10 workshops and events for over 400 members. With University support, GDSC

PolyHack 2023 - a global student-led hackathon and ideation competition organised by PolyU

successfully organised the signature PolyHack student-led competition for the second year, bringing together students from all over the world to showcase their creativity and problem-solving skills. This year's competition also received sponsorship from Huawei and the Chinachem Group, who offered over HK$100,000 in prizes and awards to more than 700 participants from over 80 countries and regions. In 2022/23, the ES has recruited 198 new members, expanding its entrepreneurship community and increasing total membership to 970. The ES has organised numerous start-up events to connect students with entrepreneurs.

Pre-incubation / Incubation through internal and external incubators

Cultivating high-quality PolyVentures through the Micro Fund (MF) Scheme and incubation programmes

PolyU is the first university in Hong Kong to partner with the Hong Kong Science and Technology Park (HKSTP) on an accelerated pathway from ideation to incubation through the Micro Fund Scheme. In 2022/23, this scheme has supported 95 start-ups, almost triple the number supported last year. Sixty of these start-ups have been fast-tracked to HKSTP's Ideation and Incubation programmes. To date, around 60% of PolyU-supported start-ups have been admitted to HKSTP or Cyberport.

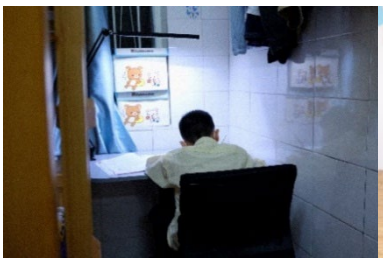
In addition to providing financial assistance, PolyU also extends comprehensive support to start-ups by collaborating closely with strategic partners that include HKSTP, Cyberport, the Hong Kong X Foundation, the Chinese Manufacturers' Association of Hong Kong, and the Federation of Hong Kong Industries to unleash the full potential of their projects.

Nurturing postdocs into technopreneurs through the GBA Start-up Postdoc Programme

PolyU's GBA Start-up Postdoc Programme is the first of its kind among local institutions to promote research-based entrepreneurship and nurture recent doctoral graduates to become 'technopreneurs' under dual mentorship by academic staff and industrialists. The two-year programme, which offers a well-structured approach to empower doctoral graduates to conduct translational research and create tech ventures, has been extended to both Hong Kong and Shenzhen. Besides receiving the University's support, four postdoc projects – in health technology, 3D modelling, education technology, and biotechnology – have also been admitted to HKSTP incubation programmes in 2022/23.

Empowering young innovators through social innovation programmes

Other than nurturing tech start-ups, the University also empowers young social innovators through the Good Seed Programme, which is funded by the Social Innovation and Entrepreneurship Development Fund (SIE Fund). Through a design thinking approach, the programme brings participants together to talk with target beneficiaries and understand their needs, helping them identify real-world problems and develop solutions that address the needs of their intended audiences. After a series of training and ideation competitions, 10 selected teams from the Good Seed 2022 Cohort 2 were chosen out of 89 teams to become social innovators. These teams will implement a nine-month social innovation milestone and receive up to HK$200,000 in funding to support their projects.



Another social innovation programme, PolyU Jockey Club Operation SoInno, tackles social issues through interdisciplinary community collaboration. In one example of this, PolyU collaborated with cross-disciplinary experts to explore practical furniture designs that can improve the use of space and the study environment, and the health and well-being of children living in subdivided flats. With generous support from the Hongkong Land HOME FUND, young PolyU innovators developed scalable production solutions for an ergonomically designed, sustainable, movable, and adjustable furniture set for 2,000 children aged between 4 and

16 living in subdivided units (SDU) to support their healthy development during their prime years. Joining hands with 24 local NGOs, over 1,500 furniture sets have been successfully delivered to pre-identified SDU families in 10 districts across the city, with the rest to be delivered by this summer.

These social innovation programmes demonstrate how PolyU can support young people in creating positive social impact in their communities. They offer a unique opportunity for young people to develop their entrepreneurial skills while making a difference in society.

PolyU's unique Industrial Centre supports prototyping and technology development

PolyU's Industrial Centre (IC), the only establishment of its kind among eight local UGC-funded universities, offers a comprehensive collection of engineering facilities, equipment, and technologies designed to support researchers and students in taking their research breakthroughs, inventions, and novel ideas from lab to life. IC offers over 100 types of facilities suitable for industries ranging from engineering to transportation, manufacturing, infrastructure, utilities, aviation, and health care. These facilities, along with technical support, are effective in helping PolyU-supported start-ups develop product prototypes to collect user feedback and improve product performance. A recent example of this is Plaper, a PolyU-supported start-up that used the IC to develop a prototype of its Next-Generation Vending Machine using near-infrared technology to precisely classify plastic for recycling. By creating a prototype, start-ups are able to gain experience and prepare for product launch.

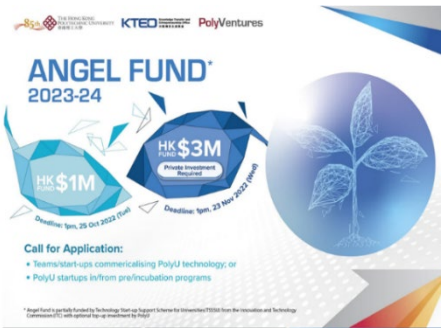
PolyU InnoHubs in Hong Kong and Shenzhen: Collaborative co-working spaces to connect with ecosystem partners

PolyU InnoHub@Hong Kong

As part of its support for start-ups in Hong Kong and Shenzhen, PolyU InnoHub@Hong Kong and PolyU InnoHub@Shenzhen provide co-working spaces and facilities that connect students, academic staff, entrepreneurs, and industry partners, enabling them to collaborate on multi-disciplinary and cross-sector projects. In 2022, PolyU InnoHub@Shenzhen was named the Hong Kong and Macao Youth Innovation and Entrepreneurship Base by the Shenzhen government. As of June 2023, InnoHub@Hong Kong and InnoHub@Shenzhen have supported more than 260 start-up teams or companies from diverse sectors such as artificial intelligence, healthcare, and education. Of these, 120 are jointly incubated at both InnoHub locations.

PolyU InnoHub@Shenzhen named Hong Kong and Macao Youth Innovation and Entrepreneurship Base

Acceleration and expansion to become impactful ventures



Accelerating start-ups through new two-tier Angel Fund scheme

To bridge the funding gap of early-stage high-potential technology start-ups, a new Angel Fund scheme was launched this year with two-tier funding support of HK$1 million and HK$3 million. The scheme is designed to leverage funding from the Technology Start-up Support Scheme for Universities (TSSSU) provided by the Innovation and Technology Commission (ITC). The scheme was well received, attracting almost 100 applications for the HK$1 million tier and 37 applications for the HK$3 million tier. After a rigorous panel selection process engaging industry leaders and seasoned investors, 15 start-ups were selected for the HK$1 million tier, while eight start-ups were recommended for the HK$3 million tier.

Nurturing winners through the PolyU Entrepreneurship Investment Fund (EIF)

The PolyU Entrepreneurship Investment Fund is an equity investment fund set up by the University to support the scaling-up of PolyU start-ups with promising innovative technologies or business models. To amplify investment support, PolyU has partnered with strategic investors to facilitate the growth and expansion of start-ups through co-investment. In 2022/23, PolyU has engaged several new strategic co-investors including Alibaba Entrepreneurs Fund, Fosun Pharma, and Law's Group to support more prospective start-ups.

Awards in innovation and entrepreneurship competitions

In 2022/23, PolyU students, researchers, and start-ups have won nearly 100 awards in local and national innovation and entrepreneurship (I&E) competitions. Over 70 of these awards were presented to those who placed in the top three of their competitions. Some prominent awards include the following:

31 Prizes (most Grand/Special Prizes)

The 48th International Exhibition of Inventions of Geneva

- **The highest number of prizes PolyU has ever received at this global event** devoted exclusively to inventions**: 3 prestigious Grand/Special Prizes** (the **most among Hong Kong delegations**), 5 Gold Medals with Congratulations of the Jury, 12 Gold Medals, 5 Silver Medals, and 6 Bronze Medals**.**

2 Global Innovation Awards

TechConnect World Innovation Conference and Expo 2023

- The **only university** in Hong Kong to win awards **in the areas of energy and new materials. This marks** the 7th consecutive year PolyU has received such recognition in **the world's largest multi-sector event for fostering translational innovations and technology commercialisation**.

6 Awards (2 Gold Awards)

The 8th China International College Students' 'Internet+' Innovation and Entrepreneurship Competition

- PolyU teams **won 2 of the 4 Gold Awards** among 266 participating teams in the Hong Kong region, in addition to 1 Silver Award and 3 Bronze Awards. The competition is the **largest global event for innovation and entrepreneurship** and has attracted over 25 million college students from 121 countries since 2015.

8 Awards (1 Special Gold Award)

Qianhai-Guangdong-Hong Kong-Macao-Taiwan Youth Innovation and Entrepreneurship Competition 2022

- PolyU teams won **8 awards** in this competition among 150 entries from secondary schools and colleges in the Hong Kong region: **1 Special Gold Award for Youth Innovation**, 2 Silver Medals, 2 Bronze Medals, 1 GBA Youth Innovation Special Award, and 2 Merit Awards.

6 Awards (Overall Champion)

Hong Kong ICT Awards 2022

- **PolyU teams won 6 awards** among 300+ competitive teams**: the Student Innovation Grand Award (overall champion)**, the Gold Award in the Tertiary or Above stream, 2 Silver Awards (for Smart Transport and Smart Ageing respectively) and 2 Certificates of Merit.

7 Prizes (out of 16 in total)

Hong Kong Techathon 2023

- PolyU teams / start-ups received **7 out of 16 prizes** in this competition, the **largest hackathon in Hong Kong** co-organised by all higher education institutes and HKSTP. The awards were **3 Champions**, 1 First Runner-up, 2 Second Runner-ups and 1 Best Presentation Award.

4. IMPACTFUL INNOVATIONS ADDRESSING GLOBAL CHALLENGES

Achieving world-class excellence for social impact is central to PolyU's Vision and Mission and reflects the spirit of our motto: "To learn and to apply, for the benefit of mankind". The impact cases presented in this section highlight the University's contributions in diverse areas covering health technologies, colour science, smart construction technologies, advanced manufacturing, biomedical advancement, and social innovation. They exemplify PolyU's dedication to making a positive difference in society.

4.1 First-in-class Drug for Multiple Obesity-related Metabolic Diseases

Obesity is widely recognised as a global health problem and increases the risk of several debilitating and deadly diseases, including diabetes, heart disease, and cancers. In Hong Kong, about one in two adults are considered overweight or obese. Researchers from PolyU and the Chinese University of Hong Kong (CUHK) have made a groundbreaking drug discovery in treating multiple metabolic diseases related to obesity and insulin resistance, such as diabetes and fatty liver disease. The new drug, ABarginase, opens a new path for safe, long-lasting cures to multiple obesity-related diseases simultaneously through arginine starvation. ABarginase shows promise for the effective treatment of multiple metabolic diseases including pre-diabetes, Type 2 diabetes, and non-alcoholic fatty liver disease. The fabrication process of ABarginase is inexpensive and highly efficient, making it affordable and widely adoptable for clinical applications.

The research is led by Prof. Thomas Leung Yun-chung, Professor of the Department of Applied Biology and Chemical Technology and Lo Ka Chung Charitable Foundation Professor in Pharmaceutical Sciences of PolyU; and Prof. Alisa Shum Sau-wun, Associate Professor at the School of Biomedical Sciences of the CUHK Faculty of Medicine. Patent applications for this invention have been filed in multiple countries, and the research team is now scaling up production to manufacture ABarginase at good manufacturing practice (GMP) grade in preparation for clinical trials. ABarginase recently won one of the two prestigious Grand Prizes – the International Federation of Inventors' Associations (IFIA) Best Invention Award – at this year's International Exhibition of Inventions Geneva. More details can be found in Appendix 3.

4.2 New DISC Lens to Slow Myopia Progression Addresses a Worldwide Problem

Myopia, a condition that requires visual correction, affects more than 30% of people worldwide and 70-90% of school-age children in Hong Kong. By 2050, it is estimated that about one billion people in Asia will suffer from high myopia, which is the second most common eye condition causing permanent blindness and visual impairment.

Since 2003, myopia has been a central research theme at the PolyU School of Optometry (SO). PolyU has developed and co-developed effective technologies to control myopia, including the Defocus Incorporated Soft Contact (DISC) lens, and the Defocused Incorporated Multi-Segment (DIMS) spectacle lens respectively. These technologies have been proven to significantly retard myopia progression.

Vision and Science Technology Limited (VST), a PolyU academic-led start-up, has collaborated with PolyU's State Key Laboratory of Ultra-precision Machining Technology in the Department of Industrial and Systems Engineering (ISE), the Research Centre for SHARP Vision, and SO to develop the Novel Nano Multi-ring Defocus Incorporated Spectacle (NMDIS) lens, which can be applied to a spectacle lens to provide added comfort while offering wearers more stable

vision. The NMDIS lens has won several awards, including the Prize of the State of Geneva and a Gold Medal at the 48th International Exhibition of Inventions Geneva and the Gold Award at the Asia International Innovative Invention Award (FITMI2023).

Through a collective interdisciplinary research and development effort, the new DISC spectacle lens had a successful market launch in December 2022. This achievement solidifies PolyU's position as a prominent technological leader in myopia control. It also demonstrates a successful entrepreneurship journey for a PolyU academic-led start-up from translation research, clinical trials, production, and commercialisation to the market, creating significant societal impact. With a range of core technologies, PolyU provides consumers with an extensive range of choices through diverse commercialisation channels, including industry partners and start-ups. This enables individuals to find the right solution for their needs and preferences. More details can be found in Appendix 3.

4.3 State-of-the-art R&D Optimises Colours in Imaging and Metaverse Systems for a Better User Experience

The human eye can differentiate a million different colours, but the best electronic displays only cover slightly over half of them. As new technologies such as virtual reality (VR), augmented reality (AR), mixed reality (MR), and the metaverse give rise to new viewing experiences, it is more important than ever to study colour appearance and colour differences under complex conditions. Prof. Tommy Wei Minchen of the PolyU Department of Building Environment and Energy Engineering is devoted to colour science. His research has made a significant impact on industries worldwide, including social media, imaging, and metaverse systems, as well as manufacturers of smartphones, drones, LCDs, and OLED displays. His research outcomes have shaped how colours are presented in the real world, and his solutions for display calibration and white balance are now standard features in high-end smartphones. His research has led to the establishment of a US national standard and an international standard for LED lighting products. Prof. Wei's efforts in colour science research enable more pleasing renderings of colours in built environments, and more faithful capture and reproduction of colours on digital devices. This enhances comfort and well-being, and creates a better overall user experience. Prof. Wei has received several awards for his contributions and achievements. These include the Google Research Scholar Award in 2021, of which Prof. Wei was the only recipient in East Asia among 75 researchers worldwide, and the PolyU President's Award for Outstanding Achievement in Knowledge Transfer in 2022. More details can be found in Appendix 3.

4.4 Smart Construction Technologies Towards Safer and More Productive Workplaces

Digital innovation and transformation are becoming essential in the construction industry to make complex and dynamic construction operations more efficient, productive, and safe. Research teams at the PolyU Department of Building and Real Estate have been leading this initiative through three technologies. The first is AI-driven approaches for collecting real-time field data. These approaches have been implemented in over 10 construction sites in South Korea, and have also been licensed to a company that undertakes formwork construction for large-scale buildings such as schools, hospitals, and condominiums. The second technology is automated construction production systems, which have been used in collaboration with several industry partners; while the third is a proactive smart construction monitoring system that has been adopted by the Nord Stream 2 Project. This project involved laying a 1,224 km natural gas pipeline from Russia to Germany through the Baltic Sea. The system was used to monitor the construction of the pipeline in real time, ensuring the safety of workers and the integrity of the pipeline. Together, these technologies have won numerous awards and have been widely recognised by both academia and industry. More details can be found in Appendix 3.

4.5 High-efficiency Antimicrobial and Biodegradable Materials for Safer and Healthier Applications

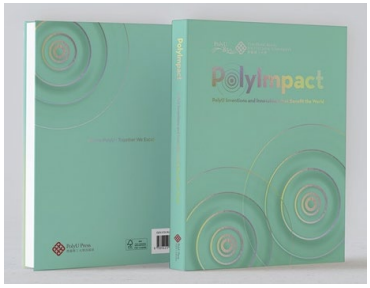
A research team led by Prof. Tao Xiaoming, Director of the PolyU Research Institute for Intelligent Wearable Systems (RI-IWEAR), has discovered that biodegradable safe polymer oligomers in the polyhydroxyalkanoates (PHAs) group like polyhydroxybutyrate (PHB) and others have strong resistance to bacteria and viruses, for instance, removing more than 99.99% of drug-resistant bacteria, and inactivating 99.99% of SARS-CoV-2, H1N1 and H3N2 viruses. The team also found that the PHA oligomers have excellent wide-spectrum antibacterial properties, including those bacteria commonly found in daily life, such as S. aureus, K. pneumoniae, and C. albicans. Based on these findings, the team has spun off a start-up technology company that mass produces the materials (up to 100 tons) and explores their applications in personal protective equipment, hygiene products, footwear, bedding, furniture and paints as well as medical devices. The start-up company has secured a licence from PolyU to exclusively exploit and commercialise the technology. More details can be found in Appendix 3.

5. SHARING POLYU's IMPACTFUL INNOVATIONS WITH THE I&T ECOSYSTEM AND THE COMMUNITY

PolyU InnoTech Open Day

The first ever PolyU InnoTech Open Day was held on 16 July 2022 to showcase PolyU's endeavours in education, interdisciplinary research, knowledge transfer, and entrepreneurship development. These endeavours are helping to advance I&T development in Hong Kong, the GBA, and beyond. The InnoTech Open Day was a signature event of PolyU's 85th Anniversary celebrations, and was supported by 19 organisations that are all key players in the I&T ecosystem. The event attracted thousands of participants, including industry partners, start-ups, entrepreneurs, researchers, young talents, secondary school students, and parents. The signature event will be held annually to share PolyU's latest developments in interdisciplinary research, knowledge transfer, and entrepreneurship efforts that deliver impactful solutions. It will also provide a platform for different stakeholders to explore academic, entrepreneurial, and collaboration opportunities.

PolyImpact: PolyU inventions and innovations that benefit the world



A new book, *PolyImpact: PolyU Inventions and Innovations that Benefit the World*, was published in November 2022 to highlight the University's contributions in developing innovative translational technologies that have created a positive impact on society. With 18 selected impactful stories, the book demonstrates how PolyU's groundbreaking solutions are helping to solve real-world problems. *PolyImpact* will become an annual publication highlighting PolyU's impact stories.

6. CLOSING AND LOOKING FORWARD

PolyU is committed to supporting the Hong Kong I&T Development Blueprint, which aims to enhance Hong Kong's I&T ecosystem, enlarge the local I&T talent pool, promote the transformation of Hong Kong into a smart city, and integrate the city into the overall development of the nation.

To align with the University's mission to pursue research, foster innovation, and facilitate knowledge transfer for the benefit of industry and the community, we will actively participate in the Government's 'Research, Academic and Industry Sectors One-plus Scheme' in partnering with industry and investors to realise the '1 to N' transformation and the realisation of PolyU's original R&D outcomes, ultimately contributing to the well-being of society.

With a strong entrepreneurship development platform built over the years, PolyU will continue to contribute to an ecosystem that nurtures not only the innovative and entrepreneurial mindset of students, but also impactful start-ups in Hong Kong, the GBA, and the nation to make our cities smarter and healthier, and our society more sustainable.

Having established the largest mission-driven interdisciplinary research and KT platform in the GBA, the University now strives to extend the impact of its research to the technological and industrial development of the nation. There are plans to establish several translational research institutes in several mainland cities in partnership with local governments. These research institutes will leverage PolyU's research strengths and educational excellence to nurture I&T talent, address industrial needs, and contribute to the technological advancement and economic development of the cities.

As an innovative world-class university, and guided by our motto "To learn and to apply, for the benefit of mankind", PolyU will continue to make impactful contributions that will support the city's growth and advance I&T in both the GBA and the nation.

Appendix 1: Performance Measure – KPIs & Additional Measures

A summary of the key performance indicators for various KT areas are presented in the table below, with financial figures expressed in HK$'000:

Performance Indicators	2021/22 Actual	2022/23 Actual
Patenting & Licensing		
No. of patents filed Note 1	175	307
No. of patents granted Note 1	100	130
Accumulative no. of licenses granted	162	174
Income generated from IPR Note 2	$11,135	$15,812
Expenditure involved in generating income from IPR	$9,056	$10,954
Consultancy, Collaborative / Contract Research & Spin-off / Joint Ventures		
No. of collaborative research, income generated and total contract value Note 3	445 $194,517 $932,514	471 $334,463 $1,023,443
No. of contract research, income generated and total contract value Note 4	366 $204,438 $726,053	408 $163,452 $778,199
No. of consultancy projects and income generated Note 5	540 $55,071	518 $59,615
No. of economically active spin-off companies Note 6	342	441
Net income generated (or net loss arising) from spin-off companies Notes 7	$979	$1,388
Other Knowledge Transfer / Dissemination Activities		
No. of equipment and facility service agreements and income	74 $2,476	128 $4,282
No. of student contact hours for business or CPD needs Notes 8,9	2,758,787	3,010,571
Income received from CPD courses Note 9	1,099,368	1,250,145
No. of public lectures / symposiums / exhibitions and speeches to community	600	670
No. of performances and exhibitions of creative work by staff or students	37	52
No. of staff engaged as members of external advisory bodies	408	423

Notes:

1. The reported figures include patent or patent applications co-owned by PolyU and external parties as well as patent or patent applications owned or co-owned by PolyU's subsidiaries. A detailed list of patents granted is presented in Appendix 2.
2. The reported figure includes license income generated from PolyU supported start-ups which licensed PolyU's IPs.
3. Collaborative research income reported is on cash-receipt basis from on-going projects in the reporting period. As some of the internally funded projects also involved third parties as collaborators for KT purpose, the number of those projects was counted here but not the income nor project value.
4. Contract research projects are those involving third parties from public, private and NGO sectors. The income reported is on cash-receipt basis from on-going projects in the reporting period.
5. The reported figure includes income from corporate and executive development training related consultancies (including those delivered by KTEO as mentioned in Note 9 below) and income from consultancy and advisory services, such as investigation, advisory on business, management, social, technical or policy related issue(s), as well as product, technology, materials or process enhancements.
6. The reported figure includes the number of all active start-ups that were either funded by PolyU funding programmes (including PolyU Micro Fund, China Entrepreneurship Fund (CEF), Tech Incubation Fund (TIF), Tech Launchpad Fund (TLF), Maker Fund, Good Seed Programme), or those obtained license from PolyU to commercialise the University's IPs. Subsidiaries set up as operating vehicles for specific functional purposes, e.g., PTeC, Hotel ICON and PolyU Base in Shenzhen are not included.
7. The reported figures represent the license income generated from PolyU supported start-ups which licensed PolyU's IPs. This license income was also included in the "Income generated from IPR" (refer to Note 2 above).
8. The student contact hours are defined to be the number of enrolments multiplied by the number of contact/course hours.
9. The CPD courses include award-bearing and credit-bearing programmes (both in and outside Hong Kong) for learners already in work who are undertaking the course for purposes of professional development / upskilling / workforce development, in addition to short term non-credit-bearing training programmes. The reported figures include both full-time and part-time taught postgraduate programmes, part-time award bearing programmes offered by PolyU Proper, SPEED and non-award bearing courses offered by PolyU Proper, SPEED and KTEO (as well as the income of corporate and executive development training delivered by KTEO via PTeC in the form of consultancy projects).

Appendix 2: List of Patents Granted in FY2022/23

No.	Official Title	Country
1	Method and Apparatus for Imparting False Twist to Yarn before Ring Spinning	India
2	具有矫正散光的自由曲面渐进式镜片的设计方法及镜片	China
3	Spectacle Lens	US
4	铣削加工装置	China
5	车削加工装置	China
6	用于促进内体及溶酶体生物降解的碳氢订书肽	China
7	用于超声脊髓刺激的设备和方法	China
8	食用油分析方法、识别系统、产生库的方法及数据载体	China
9	電池電極及其製作方法	Taiwan
10	可穿戴智能导电纺织品全自动刺绣制造技术	China
11	纺织品与皮肤的粘度测试装置及测试方法	China
12	Compounds with Antimicrobial Activity	US
13	带静电的纳米纤维介质及其制造方法	China
14	Electrostatically-charged Nanofiber Media and Fabrication Method Thereof	Hong Kong
15	光伏发电并网系统中的控制方法和装置	China
16	一種用於癌症、肥胖、代謝失調、及相關併發症與合併症之精胺酸消耗劑的組成物及用途	Taiwan
17	一种光场光学显微镜及其光场显微成像分析系统	China
18	一种用于玻璃模压脱模的监测装置及其方法	China
19	一种高精度三维点云获取方法、系统、装置及存储介质	China
20	一种基于点云数据的室内 3D 建模方法、系统及相关装置	China
21	紧凑型无线电池充电器	China
22	一种相似帧的检测方法、系统、装置及可读存储介质	China
23	一种基于影像的相邻帧间姿态信息的计算方法及相关装置	China
24	一种微电子纱线及其制备方法	China
25	直接测量饱和土中的有效应力的有效应力盒	China
26	Effective Stress Cell for Direct Measurement of Effective Stress in Saturated Soil	US
27	A Predictive Knee Joint Loading System	US
28	In-Pipe Robot and System	Hong Kong
29	一种氧化石墨烯/二硫化钼复合热电材料及其制备方法	China
30	抑制近視眼加深的透鏡和方法	Taiwan
31	一种微电子纱织物以及制造方法	China
32	直叶片垂直轴风力发电机	China
33	一种三维动态织物拉力与压力测试装置以及测试方法	China
34	一种新型 FRP 约束混凝土柱	China
35	可控液体传输材料、系统及其制备方法	China
36	岩土径向变形的测量装置和测量系统	China
37	一种低频且频率可调的浮子式波浪发电装置	China
38	超声换能器组件、探头、系统和制造方法	China
39	空气调节的面罩	China
40	一种耐洗性涤纶亲水整理剂及其制备方法	China
41	Transparent Ultrasound Transducer with Light Beam Shaping and The Method for Assembling the Same	US
42	一种可拆卸垫块加强高强螺栓剪力连接件	China
43	一种冷弯几字形刚性剪力连接件	China
44	用于控制近视加深的环焦眼镜片	China

45	Tree Monitoring System for Urban Tree Management	Hong Kong
46	一种快速构造的弹性膨胀螺母及可拆卸盲栓	China
47	物品保持装置	China
48	一种道路铺面组件及道路	China
49	一種石墨烯膜-銅網格複合透明導電器件	China
50	一种阻燃抑烟聚乳酸复合材料及其制备方法	China
51	智能湿响应紧缩织物及其制备方法、智能湿响应紧缩绷带	China
52	盲栓安装辅助工具	China
53	基于 3D 打印的礼服	China
54	一种复合构件	China
55	一种主动调节微气候的温控防反渗复合结构及纸尿裤	China
56	紡織物瑕疵檢測系統	Hong Kong
57	Jacquard Knitted Fabric Capable of Designing Various Surface Patterns	Hong Kong
58	Bidirectional Spectral-Based Transformer for Remaining Useful Life Prediction	Hong Kong
59	A Health Index System and Method of Predicting Health Condition in Underground Cables	Hong Kong
60	A Defect Detection and Localization Method and System with Fusion Data Augmentation For Plastic Injection Molding Product	Hong Kong
61	System and Method for Spray Paint Image Synthesis in Surveillance Camera Anomaly Detection	Hong Kong
62	A Deep Learning Model of Defect Detection Method and System for Plastic Injection Molding Products	Hong Kong
63	用于超声探头的压电块体和超声阵列探头及其制备方法	China
64	应用于可控静态及动态压缩的智能应力-记忆织物	China
65	一种制衣自动打版的方法、系统及终端设备	China
66	一种肌肉疲劳等级的检测方法及设备	China
67	具有双儿茶酚结构的着色剂及其制备方法和应用	China
68	一种检测系统和氢气检测方法	China
69	一种光遗传学实验方法与系统	China
70	A Method and system for temporal evolutional optogenetics enabled by optical wavefront shaping	US
71	有免疫增强功效的壳聚糖纳米硒水溶胶及制备、保存和应用	China
72	一种可穿戴式人体背部曲线检测方法及装置	China
73	水凝胶材料和药物递送系统	China
74	木脂素类化合物的代谢组学研究方法	China
75	一种二维金属有机炔纳米片及其制备方法和应用	China
76	基于声波灭火的消防系统及其灭火方法	China
77	可穿戴通信装置及可穿戴装置通信方法	China
78	一种交通流量分布预测方法、预测装置及终端设备	China
79	上转换激发单元及其激光器	China
80	双异吲哚铱(III)配合物及其制备方法	China
81	胞外多糖及其制备方法和应用	China
82	一种气体浓度传感器和气体浓度检测装置	China
83	一种基于滑坡边界多边形和坡向图的滑坡轨迹提取方法	China
84	导航系统的完好性监测方法、完好性监测装置及电子设备	China
85	一种射频识别方法、射频识别装置及服务器	China
86	通过调制 LoRa 信号幅度发送隐蔽数据的方法及装置	China
87	一种拖鞋鼠标的控制方法、拖鞋鼠标及存储介质	China
88	一种自由光谱范围可变的腔外调制方法及扫频激光器	China
89	一种多 NFC 芯片融合的防伪标签及其制作方法	China

90	一种用于高强及超高强混凝土的水泥基找平材料及方法	China
91	一种测量复材管环向弹性模量和泊松比的新型试验方法	China
92	一种提交分片型区块链下跨分片事务的方法及系统	China
93	基于偶联反应的荧光共振能量转移探针的甲醛检测方法	China
94	一种由纤维素衍生物制成的发光薄膜作为食物包装膜的应用	China
95	一种 AIS 大数据驱动的集装箱港口装卸效率计算方法	China
96	一种区分电动汽车与燃油汽车的方法	China
97	一种使用多功能标志辅助视觉 SLAM 的方法与装置	China
98	一种双重频扫频激光测距方法	China
99	一种全空间焦点可调超构透镜及其设计方法	China
100	一种基于背包式激光雷达系统的建图和地面分割方法	China
101	一种室内房间点云自动分割方法	China
102	基于执行轨迹信息的安卓应用行为表征构造方法	China
103	一种利用化学交联剂进行钙钛矿薄膜应力调控的方法与钙钛矿太阳能电池	China
104	遥感影像时空融合方法、智能终端及计算机可读存储介质	China
105	一种基于铌酸锂薄膜的槽波导辅助式声光调制器	China
106	一种 2-烷基-吲哚骨架的膦配体及其制备方法和应用	China
107	一种基于多模态人员行为意图在线预测的主动式人机共融装配系统	China
108	一种多速率子载波调制的数据收发方法和系统	China
109	光通信系统中的一种基于神经网络的光信号多参数实时监测模块	China
110	一种双功能超透镜和光的旋性探测方法	China
111	一种基于增强现实和数字孪生的人机协同控制方法及系统	China
112	一种聚光集热和发电的太阳能综合利用装置	China
113	一种带风幕屏的塔式吸热器的控制方法	China
114	一种基于光学散斑的加密人脸识别方法和系统	China
115	净零能耗建筑应用风光互补混合电力蓄能系统的优化设计和能源管理算法	China
116	Primärer vertikaler Anschlag eines Drehgestells für Hochgeschwindigkeitszüge	Germany
117	具有内置高阻尼的高速铁路列车转向架一系垂向止挡件	Japan
118	一种智能免供电无砟轨道板上拱变形状态监测方法	China
119	一种智能免供电无砟轨道板上拱变形状态监测系统	China
120	一种共格和非共格纳米相复合强化的新型超高强度马氏体时效钢及其制造方法	China
121	基于进化迁移优化的多无人机路径规划方法、终端及介质	China
122	一种基于微纳光纤中气体光热效应的全光相位调制器	China
123	一种基于气体填充空芯光纤的全光相位调制器	China
124	新型卡车排队行驶模式下的本地集装箱运输服务优化	China
125	一种基于模组复用的直调直检光通信系统及方法	China
126	电解液、二次锌空气电池及制备方法	China
127	一种双层骨软骨支架材料及其制备方法与应用	China
128	一种基于贝叶斯盲源分离技术的列车轴承故障诊断方法	China
129	一种基于轨旁声学列车轴承故障诊断装置	China
130	一种数据驱动的列车轴承故障诊断方法	China

Appendix 3: Details of Selected Impact Cases

Case 1: First-in-class Drug for Multiple Obesity-related Metabolic Diseases

1. Summary of the Impact

Researchers from The Hong Kong Polytechnic University (PolyU) and The Chinese University of Hong Kong (CUHK) have jointly made a ground-breaking drug discovery in treating multiple metabolic diseases related to obesity and insulin resistance like diabetes and fatty liver disease. The new drug, ABarginase, opens a new path for safe, long-lasting cures to multiple obesity related diseases simultaneously through an ingenious treatment mechanism – arginine starvation. Currently, patients often have to take multiple medications for these inter-related diseases, and are hence more prone to the potential risks of polypharmacy. The albumin-binding arginase (ABarginase) shows promise for the effective treatment of multiple metabolic diseases including prediabetes, type 2 diabetes and non-alcoholic fatty liver disease. The fabrication process of ABarginase is inexpensive and highly efficient, making it affordable and widely adoptable for clinical applications.

2. Underpinning Research

The research is led by Prof. Thomas Leung Yun-chung, Professor of the Department of Applied Biology and Chemical Technology and Lo Ka Chung Charitable Foundation Professor in Pharmaceutical Sciences of PolyU, and Prof. Alisa Shum Sau-wun, Associate Professor, School of Biomedical Sciences of the Faculty of Medicine of CUHK. An urgent need has emerged in the whole world to develop a drug for multiple obesity-related metabolic diseases. Obesity is not just about being fat. It is associated with many chronic diseases, such as diabetes, non-alcoholic fatty liver disease, heart disease, hypertension and cancer. Importantly, the PolyU-CUHK research team discovered that a low level of arginine (a semi-essential amino acid) in the blood can suppress fat synthesis, promote fat breakdown and sensitise cells to insulin. Native arginase can break down arginine, but it has a short circulatory half-life of less than 30 minutes.

By using an advanced fusion protein strategy, the team successfully developed a long-lasting recombinant human arginase, ABarginase, that contains an albumin-binding domain, which enables it to bind with the stable and abundant albumin in the blood stream to extend its half-life by about 200 folds. ABarginase exhibits strong catabolic activity and it would only require one dose of ABarginase a week to maintain circulating arginine at low levels to achieve arginine starvation. In preclinical studies, diet-induced obese mice were injected with ABarginase once a week, while control mice were injected with saline. The research team found that within eight weeks of treatment with ABarginase, the treatment group's body weight, fat mass, fatty liver and characteristic features of diabetes such as high blood glucose, insulin resistance and glucose intolerance were entirely reversed. The promising results showed that ABarginase has great potential in safely and effectively treating multiple metabolic diseases related to obesity, insulin resistance, diabetes, and most importantly nonalcoholic fatty liver disease, which has no FDA-approved drug so far. The team believed that they might have found the one drug that can cure them all.

Patent applications for this invention were filed in multiple countries. The research team is now scaling up the production for manufacturing ABarginase at Good Manufacturing Practices (GMP) grade in preparation for conducting clinical trials. In an affirmation of its potential benefit to patients and positive impact on global health, as well as a testament to the research excellence of inter-university collaboration, ABarginase recently won one of the two prestigious Grand Prizes awarded to Hong Kong in the 48th International Exhibition of Inventions Geneva (2023) – the International Federation of Inventors' Associations (IFIA) Best Invention Award. The joint research project is supported by the Lo Ka Chung Charitable Foundation Limited, the Health and Medical Research Fund of the Health Bureau and the State Key Laboratory of Chemical Biology and Drug Discovery of PolyU.

3. References to Research

a. Related research grants:

HMRF Project title: Development of arginine deprivation by recombinant human arginase (rhArg) as a safe and effective treatment of obesity and associated metabolic disorders; Funding body: Health and Medical Research Fund; Principal Applicant: Leung Yun-chung Thomas (PolyU); Co-Applicant: Shum Sau-wun Alisa (CUHK); Funding amount: HK$ 1,199,560; Final report rating: Excellent

b. Publications:

Leo Man-Yuen Lee, Zhi-Qiang Lin, Lu-Xi Zheng, Yi-Fan Tu, Yik-Hing So, Xiu-Hua Zheng, Tie-Jun Feng, Xi-Yue Wang, Wai-Ting Wong, Yun-Chung Leung. Lysine deprivation suppresses adipogenesis in 3T3-L1 cells: a transcriptome analysis. Int J Mol Sci. 2023 May 28;24(11):9402. doi: 10.3390/ijms24119402.

4. Impact and Benefits

Obesity is generally recognised as a global health problem. According to the latest data of the World Health Organization, more than 1.9 billion adults were overweight and over 650 million adults were obese in 2016, accounting for 39% and 13% of the world's adult population. While in Hong Kong, about one in two adults are considered to be overweight or obese. ABarginase is an albumin-binding recombinant human arginase that is engineered using an advanced fusion protein strategy. This allows for an inexpensive and highly efficient fabrication process, making ABarginase affordable and widely adoptable for clinical applications. ABarginase has a long-circulating half-life and strong enzymatic activity, which helps to maintain arginine, a semi-essential amino acid, in circulation at low levels. The research team discovered that arginine starvation induces a metabolic switch in cells, suppressing fat synthesis, promoting fat breakdown, and sensitising cells to insulin. This breakthrough has led to the development of the world's first therapy to safely and effectively treat and prevent multiple metabolic diseases related to obesity and insulin resistance, including prediabetes and type 2 diabetes, and nonalcoholic fatty liver disease via arginine starvation. This invention addresses an unmet medical need by providing a way to simultaneously treat obesity and diabetes, and their related comorbidities and complications, using just one drug.

Figure 1. For the invention of ABarginase, Prof. Thomas Leung Yun-chung and his research team recently won one of the two prestigious Grand Prizes awarded to Hong Kong in the 48th International Exhibition of Inventions Geneva (2023) – the International Federation of Inventors' Associations (IFIA) Best Invention Award.

Figure 2. PolyU-CUHK joint development of the groundbreaking drug ABarginase is awarded a Grand Prize – the International Federation of Inventors' Associations (IFIA) Best Invention Award at the 48th International Exhibition of Inventions Geneva. Researchers Prof. Thomas Leung of PolyU (left) and Prof. Alisa Shum of CUHK (right) introduced the research project to the media.

5. References to the Corroboration of Impact and Benefits

a. Press release (22 May 2023):

English: https://www.polyu.edu.hk/en/media/media-releases/2023/0522_polyu-and-cuhk-jointly-develop-abarginase-the-first-in-class-drug/
Chinese: https://www.polyu.edu.hk/tc/media/media-releases/2023/0522_polyu-and-cuhk-jointly-develop-abarginase-the-first-in-class-drug/

Online coverage 22 and 23 May 2023
PolyU and CUHK academics develop new drug to treat multiple obesity-related metabolic diseases: Prof. Thomas Leung Yun-chung, Professor of PolyU's Department of Applied Biology and Chemical Technology and Prof. Alisa Shum Sau-wun, Associate Professor of the School of Biomedical Sciences, The Chinese University of Hong Kong (CUHK), have developed a first-in-class drug, ABarginase, for treatment of multiple obesity-related metabolic diseases. The drug is an albumin-binding recombinant human arginase that is engineered using an advanced fusion protein strategy. This allows for an inexpensive and highly efficient fabrication process, making ABarginase affordable and widely adoptable for clinical applications. The new drug, ABarginase, opens a new path for safe, long-lasting cures to multiple obesity related diseases simultaneously through an ingenious treatment mechanism.

Online coverage:
TVB - https://polyu.me/3BME1oI
Now TV - https://polyu.me/3ITxVa7
RTHK - https://polyu.me/45gniHX
i-Cable - https://polyu.me/43ipRY5
Oriental Daily News - https://polyu.me/3MLmSSp
Hong Kong Economic Journal - https://polyu.me/3OvqIR9 (subscription required)
Sky Post - https://polyu.me/3od1FHS
Ta Kung Pao - https://polyu.me/42TyY1u
Wen Wei Po - https://polyu.me/3MMrCr2
Bastille Post - https://polyu.me/3pZAqkn
Yahoo HK - https://polyu.me/3pWbUR7
Line Today - https://polyu.me/43dtcYo
Dot Dot News - https://polyu.me/3OumXLy
Metro Radio - https://polyu.me/3WnA3wd
China Daily (Hong Kong Edition) - https://polyu.me/3q38coY
Ming Pao Daily News - https://polyu.me/3OyojoF

am730 - https://polyu.me/45lSpSk
The Standard - https://www.thestandard.com.hk/section-news/section/50029179/252684/Breakthrough-in-treating-diseases-linked-to-obesity
Mirage News (Australia) - https://polyu.me/3pRYh5p
Medical Express (US) - https://polyu.me/3IyHH11
Bariatric News (US) - https://www.bariatricnews.net/post/abarginase-shows-promising-outcomes-for-treating-multiple-obesity-related-metabolic-diseases
SWI Swissinfo.ch (Switzerland) - https://www.swissinfo.ch/spa/hong-kong-ciencia_universidades-de-hong-kong-desarrollan-un-nuevo-f%C3%A1rmaco-para-enfermedades-metab%C3%B3licas/48531498
El Espectador (Columbia) - https://elespectadordecaracas.com/abarginase-farmaco-antiobesidad-revolucionario/
infobae (Argentine) - https://www.infobae.com/america/agencias/2023/05/22/universidades-de-hong-kong-desarrollan-un-nuevo-farmaco-para-enfermedades-metabolicas/
Sochob (Chile) - https://www.sochob.cl/web1/abarginase-el-primer-farmaco-de-su-clase-para-multiples-enfermedades-metabolicas-relacionadas-con-la-obesidad/
The Indian Practitioner (India) - https://theindianpractitioner.com/abarginase-a-new-drug-for-multiple-obesity-related-metabolic-diseases/

b. Interviews

Part 1: 12 June 2023 (Monday)
Scientists introduce ABarginase in RTHK programme: Prof. Thomas Leung Yun-chung, Professor of the Department of Applied Biology and Chemical Technology of PolyU and Prof. Alisa Shum Sau-wun, Associate Professor, School of Biomedical Sciences, Faculty of Medicine of The Chinese University of Hong Kong, were featured in *RTHK*'s radio programme "Under the Sun", introducing the new drug, ABarginase. Jointly developed by the two scientists, the drug can treat multiple metabolic diseases related to obesity and insulin resistance.
Online coverage:
RTHK - https://polyu.me/3nBfTOH (04:42 - 24:20)

Part 2: 19 June 2023 (Monday)
Scientists introduce ABarginase in RTHK programme: Prof. Thomas Leung Yun-chung, Lo Ka Chung Charitable Foundation Professor in Pharmaceutical Sciences and Professor of the Department of Applied Biology and Chemical Technology of PolyU, and Prof. Alisa Shum Sau-wun, Associate Professor, School of Biomedical Sciences, Faculty of Medicine of The Chinese University of Hong Kong, continued introducing the new drug ABarginase and talked about the change in environment of scientific research in Hong Kong in *RTHK*'s radio programme "Under the Sun".
Online coverage:
RTHK - https://polyu.me/3nBfTOH (00:57 - 20:41)

Case 2: New DISC Lens to Slow Myopia Progression Addresses a Worldwide Problem

1. Summary of the Impact

The novel Nano Multi-ring Defocus Incorporated Spectacle (NMDIS) lens is an advanced spectacle lens designed to slow the progression of myopia in children. The NMDIS lens combines two cutting-edge technologies – the Defocus Incorporated Soft Contact (DISC) lens and Ultra-precision Nano Multi-ring Machining Technology (UPNMMT) – to produce high-quality lenses which target school children aged from 6 to 18 years old.

The NMDIS lens features annular spaced correction zones and defocus zones. The correction zones function as a regular concave lens to correct vision at the centre of the retina, while the defocus zones focus light slightly in front of the retina to achieve myopia defocus. This effectively inhibits elongation of the eyeball, slowing the progression of myopia. Figures 1 to 2 depict the concept and principle of NMDIS.

UPNMMT enables the precision moulding of NMDIS lenses by fabricating the unique tangential continuity nano multi-ring structure on the moulds (Figure 3). By optimizing the width and height of the defocus zones, it enables a reasonable distribution of optical power to generate a smooth and seamless lens surface, and strikes a good balance between clear vision, comfort, and myopia control for children.

The NMDIS lens has been commercialized and pilot produced with sales in the market. The project team launched the NMDIS lens in Hong Kong through Vision and Science Technology Limited Company (VST) which is a start-up company from the PolyU in December 2022. Through licensing to the start-up, the NMDIS lenses has been launched to the market in both Hong Kong and China.

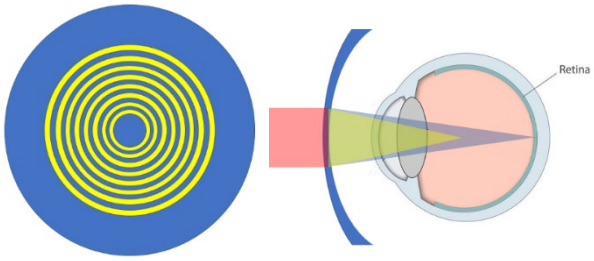


Fig.1 Schematic diagram of the NMDIS lens

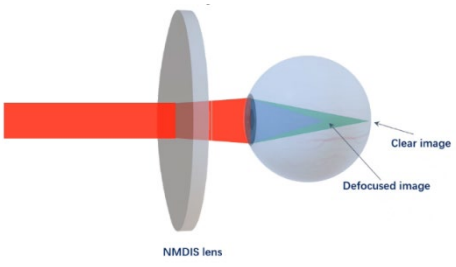


Fig.2 Principle of NMDIS

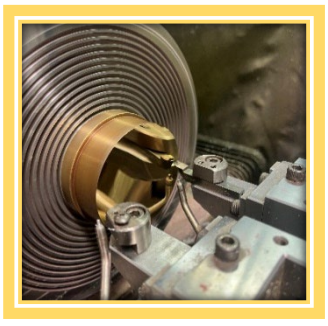


Fig.3. Ultra-precision Nano Multi-ring Machining Technology (UPNMMT)

2. Underpinning Research

This is an interdisciplinary research project among the State Key Laboratory of Ultra-precision Machining Technology, School of Optometry and VST company through a contract research project of HK$1.65 million in 2021, entitled “Optic Design, Precision Manufacture and Testing of Nanostructured Defocus Incorporated Spectacle

(NDIS) Lenses for Controlling Human Myopia. The project subsequently obtained matching funds of HK$749,250 from the University Grants Council to support the research of several generations of NMDIS spectacle lenses.

The NMDIS lens is developed based on the emmetropization feedback mechanism for effectively inhibiting elongation of the eyeball to slow children's myopia progression. The spectacle lens combined with the defocus function is very attractive and easy to accept for all patients, because it is essentially non-invasive (the same as traditional spectacle lenses), easy to wear, artistic and very safe. At the same time, the lens as a spectacle lens can maximize the wearing time to achieve the best curative effect of myopia control. In order to fully illustrate the technical advantages of the innovation, it is mainly explained in relation to the following aspects.

2.1 Novel design for invisible concentric optical nanostructures

As shown in Figure 3, the NMDIS lens not only provides clear vision for myopia patients, but also has several ring-shaped defocusing zones to form an optical defocusing effect. Since the connection between correcting zone and defocusing zone is formed by nano-scale scattered points with tangential continuity, there is seamless connection between concentric rings with different optical powers and the NMDIS lens is aesthetic as a normal spectacle lens.

2.2 Proprietary Defocus power measurement method for the NMDIS lens

The measurement of spectacle lenses' optical power is very important for production quality control and retail markets. Existing measurement equipment on the market are not suitable for accurately measuring defocus-incorporated spectacle lenses. As a result, a proprietary defocus power measurement method has been developed for the NMDIS which makes the measurement process simple and fast, and the measuring result of the optical power map is direct and easy to read, even for an ordinary consumer.

Figure 5 shows the developed proprietary defocus power measurement method for the NMDIS lens. The Taylor Hobson's Form Talysurf PGI Freeform is used to acquire the surface form data in our method to ensure the accuracy. The data is inputted into the program we developed. Firstly, we set the data picking range and reasonable precision, and then use the least squares method to obtain the radius of these segments by best fitting. The power of segment "D_i" is calculated by the following formula,

$$D_i = \frac{n-1}{R_i} \times 1000 \qquad (1)$$

where "n" means the refractive index of material, "R_i" is the radius of the segment. The output power map can be shown in the form of a table view or 2D/3D figure view, as shown in Figure 6. Our evaluation method enables quick feedback to users, and the operation of such programs results in fully automated measurement, analysis and results output.

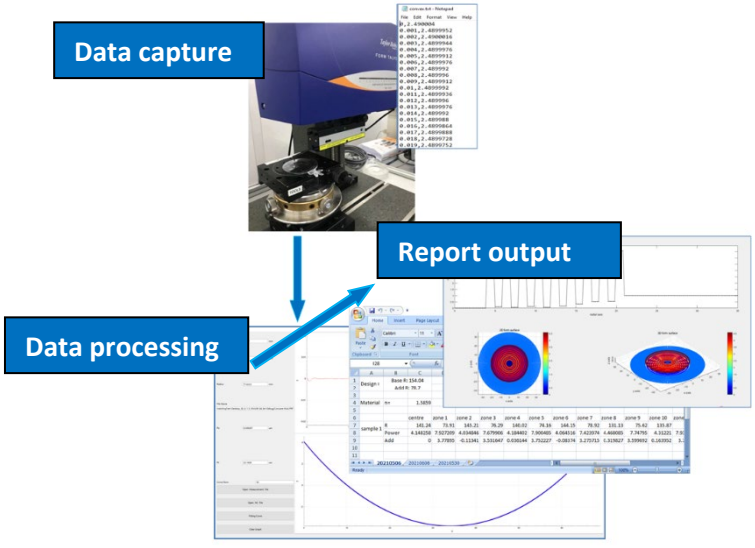


Fig.5 Developed quantitative evaluation method

2.3 Optimized precision moulding process

To reduce the production cost, a proprietary precision moulding process has been developed. As shown in Figure 6, there are a total of 3 front mould cores, 1 set of rear mould cores and a flat rear mould core involved in the procession moulding process. This process provides full powers through different combinations to avoid one myopia dioptre and one set of mould cores. At the same time, the manufacturing process provides a semi-finished lens for the NDIS lens with high myopia defocus power and high astigmatism power. Due to the small demand for high myopia defocus and high astigmatism, the semi-finished lens not only greatly reduces the number of mould cores, but also reduces the number of stock lenses, thereby greatly reducing the inventory and production cost.

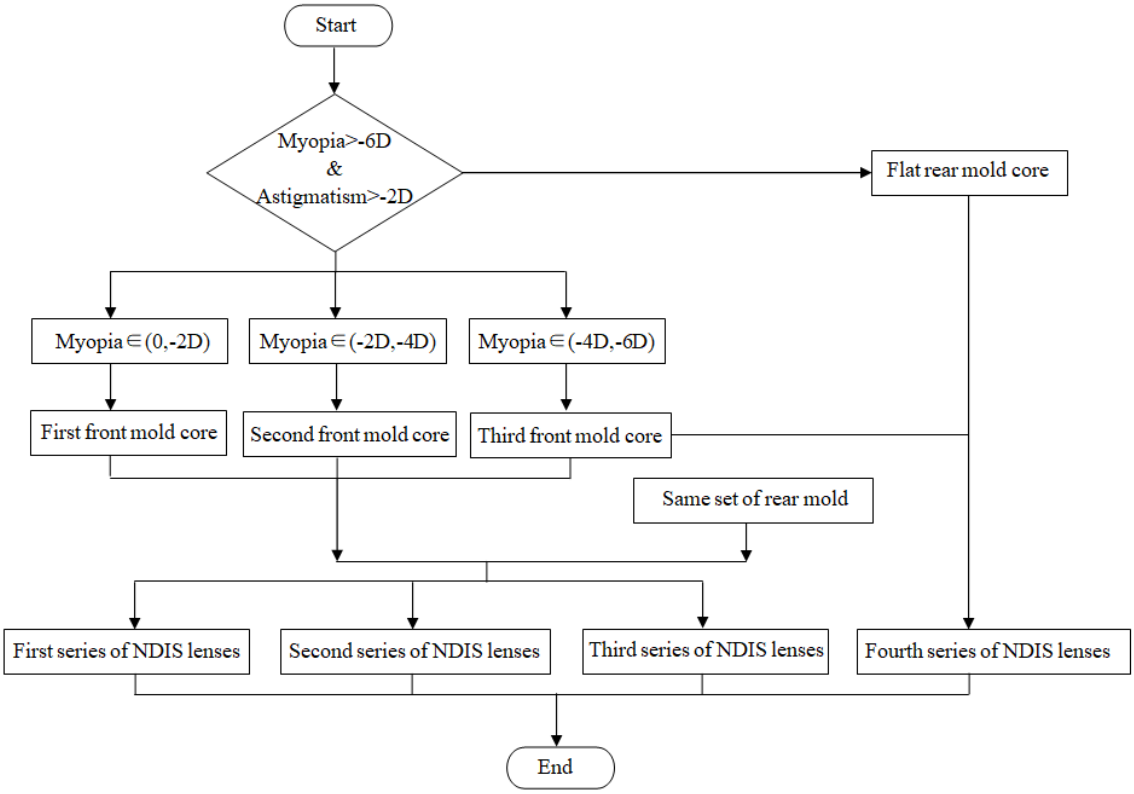


Fig.6 Flow chart of optimized precision moulding process

Fig.7 NDIS prototype

3. References to Research

Name: RING-FOCUS SPECTACLE LENS FOR CONTROLLING MYOPIA PROGRESSION AND MANUFACTURING METHOD THEREOF (background patents: 1. Method of optical treatment and 2. Method and system for retarding the progression of myopia)

Patent number: 30060394 (background patents: 1. US Patent 7,506,983 B2 and US8950860B2, CN103097940B; Filing year: 2010; grant year: 2015 (US) 2016 (CN))

Place: Hong Kong
Application year: 2021
Granted year: 2022

4. Impact and Benefits

Special Features and Advantages

The NMDIS lens provides an affordable and highly efficacious solution for myopia control to slow myopia progressio 60% non-invasively with breakthroughs in the optical design of invisible concentric optical nanostructures and ultra-precision manufacturing technology. It provides clear vision and is comfortable for children in their early years to we

In general, the NMDIS lens can not only be as beautiful as ordinary spectacle lenses and ensure clear vision, but also retard the growth of the eyeball to control myopia progression. Compared with DIMS, this technology also has the following advantages: 1) High imaging quality in defocus zones; 2) The vision is continuous and clear, without deprivation of peripheral vision; 3) No wear adaptation period; 4) Additional power can be customized.

Clinical tests were conducted on 18 children and adolescents aged 9 to 15 (average 12.5 years old, male: 11, female: 7), and the average wearing period was 9.5 months. The test data indicated that the average progression of myopia is -0.13 (dioptre) and the average axial growth <= 0.02 mm (20 mm). The myopia progression was found to be much lower than that for children and adolescents who wear ordinary spectacle lenses without myopia control whose myopia will progress by an average amount of -0.75 to -1.00 dioptre per year.

Impact & contributions made to the industry / society

One third of the global population had been affected by myopia by 2023 and the number is projected to rise to more than 50% by 2050. Nearly 60% of schoolchildren aged 12 are myopic in HK according to a study in 2012. High myopia drastically increases the risk of eye diseases such as retinal detachment, cataract, glaucoma, etc. when schoolchildren have grown into adults. Correction can be achieved either optically by spectacle lenses and contact lenses or surgically. Some schoolchildren cannot wear soft contact lenses due to eye health issues. The NMDIS lens will be a turnkey solution for all patients in the age range of 6 to 18 years old.

The NMDIS lens has been commercialized and pilot produced with sales in the market. The project team launched the NMDIS lens in Hong Kong through VST company which is a start-up company from the PolyU in December 2022. Currently, there are currently 40 authorized professional optometry centres in Hong Kong and China. It is estimated that the number will increase to 60 by the end of 2023. Up to the end of May 2023, about 500 pairs of NMDIS lenses had been sold to the optometry centres in Hong Kong. In April 2023, NMDIS lenses were launched at the International Congress of Ophthalmology and Optometry China (COOC) in Shanghai. Another 5,000 pairs of NMDIS lenses had been sold to the authorized optometry centres in China by the end of May. On the whole, it is estimated that the sale of NMDIS lenses has created economic value of about HK$22,000,000 through the authorized optometry centres in Hong Kong and China.

5. References to the Corroboration of Impact and Benefits

Awards:

The highly efficacious myopia control spectacle lens won the Prize of the State of Geneva and a Gold Medal with the Congratulations of the Jury

Gold Award at FITMI2023 Asia International Innovative Invention Award

Media coverage:

1. 商業電台
2. am730
3. Ezone
4. ToPick
5. Now 新聞
6. 明報
7. 巴士的報
8. 明報健康網
9. 星島：理大發明獲「2023 年日內瓦國際發明展」31 個獎項 研防控鏡片助兒童控制近視
10. 星島頭條：理大發明獲「2023 年日內瓦國際發明展」31 個獎項 研防控鏡片助兒童控制近視
11. 星島頭條：理大研近視防控鏡片 獲日內瓦特別大獎
12. 星島頭條：理大研近視防控鏡片揚威國際
13. 晴報：理大在日內瓦發明展囊括 31 獎-兒童近視防控片奪特別大獎
14. 晴報：日內瓦國際發明展理大 31 獎歷來最佳-近視防控鏡片-3 款功能衣獲評審團嘉許金獎
15. 晴報：理大研「睛鷹」近視防控鏡片 減慢加深速度 60% 售約$4000
16. 晴報：初創夥理大研製 「睛鷹」鏡片減青少年近視加深速度 60%
17. 東網：理大研相機登陸火星 防控鏡片助抑近視 功能服裝治療脊柱側彎
18. 東網：理大團隊研「納米多環離焦」鏡片 助減慢兒童近視加深速度
19. 香港經濟日報：理大 28 項發明奪日內瓦發明展獎項 助治療脊柱側彎、減慢兒童近視加深
20. 香港經濟日報：理大發明揚威海外 助治療脊柱側彎、減慢近視加深 Microsoft Bing 開放公測
21. Yahoo: 理大研發「納米多環離焦」鏡片 稱有效減緩近視增長
22. Yahoo: 理大研「納米多環離焦」鏡片 中學生配戴 1 年後近視無加深
23. Yahoo: 理大團隊研「納米多環離焦」鏡片 助減慢兒童近視加深速度
24. 文匯報：香港創科奪 230 獎 防近視鏡片糖尿新藥同時獲兩殊榮
25. 東網：理大研相機登陸火星 防控鏡片助抑近視 功能服裝治療脊柱側彎
26. TVB 翡翠台: 身體最誠實, Time: 22:30 – 23:00, 27 June (Tue)
27. RTHK-TV Programme 凝聚香港 for a live TV interview on 12 Dec 2022 (Monday)

Case 3: State-of-the-art R&D Optimises Colours in Imaging and Metaverse Systems for a Better User Experience

1. Summary of the Impact

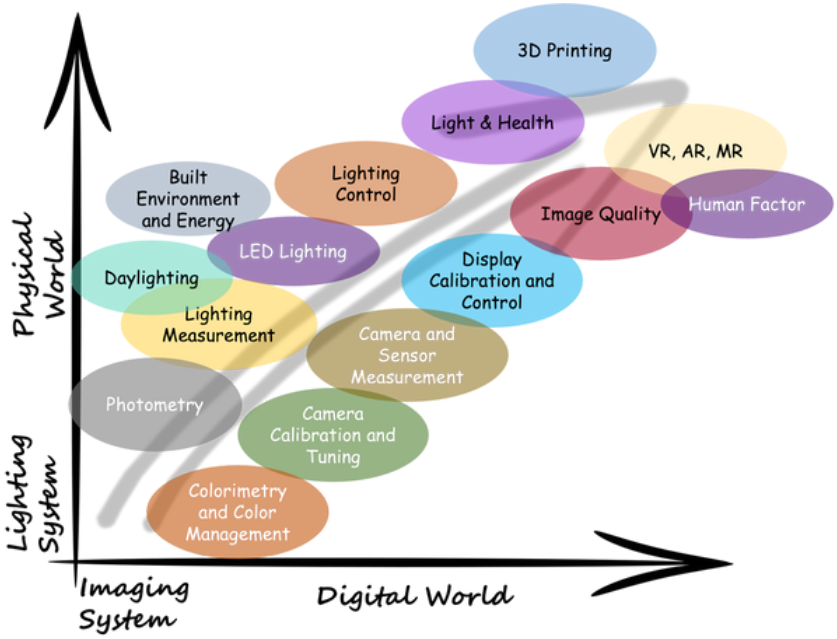
The development of new technologies has introduced a series of challenges to the lighting and imaging industries, such as characterization, capture, and reproduction. These challenges are mainly due to the new viewing conditions and experiences introduced by new technologies to human beings, which requires a deeper understanding about human perception of light and colour stimuli.

Prof. Tommy Wei Minchen from the Department of Building Environment and Energy Engineering of PolyU, is devoted to colour science and his research has made significant impacts on industries worldwide, including social media, imaging and metaverse systems, and manufacturers of smartphones, drones, LCDs, and OLED displays. The technologies he developed are a package of innovative technologies and solutions that can improve the quality of lighting and imaging systems.

These technologies and solutions were developed based on extensive fundamental research to understand how human beings perceive the appearance of colour stimuli under different conditions and algorithms that were designed based on the experimental findings. There are three main research areas: (1) spectral tuning of LED lighting for enhanced colour quality; (2) colour matching between stimuli with different spectral compositions; and (3) human visual mechanisms under different viewing conditions.

2. Underpinning Research

The development of lighting and imaging technologies are providing many new opportunities and benefits to us, but they also introduce a number of challenges. This is mainly because these technologies present new conditions that humans never experienced in the past. For example, conventional lighting products (e.g., incandescent, fluorescent) always have smooth spectral compositions, but the new products (e.g., LED and OLED) have highly structured spectrum. The sensitivities of the sensors in digital cameras to light at different wavelengths are very different from those of the photoreceptors in the human eyes, which makes the colors captured by cameras different from what humans see.



Systematic research has been carried out to carefully adjust the spectral compositions of LED products for different lighting conditions. They helped us to better understand how the human beings perceive and evaluate the

appearance of color in objects under different LED lighting spectral compositions, enabling the development of new methods to better characterize the color quality of LED lighting products. These methods also provide guidance for manufactures to develop high quality products. For different types of imaging systems (e.g., camera, display, AR, VR, MR), a series of experiments were carefully designed to understand how different variables, such as ambient light color, ambient light intensity, display brightness, display white point, display gamut, display type, affect the image quality. These studies focused on the fundamentals of color science to better understand how the human visual system responds to color and light under different conditions, so that advanced algorithms could be developed to solve the challenges and technical obstacles faced by the industry. In comparison to many AI or machine-learning based solutions, the solutions developed by Prof. Wei consider the difference between the human visual system and equipment, which allow better image quality and can be implemented directly on real products.

3. References to Research

External Funding (excluding funding from industry) in recent years:

[1]. 2023-2025 National Science Foundation of China (NSFC): China's Excellent Young Scientists Fund (PI). RMB 2,000,000.

[2]. 2023-2025 Hong Kong Research Grant Council - General Research Fund (GRF): Development of a Uniform Color Space for Stimuli under High Dynamic Range Conditions. (PI). HK$ 980,256.

[3]. 2022-2025 Hong Kong Research Grant Council – Research Impact Fund (RIF): Deeper Understanding of Color Matching Mechanism for Developing High Quality Lighting and Imaging Systems. (PI). HK$ 8,140,000.

[4]. 2022-2024 Hong Kong Research Grant Council – General Research Fund (GRF): Color Appearance of Virtual Stimuli Produced by Augmented Reality (AR) (PI). HK$ 838,393.

[5]. 2021-2024 Jiangsu Science and Technology Fund Collaboration with Hong Kong, Macao, and Taiwan Scheme: Development of Prototype for Measuring Camera Sensitivity Function. (Co-PI). Share RMB 300,000 of RMB 800,000.

4. Impact and Benefits

The research outputs generated by Prof. Wei have generated remarkable impact through technology transfer and industrial applications in the past seven years:

- Attracted over HK$ 15M collaborative and consultancy projects, with technologies being implemented on real products. Prof. Wei collaborated with various world-leading high-tech manufacturers, start-up companies and government sector to develop various customized solutions for different imaging systems (i.e., VR, AR, MR, camera, display, UAV). Many of these solutions have been implemented on real commercial products.
  - Various calibration and imaging process algorithms are used in Facebook VR, AR, and MR systems.
  - The LCD and OLED display calibration and white balance solution have been implemented on a leading smartphone marker's production line.
  - The display calibration method has been implemented on a Chinese consumer electronics manufacturer's production line.
  - The RGBACL module and control algorithm have been used in a start-up company's products, which were used for movie production in Hollywood.
  - The violet-pumped LED has been used by another start-up for high-quality LED lighting device.
- An RGC RIF project was funded. Prof. Wei's work on display calibration has led to the successful application of RGC RIF in 2021/22, with a total of HK$ 8.14 M.
- Development of a US national standard and one international standard. Prof. Wei's works on the characterization of LED lighting products are well recognized by the academia and industry, which have led

to the development of a US national standard (i.e., IES/ANSI TM-30) and one international standard (i.e., CIE 227). All the LED lighting products need to follow these standards to measure and report the color quality. Such an impact is supported by the Nobel Laureate in Physics 2014 (Prof. Shuji Nakamura).

- Awarded an international award. Prof. Wei was awarded Google Research Scholar Award. He is the only recipient in East Asia, with a total of 75 researchers worldwide.
- Attracted many invited presentations about metaverse. With Prof. Wei's work on metaverse, he has been invited to deliver talks about color management in metaverse in international conferences, leading the research direction in the community.

5. References to the Corroboration of Impact and Benefits

Research Outputs:

[1]. Wu J, ***Wei M**, Yang Y, Wang W. 2023. Color Characterization Model for OLED Displays with Crosstalk Effects. Color Research & Application.

[2]. Bai X, Liu S, Deng S, *Zhang L, **Wei M**. 2023. An Optimal Control Strategy for ASHP Units with a Novel Dual-fan Outdoor Coil for Evener Frosting Along Airflow Direction Based on GRNN Modelling. Energy and Buildings.

[3]. *Fong K, Ge X, Ting H, **Wei M**, Cheung H. 2023. The Effects of Light Therapy on Sleep, Agitation and Depression in People with Dementia: A Systematic Review and Meta-analysis of Randomized Controlled Trials. American Journal of Alzheimer s Disease and Other Dementias.

[4]. Liu S, Bai X, Deng S, *Zhang L, **Wei M**. 2023. Developing a Novel Control Strategy for Frosting Suppression Based on Condensing-frosting Performance Maps for Variable Speed Air Source Heat Pumps. Energy and Buildings.

[5]. Bai X, Liu S, Deng S, *Zhang L, **Wei M**. 2023. A Modelling Study on The Frosting Characteristics Of a Novel Dual-Fan Outdoor Coil in an Air Source Heat Pump Unit. Applied Thermal Engineering. 222:119933.

[6]. Yue S, ***Wei M**. 2023. Color constancy from a pure color view. Journal of the Optical Society of America A. 40(3):602-610.

[7]. Wang H, ***Wei M**, Qu X 2022. Constant hue loci in different color spaces for stimuli in Rec. 2020 color gamut and HDR conditions. Optics Express, 30(25):44896-44907.

[8]. Liu S, Bai X, Deng S, *Zhang L, **Wei M**. 2022. A Modelling Study on Developing the Condensing-Frosting Performance Maps for a Variable Speed Air Source Heat Pump. Journal of Building Engineering.

[9]. Huang M, Wang Y, ***Wei M**, Li Y, Gao X, Li X. 2022. Effect of Observer Age and Stimulus Size on the Performance of CIE Color Matching Functions. Optics Express.

[10]. Liu S, Bai X, Zhang L, Lin Y, Deng S, *Wang W, **Wei M**. 2022. Developing Condensing-frosting Performance Maps for a Variable Speed Air Source Heat Pump (ASHP) for Frosting Suppression. Applied Thermal Engineering.

[11]. Bai X, Liu S, Deng S, *Zhang L, **Wei M**. 2022. An Experimental Study on Achieving Even-Frosting for an Air Source Heat Pump using a Novel Dual-fan outdoor coil. Energy and Buildings. 255:111695.

Case 4: Smart Construction Technologies Towards Safer and More Productive Workplaces

1. Summary of the Impact

Digital innovation and transformation are becoming essential in the construction industry to make complex and dynamic construction operations more efficient, productive and safe. The research team at the Department of Building and Real Estate of PolyU has been dedicated to leading this initiative through three major projects, namely 1) AI-driven approaches for real-time field data collection, 2) automated construction production systems, and 3) pro-active smart construction monitoring. The research outcomes have significant impact on both academia and practice, and have been adopted in various construction projects. Their technologies have been widely recognized, winning several awards for their innovation and effectiveness.

2. Underpinning Research

Tackling challenges during complicating and dynamically changing construction operations would require timely detection of existing production issues, automation of manual construction, and proactive monitoring of ongoing operations for real-time interventions. Toward these goals, the research team has developed practical solutions and methodologies, which are listed as follows.

[AI-driven Approaches for Real-time Field Data Collection]
Due to the unstructured and dynamic nature of construction projects, real-time field data collection is one of the challenging issues to identify the causes of productivity, safety, and health problems. To tackle this issue, the research team has developed AI-driven approaches that collect and analyse operation data by using sensing technologies such as computer vision, wearable, and IoT sensors. For example, the developed approaches are able to automatically recognise workers' activities through vision and spatial clustering with an accuracy of 85% (R1) and detect potential health issues from wearable sensors with an accuracy of 99.7% (R2). Real-time capture of construction workers' behavior using these approaches enables practitioners not only to identify workers who need immediate interventions but also to re-design construction operations and workplaces, aiming to improve productivity and reduce potential safety and health issues.

[Automated Construction Production Systems]
The research team has contributed not only to automation of construction operation (e.g., construction equipment), but also automation of construction production (e.g., 3D printing). For example, the research team has developed real-time automatic operation planning algorithms of cranes under tele-operated or training scenarios and tested them by collaborating with industry partners, such as crane training facility at the Hong Kong Institute of Construction (HKIC) and an equipment supplier, Yuo-Pin Construction Co. Ltd. (R3). Also, the research team has been leading the adoption of 3D printing technologies to fundamentally replace manual-oriented traditional on-site operations by automated production systems. Especially, a novel synchronized concrete and bonding agent deposition system that has been developed by the research team has the potential to eliminate the weakness in interlayer bond strength of 3D printing processes, widening its application in practice (R4).

[Pro-active Smart Construction Monitoring System]
The Smart Construction Monitoring System developed by the research team consists of industry 4.0 wireless signal devices, a digital twinning project management platform, and smart sensors for worker safety monitoring. In the system, smart sensors (e.g., wearable insole sensors, wristband sensors, and electroencephalography (EEG) sensors) monitor workers' physical and mental feelings to ensure their well-being, and the digital twining platform can monitor project productivity and quality. The wireless signal devices ensure the efficient data transition of the whole system. Wireless signal devices and integrated cameras are installed on the construction site to undergo 24/7 real-time intelligent monitoring. This technology provides a wireless private network for long-distance transmission, approximately up to 2km between two nodes and 20+ nodes in total, and realizes full coverage of Wi-Fi (a 200m range) and ultra-wideband (a 300-400m range) in two-dimensional poisoning in any area. The project management platform can analyze construction productivity, project progress, and generate daily reports automatically. Users

can see real-time push alarm data statistics, alarm details, and face comparison results, to ensure that the privacy of the company and employees would not be violated. In the platform, innovative algorithms and methodologies for monitoring activities (R1) and unsafe actions (R2, R5) are embedded to send an alarm for potential productivity, safety, and health issues in real time. Also, a blockchain-enabled construction contract system that is one of the major components of the platform can be used for on-site construction quality inspection (R6). To sum up, the Smart Construction Monitoring System has integrated several state-of-the-art research outputs to enable the proactive monitoring of construction productivity, safety, quality, and progress.

3. References to Research

[1]. Xiaochun Luo, Heng Li, Hao Wang, Zezhou Wu, Fei Dai, and Dongping Cao, "Vision-based detection and visualization of dynamic workspaces." Automation in Construction, 104 (2019) 1–13. Doi:10.1016/j.autcon.2019.04.001.

[2]. Antwi-Afari, Maxwell Fordjour, Heng Li, Yantao Yu, and Liulin Kong. "Wearable insole pressure system for automated detection and classification of awkward working postures in construction workers." Automation in construction 96 (2018): 433-441.

[3]. Li, X., Chi, H. L., Wu, P., & Shen, G. Q. (2020). "Smart work packaging-enabled constraint-free path re-planning for tower crane in prefabricated products assembly process." Advanced engineering informatics, 43, 101008.

[4]. Weng, Y., Li, M., Wong, T. N., & Tan, M. J. (2021). "Synchronized concrete and bonding agent deposition system for interlayer bond strength enhancement in 3D concrete printing." Automation in Construction, 123, 103546.

[5]. Ting, Kong Weili Fang, Peter ED Love, Hanbin Luo, Shuangjie Xu, and Heng Li. "Computer vision and long short-term memory: Learning to predict unsafe behaviour in construction." Advanced Engineering Informatics 50 (2021): 101400. Doi: 10.1016/j.aei.2021.101400

[6]. Haitao Wu, Botao Zhong, Heng Li, and Jadong Guo. "On-Site construction quality inspection using blockchain and smart contracts". Journal of Management in Engineering, 2021, 37(6): 04021065. Doi: 10.1061/(ASCE)ME.1943-5479.0000967

4. Impact and Benefits

[AI-driven Approaches for Real-time Field Data Collection]

The research team led by Prof. Heng Li, Dr. Joon Oh Seo, and Dr. Hung-lin Chi is active in the research and development of sensor-based automated construction worker monitoring with practical applications. The research team has developed several patented technologies based on the research outcomes on AI-driven approaches. One of the technologies developed by collaborating with a partner institute, Seoul National University (SNU) has contributed to founding a spin-off company of SNU, which provides AI-driven site monitoring and data collection. The technologies are being actively implemented in more than 10 construction sites in South Korea. Also, the technologies for collecting crane operators' fatigue information have been validated with industry partner Yuo-Pin Construction Co. Ltd. through licensed crane operators' lifting task simulations.

[Automated Construction Production Systems]

The research has been led by Dr. Hung-lin Chi and Dr. Yiwei Weng. Dr. Chi has been working on automating tower crane operations, in particular, for its optimised operations. The outcomes of the research stream include 1) real-time automatic operation planning algorithms of cranes under tele-operated or training scenarios, and 2) a patented core simulation approach of the crane operations [S10]. Industry partners, such as crane training facility at the Hong Kong Institute of Construction (HKIC) and an equipment supplier, Yuo-Pin Construction Co. Ltd., were invited to support the collaborative research tasks, including sharing the conventional training materials and practice, providing testbeds, licensed crane operators, and trainers for interviews and simulated experiments.

[Pro-active Smart Construction Monitoring System]

The Smart Construction Monitoring System has contributed to transforming the construction management practice to be a population-based, intensive, and proactive process. It has improved resource productivity, reduced resource

waste and progress lagging, as well as improved project performance. In the R&D stage, the research team has closely collaborated with the Logistics and Supply Chain MultiTech R&D Centre (LSCM) to develop the new technologies. The research team has conducted several trial projects with local and mainland companies, including China State Hailong Construction Technology Company Ltd., Hip Hing Engineering Co Ltd, Able Engineering Co Ltd., Yau Lee Construction Co Ltd., Chun Wo Building Construction Ltd., Architecture & Decoration Technology Group (A & D) Ltd., SmartServ Global Integrator, and Shen Zhen TH Sware Technology Co. Ltd. Through the collaborations, these companies enjoyed the feasibility of the Smart Construction Monitoring System with improvement on their site safety, project productivity, and reducing costs. In addition, the success of the Smart Construction Monitoring System has improved the competitiveness of the Hong Kong construction industry by promoting creativity and innovation. One of the projects that recently adopted this system is the Nord Stream 2 Project. This project involved the laying of a 1,224 km-long natural gas pipeline from Russia to Germany through the Baltic Sea. The Smart Construction Monitoring System was used to monitor the construction site in real time, ensuring the safety of the workers and the integrity of the pipeline.

The technology has been well recognized by both academia and society, having won several awards, such as the 2018 Best Paper Award of the Journal of Computing in Civil Engineering, the 2019 Gold Medal in the 47th International Exhibition of Inventions, and the 2022 Hong Kong Smart Living Partnership Award. Also, the technology has been reported in various media channels, which shows its significant impact on the industry. The Smart Construction Monitoring System is a significant step forward for the construction industry in Hong Kong. It addresses the challenges faced by the industry in ensuring safety, managing site quality, and progress, and introducing new technologies. Its adoption in real projects and recognition by academia and society is a testament to its effectiveness and potential.

5. References to the Corroboration of Impact and Benefits

Awards

[1] 2018 Best Paper Award for ASCE Journal of Computing in Civil Engineering, Awardee: Dr. Xiaochun Luo, Dr. Joon Oh Seo, and Prof. Heng Li, https://web.archive.org/web/20210520095639/https://ascelibrary.org/journal/jccee5
[2] 2019 Gold Medal in the 47th International Exhibition of Inventions, Awardee: Dr. Xiaochun Luo and Prof. Heng Li, https://www.lscm.hk/eng/channel.php?content_id=50627
[3] Outstanding Construction Resources and Progress Management System, Smart Living Partnership Awards 2022, Awardee: Prof. Heng Li, https://smartcityslpa.etnet.com.hk/2022/winners.php

Public Media

[4] Construction Industry Council. Waistband Enabled Construction Workers Low Back Health Monitoring System. Public Report by Prof. Heng Li, https://www.cic.hk/files/page/10390/CICR01_15-Waistband%20Enabled%20Construction%20Workers%20Low%20Back%20Health%20Monitoring%20System_RS026.pdf
[5] Logistics and Supply Chain MultiTech R&D Centre Post, Pi: A Smart Construction Quality Management System, https://www.lscm.hk/eng/channel.php?channel=case-pi
[6] Construction Industry Council, From Virtual Prototyping to Smart Construction, https://www.bim.cic.hk/en/bim_showcases/bim_talks_detail/18?back=%2Fen%2Fbim_showcases%2Fbim_talks

Others

[7] Acknowledgment letter from SiteVision (South Korea)
[8] Hong Kong Short-Term Patent No. 30031214, “Method for Developing Synthetic Image Datasets for Vision-based Construction Site Monitoring” Mar 5, 2021

Case 5: High-efficiency Antimicrobial and Biodegradable Materials for Safer and Healthier Applications

1. Summary of the Impact

The research team led by Prof. Tao Xiaoming has first discovered that a series of linear aliphatic bio-polyester oligomers have outstanding wide-spectrum antiviral and antimicrobial properties including, gram-positive, gram-negative bacteria, drug-resistant bacteria and fungi as well as virus like COVID-19 virus while have little skin irritation and allergy. Their degradation processes in soil and in sea water have been studied and the degraded products have been found to be water and carbon-dioxide, thus have no environmental pollution like other inorganic and organic antimicrobial agents like silver, copper and N-halamine etc. Their level of greenhouse gas emission from the oligomers is much lower than the other degradable natural agents like chitosan. Now, the green textiles have been mass-produced and sold in the market in the form of filament and staple fibres, yarns, knitted, woven, and non-woven fabrics, as well as consumer products of bedding, clothing and personal protective equipment.

2. Underpinning Research

In the last eight years, Prof. Tao's group has discovered novel anti-microbial textiles from bio-based degradable polymer fibres. The team identified and further synthesized the family of the active material (PHAO) that has an excellent wide-spectrum anti-microbial effects against gram-positive, gram-negative bacteria and fungus, as well as anti-viral effects. The team demonstrated the effectiveness of PHAs in removing more than 99.99% of drug-resistant bacteria and inactivating 99.99% of H1N1 and H3N2 viruses. The research team also found that PHAs possess excellent antimicrobial properties with effective bacterial reduction of S. aureus (> 99.99%), K. pneumoniae (> 99.99%), C. albicans (> 96.68%) and Methicillin-resistant S. aureus (84.44%). It is not toxic, non- skin-allergy, and safe in human body as certified by FDA.

Apart from the nontoxicity, eco-friendliness and antimicrobial properties, the linear aliphatic bio-polyester oligomers have a number of additional advantages over other competing technologies. They can be scaled up for mass production with relatively simple processes without high capital investment and energy/environmental/material costs. They can be used as additives in polymer blends, fiber extrusion and textile finishing. The applications cover a wide range: from plastics to textiles and packaging. To fully taking the advantages of the oligomers for real large-scale applications, the group is teamed up with several public-listed industrial companies who are the leaders in personal protection equipment, personal hygiene products and medical textiles, in the process for scaling-up industrial operation.

A technology startup company has been established at the end of 2021 by researchers from Prof. Tao's group, that will drive the production of the synthesized oligomer products. Now the green products have been mass-produced and sold in the market in the form of finishing agents, filament and staple fibres, yarns, knitted, woven, and non-woven fabrics, as well as consumer products of bedding, clothing, and personal protective equipment.

The precursors of the first type of polyester oligomers exist in bio-based PHBV/PLA fibers and PHB powders made from fermentation process. Their anti-microbial properties are greatly enhanced by thermal degradation in the fiber making stage. The PolyU's group made the world-first discovery of the effective spices and successfully synthesized them at laboratory. The Minimum Inhibitory Concentration (MIC) levels were determined by us that guides the quality assurance of the fiber making process in a company. Because of the discovery and the mechanistic investigation from PolyU, the company overcame the initial huge fluctuations of the antimicrobial rate and was able to produce a commercial high-grade antimicrobial fiber under the trade name of Hesu^{TM} at RMB98000/tone with a profit margin over RMB80000/tone. Annual production capacity is 500 tones.

3. References to Research

a. Publications:

1. Bao Q, Zhang ZH, Yu BC, Sun H, Leung PHM, **Tao XM*,** 2022. Synthesis of Polylactic Acid Oligomers for Broad-Spectrum Antimicrobials, *Polymers*,14(20), 4399, https://doi.org/10.3390/polym14204399
2. W Suo D, Rao J, Wang HM, Zhang ZH, Leung PHM, Zhang HY, **Tao XM**, Zhao X*. 2022. A universal biocompatible coating for enhanced lubrication and bacterial inhibition. *Biomaterial Science.* https://doi.org/10.1039/D2BM00598K.
3. S Liu, L Ma, X Ding, KC Wong, **XM Tao***, 2022. Antimicrobial behavior, low-stress mechanical properties, and comfort of knitted fabrics made from poly (hydroxybutyrate-co-hydroxyvalerate)/polylactide acid filaments and cotton yarns, *Textile Research Journal* 92 (1-2), 284-295, https://doi.org/10.1177/00405175211035130
4. Zhang ZH, Li J, Ma LL, Yang XX, Fei B, Leung PHM , **Tao XM***, 2020. Mechanistic study of synergistic antimicrobial effects between poly (3-hydroxybutyrate) oligomer and polyethylene glycol, *Polymers*, 12(11): 2735. https://doi.org/10.3390/polym12112735
5. Ma LL, Zhang ZH, Li J, Yang XX, Fei B, Leung P, **Tao XM***, 2019. A new antimicrobial agent: poly (3-hydroxybutyric acid) oligomer, *Macromolecular Bioscience*, 19(5), 1970014. https://doi.org/10.1002/mabi.201970014
6. Huang XX, **Tao XM*** and Zhang ZH and Chen P, 2017. Properties and performances of fabrics made from bio-based and degradable polyactide acid/poly(hydroxybutyrate-co-hydroxyvalerate) filament yarns, *Textile Research Journal*, 87(20), 2464-2474. https://doi.org/10.1177/0040517516671128

b. Patents:

1. **Tao XM**, Bao Q, 合成的 3-羟基丁酸酯低聚物或寡聚物的分离纯化方法及其在 抗菌抗病毒制品中 的应用, CN 2021104589405, April 27, 2021 6.
2. **Tao XM**, Zhang ZH, Ma LL, Antimicrobial materials based on polylactic acid oligomers, process for preparing the same, and use thereof, US patent application, 63/135,814 filed on January 11, 2021 7.
3. **Tao XM**, Zhang ZH, Ma LL, 一种基于聚乳酸寡聚物的抗菌材料及其制备方法与用途, CN 2021105522065, 20 May 2021. 8.
4. **Tao XM**, Li J. Zhang ZH, Synthesis of novel antibacterial 3-hydroxybutyrate oligomer （一種寡聚 3- 羥基丁酸酯的合成方法及其得到的產品和用途）, CN20181043506.6 9.
5. **Tao XM**, Zhang ZH, Yang XX, 一種具有抗菌作用的生物基材料及用途，A bio-based antibacterial polymer material, CN 20180431508.5. 2018. 10.
6. **Tao XM**, Yang XX, Zhang ZH, Li J, Liu SR, MA LL, Fei B, Leung HM, Bio-based material with antibacterial effect and use thereof, US Patent App. 17/053,702. 11.
7. **Tao XM**, Liu SR, Liang LJ and Huang XX, 一種可生物降解的抗菌針織物, ZL201610541297.1, 1 June 2020. 12.
8. **Tao XM**, Liu SR, Liang LJ and Huang XX, Bio-based Degradable Knitted Fabric with Antibacterial Effect, US10577726B2, March 3, 2020

c. Related research grants:

1. High-efficiency eco-friendly antiviral/antimicrobial materials and their applications in personal protection equipment and hygiene products. ITF/HKRITA, **Tao XM (PC)**, Leung MH, Fei B., 03/12/2021 – 02/12/2023. **HK$ 7,995,813.**
2. Anti-viral and Anti-microbial Durable Disinfectant Coatings for Facemask. ITF/PolyU, **Tao XM (PC)**, 02/07/2020-01/10/2021. **HK$ 1,731,647.**
3. Trial: Intrinsic antimicrobial textiles for reduction of hospital-acquired infections. ITF/HKRITA, **Tao XM (PC)**, Leung MH., 30/12/2020 - 29/03/2022. **HK$ 3,631,184.**
4. Novel bio-based anti-bacterial textiles for healthcare applications. ITF/HKRITA, **Tao XM (PC)**, Leung MH, Guo Xia, Zhou Jinyun, 11/10/2016–10/04/2019. **HK$ 10,255,610.56.**
5. Manufacturing Technology of Green Textiles with High Added Value. ITF/HKRITA, **Tao XM(PC)**, Shang SM, Chen P., Zeng W., Tse CCW., 31/03/2014–30/03/2016. **HK$ 6,615,022.**

4. Impact and Benefits

In the project, our research team of PolyU firstly discovered that textile fabrics made from polylactide acid and Poly(hydroxybutyrate-co-hydroxyvalerate) (PLA/PHBV) blend filaments exhibited wide spectrum antimicrobial effects against S. aureus, K. pneumoniae and C. albicans in 2016. And the team identified and further synthesized the family of the active material (PHAO) that has an excellent wide-spectrum anti-microbial effects against gram-positive, gram-negative bacteria and fungus, as well as anti-viral effects. The research promoted the eco-friendly use of biodegradable antiviral/antimicrobial agents and reduction in heavy metal pollution and toxic threats in antiviral/antimicrobial industry. And the development of antiviral/antimicrobial agents, personal protective equipment and hygiene products could bring great significance to society in terms of public medical, hygiene, and healthcare.

Based on the results of projects completed (ITF/HKRITA- ITSP-Platform Projects: Novel bio-based anti-bacterial textiles for healthcare applications (11/10/2016–10/04/2019), and Manufacturing Technology of Green Textiles with High Added Value (31/03/2014 – 30/03/2016)), Nanjing Bioserica Era Antibacterial Materials Technology Co., Ltd (Jiangsu, China), Joint venture between China and Hong Kong, has purchased the license in April 2020: "Bio-Based Degradable Knitted Fabric with Antibacterial effect", granted in September 2020 (China, ZL 2016 1 0541297.1). The company also has established the special antibacterial brand in Bioserica Era. and produced a series of new antibacterial/antivirus products rolled out in the market now, such as PLA/PHBV (Bioserica) and blend (cotton, wool, viscose and silk) antibacterial yarns (filament and staple), PHBO agents, PLA/PHBV (Bioserica) antibacterial woven and knitted fabrics, PLA/PHBV (Bioserica) antibacterial socks, textile and apparel costume, home textile products, infant products, cosmetics and sanitary supplies.

Based on the results of project completed (ITF, Trial: Anti-viral and Anti-microbial Durable Disinfectant Coatings for Facemask, ITC (SST/040/20GP: 02/07/2020-01/10/2021), Ecolar Technology Limited is established in January 2022 in Hong Kong, obtained the antimicrobial brand BLESSTAR™, and produced various kinds of agents used for PPEs, antimicrobial yarns, public health, hygienic products, home, hotel, and hospital textiles. The company also has purchased the license from PolyU in October 2022: 合成的 3-羟基丁酸酯低聚物或寡聚物的分离纯化方法及其在抗菌抗病毒制品中的应用（China, Patent no. 2021104589405, filed in 27 April 2021）; 一种基于聚乳酸寡聚物的抗菌材料及其制备方法与用途技术 （China, Patent no. 2021105522065, filed in 20 May 2021）; A biodegradable antimicrobial material based on polylactic acid (PLA) oligomers and its applications（USA, Patent no. 17/569,743, filed in 6 Jan 2022）.

From January 2020-now, the company have also established another company, Ecolar Technology (ZHEJIANG) Company Limited, in Zhejiang of China in August 2022. At present, the company has a laboratory of 500 square meters in mainland of China and a pilot plant of 5,000 square meters. The company has completed the pilot test of antiviral and antibacterial stock solution (100 litres per batch). Over the next 12 months, the company will prepare industrial equipment for further mass production (500 L/lot) (in collaboration with chemical companies), optimize the finishing process of textiles and apply it to a variety of products, such as personal protective equipment and hygiene products (in cooperation with public health and hygiene textiles listed companies).

Apart from serving the industry, the project results have dovetailed government policies and brought benefit to the community at large:

Three PSTS projects approved by ITC have been completed:

1. Trial: Green functional underwear for elderly with limited mobility (ITT-037-18TP: 29/03/2019-28/08/2020). The PLA/PHBV fabrics and underwear developed from this project are fully degradable, use less energy in dyeing, save energy and water in cleaning. The results of the project support the government policy of eco-friendly environment.

2. Trial: Anti-viral and Anti-microbial Durable Disinfectant Coatings for Facemask, ITC (SST/040/20GP: 02/07/2020-01/10/2021). The prototypes are trialed successfully in nursing home, it brings large social benefit as follows: The manufacturing technology and prototypes will help the elderly to improve their quality of life by wearing the masks with excellent antimicrobial and anti-virus property.

3. Trial: Intrinsic antimicrobial textiles for reduction of hospital-acquired infections, ITC (ITT/029/19TP: 30/12/2020 - 29/03/2022). The manufacturing technology and prototypes help the hospital and nursing home to reduce hospital-acquired infections to ensure the safety of patients, staff, and visitors in hospitals. Meanwhile, it also helps them to reduce health risks to become sick.

5. References to the Corroboration of Impact and Benefits

Awards:

1. **Silver Award** of Hong Kong Green Innovation Awards: Green Textiles with High Added Value, 2016.
2. **Gold Medal** with Jury's Commendation and **Special Award** by the Scientific Community of Romania in 45th International Exhibition of Inventions of Geneva, 2017.
3. 2018 R&D 100 Award: Bio-based and Degradable Textiles with Multi-Functions and Added Values, **Bronze medal award**, 2018.
4. HKGIA-2019: Title of the entry: New Bio-based Anti-microbial Agent and Textiles for Healthcare Applications, **Certificate of Merit**, 2019 Hong Kong Green Innovations Awards.
5. **1st Runner up** Award of Hang Seng x PolyU Sustainable Future Challenge: Textile & Fashion , project: Green Wide-spectrum Antiviral/Antimicrobial Materials and their Textiles, March 2023.
6. **2nd Runner-up** of the 5th Hong Kong Innovation Day cum Innovation Awards Competition, Project: A novel green wide-spectrum antiviral/antimicrobial material: Polyhydroxyalkanoate (PHA) oligomer, April 2023.
7. **Gold Medal** of the 48th Geneva Inventions: Safe and Eco-friendly Antimicrobial Materials with High Efficiency, April 2023
8. **Gold Medal** of FITMI - Asia International Innovative Invention Award: Safe and Eco-friendly Antimicrobial Materials with High Efficiency, June 2023.

Newsletter and forums:

1. https://www.polyu.edu.hk/itc/en/news/staff-achievements?itceventid=396, Newsletter, **2019-08-08**
2. https://mailchi.mp/27c9f7e7f599/iaf-newsletter-june-1524657?e=a9e82dcbe6, International Apparel Federation Newsletter, **2019-07**
3. New Fibre Vision - Textile Materials Innovation Forum, China International Textile & Yarn Exhibition, "鏗鏘三人行", Prof. Xiaoming TAO, Prof. Jintu Fan and Dr. Lili, **Size of Audience: 4179**, 2020-5-28

Appendix 4: PolyU InnoHub / Entrepreneurship Activities

Date	Event	Partnering Organisation(s)
5 Jul 2022	Startups' Guide - IP Management	
12, 14, 19 Jul 2022	IP Consultation for PolyU Maker Fund Teams	
15 to 16 Jul 2022	Health Future Challenge – Ideation Gala	
16 Jul 2022	PolyU I&T Open Day	
4 Aug 2022	Health Future Challenge Pitching	
13 Aug 2022	Startups' Guide Risk Management & Corporate Governance	
18 Aug 2022	GBA Startup Postdoc Programme- Briefing Session	
25 – 26 Aug 2022	PolyU Orientation Showcase 2022	
30 Aug 2022	POC-22(2) – Briefing Session	
8 Sept 2022	Sustainable Future Challenge – Launching Ceremony	Hang Seng Bank
13 -16 Sept 2022	Accounting & Tax Consultation for PolyU Maker Fund Teams	
21 Sept 2022	Sustainable Future Challenge - Briefing session	
23 Sept 2022	ES Seminar: Build your start-up	
1 Oct 2022	POC-22(2) Bootcamp	
6 Oct 2022	Sustainable Future Challenge – Online Briefing session	
11 Oct 2022	Micro Fund 2022-23 Cohort 1 - Online Briefing Session	
14 Oct 2022	HKAI Lab x PolyU Webinar: AI Technology and Career Opportunities	HKAI Lab
15 Oct 2022	POC -22(2) - Introductory training on" Location and Geospatial Intelligence"	Esri China (Hong Kong)
21 Oct 2022 to 23 Oct 2022	Sustainable Future Challenge Ideation Gala for Tertiary Student Group"	Hang Seng Bank
26 Oct 2022	GDSC: GDSC PolyU Yearly Kickoff Mingle	
1 Nov 2022	Digital Future Challenge – Online Briefing Session	
1 Nov 2022	Micro Fund 2022-23 Cohort 1 - Online Briefing Session	
3 Nov 2022 to 5 Nov 2022	Startup's Guide: Fundraising Bootcamp	
5 Nov 2022	Sustainable Future Challenge – POC bootcamp	
11 Nov 2022 to 13 Nov 2022	Sustainable Future Challenge Ideation Gala for Open Group	Hang Seng Bank
14 Nov 2022	Digital Future Challenge Webinar: How Might We Flip the Climate Change by Blockchain & Data?	Orion Astropreneur Space Academy
12 Nov 2022	Digital Future Challenge - Briefing Session	
24 Nov 2022	GDSC: Robotics? Let's get started with EV3	
8 Dec 2022	Recycling Fund: HK$15 million Cumulative Funding Ceiling per Enterprise	Hong Kong Productivity Council
12 Dec 2022	Joint event InnoX Plus+ @PolyU	Hong Kong X Foundation
20 Dec 2022	Digital Future Challenge Pitching	
3, 9, 16, 30 Jan 2023	PolyU Micro Fund Scheme 2022/23 Cohort 2 - 5-Week Lean Launchpad Programme	
6 Jan – 11 Feb 2023	Hong Kong Techathon 2023	Hong Kong Science & Technology Parks Corporation
10 Jan 2023	GDSC: Simplify & Advance Your Work with ServiceNow	
19 Jan 2023	Startup's Guide: Crowdfunding Strategy	
31 Jan 2023	GDSC: Empower your skills with dashboard	
31 Jan 2023	POC-23(1) Briefing session	

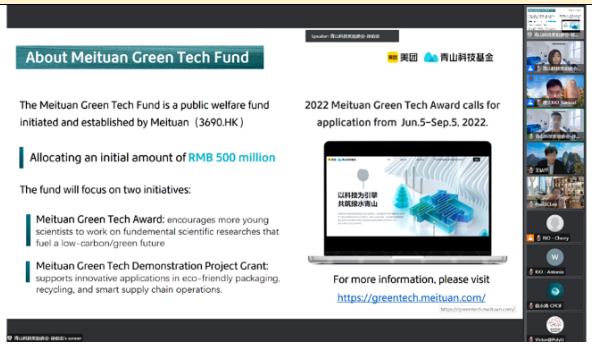
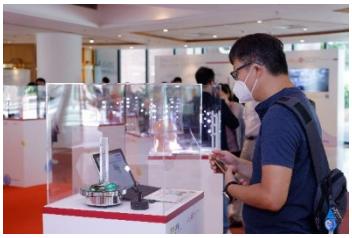
9 Feb 2023	Startup's Guide: Pitching with Impact	
15 Feb 2023	GBA Startup Postdoc Programme – Online Briefing Sessionn	
22 Feb 2023	GDSC: AI/ML Workshop Series #1: A Journey through the AI frontier	
27 Feb 2023	Sustainable Future Challenge Grand Finale Presentation	
1 Mar 2023	PolyU Micro Fund Scheme 2022/23 Cohort 2 – Online Briefing Session	
9, 15, 16 Mar 2023	IP Consultation for PolyU Maker Fund Teams	
11 Mar 2023	POC-23(1) Bootcamp	
24 Mar 2023	PolyU x Hillhouse Innovation & Investment Connect	Hillhouse
28 Mar 2023	HKAI X PolyU GDSC: AI Entrepreneurship and Career Opportunity	HKAI Lab
28 Mar 2023	PolyU Micro Fund Scheme 2022/23 Cohort 2 – Online Briefing Session	
23 Mar 2023	Startup's Guide: Start your Business in China - Setting Up company in China	
30 Mar 2023	Startup's Guide: Start your Business in China - Taxation in HK/China	
13 Apr 2023	Startup's Guide: Navigating Contractual Matters	
21 Apr 2023	GDSC: Let's Get Started with Arduino!	
19,20,21,24,25,26 Apr 2023	Legal Consultation for PolyU Maker Fund Teams	
29 Apr 2023	POC-23(1) training on 'Location and Geospatial Intelligence'	Esri China (Hong Kong)
11 May 2023	Startup's Guide: Building a Strong Brand Identity with Effective Communication Strategies - Unlocking the Power of Branding	
17 May 023	Startup's Guide: Building a Strong Brand Identity with Effective Communication Strategies - Effective Communication Strategies for Connecting with your Audiences	
18, 29 May, 5,12,19 Jun 2023	PolyU Micro Fund Scheme 2022/23 Cohort 2 - 5-Week Lean Launchpad Programme	
23 May to 25 May 2023	Accounting & Tax Consultation for PolyU Maker Fund Teams	
1 Jun 2023	Startup's Guide: Effective Digital Marketing - The Impact of Generative AI on Digital Marketing	
6 Jun 2023	Innohub X IC Tour	Industrial Centre (IC)
8 Jun 2023	Startup's Guide: Effective Digital Marketing - Creating a Digital Marketing Strategy	
8-24 Jun 2023	GDSC: PolyHack 2023	HKSTP, Huawei, Chinachem Group, Deloitte Digital, ServiceNow and RS Grassroots
15 Jun 2023	Startup's Guide: Effective Digital Marketing - Testing and Formulation of Business Ideas with Digital Marketing Tools	
26-28 Jun 2023	IP Consultation for PolyU Maker Fund Teams	
27 Jun 2023	Amplifying Deep-Tech Ventures' Global Edge	Hello Tomorrow Asia Pacific
28 Jun 2023	Good Seed X KTEO networking Dinner	Jockey Club Design Institute for Social Innovation
26-30 Jun 2023	Jumpstarter 2023 – Semi-final at PolyU	Alibaba Entrepreneurs Fund

Appendix 5: Awards Won by PolyU Teams / Start-ups

Name of Competition / Award ***(by alphabetical order)***	**No. of Awards won by PolyU Teams / Start-ups**
Asia International Innovation Invention Exhibition 2023 by Hong Kong Federation of Innovative Technologies and Manufacturing Industries (FITMI)	11
Esri Young Scholars Award 2023	10
Forbes Asia 100 to Watch 2022	3
Hong Kong ICT Awards 2022	6
Hong Kong Innopreneur Awards 2023	1
Hong Kong Techathon 2023	7
Inno Impact 2022	2
Qianhai-Guangdong-Hong Kong-Macao-Taiwan Youth Innovation and Entrepreneurship Competition 2022 (Hong Kong Region, Tertiary Division)	8
TechConnect World Innovation Conference and Expo 2023	2
TERA-Award Smart Energy Innovation Competition 2022	1
The 15th International Convention on Rehabilitation Engineering and Assistive Technology (i-CREATe Award) 2022	9
The 48th International Exhibition of Inventions Geneva	31
The 8th China International College Students' "Internet+" Innovation and Entrepreneurship Competition	6
Total	**97**

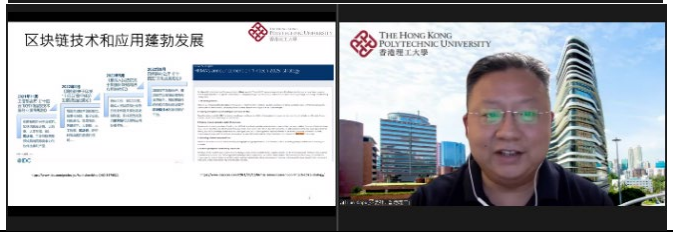
Appendix 6: Marketing, Networking and Engagement Activities

Date	Event	Photos
Jul 2022	**PolyU InnoTech Open Day (Research and Innovation session)** PolyU InnoTech Open Day showcased the latest endeavors in interdisciplinary research, innovation, knowledge transfer, and entrepreneurship for the benefit of Hong Kong, the Nation, and the world. The breakout sessions featured novel and frontier topics related to life science, smart cities, future society, energy technologies, sustainable development for carbon-neutrality, future manufacturing, and artificial intelligence of things together with industrial partners.	
Jul 2022	**PolyVentures InnoTech Showcase** PolyVentures InnoTech Showcase has provided a valuable opportunity for PolyU start-ups to demonstrate their achievements in promoting the adoption of innovative ideas and disruptive technologies. It is a special occasion on which entrepreneurs, business partners, venture capitalists, industrialists, PolyU Court and Council members, researchers and students converged to celebrate the spirit of entrepreneurship. The showcase featured an exhibition of 14 PolyU supported start-ups, a ceremony to show appreciation for PolyVentures' strategic partners, a start-up pitching session, and sharing by PolyU unicorns and students.	 
Jul 2022	**PolyU-APPT（航天六院）Joint Research Centre** PolyU and the Academy of Aerospace Propulsion Technology (AAPT) signed an agreement to establish the "Joint Research Centre of Advanced Aerospace Propulsion Technology". The collaboration aims to develop a highly competitive scientific and technical team in the field of advanced aerospace propulsion technology through a long-term and strategic partnership. It is expected to further contribute to the development of the Nation's aerospace technology.	

Date	Event	Photos
July 2022	**Meituan Green Tech Award Seminar** The Meituan Green Tech Award seminar held in July 2022, introduced the eligibility, application procedures, and assessment mechanism to around 40 PolyU research community members. The award aims to encourage more young scientists to work on fundamental scientific research that fuels a low-carbon and green future.	
Jul – Nov 2022	**Exhibition of President's Awards for Outstanding Achievement in Knowledge Transfer** PolyU set up the President's Awards for KT to recognise and reward staff members on their knowledge transfer endeavors, which are underpinned by research and innovation and have created significant impact on industry and society. The ten individuals or teams that won the President's Awards for Outstanding Achievement in Knowledge Transfer (KT) have made contributions in areas ranging from space exploration, smart energy, smart city, and optometry, to education, transportation, healthcare, and textile and printing technology. The Awards were showcased widely at special campus events, such as PolyU InnoTech Open Day, PolyU Main Entrance Unveiling Ceremony, PolyU Entry Scholarship Award Ceremony 2022 and PolyU 85th Anniversary Celebration Dinner.	   

Date	Event	Photos
Jul – Nov 2022	**Partnership with EMSD** PolyU collaborated with the Electrical and Mechanical Services Department (EMSD), HKSAR, to promote innovation and technology (I&T) by showcasing various PolyU start-ups at their signature events, such as E&M I&T Day 2022, Green I&T Day 2022 and Inno@E&M Open Day, as well as in the E&M InnoZone at the EMSD Headquarters. These start-ups provide innovative I&T solutions in the areas of healthcare and public hygiene, AI and robotics, sustainable construction, and smart and green buildings.	  
Jul 2022 – May 2023	**Partnership with CMA** PolyU and The Chinese Manufacturers' Association of Hong Kong (CMA) signed a memorandum of understanding (MoU) to cultivate more I&T talents and drive the application of PolyU's research outcomes on various industries, so as to facilitate knowledge transfer and industrialisation, contribute to the development of I&T and advanced manufacturing of the city, and promote the brand image of "Made in Hong Kong". The joint activities include a "CMA x PolyU Forum Series", "在商『研』商" 交流會 and "香港・創・新工業" 高峰論壇. These activities provided excellent opportunities for PolyU academics and start-ups to connect with industry players and discuss the use of their inventions and innovations to tackle real-world industry issues and challenges. A visit to various PolyU laboratories has also been arranged for CMA delegations to understand research and development at PolyU.	  

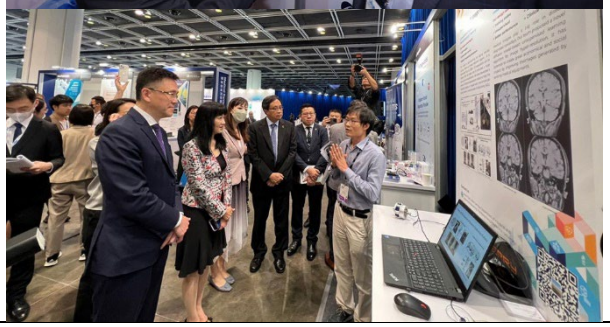
Date	Event	Photos
		
Jul 2022 – Jun 2023	**CEO Club PolyVentures Seminar Series** The CEO PolyVentures Series focused on PolyU research being translated into impact through knowledge transfer and commercialisation. The seminars facilitated an exchange between PolyU start-ups founded by the PolyU community and industry partners, presenting to the audience their innovations such as AI-enabled automated construction management, an AI-based healthcare system, a smart machine vision, a smart 3D machine vision system, vacuum insulated glazing technology, and green functional materials. The audience from different industries was greatly inspired by the seminars and interacted with the speakers to explore collaboration opportunities.	 
Aug 2022	**Academic Symposium on Carbon Neutral and Smart and Healthy City** PolyU held the Academic Symposium on Carbon Neutral and Smart and Healthy City in August 2022, aiming at enhancing research collaboration. Academic exchanges have taken place to establish future research directions and explore innovative solutions for achieving carbon neutrality and building a smart healthy city. The two-day hybrid symposium gathered 33 renowned scientists from 16 universities in Hong Kong and Mainland to share research findings.	 

Date	Event	Photos
Aug 2022	**Launch Ceremony of Innovation Hub@HK Website** The Innovation Hub@HK website (www.innovationhub.hk) provides a platform for Hong Kong' universities and research institutes to showcase their research and development outcomes to facilitate technology transfer and commercialisation for the creation of practical impact. The website provides an effective channel for PolyU to showcase its innovations and connect with potential partners year-round.	
Aug – Oct 2022	**Visits by Industry Delegations** Delegates from the Shanghai Pharmaceuticals Holding Co. (SPH) and the Hong Kong Federation of Innovative Technologies and Manufacturing Industries (FITMI) respectively paid an exchange visit to PolyU and were greeted by the University's Senior Management and research teams. PolyU's medical and AI inventions were showcased respectively during these visits, which significantly deepened the mutual understanding and paved way for future cooperation.	 
Sep 2022	**Jiangsu-Hong Kong InnoTech Webinar** PolyU has participated in and presented the latest research advancement in the areas of Carbon Neutrality and Blockchain Distributed Applications in the webinar. More than 3,600 online and offline attendees from 14 Jiangsu companies have joined the webinar and showed interest in exploring research collaboration opportunities with PolyU.	 

Date	Event	Photos
Sep 2022	**PolyU-CSG Joint Institute for Green and Secure Power Grid** PolyU and China Southern Power Grid Co., Ltd. (CSG) signed an agreement to establish the "Joint Institute for Green and Secure Power Grid". The long-term and in-depth strategic collaboration aims to build a highly competitive and interdisciplinary research team in the fields of green and secure management of power equipment and green and safe power supply for smart cities to foster the development of new power systems.	
Sep 2022	**PolyU-OPPO Joint Innovation Lab** PolyU signed a cooperation agreement with Guangdong OPPO Mobile Telecommunications Corp., Ltd (OPPO) for the establishment of the "PolyU-OPPO Joint Innovation Lab". The laboratory will focus on joint research projects on the topics of AI-driven computational imaging and its chipisation, computer vision, immersive multimedia, and AR/VR technology.	
Sep 2022	**PolyU-Wuxi Technology and Innovation Research Institute** PolyU and the city government of Wuxi, Jiangsu province jointly set up the PolyU-Wuxi Technology and Innovation Research Institute. The new institute will foster I&T collaboration between government, industry, academia, and research institutions through the provision of an advanced research platform, engineering doctorate programme, and incubation support backed by a robust local manufacturing sector.	 

Date	Event	Photos
Oct 2022	**PolyU-NECHK MoU Signing** PolyU signed an MoU with NEC Hong Kong (NECHK) to provide intelligent interactive social robots for older adults and their caregivers. A series of research projects will also be carried out to investigate the effects of using social robots on managing self-care and to encourage older adults' proactive engagement in interpersonal activities to foster a physically and mentally healthy life. The collaboration provides innovative solutions for the ageing population and the ageing-in-place trend.	
Oct 2022	**InnoCarnival 2022** The PolyU pavilion at the nine-day exhibition showcased six innovations from PolyU start-ups, including those led by academics. It covered advanced technologies in the domains of healthcare, materials and education. Visitors from all walks of life gained a better understanding of the contribution made by the PolyU community in driving I&T development in Hong Kong.	
Oct 2022 – Apr 2023	**Tradeshows and Exhibitions** A total of 16 PolyU-nurtured start-ups were showcased in Hong Kong Electronics Fair (Autumn Edition), Entrepreneurship Day, Business of IP Asia Forum (BIP Asia), as well as InnoEx. A wide range of domain areas were covered, which include healthcare, green and sustainability, optometry, AI, robotics, smart 3D machine vision, etc. The promising young companies presented their innovations and technologies to visitors from industry and the general public, and attracted attention from visitors from various sectors.	

Date	Event	Photos
Nov 2022	**PolyU-SenseTime MoU Signing** PolyU and SenseTime signed an MoU for collaboration on research and development related to metaverse technologies and autonomous driving applications aiming to translate their joint research outcomes into applications to improve people's daily lives. The research focuses on metaverse-related imaging technologies and solutions for different applications such as education, art, and tourism; and high-performance collaborative edge computing enabling autonomous driving applications.	
Nov 2022	**SZ-HK Collaborative Innovation Summit** Shenzhen-Hong Kong Collaborative Innovation Summit held in November 2022 with experts and scholars sharing their insights under the theme of "Innovation: Sustainable Development-SZ-HK Collaboration". Representatives of universities, research institutes, and technology companies joined discussions and exchanges physically and online to discuss collaboration for science and technology advancement, exploring and promoting cross-regional technology transfer cooperation, and expanding the development opportunities in the GBA.	
Nov 2022	**PolyU-SHKP MoU Signing** Sun Hung Kai Properties Limited (SHKP) and PolyU signed two framework MoUs, under which the two parties will join hands to conduct research projects on green applications, green building materials, and green construction processes, which aim to explore new opportunities to translate PolyU's research into practical applications to help Hong Kong develop into a smart city. Meanwhile, SHKP has set up a scholarship programme for PolyU students in Real Estate/Engineering related subjects to groom talents for the Hong Kong construction industry.	

Date	Event	Photos
Nov 2022	**PolyU-Chinachem MoU Signing** PolyU and Chinachem Group (Chinachem) signed an MoU to strengthen research collaboration among industry, academia, and research organisations to drive innovative solutions for sustainable development of the Greater Bay Area (GBA). The partnership leverages the combined strengths and experience of PolyU in interdisciplinary research with that of Chinachem in property and community development.	
Nov 2022	**PolyU-Shanghai Pharmaceuticals and Biopharma Evolution MoU Signing** **PolyU, Shanghai Pharmaceutical Holdings Limited (SPH)** and **Biopharma Evolution**, a subsidiary of SPH, signed an MoU to explore academia-industry collaboration on biomedicine research projects in Shanghai and Hong Kong. The partnership creates a synergy among the three entities' innovation strengths and aims to integrate the three institutions' expertise to contribute to the Nation's biomedical research and development.	 
Nov 2022 & May 2023	**Asia Summit on Global Health 2022, 2023** PolyU participated in the Asia Summit on Global Health (ASGH) for two years, showcasing its research expertise in health innovation, healthcare, life sciences, AI innovations, and material application, as well as impactful innovations of InnoHK R&D Centres, to highlight Hong Kong's strengths in the healthcare sector. Prof. Wing-tak Wong and Prof. Kwok-yin Wong also spoke at the thematic sessions of the conference to share their insights.	 

Date	Event	Photos
Dec 2022	**Press Conference for Launch of Nano Multi-rings Defocus Incorporated Lens for Myopia Control** KTEO has organised a press briefing to publicise the successful commercialisation of multi-rings defocus incorporated lens for myopia control in children through PolyU academic-led start-up Vision Science Technology Limited (VST), which collaborated with State Key Laboratory of Ultra-precision Machining Technology (The Hong Kong Polytechnic University) (SKL-UPMT) and PolyU's School of Optometry to create the new solution by integrating DISC technology and Ultra-precision Nano Multi-rings Machining Technology. The press event has generated extensive media coverage, reaching 20M+ people.	 
Dec 2022	**BIOHK 2022** BIOHK2022 is the international biotechnology convention in Hong Kong to introduce novel state-of-the-art biotech innovations, providing an extensive platform to allow pioneers of the biotech industry to convene. PolyU participated in BIOHK2022 to promote its research impact in life sciences.	 
Dec 2022	**The 2nd China Aerospace Dream Hong Kong Knowledge and Essay Competition Award Ceremony** PolyU co-organised the 2nd China Aerospace Dream Hong Kong Knowledge and Essay Competition cum Award Presentation Ceremony in December 2022 to promote space science education and the development of innovation and technology among young people. The ceremony highlighted PolyU's achievements in national space exploration, pursuing scientific excellence and leading innovation in the aerospace field.	

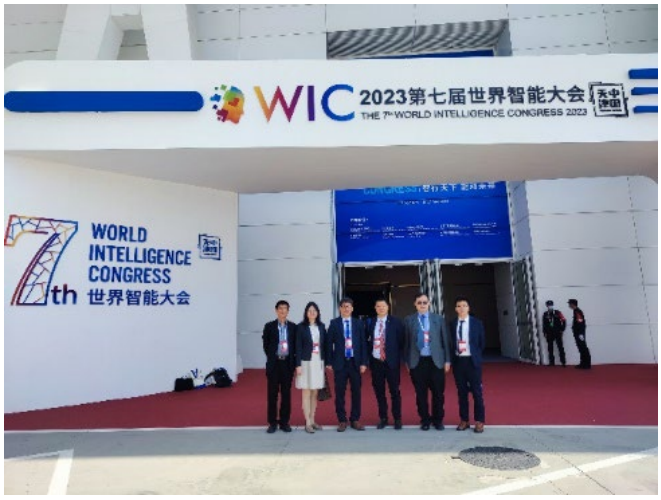
Date	Event	Photos
Dec 2022	**PolyU-Hanson Robotics hosted workshop and inaugurate the Centre for Humanistic Artificial Intelligence and Robotics** PolyU and Hanson Robotics hosted a workshop in September 2022 to introduce the latest human-like robot and discuss how to facilitate more practical research development to cater to the emerging human and technological needs in the marketplace. With the inspiring and fruitful exchange in the workshop, later in December 2022 PolyU and Hanson Robotics signed an MoU to establish the Centre for Humanistic Artificial Intelligence and Robotics (CHAiR) for translational research to advance the well-being of humanity. The partnership integrates PolyU's strength in interdisciplinary research and Hanson's well-known humanoid robotics platform to explore technology applications.	 
Dec 2022	**PolyU and Sinopec Signed Agreement to Award Thesis Excellence** PolyU and China Petrochemical Corporation (Sinopec) signed a collaborative agreement to award students' thesis excellence. Sinopec donated RMB500,000 to award PolyU students for outstanding theses in the 2022-2023 year, which aims to encourage students' creative thinking for innovative solutions and technology. PolyU and Sinopec embark on this agreement to explore further collaborative opportunities and platforms.	
Dec 2022 – Mar 2023	**MoU Signing with Industry Partners** PolyU entered into several strategic partnerships with industry players, which include partnership with GL Ventures, Hong Kong X Foundation (HKXF) and JS Global Lifestyle Company Limited (JS Global). Aiming to nurture innovation and entrepreneurship talents as well as advance the translation of research into impact, these strategic partnerships intensify University-industry collaboration, enhance the I&T ecosystem, and better prepare PolyU innovators to contribute to the I&T development in Hong Kong and the Greater Bay Area. Seminars were held along with two MoU signing ceremonies to discuss specific topics,	

Date	Event	Photos
	opportunities and challenges, connecting academics, innovators, industry partners, entrepreneurs and investors.	 
Jan 2023	**International Symposium on Colour Imaging and Metaverse cum Launching Ceremony of Colour Imaging and Metaverse Research Centre** PolyU co-hosted the International Symposium on Colour Imaging and Metaverse in January 2023, which attracted around 100 researchers and industry professionals from Apple, ByteDance, Huawei etc. Distinguished international speakers shared their works and insights in colour, imaging and metaverse-related technologies from various areas, including product design for better user experience, next-generation display applications, fashion and textiles, human skin colour in the virtual world, etc.	 

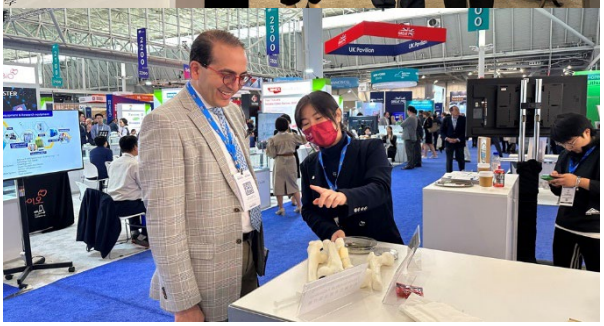
Date	Event	Photos
Feb 2023	**1st Carbon-Strategic Catalysis International Conference cum Inauguration Ceremony of Research Centre** PolyU co-hosted the 1st Carbon-Strategic Catalysis International Conference cum Inauguration Ceremony of the Research Centre for Carbon-Strategic Catalysis in February 2023, which attracted more than 350 scholars, researchers and professionals in-person and online. International renowned scholars joined the conference to share their research and strategic, conceptual and technical insights towards carbon neutrality goals. During the three-day conference, participants had thoughtful discussions on advanced research, promoting interdisciplinary collaborations and innovations.	 
Feb 2023	**PolyU and the city government of Jinjiang signed a framework agreement to drive the establishment of the PolyU-Jinjiang Research Institute** PolyU and the city government of Jinjiang signed a framework agreement in February 2023 to drive the establishment of the PolyU-Jinjiang Research Institute with the aim to strengthen research collaboration among industry, academia and research institutions to foster development along the 21st Century Maritime Silk Road. Meanwhile, PolyU's Policy Research Centre for Innovation and Technology (PReCIT) and the Jinjiang Science and Technology Bureau signed a collaborative agreement in which the two parties collaborate to carry out research projects on leveraging Hong Kong's resources and advantages in innovation and technology in response to Jinjiang's industrial modernisation needs.	

Date	Event	Photos
Mar 2023	**PolyU-COMAC 6th International Innovation Week** PolyU and the Commercial Aircraft Corporation of China, Ltd. (COMAC) co-organised the international innovation week and signed an MoU to collaborate on advancing civil aviation technology. Over 500 experts and scholars from government, academia, research institutions and industry attended the week-long event. They exchanged ideas on basic as well as frontier science and technology in areas such as aviation big data, artificial intelligence and advanced materials.	 
Mar 2023	**PolyU - Qianhai - SIA Strategic Collaboration Framework to Promote Smart Sensor Technology & Research Development** PolyU, Qianhai Authority and the Sensors and IoT Industry Association (SIA) in Qianhai Cooperation Zone signed a strategic collaborative framework agreement in March 2023. By leveraging each other's expertise and specialty in academia, research, and industry, PolyU strives to establish a long-term partnership with the top-notch smart sensor industry through SIA, leading to more industrial collaboration in Qianhai.	
Apr 2023	**Digital Economy Summit 2023** PolyU participated in the Digital Economy Summit (DES), co-hosted by the Government of HKSAR and Cyberport in April 2023 as the only Innovation Research Partner. The hybrid summit was well received by 4000+ online and offline attendees from all over the world. PolyU showcased five impactful technologies and innovations at the DES.	

Date	Event	Photos
Apr 2023	**Jiangsu-Hong Kong Innovation Exchange Seminar (JITRI platform) 2023** PolyU participated in the Jiangsu-Hong Kong Innovation Exchange Forum to facilitate the sharing of scholars from ISE and ME on their research results with Jiangsu industrial partners and gained fruitful exchanges and discussions with Jiangsu partners.	
Apr 2023	**Better Web3 Forum** PolyU and Cybaverse Academy Joint Lab on Law and Web3 co-organised the 1st Better Web3 Forum in April 2023 under the theme of Blockchain-Powered Web3 Ecosystem through Industry-Academic Collaboration. The Forum brought together around 100 participants of renowned international scholars, industry practitioners and Web3 enthusiasts to explore the challenges and opportunities associated with building a decentralised web on secure, private, regulated and emphasised the importance of industry-academia collaboration.	
Apr 2023	**Making Impact with Innovative AI & Robotics Technologies - Dialogue with PolyU Unicorn Hai Robotics' Mr. Fang Bing** Joining hands with Hai Robotics, PolyU launched a cutting-edge Smart Delivery System in its new Artificial Intelligence and Robotics Lab (AIR Lab) at the University's Industrial Centre. The system, including Hai Robotics' Autonomous Case-handling Robot system, aims to strengthen PolyU's robotics education and encourage co-creation and innovation among students and researchers. On the day of the launch, Mr. Fang Bing, Co-founder of Hai Robotics, shared his entrepreneurial experience and had an open discussion on the impact of AI and robotics technologies in the overall I&T advancement.	

Date	Event	Photos
Apr 2023	**48th International Exhibition of Inventions Geneva** PolyU had won a record-breaking number of accolades at the 48th International Exhibition of Inventions Geneva. A total of 28 PolyU innovations garnered 31 prizes, including 3 Grand/Special Prizes – the highest number of prizes PolyU teams ever received at this annual expo. Among the awarded innovations, 12 are driven by PolyU start-ups, including those led by PolyU scholars. As post-event activities, two press events were arranged and a series of advertorials published, which together generated impressive media coverage and publicity.	
May 2023	**PolyU-NVIDIA MoU Signing** PolyU and NVIDIA signed an MoU to establish a joint research centre on cultural and art technology. The collaboration creates a strong synergy by combining the AI expertise of NVIDIA and PolyU's research excellence, leveraging strengths and experience to develop innovative solutions that can benefit the creative industry and foster knowledge transfer on cultural aspects and promote economic benefits in HK and GBA.	
May 2023	**7th World Intelligence Congress (WIC)** PolyU participated in the 7th World Intelligence Congress (WIC) in Tianjin to showcase technology innovations and to join other valuable exchange activities. With the theme of "Intelligence: Extensive Development Space, Sustainable Growth Driver", WIC focused on cutting-edge scientific topics such as generative artificial intelligence (AI), 5G+AI, and smart manufacturing. The three-day event brought together government officials, scientists and entrepreneurs to explore cooperation opportunities.	

Date	Event	Photos
May 2023	**YIRA 2023** PolyU Young Innovative Researcher Award (YIRA) is a university-level award to recognise young faculty members whose researches demonstrate excellence in addressing global challenges. Following the success of its debut in 2022, numerous outstanding submissions from 14 Departments covering all Faculties were received this year. 6 young researchers were selected and a research funding support of HK$500,000 and a personal cash prize of HK$20,000 were given as the encouragement for their research excellence.	
May 2023	**PolyU and Wenzhou government signed an agreement to drive the establishment of a joint technology and innovation research institute** PolyU and the Wenzhou Municipal People's Government have reached an agreement to drive the formation of the PolyU-Wenzhou Technology and Innovation Research Institute, with the aim of promoting Wenzhou to become a key innovation and technology hub for entrepreneurs and talents. Through this innovation platform resulting from government-academia collaboration, both sides will partner in the research of core technologies in various fields including new energy, advanced materials, intelligent wearable devices, maritime engineering equipment, offshore wind power, blockchain, and fashion design.	
Jun 2023	**Asia International Innovation Invention Exhibition 2023 cum Hong Kong Innovative Technologies Achievement Award** The exhibition and award were staged by Hong Kong Federation of Innovative Technologies and Manufacturing Industries (FITMI). PolyU participated in the event with 11 projects, mostly from PolyU start-ups, garnering 11 awards. The awarded PolyU inventions have a wide range of applications, from innovative textile materials and clothing, to human-machine collaborative manufacturing, and environmental health and public hygiene.	

Date	Event	Photos
Jun 2023	**BIO International Convention 2023** PolyU joined as an exhibitor at the BIO International Convention (BIO2023) held in Boston in June 2023 to showcase research expertise in Life Sciences and explore new opportunities for global partnerships. This year's event attracted more than 15,000 attendees from 7,000 companies and 84 countries for a variety of business meetings and conferences. As the only University in Hong Kong exhibiting at this annual largest biotechnology meeting, PolyU showcased its capabilities in drug discovery and development, biomedical engineering, diagnostics, material science etc.	 
Jun 2023	**TechConnect World Innovation Conference and Expo 2023** PolyU, as the only higher education institution in Hong Kong, is the seventh consecutive year to be awarded the prestigious prizes at the TechConnect World Innovation Conference and Expo (TechConnect) which was held in Washington DC in June 2023. Two awarded PolyU innovations are dedicated to bringing significant impact in the areas of Electrical and Biomedical Engineering, tackling the long-term transportation and healthcare industry issues, and paving the way for building a sustainable society. PolyU delegation also showcased a number of innovative projects to meet with technology prospectors for potential collaborations at the TechConnect.	 

Date	Event	Photos
Jun 2023	**PolyU-Jinjiang Technology and Innovation Research Institute** PolyU and the Jinjiang Municipal People's Government signed an MoU in June 2023 to establish the PolyU-Jinjiang Technology and Innovation Research Institute, aiming to strengthen and facilitate research collaboration among industries, academia and research organisations in Hong Kong and Jinjiang. The research institute will leverage PolyU's research strengths and achievements to meet Jinjiang's industrial needs and facilitate the city's industrial transformation.	
Jun 2023	**PolyU-Ningbo Technology and Innovation Research Institute** PolyU and the Eastern Institute of Technology (EIT, tentative) signed an agreement in June 2023 to establish the PolyU-Ningbo Technology and Innovation Research Institute, aiming to strengthen and facilitate research collaboration among industry, academic and research organisations in Hong Kong and Ningbo by providing a platform for joint research projects and knowledge exchange. The institute will leverage PolyU's research strengths and EIT's current development status as a higher education research platform in Ningbo to facilitate in-depth and effective industry-university-research cooperation.	
Jun 2023	**PolyU-Hangzhou Technology and Innovation Research Institute** PolyU and Hangzhou Gongshu Government signed an agreement in June 2023 to establish the PolyU-Hangzhou Technology and Innovation Research Institute, aiming to strengthen and facilitate research collaboration among PolyU and Hangzhou-Gongshu District by providing a platform for joint research projects and knowledge exchange. Research Areas include culture and tourism along the Grand Canal of China, intelligent transport system, and medical & skincare technologies.	

Date	Event	Photos
Jun 2023	**PolyU signed MOU with leading enterprises in Jinjiang to strengthen and facilitate research and technology collaboration** PolyU signed MOUs with 3 leading enterprises in Jinjiang namely, ANTA Sports Products Limited, SinceTech Group and Huaqing Electronic Material (TEM) to strengthen and facilitate research and technology collaboration in various fields, including new textile materials, intelligent wearable systems and microelectronics. Through this collaboration, PolyU aims to unleash the strengths of its researchers and innovative technologies and attract more quality Hong Kong-based innovation and technology (I&T) enterprises and talents to engage in research exchange in Jinjiang.