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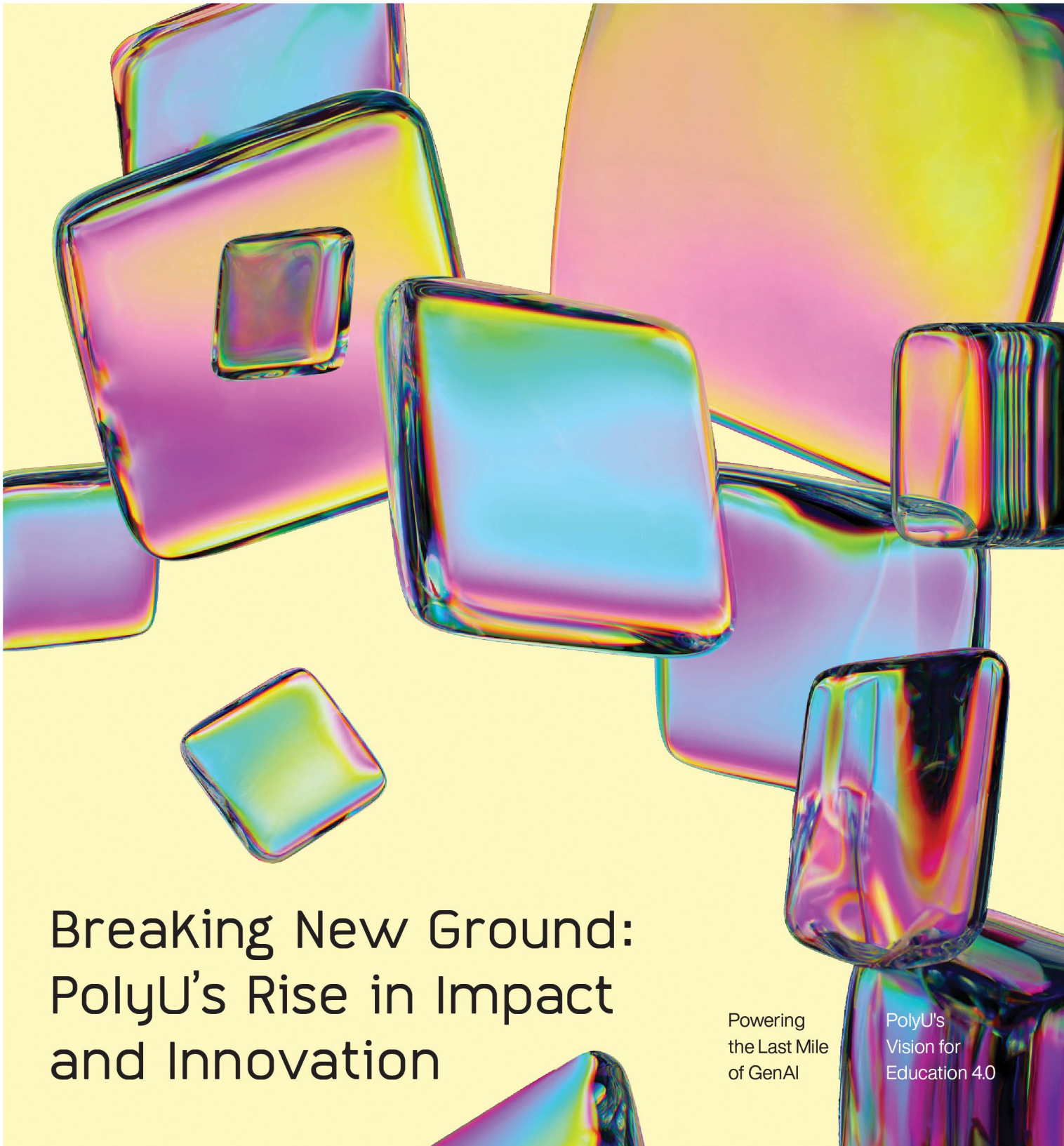

Breaking New Ground: PolyU's Rise in Impact and Innovation

Powering the Last Mile of GenAI

PolyU's Vision for Education 4.0

The Hong Kong Polytechnic University Magazine

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2025 Issue 17

President's Message

Jin-Guang Teng
President
The Hong Kong Polytechnic University

One of our mission statements under our new Strategic Plan for 2025/26–2030/31 is to "pursue world-leading research and innovation for societal benefits". We have already made remarkable progress on this front.

Our research achievements speak for themselves. The total externally secured research funding for PolyU has risen from slightly below HK$500 million in 2019/20 to over HK$1.4 billion in 2024/25—an increase of nearly 190%. Moreover, 428 PolyU scholars are now among the top 2% most-cited scientists worldwide based on single-year or career-long citation impact, according to a 2025 Stanford University index. This positions PolyU second among Hong Kong universities for the number of scholars listed—a clear testament to our growing momentum as a world-class research powerhouse.

In line with our motto, "To learn and to apply, for the benefit of mankind", we want our research excellence to be translated into impact. That is why we have established 12 Mainland Translational Research Institutes and one Mainland Translational Research Centre across cities in the Chinese Mainland. Each of these institutes is dedicated to turning high-impact research and development work into real-world solutions that address local societal and industrial needs.

We are applying a similarly visionary approach to education. To strengthen our leadership in AI-enhanced learning and equip our students with the communication skills to thrive in a globalised world, we are introducing a new compulsory subject, "AI as a Tool for Language Learning", for first-year-first-degree students beginning from the next academic year. We have also launched the PolyU Education 4.0 initiative, aiming to integrate AI and digital technologies into a student-centred approach that fosters innovation, promotes the wider use of AI and educational technologies in learning and teaching, and prepares students for the future.

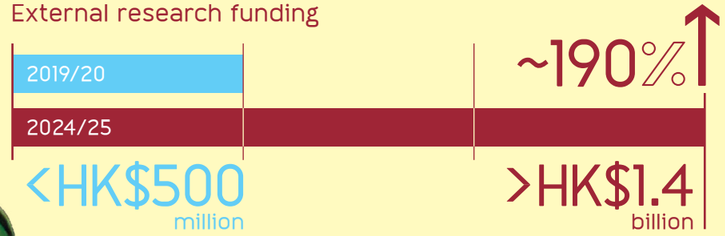
We will keep advancing with vision and determination, addressing the evolving needs of our time and creating lasting value for Hong Kong, the Nation, and the world through excellence in education, research, and innovation.

Breaking New Ground: PolyU's Rise in Research Impact and Innovation

At the forefront of discovery and innovation, The Hong Kong Polytechnic University (PolyU) is leveraging the power of research to create meaningful societal impact. Guided by its mission to achieve "world-leading research and innovation for societal benefits"—as set out in its latest Strategic Plan—PolyU has reached remarkable new heights in recent years, affirming its position as a leader in research and innovation.

One of the most striking indicators of this progress is the University's sustained growth in securing external research funding, which has surged from just under HK$500 million in 2019/20 to more than HK$1.4 billion in 2024/25—increasing nearly by 190% in just five years. Further underscoring this trajectory of excellence, PolyU topped all University Grants Committee (UGC)-funded universities in the Research Grants Council (RGC) Collaborative Research Fund 2024/25, earning both the highest number of grants and the total funding amount awarded.

External research funding



These milestones highlight PolyU's transformation into a world-class research powerhouse. To explore the University's vibrant culture of research excellence, its forward-looking strategies, and its aspirations for the future, we spoke with Professor Christopher Chao, Senior Vice President (Research and Innovation), for an insider perspective.

Attracting top talent for world-leading research

Professor Chao attributes much of PolyU's success in securing funding and driving innovation to its strategic focus on recruiting world-class talent engaged in cutting-edge, frontier research. The University has implemented several targeted initiatives to attract leading academics and researchers. One such initiative is the "Global STEM Professorship Scheme", supported by the Hong Kong Special Administrative Region Government, which enables PolyU to bring internationally renowned scholars to its campus. Additionally, the University's own "Strategic Hiring Scheme" has been instrumental in recruiting exceptional talent, while the "Presidential Young Scholars Scheme" focuses on nurturing promising early-career researchers.

Central to PolyU's recruitment philosophy is a commitment to impact-driven research.

This approach aligns seamlessly with PolyU's motto, "To learn and to apply, for the benefit of mankind". By building a community of researchers and innovators devoted to societal betterment and addressing real-world challenges, PolyU not only wins increased funding but also fosters stronger partnerships with donors and industry stakeholders. These collaborators are drawn to the University's shared vision of driving transformative impact across industries and communities.

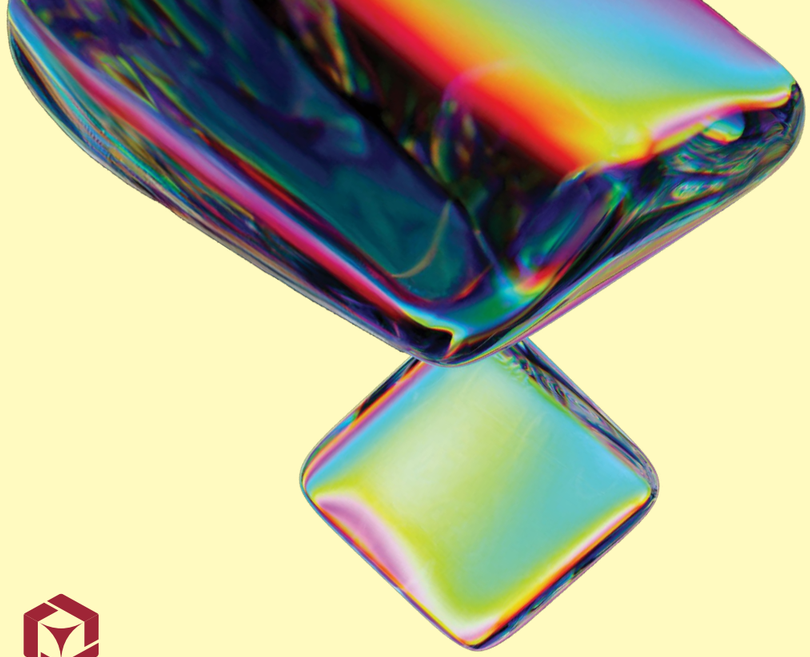
> Our focus has shifted beyond traditional metrics like publication counts. We now prioritise hiring individuals who are dedicated to creating meaningful, lasting change in society.
>
> Professor Christopher Chao

Exploring diverse pathways in research funding

This focus on tangible impact also inspires the University to seek out a wider array of funding opportunities that directly align with specific societal needs, in addition to conventional grants from the RGC or Innovation and Technology Fund (ITF). Notable examples include the Smart Traffic Fund by the Transport Department and the Green Tech Fund by the Environment and Ecology Bureau. Since the inception of both funds in 2021 and 2020 respectively, PolyU has distinguished itself by securing both the highest number of funded projects and the largest total funding among all UGC-funded universities.

In parallel, PolyU empowers its researchers through substantial internal funding, allocating nearly HK$2.5 billion from 2022/23 to 2024/25 to cultivate a robust research ecosystem and drive innovations for the betterment of society. This includes matching schemes that incentivise researchers to pursue external grants, magnifying overall funding impact. Ultimately, PolyU's funding strategy creates a multiplier effect—expanding resources, building confidence, and cultivating a culture of research excellence across the University.

Professor Christopher Chao
- Senior Vice President (Research and Innovation)
- Director of Policy Research Centre for Innovation and Technology
- Chair Professor of Thermal and Environmental Engineering, Department of Building Environment and Energy Engineering and Department of Mechanical Engineering



2020 — PAIR
PolyU Academy for Interdisciplinary Research

2023 — MTRIs
Mainland Translational Research Institutes

2025 — PAAI
PolyU Academy for Artificial Intelligence

Mid 2026 — PARA
PolyU Aerospace Research Academy

Coming soon — Future Technology Academy or Research Institute

Driving knowledge transfer for societal benefits

To further amplify PolyU's research influence and drive knowledge transfer, the University has set up 12 Mainland Translational Research Institutes (MTRIs) in strategic cities across the Chinese Mainland, with several of them already in full operation. Professor Chao explains, "Through these MTRIs, PolyU aligns its research strengths with local industrial and societal needs, enabling translational research that directly fuels each city's economic development." This model establishes a powerful partnership: host cities provide research space, facilities, and funding, while PolyU contributes its world-class expertise, advanced technologies, and exceptional talent to develop impactful solutions for each city.

The MTRIs also play an important role in strengthening PolyU's broader ecosystem of fostering entrepreneurship. For instance, the University's Graduate School is launching a Master of Technology Entrepreneurship in January 2026, designed to empower students to turn innovative ideas into successful ventures and emerge as future leaders in technology-driven entrepreneurship. As part of the programme, students are required to complete a startup project at an MTRI, ensuring a direct connection between academic learning and practical application. Similarly, PolyU's International Future Challenge competition, which inspires young innovators to commercialise innovative technologies, leverages the networks and resources of the MTRIs to accelerate the growth of student-led ventures.

Looking ahead, Professor Chao sees the MTRIs as having the potential to serve as gateways for PolyU's technologies, innovations and start-ups to enter the international market, beyond the Chinese Mainland. By first demonstrating success in the diverse Mainland market via the MTRIs, PolyU can build a strong foundation for its innovations to be embraced internationally. This strategic trajectory amplifies PolyU's global presence while reinforcing Hong Kong's role as a pivotal "super connector" between the Chinese Mainland and the world.

Read more on p.38

Expanding interdisciplinary research excellence

As global challenges grow ever more complex, there is a need for solutions that transcend traditional academic boundaries, incorporating insights from different fields. The PolyU Academy for Interdisciplinary Research (PAIR) provides a vital platform for advancing such solutions. Now well-established, PAIR encompasses 19 research institutes and centres.

Read more on p.14

Building on this foundation, PolyU is establishing new academies, also with an interdisciplinary ethos, to address emerging societal needs. In April 2025, the University launched the PolyU Academy for Artificial Intelligence (PAAI). This new academy positions PolyU at the forefront of AI research and applications, while helping to establish Hong Kong as a global hub for generative AI. PAAI will integrate AI into fields such as medicine, robotics, and smart manufacturing—advancing innovation that directly benefits society.

Read more on p.10

By the end of the 2025/26 academic year, PolyU will also establish the PolyU Aerospace Research Academy (PARA) to coordinate and strengthen its expertise in aerospace research and applications. Looking further ahead, the University plans to launch a Future Technology Academy or Research Institute.

> The core mission of these Academies is to better align, manage and amplify the University's research strengths, fostering interdisciplinary collaboration and greater synergy to address the most pressing societal challenges.
>
> Professor Christopher Chao

Embracing a global vision

When asked how PolyU can sustain its competitive edge in research and innovation among the world's leading universities in the years ahead, Professor Chao offers a compelling vision: "We must adopt a truly global outlook. This means staying attuned to worldwide developments and leveraging our technologies and solutions to address pressing global challenges. PolyU must position itself as a pivotal player in tackling emerging global trends." He highlights the United Nations Sustainable Development Goals as a key framework, embodying the universal challenges and trends that PolyU is committed to addressing through impactful research.

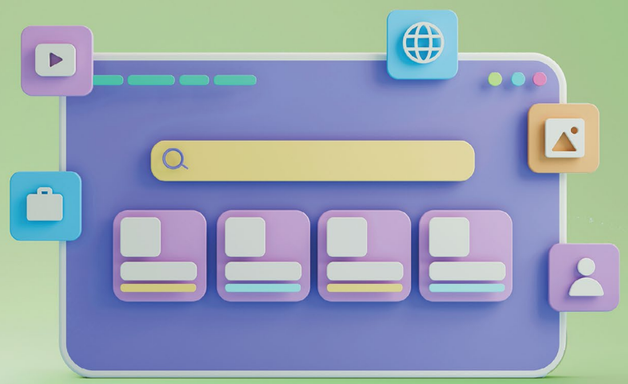
Additionally, PolyU will aim to attract more international students, including PhD students, by enhancing its outreach efforts in overseas countries and markets to recruit outstanding non-local candidates. "By welcoming more students from different regions of the world, we will enrich our University community with a wealth of different perspectives and wisdom. This diversity will help fuel creativity, drive innovation, and spark breakthrough research ideas," Professor Chao suggests.

Lastly, PolyU will strategically forge and expand joint collaborations with world-renowned universities and leading global enterprises, creating powerful synergies that amplify the reach and real-world impact of its research and knowledge transfer initiatives on a truly international scale.

Hence, as PolyU looks to the future, its bold strategies, global vision, interdisciplinary research culture, and steadfast commitment to societal impact set the stage for continued growth and influence in the higher education research and innovation landscape.

Reimagine Education: PolyU's Vision for Education 4.0 in the AI Era

Prompt Student A: Logic, Maths, Engineering



Prompt Student B: Culture, Humanity

Prompt Student C: Creativity, Strategy

As the world enters a new era shaped by artificial intelligence, The Hong Kong Polytechnic University (PolyU) is taking a step to transform learning and teaching. Under the leadership of Professor Cao Jiannong, newly appointed Vice President (Education) in September 2025, PolyU is advancing towards Education 4.0—an AI-empowered, student-centred model that underscores the University's pedagogical attempt and reinforces its standing as a world-class innovative institution.

> Every student is different. Their levels, backgrounds, and learning preferences vary significantly. The future of education lies in personalised and self-directed learning.
>
> Professor Cao Jiannong

From traditional classrooms to AI-powered personalised learning

For decades, education has largely followed a uniform approach—teachers decide what and how students learn. PolyU's vision for Education 4.0 represents a shift towards empowering students to take ownership of their learning.

In this new model, students will design their own learning pathways, supported by AI and new pedagogy. The idea is to develop and leverage on PolyU's AI and digital platforms to gather data to understand students' progress, guide and match resources to their individual needs. With AI-backed support, the University aims to foster independent, self-motivated learners who are future-ready—equipped with creativity, adaptability, problem-solving, and collaboration skills to face a rapidly changing world.

Building the foundations for digital and AI transformation

The transformation relies on a strong digital backbone. PolyU has set its sight on establishing a Digital Education Data Hub to unify teaching processes and consolidate data across departments, enabling intelligent and timely decision-making. This builds on earlier experience from Professor Cao's time as Dean of the Graduate School, where he developed a one-stop, data-driven admission system with AI evaluation to improve efficiency and transparency.
At the institutional level, this digital foundation will support the establishment of an integrated, data-informed educational ecosystem. The ultimate goal is data-driven management and teaching that ensures quality assurance and continuous improvement across all aspects of education.

Introducing PolyU's Education 4.0 initiative

In parallel with Industry 4.0's smart tech-driven demands, Education 4.0 transforms education to cultivate a new set of talents. It marks the next stage of learning and teaching. Where previous eras—from printed materials to electronic communication to internet-enabled multimedia—remains largely teacher-centred, Education 4.0 puts the student at the core. An AI-empowered learning environment aims to provide a personalised, interactive, and flexible education. Students engage in active learning through discussion, exploration, and application, while teachers evolve into advisors and facilitators who mentor students, guide them through resources, and inspire critical thinking.

Fostering educational innovation through IHERD

PolyU's Institute for Higher Education Research and Development (IHERD), established two years ago, anchors the University's transformation as a hub for innovation, research, and collaboration. It comprises various units. The Digital Transformation Unit takes on initiatives that strive to advance campus-wide digital adoption and unified data systems for academic and administrative support. The Educational Research Centre leads studies on emerging teaching technologies and AI in education, spanning AI teaching assistants, curriculum reforms, policy, and ethics. The Education Development Centre focuses on teacher training and pedagogy innovation, enabling disciplinary experts to leverage AI to enhance teaching.

To accelerate education research, PolyU also established an Education Innovation Committee to support large-scale, theme-based projects. The University will invest in AI-powered learning tools, teaching methodology reform, teacher development and empowerment, student-centred curriculum design, and student wellbeing. Education research at PolyU targets to bring together AI, smart technology, education psychology, and pedagogy to drive meaningful impact.

A bold start: AI as a tool for learning

Among the University's most innovative projects is a comprehensive reform of language education. Starting in 2026/27, PolyU will launch a compulsory, 3-credit course for all first-year-first-degree students on the use of AI as a tool for language learning, which shifts the focus from placement to empowerment. The course teaches all students to use AI strategically to enhance proficiency in English and Chinese and to manage workplace communication confidently and responsibly.

This foundation course marks a change in learning: instead of relying solely on instruction, they will use AI tools to drive their own progress. After completing it, students can select from a suite of elective language modules, gaining greater flexibility and autonomy. To support this approach, PolyU is developing an "AI-powered competency assessment system". Students will be able to take AI-assisted tests multiple times, receive feedback, and be guided their growth. The model rewards progress and mastery rather than merely achievement, and results will be reflected on transcripts.

This pilot may pave the way to similar AI-empowered learning across disciplines—from AI as a tool for marketing to AI as a tool for engineering and science—broadening the University's reach in AI-enabled pedagogy.

Enriching student skills through AI-driven applications

Beyond course design, PolyU is building practical AI applications that strengthen students' professional and interpersonal capabilities, for example, an AI debate platform that helps students enhance communication and critical thinking through interactive, AI-generated debates. A job interview simulation tool can use AI to provide tailored feedback, boosting students' confidence and readiness for real-world employment. These tools in the pipeline aim to make learning more interactive and reflective, enabling students to learn by doing and receive immediate, actionable insights.

Engaging partners for global educational transformation

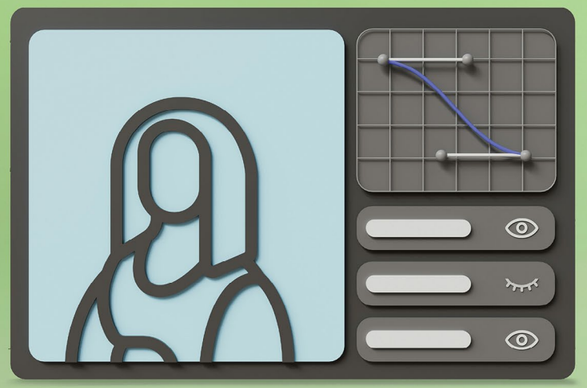
To accelerate progress and foster knowledge exchange, PolyU is establishing an Education Transformation Consortium that brings together leading universities from China and around the world. Invitations have been extended to institutions such as Xi'an Jiaotong University, Zhejiang University, Fudan University, and Tongji University in the Chinese Mainland, as well as internationally recognised universities including those in Finland, renowned for educational innovation. The Consortium will serve as a platform to co-create best practices, share research, and drive forward AI-enhanced education globally. This will also help reinforce Hong Kong's status as a hub for innovation and technology.

Empowering future-ready graduates

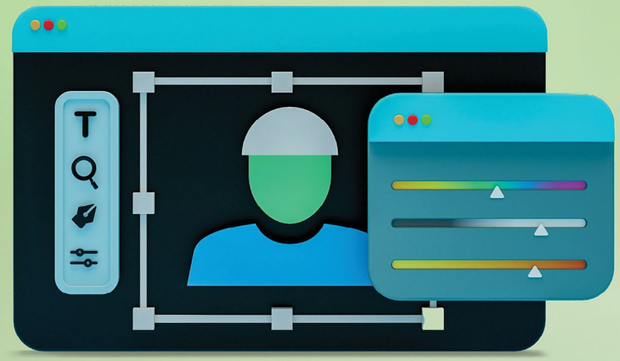
Ultimately, PolyU aims to redefine higher education through AI and digital transformation, nurturing graduates who are not just knowledgeable but adaptable, innovative, and capable of lifelong learning. Through Education 4.0, IHERD, and AI-enabled learning tools, the University is building an ecosystem that empowers both students and teachers to grow, innovate, and lead in an AI-driven future.

Professor Cao Jiannong
- Vice President (Education)
- Otto Poon Charitable Foundation Professor in Data Science
- Chair Professor of Distributed and Mobile Computing, Department of Computing
- Director of the Institute for Higher Education Research and Development

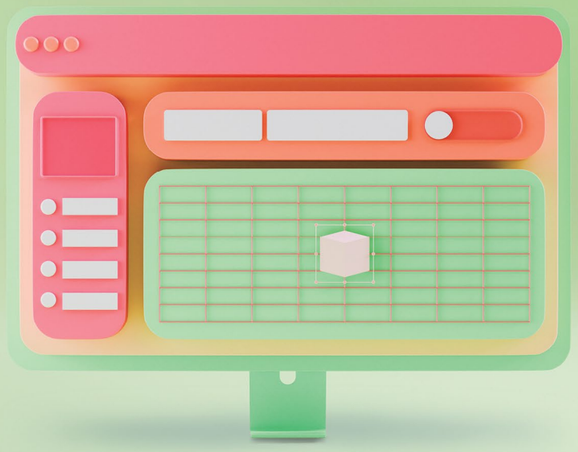
> Education must evolve with the times.
>
> Professor Cao Jiannong



Prompt Student D: Tourism, History



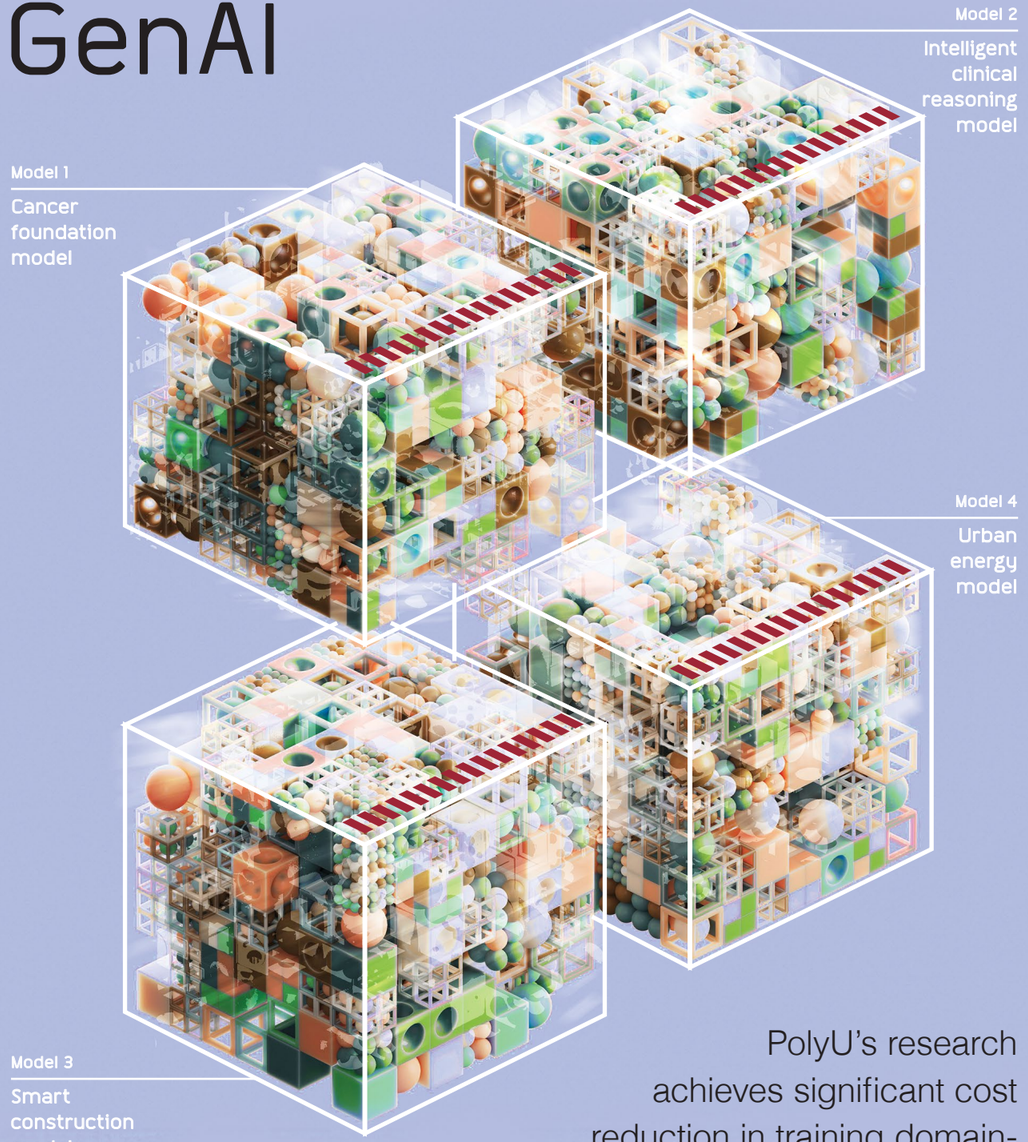
Prompt Student E: Design, Arts



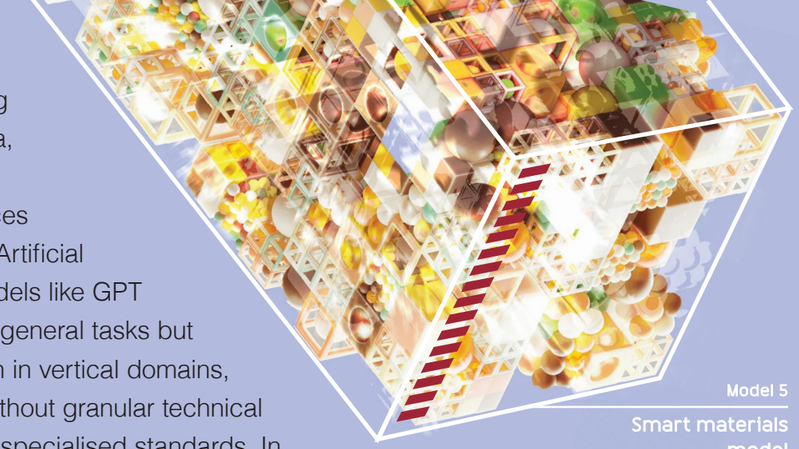
Prompt Student F: Healthcare, Medicine

> By embracing AI and digital transformation, we are not replacing the human element of teaching—we are enhancing it. We are giving both teachers and students new power to learn, to create, and to thrive.
>
> Professor Cao Jiannong

Powering the Last Mile of GenAI



PolyU's research achieves significant cost reduction in training domain-specific GenAI, democratising AI development and paving the way for Artificial General Intelligence (AGI)



AI is rapidly transforming industries and academia, yet its integration into specialised domains faces challenges. Generative Artificial Intelligence (GenAI) models like GPT and DeepSeek excel at general tasks but lack consistent precision in vertical domains, producing responses without granular technical depth or alignment with specialised standards. In highly specialised scenarios such as healthcare, such models still struggle to achieve reliable accuracy levels.

On the other hand, domain experts, such as university researchers and professional practitioners, struggle with limited computing resources to train models at scale for their fields. Fragmented data, privacy, and copyright restrictions pose further hurdles.

Professor Yang Hongxia, Executive Director of the PolyU Academy for Artificial Intelligence (PAAI), led a research team to discover a novel approach to training and building highly robust, decentralised GenAI models for individual domains at extremely low cost. The team also open-sourced the training framework, enabling more contributors to add domain knowledge.

Decentralising and merging

"Domain experts possess numerous high-quality, domain-specific data, which the major AI players such as OpenAI will not find on the Internet," Professor Yang said. "PAAI was established to iron out the hurdles for universities and professional organisations such as hospitals and financial enterprises to make full use of their proprietary data to harness AI for knowledge discovery and effective applications."

Professor Yang's breakthrough introduces a two-pronged innovation. The decentralised Collaborative Generative Artificial Intelligence (Co-GenAI) platform developed by her team uses low-bit training to significantly reduce the computational resources required for training domain-specific models without compromising performance, creating favourable conditions for the development of small, specialised models.

Furthermore, Professor Yang's team uses a model fusion technique to merge domain-specific models, so that the model can obtain new domain-specific knowledge at a very low cost while retaining existing knowledge. It is proved that this innovative collaborative training method can efficiently merge multiple models and form a comprehensive domain-specific GenAI model without relying on centralised computing resources. Under a "co-build models, keep data local" paradigm, their innovation, supporting cross-institution, cross-disciplinary collaboration, has proved to surpass state-of-the-art models across 11 widely adopted benchmarks in reasoning, coding, mathematics, and instruction-following. By dramatically reducing reliance on high-end Graphic Processing Unit (GPU) clusters, the team has opened the door for domain experts to actively participate in the training process and shape GenAI innovation.

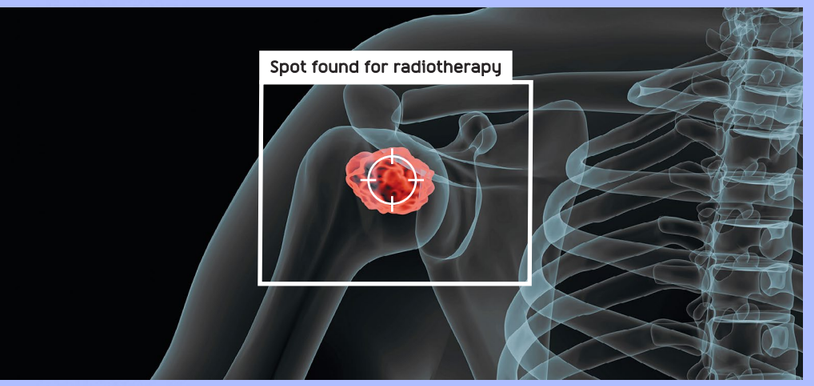
> Ultra-low-resource foundation model training, combined with efficient model fusion, enables academic researchers worldwide to advance GenAI research through collaborative innovation.
>
> Professor Yang Hongxia

Delving deeper

Training a GenAI model typically involves pretraining and post-training phases. Pretraining is the foundational stage where the model learns general patterns, language structures, and world knowledge from extensive, unlabelled datasets, requiring significant computational resources. This equips the model with broad capabilities, which are then refined through fine-tuning on smaller, task-specific datasets for applications like chatbots or translation. Post-training occurs after pretraining, focusing on further enhancing the model's performance, safety, and alignment with user expectations. Techniques such as supervised fine-tuning, preference alignment and reinforcement learning help ensure the model's outputs are accurate, reliable, and ethically sound.

Centralised training of GenAI models typically demands millions of GPU hours—a level of computational power accessible only to a handful of organisations. In contrast, Professor Yang's Co-GenAI platform enables the training of local models using ultra-low resources. While most centralised models rely on floating point (FP) 16 precision, her team has pioneered an FP8 training pipeline that spans both continual pre-training and post-training stages. This approach reduces computing time by 22%, while maintaining model performance. By using this cutting-edge technique, PAAI places PolyU among the few institutions globally capable of mastering such an innovation.

Complementing this breakthrough is the team's model fusion strategy, which transfers knowledge from multiple source models into a single pivot model simultaneously. Using just 160 GPU hours, the team successfully merged four state-of-the-art models—including Qwen-2.5-14B-Instruct and Phi-4—avoiding the need for million-scale training budgets. The resulting fused models consistently outperform their original counterparts across key benchmarks, achieving superior performance with a fraction of the computational cost.



> We are dealing with an immense quantity of medical data, including not only texts but also images and videos. If we can tackle cancer, other medical problems will not be too difficult.
>
> Professor Yang Hongxia

Applications in the medical domain

PAAI has already kicked off its support for medical-related research. It is achieving this goal in collaboration with leading hospitals, including Queen Elizabeth Hospital and Sun Yat-sen University Cancer Center, in developing a cancer foundation model.

Among the many tasks enabled by the cancer foundation model is the identification of target areas for radiotherapy. It is expected that Professor Yang's model can save two-thirds of a medical doctor's time spent on a case. With the decentralisation strategy, Professor Yang envisions the development of a powerful and reliable GenAI model for the medical sector at a low cost, while ensuring the protection of medical data and patients' privacy.

PolyU plans to employ the Co-GenAI platform to further foster collaborative research and applications of GenAI across diverse fields, including urban energy, business transformation, smart manufacturing, robotics, intelligent clinical reasoning, grid modernisation, smart construction and smart materials.

"We open-source the training platform, with a long-term mission of making GenAI accessible to all. This will enhance intelligence across society and ensure its benefits are widely shared," Professor Yang said.

> Our team is committed to bridging the final mile in deploying large AI models, enabling businesses, hospitals, and government agencies to effectively leverage AI in real-world scenarios. Integrating domain-specific data and expertise into these models is key to their successful adoption.
>
> Professor Yang Hongxia

Professor Yang cited two examples of mature project ideas. "One is an integrated training and inference system. It deeply integrates domestic computing platforms with ultra-low-resource algorithms, achieving collaborative hardware-software design to build an all-in-one system supporting both local training and inference services. The other is the establishment of a full-process community platform for GenAI. Empowered by blockchain-based collaboration and transparent incentive mechanisms, this platform will work with developers worldwide to advance GenAI and jointly build globally collaborative, high-quality foundational models."

Contributing to AGI

Professor Yang is also excited about PAAI's readiness in laying a promising architectural step towards Artificial General Intelligence (AGI). AGI is a hypothetical future concept for an AI system that possesses human-like cognitive abilities across all domains. It is general-purpose and all-encompassing, aiming to match or surpass human intelligence.

It is widely believed that the Scaling Laws are key to achieving AGI. According to Scaling Laws for models, increasing model parameters, dataset size, and computational power leads to more advanced intelligence and complex cognitive capabilities. However, as models grow larger, concerns have emerged about diminishing returns and plateauing performance. Compounding this challenge is the scarcity of high-quality data for continued training.

In the past, merging multiple models into one was often based on empirical experience, and its effectiveness was difficult to predict. The concept of model merging—strongly advocated by the AI startup Thinking Machines Lab founded by Mira Murati, former CTO of OpenAI, together with several former management team members of OpenAI—has now been theoretically demonstrated for the first time by Professor Yang's research team. Through rigorous mathematical derivation, the team proposed the Model Merging Scaling Laws, suggesting that there may be another possible path toward AGI via decentralised AI.

> We are very excited about the potential of achieving AGI through decentralisation and model merging.
>
> PolyU is poised to provide the infrastructure to contribute to not only the scientific discovery in academia, but also the primary global goal for AGI.
>
> Professor Yang Hongxia

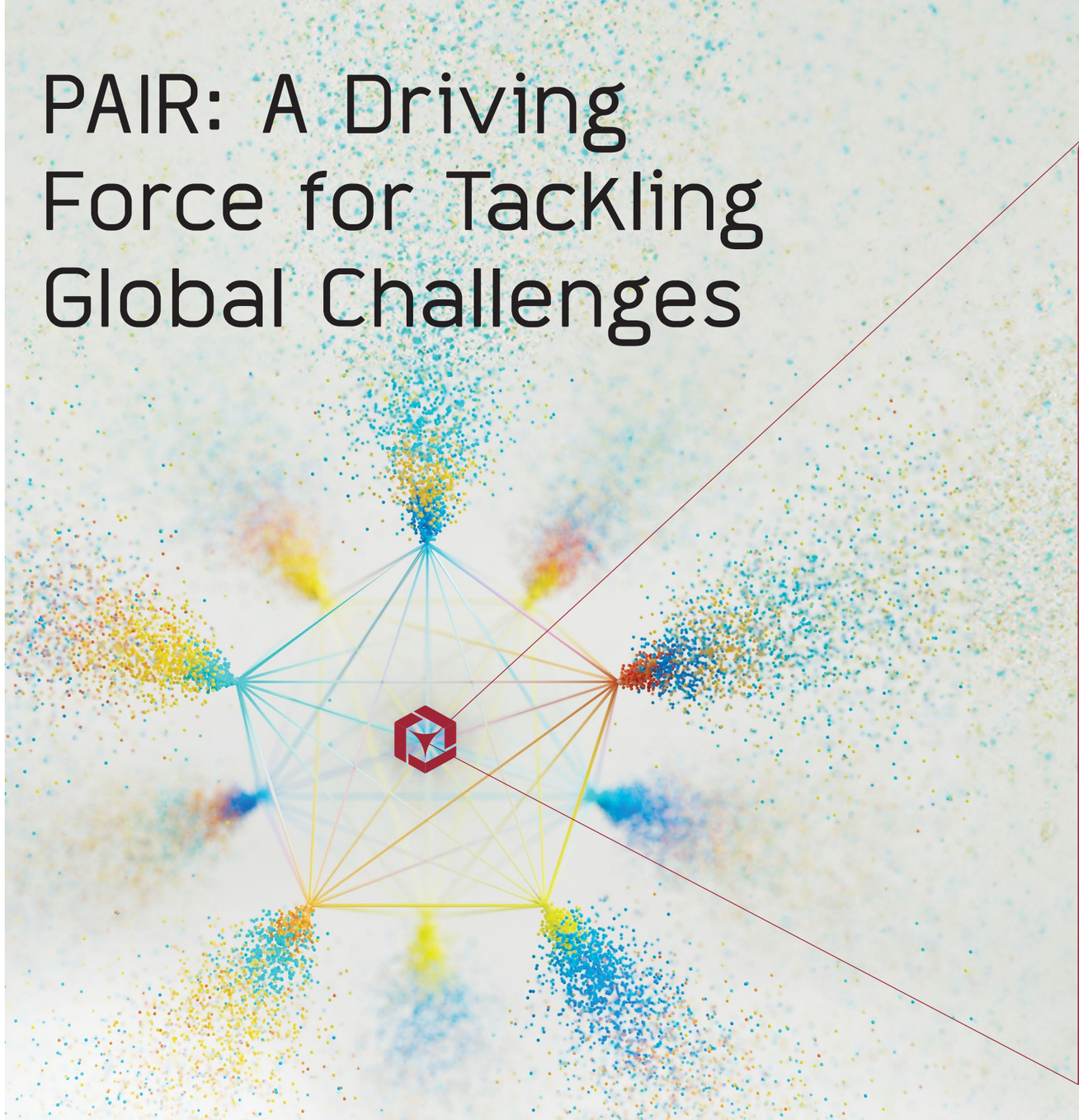
Professor Yang Hongxia

- Executive Director of PolyU Academy for Artificial Intelligence
- Associate Dean (Global Engagement), Faculty of Computer and Mathematical Sciences
- Professor, Department of Computing
- Director of University Research Facility in Big Data Analytics

Prior to joining PolyU in July 2024, Professor Yang Hongxia served as Head of Large Language Models in the US at ByteDance, AI Scientist and Director at Alibaba Group, Principal Data Scientist at Yahoo! Inc., and Research Staff Member at the IBM T.J. Watson Research Center. Notably, she founded the foundation model teams at both Alibaba and ByteDance, establishing herself as a pioneer in Generative AI.

Professor Yang's research in GenAI has gained support from industry partners such as Hong Kong Science and Technology Park, Alibaba, and Huashan Hospital affiliated to Fudan University. Her projects have received the funding support of the Theme-based Research Scheme 2025/26 under the Research Grants Council; the Research, Academic and Industry Sectors One-plus Scheme under the Innovation and Technology Commission of the Government of the Hong Kong Special Administrative Region of the People's Republic of China; and the Artificial Intelligence Subsidy Scheme under Cyberport.

PAIR: A Driving Force for Tackling Global Challenges



We live in an era defined by challenges that are global in scope, complex in nature, and profound in their impact—from climate change and widening inequality to food and energy insecurity, global health threats, rapid urbanisation, and the disruptive power of new technologies. These are not problems that can be solved in isolation or confined within the boundaries of a single discipline. They demand new ways of thinking—bold, collaborative approaches that bring together diverse fields of knowledge.

The PolyU Academy for Interdisciplinary Research (PAIR)

12 Research Institutes on

- Advanced Manufacturing
- Artificial Intelligence of Things
- Future Food
- Intelligent Wearable Systems
- Land and Space
- Photonics
- Quantum Technology
- Smart Ageing
- Smart Cities
- Smart Energy
- Sports Science and Technology
- Sustainable Urban Development

7 Research Centres on

- Chinese Medicine Innovation
- Deep Space Explorations
- Digital Transformation of Tourism
- Mental Health
- Resources Engineering towards Carbon Neutrality
- SHARP Vision
- Textiles for Future Fashion

The PolyU Academy for Interdisciplinary Research (PAIR) was officially inaugurated in 2022 to meet precisely this need. As a dynamic platform for cutting-edge, boundary-crossing research, PAIR unites experts from across disciplines to focus on issues of socioeconomic importance—from advanced technologies and manufacturing, good health and well-being, to smart and sustainable cities.

To explore PAIR's achievements, strategies, and future vision, we spoke with its Director, Professor Chen Qingyan.

Professor Chen Qingyan
- Director of PolyU Academy for Interdisciplinary Research
- Chair Professor of Thermal Building Science, Department of Building Environment and Energy Engineering

> PAIR is not just about generating knowledge for its own sake.

> Our vision is closely aligned with PolyU's strategic direction to create societal impact on a global scale. By harnessing the University's world-class strengths in science, technology, and engineering, we are committed to driving innovations that improve lives, enhance industries, and pave the way to a brighter future.

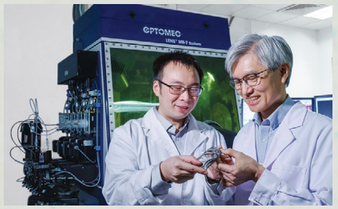
Professor Chen Qingyan

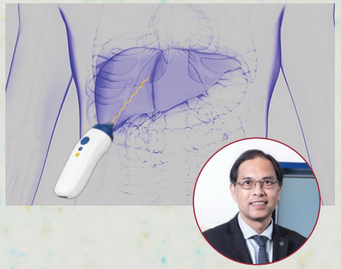
Breakthrough research for societal impact

What follows is a series of pioneering projects by PAIR researchers, reflecting the Academy's diversity of expertise and commitment to addressing pressing societal challenges.

Stronger, More Sustainable Materials: 3D-printed Titanium Alloys

Professor Keith Chan (photo, right), Associate Director of PAIR's Research Institute for Advanced Manufacturing (RIAM) and Chair Professor of Manufacturing Engineering at the Department of Industrial and Systems Engineering (ISE), together with Professor Chen Zibin (photo, left), a member of RIAM and Assistant Professor at ISE, is working in partnership with RMIT University and the University of Sydney, to develop a novel high-strength, ductile, and sustainable titanium alloy (α–β Ti-O-Fe) using 3D printing techniques. This breakthrough alloy holds enormous promise for applications as diverse as aerospace, marine engineering, consumer electronics, and biomedical devices. Beyond its versatility, it offers distinct advantages—lower production costs, enhanced performance, and sustainable waste management.





Fatty Liver Detection Device: Assessment in Just 30 Seconds

A startup co-founded by Professor Zheng Yongping, Director of PAIR's Research Institute for Smart Ageing, Henry G. Leong Professor in Biomedical Engineering, and Chair Professor of Biomedical Engineering, Department of Biomedical Engineering, has recently launched the world's first lightweight intelligent fatty liver detection device—FattaLab®. Weighing only 140 grams, this palm-sized portable device can complete fatty liver assessment within 30 seconds along with the use of a mobile app, with a detection accuracy at medical-grade standards. This device marks a technological breakthrough from "estimation" to "diagnosis level" for fatty liver point-of-care assessment, enabling timely intervention in community settings to improve health outcomes.

Intelligent Clothing that Outperforms the Heat

Professor Shou Dahua, Associate Director of the Research Centre of Textiles for Future Fashion, a member of the Research Institute for Intelligent Wearable Systems and the Research Institute for Sports Science and Technology, Limin Endowed Young Scholar in Advanced Textiles Technologies, and Associate Professor of the School of Fashion and Textiles, and his team have developed a first-of-its-kind thermally insulated and breathable soft robotic clothing that can automatically adapt to changing ambient temperatures, helping to ensure worker safety in hot environments. Professor Shou has also developed the award-winning iActive™, an intelligent, electrically activated sportswear with a nature-inspired active perspiration function, which reduces the weight and stickiness caused by sweat accumulation during exercise, enhancing athletic performance.

These are just a few examples of PAIR's groundbreaking research. Other bold initiatives being undertaken by PAIR researchers include the creation of sustainable and smart floating farms to strengthen food security, innovative lenses to slow the progression of myopia, low-fat ice cream that tastes as good as regular ice cream, and sophisticated space instruments capable of collecting lunar soil using robotic arms—all part of PAIR's mission to deliver research that genuinely matters for people, industry, and the world.

Shaping minds: the advanced education programme

This academic year marks a milestone for PAIR, as the Academy extends its reach beyond cutting-edge research into education with the launch of the Advanced Education Programme (AEP). Designed to equip students with up-to-date insights into the world's most pressing challenges, AEP blends academic depth with real-world relevance. Delivered in a flexible hybrid format (online and in person), the programme harnesses the expertise of PAIR's leading research units and top scholars.

The inaugural course, Healthy Life and Smart Living, has been successfully launched, offering students a holistic understanding of how to live well in a rapidly changing world. Looking ahead, upcoming courses will address Sustainable Cities and Advanced Technologies, further broadening the scope to cover themes that define our collective future.

> The purpose of AEP is to give students a comprehensive, end-to-end perspective on issues of profound relevance to their lives—from the science of healthy living to the transformative power of advanced technologies.
>
> Through AEP, we not only enrich student learning but also reinforce PolyU's global reputation as a university engaged with the big issues shaping society and everyday life.
>
> Professor Chen Qingyan

Accessible to all, AEP is offered free of charge, with a certificate of completion available at a small fee for those who wish to formally credential their learning.

A hub of world-class talent

One of PAIR's greatest strengths lies in its community of world-leading scholars, each an expert in their domain. By uniting these exceptional minds under a shared interdisciplinary mission, PAIR not only accelerates groundbreaking research but also serves as a powerful magnet for attracting more renowned academics to PolyU by providing them with a platform to push the boundaries of knowledge.

PAIR also offers seed funding to its academics undertaking interdisciplinary research projects that demonstrate potential for securing funding from external sources, growing and scaling up into larger initiatives that make a real impact.

Professor Chen emphasises the importance of this model in nurturing the next generation of researchers and innovators.

> Younger talents have the chance to work under the guidance of seasoned scholars and Chair Professors on projects supported by substantial external funding.
>
> Through mentorship, they learn how to develop compelling proposals that win major grants, preparing them to become leading research talents of the future.
>
> Professor Chen Qingyan

Beyond fostering a community of leading academics at PolyU, PAIR also engages in collaboration and knowledge exchange with top scholars outside the University. A prime example is the "PAIR Distinguished Lecture Series", which brings visionary thinkers from around the world—including Nobel Laureates and Academicians—to PolyU to share their insights. These lectures not only inspire and educate the PolyU community but also open doors to potential collaboration opportunities. Recent speakers have included distinguished scholars from the University of Cambridge, Tsinghua University, Princeton University, Northwestern University, and other leading institutions—further establishing PolyU as a vibrant hub for the world's leading scholars.

What's next for PAIR

In terms of the future, Professor Chen envisions PAIR forging new frontiers in addressing some of the world's most urgent challenges. There are plans to establish a research institute on microbiology—an area of growing global importance in the face of infectious diseases such as COVID-19, earlier epidemics like swine flu and SARS, the threat of antimicrobial resistance, and other urgent public health concerns. Recently, the University has approved the establishment of the Research Centre for Environmental, Social and Governance Advancement, underscoring the critical role of policy in shaping a sustainable future.

With its world-class talent, strategic focus, and unwavering commitment to impact, PAIR is poised to continue shaping impactful solutions that matter for communities, industries, and humanity at large.

The Making of a Designer: Key Inspirations from the Creative Journey at PolyU

These graduating students have shown that becoming a designer goes beyond talent or technical skill. It is also about resilience, embracing opportunities, learning through observation and practical experience, and always putting users first to solve real-world problems. PolyU young designers have uncovered the deeper values that spark true innovation and meaningful impact. Their creative journeys remind us that behind every great design lies a thoughtful, transformative process.

What comes to mind when you think of a designer? Perhaps it's a keen eye for aesthetics, a flair for imagination, or the boldness to create—qualities often noticed in those starting their design journey. However, after years of immersive study at PolyU, graduating students reveal that being a designer goes far beyond these traits. Let's explore the inspirations and transformative experiences that have shaped the aspiring designers at PolyU across various specialisms.

Neo Wong Wai-Kit

BA (Hons) Scheme in Fashion,
Specialism in Contour Fashion and Activewear

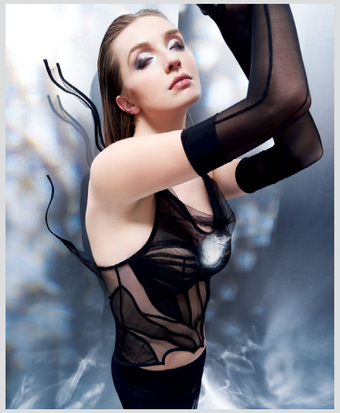
School of Fashion and Textiles

Thoughtful and meticulous, Neo sees fashion as a philosophical journey. His award-winning collection, "The First Light", explores existentialism through contour fashion, telling the story of a restless teenager finding clarity as dawn breaks. This narrative mirrors Neo's own process of adapting to change and blending emotion with wearable art.

> Master problem-solving skills and have a Plan B.

For Neo, design is a transformative exercise, which "allows us to turn intangible ideas into a visual language that connects us all." Central to his creative process is problem-solving—a skill he honed at PolyU. "The most important thing I learned here is to always have a backup plan," he shares, believing this mindset is invaluable in both design and life.

Looking ahead, Neo aims to venture into menswear, create innovative collections, and build his own brand.



Neo's collection, "The First Light", clinched the Hong Kong Intimate Apparel Industries' Association (HKIAIA) Overall Grand Award 2025. It is a philosophical narrative collection that tells the story of a restless teenager finding clarity and peace at dawn.

Xu Lulu

BA (Hons) Scheme in Fashion, Specialism in Knitwear Design

School of Fashion and Textiles

The inspiration for Lulu's award-winning collection, "Embodied Perception", came from Pakistani worshippers' sacred postures during prayer. Beyond observation, she conducted kneeling experiments in different natural environments, documenting sensations like the wind's caress, rugged rocks, and splashing water droplets. These multisensory experiences were transformed into innovative textile designs, with knitted structures embodying environmental interactions through material and technique.

> Observe, and experience it yourself.

Lulu's journey at PolyU highlighted the importance of observation and self-experience. She credits her classmates for their encouragement and insightful feedback, which helped her grow creatively and integrate knowledge into her work.

She is eager to advance her career in Hong Kong's fashion scene, participate in more competitions and experiment with new techniques.

Lulu's collection, "Embodied Perception", was awarded First Runner-up in the Young Knitwear Designers' Contest 2025, as well as the Consinee Grand Award at the PolyU Fashion Show 2025. The collection translates environmental interactions into innovative textile designs, reflected through thoughtful material choices and technical craftsmanship.

Jerry Chan Chun-yu

BA (Hons) in Product Design

School of Design

Jerry's fascination with cars fuels his dream of designing the vehicles of the future. At first, he thought that creating a car with a striking appearance was the ultimate goal, but his teachers made him realise the crucial importance of the user experience—a great car must balance both function and aesthetics to meet users' needs. This insight now guides his design approach.

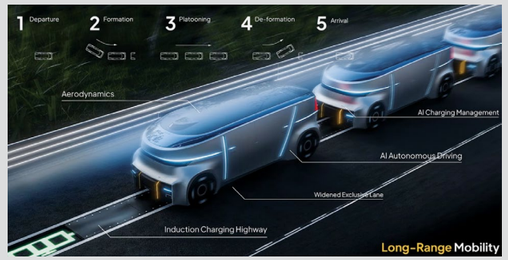
> Be mindful of user experience.

"Product design is about thinking on behalf of users so they don't have to," Jerry quips.

As Jerry embarks on exploring the world of product design after graduation, he advises design students to "spend more time engaging with diverse individuals and observing user behaviours, rather than focusing solely on perfecting your technical skills."

Jerry has recently won a Special Mention Award at the DFA Hong Kong Young Design Talent Award 2025.

Jerry seized the exciting opportunity to join PolyU's E-Formula Racing Team, where he designed a race car built for the track, blending creativity with technical expertise.



Jerry's graduation project, "Locomobile—Your private train, in 2050", illustrates his vision of what cars might look like in the future.

Wan Zhilin (left) & Song Xin (right)

MSc in Innovative Multimedia Entertainment

School of Design

With experience in virtual reality (VR) production, Wan Zhilin and Song Xin teamed up with two other classmates to create "Echo of Spring", a VR interactive narrative game about resilience. "Everyone has their own life lesson. Resilience and perseverance are essential in any situation," they share, echoing the game's heartfelt message.

> Be resilient and seize opportunities.

From their study, they truly discovered VR's potential as an artistic medium capable of conveying subtle emotional experiences through body and space. Their project quickly gained recognition at major game exhibitions, like China Joy 2025 and the Hong Kong ACG Exhibition 2025, and is now available online. Their success led to the founding of GoGo Gull Interactive Limited, a creative studio dedicated to pushing the boundaries of VR storytelling and game design. Supported by PolyVentures and the PolyU Micro Fund, they have showcased their work across Hong Kong and different Chinese Mainland cities. Their advice to fellow creators: "Be brave and seize opportunities."

The duo's graduation project, "Echo of Spring," incorporates artificial intelligence to create an immersive virtual space for reflection.

Their VR game business will expand into cross-media collaborations and experimental storytelling that bridges art and technology.

Bridging the Digital Divide

PolyU students empower rural children with tech skills

While urban students often enjoy advanced technology, reliable internet, and a wealth of educational resources, their rural counterparts frequently encounter obstacles such as limited device availability, poor connectivity, and insufficient training. These challenges can hinder the development of essential digital literacy, perpetuating educational and economic disparities. Addressing this digital divide is crucial to ensuring that all students can thrive in today's digital world and seize opportunities for academic, professional, and social growth.

> I used to think that surveying and mapping were out of reach, but now I've learned them like playing a game.
>
> One fifth-grade student

In a remarkable effort to narrow this gap, students from PolyU's Department of Land Surveying and Geo-Informatics (LSGI) have been continuously engaged in Service-Learning projects in rural areas internationally—including Cambodia, as well as several counties and cities in the Chinese Mainland such as Xianning, Wenchuan, and Laixi. Their mission is to empower local children by enhancing access to modern technology and digital education resources.

Advancing educational equity with Service-Learning initiatives

In May 2025, the LSGI students launched the Empowering Rural Development with Spatial Technologies programme in Wolongzhen, a rural town in Wenchuan County, Sichuan Province, with the support of the Wolongzhen Center Elementary School—a school that was severely affected by the 2008 Sichuan earthquake.

The PolyU team guided local students to use drones to capture oblique images for three-dimensional geological modelling to monitor the risk of landslides and employ spatial data to optimise village layouts and town planning. Apart from demonstrating these technical innovations, the PolyU students delivered STEAM courses focusing on spatial thinking and disaster prevention to more than 130 Wenchuan school children.

The opportunity to control drones, experience virtual reality and explore land-use maps created with spatial technology is rare, if not unique, to the Wolongzhen children. These hands-on experiences sparked excitement and curiosity in them, making digital learning both accessible and enjoyable.

Wolongzhen school children lining up for a virtual reality experience

Inspiring rural students with hands-on digital experiences

A month later, another LSGI team visited Laixi, a county-level city in Shandong Province, to launch the Surveying and Mapping Technologies Young Talent Cultivation Programme at Dongdazhai Primary School. Over 200 primary students participated, immersing themselves in land surveying with virtual reality goggles and learning to apply mapping and Geographic Information System (GIS) technologies to create maps of their hometowns under themes such as Smart Agriculture Map and Rural Tourism Navigation.

3D model of the Dongdazhai Primary School campus built upon drone images

> The LSGI team not only imparts technology, but also brings a rigorous academic spirit. The seeds of technology planted in children's hearts may rewrite their trajectory of life.
>
> Mr Tang Zhen,
> Principal of Dongdazhai Primary School

A model for collaborative impact

These projects had a profound and positive impact on the rural children, many of whom had rarely encountered digital devices or online resources. The workshops didn't just teach practical digital skills—they unlocked new worlds of learning and possibility. These initiatives also ignited a genuine excitement for technology, inspiring some students to dream bigger and consider futures in science and technology. Teachers and local leaders observed a surge in digital literacy, curiosity, and creative thinking among the students. The PolyU students thus made a lasting difference, inspiring hope and opening doors for rural youth to participate fully in the digital age.

The dedication of PolyU students is a testament to the game-changing power of university-led Service-Learning. By bridging the digital divide, these projects champion educational equity and drive social progress, proving just how impactful collaboration between universities and local communities can be.

LSGI plans to extend the programme to more rural primary schools to help rural revitalisation with technology education.

Summer at PolyU: Where Cultures Meet Innovation

Discover new worlds and vibrant cultures with PolyU's summer programmes, designed to expand academic horizons and immerse students from the world in the dynamic spirit of Hong Kong

At PolyU, summer isn't just a season; it's an adventure waiting to unfold. Students from high schools and universities from around the world arrived this summer with a shared goal to grow academically and explore new challenges. Along the way, they gained international exchange experience and learned about Hong Kong's dynamic culture. This empowering journey prepared them to navigate the future with confidence and curiosity, making PolyU a hub for international learning and growth.

Seven students shared how PolyU's summer programmes sparked creativity and created valuable networking opportunities, enhancing their learning experience.

A sip of university life: Summer Institute

This August, nearly 270 local and international high school students from 19 countries and regions stepped into a five-day programme offered by the PolyU Summer Institute (SI). They explored the campus, attended AI and entrepreneurship lectures, and went behind the scenes on company visits. With the support of academic and student mentors, they enjoyed a bit of university life in a global learning community.

Among them was Manos Filippidis, a high school student from Greece. For Manos, the SI was not just a programme; it was his first trip to Asia. Immersed in hands-on 3D printing sessions, he discovered new ways to explore the future of technology. The adventure extended beyond the classroom. Wandering through Hong Kong's lively streets and iconic landmarks, Manos felt the pulse of a city where tradition meets innovation. This experience expanded his knowledge and deepened his appreciation for a world much bigger than he had imagined.

> Visiting PolyU was a once-in-a-lifetime experience. I enjoyed Hong Kong's nightlife, learning basic Cantonese, and savouring delicious Chinese cuisine. I'm eager to explore Asia further in the future.

Mano Filippidis
2nd from left in the photo

> The SI completely sparked creativity and passion in me I hadn't realised before—it didn't just clarify my future; it ignited my desire to inspire others.

Bonnie Wong

As a group leader of the SI this year, local second-year student Bonnie Wong reflected on her journey, which began when she joined SI two years ago. Initially unsure between art and design, she discovered her passion while crafting a 3D model that captured the emotion of a video created from photographs taken around the PolyU campus as part of the programme's creative project.

Inspired, she worked tirelessly for her public exams, securing a spot in the School of Design at PolyU. Her first year was an exciting venture, filled with challenges that sharpened her collaboration skills. Now, she eagerly shared her experiences, celebrating her growth from a hesitant learner to a confident design major student.

Fostering learning and cultural connection: International Summer School

Nearly 470 university students from 17 countries and regions spent four weeks discovering new academic interests and the diverse culture of Hong Kong through the PolyU International Summer School (ISS). Sofia Fellinger, Daisy Dai, and Zach Gao followed their passions, taking courses that stretched their skills and imagination. Beyond the classroom, they explored campus life and immersed themselves in the city's traditions and activities. For them, the summer was not just about learning—it was about personal growth and creating lasting memories.

Sofia's experience offers a glimpse into future opportunities. Nominated by her school, Sofia, a design student from Germany, was captivated by the course "The Evolution of World Cuisine", where food culture met design in unexpected ways. Her experience included structured lessons, engaging discussions, and a memorable meeting with a professional chef. What stayed with Sofia most was the visit to Lamma Island, connecting her with nature and revealing how Hong Kong, a bustling metropolis, maintains ties to its natural surroundings.

> The University feels well-organised, making it easy to access information and connect with others. This positive experience has motivated me to consider continuing my education here in the future.
>
> Sofia Fellinger

> During the academic year, exchange opportunities were rare. The ISS programme gave me a valuable chance to grow personally. I highly recommend it to anyone looking for a unique and rewarding summer experience.
>
> Daisy Dai

With a demanding schedule back home in Nanjing, Daisy, now a third-year law student, sought a summer escape that offered more than just a break. When she discovered the ISS at PolyU, with its strong reputation and relevant courses, she knew this was her chance. Bringing her Chinese bamboo instrument, Daisy aimed to share her passion for music and connect with others.

Between classes, Daisy explored tourist spots like Kennedy Town, finding a refreshing break from her intense routine. She admired PolyU's modern campus and impressive library, which became her favourite quiet retreat.

Inspiring research explorations: International Research Summer School

Under warm summer skies, nearly 60 senior undergraduate and master's students from five continents gathered for PolyU's International Research Summer School (IRSS) 2025. Over ten inspiring days, they explored topics like health, AI, and sustainability, joined practical workshops, connected with potential supervisors, and appreciated the cutting-edge research facilities. For these bright minds, the programme was much more than academics—it sparked bold new paths toward their research futures.

Aaron Thomas Moffatt from Australia saw IRSS as a unique opportunity to explore AI in healthcare with guidance of PolyU experts. Through discussions with professors, he gained practical insights that inspired new ideas for his research. Visits to PolyU's advanced laboratories allowed him to experience first-hand the technologies shaping the future of medicine. This experiential learning fuelled Aaron's passion and helped him envision the real-world impact of research.

Meanwhile, Alexandre Gasper Mendes Alves from Portugal found IRSS essential in clarifying the path toward a research degree. Conversations with PhD students and supervisors provided valuable insights into the academic journey and what to expect. Connecting with people from diverse cultures enriched his experience, offering useful advice and personal growth. These interactions gave Alexandre confidence and clear direction as he prepared for the next stages of his academic career.

Zach, originally from the Chinese Mainland, came to Hong Kong to pursue his undergraduate studies in electrical and electronic engineering at PolyU. Now in his second year, he finds PolyU's hands-on labs and supportive academic staff enrich his learning experience. This summer, joining the ISS programme became a highlight of his time at the University. He enrolled on innovative courses, engaged in practical projects, and connected with a lively global community. Leading campus tours allowed him to share Hong Kong's unique culture while building lasting friendships.

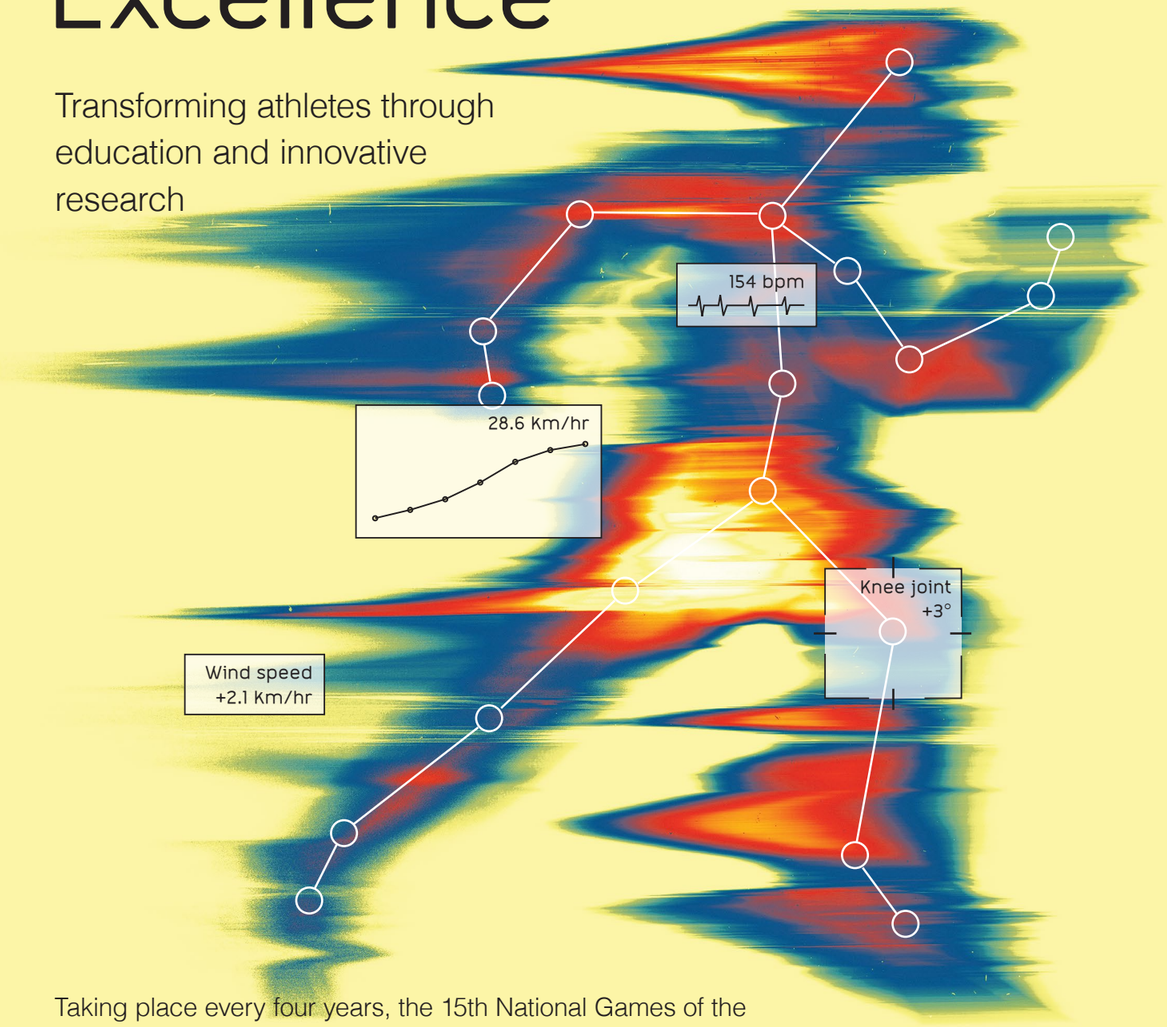
For Zach, the summer programme deepened his academic skills and broadened his worldview. He sees PolyU as a launchpad for expanding his international perspective.

> PolyU isn't just about academics; it's also about building a global community and discovering yourself.
>
> Zach Gao

The three summer programmes—Summer Institute, International Summer School, and Research Summer School—offer local and international students from high school to postgraduate levels an immersive experience within PolyU's vibrant academic and supportive community, making summer study a truly unique and transformative journey.

Instilling Sporting Excellence

Transforming athletes through education and innovative research



Taking place every four years, the 15th National Games of the People's Republic of China (National Games) was held in November. The Games embodies a philosophy that sport builds character, fosters unity and drives societal progress—the same spirit PolyU champions through its student-athlete admissions programmes, cutting-edge sports science research and holistic education that recognises sporting achievement as integral to personal development.

With more than 60 student-athletes and alumni representing Hong Kong, China at the Games, PolyU's transformative impact on the city's sporting landscape has never been more pronounced.

These elite competitors exemplify years of dedicated training and academic pursuit within a support ecosystem specifically designed to nurture dual excellence. Their participation reflects not only individual achievement, but also the success of a philosophy that does not separate academic rigour from sporting ambition.

Among the many PolyU student-athletes joining the 15th National Games are:

Judo

"I balance my studies and training by managing my time effectively and remaining dedicated. This approach enables me to excel both in sports and in my academic pursuits."

Mak Hong-nin
- BSc (Hons) in Nursing, Year 2
- Admitted through SALSA

Volleyball

"It is a great honour to represent Hong Kong, China in the National Games held in Macao. Training takes up most of my spare time, but I make good use of commuting time to study."

Suen Yee-tung
- BSc (Hons) in Physiotherapy, Year 3
- Admitted through OSRS

Holistic student-athlete support

Our sporting culture begins with admission. The Special Talents Admission and Recognition Scheme (STARS), Student-Athlete Learning Support and Admission Scheme (SALSA), and Outstanding Sportsmen Recommendation Scheme (OSRS) create multiple pathways for talented students to access higher education while pursuing sporting excellence. In the 2024/25 academic year, 54 student-athletes gained admission through these schemes—a testament to the University's commitment to recognising diverse forms of excellence.

PolyU has strengthened its commitment to sports education through academic programmes such as the MSc in Sports Technology and Management, and the BSc (Hons) in Sports Science and Technology to be launched in 2026. The University also offers custom-designed curricula for elite athletes at undergraduate, postgraduate and doctoral levels, and scholarships for those studying Bachelor's or PhD degrees, empowering them to excel both academically and athletically.

The University's holistic support extends to providing student-athletes with specialised accommodation through the STARS Residential College, which offers coaching, mentoring and action learning projects that foster both athletic and personal development.

Building a championship culture

This philosophy has yielded remarkable results. PolyU claimed both the Men's and Women's Overall Championships in the 2024/25 Inter-Collegiate Sports Competitions, securing an unprecedented seventh consecutive Grand Slam title. Demonstrating the University's ability to develop world-class athletes who compete at the highest levels, Karen Lee Hoi-man won a Bronze Medal in Women's Team Table Tennis at the 2025 FISU World University Games, while Lydia Sham Hui-yu, who is also competing at the 15th National Games, took the Gold Medal in the Women's Taolu Changquan–Jianshu–Qiangshu combined event at the 12th World Games.

Karen Lee Hoi-man
- Undergraduate, the BSc (Hons) in Physiotherapy
- Admitted through the SALSA

Lydia Sham Hui-yu
- Undergraduate, the BSc (Hons) in Physiotherapy
- Admitted through the OSRS

Photo credit: Sports Federation & Olympic Committee of Hong Kong, China

RISports: When science drives performance

The University established the Research Institute for Sports Science and Technology (RISports) in 2022, aiming to address the evolving needs of sports participants at all levels. RISports navigates dual challenges: empowering athletes seeking performance enhancement, while also motivating broader community participation in sports through accessible, scientifically-backed innovations.

Professor Zhang Ming, Director of RISports, explained, "We bring together researchers from 17 different departments across the University, about 70 scholars all working on sports-related research that impacts on sports that include cycling, fencing, karate, swimming, taekwondo and various ball sports." They deliver advanced scientific solutions through research in four areas: Sports Biomechanics and Human-Product Interaction; Sports Product Design, Materials and Manufacturing; Sports Measurement, Feedback and Instrumentation; and Sports Training and Rehabilitation. This multifaceted approach tackles sporting challenges from multiple perspectives.

AI-powered 3D motion analysis

The RISports team leverages AI and computer vision to reconstruct three-dimensional models from two-dimensional competition footage of elite athletes, extracting crucial biomechanical parameters including muscle force, joint force and individual athlete characteristics. This revolutionary technology provides coaches and athletes with invaluable insights into force application techniques and injury prevention strategies.

The research extends to real-time sports analysis through camera systems that capture athletes' movement dynamics, including joint angles, velocity, acceleration and more.

> "For martial arts or boxing, when two athletes are sparring, we can measure the speed and impact force of each punch."
>
> Professor Zhang Ming

Through partnerships with the Hong Kong Sports Institute, PolyU has secured considerable government funding for sports science and research projects, demonstrating the University's leadership in enhancing elite athlete performance. Additionally, Professor Zhang spearheaded the establishment of the International Society of Sports Science and Technology dedicated to bringing together leading academics, practitioners and industry experts from around the world to foster interdisciplinary collaboration, promote cutting-edge research, and drive innovation in athletic performance, health and well-being.

Professor Zhang Ming
⁄ Chair Professor of Biomechanics and Head, Department of Biomedical Engineering
⁄ Director of RISports

Revolutionary innovations in action

Beyond rehabilitation and performance optimisation, RISports researchers are revolutionising athletic equipment through innovations in sportswear technology.

One breakthrough innovation developed by Professor Shou Dahua's team is iActive™ intelligent sportswear. This technology uses low-voltage-driven artificial "sweat glands" and a root-like liquid network mapped to sweat zones to quickly eject perspiration as droplets, reducing weight and cling, keeping the skin dry, and removing sweat up to three times faster than peak human sweating.

The team has also developed Omni Cool Dry™, a breathable skin-like fabric that routes sweat directionally while providing spectrum selective cooling. By reflecting solar and ground radiation and emitting mid-infrared body heat, it helps keep wearers cool and dry even under the sun, lowering skin temperature by about 5°C compared to conventional fabrics.

> "Drawing on directed liquid flow and thermal insulation phenomena in nature, we aim to foster innovation in garment manufacturing by inventing intelligent clothing to address global challenges."
>
> Professor Shou Dahua

Professor Shou Dahua
⁄ Limin Endowed Young Scholar in Advanced Textiles Technologies
⁄ Associate Professor, School of Fashion and Textiles
⁄ Associate Director of the Research Centre of Textiles for Future Fashion
⁄ Associate Director of the PolyU–Xingguo Technology and Innovation Research Institute

Sports physiotherapy excellence

Behind every great athlete is a team of experts working tirelessly to ensure optimal health and peak performance. Among these unsung heroes is the PolyU rehabilitation sciences (RS) team, led by Professor Amy Fu, Associate Director of RISports. Her extensive experience includes supporting athletes at major international events such as the 2008 Beijing Olympics and the 2023 Hangzhou Asian Games.

> "We are thrilled to be part of the 15th National Games, where we can leverage our unique strengths in sports science and sports physiotherapy to support the growth of sports in China."
>
> Professor Amy Fu

For the National Games, Professor Fu leads a dedicated multidisciplinary RS team comprising nine faculty members, alumni from the department and over 30 students pursuing PolyU sports physiotherapy programmes. This specialised team will provide comprehensive sports physiotherapy services to elite athletes competing for Hong Kong, China, as well as support for the Guangdong province's table tennis and fencing teams.

Their services encompass pre-competition personalised performance assessments and analysis, health and training load monitoring, training support and clinical physiotherapy consultations, with on-site medical support for the sports teams.

The RS team has spent over a year preparing, conducting thorough assessments to identify injury risks, analysing movement patterns and providing rehabilitation therapy for injured athletes. The team has adopted several innovative in-house technologies, including the Patellar Auto-mobilising Device for knee pain relief and a unique shoulder brace specifically designed for judo athletes. Their comprehensive approach includes educating athletes on recovery strategies to ensure swift return to training and competition.

Professor Amy Fu
⁄ Peter Hung Professor in Pain Management
⁄ Associate Head and Professor, Department of Rehabilitation Sciences
⁄ Associate Director of RISports

Vision for the future

The integration of student-athlete support, sports education and research excellence aligns with the University's broader sporting development goals.

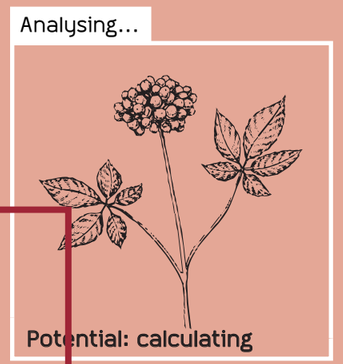
> "The 15th National Games provides a platform for sports collaboration while elevating local sports standards. I hope all citizens will come together to support the National Games and create a sports extravaganza that belongs to each of us."
>
> Mr Kenneth Fok, PolyU Council Member

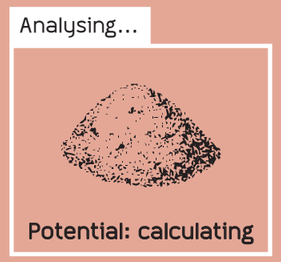
PolyU Council Member Mr Kenneth Fok is also Vice-President of the Sports Federation & Olympic Committee of Hong Kong, China and Chairperson of the Hong Kong, China Olympic Academy.

PolyU demonstrates how universities can transform athletic performance and sporting landscapes through comprehensive support, holistic education and cutting-edge research, working to enhance sports excellence at all levels while inspiring greater community participation in sports. Through its innovative approach, the University creates a ripple effect that extends beyond elite competition, fostering a culture where sporting achievement becomes a shared aspiration across society.

New Hope for Parkinson's and Alzheimer's Sufferers

The innovative LifeChip platform is mixing Chinese medicine and cutting-edge technology to accelerate the search for natural ways to treat debilitating neurodegenerative diseases





One worrying aspect of an ageing global population is the increase in deadly neurodegenerative diseases, such as Alzheimer's and Parkinson's, as well as neurological disorders like insomnia, depression, and anxiety. However, hope is on the horizon. Professor Simon Lee Ming-yuen, Chair Professor of Biomedical Sciences at the Department of Food Science and Nutrition, has won funding from the Research, Academic, and Industry Sectors One-plus (RAISe+) Scheme to develop new drugs and nutraceuticals derived from foods and other natural sources, to treat these debilitating conditions.

Professor Simon Lee Ming-yuen

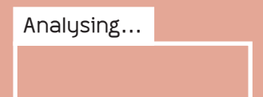
- Cally Kwong Mei Wan Professor in Biomedical Sciences and Chinese Medicine Innovation
- Chair Professor of Biomedical Sciences, Department of Food Science and Nutrition
- Director of the PolyU-BGI Joint Research Centre for Genomics and Synthetic Biology in Global Ocean Resources

His research includes LifeChip, a cutting-edge technology platform that combines traditional Chinese medicine with next-generation DNA sequencing, AI-driven compound discovery, advanced chemical separation, high-throughput in vivo screening, and synthetic biology. This highly integrated strategy offers tremendous potential for both disease prevention and treatment.

Multidisciplinary approach pinpoints powerful therapeutics

Professor Lee's research interests are diverse, covering everything from brain disorders and neurodegenerative diseases to oncology, environmental health, and toxicology. He is fascinated by drug discovery, using natural products and medicinal plants found in his ancestral home of Southern China. This broad outlook laid the groundwork for the multidisciplinary LifeChip platform, which condenses the entire drug discovery process onto a chip the size of a few coins.

> Usually in the laboratory, a researcher may screen only a few drug candidates, but LifeChip can automate hundreds. Through this technology, we can find some of the natural ingredients we are looking for faster and more accurately. We have also improved the chip, placing cells or organisms inside to test the toxicity and efficacy of a drug.
>
> Professor Simon Lee Ming-yuen



Neurodegenerative conditions like Parkinson's pose a formidable challenge in neurology. Despite extensive investigations, understanding its pathophysiology remains elusive. Professor Lee believes that nutraceuticals could hold the key to preventing diseases and promoting health by supporting important bodily structures and functions. The trick is finding them.

"By integrating several advanced technologies, LifeChip creates a unified development pipeline. This fusion enables the rapid identification and validation of bioactive compounds from natural sources, especially those rooted in Chinese medicine," he said.

Promising neuroprotective potential

LifeChip has already identified a development candidate called Oxyphylla A (OPA), which is a natural compound extracted from the seeds of the Alpinia Oxyphylla plant. Known as Yi Zhi Ren in traditional Chinese medicine, the plant is believed to nourish the brain and kidneys, helping to enhance memory, halt male reproductive decline, resist ageing and reduce oxidative stress.

OPA has shown potential in experimental models of various neurodegenerative disorders, notably through novel mechanisms like the degradation of α-synuclein—a key protein implicated in Parkinson's. The compound has exhibited encouraging neuroprotective activity against Parkinson's by addressing mitochondrial dysfunction, suggesting its potential as a multi-targeted therapeutic.

A unique "first-in-class" drug, OPA is currently undergoing clinical trials. It represents a true advancement in neurological health, which may eventually provide patients with a viable, disease-modifying therapy. Professor Lee's team has already produced strong Proof-of-Principle evidence of its protective and rescue effect on neurodegenerations and associated symptoms in animal studies.

"Experimental data shows neuroprotective effects of OPA on neurons in the brain, and improved behavioural and cognitive impairments in multiple Parkinson's disease mouse models. Pharmacokinetic and toxicity results have proved that OPA has high bioavailability, crosses the blood-brain barrier, is absorbed quickly, and offers high levels of safety," said Professor Lee.

The neuroprotective performance suggests OPA has potential as a multi-targeted therapeutic for Parkinson's disease. A total of six global patents, including the US, EU, Spain, China, and Japan, covering OPA's treatment claims, synthesis method, therapeutic use and application, have been granted so far.

In addition to addressing Parkinson's disease, natural products and their constituents present possibilities for treating other neurodegenerative diseases. For example, OPA appears to ameliorate cognitive deficits and alleviate neuropathology in Alzheimer's disease, which is now one of the most common causes of dementia and amnesia. Experimental results show that OPA reduces the expression levels of amyloid precursor protein (APP) and amyloid beta (Aβ) proteins, and attenuates cognitive decline in mice.

> Taken together, our results suggest a new horizon for the discovery of therapeutic agents for Alzheimer's disease.
>
> Professor Simon Lee Ming-yuen

Floating into a More Spacious and Sustainable Future

Visionary S²FS² concept combines conventional reclamation with advanced floating structures to create resilient and sustainable urban spaces

S²FS² proposes a hybrid model that combines conventional land reclamation with advanced floating platforms, creating new urban spaces that are both adaptive and resilient.

Limited land has made Hong Kong property prices among the highest in the world. However, space is running out. The HKSAR Government's "Hong Kong 2030+" development strategy projects a land shortfall of approximately 3,000 hectares in the 30-year period between 2019 and 2048.

New land is usually created by sea reclamation, which is expensive and hard on the environment. Professor Zhao Xiaolin, Chair Professor of Civil Infrastructure of the Department of Civil and Environmental Engineering, also Associate Director of Research Institute for Land and Space, believes Hong Kong should shift from battling the sea to building on it. He is leading research into Sustainable and Smart Floating Structure Solutions (S²FS²), which offers a promising path towards environmentally-conscious urban development for Hong Kong and other coastal cities.

> The long-term goal is to make S²FS² a widely accepted option for creating land space, and a powerful policy tool for relieving the land shortage problem through the active involvement of the international community on floating structures.
>
> Professor Zhao Xiaolin

Relieving pressure on limited land resources

Unveiled at the Third World Conference on Floating Solutions (WCFS 2023), S²FS² envisages large-scale floating platforms, constructed from durable, lightweight, and eco-friendly materials, supporting a variety of superstructures for recreation, community facilities, and even housing.

Combining floating structures with land reclamation, S²FS² aims to reduce environmental impact, with minimal disruption to water quality or impact on undersea life. Construction time is also significantly shorter. The mooring system, floating modules and superstructure can be built simultaneously in different locations. With no delay from a lengthy soil consolidation period, floating infrastructure can go on-line almost immediately.

Professor Zhao developed the S²FS² concept in collaboration with Professor C.M. Wang and Dr B. Wang at The University of Queensland in Australia, and Dr R. de Graaf-van Dinther, the founder of Blue21 in the Netherlands.

The S²FS² hybrid approach is particularly well-suited to Hong Kong's unique geographical and demographic circumstances. Spaces within floating pontoons can be repurposed for parking, storage, or industrial activities, maximising the usability of every square metre. Floating facilities can also be reconfigured or relocated relatively easily.

S²FS² also shows strong economic promise. A preliminary cost analysis for an artificial island project suggests that a hybrid approach—combining 75% land reclamation with 25% floating structure—could yield cost savings of up to 16.5%, amounting to HK$27 billion for a 1,000-hectare development.

Tackling challenges and unlocking sustainability

Implementing S²FS² requires strong, watertight, and corrosion-resistant construction materials, as well as innovative connector systems that can withstand dynamic loads from waves, wind, and typhoons. Professor Zhao and his team are developing solutions using recyclable, low-carbon, and durable materials such as fibre-reinforced polymers, ultra high-performance concrete, and corrosion-resistant steel.

Construction adds another layer of complexity. The large floating modules need to be fabricated, transported, and precisely assembled despite the sea conditions. It is necessary to explore automated construction, sophisticated drone imagery, and Building Information Modelling for accuracy and efficiency. Sensors and embedded IoT can monitor the health of floating structures in real-time and predict maintenance needs.

The ecological impact of large floating developments requires careful observation and mitigation. However, floating structures open up many new opportunities, such as green aquaculture, renewable energy integration, and climate-resilient urban development.

> Approximately 90% of the world's megacities are vulnerable to rising sea levels due to climate change. The development of S²FS² hybrid solutions will enable Hong Kong to be one of the early adopters of climate resilient buoyant urbanism and amphibious architecture through the development and use of floating structures.
>
> Professor Zhao Xiaolin

Professor Zhao Xiaolin (front, centre), a Fellow of the Australian Academy of Technological Sciences and Engineering and a recipient of the Humboldt Research Award and the International Institute of Welding Thomas Medal, discussing S²FS² with his team

Brain Declines with Sustained Obesity

Excess weight not only takes a toll on physical well-being, but also impacts brain health

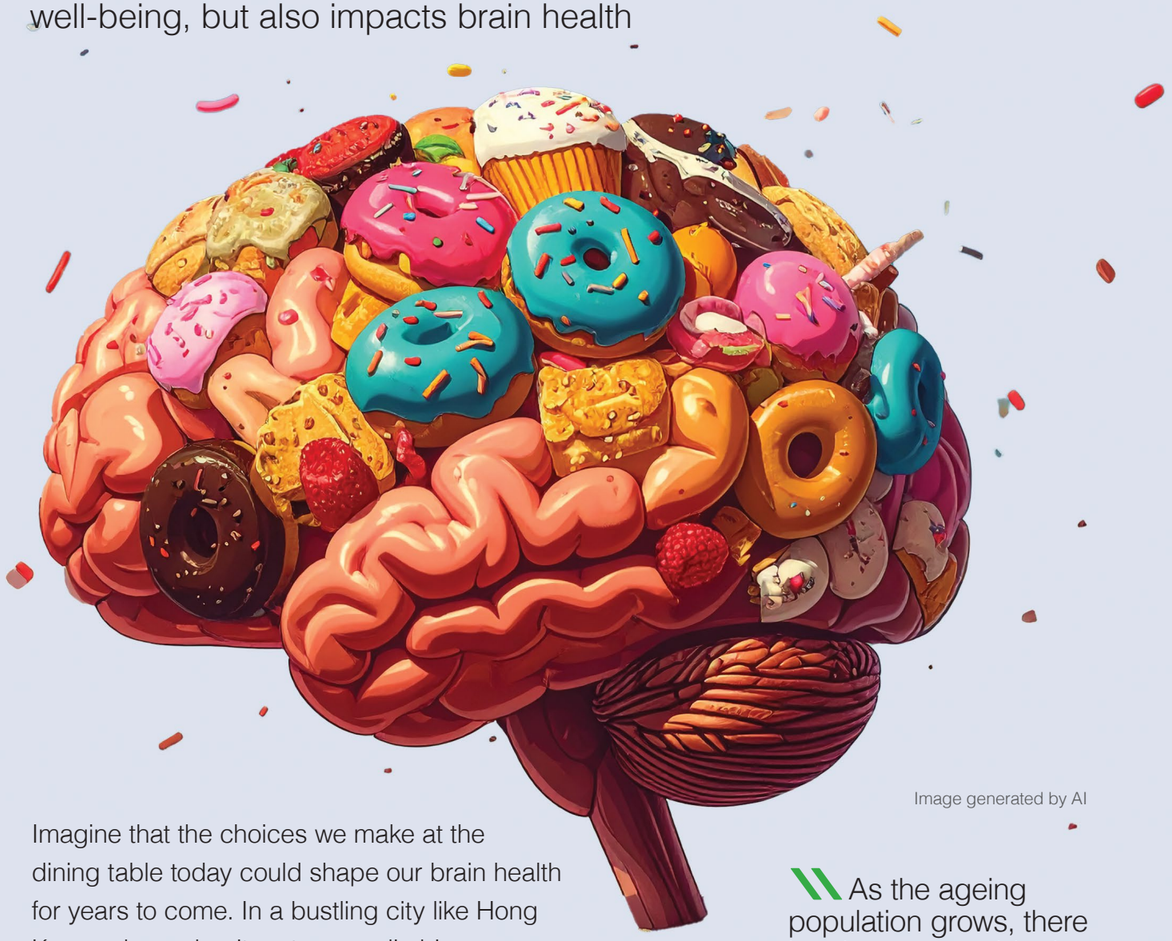


Image generated by AI

Imagine that the choices we make at the dining table today could shape our brain health for years to come. In a bustling city like Hong Kong, where obesity rates are climbing, our eating habits matter more than we realise. While we often associate excess weight with heart disease and diabetes, new research suggests a surprising connection between our waistlines and cognitive health. Could those extra pounds stealthily contributing to memory loss or cognitive decline as we age?

> As the ageing population grows, there has been a notable rise in neurodegenerative diseases, such as Alzheimer's disease, Parkinson's disease, and others, that currently lack a cure. This research proposes that maintaining long-term weight control can contribute to improved brain health.
>
> Professor Qiu Anqi

Unlocking new insights into the hidden connections between obesity and neurological function, Professor Qiu Anqi of the Department of Health Technology and Informatics, also Director of the Mental Health Research Centre at PolyU, is conducting groundbreaking research into how various obesity trajectories shape brain ageing and cognitive decline—an area that still holds many secrets waiting to be discovered.

Large-scale study on obesity's impact on brain over time

In contrast with conventional studies that rely on cross-sectional data, Professor Qiu has initiated a comprehensive longitudinal study to examine the effect of obesity patterns—weight gain or loss over time—on brain and cognitive health in adults, harnessing data from the UK Biobank. This biobank collects health information which includes obesity measures, brain images, and cognitive assessments from over 500,000 participants aged 40 and older, representing a diverse array of ethnic backgrounds.

The pivotal study identifies five distinct obesity trajectories: low-stable, moderate-stable, high-stable, increasing, and decreasing. By examining how these lines of development influence brain structure, function, and cognition in middle-aged and older adults, the research sheds light on the long-term neurological effects of obesity.

Key insights on obesity duration and brain ageing

This detailed classification of obesity trajectories emphasises sustained patterns rather than just current weight. Understanding these trajectories is important for assessing their impact on brain health, offering valuable insights into how obesity duration affects brain ageing.

Interestingly, the research indicates that individuals who successfully lose some weight exhibit minimal negative effects on their brain structure and cognitive abilities, especially compared to those with consistently low obesity levels, whereas those who maintain a high level of obesity or see their weight increase face more cognitive challenges.

The findings underscore the ongoing connection between obesity and brain health. They reveal a clear pattern of brain decline associated with obesity, suggesting that prolonged obesity may accelerate brain ageing.

The study concludes that the impact of obesity on brain health varies depending on weight fluctuations, and lasting obesity could be a useful indicator for evaluating brain ageing. It highlights the need for long-term monitoring and management of obesity, and suggests that reducing both the intensity and duration of obesity may be vital for protecting brain health.

The research titled "Long-term obesity impacts brain morphology, functional connectivity, and cognition in adults" was published in *Nature Mental Health*.

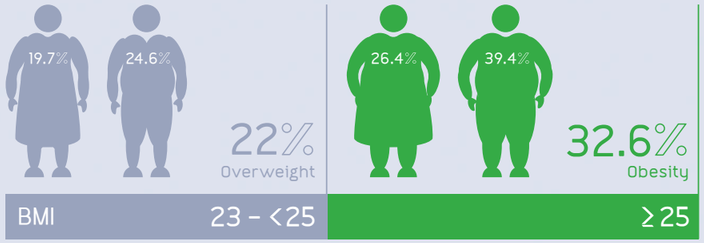
Professor Qiu, a Global STEM Scholar at PolyU under the HKSAR Government's Global STEM Professorship Scheme, started to focus her neuroscience research on maternal mental health and early brain development in her past research role in Singapore. The research provided new evidence that improved maternal positive emotion during pregnancy has the potential to promote the hippocampal development of children. She incorporated brain imaging into the study, which is a pioneering neonatal imaging work ahead of its time.

Elected the Chair of the Organization for Human Brain Mapping and recognised as one of the "Top 50 Asia Women Tech Leaders 2025" for advancing mental health and brain research, Professor Qiu Anqi emphasises that minimising obesity's severity and duration is crucial for brain health.

Professor Qiu aims to integrate diverse neuroimaging expertise to make a significant impact on brain health. Looking ahead, her research team plans to incorporate comprehensive biological analyses to explore pathways influencing brain and body health, aligning with her commitment to interdisciplinary collaboration and promising new strategies for improving cognitive health and overall well-being.

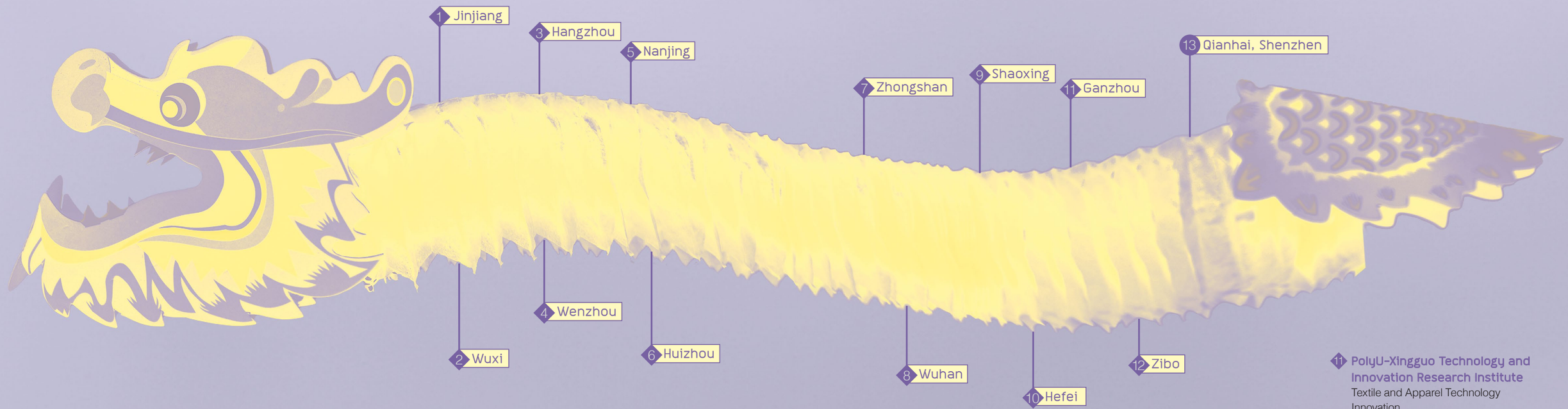
Obesity in Hong Kong

Chinese adults aged 15-84 living in Hong Kong



Source: "Population Health Survey (PHS) 2020-22" conducted by the Department of Health

Fuelling Innovation and Transformation across the Chinese Mainland



In Autumn 2023, a new chapter began for both Jinjiang and PolyU with the inauguration of the PolyU-Jinjiang Technology and Innovation Research Institute—PolyU's first Mainland Translational Research Institute (MTRI). More than a ceremonial milestone, the launch reflected a shared vision for innovation and transformation, with the research institute offering a blueprint for other cities navigating modern economic challenges.

PolyU's Mainland Translational Research Institutes (MTRI) and Mainland Translational Research Centre (MTRC) and their research focuses

MTRI ◆
MTRC ●

1 **PolyU-Jinjiang Technology and Innovation Research Institute**
Textile Materials / Microelectronics / Future Food Technology / Public Policy / Healthcare / Tourism Management

2 **PolyU-Wuxi Technology and Innovation Research Institute**
AI / Data & IT related / Aeronautical & Aviation / Advanced Manufacturing and New Materials

3 **PolyU-Hangzhou Technology and Innovation Research Institute**
Culture & Tourism along Grand Canal / Intelligent Transport System / Medical Cosmetics

4 **PolyU-Wenzhou Technology and Innovation Research Institute**
Marine Engineering Equipment / Soft Materials and Devices / Ultra Precision Machining

5 **PolyU-Nanjing Technology and Innovation Research Institute**
Robotics and Mechatronics / AI & IoT / Smart Construction / Vision Health

6 **PolyU-Daya Bay Technology and Innovation Research Institute**
Spatial computing and imaging / Green & Smart Manufacturing / Green Chemistry & Sustainable Catalysis / New Energy / New Materials

7 **PolyU-Zhongshan Technology and Innovation Research Institute**
Biomedical Technology

8 **PolyU-Wuhan Technology and Innovation Research Institute**
Optometry / Digital Health / Rehabilitation Science / Advanced Medical Technology / Smart Ageing

9 **PolyU-Shaoxing Technology and Innovation Research Institute**
Textile Technology / Carbon Fibre Composite Materials and Applications / Advanced Construction

10 **PolyU-Hefei Technology and Innovation Research Institute**
Aerospace / Low-altitude Economy / Biosensor Technology

11 **PolyU-Xingguo Technology and Innovation Research Institute**
Textile and Apparel Technology Innovation

12 **PolyU-Zibo Technology and Innovation Research Institute**
Nanotechnology / Industrial Artificial Intelligence / Rehabilitation Therapy / Digitalisation and Cultural Tourism

13 **PolyU-Qianhai Disruptive Technology and Innovation Research Centre**
AI Sensors and Smart Manufacturing / Intelligent Medicine and Healthcare / Innovative Design

Jinjiang, a manufacturing powerhouse in Fujian, is rapidly modernising through innovation-led development. The city's economy is driven by around 96,000 private enterprises which contribute over 90% of local GDP and jobs. Its entrepreneurial success, with global brands like ANTA, defines the nationally recognised "Jinjiang Experience" in county-level growth.

Elevating the "Jinjiang experience"

PolyU's first research institute beyond the Greater Bay Area (GBA) is accelerating Jinjiang's transformation into a high-tech hub by integrating academic research with industry. A landmark collaboration between PolyU and the Jinjiang Municipal Government, the MTRI supports the city's R&D in textile materials, microelectronics, future food technology, and policy research.

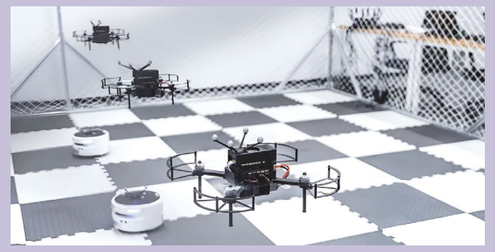
To date, the Jinjiang MTRI is partnering with over 40 entities, launching innovative projects such as thermal comfort evaluation methodology with ANTA, novel antimicrobial materials with Fynex Textiles, a pilot service platform for innovative R&D of medicine-food homologous functional beverages jointly established with Panpan Food, and functional confectionery products development with Qi Feng (Fujian) Food Co., Ltd. PolyU researchers have also achieved breakthroughs in healthcare applications using optical fibre interferometers.

Professor Yu Changyuan, Director of the PolyU-Jinjiang Technology and Innovation Research Institute, noted Jinjiang's industrial strengths align closely with PolyU's R&D priorities.

> The research institute not only serves Jinjiang but the entire province. It exemplifies Fujian–Hong Kong cooperation and enjoys strong support from both governments.

Professor Yu Changyuan,
Director of the PolyU-Jinjiang Technology and Innovation Research Institute

Professor Yu Changyuan (first from left) introducing the projects undertaken by PolyU-Jinjiang Technology and Innovation Research Institute to a Fujian governmental delegation led by Mr Zhou Zuyi (second from left), Secretary of the CPC Fujian Provincial Committee



The Nanjing MTRI is developing a UAV-UGV Air-Ground Collaboration System for district patrolling.

Vibrant development in Nanjing

Sharing the Jinjiang experience, the Gulou District of Nanjing Municipal People's Government pledged support for the PolyU-Nanjing Technology and Innovation Research Institute at its unveiling ceremony in July 2024. A hub for cross-border collaboration and scientific excellence, the Nanjing MTRI becomes a dynamic platform for pioneering research, talent cultivation, and industrial innovation in the fields of intelligent robotics, AI and IoT, smart construction, and vision health technologies.

The Institute is currently developing humanoid robots with an orthopaedic device company for applications in rehabilitation and elderly care, and is leveraging Nanjing resources to develop a UAV-UGV Air-Ground Collaboration System for district patrolling. It also delves into drug discovery with a Chinese medicine university for macula treatment.

> We have set up an InnoHub, facilitating enterprise interaction and fostering investment and business opportunities. The local government is very pleased with that.

Professor Zhang Dan,
Director of PolyU-Nanjing Technology and Innovation Research Institute

Huizhou: Tackling new-economy challenges in the Greater Bay Area

Located in east-central Guangdong bordering Daya Bay, Huizhou has positioned green petrochemicals, advanced materials, and next-gen IT as strategic industries. Since its launch in September 2024, the PolyU-Daya Bay Technology and Innovation Research Institute has become a key platform for green energy and technological innovation between Hong Kong and Huizhou.

Recently, the Institute has established an Artificial Intelligence Research Centre and the Seton-PolyU Daya Bay Institute AI Intelligent Light Health Laboratory. It also signed cooperation agreements with local enterprises, including Kingbali New Material Company and COMAC Beijing Civil Aeroplane Technical Research Centre. These efforts support the GBA's ambition to become a global hub for science and technology.

The PolyU-Daya Bay Technology and Innovation Research Institute was launched with the support of the Huizhou Municipal People's Government and the Daya Bay Economic and Technological Development Zone.

> Another joint lab will be launched next year with a few projects under discussion. Furthermore, we have already secured funding of HK$20 million from a Hong Kong industry partner.

Professor Zheng Zijian,
Director of PolyU-Daya Bay Technology and Innovation Research Institute

The MTRI formula: A blueprint for transformation

Over the past two years, PolyU has established 12 MTRIs and one Mainland Translational Research Centre in 13 cities across China. Each of these units adapts PolyU's expertise to the unique challenges and opportunities of its host city. This growing network of MTRIs and MTRC is fast becoming a cornerstone of PolyU's strategy to drive high-quality development nationwide. At the heart of the MTRI model is a simple yet powerful formula:

PolyU research
+
Chinese Mainland industrial chain
+
Chinese Mainland market
=
societal benefit

> The Mainland Translational Research Institute is a strategic initiative to further enhance PolyU's translational research and its impact in the Chinese Mainland. Our MTRIs are more than research institutes—they are engines of transformation.

Professor Christopher Chao,
Senior Vice President (Research and Innovation)

Nurturing innovation across borders

With the MTRI network, transformation is taking place not only in the Chinese Mainland cities but also among startups nurtured by PolyU. For these enterprising ventures, the Chinese Mainland offers more than scale—it's a launchpad for growth. With a vast consumer base, robust government support, and thriving tech ecosystems, startups gain access to funding, talent, and commercialisation platforms.

Harnessing the network, PolyU has recently organised the International Future Challenge (IFC) in Hong Kong and six Chinese Mainland cities: Huizhou, Jinjiang, Nanjing, Shanghai, Wenzhou, and Qianhai (Shenzhen) to empower students and startups to transform ideas into impact.

A dynamic platform that integrates education, research translation, incubation and investment, IFC has attracted more than 700 outstanding teams worldwide. The winning startups will gain international exposure and exciting opportunities for trial adoption, funding, fundraising referrals, and access to the incubation centres of the MTRIs.

The MTRI network's role in nurturing student entrepreneurs is further manifested with the Master of Technology Entrepreneurship programme, which requires students to develop startup projects at MTRIs, offering hands-on experience in market dynamics and venture building.

The International Future Competition (Shanghai Region) held in August 2025 was sponsored by Flair Capital.

Cooling the Planet, One Data Centre at a Time

A nearly zero-energy cooling system is ready for commercial use

Data powers everything from AI to streaming apps, relying on massive data centres that consume about 3% of the world's energy. By 2028, their power demand could reach 130 gigawatts, equivalent to the output of 130 large nuclear plants. Did you know nearly 40% of this amount of energy is just for cooling? Improving cooling efficiency would bring significant benefits to both industry and the environment.

Data centres generate substantial heat due to densely packed servers and networking equipment. Efficient cooling is essential to prevent overheating, hardware failure, and downtime. Traditional cooling methods such as air conditioning and raised floor distribution are energy-intensive and costly, while others like evaporative cooling are climate-dependent.

Professor Wang Zuankai has developed a better solution. His innovative Energy-Efficient Liquid Cooling System (ELCS) enables ultra-efficient, low-energy cooling for data centres and could play a major role in next-generation green data centre designs.

Overcoming a centuries-old challenge

ELCS is the result of Professor Wang's efforts to tame the challenges posed by the Leidenfrost effect since 1756, where a vapour cushion beneath a water droplet on a hot surface reduces heat transfer. To address this, he developed Structured Thermal Armour (STA), a multi-textured material that disrupts the vapour layer, enabling more effective liquid-surface contact at high temperatures.

He has also engineered a hybrid surface combining superhydrophobic (water-repelling) and superwicking (water-attracting) properties. These microscopic structures use surface tension and capillarity to guide water droplets for rapid movement and evaporation. Superwicking zones draw water to hot areas for efficient cooling, while superhydrophobic regions control flow and prevent buildup. This design maximises droplet contact and evaporation, significantly improving heat transfer from hot components such as CPUs and GPUs.

ELCS leverages STA and the hybrid surface to maximise heat removal using liquids, maintaining efficient cooling even at very high temperatures. The system enables ultra-efficient evaporation and condensation cycles, with coolant drawn to hot spots, absorbing heat as it vaporises, then condensing back into liquid for reuse. This cycle uses minimal energy and handles much higher heat loads than traditional methods.

Advantages for data centre cooling

ELCS can reduce the need for energy-hungry air conditioning or liquid pumps, enabling faster and more effective cooling, higher server densities, and lower energy use. It uses less water than traditional evaporative cooling and is less prone to fouling or mineral buildup. Integrating AI and Intelligence-of-Things technologies, ELCS constantly monitors and optimises its own performance.

Furthermore, the system is scalable using advanced manufacturing techniques, making liquid cooling safer, more efficient, and sustainable. Data centres can operate at higher performance with less environmental impact.

From a cost perspective, the initial investment for ELCS is somewhat higher than conventional cooling methods. However, the return is transformative.

ELCS reduces cooling energy consumption by **40–50%**, resulting in potential annual cost savings of up to **HK$790,000** per rack.

Unleashing innovation to the market

With funding support from sources including the Innovation and Technology Commission of the HKSAR Government through the Research, Academic and Industry Sectors One-plus (RAISe+) Scheme, Professor Wang has founded LiquiCool Tech Limited, a PolyU academic-led startup, to commercialise the system.

"We have reached a significant milestone by validating ELCS's core thermal performance in the lab," Professor Wang said. "In Stage I of the RAISe+ Scheme, our focus is on system integration, durability, and customisation, with the goal of completing the prototype and initiating pilot deployments in Hong Kong. Stage II will deepen our presence in Hong Kong through partnerships and drive expansion into the Chinese Mainland, and Southeast Asia."

The scale and environment of Hong Kong and Chinese Mainland provide an ideal foundation for advancing the technology and supporting the global transition to carbon neutrality. To ease adoption, LiquiCool offers free installation and maintenance, charging only a share of verified energy savings—making energy efficiency and carbon neutrality accessible and risk-free for partners.

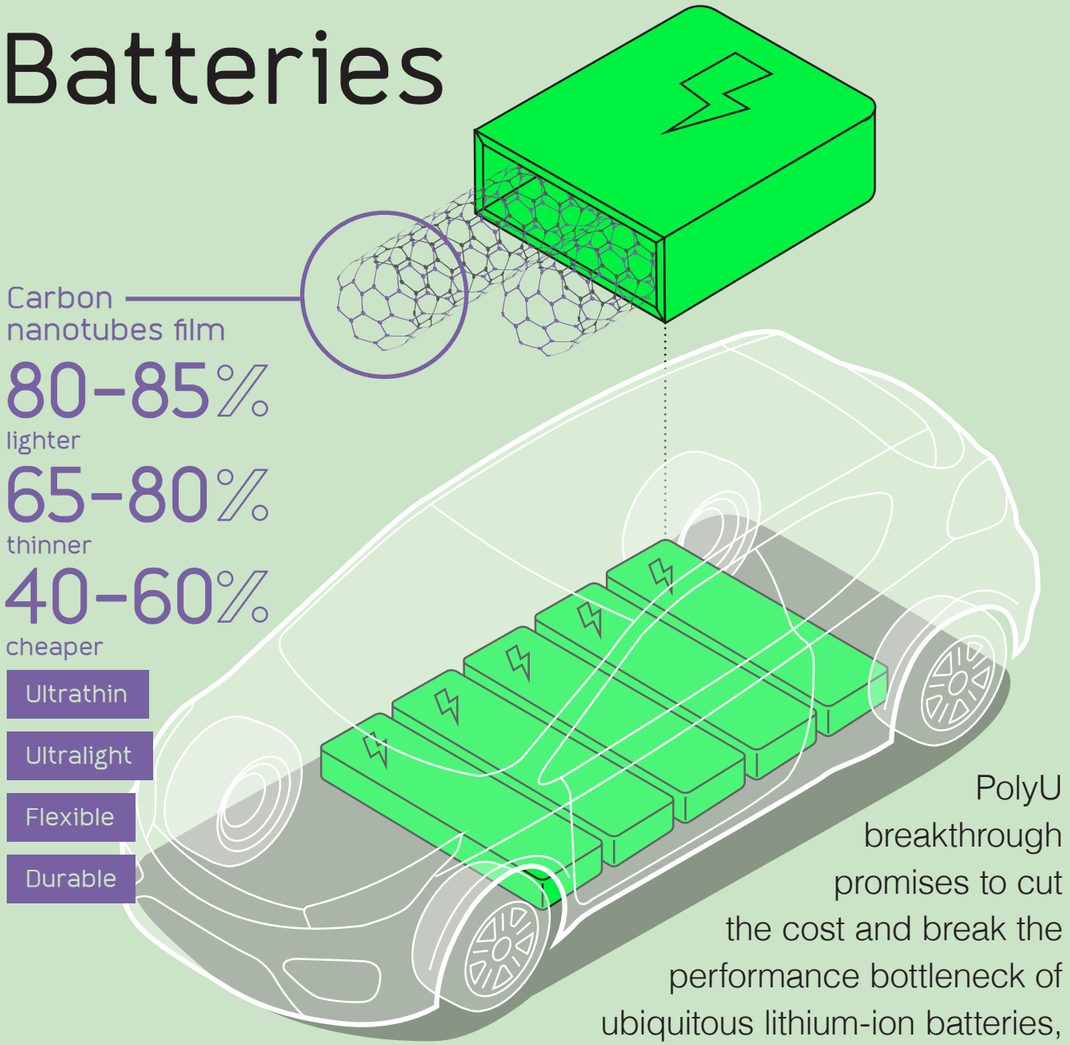
For individuals, this results in more affordable and accessible digital services, as operators pass on energy savings. Reduced energy consumption and lower carbon emissions also contribute to a cleaner environment.

> In essence, ELCS is not just about cooling servers but about cooling the planet, ensuring that the digital progress we all rely on—from streaming content to smart cities to AI innovations—can be powered without environmental cost, shaping a more sustainable and resilient future for society.
>
> Professor Wang Zuankai

Professor Wang Zuankai
Associate Vice President (Research)
Dean of Graduate School
Kuok Group Professor in Nature-Inspired Engineering
Chair Professor of Nature-Inspired Engineering, Department of Mechanical Engineering

Reshaping Energy Storage with Next Generation Batteries

Professor Zheng Zijian
// Director, PolyU-Daya Bay Technology and Innovation Research Institute
// Associate Director, Research Institute for Intelligent Wearable Systems
// Associate Director, University Research Facility in Materials Characterisation and Device Fabrication
// Chair Professor of Soft Materials and Devices, Department of Applied Biology and Chemical Technology



PolyU breakthrough promises to cut the cost and break the performance bottleneck of ubiquitous lithium-ion batteries, especially in booming electric vehicle market

The future will be battery-powered. Our increasingly mobile-centric world is shifting to renewable energy to run everything from personal digital devices to electric vehicles. Now, a team of PolyU researchers led by Professor Zheng Zijian, Chair Professor of Soft Materials and Devices of the Department of Applied Biology and Chemical Technology, is leading the transformation. They are commercialising a breakthrough materials technology designed to cut the cost and boost the performance of widely used lithium-ion batteries.

The timing is perfect. According to the international consulting firm, McKinsey & Company, global demand for lithium-ion batteries will soar nearly seven-fold by 2030. At the same time, revenues throughout the battery value chain are expected to explode, from US$85 billion in 2022 to over US$400 billion in 2030, with active materials and cell manufacturing accounting for the largest revenue pools.

New materials for new energy

Traditional lithium-ion batteries use thin layers of copper or aluminium foil as “current collectors” (CCs) to conduct electricity during charging and discharging. Reducing the weight and thickness of these CCs is an effective way to shrink the size and increase the energy density of batteries. However, this approach has reached the mechanical limits of metals, making them more expensive to produce and easy to break.

Professor Zheng’s “Next-Generation Composite Current Collectors for Mobility and Energy Storage Batteries” project, has developed an ultrathin, ultralight, flexible and durable film made from carbon nanotubes instead of metal. It is 80% to 85% lighter and 65% to 80% thinner than metal foils, and costs 40% to 60% less. It also offers better electrical and thermal conductivity, as well as chemical and electrochemical stability than existing metal foils, while being more compatible with various electrode materials. The composite CC also boosts gravimetric energy density of lithium-ion batteries by 20% to 25% and the volumetric energy density by 9% to 12%.

Other research teams around the world, and even some companies, are making so-called composite current collectors. “But, while they use polymer and polymer films, we use carbon nanotubes, which deliver very different material properties. Our batteries can be used anywhere, and they will last longer after charging, making them ideal for EV applications,” Professor Zheng said.

In addition, the composite current collectors offer an important energy storage advantage. “Many batteries are used in urban settings, such as within a building or a public area. In high-density environments like Hong Kong and other busy cities, smaller and lighter batteries can be a cheaper and more efficient solution,” he added.

Coming soon to an EV near you

The project was one of the first two PolyU initiatives to win funding from the Research, Academic and Industry Sectors One-plus (RAISe+) Scheme, which aims to unleash the potential of local universities in the transformation and commercialisation of R&D outcomes. “Under this scheme, research teams are entitled to at least 70% of the IP benefits, which is highly motivating for entrepreneurs, compared to other countries’ schemes that usually offer less than 50%,” Professor Zheng explained.

This is a powerful motivator for researchers to commercialise their innovations, bridging the gap between academic research and practical application. Professor Zheng is confident his team can take the concept from lab bench to pilot testing within two years, and begin mass production in the Chinese Mainland market some time in 2027.

He has already set up a startup, MatraVolt Limited, to focus on financing, while PolyU signed an MoU with Chinese Mainland’s premium smart EV manufacturer, Shanghai NIO Co., Ltd, last November. NIO is now partnering with the PolyU research team to test the new materials and provide expert feedback.

> “Our technology could reduce the cost of an EV battery by about HK$5,000, which makes a big difference for end-users. Cars will be cheaper, and owners will be able drive longer and further.”
>
> Professor Zheng Zijian

He believes new materials and new energy will open new economic possibilities, and help Hong Kong become an innovative, green centre, in-line with the national government’s “new quality productive forces” initiative.

“PolyU is committed to integrating the University’s research outcomes with the Chinese Mainland’s industrial chains and markets, and boosting the development of new energy technology,” he said.

The Bug Fix: Turning Waste into Worth

Evolving from a student-led initiative to a thriving startup, JAP JAP leverages bioconversion technology to transform food waste into sustainable solutions

> Entrepreneurship demands a spirit of adaptability and resilience—always preparing for plan B. It's not taught in any course; it's earned through relentless effort and investment.
>
> Rosie Chan, founder of JAP JAP

What if your leftovers could help save the planet? In a world grappling with food waste, innovative solutions are emerging. Meet JAP JAP, a groundbreaking self-service recycling system developed by Rosie Chan, a PolyU alumna from the School of Design and current MPhil student in Building Environment and Energy Engineering, using black soldier fly larvae to bioconvert waste into valuable resources.

Food waste is shredded and fed to BSFL, which efficiently consume the waste over 14 to 16 days, converting it into protein- and lipid-rich biomass.

The JAP JAP system features various stackable, upcycled plastic pallets that can be configured into different sizes to fit different needs and environments.

Food waste is a major part of Hong Kong's municipal solid waste, accounting for about 30% in 2023. However, only a small fraction, around 5%, is recycled, with over 3,190 tonnes sent to landfills daily—equivalent to the weight of seven fully-loaded Boeing 747s! Despite government efforts since 2021 to collect food waste, centralised methods alone are insufficient for the city's dense urban environment. Additional community-driven strategies are essential, which is where JAP JAP comes in.

Driving carbon reduction with localised waste solutions

JAP JAP transforms food waste management by combining advanced bioconversion technology with sustainable practices. A standout feature is the use of Black Soldier Fly Larvae (BSFL) to bioconvert food waste into valuable biomass rich in protein, lipids, and chitin, effectively reducing landfill-bound waste. The larvae consume various organic substrates—the food waste materials—and turn them into nutrient-dense biomass used for animal feed, oil production, and nutrient-rich fertilisers. The process also enhances composting, promoting the regeneration of nutrients.

The system adopts a decentralised approach, processing organic waste at the source using a stackable, modular design that ensures efficiency and adaptability. Made from upcycled plastic pallets, this innovative solution supports versatile spatial configurations. It integrates AIoT technology—combining Artificial Intelligence, Internet of Things, and machine learning—to monitor temperature, humidity, and weight, ensuring optimal waste conversion into compost that enriches plant growth.

By processing food waste locally, JAP JAP reduces transportation emissions and reliance on landfills, markedly lowering the environmental footprint of waste management while fostering a sustainable agricultural ecosystem.

JAP JAP is more than a food waste solution—it's an educational platform promoting sustainable living. Partnering with STEAM-based institutions, it encourages students to adopt eco-friendly habits. Since launching its first recycling station in 2023 at a secondary school in Hong Kong, JAP JAP has expanded to seven additional schools and delivered tailored workshops in over ten others. These initiatives empower students to transform food waste into valuable resources while raising awareness of waste reduction.

Fuelled by PolyU's entrepreneurial ecosystem

The idea of JAP JAP dawned upon Rosie when she once worked in a Japanese farm before she became an undergraduate studying Environmental and Interior Design at PolyU. There she learnt that nothing is truly waste—natural resources can be reused and returned to the soil. Inspired by the experience, she formulated a capstone project for her final year of study and subsequently launched the green technology startup in 2023, bringing the idea to fruition.

Rosie advanced her vision with funding from PolyU's MicroFund and Angel Fund, and the support of the University's Industrial Centre, where she gained vital resources—from technical guidance to prototyping facilities—that accelerated JAP JAP's development and market presence. Now pursuing an MPhil in Building Environment and Energy Engineering at PolyU, she credits the University's ecosystem as instrumental to JAP JAP's growth.

With a strong foundation, the venture is poised to scale across commercial and residential sectors. Anchored by Rosie's commitment to sustainability, JAP JAP continues to innovate in education, waste management, and carbon neutrality—driving meaningful change for a greener future.

ExcelXImpact

is published biannually to showcase PolyU as an innovative world-class university excelling in talent nurturing, cutting-edge research, and knowledge transfer, as well as raising awareness of the University's developments and achievements among local and international communities. For contributions and enquiries, please contact the Communications and Public Affairs Office at paadmin@polyu.edu.hk.

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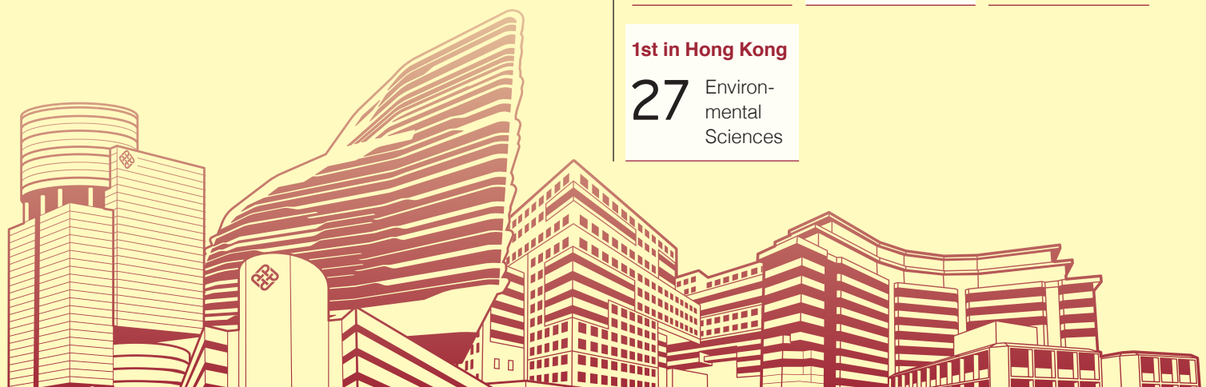

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