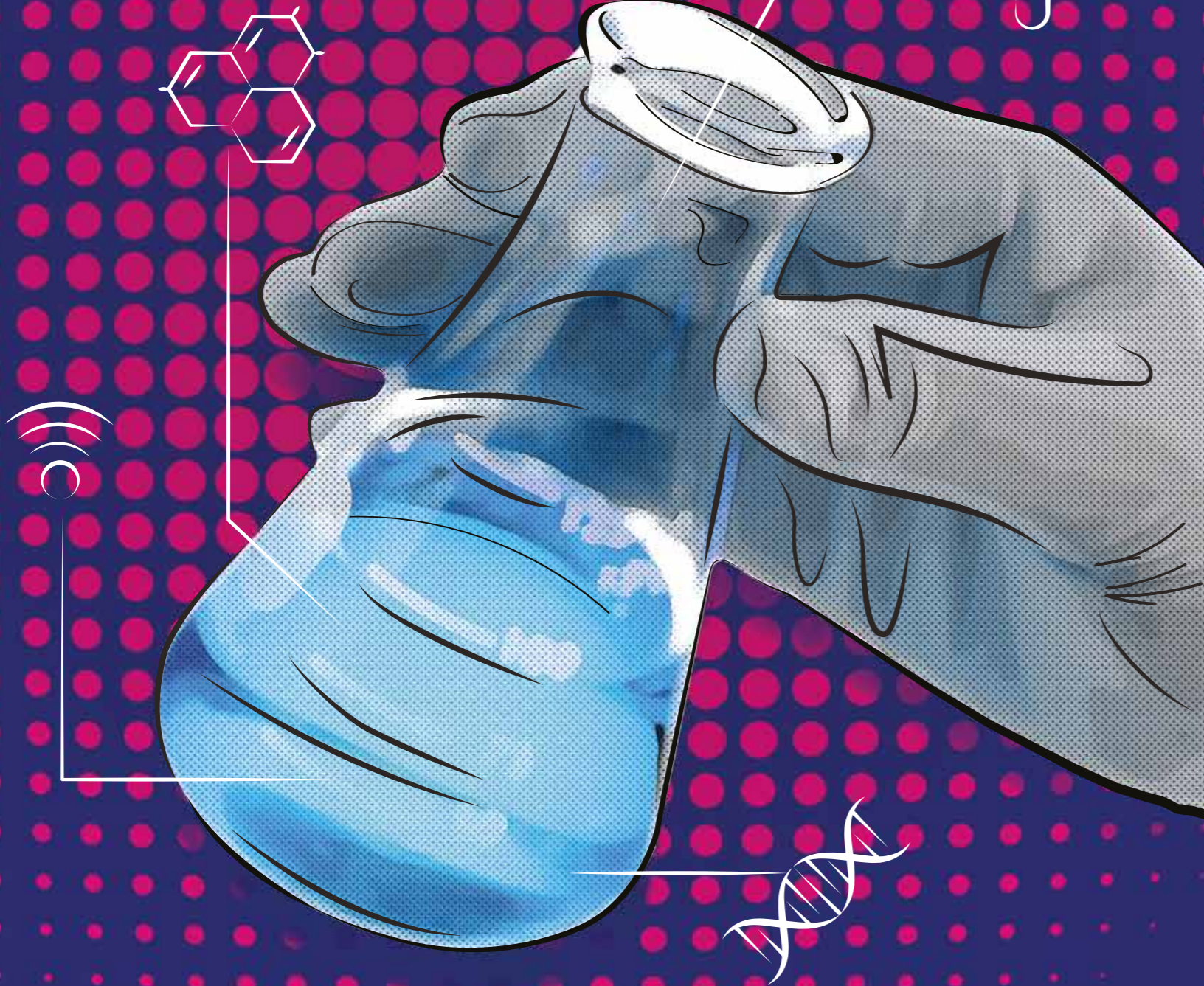


RESEARCH AND DEVELOPMENT

Strong expansion into innovation and creativity
大力發展創新創意



Research and Development 研究及發展

The research conducted by faculty over the past 12 months has been exciting, at times groundbreaking, and overall highly impressive, helping CityU fulfill its mission to give back to society.

過去一年，城大教研人員的成就振奮人心，不時有新的突破，總體進展令人矚目，使大學能夠履行回饋社會的使命。



Innovative green technology capable of recycling textile waste developed by a research team at CityU.
城大科研團隊研發出一項創新技術，可循環再用紡織廢料。

Research and Development 研究及發展

Highly Cited Researchers

To begin with, seven faculty members were selected for the list of Highly Cited Researchers announced by Clarivate Analytics for 2017. The annual list recognises leading researchers in sciences and social sciences around the world. The list included: Professor Ron Chen Guanrong (Mathematics, Engineering), Professor Paul Chu Kim-ho (Materials Science), Professor Gary Feng Gang (Engineering), Professor Daniel Ho Wing-cheong (Engineering), Professor Alex Jen Kwan-yue (Materials Science), Professor Zhang Qingfu (Computer Science), and Professor Zhou Ding-Xuan (Mathematics).

CityU had the second largest number of researchers in Hong Kong on the 2017 list of Highly Cited Researchers.

Materials for Medical Use

The field of materials has been outstanding over the past year especially in the realm of medical applications. We saw a key breakthrough in the development of treatment for cancer. One of the applications involves using intense heat triggered by a photothermal process to kill cancer cells. Photothermal therapy, an emerging cancer treatment, involves the targeted delivery of photothermal agents, and subsequent light irradiation to produce a high local temperature to kill tumour cells. CityU's research team is led by Professor Paul Chu Kim-ho, Chair Professor in the Department of Physics and the Department of Materials Science and Engineering.

The other application is thermochromic smart coating, which can control the transmission of solar radiation dynamically and automatically in accordance with the ambient temperature and illumination intensity. The smart coating blocks heat under strong illumination at 28 degrees Celsius, but is heat transparent in weak irradiation conditions or at a temperature of 20 degrees Celsius or lower.



Professor Paul Chu Kim-ho has developed breakthrough technologies that hold great promise for effective cancer treatment. 朱劍豪教授取得突破性技術研究成果，可望有效治療癌症。

學者成果廣獲引用

城大七位教研人員入選科睿唯安公佈的2017年「高度被引用的科學家」名單。該名單旨在表彰全球在科學及社會科學領域的領先研究者。獲選上榜的城大學者是：陳關榮教授(數學、工程學)、朱劍豪教授(材料科學)、馮剛教授(工程學)、何永昌教授(工程學)、任廣禹教授(材料科學)、張青富教授(電腦科學)、周定軒教授(數學)。

城大獲選入「高度被引用的科學家」名單的教員人數，高居香港院校第二。

醫藥用新材料

過去一年，城大在醫學應用材料領域的研究成果尤為顯著。首先，在治療癌症方面取得重大突破。其中一項技術是以光熱過程中產生的高溫殺死癌細胞。光熱療法是新興治療方法，其原理是把光熱藥劑傳送至目標腫瘤，然後利用光輻射局部發出高溫，殺死腫瘤細胞。研究團隊由物理學系和材料科學及工程學系朱劍豪講座教授領導。

這項發明的另一個應用是感溫智能塗層，能夠按環境溫度和光度，自動靈活控制太陽輻射的傳輸。智能塗層在攝氏28度及強光下會隔熱，在攝氏20度及以下或低輻射環境下卻會透熱。

Research and Development 研究及發展

Such is the importance of this research that the findings have earned the team, comprising researchers from CityU, mainland China and Germany, the highly prestigious First Class Award (Natural Science) in the 2017 Higher Education Outstanding Scientific Research Output Awards (Science and Technology) of the Ministry of Education, China.

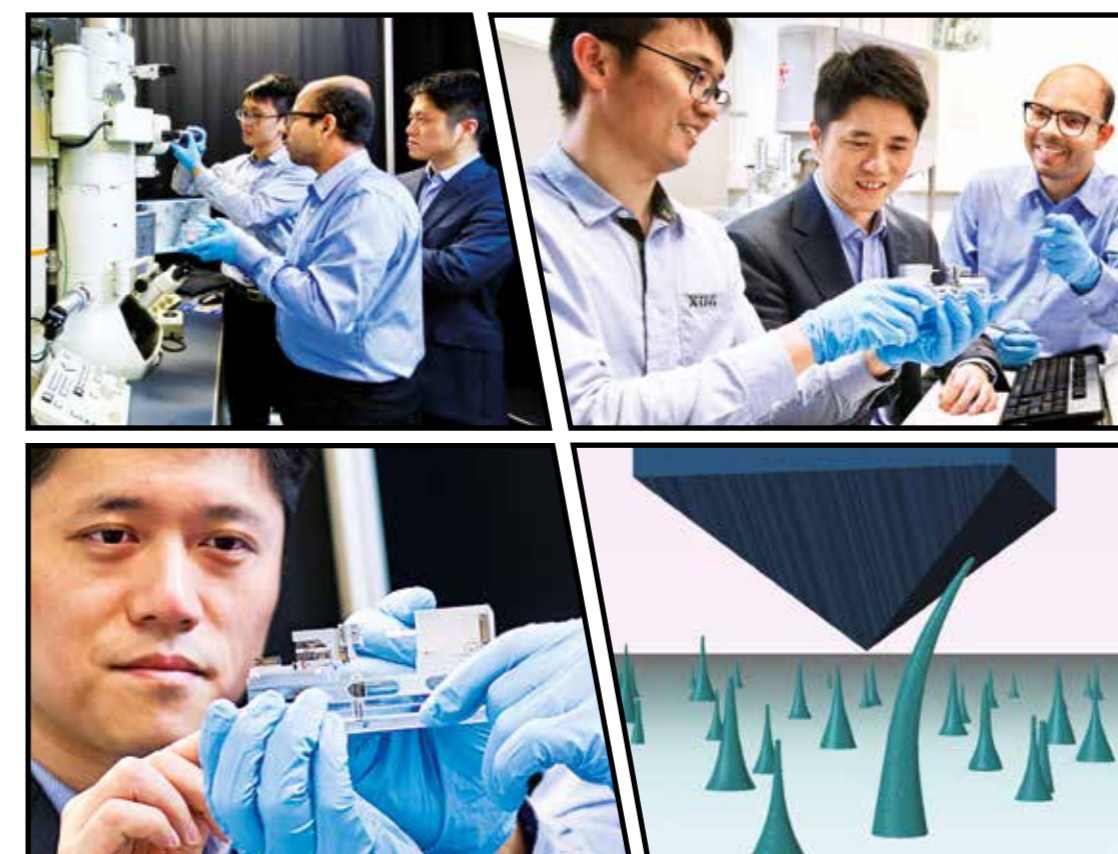
Professor Chu has also pioneered leading work in developing a capacitive coating that kills bacteria when it is charged with electricity. When applied to orthopedic implants such as artificial joints and dental implants, the novel technology can reduce the risk of infection after surgery and help patients recover more quickly. The research has been published in the international journal *Nature Communications*.

Another notable project that caught our attention during the year was the news from an international research team led by CityU that diamonds at nanoscale can undergo ultralarge, fully reversible elastic deformation. These findings, a world's first, could have a profound impact on the nanotechnology and biomedical fields, and even quantum information technologies.

項目的研究團隊由來自城大、內地及德國的研究員組成。這項重要研究成果榮獲國家教育部2017年度「高等學校科學研究優秀成果獎」(科學技術)自然科學獎一等獎。

另外，朱教授及其團隊成功研發電容塗層，只須持續充電便可殺菌。這項創新技術若應用於骨科植入材料，如人工關節及植牙物料，能減低病人手術後受感染的風險，加速康復。研究成果已在國際著名期刊《自然通訊》上發表。

本年度值得注意的另一項重要研究成果，是城大領導的國際研究團隊發現納米級鑽石能夠承受極大的變形然後完全恢復原狀。這項全球首次新發現，將對納米科技、生物醫學領域，以至量子資訊科技產生重大影響。



A CityU team led by Dr Lu Yang (bottom left), Associate Professor in the Department of Mechanical and Biomedical Engineering, has discovered that nanoscale diamond can experience a significant amount of elastic deformation.

機械及生物醫學工程學系副教授陸洋博士(左下圖)領導的研究團隊發現納米級鑽石能夠承受極大的彈性變形。

Research and Development 研究及發展

Recycling for the Environment

Staying with materials, but of a different kind, a member of faculty advanced our knowledge about innovative green technology capable of recycling mixed textile with groundbreaking research that won a Gold Medal at the 46th International Exhibition of Inventions of Geneva. Dr Carol Lin Sze-ki, Associate Professor in the School of Energy and Environment, and the research team won the award for a novel bioprocess that makes use of textile waste for the sustainable production of value-added products such as glucose, synthetic fibre, bioplastics, bio-chemicals and bio-surfactants.

Saving Energy for a Better World

This field remains an urgent one given the challenges posed by climate change, sustainability and pollution, and these three projects were particularly noteworthy. A smart thermostat for central air-conditioning systems that can save more than 10% on power and improve indoor comfort levels was launched by a team comprising two PhD students in the Department of Electronic Engineering (EE) and a postdoctoral fellow in the Division of Building Science and Technology (BST). The consultants for the team were Professor Henry Chung Shu-hung from EE and Dr Norman Tse Chung-fai from BST. The technology belongs to a new generation of indoor thermostats that can boost energy efficiency for central air-conditioning systems in buildings. Its energy-saving and carbon-reduction features perfectly align with the objectives of the "Energy Saving Plan for Hong Kong's Built Environment 2015~2025+" mentioned in the latest policy address of the Hong Kong government.

Academic Publications by CityU Staff in 2017/18**2017/18年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

41**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

3,488

Arts and Humanities 藝術及人文

179

Business and Economics 商業及經濟

228

Science (including Medicine) 科學(包括醫學)

2,767

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

314

Note:
Figures as at end of June 2018.註：
數字以2018年6月底為準。**循環再用護環境**

城大學者還發明了一種利用廢料的新技術。能源及環境學院副教授連思琪博士及其團隊研發一項創新技術，可循環再用紡織廢料，於第46屆日內瓦國際發明展榮獲金獎。該項新技術可將紡織廢料轉為葡萄糖、合成纖維、生物塑料、生物化學品及生物表面活性劑等增值產品。

節能營造更美好世界

氣候變化、可持續發展及污染帶來種種挑戰，能源領域依然有不少問題亟待解決，因此城大以下三項研究計劃特別值得關注。第一項是適用於中央冷氣系統的智能溫度調節器，可節省逾一成電力及提升室內舒適度。團隊成員由兩名電子工程學系博士生及一名建築科技學部博士後研究員組成，指導老師為電子工程學系鍾樹鴻教授和建築科技學部謝松輝博士。這種調節器是新一代室內恆溫器，可提高使用中央冷氣系統的建築物的能源效益，有助節能減排，正好配合政府最新施政報告中提到的「香港都市節能藍圖2015~2025+」。

Research and Development 研究及發展

Another smart system caused a buzz, too. A smart real-time battery state and health diagnostics system developed at CityU that can reduce diagnosis time from hours to three minutes and save the loss of energy by 90% was presented by a team led by Professor Henry Chung Shu-hung from EE in collaboration with the Electrical and Mechanical Services Department of the Hong Kong government.

Meanwhile, a project that converts low-temperature heat into electricity has been granted more than HK\$20 million in research funding. The idea grew in relevancy over 2018 following the heat wave that affected millions all over the world. Professor Michael Leung Kwok-hi, Associate Dean of the School of Energy and Environment, leads this two-year project.

Professor Leung is working on another research project with the University of Hong Kong concerning an eco-friendly antifouling paint that can protect marine ecology. In addition, the paint's super hydrophobicity and super wettability features can prevent micro-organisms from attaching to hulls and thus reduce water resistance and fuel consumption.

另一個智能系統亦頗受關注。這個智能實時電池狀態監測系統可將檢測時間由過往以小時計，大幅縮短至三分鐘，並可減少高達90%能源消耗。研究團隊由電子工程學系鍾樹鴻教授領導，並與香港政府機電工程署合作。

此外，城大獲撥款逾二千萬元，研發低溫熱轉電技術，而就在2018年夏天，熱浪影響了全球數百萬人。能源及環境學院副院長梁國熙教授負責這項為期兩年的研究計劃。

梁教授同時與香港大學共同研發一款有助保護海洋生態的船底防污漆，其超疏水和超親水特性可使微生物不能依附於船底，有助降低水阻力及減少燃料消耗。



Professor Michael Leung Kwok-hi has developed the novel technology that converts the waste heat from air-conditioning systems into useful electricity. 梁國熙教授研究將空調排放的熱能轉化為電能的技術。

Research and Development 研究及發展

New Research Centre

CityU continues to look for ways to contribute especially in areas such as sustainability. A new applied strategic development centre will analyse and develop solutions that meet critical sustainability issues in Hong Kong from a multi-disciplinary perspective. The inauguration ceremony for the Research Centre for Sustainable Hong Kong (CSHK) was held in October 2017. CSHK, which houses the Sustainable Hong Kong Research Hub and the CSHK International Hub for the Belt and Road, supports related research and collaborative activities with stakeholders from different sectors and regions.

Notable Achievements

Several notable achievements were recorded in 2017/18, underlining the high quality of research that CityU undertakes.

Professor Luk Kwai-man, Chair Professor in the Department of Electronic Engineering at CityU, was conferred the prestigious IEEE AP-S John Kraus Antenna Award.

Professor Wang Xunli, a renowned scholar in neutron scattering, was elected Fellow of the AAAS. He was the only scholar elected from Hong Kong in 2017.

CityU presented many of its research projects and won the Special Gold Award at the 2nd China University Scientific and Technological Achievements Fair in May 2018. A project led by Professor Lu Jian, Vice-President (Research and Technology), and titled “Structural Morphing Enabled Submerging and Surfacing System” won the Special Gold Award.

That month the 12th Guanghua Engineering Science and Technology Award was awarded to Professor Lu for his work on structural metallic materials.

Maths Award

Last but not least, in June 2018, an internationally acclaimed scholar in wavelet theory who has significantly advanced digital data processing was awarded the William Benter Prize in Applied Mathematics 2018. Professor Ingrid Daubechies, James B. Duke Professor of Mathematics and Electrical and Computer Engineering at Duke University, is the first female recipient of this prize.

成立新研究中心

城大不斷尋求新方法，在可持續發展及其他領域作出貢獻。新成立的「香港持續發展研究中心」是一所應用策略發展中心，旨在從多學科角度分析香港持續發展的關鍵議題，並提供解決方案。中心成立典禮於2017年10月舉行，內設「香港持續發展研究樞紐」及「一帶一路國際樞紐」合作平台，支援各行業及地區的研究及協作。

學者屢獲殊榮

城大學者在2017/18年度獲得多個重要獎項，突顯大學學術研究的優良質素。

電子工程學系講座教授陸貴文教授榮獲著名電機電子工程師學會天線及傳播分會John Kraus天線獎。

知名中子散射專家王循理教授膺選美國科學促進會院士。他是2017年香港唯一獲選為該會院士的學者。

城大在2018年5月舉行的第二屆中國高校科技成果交易會上展出多項科研成果，並獲得「特別金獎」。副校長(研究及科技)呂堅教授領導的「由結構形態轉換實現的自主式沉降上浮系統」項目榮獲大會「特別金獎」。

同在5月，呂教授因其對金屬結構材料的研究而榮獲第十二屆光華工程科技獎。

頒發數學大獎

2018年6月，城大頒授2018年度「William Benter 應用數學獎」予美國杜克大學James B. Duke數學、電機及電腦工程學教授Ingrid Daubechies教授。Daubechies教授以小波數學理論的研究聞名國際，並在數碼數據處理領域作出傑出貢獻。她是首位獲頒「William Benter應用數學獎」的女學者。

Research and Development 研究及發展

**Research Projects 2017/18
2017/18年度研究項目**

Total 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	2,428
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	295
College of Liberal Arts and Social Sciences 人文社會科學院	355
College of Science and Engineering 科學及工程學院	1,310
College of Veterinary Medicine and Life Sciences 動物醫學及生命科學院	202
School of Creative Media 創意媒體學院	85
School of Energy and Environment 能源及環境學院	125
School of Law 法律學院	53
Other Academic Supporting and Administrative Units 其他學術支援及行政部門	3

Note:
Including CityU-funded, RGC-funded and externally funded research projects, with 662 new starts-ups during 2017/18. Figures as at end of June 2018.

註：
包括由城大、研究資助局及校外資助的研究項目，其中662項是2017/18年度內新發展的項目。數字以2018年6月底為準。

**Funded and Contract Research 2017/18
2017/18年資助及合約研究**

Total Funding 資助總額	million 百萬元
Innovation and technology fund 創新及科技基金	192.35
Contract and privately/government funded projects 業界贊助及政府資助	175.72