

# LEADING RESEARCH ACROSS THE DISCIPLINES

## 領導 跨學科研究

The relevance of our research outputs to the well-being of society became more palpable over the past few months. We are fulfilling our mission to improve people's lives through dynamic, insightful and highly influential projects.

城大的研究成果與社會福祉息息相關，在過去幾個月內尤為顯著。我們一如既往，堅守大學使命，從事創新、卓有遠見、影響深遠的研究計劃，以改善大眾生活。

# Research and Development

## 研究及發展

### Improving health

Public health is a priority, especially in the Covid-19 era. CityU has continued to contribute through a rich range of highly relevant research projects.

In August 2020, a team led by Dr Yan Jian, Assistant Professor; Dr Zhang Liang, Assistant Professor; and Dr Chan Kui-ming, Associate Professor in the Department of Biomedical Sciences (BMS), developed a new method for identifying binding proteins of non-coding RNAs in living cells that can be applied in cancer diagnosis and stem cell research, and may even help to identify potential antiviral drug targets to combat Covid-19.

In September 2020, a new method for making anti-bacterial graphene masks quickly and cost effectively was revealed by Dr Ye Ruquan, Assistant Professor in the Department of Chemistry, and his team. The masks have the potential to combat viruses as well. That same month, a new method for identifying gastric cancer cells within minutes and more accurately than by using traditional methods was announced by Professor Li Wen Jung of the Department of Mechanical Engineering (MNE) and Associate Provost (Institutional Initiatives), with collaborators in mainland China. The research aims to reduce the number of deaths from gastric cancer, one of the leading causes of cancer deaths worldwide.

A “magic” spray for turning objects into agile millirobots for delivering drugs precisely inside a living body was presented by Dr Shen Yajing, Associate Professor in the Department of Biomedical Engineering (BME), in November 2020. This pioneering approach to creating millirobots hinges on the M-spray, a glue-like magnetic spray. After an object has been sprayed with the M-spray, a magnetic force can move the object over different surfaces. This technology has great potential for biomedical applications, including catheter navigation and precision drug delivery.

### 改善公共衛生

公共衛生向來是要務，在新冠疫情期間尤其重要。城大開展各類與此密切相關的研究計劃，繼續為抗擊疫情作出貢獻。

2020年8月，生物醫學系助理教授嚴健博士、助理教授張亮博士和副教授陳居明博士共同領導的研究團隊開發了嶄新方法，能夠檢測活細胞內與非編碼RNA（核糖核酸）結合的蛋白質。這項新技術有望應用於癌症診斷與幹細胞研究，甚至有助找出治療新冠病毒的潛在抗病毒藥物靶點。

2020年9月，化學系助理教授葉汝全博士及其團隊研發出新技術，能以低成本快速製造抗菌的石墨烯口罩。這種口罩具有抗病毒潛力。同月，機械工程學系教授兼協理學務副校長（大學策略）李文榮教授與內地研究人員合作，研發出檢測胃癌的新方法，可在數分鐘內識別胃癌細胞，且比傳統檢測方法更準確。胃癌是全球主要致命癌症之一，研究旨在減少胃癌致死個案。

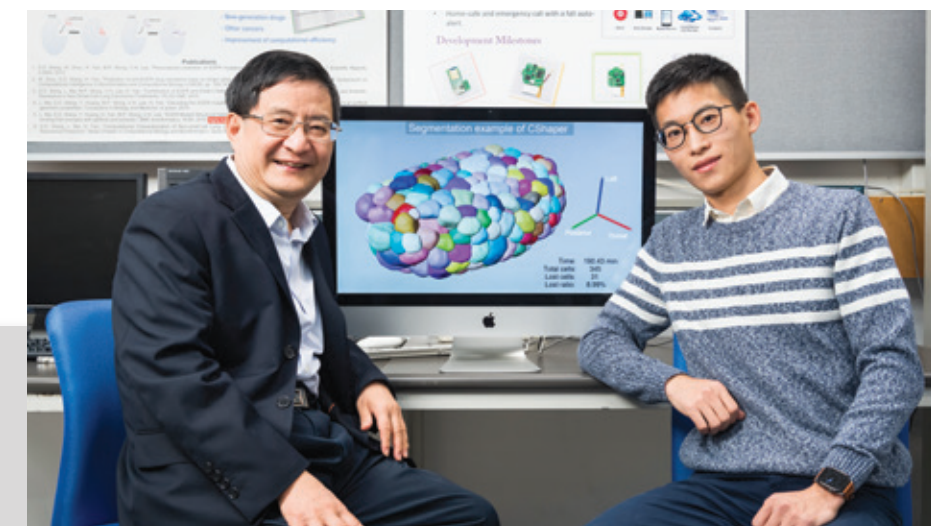
2020年11月，生物醫學工程學系副教授申亞京博士領導的團隊研發出一種「神奇」噴霧，噴塗在物件表面後，便可將其變為敏捷的微型機械人，能在活體內精準傳輸藥物。這種製造微型機械人的新方法，運用一種像膠水般的磁性噴霧，名為「M-spray」。當物件表面噴塗M-spray後，透過磁場驅動，可於不同表面移動。這項技術於生物醫學上極具應用潛力，例如在導管插入和藥物傳輸方面。

At the start of 2021, a novel computer tool for extracting, tracking and visualising cells, and analysing the formation, structure and functions of *C. elegans* (a type of worm) during cell division was introduced by Professor Yan Hong, Wong Chun Hong Professor of Data Engineering in the Department of Electrical Engineering (EE). The findings were published in *Nature Communications*. The research can help scientists better understand cancer and find a possible cure by enabling them to learn how an animal's body and organs are formed through cell division.

Also in January 2021, three projects were granted HK\$8.3 million by the Health and Medical Research Fund under the Food and Health Bureau to bolster the fight against Covid-19. Two of the projects fall under the area of “Effective detection and surveillance”. One of these projects is led by Professor Vanessa Barrs, Associate Dean at the Jockey Club College of Veterinary Medicine and Life Sciences (JCC), and Dr Li Jun, Assistant Professor in the Department of Infectious Disease and Public Health (PH). Their research explores the implications for control of human infections through a system-level, multidimensional quantification and prediction of SARS-CoV-2 infections among animals. SARS-CoV-2 is the strain of coronavirus that causes Covid-19.

2021年1月，電機工程學系黃俊康教授（數據工程）嚴洪教授研發出新電腦軟件，可在秀麗隱桿線蟲的細胞分裂期間抽取及追蹤細胞，並擷取其影像，以分析細胞的形成、結構及功能。研究結果刊載於著名期刊《自然通訊》。這項研究有助科學家明白動物如何通過細胞分裂而形成器官及身體，從而更深入了解癌症及找出可行療法。

同在2021年1月，城大獲食物及衛生局轄下醫療衛生研究基金撥款830萬港元，資助三個應對新型冠狀病毒的研究項目。兩個獲資助項目屬於「有效檢測及監控」類別，其一由賽馬會動物醫學及生命科學院副院長Vanessa Barrs教授與傳染病及公共衛生學系助理教授李俊博士領導。他們的研究是透過對動物群體的新型冠狀病毒（SARS-CoV-2）感染作系統水平的多維定量及預測，探討其對控制人類感染的作用。SARS-CoV-2是引起新型冠狀病毒的冠狀病毒株。



Professor Yan Hong (left) and his team have developed a novel computer tool for studying cells.

嚴洪教授（左）及其研究團隊研發嶄新電腦軟件用作研究細胞。

The other project in this category is led by Dr Ioannis Magouras, Assistant Professor in PH. This project will develop sampling and detection procedures for water sources to improve surveillance and the early detection of local and imported Covid-19 cases to Hong Kong. The third project fell under the tier “Enhanced infection control and prevention strategies” and is led by Dr Sean Yuan Hsiang-yu, Assistant Professor in BMS. It predicts the effects of quarantine, contact tracing and border control measures under different scenarios.

In February 2021, researchers found that school closures were not as effective as social distancing in public facilities for controlling Covid-19. A new data science model developed by Dr Zhang Qingpeng, Associate Professor in the School of Data Science, found that non-pharmaceutical interventions in New York City could contain the epidemic with minimal disruption to social contacts, which is particularly important for cities like Hong Kong, whose economy relies on international trade.

Later that same month, the results of a survey conducted by Professor Christine Huang Yi-hui, Chair Professor of Communication and Media in the College of Liberal Arts and Social Sciences, suggested that background and trust in government affected citizens’ willingness to receive coronavirus vaccines. The poll revealed young people (aged between 20 and 24) in particular were the least enthusiastic.

In March 2021, a bioaerosols research project aimed at developing innovative and effective methods for detecting and disinfecting bacteria and viruses including SARS-CoV-2 in indoor environments secured HK\$6.15 million from the Research Impact Fund. The study would significantly raise our preparedness for future pandemics, according to Professor Alvin Lai Chi-keung, Associate Head of the Department of Architecture and Civil Engineering (ACE) and Project Coordinator.

另一個相同類別的研究項目，由傳染病及公共衛生學系助理教授Ioannis Magouras博士領導，將開發水源採樣和檢驗程序，以及早發現和改善對香港本地及輸入個案的監測。第三個項目由生物醫學系助理教授阮相宇博士領導，屬於「改進傳染病防控策略」類別，預測香港在不同情況下隔離檢疫、追蹤接觸者及邊境控制措施的成效。

2021年2月，城大研究人員發現停課對控制疫情的效用並不如實施社交距離顯著。數據科學學院副教授張清鵬博士研發嶄新數據科學模型，顯示紐約市採取非藥物干預的方法能夠控制疫情，並對社交接觸的影響最小。這一點對於類似香港這種經濟倚重國際貿易的城市尤其重要。

同月下旬，人文社會科學院媒體與傳播系講座教授黃懿慧教授及其團隊的調查發現，市民個人背景及對政府的信任程度，影響他們對新冠疫苗的接受程度。調查發現，年輕人(20至24歲)注射疫苗的意願最低。

2021年3月，城大獲研究影響基金撥款615萬港元，以研發創新有效的方法偵測室內環境中的生物氣溶膠，並殺滅其中的細菌及病毒，包括新型冠狀病毒。建築學及土木工程學系副主任兼該計劃統籌賴志強教授表示，這項研究可大幅提升我們未來應對其他疫症的能力。

Also in March 2021, funding worth HK\$19 million was secured for four highly competitive collaborative research projects into Covid-19. The research spans biomedical engineering, environmental sciences, supply chain management, and law and policy, and the funding comes from the One-off CRF Coronavirus Disease and Novel Infectious Disease Research Exercise of the Collaborative Research Fund (CRF) under the University Grants Committee.

Professor Sun Dong of BME was awarded HK\$6.2 million for developing a novel vaccination strategy that uses a microrobot platform for DNA vaccine delivery and antigen presentation. Dr Carol Lin Sze-ki, Associate Professor in the School of Energy and Environment, is coordinating a project on reducing the transmission of the novel coronavirus and other infectious diseases using food waste-derived medical textiles via electrospinning for healthcare apparel and personal protective equipment (PPE). Professor Yan Houmin of the Department of Management Sciences and his fellow collaborators are exploring resilient PPE supply chains for Hong Kong health systems, both for now and in the post Covid-19 era.

Professor Wan Wai-ye of the School of Law is investigating with her collaborators insolvency and restructuring aspects of law and policy in response to Covid-19. In addition, research led by Professor Wang Zuankai of MNE as a regular CRF project received HK\$4.8 million for his studies into a universal solid/liquid-based framework for efficient water energy harvesting.

The following month an international team co-led by Dr Yan Jian, Assistant Professor in BMS, showed off a high-throughput biological assay technique for finding type-2 diabetes key biomarkers for diagnostics and treatment.

Meanwhile, in May 2021, CityU biologists led by Dr Wang Xin, Associate Head and Associate Professor, and Dr Rebecca Chin Yuet-ming, Assistant Professor, in BMS, identified a set of specific super-enhancers that stimulate the activity of the Triple-Negative Breast Cancer (TNBC) genes, and that deleting certain specific super-enhancers could reduce tumour growth. Their findings may help discover new drug targets for TNBC patients. The research has been published in *Nature Communications*.

同月，城大學者領導有關新冠病毒的四個甚具競爭力的協作研究項目，共獲撥款1,900萬港元資助。這些研究涵蓋生物醫學工程學、環境科學、供應鏈管理及法律與政策四個領域，獲大學教育資助委員會轄下研究資助局「協作研究金與2019冠狀病毒病及新型傳染病相關的一次性研究計劃」撥款。

生物醫學工程學系孫東教授領導的項目獲撥款620萬港元，用以研發遞送基因疫苗和呈遞抗原的微型機械人平台，開創接種疫苗新方法。能源及環境學院副教授連思琪博士統籌的項目，研究採用以廚餘轉化製成的醫療布料，經靜電紡絲製成醫療保健衣服及個人防護裝備(PPE)，以減低新型冠狀病毒病及其他傳染病的傳播。管理科學系嚴厚民教授及其協作學者為香港醫療系統研發具彈性的PPE供應鏈，既適用於現在，也適用於新冠疫情過後。

法律學院溫慧儀教授及其協作學者研究由新冠病毒引致的破產及架構重組之相關法律及政策問題。此外，機械工程學系王鑽開教授領導的研究項目獲常規協作研究金撥款480萬港元，以研發用作高效率水力發電的通用固體／液體為本框架。

2021年4月，生物醫學系助理教授嚴健博士聯合領導的國際研究團隊，研發出高通量生物檢測技術，有助找出診斷和治療2型糖尿病的主要生物標誌。

此外，在2021年5月，生物醫學系副系主任兼副教授王鑫博士及助理教授錢玥明博士帶領的生物學家，成功發現一組獨特的超級增強子，會刺激與三陰性乳腺癌有重要關連的基因，使之變得活躍；若除去某些超級增強子，就能減慢腫瘤增長。研究成果於《自然通訊》發表，或有助研發針對三陰性乳腺癌患者的藥物。

### Cleaning up the environment

In keeping with our drive to promote One Health, our scholars are deeply involved in research into environmental problems. In July 2020, environmental scientists at CityU proposed a new pathway for the formation of sulfate, providing new insights for improving haze prediction. Sulfate is a key component of particulate matter during haze episodes in China. A paper on the research, led by Professor Chan Chak-keung, Dean of the School of Energy and Environment (SEE) and Chair Professor of Atmospheric Environment, and his fellow collaborators was named one of the five Best Paper Awards winners in 2019 in the prestigious journal *Environmental Science & Technology Letters*, and was the only winner in the research area of atmospheric pollution.

A team of marine ecologists led by Professor Kenneth Leung Mei-yee, Director of the State Key Laboratory of Marine Pollutions (SKLMP), announced in November 2020 promising results for enhancing marine biodiversity on seawalls in the western waters of Hong Kong via eco-engineered tiles.

Staying with the oceans, an inter-university team led by Professor Kenneth Leung discovered in March 2021 that the prohibition of trawling activities in the Hong Kong marine environment for two and a half years had significantly improved biodiversity.

In April 2021, new methods for reducing air pollution and generating solar fuels were announced. Dr Ng Yun-hau, Associate Professor in SEE, and his team have designed a new solar-powered catalyst that can convert carbon dioxide into methane fuel through artificial photosynthesis. The research was published in the top chemistry journal *Angewandte Chemie*.

The other study, carried out by the team led by Dr Shang Jin, Assistant Professor in SEE, aims to control pollution resulting from nitrogen dioxide, a major roadside pollutant causing photochemical smog and damage to the human respiratory tract.

### 建設潔淨環境

城大學者深入研究多個環境問題，貫徹大學致力推廣健康一體化的方向。2020年7月，城大環境科學家揭示硫酸鹽形成的新途徑，有助提升霧霾預測的準確度。硫酸鹽是內地霧霾天氣常見懸浮粒子的主要成分。領導該項目的能源及環境學院院長兼大氣環境學講座教授陳澤強教授及其協作學者，在知名學術期刊《環境科學與技術通訊》上發表了有關研究結果，文章獲選為該刊2019年五篇最佳論文之一，亦是大氣污染研究領域的唯一得獎論文。

2020年11月，海洋污染國家重點實驗室主任梁美儀教授領導的海洋生態學家團隊宣佈，他們利用人工生態組件在香港西面水域成功提升海堤上的海洋生物多樣性。

同樣在海洋研究領域，梁教授領導的跨院校研究團隊在2021年3月發現，禁止在本港海洋環境拖網捕撈兩年半後，生物多樣性得到重大改善。

2021年4月，能源及環境學院副教授吳永豪博士及其研究團隊公佈，他們研發的太陽能催化劑，能透過人工光合作用把二氧化碳轉化為燃料甲烷，新技術可減輕空氣污染及利用太陽能生產燃料。研究結果於著名化學期刊《德國應用化學》上發表。

另一項研究由能源及環境學院助理教授尚進博士領導的團隊負責，目標是控制由二氧化氮引起的污染。二氧化氮是路邊的主要污染物，可引起光化學煙霧，損害人體呼吸道。

In June 2021, it was announced that SKLMP had been endorsed by the UN to initiate a ten-year “Global Estuaries Monitoring” programme to collect and study environmental pollutants in the estuaries of major cities around the globe so as to formulate a long-term policy for promoting clean estuaries. The project falls under “Ocean Decade Actions” for the “UN Decade of Ocean Science for Sustainable Development (2021–2030)”. The CityU project was the only endorsed proposal from Hong Kong and one of only two endorsed “Ocean Decade Actions” from China.

### Saving, storing and wisely using energy

Energy-related studies continue to add perspective and insight into matters related to sustainability, usage and storage. In October 2020, a research team led by Professor Alex Jen Kwan-yue, Chair Professor of Chemistry and Materials Science, revealed an exciting new way to make solar power more effective and more environmentally friendly. The breakthrough concerns the use of a new metal-organic framework that not only improves operational stability but also contains the lead that can potentially leak from perovskite solar cells.

In January 2021, research led by Dr Sam Hsu Hsien-yi, Assistant Professor in SEE, indicated how a three-fold improvement in the efficiency of solar-to-hydrogen energy conversion can facilitate solar energy harvesting technology. The research outcome can help to tackle the global energy shortage and provide new insights into the development of solar-to-fuel materials for photocatalytic applications in the emerging field of hydrogen technology.

Later that month, the findings of a research team led by Professor Johnny Ho Chung-yin, Associate Head in the Department of Materials Science and Engineering (MSE), showed how the energy consumption of a new artificial visual system developed through joint research can be reduced by over 90% per synaptic event when compared to synapses in the human brain. The new system's low energy usage will be a boon to the next generation of AI. The results were published in *Science Advances*.

2021年6月，海洋污染國家重點實驗室獲聯合國認可，統籌一項為期十年的「全球河口監測計劃」，收集和研全球主要城市河口的環境污染物，從而制訂推動潔淨河口的長遠政策。該計劃獲選為「聯合國海洋科學促進可持續發展國際十年(2021–2030)」的行動計劃。城大倡議的這個項目是香港唯一入選的行動計劃，也是全中國入選的兩份行動計劃之一。

### 節能儲能 善用能源

城大開展各項與能源相關的研究，繼續為可持續發展、能源使用及儲存等題目帶來新觀點與新發現。2020年10月，化學及材料科學講座教授任廣禹教授領導的團隊研發出新方法，令太陽能發電更有效、更環保。這項突破是在鈣鈦礦太陽能電池中使用新型金屬有機框架材料，不僅令其操作更穩定，也能使電池中的鉛不易洩漏。

2021年1月，能源及環境學院助理教授徐先億博士領導其團隊，展示如何將太陽能轉化為氫能的效率提高三倍，提升太陽能收集技術。研究成果有助解決全球能源短缺問題，並為在新興氫技術領域開發太陽能轉化為燃料材料的光催化應用帶來新思路。

同在1月，材料科學及工程學系副系主任何頌賢教授領導的聯合研究研發出嶄新人工視覺系統，每次突觸反應耗能較人腦少逾九成。新系統的極低耗電量有利新一代人工智能發展。研究成果已在學術期刊《科學進展》上發表。

### New materials for industry

New materials are essential for engineering, manufacturing and other related industries. A research team led by Professor Liu Chain-tsuan, University Distinguished Professor in the College of Engineering, said in November 2020 that it had discovered a new strategy for fabricating multicomponent superlattice alloys with disordered interfacial nanolayers that have both high strength and good ductility at various temperatures. The findings were published in *Science*.

In January 2021, a joint research team co-led by Dr Lu Yang, Associate Professor in MNE, announced that it had achieved elastic straining of diamond at an unprecedented level, a breakthrough that heralds a new age in the utilisation of the gemstone in microelectronics, photonics, and quantum information technologies. The results of the research, a collaboration with MIT and Harbin Institute of Technology, were published in *Science*, too.

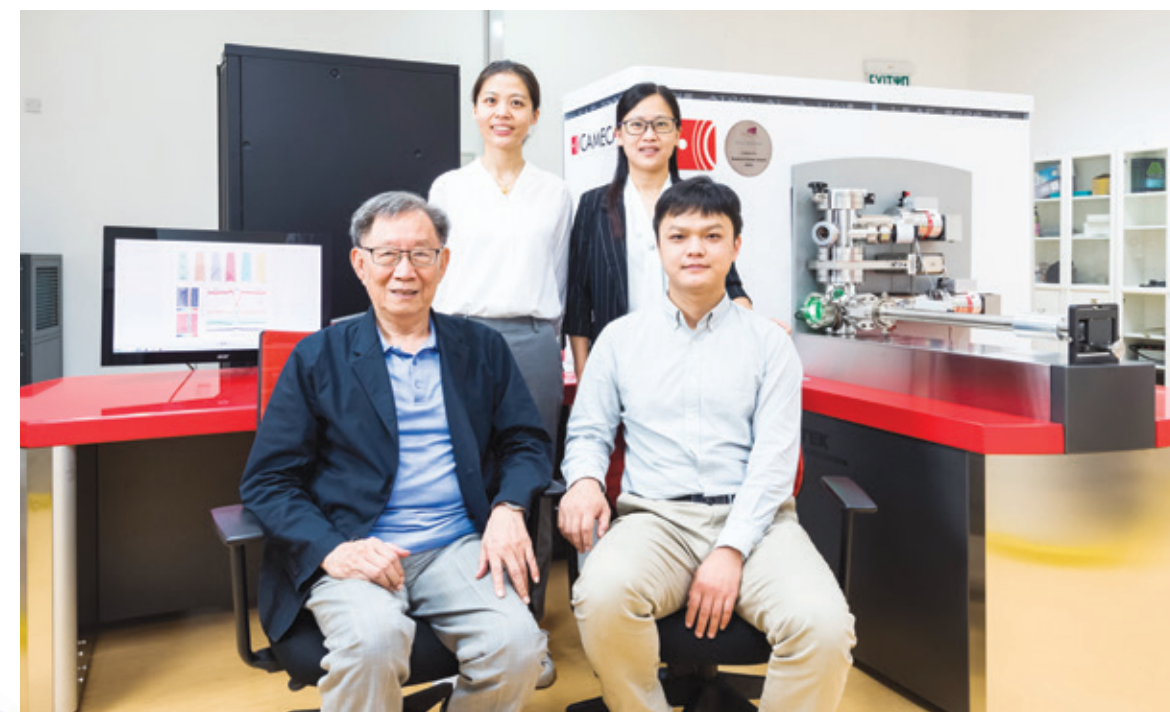
The use of a simple organic molecule during the fabrication of a 2D perovskite resulted in one of the highest recorded efficiencies for perovskite-based devices, according to Professor Andrey Rogach, Chair Professor in MSE, in April 2021. Light-emitting diodes (LEDs) employing this 2D perovskite material achieved an external quantum efficiency as high as 20.5%, which rivals the best organic LEDs.

### 為業界研發新材料

新材料對於工程製造業與其他相關行業至關重要。2020年11月，工學院大學傑出教授劉錦川教授領導的團隊研發出新策略，可製造出含無序界面納米層的多組元超晶格合金，這種合金於不同溫度下都兼具高強度及延展性。研究結果已在學術期刊《科學》上發表。

2021年1月，機械工程學系副教授陸洋博士與來自麻省理工學院及哈爾濱工業大學的學者合作，成功實現鑽石的均勻彈性拉伸應變達至前所未有的水平。這項突破可令鑽石在微電子、光子學與量子資訊技術的應用進入嶄新時代。研究成果亦已在《科學》上發表。

2021年4月，材料科學及工程學系講座教授Andrey Rogach教授領導的研究顯示，在製造二維鈣鈦礦的過程中使用一種簡單有機分子，即可令鈣鈦礦製成的器件效率達到最高紀錄。採用這種二維鈣鈦礦材料製作的發光二極管(LED)，其外量子效率高達20.5%，可媲美最好的有機LED。



The research team led by Professor Liu Chain-tsuan (front row, left) discovered a new approach for fabricating alloys that have both high strength and good ductility.

劉錦川教授(前排左)領導的研究團隊，發現了製造兼具高強度及延展性的合金的新方法。



A research team led by CityU discovered that kangaroos can intentionally communicate with humans.

城大領導的研究團隊發現，袋鼠能有意識地與人類溝通。

### Looking out for animals

The creation of JCC is inspiring groundbreaking research into animals. A research team led by Dr Alan McElligott, Associate Professor in Animal Behaviour and Welfare at JCC, has discovered that kangaroos can intentionally communicate with humans, challenging the notion that this behaviour is usually restricted to domesticated animals like dogs, horses or goats. Additionally, Dr McElligott said in March 2021 that goats could adapt to changing environmental conditions more quickly than sheep probably because of different feeding ecologies. The ability to adapt is one of the key factors for survival in an ecosystem. The study was a collaboration between researchers at CityU, Martin Luther University of Halle-Wittenberg, the Research Institute for Farm Animal Biology in Germany, and Canterbury Christ Church University and Queen Mary University of London, both in the UK.

Professor Julia Beatty, Chair Professor of Veterinary Medicine and Infectious Diseases in JCC, said in February 2021 that, using big data analysis, she had found that, although more than 80% of cats in Australia had been desexed, only a fraction had had the surgery before reaching puberty, thus creating a “pregnancy gap”. Her team recommended that the age of desexing should be before the kitten reaches four months old.

It was exciting to hear in May 2021 that a HK\$12 million government grant had been awarded by the Sustainable Fisheries Development Fund under the Agriculture, Fisheries and Conservation Department to JCC. The grant will support a three-year project titled “Improving Fish Health and Production in Hong Kong 2020”. The funding will expand and support additional applied research to improve and grow local fish production in Hong Kong.

### 致力動物研究

城大創建賽馬會動物醫學及生命科學院，促進了動物醫學的開創性研究。該學院動物行為及福利副教授Alan McElligott博士領導的研究團隊發現，袋鼠能有意識地與人類溝通。這項發現推翻了人們認為只有狗、馬或羊等家畜才有類似行為的固有想法。此外，McElligott博士在2021年3月指出，山羊比綿羊更快適應環境變化，這可能與牠們的餵養生態不同有關。適應能力是動物在生態系統中生存的重要因素。參與該項協作研究的學者來自城大、德國的哈勒威登堡馬丁路德大學與農場動物生物學研究所，以及英國的坎特伯雷基督教會大學與倫敦瑪麗皇后大學。

2021年2月，該學院臨床動物醫學系系主任、動物醫學及傳染病講座教授Julia Beatty教授指出，大數據分析發現，雖然澳洲逾八成的貓已絕育，惟當中只有部分在青春前期接受絕育手術，因而出現「懷孕空窗期」。她的研究團隊建議，應在貓四個月大之前做絕育手術。

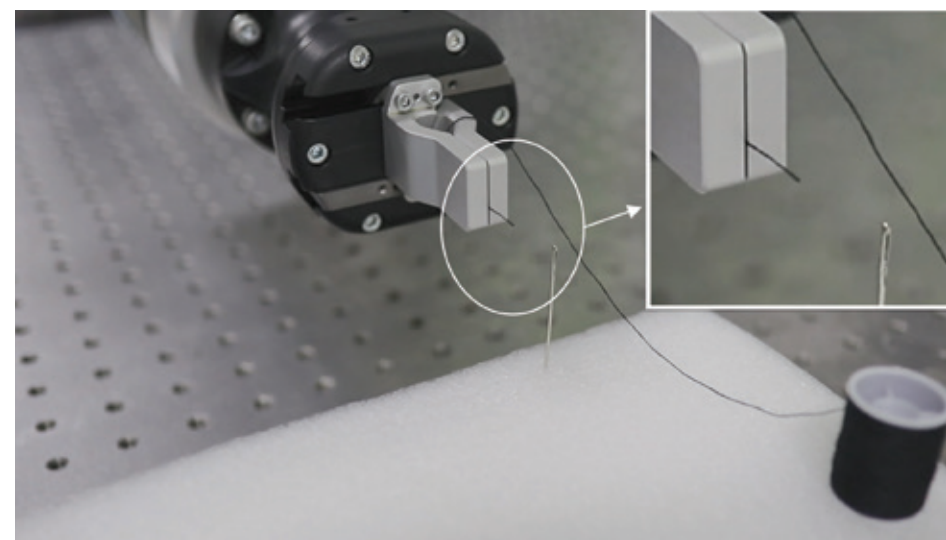
2021年5月，賽馬會動物醫學及生命科學院喜獲漁農自然護理署漁業持續發展基金撥款1,200萬港元，資助名為「改善香港的魚類健康和生產2020年」的項目，為期三年。新撥款將擴展並支持其他應用研究，以改善及增加本地魚類產量。

### IT and robots

In July 2020, Dr Chu Sai-tak, Associate Professor in the Department of Physics, and an expert in integrated photonic devices, played a pivotal role in advancing data transmission speed on the internet to make it the fastest in the world through the development of a novel chip. The research was published in *Nature Communications* and the team comprises researchers from Australia, Canada, mainland China and Hong Kong.

In June 2021, Professor Kuo Tei-wei, Lee Shau Kee Chair Professor of Information Engineering and Dean of the College of Engineering, was awarded the Humboldt Research Award from the Alexander von Humboldt Foundation in recognition of his achievements as a pioneer in system and software designs of non-volatile memory.

In May 2021, new kinds of tactile sensor technologies were introduced that offer hope to improving the quality of life for people suffering serious injuries and disabilities. Dr Shen Yajing, Associate Professor in BME, has co-led joint research on developing a new kind of soft sensor with skin-comparable characteristics. A very special feature is that the sensor can “decouple” the external force automatically into two components, providing an accurate measurement of these two forces, respectively, in order to analyse or control the stationary or moving state of an object. Dr Yang Zhengbao, Assistant Professor in MNE, has created a highly sensitive tactile sensor array that has the potential to restore touch and sensation, as well as monitor health.



By mounting the sensor developed by Dr Shen Yajing at the fingertips of a robotic gripper, a needle can be threaded via teleoperation.

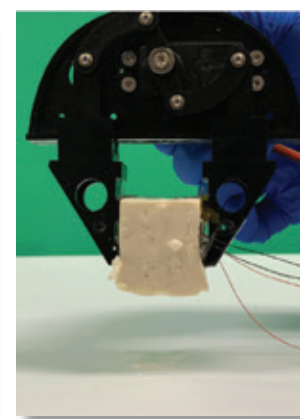
申亞京博士的團隊將傳感器安裝在機械手上，可在遠程操控下拿線穿針。

### 資訊技術與機械人

2020年7月，物理學系副教授、集成光子器件專家朱世德博士在一項研究中發揮重要作用，參與開發的新型芯片能把互聯網數據傳輸速度推進至全球最快。團隊成員分別來自澳洲、加拿大、中國內地和香港，研究成果已在《自然通訊》上發表。

2021年6月，李兆基講座教授(資訊工程)兼工學院院長郭大維教授獲德國洪堡基金會頒發洪堡研究獎，以表彰他在非揮發性記憶體系統及軟件設計領域的先驅研究成果與成就。

2021年5月，生物醫學工程學系副教授申亞京博士聯合領導的一項合作研究計劃，研發出可媲美人類皮膚的新型柔性觸覺傳感器，這種恍如人類皮膚的新型觸覺傳感技術，有望改善身體有嚴重創傷人士的生活質素。此傳感器的最大特點是具解耦能力，即把外力自動區分為兩類不同力量，並準確量度該兩種力度，以分析或控制物體的靜止或運動狀態。此外，機械工程學系助理教授楊征保博士共同領導的研究，研發出高度敏感的觸覺傳感器陣列，有望助皮膚受損者及截肢者重拾觸覺，並可應用於監測人體健康狀況上。



The robotic hand equipped with a tactile sensor developed by Dr Yang Zhengbao can grasp a fragile piece of tofu without spillage.

楊征保博士的團隊將觸覺傳感器安裝在機械手上，能夠成功將豆腐抓住而不捏碎。

### Success in Ministry of Education awards

Two projects took home the 2020 First-Class and Second-Class Awards, respectively, in the Natural Science category at the Higher Education Outstanding Scientific Research Output Awards (Science and Technology) for the Ministry of Education.

The project that won the First-Class Award was “Uncertainty Analysis and Reliability Control of Geotechnical Structures in Hydraulic Engineering” by Professor Wang Yu of ACE and his team.

The Second-Class Award was won by a project titled “High-efficiency Computing Theory and Method for Video Coding” conducted by Professor Sam Kwong Tak-wu, Chair Professor of Computer Science in the Department of Computer Science (CS), and collaborators in mainland China, all of whom have connections with CS.

### An app in time

A new app “CITY IN TIME” unveiled in March 2021 was a collaboration between the Centre for Applied Computing and Interactive Media in the School of Creative Media (SCM) and local artists, historians, and the Tourism Commission. Using cutting-edge augmented reality technology, the app offers users a fully immersive way to experience Hong Kong’s geographical and environmental transformation over time via a smartphone.

### Marching in step

In February 2021, scholars from ACE showed that synchronisation enhances coordination and cooperation among members of a crowd and possibly increases movement efficiency. In the study that was published in *Nature Human Behaviour*, they showed that the phenomenon of human self-organisation known as synchronisation forms spontaneously when the safety distance between pedestrians seems insufficient. These insights into the collective motion behaviour of humans may help prevent the synchronisation-induced wobbling effect that can affect bridges, for example. The scholars were Professor Richard Yuen Kwok-kit, Chair Professor and Chief-of-Staff; Dr Eric Lee Wai-ming, Associate Professor; and Dr Shi Meng, former Research Assistant.

### 教育部高等學校科學研究優秀成果獎

城大參與的兩個合作項目分別獲得教育部2020年度高等學校科學研究優秀成果獎(科學技術)自然科學獎一等獎及二等獎。

建築學及土木工程學系王宇教授及其團隊的研究「水工岩土工程不確定性分析與可靠性控制」獲得一等獎。

電腦科學系電腦科學講座教授鄭得互教授與內地電腦科學專家合作的項目「視頻編碼高效計算理論與方法」獲得二等獎。這些專家都與城大電腦科學系頗有淵源。

### 應用程式 重現城市今昔

2021年3月，創意媒體學院互動媒體電算應用中心與本港青年藝術家、歷史學家及旅遊事務署合作，推出名為「城市景昔」的全新應用程式。這個程式運用最先進的擴增實境技術，為用家提供全面沉浸體驗；用家可使用智能手機，體驗香港地理及環境的今昔變遷。

### 預防「同步」保安全

2021年2月，建築學及土木工程學系三位學者指出，同步增強群眾之間的協調和合作，相信能提高群眾的移動效率。他們發現，行人在彼此安全距離不足的情況下，會出現稱為「同步」的自組織現象，其研究結果已在《自然人類行為》期刊上發表。了解人類這種集體移動行為，或有助防止因群眾自發同步而引致橋樑之類的建築物搖晃。參與此項研究的三位學者是該系講座教授兼大學秘書長袁國傑教授、副教授李偉明博士及前研究助理施濠博士。

### Chips with power

Dr Wang Cheng, Assistant Professor in EE, won the Croucher Innovation Award 2020 for his contributions to developing compact and high-performance integrated photonic chips for optical communications. This technology can also be applied in quantum as well as millimetre-wave and terahertz photonics. His research team is developing advanced nano-fabrication approaches to integrate optical fibre components onto small chips, and to make them transmit more data at lower power consumption and cost.

### Funding for new Joint Lab

The Greater Bay Area Joint Laboratory of Big Data Imaging and Communications established by EE and the State Key Laboratory of Terahertz and Millimeter Waves will focus on big data imaging and wireless communications applications for a new generation of information technology for the advancement of Guangdong and Hong Kong as an international innovation and technology hub. In December 2020, the lab received RMB21 million from the Designated Strategic Fund for Innovative Technology, approved by the Department of Science and Technology of Guangdong Province, and contributions from members of the Joint Lab.

### Academic Publications by CityU Staff in 2020/21 2020/21年城大教職員的學術著作

<b>Total number of books (including research books or monographs, textbooks, literary works and translation) authored by CityU staff</b> 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	<b>33</b>
<b>Total number of research papers authored by CityU staff in peer-reviewed academic journals, externally refereed policy or professional journals worldwide</b> 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	<b>4,653</b>
Arts and Humanities 藝術及人文	254
Business and Economics 商業及經濟	250
Science (including Medicine) 科學 (包括醫學)	3,779
Social Sciences (including Law) 社會科學 (包括法律)	370

Note: Figures as at end of June 2021.

### 小芯片 高性能

電機工程學系助理教授王騁博士榮獲「裘槎前瞻科研大獎2020」，以表彰他在研發用於光通訊的小型、高性能集成光子芯片方面的貢獻。這項技術也可用於量子、毫米波及太赫茲光子學等領域。他的團隊正研發利用先進納米製造方法，把光纖組件集成到小型芯片上，並使其以更低耗電量和成本傳輸更多數據。

### 共建聯合實驗室

電機工程學系聯合太赫茲及毫米波國家重點實驗室，成立「粵港大數據圖像和通信應用聯合實驗室」，研究重點為大數據成像和無線通訊應用兩大範疇，旨在促進新一代訊息技術產業，為粵港發展為國際科技創新中心作出貢獻。2020年12月，實驗室獲得2,100萬元人民幣資助，當中包括廣東省科學技術廳科技創新戰略專項資金的撥款，及實驗室成員的捐款。

註：數字以2021年6月底為準。

### On-going Funded and Contract Research 2020/21 2020/21年度進行中的資助及合約研究

	<b>Total Funding (million) 資助總額 (百萬元)</b>
Innovation and Technology Fund (ITF) 創新及科技基金*	359.42
Contract research and privately/government funded projects 業界贊助合約研究項目及政府資助研究項目	296.08

Note: Included are industry sponsorship for ITF projects and annual funding support from the Innovation and Technology Commission at \$10m each to the State Key Laboratory in Marine Pollution, State Key Laboratory of Terahertz and Millimeter Waves and Hong Kong Branch of National Precious Metals Material Engineering Research Center.

註：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1,000萬港元資助。

### Research Projects 2020/21 2020/21年度研究項目

<b>Total number of on-going research projects funded by external funds and CityU research grants</b> 由校外及校內撥款資助的研究項目總數	<b>3,083</b>
<b>Number of on-going research projects by Colleges/Schools/support centres</b> 各學院/學術支援部門的研究項目數目	
College of Business 商學院	337
College of Engineering 工學院	1,176
College of Liberal Arts and Social Sciences 人文社會科學院	465
College of Science 理學院	421
Jockey Club College of Veterinary Medicine and Life Sciences 賽馬會動物醫學及生命科學院	303
School of Creative Media 創意媒體學院	76
School of Data Science 數據科學學院	74
School of Energy and Environment 能源及環境學院	173
School of Law 法律學院	54
Other Academic Supporting and Administrative Units 其他學術支援及行政部門	4

Note: Including CityU-funded, RGC-funded and externally funded research projects, with 850 new start-ups during 2020/21. Figures as at end of June 2021.

註：包括由城大、研究資助局及校外資助的研究項目，其中850項是2020/21年度內新發展的項目。數字以2021年6月底為準。