香港城市大學
City University of Hong Kong

UGC
KNOWLEDGE TRANSFER ANNUAL REPORT
2022 – 2023

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Executive Summary

City University of Hong Kong (CityU) shifted its knowledge transfer focus by introducing HK Tech 300™ in 2021 which is a large-scale flagship innovation and entrepreneurship programme for aspiring entrepreneurs among CityU students, alumni, research staff and others to launch start-ups and ignite their entrepreneurship journey. The Programme aims to provide educational and growth opportunities for CityU students and, most importantly, translate CityU research results and intellectual properties into practical applications.

With HK Tech 300™ moving into its third year of operation, we are pleased to report that tremendous progress has been made as a result of overwhelming support from our strategic partners and supporting organisations in the start-up ecosystem. The innopreneurship ecosystem at CityU has flourished rapidly. As of June 2023, over 1,500 students, staff, alumni, and the general public were attracted to join the HK Tech 300™ training programme; over 560 teams/start-ups in Biotech and Health, Fintech, Deep Tech, EduTech, EnviroTech, Information and Communications Technology, and Artificial Intelligence were awarded with seed funding of HK$100,000 each; and 119 start-ups have been approved to receive Angel Fund investment of up to HK$1 million each. The first nationwide HK Tech 300 Start-up Competition was launched in June 2022, with 14 start-ups from Hong Kong and the mainland selected as winning teams after vigorous assessments. HK Tech 300™ is extending to Southeast Asia with the aim of helping start-ups in the region to expand businesses to Hong Kong and mainland China by leveraging Hong Kong's unique advantages and resources.

In the area of IP creation, CityU, with 76 US patents granted in calendar year 2022, ranked 42nd in the Top 100 Worldwide Universities Granted US Utility Patents ranking. CityU has been top in Hong Kong for the past seven consecutive years, consistently receiving the highest annual number of US utility patents.

For the third year in a row, CityU researchers won the highest number of awards among local institutions at the 48th International Exhibition of Inventions Geneva. They received a total of 36 awards, including a prestigious Special Prize and three Gold Medals with Congratulations of the Jury, demonstrating CityU's outstanding translational research and technology transfer achievements, in particular, our vibrant start-ups.

The three research centres established in collaboration with world-renowned universities under the Innovation and Technology Commission's InnoHK Clusters have been operating smoothly since their launch. By developing close collaborations with overseas collaborating institutes and bringing together top researchers from multi-disciplinary areas, both locally and internationally, the centres are taking steps towards commercialisation and technology transfer, thereby turning research outputs into impactful innovations.

1. Innovation and Entrepreneurship Ecosystem

To support Hong Kong's development into an innovation and technology hub, City University of Hong Kong (CityU) launched a university entrepreneurship programme, HK Tech 300^{TM}, that comprises entrepreneurial training, incubation, and capital investment. Since its launch in late March 2021, HK Tech 300^{TM} has made tremendous progress as a result of overwhelming support from our strategic partners and supporting organisations in the start-up ecosystem. Details of the Programme achievements are given in the ensuing paragraphs.

1.1 Recruiting and Training

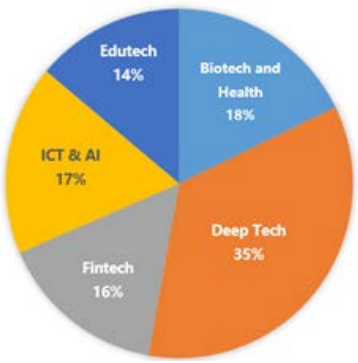
Mass campus recruitment campaigns have been launched that include a series of presentations during Orientation Days, Gateway Education courses, and events in departments, research centres, and student associations to facilitate networking and team formation.

Entrepreneurship training to potential start-up teams is packaged into an eight-week or 3-day intensive bootcamp programme delivered by external acceleration and training firms. The training programme covers a range of skills essential to kick-start an entrepreneurial journey, develop a business plan, and deliver a pitch. As of June 2023, ten cohorts of entrepreneurship training have been conducted and participants of over 1,500 students, staff, alumni, and the general public were attracted to join the HK Tech 300^{TM} training programme.

1.2 Funding

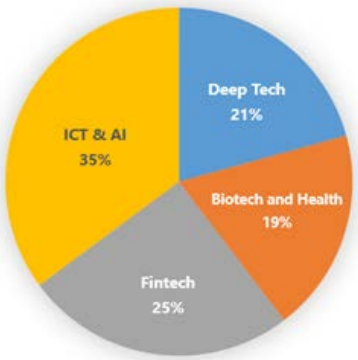
The HK Tech 300^{TM} Seed Fund transforms innovative ideas into start-ups. Of the 1,040 applications received from nine rounds of applications from undergraduate and postgraduate students, alumni, research staff, and the general public using CityU's intellectual property (IP), over 560 applications covering areas in Biotech and Health, Fintech, Deep Tech, EduTech, EnviroTech, Information and Communications Technology, and Artificial Intelligence were awarded with seed funding of HK$100,000 each.

Teams Awarded Seed Fund in Terms of Field



The HK Tech 300™ Angel Fund is an investment fund that supports early-stage start-up efforts to develop a minimum viable product/service and business model validation. As of June 2023, 119 start-ups have been approved to receive Angel Fund investment of up to HK$ 1 million each, after stringent assessment by the Screening Panels, Investment Sub-committee and Recommendation Committee, and Investment Evaluation Panel of CityU Enterprises Limited (CityUE) and CityUE Board.

Start-ups Awarded Angel Fund in Terms of Field



Further to the above funding schemes, the Technology Start-up Support Scheme for Universities (TSSSU) continues to offer funding support to CityU start-ups seamlessly at different stages of their life cycle. For the 2022-23 round of application, 13 start-ups were approved to receive a total funding of HK$ 8 million.

1.3 Co-Investment

HK Tech 300™ has established a number of co-investment collaborations with venture capitalists for investing in Angel Fund start-ups with details below:

Venture Capitalists	Investment Focus Areas
China Resources Enterprise Limited (CRE) (A joint venture, HK Tech Venture Investment Co. Ltd., was incorporated in January 2022.)	Life Science and Health, Biomedical Engineering, Materials Science and Engineering.
Gravity Capital Partners Company Limited (Gravity)	ESG related.
Market Trend Interactive Solution Limited	Virtual Reality and Augmented Reality, Interactive Solution Services, Metaverse related technology, and Gamified Solutions.
Allied Power Technology Venture LPF (Allied Power)	Financial Technologies (Fintech).
Particle Accelerator Limited	AI, Blockchain, Data Analytics, Robotics, and IoT with ESG impact.
Hong Kong - Shenzhen United Investment Fund Limited	AI, Semiconductors, New Materials, New Energy, Internet, and Health.
Shenzhen ZebraS Technology Start-up Acceleration Limited (ZebraS)	AI in Health, AI in Logistics, Robotics, Education, Web 3.0, and Smart Retail.
Lion Rock Investment Management Company Limited (Lion Rock)	Web 3.0, Software Development, and Healthcare.
Marathon Venture Partners Management, Ltd.	Digital Health.

The co-investors have each committed an investment funding of HK$5 million (CRE committed HK$50 million as initial funding) to match with the HK Tech 300 Angel Fund on a 50:50 basis, providing up to HK$1 million of investment funding per approved project. In the past year, a total of nine Angel Fund teams were shortlisted by our co-investment partners, including Radiance (co-invested by CRE out of 50 reviewed teams), AiR World (by Gravity out of 32 teams, and by Allied Power out of eight teams), Caelus Technologies (by ZebraS out of six teams), Kanaya AI Technology (by Lion Rock out of 14 teams), as well as Infinity Technology, Lacess, Novelte, Starkid, and MTN (all by Gravity).

Further to the above, CityU also signed Memoranda of Understanding (MoUs) with six venture capital and investment funds from the mainland on 14 July 2023, providing around RMB 1 billion in investment to promising HK Tech 300™ start-ups. The MoUs mark another milestone in the development of HK Tech 300™.

1.4 Co-Working Space

With the University's support, co-working space is made available for the start-up teams on CityU's main campus and 8/F of United Centre at Admiralty, amounting to a total area of ~2,500 m^2. The co-working space in Admiralty has been in use since mid-November 2021, providing off-campus office space for the start-up teams while also serving as a hub of various kinds of activities including meetings with potential investors, business matching, collaborative meetings, investment and incubation events, and workshops.

1.5 Mentorship Scheme

The HK Tech 300™ Mentorship Scheme aims to facilitate sharing of knowledge, expertise, skills, insights and experiences through interaction and communication between mentors and mentees. An introductory Mentor-mentee Meet-up session has been arranged for each cohort to connect the mentees with their mentors. So far, more than 150 mentors have been assigned to the teams to provide guidance and advice for one year during their seeding stage. The scheme is continuously expanding to include more mentors who are veteran entrepreneurs and business leaders.

1.6 Co-Development Programmes with Partners

The launch of HK Tech 300™ has been enthusiastically welcomed and supported by relevant sectors of the society, including but not limited to the following:

- A thematic round-table discussion on "New opportunities for Innovation and Technology Enterprises – How to Identify Opportunities in Hong Kong's Capital Market", co-organised with Deloitte China was held in November 2022. In the discussion, industry experts and government representatives exchanged views on issues such as the development and financing of innovation and technology enterprises and discussed the prospective establishment of Hong Kong Investment Corporation Limited (HKIC) by the government, and the newly proposed Chapter 18C of Hong Kong's listing regime, as proposed by the Hong Kong Stock Exchange. CityU also signed an MoU with Deloitte China to jointly support the development of HK Tech 300™ start-ups.

- An MoU was signed with Pacific Coffee, owned by China Resources Enterprise Limited, in December 2022 to collaborate on fostering an innovative entrepreneurship culture, thereby contributing to innovation and technology development in Hong Kong. Pacific Coffee cafés in targeted districts in Hong Kong have become venues for networking and knowledge exchange activities for HK Tech 300™.

- An MoU was signed with the Human Resources and Social Security Bureau of Shenzhen Municipality in March 2023 to jointly establish an innovation and entrepreneurial base for young people in CityU's HK Tech 300™ Co-working Space in Admiralty and to promote the establishment of a special fund by investment institutions such as Shenzhen Angel FOF Management Co., Ltd. The fund will invest in start-up teams supported by HK Tech 300™ that establish their businesses in the Greater Bay Area. In addition, it will support eligible start-up projects with entrepreneurial subsidies, loan guarantees, etc.

1.7 Collaborative Partners

As of June 2023, the Programme has secured a total of 80 partners including the major business chambers, incubators, accelerators, venture capitalists, and industry associations. They provide our start-up teams with a range of services and business opportunities, ultimately benefitting the overall HK Tech 300™ entrepreneurship ecosystem.

1.8 Support from CityU Alumni

The success of HK Tech 300 ™ would not have happened without the staunch support of our enthusiastic and dedicated alumni. While the CityU Eminence Society, an organisation formed by senior alumni who are dedicated to contributing to CityU's development through their resources, networks, and expertise, is already a HK Tech 300™ supporting organisation, alumni from different industries have been actively involved in serving as Seed Fund or Angel Fund selection panelists to help review and shortlist suitable applicants; participating in the mentorship scheme as mentors to nurture the teams; and providing professional services and consultations to facilitate the teams' business development.

1.9 CityU IPs and Licensing

One of the objectives of launching HK Tech 300™ is to broaden the application and commercial use of CityU's IPs. As of June 2023, around 116 start-ups/start-up teams have signed Evaluation License Agreements and/or Technology License Agreements with CityU, bringing real benefits to society by putting our research results to practical use in the community at large.

1.10 Achievement Highlights of HK Tech 300™ Teams

- **48th International Exhibition of Inventions Geneva**

CityU received 36 awards, including one Special Prize, three Gold Medals with Congratulations of the Jury, 17 Gold Medals, nine Silver Medals and six Bronze Medals. Fourteen of the winning teams are under HK Tech 300™.

- **13th National Challenge Cup Competition**

Six participating teams from CityU, including five from HK Tech 300™, achieved outstanding results, receiving two gold, two silver and two bronze awards. CityU's overall score ranked among the top 20 participating universities nationwide, earning the team "優勝盃" (Winners' Cup) for the first time. This result was the best among participating universities in Hong Kong.

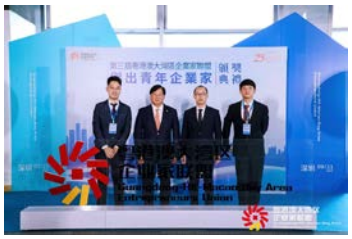
- **InnoTech Expo 2022 and BIOHK 2022**

CityU participated in the above two exhibitions in late 2022 to showcase the University's impressive achievements in research, innovation and entrepreneurship, and to explore new innovation and technology areas with industry, thereby fostering an innovative entrepreneurship culture in the community.

- **Hong Kong University Student Innovation and Entrepreneurship Competition hosted by the Hong Kong New Generation Cultural Association**

CityU received the Outstanding Organisation Award and won the most awards in the competition (one Grand Prize, three First Prizes, two Second Prizes, four Third Prizes, and nine Merit Prizes).

- **Guangdong-HK-Macao GBA Outstanding Young Entrepreneur Award**



Three HK Tech 300™ start-ups won the Best Innovation and Technology Awards. CityU alumni who founded Cellomics, a pioneer of cancer liquid biopsy technology, won the Outstanding Young Entrepreneur Award.

1.11 New Initiatives of HK Tech 300™

- **Nationwide HK Tech 300 Start-Up Competition (HK Tech 300 全國創新創業千萬大賽)**

The first nationwide HK Tech 300 Start-Up Competition (the Competition) was launched in June 2022. The Competition was held in eight cities including Hong Kong, Beijing, Shanghai, Shenzhen, Chengdu, Changsha, Qingdao, and Suzhou. Applications were called for in the following five fields: Biotech and Health, Deep Tech, Fintech, Information Technology and Artificial Intelligence (AI), and Energy and Green Technology.

Preliminaries and finals were held from September to early November 2022 in the respective regions. A total of 285 applications from the mainland and Hong Kong were received, and 86 projects from the mainland were shortlisted for the Regional Finals. Finally, a total of 50 start-ups, including 40 start-ups from the mainland finals and 10 start-ups from Hong Kong, competed in the Grand Final (全國總決賽) in mid-November 2022. After rigorous assessments, which aligned with HK Tech 300 Angel Fund selection criteria, by the Grand Final panels comprising panelists from Hong Kong and the mainland, 14 start-ups were selected as winning teams.

An Awards Presentation Ceremony cum Launch of the 2nd Competition was held on 14 July 2023. The ceremony was officiated by Dr Wang Weiming, Director-General of the Department of Educational, Scientific and Technological Affairs,

Liaison Office of the Central People's Government in the Hong Kong Special Administrative Region (HKSAR), Ms Lilian Cheong Man-lei, JP, Under Secretary for Innovation, Technology and Industry, HKSAR Government, Mr Lester Garson Huang, SBS, JP, CityU's Council Chairman, and CityU's President Professor Freddy Boey Yin Chiang.

- **"HK Tech 300 Southeast Asia Start-Up Competition"**

Leveraging the success of the HK Tech 300 National Start-Up Competition in mainland China, the impact of HK Tech 300™ is extending to Southeast Asia with the launch of the HK Tech 300 Southeast Asia Start-Up Competition, which aims to help Southeast Asian start-ups expand their businesses to Hong Kong and mainland China by benefiting from Hong Kong's unique advantages and resources. The competition will also promote technology transfer and commercialisation in the Southeast Asian region, fostering closer ties between the entrepreneurship and innovation ecosystems in Hong Kong and the region. The HK Tech 300 Southeast Asia Start-Up Competition was kicked off in May 2023, and is expected to award Top 10 winners in the Final Round in Q4 2023, each receiving up to HK$1 million Angel Fund investment. The Competition is supported by regional partners including universities in Malaysia, Brunei, Thailand, and Vietnam, as well as business chambers and government departments. More regional partners from Southeast Asia will be invited throughout the competition, so as to enhance the impact of the competition as well as leverage the networks of different partners.

The launch ceremony of HK Tech 300 Southeast Asia Start-up Competition was conducted in May 2023, with over 100 attendees, including Malaysian government officials (Deputy Minister of Higher Education and Higher Education Adviser to the Minister of Higher Education), representatives from Malaysian incubators (MDEC and SIDEC), representatives from the collaborating universities in the region (Universiti Malaya and Universiti Putra Malaysia from Malaysia, Universiti Brunei Darussalam from Brunei Darussalam, Chulalongkorn University from Thailand), as well as over 20 media/writers from 12 media organisations. In total, over 162 media coverage was received, not just in Malaysia, Hong Kong, but also in Thailand and Vietnam, with more advertorials coming up in Malaysia, Singapore and Hong Kong.

- **Regular Participation in Shenzhen Venture Capital Day**

The Shenzhen Venture Capital Day (SZ VC Day) has been a signature venture capital event held on a monthly basis in the Greater Bay Area since November 2022, attracting global experts from the venture capital world. The event provides a valuable opportunity for our start-ups to connect with the technology market and the capital market globally through a one-stop platform. HK Tech 300™ has invited teams, panelists, co-investment partners and representatives from different universities to join the SZ VC Day since March 2023 and will continue to support and participate in this event which will be held in different districts in Shenzhen on a monthly basis.

2. Facilitating Knowledge Transfer and Commercialisation

2.1 IP Management

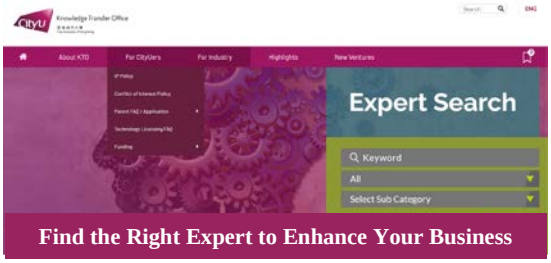
The University has in place a well-established administrative framework and policy protecting the IP generated from research activities. After a stringent vetting process, inventions of high commercialisation value are pursued for patent filing. In the year under review, 298 new patent applications were filed in the US, Mainland China, and other jurisdictions in various fields of technologies, with 107 patents granted during the same period. By June 2023, CityU's IP portfolio consists of 767 patents granted and a further 679 patents pending.

After years of cultivation, our patenting work is beginning to bear fruit. With 76 US patents granted in calendar year 2022, CityU ranked 42nd in the Top 100 Worldwide Universities Granted US Utility Patents ranking. CityU has been top in Hong Kong for the past seven consecutive years, receiving the highest number of US utility patents annually. The University will make our best effort to sustain this leading position and continue to excel in this area.

2.2 IP Portal and Expert Search Portal

CityU's Knowledge Transfer Office website hosts a list of IPs, the IP Portal, to broaden marketing channels for licensing; and a list of experts, the Expert Search Portal, to help industry and businesses solving their problems. The IP Portal offers Technology Briefs in layperson's terms with emphasis on applications and usage. The two Portals together serve as effective channels for technology licensing and industry collaboration for research and consultancy.

Uncover Technologies from this IP Portal



Find the Right Expert to Enhance Your Business

2.3 Outreach

Through participating in technology transfer or innovation exhibitions, CityU aims to showcase its latest inventions for commercialisation and expand its client base. Four exhibitions were participated in during the year under review:

- InnoCarnival organised by the Innovation and Technology Commission of the HKSAR Government (22-30 October 2022)
- InnoTech Expo 2022 organised by Our Hong Kong Foundation (12-22 December 2022)
- BIOHK 2022 organised by the Hong Kong Biotechnology Organization (14-17 December 2022)
- 48th International Exhibition of Inventions Geneva (26-30 April 2023)

InnoCarnival


BIOHK


InnoTech Expo

2.4 48th International Exhibition of Inventions Geneva

For the third year in a row, CityU researchers received the highest number of awards among local institutions at the annual International Exhibition of Inventions Geneva, one of the biggest global events showcasing innovations and inventions. CityU won a total of 36 awards, including one Special Prize, three Gold Medals with Congratulations of the Jury, 17 Gold Medals, nine Silver Medals and six Bronze Medals, demonstrating the University's outstanding research achievements, in particular, our vibrant start-ups. A list of the winning projects is given in Appendix 2.

2.5 Promoting Knowledge Transfer beyond Science and Engineering Disciplines

To encourage KT and nurture a KT culture in non-science disciplines, the Excellence in Knowledge Transfer Award has been offered since 2011. The Award gives recognition to faculty members in the College of Liberal Arts and Social Sciences (CLASS) who have made outstanding achievements in applying their knowledge for creating high social impact. The 2022-23 Excellence in Knowledge Transfer Award and Certificate of Merit winners were as follows:

Project Title	Department	Recipient
Excellence in Knowledge Transfer Award		
Shanxi Cultural Exhibition	Department of Chinese and History	Mr. Li Lin
Certificate of Merit		
Optimising Caretaker Input for Multilingual Children: from Predictive Models to Input Recommendations	Department of Linguistics and Translation	Professor Maggie Mai Ziyin
Monitoring and Predicting the International Talent Flow	Department of Media and Communication	Professor Wang Xiaohui

3. Industry Engagement through Contract and Collaborative Research

3.1 Contract and Collaborative Research

Part of the University's mission is to anticipate and respond to the needs of industry, commerce and the community by engaging in applied research and using its results to directly benefit Hong Kong and beyond. The University continues to maintain close ties with local and overseas industries and organisations through various forms of collaboration including contract research. Highlights of some contract research projects (including projects from the Government and Innovation and Technology Commission's Innovation and Technology Fund) in a wide spectrum of disciplines are set out below:

- *Development of a Non-Viral Gene Therapy Platform for Retinal Degenerative Diseases*
- *Development of Point-of-Care Testing Technology and Portable Device for Simultaneous Detection of Multiple Respiratory Tract Pathogens*

- *Microfluidic Patient-Derived Tumor Models to Monitor Disease Response in Real-Time*
- *Novel Net Technology to Reduce the Impact of Fish Disease in Ocean Cage Farming*
- *AI Wearable Wireless Micro Motes for Real-Time Motion Analytics of Gymnastics and Wushu Athletes*
- *Research and Commercialisation of a High-Performance, Low-Cost Dual Band mm-Wave Antenna System*
- *Energy-Efficiency Aware Collaborative Computing for Heterogeneous OS Platforms*
- *Highly Safe Large-Scale Electrochemical Energy Storage Systems with Long Lifespan and their Key Materials*
- *Dissemination of Caregiver Support Model & Psycho-Education Programme on Empowerment: Development and Validation*
- *Economic Impact Study on Development of the 3rd Generation Semiconductor Innovation Infrastructure and Blueprint in Hong Kong*

3.2 InnoHK World-Class Research Clusters

CityU has established three research centres under InnoHK, and the centres have been operating smoothly since their launch. By developing close collaborations with overseas collaborating institutes and bringing together top researchers from multi-disciplinary areas, both locally and internationally, the centres are taking steps towards commercialisation and technology transfer, thereby turning research outputs into impactful innovations.

- The Hong Kong Centre for Cerebro-Cardiovascular Health Engineering (COCHE) focuses on early detection, prevention and intervention of cardiovascular disease with innovative technologies. With strong interdisciplinary global research collaborations, COCHE is developing flexible sensing, biomedical and molecular imaging, nano-biosensing, and AI in health. COCHE's focus is on innovative wearables that collect key vital signs on an unobtrusive and real-time basis. The collected data is transmitted for further analysis and integration with other biomarkers, paving the way for early detection and diagnosis of possible acute cerebro-cardiovascular diseases.

- The Laboratory for AI-powered Financial Technology (AIFT) combines artificial intelligence, big data and blockchain technology with modern financial tools. AIFT has made significant progress and implemented research outcomes in three major areas. These areas include providing supply chain finance solutions to commercial sectors, combining AI algorithms and data to offer asset analysis tools for investment in China's bond markets, and developing a flagship investment application that provides value-adding information to assist investors in making investment decisions in various assets, including stocks, bonds and cryptocurrencies. AIFT has been actively searching for business partners and has secured relationships with banks, payment firms, and credit rating agencies. AIFT has signed an official agreement with Bank of China (Hong Kong) Limited (BOCHK) to be a funding-partner for a defined financing business for selected supply chain merchants.

- The Centre for Intelligent Multidimensional Data Analysis (CIMDA) provides world-class research and product development in AI and big data analysis for a wide range of applications including image, video and biomedical data analysis, and computer graphics and animation. CIMDA has recently showcased their latest AI-based technologies for sports data analysis designed to enhance the quality of physical education. The Sports Activity Assessment System is a system that gamifies warm-up activities in physical education lessons, while the AI Runner Track System can monitor performance to emulate a running race for a large group of runners, providing accurate real-time evaluations of students' performance. These systems can facilitate physical education lessons in schools and improve the quality of education. CIMDA has been organising workshops in local schools, participating in exhibitions, and taking steps towards commercialisation.

4. Deepening Research Collaboration and Knowledge Transfer with the Mainland

4.1 Research Institutes in Mainland China

With the addition of the CityU Shenzhen Futian Research Institute, which was established in March 2020, CityU now maintains three research institutes, two of which are in the Greater Bay Area, for deepening research collaboration and knowledge transfer with the Mainland.

- **CityU Shenzhen Futian Research Institute**

  CityU Shenzhen Futian Research Institute, the first discipline-specific research institute in the Hetao Shenzhen-Hong Kong Science and Technology Innovation Cooperation Zone (Zone) set up by universities in Hong Kong, receives various support from the Futian District People's Government that includes not only research space, but also research funding, talents and training, and innovation and entrepreneurship support.

  In its two years of development, with the support of a series of Shenzhen-Hong Kong collaborative innovation policies promulgated by the Futian District People's Government, the Institute has taken the lead in introducing four cutting-edge research projects and CityU teams into the Zone and has achieved excellent results in the fields of high-end electronic devices, precision medicine, advanced materials, and photovoltaic cell research and development.

  The CityU-Shenzhen Futian Research Institute leverages CityU's top-notch research capabilities and talents to respond to the needs of our country through research results transformation and commercialisation.

- **CityU Shenzhen Research Institute**

  Research development in Shenzhen fared well in 2022-23. A total of 45 new research projects were obtained via the research platform in Shenzhen: the CityU Shenzhen Research Institute. These included 20 projects funded by the National Natural Science Foundation of China, 15 by the Shenzhen Science, Technology and Innovation Commission (SZSTI), three by the Ministry of Science and Technology of the People's Republic of China (Major Programme), and five by the Department of Science and Technology of Guangdong Province, etc. CityU topped all the universities in Hong Kong in receiving the highest number and amount of approved project grants from the SZSTI-Basic Research Programme.

- **CityU Chengdu Research Institute**

  The CityU Chengdu Research Institute (CityUCRI) continues to serve as a strategic platform of the University in inland China for research and development, incubation and innovation, as well as professional education and training. Research activity at CityUCRI is gaining momentum. Four new research projects received funding from the Science and Technology Department of Sichuan Province and the Science and Technology Bureau of Chengdu, with another eight research projects ongoing.

5. Impact Cases

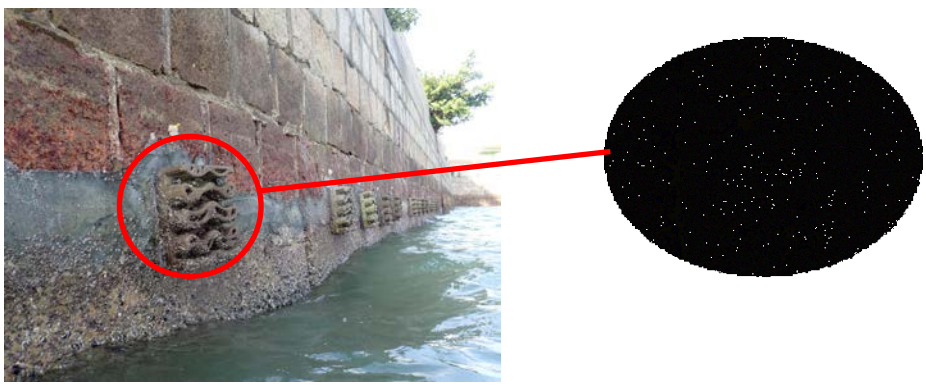
Highlighted below are some examples of significant knowledge transfer endeavors of the University carried out during the year under review. The University's entrepreneurial programme, HK Tech 300^{TM}, played an important role in the application and commercialisation of these technologies.

5.1 Eco-Tiles for Enhancing Marine Biodiversity

Environmental sustainability is crucial to improving the quality of human life. To this end, CityU's State Key Laboratory of Marine Pollution, under the leadership of Professor Kenneth Leung, invented Eco-Tiles for enhancing marine biodiversity, thereby greatly improving the entire marine ecosystem. Eco-Tile has earned the research team a Special Prize at the 48th International Exhibition of Inventions Geneva which demonstrates the impactful significance of the research results.

The prevalence and increased spread of artificial shorelines has become a major issue for coastal areas. The damage caused by artificial shorelines to the environment impacts the entire ecosystem, including the local water quality and fisheries. As coastal areas have become more populated and climate change has threatened shorelines, more artificial shorelines are built.

In contrast to the traditional seawalls commonly used around the world, Eco-Tiles encourage the growth of marine life and lead to a healthy ecosystem. The crevices and holes of the Eco-Tiles can harbour twice as many species as traditional seawall, and are used by fish and oysters, filtering the seawater and promoting sustainable fisheries. The eco-friendly concrete of the Eco-Tiles uses 20-24% recycled material, lowering the carbon footprint as compared to traditional concrete. The Eco-Tiles play a significant role in restoring the seawalls of cities and ports, thereby creating more healthy ecosystems. A start-up company under HK Tech 300^{TM}, Afternature Limited, was formed to commercialise the Eco-Tiles.



5.2 Sports with AI Revolution

Headed by Professor Hong Yan, CityU's Centre for Intelligent Multidimensional Data Analysis under the Innovation and Technology Commission's InnoHK programme has developed two new AI technologies that support physical fitness for students and teachers. The Education Bureau (EDB) and local PE teachers have expressed keen interests in these two systems. Currently, about 600 students are actively using them.

Sports Activity Assessment and AI Runner Track, which are affordable and easy to set up, provide students with an immersive digital experience and make it easier for teachers to monitor progress accurately.

Sports Activity Assessment is a runner simulation system. Users only need to wear a small and lightweight ankle band for warm-up exercises simulated as a racing game with five modes: skipping, star jump, high knee run, push-ups, and sit-ups.

AI Runner Track is a runner assessment system gamified with racing elements but with a heavier focus on monitoring time and speed. A tag that users attach to their vests while running will be automatically detected by cameras along a running track. The system can accurately capture the running time and speed in real-time of a large group of users, even ranking them from fastest to slowest.

Employing AI technologies in physical education relieves teachers from tedious and lengthy evaluation work with quicker and more accurate solutions while also giving students the benefit of a more fun and efficient PE lesson overall. The systems can be used at schools and any sports institutions that hope to introduce technology to aid physical training for groups of over 35 people and, even if the subjects move quickly. The evaluations are automatic and instant, capturing results shown in real-time and making it easier for students and teachers to monitor progress and improve performance.

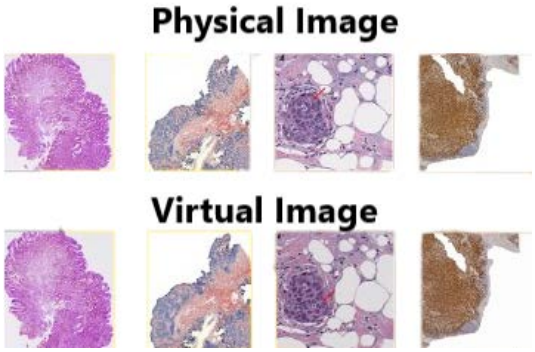
5.3 AIstain: Virtual Immunostaining for Veterinary Pathology

AIstain is another example of successful application of AI technology. Three professors from cross-disciplines namely the Department of Physics (Professor Condon Lau), School of Data Science (Professor Xinyue Li), and the Department of Infectious Diseases and Public Health (Professor Fraser Hill), together with practitioners of artificial intelligence, pathology, oncology, and veterinary pathology jointly developed AIstain which employs AI technology for medical image analysis in veterinary cancer diagnosis. AIstain has earned the research team a Gold Medal with Congratulations of the Jury at the 48th International Exhibition of Inventions Geneva. A start-up under HK Tech 300™, ITsci Company Limited, was formed to commercialise the product.

The research team develops AI-based image-to-image translation models to translate H&E-stained images to antibody-stained images, thereby achieving virtual immunostaining. During surgery, tissues from the surgical area are stained, imaged, and examined by pathologists for cancer. If cancer is detected, the surgery must continue, or else it can end. AIstain is a novel generative AI technology that enables a computer to virtually perform immunohistochemistry, replacing slow, expensive, and difficult-to-use antibody stains. The neural networks behind AIstain are trained with accurate immunohistochemistry data obtained using antibodies, resulting in accurate outputs.

To the pathologists, virtual immunohistochemistry looks similar to traditional immunohistochemistry, but results are available in minutes, not hours.

AIstain provides a generative AI tool for virtual tissue staining that is much faster, cheaper, and easier to use than conventional veterinary pathology tools for advancing disease diagnostics.



5.4 A Powerful Analytical Sensor for Disease Detection, Food Safety and Commodity Safety

The healthcare industry has been one of the fastest growing sectors in recent years. The COVID-19 outbreak further raised the public's awareness of health. The market is yearning for a comprehensive product that can be used for disease detection, food safety and commodity safety. A Surface-enhanced Raman spectroscopy (SERS) substrate developed by the Hong Kong Branch of National Precious Metals Material Engineering Research Center (NPMM) promises to be a boon to the demand.

SERS is a field-enhanced spectroscopy technique wherein the Raman scattering of molecules is enhanced by 10^4 to 10^8 times in the proximity of precious metals such as gold (Au), silver (Ag), and copper (Cu). Led by Professor Jian Lu from the Department of Mechanical Engineering and Professor Yangyang Li from the Department of Materials Science and Engineering, the team developed a simple, efficient, and environmentally-friendly electrochemical treatment process that can bestow the surface of common precious metal materials with nanotopology. It was applied to develop a series of low-cost and high-performance SERS sensors. The optimised product of this research is 10 to 100 times more sensitive and 50% cheaper than the current high-performance commercial SERS sensors. Two patents have been licensed to a HK Tech 300™-funded start-up, LuMAT-SERS Limited, for the commercialisation of these technologies.

Given its ultra-sensitivity, rapidness, and noninvasiveness, the application of SERS in various practical scenarios has been explored. Its application to disease detection is particularly noteworthy. The technology can be able to identify early-stage lung cancer by quantitative analysis of 2-naphthalenethiol, a toxic volatile organic compound overexpressed in the exhaled breath of patients. The team has received funding from the Shenzhen Municipal Government (深圳市抗疫專項, Shenzhen Anti-COVID project) with the University of Hong Kong, for the development of quick detection of COVID-19, the solution is with higher accuracy than Rapid Antigen Tests available in the market. In addition to disease detection, the SERS sensor can be used for the point-of-care testing of skin care products and antibiotics, the rapid identification of fish freshness, and the analysis of various components in urine. It also shows excellent potential in the quality control of edible sugar and liquor.

Until now, NPMM has published nine research papers and obtained 11 patents regarding SERS technology. The team won the Silver Medal in the National Exhibition of Inventions in 2021, a Gold Medal at China (Shanghai) International Exhibition of Invention and Innovation, the 24th CHTF Excellent Product Award in 2022, and a Gold Medal at the International Exhibition of Inventions Geneva 2023, showing that the technology is highly recognized.

5.5 Jockey Club Project IDEA

Leveraging CityU's School of Creative Media's strengths in Arts and Technology (Arts-Tech), the "Jockey Club Project IDEA" aims to enhance the literacy and technical skills of secondary school students and teachers to work efficiently in the area of Arts-Tech which in turn will promote artistic expression and social innovation. The project also strives to enhance participation and art accessibility for people with disabilities (PWDs) and facilitate social inclusion among the youth and the general public, thereby creating a better and more harmonious community. The project was featured on Commercial Radio Hong Kong 881's programme "The Way We Are" on 12 March 2023 and has received very positive feedback on its societal impact.

Receiving a donation of HK$17 million from The Hong Kong Jockey Club Charities Trust, the project is a three-year education project commencing from December 2022. With six phases altogether, we are now at the end of the second phase. Phases 1 and 2 involved the participation of 20 schools, 33 teachers and around 2,000 students.

Arts-Tech workshops in Phase 1 included DrawSound which taught students physical computing and use of conductive paint to make touch-sensitive audio-visual art which will enable one to hear different sounds while touching different parts of a painting. It also included the Digital Senses workshop, where students learned simple coding in order to transform signals across different senses and produce sound visualizations and the sonification of visual signals. In Train-the-Trainer Workshop, teachers were provided with an overview of the Arts-Tech and New Media Arts fields, along with hands-on training in physical computing and creative coding. The Inclusive Arts Experience Learning Workshop included demonstrations and sharing sessions with artists with disabilities, to help students gain insight into the everyday challenges of PWDs. The Arts x Tech Training Workshop introduced students to the concepts and processes associated with creating New Media Art using technology.

The social impact of the project is evidenced both in education and also in terms of social inclusion. The literacy and technical skills in Arts Tech of both teachers and students will be enhanced by this project and will lead them to a promising new direction for professional development and interdisciplinary mastery. This project will promote social inclusion by highlighting the challenges of PWDs, by popularising the idea of arts accessibility and advocating an inclusive society through arts and technology. The project will not only develop future talents with the capacity for innovation in creative and cultural industries but also promote economic benefits in multiple industries in Hong Kong by igniting the creative potential of technology.

Appendix 1

Summary of Knowledge Transfer Performance Indicators

(Amounts are in Hong Kong dollars)

Performance Indicators	2022-23
[1]Intellectual Property (IP)	
No. of patents filed in the year	[2]298
No. of patents granted in the year	[2]107
Expenditure involved in generating income from intellectual property rights	$18.2M
IP Licensing	
No. of active licences during the reporting year (includes newly granted ones but excludes evaluation license agreements)	[3]74
Income generated from intellectual property rights	$3.75M
Industry Engagement	
No. of collaborative research projects and income thereby generated (inclusive of ongoing and new projects)	73/$39M
No. of contract research projects (other than those included in "collaborative researches" above), and income thereby generated (inclusive of ongoing and new projects)	224/$104M
No. of consultancies, and income thereby generated	75/$10.77M
Continuing Professional Development (CPD) courses	
Income received from and number of attendees of CPD courses (inclusive of professional doctorate programmes and taught postgraduate programmes except for PCLL)	$1,174M/12,642
Community Engagement	
No. of public lectures/symposiums/exhibitions and speeches to a community audience organised/co-organised by CityU (seminars and workshops are included)	245
No. of performances and exhibitions of creative works (by staff or students) organised/co-organised by CityU	18
No. of staff engaged as members of external advisory bodies including professional, industry, government, statutory or non-statutory bodies	391

[1] The figure reported includes the patents of the University's Mainland research set-ups.

[2] Updated figure as of December 2023.

[3] Excluding the Evaluation License Agreements, the number of active licences for 2021-22 was adjusted to 50.

Performance Indicators	2022-23
Entrepreneurship	
[4]Number of start-ups/projects (championed by our students/alumni/staff, inclusive of those championed by non-CityU members but using CityU IP) which have received CityU entrepreneurial funding/investment support	302

[4] The figure is derived from the summation of the number of recipients under different entrepreneurial funding and investment schemes of the University during the reporting period.

Appendix 2

List of Winning Projects in 48th International Exhibition of Inventions Geneva

Key Inventors	Invention name	CityU Start-up
Special Prize and Gold Medal with Congratulations of the Jury		
Professor Kenneth Leung Mei-yee	Eco-Tiles for Enhancing Marine Biodiversity	√
Gold Medal with Congratulations of the Jury		
Mr Louis Sze (Syngular Technology Limited, a start-up under HK Tech 300)	Syngular Mixed Reality Platform	√
Professor Condon Lau, Professor Li Xinyue, and Professor Fraser Hill	AIstain: Virtual Immunostaining for Veterinary Pathology	√
Gold Medal		
Professor Chan Chi-hou and Professor Stella Pang	Terahertz Metasurface Antenna for 6G Communications	
Professor Luk Kwai-man and Professor Stella Pang	Low-profile High-gain Terahertz Antenna for Future Wireless Applications	
Professor Li Haoliang and Professor Wang Shiqi	Echo-FAS: Acoustic-based Face Anti-Spoofing	
Professor Paul Chu Kim-ho	Low Cost and Large-Scale Production of Carbon Nanotubes	√
Professor Yu Xinge and Professor Lei Dangyuan	Cooling Technology for Epidermal Electronics	
Professor Stella Pang	Neural Implant with Dynamic Electrode Position Control	
Professor Peggy Lo Pik-kwan	TNA-Based Probes for miRNA Detection	
Professor Lu Jian and Professor Li Yangyang	Multifunctional Detection System Based on Nano-engraved Sensor	√
Professor Michael Lam Hon-wah	Smart Food Label: Colorimetric Chemosensor for Freshness	√
Professor Raymond Lam Hiu-wai	Label-free High-throughput Multi-physical Cell Cytometer	

Professor Wu Wei	Energy-free PV Cooler and Water Harvester	
Professor Johnny Ho Chung-yin	Solar-Electrocatalytic System for Hydrogen Generation	
Professor Zhi Chunyi	Aqueous Batteries with Ultimate Safety	
Professor Wu Wei	Power-to-water Battery	
Professor Walid Daoud	Omni-direction Omni-frequency Wave Energy Converter	
Professor Lu Jian	EcoSponge–Utilising Solar Energy for Sustainable Freshwater Production	
Professor Zhu Zonglong	HarvSolar: Eco-friendly Perovskite Photovoltaics	
Silver Medal		
Professor Khoo Bee-luan	Personalised care: PIEB Biochip	√
Dr Danny Lo, Ir Dr Kelvin Siu, and Mr Raymond Lau (all from InnoSpire Technology Limited, a start-up under HK Tech 300)	WeVoice Glasses	√
Professor Sam Kwong Tak-wu and Professor Wang Shiqi	Learning-based Genome Codec	
Professor Zhao Shijun	Superior AI Modeling of Large Atomic Systems	
Professor Edwin Tso Chi-yan	Energy-saving Cooling Ceramic for Building Exteriors	√
Professor Zhang Wenjun	Advanced Bifunctional Electrodes for Green Hydrogen Generation	√
Professor Khoo Bee-luan	Microplastic Concentrator (MPC)	√
Professor Tu King-ning and Professor Liu Yingxia	High-performance Copper-based Filter for Fast Virus Elimination	√
CityU, Electrical and Mechanical Services Department (EMSD) and MTR joint-submission Professor Thomas Ng Shiu-tong, Professor Eric Lee Wai-ming, Professor	Train-borne Railway Infrastructure Inspection System	

Lam Heung-fai, Professor Luo Xiaowei, Professor Zhang Zijun, and Professor Zhao Xiangyu		
Bronze Medal		
Professor Yan Hong and Professor Xie Min	Holistic AI-based Battery Health Tracker	
Mr Forte Fung (MotoNerv Limited, a start-up under HK Tech 300)	MotoNerv: Intelligent Analytics of Driver Behaviour	√
Professor Zhu Kening	PropelWalker: Wearable Haptics for VR Walking	
Professor Jing Xingjian	New-Gen Anti-Vibration X-Seating Technology	
Professor Hu Jinlian	JanusLean Electrospun Energy Eye Mask	√
CityU and EMSD joint-submission Professor Norman Tse Chung-fai	Electrical Doctor-Real-time Health Diagnosis for Electricity Supply System	