



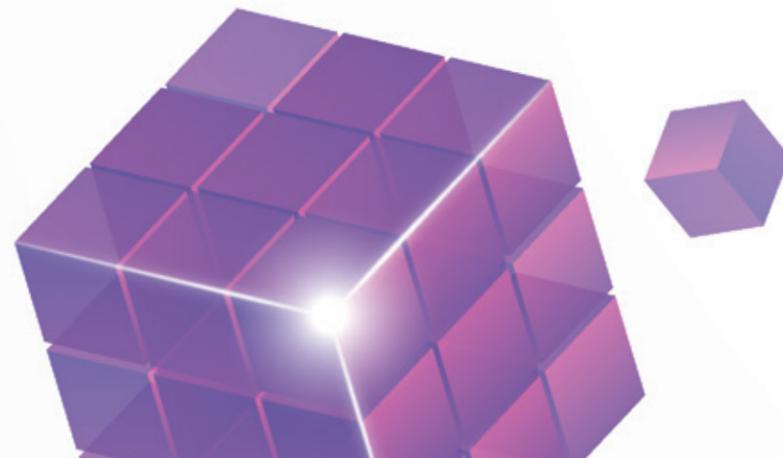
RESEARCH AND DEVELOPMENT

研究及發展

LEADING RESEARCH ACROSS THE DISCIPLINES 領導跨學科研究

New knowledge for the new era — that is the aim of the research agenda set forth by CityU as it pursues a range of projects designed for maximum impact for people today. This is a snapshot of the incredible work undertaken by our scholars.

為新時代創造新知識 —— 這是城大訂立的研究目標，以盡力為現今社會謀福祉。以下簡介城大學者的傑出研究成就。



Research with meaning

More than 180 CityU faculty members were listed among the top 2% of the most cited scientists in the world, according to Stanford University in October 2022. This achievement reflects our faculty's excellent academic standards and outstanding research performance. Compared to faculty size, CityU's percentage of the top 2% of the world's most highly cited scientists is among the top 100 in the world, while only a very few universities in Asia made the list.

An awards ceremony held by Clarivate at CityU in March 2023, commended 29 CityU scholars for being named Highly Cited Researchers for 2022, an achievement that placed CityU 50th worldwide in this citation ranking. By faculty size, CityU's percentage of the world's most Highly Cited Researchers puts it first in Hong Kong and Asia. A total of 6,938 researchers from 69 countries and regions made the list, all of whom had published multiple highly cited papers in their fields and rank in the top 1% by citations. Of the world's population of scientists and social scientists, Highly Cited Researchers are 1 in 1,000.

富意義的研究

根據史丹福大學2022年10月公佈的「全球前2%頂尖科學家」，逾180位城大教研人員榜上有名，反映城大的極高學術水平及卓越研究成就。以大學教研人員與膺選學者計算，城大頂尖科學家比例之高，為世界大學前100名，亞洲只有極少數幾家大學能位列其中。

科睿唯安於2023年3月舉行頒授典禮，嘉許城大29位學者獲選為「2022年最廣獲徵引研究人員」。城大於該項排名中位列全球第50，而以教研人員與獲得該殊榮的人數比率計算，在香港以至亞洲均名列第一。在全球69個國家和地區中，共有6,938位學者獲選為「2022年最廣獲徵引研究人員」。他們均在各自學術範疇發表多篇論文，並因獲徵引次數位居最高1%之列而膺選。以全球科學家和社會科學家計算，最廣獲徵引研究的人員僅為千分之一。



Professor Yan Hong (first from left), Director of CIMDA, and his team
CIMDA總監嚴洪教授(左一)及其團隊

AI for best health

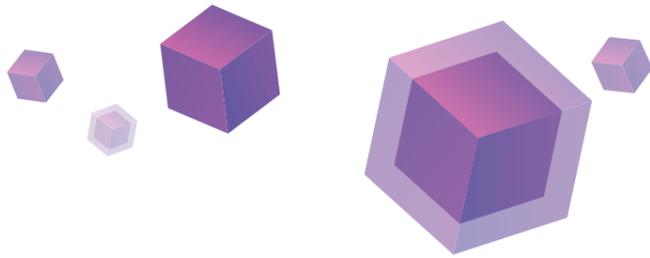
Two new AI technologies that support physical fitness for students and teachers have been developed by the Centre for Intelligent Multidimensional Data Analysis (CIMDA) at CityU, it was announced in May 2023. CIMDA is a world-class research centre established under the InnoHK programme funded by the Innovation and Technology Commission. The 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 athletic progress more accurately.

促進健康的人工智能技術

城大的智能多維數據分析研究中心 (Centre for Intelligent Multidimensional Data Analysis, CIMDA)於2023年5月宣佈，成功研發兩項人工智能新技術，可支援學生和教師進行體能活動。CIMDA是獲創新科技署轄下InnoHK計劃資助而創立的世界級研究中心。新研發的兩項技術「運動項目評估系統」和「AI跑步系統」均成本低且容易安裝，可為學生帶來沉浸式數碼化運動體驗，並可讓教師更準確地監察學生的運動進度。



29 CityU scholars are named Highly Cited Researchers for 2022, placing CityU 50th worldwide in this citation ranking.
城大29位學者獲選為「2022年最廣獲徵引研究人員」，位列全球第50。

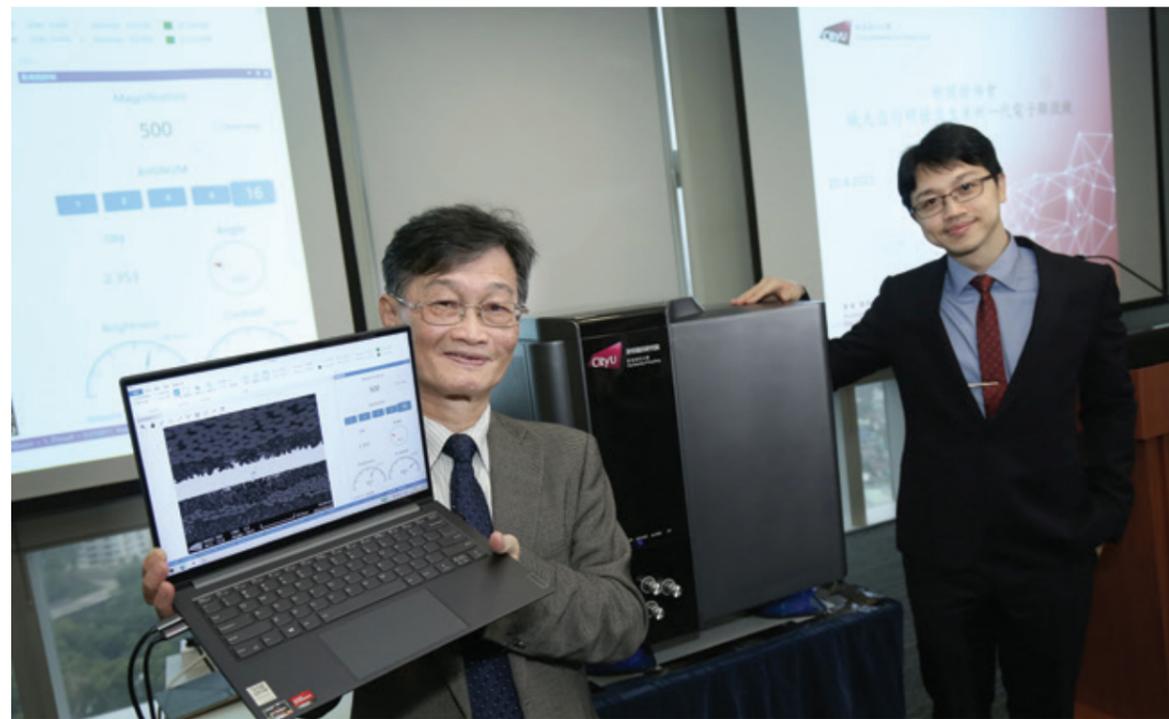


World-first in electron microscopes

Next-generation electron microscopes (EMs) composed of a pulsed electron source, a fast camera, a staged pumping vacuum system, and an aberration corrector have been developed by a team led by Professor Chen Fu-rong, Chair Professor in the Department of Materials Science and Engineering. It was announced in April 2023 that by equipping the fast camera with a deflector, the speed of imaging is not limited to the readout time, the first time that such a concept can be verified on a desktop EM system. The team's ultimate goal is to develop a miniature high space-time resolved "quantum" EM that can be used to study atom dynamics of beam-sensitive materials.

世界首創的電子顯微鏡

材料科學及工程學系講座教授陳福榮教授帶領的團隊，研發出新一代電子顯微鏡。團隊於2023年4月宣佈，新研發的顯微鏡包括脈衝電子源、超快相機、分段抽氣真空系統及像差校正器。新系統的快速相機加裝偏向器後，可令成像速度不再受制於成像輸出時間，這是全球首次在桌面電子顯微鏡系統上證實這一概念。團隊的最終目標是研發出一款小型高時空分辨「量子」的電子顯微鏡，用以研究光束靈敏材料的原子動態。



Professor Chen Fu-rong (left), and Dr Hsueh Yu-chun, Research Fellow, the Time-Resolved Aberration-Corrected Environmental EM Unit
陳福榮教授(左)與高時空分辨電子顯微中心研究員薛又峻博士



Professor Chan Chi-hou (second from left, front row), Professor Tsai Din-Ping (right, front row) and researchers at CityU have developed a novel tunable terahertz meta-device.
陳志豪教授(前排左二)、蔡定平教授(前排右)及其他城大研究人員研發出新型可調的太赫茲超構器件。

Novel antennas for boosting communications

A new-generation antenna developed by a research team led by Professor Chan Chi-hou, Chair Professor in the Department of Electrical Engineering (EE) and Director of the State Key Laboratory of Terahertz and Millimeter Waves (SKLTMW), allows manipulation of the direction, frequency and amplitude of the radiated beam. It was announced in December 2022 that the technology is expected to play an important role in the integration of sensing and communications for 6th-generation (6G) wireless communications.

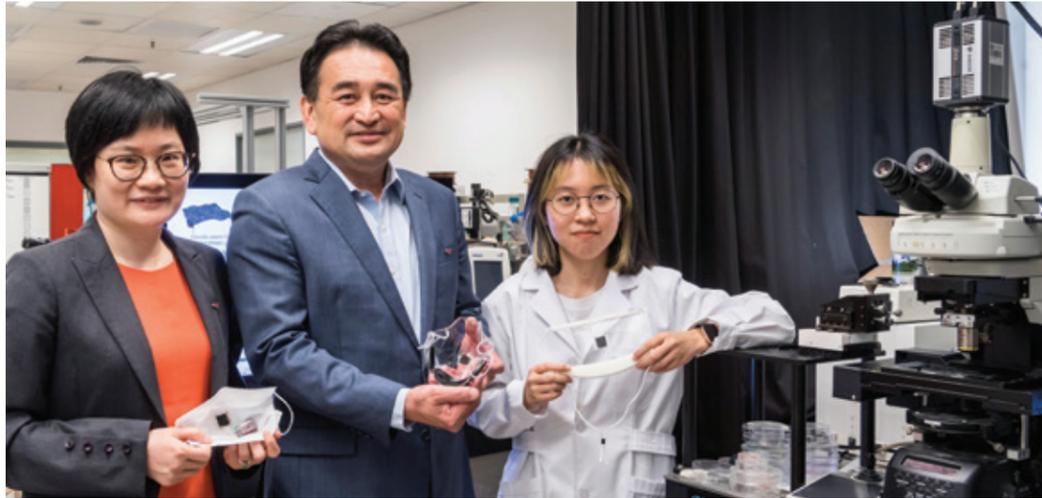
推動通訊發展的新天線

電機工程學系講座教授兼太赫茲及毫米波國家重點實驗室主任陳志豪教授領導的團隊於2022年12月宣佈，研發出可調控輻射波束的方向、頻率和幅度的新一代天線，有望在第六代無線通訊的通訊感知一體化中發揮重要作用。

A novel tunable terahertz meta-device that allows for signal delivery to specific receivers has been developed, announced the researchers from State the Key Laboratory of Terahertz and Millimeter Waves and the Department of Electrical Engineering in March 2023. The widespread adoption of such a device, made using advanced 3D printing technology, has implications for saving energy and protecting privacy plus benefits for 6G communications, wireless power transfer and remote sensing. The team behind the discovery is led by Professor Chan Chi-hou; Professor Tsai Din-Ping, Chair Professor in EE; Professor Chen Mu-Ku in EE; Dr Wu Gengbo, a postdoctoral fellow at SKLTMW; and Zhang Jingcheng, a PhD student in EE.

太赫茲及毫米波國家重點實驗室及電機工程學系於2023年3月宣佈，研發出新型可調的太赫茲超構器件，可將訊號傳送至特定接收器。這種超構器件使用先進三維打印技術製造，如廣泛應用，將有助節能及提升信息傳遞的保密性，對促進第六代通訊、無線電力傳輸及遙距感應系統的發展有莫大裨益。負責這次研究的城大團隊包括陳志豪教授、電機工程學系講座教授蔡定平教授、陳沐谷教授、太赫茲及毫米波國家重點實驗室博士後研究員吳耿波博士，及電機工程學系博士研究生張景程。

(From left) Professor Wang Jianping, Professor Li Wenjung, and Suo Jiao, PhD student of the Department of Mechanical Engineering
(左起)汪建平教授、李文榮教授及機械工程學系博士生索姣



Battling disease, saving lives

A research project titled “Multi-disciplinary approaches to tackling the global public health threat of hypervirulent and multidrug-resistant *Klebsiella pneumoniae*” led by Professor Chen Sheng, Associate Dean of CityU’s Jockey Club College of Veterinary Medicine and Life Sciences, and Professor in the Department of Infectious Diseases and Public Health, received HK\$38 million in research funding in the 12th round of the Theme-based Research Scheme under the Research Grants Council of the University Grants Committee in July 2022. *Klebsiella pneumoniae* is part of the normal gut flora and is the most common opportunistic pathogen, especially in elderly and immunosuppressed patients.

An Internet of Things Smart Mask integrating an ultrathin nanocomposite sponge structure-based soundwave sensor, which can detect and classify various respiratory sounds using deep learning, thus helping to improve personal and public health, has been developed by Chair Professor Li Wenjung in the Department of Mechanical Engineering; Professor Wang Jianping in the Department of Computer Science; and Professor Yu Xinge in the Department of Biomedical Engineering. Introduced in October 2022 as a potentially low-cost, daily smart wearable device, this new IoT Smart Mask will help personal and public health management of respiratory disease screening, especially for cities with dense populations, such as Hong Kong.

In January 2023, led by Professor Eddie Ma Chi-him in the Department of Neuroscience and Director of the Laboratory Animal Research Unit, CityU scientists announced that they had identified and demonstrated for the first time a therapeutic small molecule, M1, that can restore the visual function in the

治療疾病，拯救生命

賽馬會動物醫學及生命科學院副院長、傳染病及公共衛生學系陳聲教授帶領研究的項目「多學科協作以解決高毒性和多重耐藥肺炎克雷伯菌對全球公共衛生的威脅」，於2022年7月獲大學教育資助委員會研究資助局的第十二輪「主題研究計劃」撥款3,800萬港元資助。肺炎克雷伯菌是正常腸道菌群的一部分，也是最常見的條件致病菌，在長者和免疫功能受抑制的患者中常見。

機械工程學系講座教授李文榮教授、電腦科學系汪建平教授，及生物醫學工程學系于欣格教授領導的研究團隊，於2022年10月宣佈研發出物聯網智能口罩，結合超薄納米複合海綿結構的聲波感測器，利用深度學習方法對各種呼吸聲音進行檢測與分類，協助改善個人及公共衛生。這種新型物聯網智能口罩，具潛力成為低成本的日常智能可穿戴設備，有助呼吸系統疾病篩查方面的個人及公共衛生管理，特別是香港這種人口密集的城市。

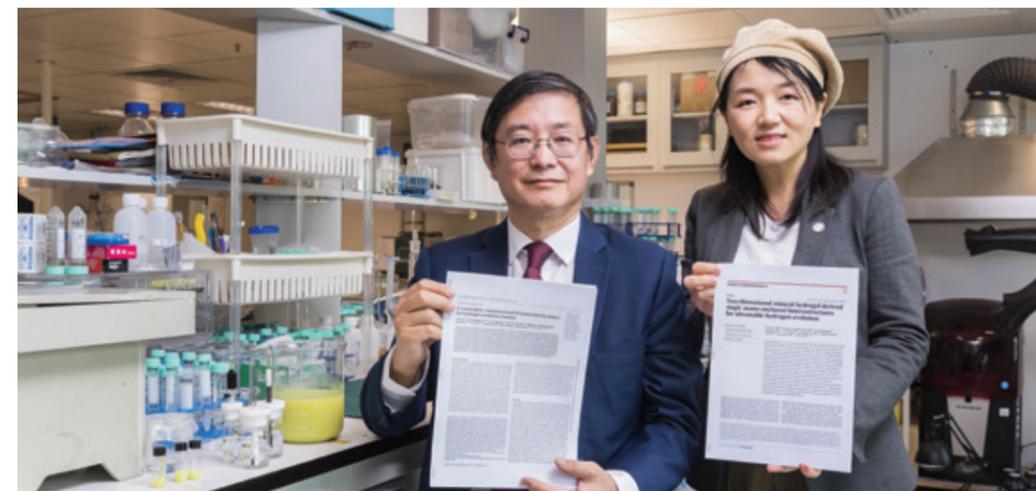
身兼實驗動物研究中心總監的神經科學系馬智謙教授領導的研究團隊，於2023年1月宣佈首次發現並展示一種具治療功能的小分子M1，能恢復哺乳類動物中樞神經系統的視覺功能，為

mammalian central nervous system (CNS), offering hope for patients with optic nerve damage such as glaucoma-related vision loss. CNS injuries to the optic nerve, brain and spinal cord are among the leading causes of disability worldwide for which there is no available treatment. M1 stimulates the fusion and motility of mitochondria (the powerhouse of a cell to generate energy) and induces robust axon regeneration by enhancing the intrinsic growth capacity of injured neurons.

In March 2023, the discovery of a novel protein, Lysyl hydroxylase 1 (LH1), a key factor in promoting cancer cell migration and metastasis in liver cancer (hepatocellular carcinoma, HCC) and pancreatic cancer (pancreatic ductal adenocarcinoma, PDAC), was announced. The CityU team and their collaborators, led by Professor Michael Yang Mengsu, Vice-President (Research and Technology) and Yeung Kin Man Chair Professor of Biomedical Sciences, found that a high LH1 level is associated with a poor prognosis for HCC and PDAC patients. The team expects the research findings to provide a new potential treatment target for cancer therapy.

Sustainable green energy solutions

Two efficient and inexpensive novel electrocatalysts for hydrogen production offering sustainable green solutions for the energy crisis have been developed by materials scientists. Hydrogen is a clean and sustainable alternative to fossil fuels while the production of low-cost, high-performance hydrogen evolution catalysts is a core problem in the energy field. Introduced in December 2022, the electrocatalyst is based on two-dimensional mineral gel nanosheets. Professor Lu Jian, Chair Professor of the Department of Mechanical Engineering and the Department of Materials Science and Engineering, led the research.



Research teams co-led by Professor Lu Jian (left) and Professor Li Yangyang have developed two novel electrocatalysts for hydrogen production.
呂堅教授(左)、李揚揚教授領導的團隊，研發出兩款新型電解水製氫催化劑。

因青光眼等疾病引致視神經受損而喪失視力的病人帶來希望。中樞神經系統受損(包括視神經、腦部及脊髓受損)是全球引致殘疾的主要原因，目前仍未有治療方法。M1能促進為細胞產生能量的線粒體的融合及軸突運輸，並通過促進受損神經元的內在再生能力，令神經軸突再生。

城大與其他機構合組的研究團隊於2023年3月表示，發現一種名為「賴氨酸羧化酶1」(LH1)的蛋白質，是促使肝細胞癌和胰臟導管腺癌的癌細胞轉移和擴散的一個主要成因。研究由副校長(研究及科技)兼楊建文講座教授(生物醫學)楊夢甦教授領導，發現肝細胞癌和胰臟導管腺癌患者有較高的LH1，與他們較差的預後情況(癌症的發展和長期存活率)有關。團隊期望研究結果可為癌症治療提供新治療靶點。

可持續的綠色能源

機械工程學系兼材料科學及工程學系講座教授呂堅教授領導的研究團隊於2022年12月宣佈，研發出兩款高效而價格低廉的新型電解水製氫催化劑，為能源危機提供可持續的綠色解決方案。氫氣是潔淨及可再生的能源，可用作化石燃料的替代品。基於二維礦物凝膠納米片的新研發電催化劑，生產成本低而效能高，有助解決能源領域的核心問題。

Plucky research for chicken welfare

A deep learning model that can identify and quantify distress calls from chickens among natural barn sounds with 97% accuracy was the focus of research aimed at improving the welfare of chickens raised on crowded commercial farms. The technology could allow staff to remotely monitor chicken welfare in real-time, promoting earlier husbandry interventions when necessary, which could reduce the workload of analysts and facilitate the analysis of large datasets, thus improving husbandry and management. The research is co-led by Professor Alan McElligott and Professor Liu Kai of the Department of Infectious Diseases and Public Health at the Jockey Club College of Veterinary Medicine and Life Sciences and their international collaborators.

為雞隻謀福祉

城大領導的研究團隊研發出深度學習模型，可從雞舍的自然雞聲中辨認及量化雞隻的求救啼聲，準確度高達97%，將可為居於擁擠商業農場的雞隻改善生活條件及福祉。這項新技術可讓工作人員實時及遠距離監察雞隻的福祉，並且在有需要時及早對養殖情況作出干預。新技術亦可減少分析師的工作量，有助他們進行大型數據分析，以改善養殖及動物管理。有關研究由城大賽馬會動物醫學及生命科學院傳染病及公共衛生學系Alan McElligott教授及劉凱教授領導，團隊成員包括城大及其他國際機構的學術人員。

Academic Publications by CityU Staff in 2022/23 2022/23年度城大教職員的學術著作

Total number of books (including research books or monographs, textbooks, literary works and translation) authored by CityU staff
城大教職員的學術著作(包括研究書籍、課本、文學及翻譯作品)總數

44

Total number of research papers authored by CityU staff in peer-reviewed academic journals, externally refereed policy or professional journals worldwide
刊登在世界各地學術及專業期刊的城大教職員研究論文總數

5,488

Arts and Humanities 藝術及人文

253

Business and Economics 商業及經濟

240

Science (including Medicine) 科學(包括醫學)

4,599

Social Sciences (including Law) 社會科學(包括法律)

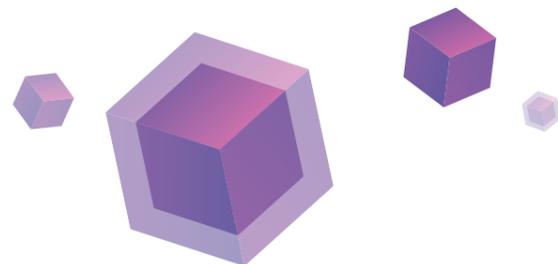
396

Note:

Figures as at end of June 2023.

註：

數字以2023年6月底為準。



Research Projects 2022/23 2022/23年度研究項目

Total number of on-going research projects funded by external funds and CityU research grants
由校外及校內撥款資助的研究項目總數

3,392

Number of on-going research projects by Colleges/Schools/support centres
各學院/學術支援部門的研究項目數目

College of Business 商學院

292

College of Engineering 工學院

1,390

College of Liberal Arts and Social Sciences 人文社會科學院

370

College of Science 理學院

487

Jockey Club College of Veterinary Medicine and Life Sciences
賽馬會動物醫學及生命科學院

383

School of Creative Media 創意媒體學院

74

School of Data Science 數據科學學院

106

School of Energy and Environment 能源及環境學院

215

School of Law 法律學院

66

Other Academic Supporting and Administrative Units 其他學術支援及行政部門

9

Note:

Including CityU-funded, RGC-funded and externally funded research projects, with 795 new starts-ups during 2022/23. Figures as at end of June 2023.

註：

包括由城大、研究資助局及校外資助的研究項目，其中795項是2022/23年度內新發展的項目。數字以2023年6月底為準。

On-going Funded and Contract Research 2022/23 2022/23年度進行中的資助及合約研究

	Total Funding (\$ million) 資助總額 (百萬元)
Innovation and Technology Fund (ITF) ¹ 創新及科技基金 ¹	499.84
Contract and privately/government-funded projects 業界贊助合約研究項目及政府資助研究項目	416.79

Note:

¹ Included are industry sponsorship for ITF projects and annual funding support from the Innovation and Technology Commission at \$20m each to the State Key Laboratory of Marine Pollution, State Key Laboratory of Terahertz and Millimeter Waves and Hong Kong Branch of National Precious Metals Material Engineering Research Center.

註：

¹ 包括業界對創新及科技基金研發項目的贊助，以及創新科技署每年分別向海洋污染國家重點實驗室、太赫茲及毫米波國家重點實驗室、國家貴金屬材料工程技術研究中心香港分中心提供的2,000萬港元資助。