

Overview of Research Activities of The University of Hong Kong 2017–18

1. Institutional Policy on Research

1. At the core of the mission of the University of Hong Kong (HKU) is creating opportunities for excellence and impact in both research and innovation as well as to advance human knowledge for the benefit of society in Hong Kong, the wider region and the rest of the world. The University's vision for 2016–2025 to be **Asia's Global University** is underpinned by three pillars: teaching and learning, research and innovation, and knowledge exchange and impact. The realisation of this vision is based on (3+1)Is: Internationalisation, Innovation and Interdisciplinarity, which converge to create Impact.

2. HKU intends to undertake world-leading research in critical areas that leads to knowledge creation, translation, realisation and impact that can be benchmarked against the best institutions in the world. Its research policy provides the framework to strengthen capabilities in both fundamental and outcome-driven research as well as knowledge exchange in a culture that enables our researchers to flourish and create impact. The University emphasises innovative, high-impact and multidisciplinary research, and develops a research culture that enables quality research postgraduate (RPg) education and enriches career opportunities. It recognises full accountability for the effective management of public and private research resources, and embraces the opportunity to partner with the wider community to generate, disseminate and apply knowledge to create social, cultural and economic impact in the open innovation system.

3. HKU's research strategies and policies are formulated by the Office of the Vice-President and Pro-Vice-Chancellor (Research) (VP(R)). In line with the University's vision, the University Research Committee (URC) – a Senate committee chaired by the VP(R) – has sharpened its strategies to further cultivate a supportive, dynamic environment in which staff and students can excel in research at an international level and realise their full potential in advancing, translating and transferring knowledge. The University aims to

- (a) Focus on research quality and impact, and the translational potential and value to industry, business and the community,
- (b) Emphasise fundamental research that can be benchmarked with the world's best and foster a research culture and environment to attract, nurture and retain talents,
- (c) Raise competitiveness towards external funding and strategic partnership,
- (d) Foster outcome-based, cross-disciplinary, trans-faculty and inter-institutional collaboration locally, regionally and globally,
- (e) Promote social and technological innovation, entrepreneurial incubation and public-private partnership, and drive innovation and entrepreneurship through research and talent development, and
- (f) Build core capabilities for sustainable growth.

4. In the reporting year, the University sharpened its research priorities through the development of a Strategically Oriented Research Themes (SORT) initiative as a key mechanistic element, encompassing areas not just of strength, but also ambition and potential. (See paragraph 8 for more information.)

5. Supporting these research strategies, the University continues to invest in the human resources that are necessary to sustain a research culture dedicated to excellence and impact. This includes developing a proactive human resource policy and management structure to, inter alia, facilitate academic recruitment and retention, recognise performance, and enhance diversity in international staff recruitment. Dual-focus on inputs, notably competitive and diverse research grants, and outputs, quality and impactful international publications, as well as the launch in 2015–16 of the specialist track in research in academic staffing are some examples of the University’s approach. HKU attracts outstanding staff from around the world, bringing with them international expertise. For example, in 2017–18 around 39% of professoriate staff were from overseas, 22% from mainland China and the remaining 39% from Hong Kong.

6. Within this broad strategic framework, the University continues to encourage research excellence in a number of important focused areas. It continues to fund curiosity-driven research and to incubate new research initiatives with seed-funding grants. Funding is provided for, inter alia, individual and collaborative projects, fellowship and visitorship schemes, conference support and so on. Emphasis is also increasingly placed on the impact of its research through the translation and application of its findings and through knowledge exchange and technology transfer. The University also continues, through its RPg policies, to develop a culture of student-centred, performance-based and shared-responsibility research.

7. The following institutional policy developments took place during the report period.

Strategically Oriented Research Themes

8. Launched in the reporting year, the University’s new Strategically Oriented Research Themes (SORT) initiative builds on its earlier (Emerging) Strategic Research Themes, as well as ongoing large-scale projects such as through the State Key Laboratories, Areas of Excellence Scheme and Theme-based Research Scheme. The research themes are led by outstanding investigators, driven by new knowledge, motivated by cross-disciplinary challenges, and inspired by seeking solutions to complex problems. The topics chosen are representative, and necessarily selective, given the large array of excellent research across ten faculties in a comprehensive university that values diversity and dynamism. The themes demonstrate strength, ambition and potential and are grouped into four areas:

- (a) SmartBio & HealthTech (SH)
 - Chemical Biology for Drug Discovery
 - Well-Being of the Brain and Mind
 - Infectious Diseases and Microbial Resistance
 - Precision Cancer Medicine
 - Precision Biology and Stem Cells
- (b) Future Innovative Technologies (FIT)
 - Electric Energy Conversion and Utilisation
 - Functional Materials for Molecular Electronics
 - Two-Dimensional Materials
- (c) Smart Systems & Sustainable Society (S4)
 - Mitigating Mega-City Hazards
 - Sustainable Water Environment
 - Contemporary China

- (d) Intelligence, Data, E-Commerce & Automation (IDEA)
 - China and ‘Belt and Road’ Economies
 - FinTech, RegTech and the Future of Finance
 - Artificial Intelligence to Advance Well-Being and Society

9. A brochure titled *Strategically Oriented Research Themes* describes HKU's research strategy and outlines the themes, capturing past achievements, present activities, current plans and future targets (www.hku.hk/research/strategic-research).

10. The University continues to provide a Seed Funding for Strategic Interdisciplinary Research Scheme that is used to groom large-scale and competitive research projects involving interdisciplinary collaboration, such as the Collaborative Research Fund, Areas of Excellence Scheme, Theme-based Research Scheme, State Key Laboratories and international grants.

Research Integrity

11. While pursuing excellence and impact in research, HKU intends to establish a culture among the university community of upholding research integrity. Promoting responsible academic conduct has therefore been made a top priority of the research management as it is the core value of the University.

12. Professor Frederick K.S. Leung has been appointed as the Director of Education and Development for Research Integrity since June 2011. His remit includes areas covering training and education for staff and students, as well as sharing the latest developments in research and good international practice. To strengthen the team, Professor Danny Chan has been appointed as the Deputy Director of Education and Development for Research Integrity since January 2015. The research ethics compliance continues to be handled by the relevant ethical approval bodies, namely the Human Research Ethics Committee, the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster, and the Committee for the Use of Live Animals in Teaching and Research.

13. A number of ongoing and new initiatives are undertaken at HKU to promote responsible conduct of research (RCR). RCR seminars for staff are a regular event at the University, generally held once each semester. Since March 2010, more than 2,650 academics at all grades – from Post-doctoral Fellows to Chair Professors, including Heads of academic departments – have attended the 22 RCR seminars that have been organised. Since July 2012, all new staff are required to attend an HKU RCR session/seminar within 12 months of assuming duty at the University to be eligible for internal research and conference support and RPg student supervision. This mandatory requirement was extended in February 2015 to existing staff who joined the University before July 2012, who had to attend at least one RCR seminar by June 30, 2017. The most recent RCR seminars were held in February and October 2018.

14. Other measures at the University to promote research integrity include a compulsory research ethics course for RPg students, online RCR materials for self-education, and active participation in research integrity networks. The Research Integrity Funding Scheme was established in 2012–13 to encourage Faculties to tailor research integrity education and training programmes/activities for their members to promote their awareness of research integrity. A total of 27 proposals were funded in the past six rounds.

15. Since 2010, HKU has been an active participant in the series of World Conferences on Research Integrity, the largest international event on RI. In 2019, HKU will co-host (with RMIT, Melbourne, Australia) the 6th World Conference on Research Integrity to be held at HKU on June 2–5. This will be the first conference of its kind in Hong Kong in its history. The University is in the midst of preparations for this key gathering of researchers, teachers, funding agencies, government officials, journal editors, senior administrators and research students, who will have opportunities to share experiences, to learn about the best global research practices, and to discuss and promote integrity in research. More information can be found at www.wcri2019.org/.

Preparations for the Next Research Assessment Exercise (RAE)

16. In preparation for the Hong Kong-wide assessment of research by the University Grants Committee (“RAE 2020”), HKU undertook a mock exercise in 2017 with the objective of self-assessment and improvement. A Small Group was set up under the URC to oversee the exercise. The aims of the exercise were to (i) give some indication of how the University stood today as compared with the last RAE in 2014, (ii) help follow-up actions and plans to sustain effort in areas of strengths and improve in areas with shortcomings, (iii) focus on both the quality and impact of the research, and (iv) raise the awareness of and readiness for RAE 2020. The exercise was coordinated with faculty-based assessments, and appropriate experts with relevant experience were engaged in the review process to adopt a stringent approach and have a good reflection of the current strengths/weaknesses. Faculties were asked to review both research outputs and impact case studies, both of which are important elements of RAE 2020, with the third being environment.

17. It is important to re-emphasise that the RAE is simply a “health-check” mechanism for the University, whose goal is to develop sustainable world-leading research in a robust, vibrant and innovative environment for knowledge creation and translation.

18. The University is running an RAE Colloquium series in which renowned global scholars from different disciplines share their ideas and insights with our academics based on their experiences of the UK’s Research Excellence Framework (REF) and related assessment. The Office of the VP(R) launched a series beginning in 2016 with a talk by Professor Michael Mingos FRS, Emeritus Professor of the University of Oxford. This has been followed by four sessions in the reporting year:

- November 24, 2017: “RAE – Everything You Need to Know but Haven’t Asked”, given by Professor Nicholas J. Long FRSC, Sir Edward Frankland BP Professor of Inorganic Chemistry at Imperial College London.
- December 13, 2017: “From Economies of Prestige to Impact Metrics: How REF is Shaping the Humanities”, given by Professor Dina Iordanova FRSA, Professor and Chair in Film at the University of St Andrews.
- February 2, 2018: “Research Assessment in the United Kingdom: History, Changing Rules and Tactics”, given by Professor David Fearn FRSE, International Dean at the University of Glasgow.
- June 1, 2018: “Experiences from Research Assessment Exercises”, given by Professor Phil Jones, Chair of Architectural Science at Cardiff University.

19. The University has provided funding for Faculties and Units of Assessment (UoA) for RAE preparation, such as the appointment of external advisors and evidence collection

for impact cases. At the central level, the University has appointed impact case consultants and international advisors. Two senior professors have also been appointed by the VP(R) as HKU RAE Project Co-ordinators, who are working together to oversee the preparatory work and liaise with Faculty Deans and UoA co-ordinators.

20. The University's ongoing series of impact workshops – organised by the Knowledge Exchange Office – continued in the reporting year, involving sessions with UK academics sharing their experience of working on impact case studies during the UK's REF 2014 (see paragraph 43). The workshops offer useful insights for HKU researchers in preparing evidence of research impact for RAE 2020.

Research Data and Records Management Policy

21. In recent decades, measures to tackle the challenge of effectively managing growing amounts of research data have been introduced overseas, for example in the UK and the USA. Although Hong Kong currently has no mandatory requirement in place, HKU acknowledges its responsibility to manage and safeguard research data, and it has implemented a requirement in view of the increasing emphasis on proper data management as part of responsible research conduct. The University's Policy on the Management of Research Data and Records (www.rss.hku.hk/integrity/research-data-records-management) was approved by the Senate in May 2015, along with the establishment of a Task Force on Management of Research Data and Records to oversee the planning of the implementation of the Policy. The Policy stipulates that researchers are responsible for, among other things, planning for the ongoing custodianship of their research data.

22. HKU has now prepared a platform, through the Libraries, for depositing public and restricted research data through the HKU Scholars Hub, and researchers are encouraged to make use of this new infrastructure for depositing their research data. There are challenges in the implementation, as such culture among staff and students is weak, not just in HKU but HK-wide, and the data are massive, diverse and complex. The University nevertheless is taking on this task and leading by example. Principal Investigators of external research grants from the Research Grants Council, Food and Health Bureau, Education Bureau and Innovation and Technology Commission that are administered by Research Services with funds released from July 2018 onwards are required to submit a Data Management Plan (DMP) together with any revised budget before the funding can be spent for all projects that involve the collection, generation or use of research data. They are also required to submit additional information and deposit the raw data for these projects before final reporting. RPg students admitted during the September 2017 intake and thereafter will also have to comply with the University's Policy to submit a DMP and upload a dataset. The Libraries and the Graduate School have incorporated such a training component into their workshops and courses.

Research and Innovation Colloquium

23. A colloquium titled "Strategies for University-Industry Partnerships and Engagement" by Dr Warwick Dawson, Director, Knowledge Exchange, University of New South Wales, Australia was held at HKU on March 1, 2018. During the session, Dr Dawson provided an overview of the Australian R&D and innovation system, including contextualising the current landscape, highlighting the drivers of collaboration, and outlining some perceived barriers to partnership and potential incentives. He shared with the HKU audience the strategies that UNSW is using to support knowledge exchange and

technology transfer, and also information on the University's ongoing collaboration with China, which includes five joint laboratories and the planned development of an "Innovation Precinct". Discussion with participants covered a wide range of issues, including details of intellectual property, perceptions of industry funding, training for researchers, alumni engagement, start-up firms, inter-institutional partnerships, and problems, strategies and goals in knowledge exchange.

2. Collaborative Research

24. Collaboration in research at a wide range of levels is highly valued by the University's management and by individual researchers. Research across disciplines at HKU is actively encouraged, for example through the Seed Funding for Strategic Interdisciplinary Research Scheme. Other examples of initiatives at the University to stimulate cross-fertilisation include the Hong Kong Jockey Club Building for Interdisciplinary Research, which focusses on research on the well-being of humans, particularly relating to human health and disease, which brought together researchers from Medicine, Science and Social Sciences. Cross-discipline research centres, such as the Centre for the Humanities and Medicine and the Law and Technology Centre, also aim to encourage productive relationships across fields. The Interdisciplinary Research Competition is co-organised by Graduate House, the Postgraduate Student Association and the Graduate School to promote interdisciplinary research amongst postgraduate students. In 2018, the champion award went to the project "3D Printing System for Cartilage Repair". The winning team comprised 5 PhD candidates from Mechanical Engineering and Civil Engineering.

25. Researchers of the University are also heavily involved in large-scale collaborative projects with local institutions and international partners. For example, of the 61 Areas of Excellence (AoE) and Theme-based Research Scheme (TRS) projects awarded to date, HKU is co-ordinating 26 and participating in a further 27. Such projects thrive on local and international collaboration; for example, the most recently funded TRS project (see paragraph 62), which is investigating a functional cure for HIV/AIDS patients, involves collaborators from Hong Kong, Mainland China, the US and Europe. As outlined below, partnership between the University and industry is also an ongoing focus to promote the application of research results.

26. Internationalisation through productive and strategic engagement in China, Asia and the rest of the world is a key feature that is embedded in many elements of the University's strategic plan. HKU has positioned itself to be a globally competitive, regionally engaging and locally impactful university, and in the face of the challenges ahead, the enhancement of collaboration with international and Mainland partners is highly valued. In addition to working closely with other local institutions, HKU actively participates in Universitas 21, a consortium of leading universities around the world dedicated to the internationalisation of higher education. The University is also a member of the Association of Pacific Rim Universities (APRU), a regional network of 50 world-class institutions. The VP(R) is the serving convenor of the Research Leaders of U21.

27. HKU also collaborates with a number of leading institutions, laboratories, pharmaceutical companies, research institutes and government bodies, both overseas and in mainland China. The University currently has five State Key Laboratories (SKLs) – the highest in Hong Kong – in the areas of Brain and Cognitive Sciences, Emerging Infectious

Diseases, Liver Research, Synthetic Chemistry, and Pharmaceutical Biotechnology. The research at the SKLs is integrated with mainland Chinese engagement strategies, and HKU's SKLs are evolving as innovation hubs. A review of the SKLs established in or before 2010 has recently been completed by the Ministry of Science and Technology. This was the first round of re-assessment of the SKLs in Hong Kong, and HKU's four SKLs re-assessed in this round received outstanding/meritorious grading.

28. The University also has the following five joint laboratories with the Chinese Academy of Sciences (CAS): Stem Cell and Regenerative Medicine Research Centre (with the Guangzhou Institute of Biomedicine and Health); Chemical Geodynamics (with the Guangzhou Institute of Geochemistry); Biomaterials (with the Shenzhen Institutes of Advanced Technology and the Chinese University of Hong Kong); Chemical Synthesis (with the Shanghai Institute of Organic Chemistry and the Chinese University of Hong Kong); and New Materials (with the Technical Institute of Physics and Chemistry). This year, in the Fifth Assessment of the HK-CAS Joint Laboratories, the Biomaterials and Synthetic Chemistry laboratories were rated as "distinguished", with the other three rated as "good".

29. Another form of international partnership by the University to enhance research collaboration is joint supervision of PhD students with prestigious overseas universities through joint programmes. At present, the University offers a joint PhD programme with King's College London, and joint placement with the University of Toronto and the Southern University of Science Technology. Through these joint programmes, students have the opportunity to spend half of their study period at the partner university, enabling them to benefit from shared research excellence in a wide range of disciplines between HKU and its partners and to acquire enriching international experience. In addition, there are over 30 partners for RPg exchange at the university level in Europe, the USA, Southeast Asia, mainland China, etc., along with many more at faculty and department levels, which allow students to gain academic and/or research experiences overseas.

30. In 2017, a research project led by 3 PhD candidates from HKU and their supervisor won the Universitas 21 (U21) Graduate Collaborative Research Award. The award aims to enable doctoral candidates to participate in international research collaborations within the U21 network. The project team consisted of 7 doctoral candidates and 5 advisors from 5 U21 member universities (HKU, Shanghai Jiao Tong University, the University of New South Wales, the University of Birmingham and University College Dublin) with multidisciplinary expertise.

31. The University has set targets for 50% of full-time RPg students to have at least one research experience overseas or in mainland China by 2019, and 100% by 2022. With an additional one-off fund from the UGC, an allocation from the URC and matching funding provided by Faculties, RPg students are supported to gain international exposure through various opportunities arranged by their Departments, supervisors and the students themselves. Four-fifths (80.7%) of RPg students at completion in 2016/17 had industry or international (including Mainland) experience.

32. Recent examples of the University's diverse collaboration initiatives within and beyond academia include the following:

- (a) A memorandum of understanding (MoU) was signed between HKU and Cyberport in August 2017 to set up the HKU x Cyberport Digital Tech Entrepreneurship Platform. The Platform is a first-of-its-kind collaboration

between HKU and Cyberport aiming to form a closer partnership to build a unique digital tech ecosystem for Hong Kong spanning the aspects of human capital, innovation and technologies, entrepreneurship, and legal and business expertise. Through this Platform, the “HKU x Cyberport FinTech Nucleus” was also set up, representing the first step to introducing more creativity and innovation to the Cyberport Centre of Global FinTech Innovation, an important avenue where FinTech solutions will be spotlighted to stimulate exchanges and adoption, as well as to spawn further innovation and collaboration. Since being set up, the FinTech Nucleus has facilitated the deployment of a network security system called SHIELD, developed by an HKU technology spinoff from the Department of Computer Science; 50 Cyberport FinTech companies participated in a trial run of the system for three months and confirmed that the product is robust in protecting their company networks from cyber-attacks. After the successful conclusion of the trial run, the spinoff company is in discussion with Cyberport on a commercial arrangement for providing the SHIELD solution to Cyberport’s tenant companies.

- (b) HKU and the Dunhuang Research Academy signed an MoU in October 2017 in Dunhuang for academic collaborations in preservation research, particularly Buddhist art, and promotion of Dunhuang cultural heritage. HKU Director of Jao Tsung-I Petite Ecole Professor Lee Chack-fan was also appointed as the director of the academy’s Buddhist studies centre.
- (c) HKU and TCL Corporate Research (Hong Kong) Co. Ltd (TCL) officially signed an agreement in January 2018 to establish the “TCL Innovative Research Fund for Science 80th Anniversary” with a donation of HK\$3.2 million to be deposited in two phases, in support of PhD students in HKU’s Faculty of Science to develop innovative research projects. The fund celebrates HKU Science in moving forward to its 80th anniversary by enhancing its competitiveness globally across research in diverse disciplines, funding innovative research projects of 10 PhD students in biomedical science, big data analytics, artificial intelligence and material science over a four-year period. While realising the vision and strategy of TCL in pursuing innovation and translating advance technology to solutions for daily life, the fund also demonstrates the Faculty’s determination in becoming a pioneer in scientific research.
- (d) During a visit by an HKU delegation – including the Vice-President and Pro-Vice-Chancellor (Global) and members from the Faculties of Arts, Architecture, Medicine, Science, and Social Sciences and the Graduate School – to the University of Toronto in April/May 2018, the two universities established a Global Strategic Partnership Fund that will foster a deeper institutional engagement across all levels and result in broader local and international impact. The institutions will contribute to the fund on a matching basis, which will offer faculty and students increased access to research and learning opportunities across disciplines and across borders. Building upon HKU-University of Toronto existing collaborations, a trilateral collaboration with the University of Toronto and non-profit national research organisation MITACS was established.

- (e) An MoU was signed between HKU and the University of California, Davis in May 2018 to promote and facilitate exchanges and cooperation, particularly through collaboration on research projects in common areas of research interests in scientific research such as in neuroscience and sustainable transportation, and related disciplines. Two projects on neuroscience and sustainable transportation were chosen for the inaugural funding.
- (f) HKU has developed plans to collaborate on biomedical innovation with Institut Pasteur (IP) and the Hong Kong Science and Technology Parks Corporation (HKSTP). The three parties signed an MoU in Paris in June 2018. HKU, IP and HKSTP aim to establish an interdisciplinary biomedical research centre for immunology, infection and personalised medicine within the HKSTP's healthcare technologies research cluster ("Health@Inno Cluster"), in response to the HKSAR Government's initiative to turn Hong Kong into a centre of biomedical innovation and technology. The proposed new research centre will provide a unique platform for deepening understanding of human health and disease and formulating innovative solutions for public health challenges.
- (g) The University signed an MoU with Tsinghua University in October 2018 for a fund to promote and encourage collaborative research and development in areas of common interest in the form of, for example, personnel exchange, joint workshops and joint publications.
- (h) HKU and the Guangdong Pharmaceutical University (GDPU) have jointly launched the GDPU-HKU Innovations Platform in Zhongshan to collaborate on bio- and health technology and translational medical research and development in Guangdong-Zhuhai-Macau Greater Bay Area. The Innovation Platform is to take part in and ride on the "Healthy China 2030" blueprint and other national strategic documents to delineate the development plan of bio-medicine in China, which will capacitate the growth of its medical health industry to RMB 8 trillion by 2020 and RMB 16 trillion by 2030. The launch of the Innovation Platform is a significant step to mark the University's presence and contribution to development in the Greater Bay Area. A satellite branch of HKU's State Key Laboratory of Pharmaceutical Biotechnology at GDPU was also launched. The Innovation Platform consists of an incubator for new technological start-up companies, a joint laboratory for researchers from HKU and GDPU to conduct joint research projects, and a technology transfer unit that can facilitate technology transfer and commercialise HKU's IPs as well as GDPU's translational research to industrial enterprises and technology companies in Zhongshan City. The Innovation Platform is also expected to bring in additional research funding and collaboration opportunities for HKU researchers on bio-medicine research. The platform provides access to key facilities in Zhongshan such as clinical trials, an animal laboratory and incubation space as well as partnership opportunities with the emerging healthtech industry in Zhongshan.

33. Through partnership with local governments, HKU has established bases in Shenzhen and Zhejiang for research, innovation and enterprise. The institutes represent an integral part and an extension into the Chinese Mainland of the University's research. The

facilities offer opportunities for HKU researchers to widen their areas of investigation and strengthen partnerships with Mainland research communities. They also play an important role in harnessing technology and innovations from HKU and incubating them in mainland China with potential industry adoption. Administrative support for activities and developments in the Mainland is provided by HKU's Mainland Research Projects Office (MRPO).

34. MRPO supports and promotes HKU's research in the Mainland by informing the HKU community about funding opportunities in China, coordinating submissions, monitoring award progress and managing project completions. This complements other administrative units to create synergy and coordinate research activities in the Mainland. MRPO also organises seminars and workshops that promote Mainland research, innovation and entrepreneurship opportunities on the HKU campus. A grant briefing workshop and a grant writing workshop were held on January 10, 2018 and February 7, 2018, respectively.

35. The HKU-Shenzhen Institute of Research and Innovation (HKU-SIRI, www.siri.hku.hk) provides an HKU base in the Pearl River Delta region. HKU-SIRI has been relocated from the Shenzhen Software Park to the nearby Shenzhen Virtual University Park. Since its inception in 2011, HKU-SIRI has attracted considerable funding at both local and national levels such as the National Key Research and Development Program of China (previously known as the 973 Program) (國家重點研發計劃-前稱 973 計劃), the National Natural Science Foundation of China (NSFC) (國家自然科學基金), and the Shenzhen Science and Technology Program. In 2017-18, HKU-SIRI received total funding of RMB4 million for 3 projects under the National Key Research and Development Program, over RMB14 million for 23 projects under NSFC, and around RMB8.6 million for 9 projects under the Shenzhen Science and Technology Program. To date, there have been about 130 research projects funded, 6 patents granted and 2 filed, and nearly 280 papers published.

36. The HKU-Zhejiang Institute of Research and Innovation (HKU-ZIRI, www.ziri.hku.hk) is a tactical initiative of HKU for research-innovation-enterprise value-chain development in a strategic location in China. It was set up through a four-party agreement, and collaborations with Zhejiang local institutes and enterprises are expanding. HKU-ZIRI works along five research directions – Alternative Energy, Smart Materials, Advanced Manufacturing, Biomedical Interfaces and Sustainable Environment – under HKU's framework of (3+1)Is: Internationalisation, Innovation and Interdisciplinarity, all converging to create Impact. HKU-ZIRI has wet lab facilities for chemical and biological sciences. HKU-ZIRI members also attract national and local funding – for example, through the Zhejiang Provincial Key Research Plan (浙江省重點研發計劃) and the NSFC – and received total funding of RMB 1.45 million for 3 research projects in the reporting year. To date, nearly 100 papers have been published. It is planned to expand ZIRI's five main research areas into 50 research teams and more than 1,000 research members by 2022.

37. A delegation of the Hong Kong and Macao Affairs Office of the State Council led by its Deputy Director Mr Huang Liuquan (黃柳杈副主任) visited HKU-ZIRI in May 2018. Director Huang highlighted the rapid development of Zhejiang especially in the area of innovation, advanced technologies and talent development, and trusted that the Institute would take advantage of the opportunities to develop its strength and impact. He valued

this unique quadripartite partnership (HKU-ZIRI-Zhejiang Province-Hangzhou-Lin'An Science & Technology Park) and expressed optimism about this development.

38. Large numbers of individual researchers undertook collaborative projects during the report period with researchers in mainland China or elsewhere in the world across a wide range of activities, including joint research projects, co-authoring of papers, academic visits with or without teaching activities, providing consultancy or peer review services, supervising research students, serving as external examiners, and so on.

39. HKU has a number of initiatives to help increase research competitiveness and international collaboration:

- (a) *Distinguished Visiting Scholars Scheme*: The scheme, introduced in 1996, aims to enhance the University's visibility in the international academic community; provide opportunities for our academics to interact with world-class scholars; provide the impetus to promote the development of targeted academic areas; and establish links with institutions leading in the discipline.
- (b) *Visiting Research Professors Scheme*: Since its inception in 2009, the Visiting Research Professors Scheme has attracted nearly 60 leading scholars from around the world.
- (c) *HKU Centennial Distinguished Chinese Scholars Scheme*: This scheme, introduced in 2015–16, aims to further strengthen the scientific exchange with top scholars from the mainland China.
- (d) *HKU Overseas Fellowships*: HKU established these awards to support academic staff members to visit overseas institutions for research collaborations.
- (e) *Glasgow/HKU Early Career Mobility Funds*: HKU and the University of Glasgow launched the reciprocal Glasgow/HKU Early Career Mobility Funds to enable early career researchers to spend part of their research time in the partner institution.
- (f) *King's/HKU Fellowships*: HKU and King's College London established reciprocal King's/HKU Fellowships to strengthen their partnership by enabling their academic staff members to visit the partner institution.
- (g) *Doris Zimmern HKU-Cambridge Hughes Hall Fellowship*: HKU offers co-funding alongside the Doris Zimmern Charitable Foundation to enable teaching and research staff of the University to spend a period of time at Hughes Hall, as visiting fellows, for research collaboration and other academic exchange.

3. Knowledge Exchange

40. Translating knowledge and discovery into societal impact is the University's ultimate goal, and knowledge exchange (KE) is regarded as the engine of impact. The UGC's earmarked funding for knowledge transfer (KT) has enabled the University to build capacity and develop strategies that take HKU knowledge from the campus to the community through technology transfer, entrepreneurship, community engagement, and

knowledge access. Since 2009, the University has put in place infrastructure to support KE, including a KE Office (KEO, www.ke.hku.hk) and counterpart units within each faculty. HKU provides an annual KE report to the UGC; the information below provides some highlights for the 2017-18 reporting year.

Deepening institutional capacity for realising and corroborating impactful research

41. In the reporting year, KEO conducted a special funding round to support projects designed to collect evidence for corroboration and evaluation of impacts arising from previous research or KE projects. A total of 19 proposals from across all Faculties were supported. This exercise has prompted Faculties and departments to look deeply into past and ongoing research projects of broader social relevance and benefits with a view to identifying potential impact case studies for the new impact requirement in the UGC's Research Assessment Exercise 2020.

42. KEO spearheaded the proposal to make KE explicit and articulate the KE elements – including impact beyond academia, technology transfer, and community engagement – in the promotion and tenure criteria for professoriate staff, which has been implemented from the Spring Review 2017/18 onwards. Essentially, this further advancement in the University's human resource policy is part and parcel of the institutional reward and recognition system for KE that KEO has been building up over the past eight years.

43. KEO has been organising impact workshops since 2013/14, mostly delivered by experts from the UK who were involved in the Research Excellence Framework (REF) 2014. The UGC's RAE 2020 will be the first time that the RAE includes research impact as part of the assessment. The framework is very close to that of REF 2014 in the UK. KEO's efforts in promoting the importance of impact beyond academia among our faculty members in the past five years are in full alignment with this development in the UGC sector. In the reporting year, 5 impact workshops were organised by KEO in collaboration with the Faculties concerned.

44. The University has in place KE Award Schemes to recognise outstanding KE accomplishments that have made significant economic, social or cultural impacts to benefit society. The 2017 university-wide KE Excellence Award went to a team led by Professor P.S.F. Yip, of the Hong Kong Jockey Club Centre for Suicide Research and Prevention for their work on a "Public Health Approach to Suicide Prevention". Other examples of the impact of HKU's KE (which were also recognised in the KE Award Schemes) include (i) a collection of projects on improving liveability in ageing Hong Kong, (ii) engagement with research on the Great Kantō Earthquake and new understanding of responses to natural disasters, (iii) high-strength lightweight steels for low emission automobiles, and (iv) plugging the justice gap for minorities under the law: applied intersectionality research and substantive equality.

45. HKU's Impact Project Funding Scheme continues to support academic staff to undertake KE projects that are underpinned by their research or expertise to bring benefits to the wider community. Supported by the UGC's Knowledge Transfer funding over the years, it has encouraged our researchers to proactively consider different non-academic sectors, both locally and overseas, which may be engaged as potential KE partners or beneficiaries in their work. In the reporting year, 77 proposals were received, of which 52 were supported.

Commitment to Knowledge Access and Community Engagement

46. KEO launched a new KE website (www.ke.hku.hk) in October 2017 that showcases the KE success stories of our researchers under ‘Impact’, ‘Innovation’, ‘Partnership’, ‘Global’, and ‘Engagement’. This new website has been the first HKU website that is organised along the strategic themes stated in the University’s strategic document, HKU Vision 2016-2025, serving the dual purposes of sharing HKU knowledge with the general public and publicising the KE contributions and achievements of our faculty members.

47. All Faculties are committed to public engagement to share knowledge and raise awareness on important issues facing society. Examples in the reporting year include (i) a series of events organised by the Faculty of Education for the Centenary Celebration of Teacher Education at HKU, which provided many opportunities for our faculty members, alumni, primary and secondary school principals and teachers, parents, students, and members of the public to exchange ideas and views in different aspects in education; (ii) 50 videos produced by the Faculty of Social Sciences to capture the tremendous achievements of 50 projects/programmes with real community impact in its history to celebrate the Faculty’s 50th anniversary; (iii) an End-of-Life Care Public Seminar and premiere of the mini-movie ‘My Little Story with Mom’ – organised by the Jockey Club End-of-Life Community Care project funded by The Hong Kong Jockey Club Charities Trust and co-organised by the Faculty of Social Sciences – in which 1,000 participants from the healthcare, social welfare, and education fields and the general public took part; and (iv) a public lecture organised by the Faculty of Law on the ‘Special Needs Trust Fund’, attracting over 500 attendees who wanted to learn about an asset management mechanism recommended by our legal researchers, which could provide trust services to parents of children with special needs.

48. In the reporting year, the KT funding provided to the University by the UGC was also used to support 33 student KE projects. In particular, our dental students are passionate about applying their skills learned at the top dental school in the world to serve different deprived groups in society. Their KE projects this year included services to patients with Angelman syndrome, elderly people living alone, students with special educational needs, people with mental disabilities and their families and caregivers, and children and villagers in Cambodia and Sri Lanka.

Technology Transfer and University–Industry Partnership

49. An important part of KE is university–industry partnership, and a key aim at HKU is to bring the University’s innovative research results to the wider world through technology transfer, as the practical application of technological advances benefits both the University and the community as a whole. The Technology Transfer Office (TTO) provides services relating to Intellectual Property (IP) management, technology marketing and transfer, research contract review and liaison with industries and businesses, while commercial operations come under Versitech, a wholly-owned subsidiary of HKU.

50. During the reporting year, TTO joined hands with Microsoft Hong Kong Limited (“Microsoft”) to provide support to HKU researchers for tapping into the vast resources and AI-related technologies to be offered by Microsoft. Under the collaboration and research support programme, Microsoft Research Lab–Asia (MSRA) intends to work closely with selected HKU faculty members and researchers on their R&D projects. Moreover, HKU researchers will be provided with an enhanced version of Microsoft Academic Graphical Services whereby they will be able to access scientific publication records, citation

relationships between those publications, as well as authors, institutions, journals, conferences, fields of study, etc. To provide training to HKU researchers on the latest AI technologies and enhance their knowledge in AI so they can use it effectively to support their research projects, Microsoft will assist HKU researchers and their teams to join the Microsoft Professional Program and to receive training on subjects such as data science and machine learning. Furthermore, technical workshops on Microsoft's Azure and AI computing platform will be organised for the HKU community to help them to apply these technologies to their research projects. In less than three months since the announcement of the collaboration, TTO has worked with faculty members and successfully established 13 new AI projects on the Microsoft platform, covering research projects on cancer diagnostics and treatment, drug screening, RNA sequencing, suicide prevention, dental implants and the development of new AI algorithms.

51. The HKU FinTech Nucleus setup at Cyberport's FinTech Smartspace last year has facilitated the deployment of a network security system called SHIELD, developed by an HKU technology spinoff, tested in a three-month trial run with 50 Cyberport FinTech companies, and currently being considered for commercial use by Cyberport's tenant companies (see paragraph 32(a) for more information).

52. Over the past year, TTO has continued to strengthen professional capabilities in technology transfer in support of the University's mission of KE. The following training courses and events were organised in the 2017–18 reporting year:

- (a) *HKU FinTech Day 2017*: HKU FinTech Day was held on October 30, 2017 jointly by TTO, the Faculty of Law and SuperCharger, the leading FinTech Accelerator in Asia. This event highlighted the work of leading academics at HKU as well as a range of new educational initiatives to support human capital development in Hong Kong and around the world. Asia's first FinTech MOOC – developed by HKU with collaborators from SuperCharger, Cyberport, CFTE, UNSW Sydney, Microsoft and ACMI – was also announced at the event. In addition to presentations and panels, HKU FinTech Day also featured a student start-up competition as well as information for students considering studying FinTech at HKU.
- (b) *InnoCarnival 2017*: HKU was one of the co-organisers for this major nine-day event that was organised by the Innovation and Technology Commission and held from October 21-29, 2017 at the Hong Kong Science Park. Under the theme of "Innovation for a Better Future", HKU showcased 5 research projects related to health technology and information technology to illustrate how innovative research can contribute to smart living.
- (c) *The 46th International Exhibition of Inventions of Geneva*: This event – held in Geneva, Switzerland annually – is exclusively devoted to inventions and innovations and is one of the most prestigious innovation exhibitions and technology competitions. This year, HKU participated for the first time and brought 7 of its innovations over for the event. These 7 innovations received a total of 8 awards from the international jury of experts:
 - (i) "Passive LED Power Driver: A Smart and Environmental-Friendly Street Lighting Technology" by Professor S.Y.R. Hui (Department of Electrical and Electronic Engineering) was awarded the Prize of the Patent Office of the Cooperation Council for the Arab States of the

Gulf and a Gold Medal with Special Recognition by the International Jury of Experts. This winning LED Power Driver has a lifetime of more than 10 years and can withstand extreme outdoor deployment conditions such as thunder strikes – a performance benchmark not attainable by other active switching-mode LED power drivers. The technology is being commercialised by a licensee, with the first installation successfully deployed in Guangdong's Heshan City in 2015. Patent protection is currently being sought in 27 countries around the world.

- (ii) “Arsenol® : The First Oral Formulation of Arsenic Trioxide” by Professor Y.L. Kwong and Professor C.R. Kumana (Department of Medicine) was awarded a Gold Medal. Arsenol® is a drug for acute promyelocytic leukemia (APL) patients that has a low cardiac toxicity but a bioactivity similar to IV formulation. It provides a convenient, safe and cost-effective way for outpatient treatment. Hundreds of APL patients have been treated with Arsenol®, the majority of whom went into complete remission. It is the first prescribed drug to be developed and registered in Hong Kong.
- (iii) “Development and Applications of Next Generation Histology for 3D Interrogation of Human Brain” by Professor W. Wu and Mr H.M. Lai (School of Biomedical Sciences) was awarded a Gold Medal. This invention reduces tissue treatment steps for hard-to-clear human tissues before optical clearing, and it consists of three key chemical components to adjust the refractive index of different tissue compartments and make the tissue transparent. Mr Lai is a 6th-year MBBS student of HKU and this work also earned him first prize in the “Challenge Cup” National Undergraduate Curriculum Academic Science and Technology Works competition in China in 2017.
- (iv) “Angle Difference Method for Vehicle Navigation in Multilevel Road Networks” by Professor A.G.O. Yeh, Dr T. Zhong and Dr Y. Yue (Department of Urban Planning and Design) was awarded a Gold Medal. This invention solved the limitation of present vehicle navigation systems that use GPS; it comes with 10–30 metres of positioning errors and enables the correct identification of the road level on which a vehicle is currently riding.
- (v) “Efficient and Rapid Mixing of Highly Viscous Fluids” by Dr T.T. Kong, Dr Z. Liu, Dr H.C. Shum and Professor L.Q. Wang (Department of Mechanical Engineering) was awarded a Silver Medal. This novel method mixes two or more viscous fluids using a very simple setup at industry scale by inducing them to fold using an electric field. It speeds up the mixing process and consumes much less energy. Dr Shum was selected as one of the New Innovators in NANOMED 2018, which recognises individuals in their early career who have demonstrated exceptional technical advancement and innovation in the field of Nano/Molecular Medicine and Engineering.
- (vi) “Anti-penetration Bone Implant Device and Method” by Mr S.A. Kulper, Professor W.W. Lu, Professor F.K.L. Leung and Dr C.X. Fang (Department of Orthopaedics and Traumatology) was awarded a Silver Medal. This invention reduces the stress in bone tissue by an

implant that includes an expandable tip to increase the contact area between the bone tissue and the implant. A spinoff company founded by engineers and surgeons from MIT and HKU was setup to further commercialise the invention, and the first product from its R&D pipeline is currently undergoing US FDA/CE registration review as a 510(k)/Class II device.

(vii) “Development of Next-Generation Antibacterial Drugs” by Dr X.C. Li (Department of Chemistry) was awarded a Silver Medal. Daptomycin is used in the treatment of infections caused by Gram-positive organisms. Total chemical synthesis over biosynthesis of Daptomycin makes generating analogues against resistant strains much easier. Further development and commercialisation of this invention is being actively pursued by a licensee, which is a pharmaceutical company.

(d) *TechConnect World Innovation Conference & Expo*: This event was held in Anaheim, USA from May 14-16, 2018. HKU showcased seven innovations with their prototypes and working demonstration units. The event provided a good opportunity for HKU to meet with technology scouts and representatives from a number of Corporate Partners. Two of HKU’s innovations – “Omniphobic Porous Membrane and Methods for Preparing the Same” (developed by Professor L.Q. Wang and P.A. Zhu) and “Super Steel - A Method for the Fabrication of a Super-strong and Ductile Multi-phase Steel” (developed by Dr M.X. Huang and Dr B. He) – were ranked by the TechConnect Corporate & Investment Partner Committee amongst the top 15% of the submitted technologies in this exhibition and received the TechConnect Innovation Awards.

HKU Innovation and Entrepreneurship Hub – iDendron and DreamCatchers

53. iDendron – HKU’s innovation and entrepreneurship hub – was established in October 2017 with the aim of nurturing entrepreneurial and innovative spirit on campus. It provides support for HKU’s early-stage start-ups and for establishing interdisciplinary cooperation, as well as funding support for HKU start-ups through the DreamCatchers programme.

54. So far, iDendron has been hosting over 40 HKU students and alumni start-up teams and organised more than 50 events, workshops, and sharing by founders with partners in the innovation, technology, and entrepreneurship sector including Facebook, Google, Startup Weekend and Cocoon.

55. As the signature programme under iDendron, DreamCatchers covers a series of programmes including the Seed Fund Competition (DreamCatchers 100K), Hackathon, Entrepreneurship Academy and other events for our students, staff and alumni.

(a) *Entrepreneurship Academy 2017*: This popular workshop on entrepreneurship was offered again in October 2017. Over 300 students, alumni, staff and friends participated in 10-week Entrepreneurship Courses, covering the topics of the core of entrepreneurship, focusing on integrating information and ideas from multiple perspectives in order to help participants recognise and gauge the critical factors in the commercialisation process of innovation.

- (b) *2018 DreamCatchers 100K*: DreamCatchers 100K is the seed fund competition for all entrepreneurial students and young alumni under the age of 35. A new feature this year was to identify and focus on four themes for the teams of students and young alumni to put forward their creative ideas: (1) E-commerce, FinTech, Big Data, AI; (2) Healthcare, Healthy Ageing; (3) Social Innovation, Creative Industry, Education Tech; and (4) Engineering, Robotics, Wearables, Internet of Things. There were 85 applications involving 286 students and young alumni this year, and 18 finalists joined the final pitch held on April 15, 2018.
- (c) *DreamCatchers MedTech Hackathon 2018*: 55 students from local universities, Shanghai Jiaotong University and Stanford University and young professionals from Hong Kong Science Park with backgrounds in medicine, biomedicine, engineering, science and business joined the one-week hackathon to experience Stanford Biodesign methodologies, design thinking, and business model canvas, to visit real clinical settings and to work in interdisciplinary teams to come up with prototypes of sustainable healthcare solutions with the help of mentors.

TSSSU@HKU

56. In the reporting year, the TSSSU@HKU funding scheme entered its fifth round of application. A total of 25 applications were received in November 2017 for new and existing start-up companies, and 16 start-ups were awarded (12 of which are commercialising HKU technologies), with total funding of HK\$4 million:

- (a) Brain Investing Limited (new) – all-in-one FinTech solutions based on artificial intelligence technologies;
- (b) CISC Limited – provision of cyber intelligence and cyber security consulting;
- (c) Conzeb Limited – high-speed imaging for cancer diagnostics;
- (d) Corvidae Technology Limited (new) – automation of industrial inspection of wind turbines and other commercial sites by drones and associated technologies;
- (e) Datas Limited (new) – a digital platform built on a blockchain for data exchange;
- (f) EN Technology Limited – novel encapsulation technologies for food and cosmetics industries;
- (g) Eonzen Technology Company Limited – non-invasive blood glucose monitoring;
- (h) HACTIS Limited – provision of virtual reality technology for training and education;
- (i) High Performance Solution Limited (new) – thermo-electrochemical capacitor for converting low-grade wasted heat into electricity;
- (j) ImmunoDiagnostics Limited – biomarker discovery, assay development and in vitro diagnostics of major chronic diseases;
- (k) Lifespans Limited – implants for repairing bone fractures in the elderly;
- (l) m-Chinese Solution Limited (new) – a mobile app for enhancing teaching and learning in Chinese and connecting and supporting individual learners and experts to organise mobile consultation and learning courses;
- (m) Novel Sonics Limited (new) – novel ultrasound imaging techniques for

- (n) economical, real-time and non-invasive diagnosis of cardiovascular diseases; QuantumFabless Limited (new) – fast and reliable quantum mechanical modelling and simulation tools for nanoscale materials, devices and applications modelling, to accelerate research and development, improve quality and reduce costs;
- (o) SkinData Limited – advancement of naturally sourced active pharmaceutical grade compounds to consumers seeking to maintain and improve skin health;
- (p) Weavertools Limited (new) – collaborative research tools that simplify the research process for students and corporations around the world

Contract Research Projects and Licensed Inventions

57. A number of examples of successful university-industry partnerships took place during the reporting year. Versitech Ltd undertook a total of 9 contract research projects within 2017–18 with various industrial sectors.

58. Some examples of the latest developments of HKU technologies transferred include the following:

- (a) *Passive LED Drivers for Street Lighting*: A passive power driver technology for powering LED street lighting that was licensed to a local technology company was conferred the Prize of the Patent Office of the Cooperation Council for the Arab States of the Gulf and also a Gold Medal with Special Recognition at the 46th edition of the International Exhibition of Inventions of Geneva, held in Switzerland in April 2018 (see 75(c) above).

As well as enduring extreme outdoor conditions such as wide temperature variation, high humidity, and lightning strikes, this award winning technology provides an operation lifetime of over 10 years, three times that of a conventional active LED driver. The technology is commercialised by Federal Group Global Limited, a local technology company established at the Hong Kong Science and Technology Park. The first installation was successfully deployed in Guangdong’s Heshan City in 2015 and in the three years since, not a single case of failure has been reported. Currently, patent protection for this invention is being sought in 27 countries around the world.

- (b) *Transparent Conductive Film for Display Application*. Flectrode Limited – an HKU technology spinoff company that is commercialising an innovative conductive film technology developed by Dr W.D. Li of the Department of Mechanical Engineering – has set up a factory in Xiamen and installed a pilot line for trial production during the reporting year.

Flectrode’s new transparent conductive film (TCF) technology has been found to be more effective than the current TCFs used in displays. It is cheaper to produce and has 100 times better conductivity than the existing technology. The new TCF also can improve the photovoltaic efficiency in solar cells, so more electricity is produced from light, including artificial light.

As a result of the factory setup, the company has been singled out as one of the major technology companies in Xiamen and it is currently developing touch screen prototypes for major display manufacturers in mainland China.

4. Undergraduate Research

59. The seventh round of the Undergraduate Research Fellowship Programme (URFP) was undertaken in the reporting year. The URFP was introduced by HKU in 2011 with the aims of enhancing the learning experience of undergraduate students and nurturing the next generation of researchers/scholars through providing opportunities for students to undertake research study under the guidance and supervision of academics with a strong research track record and experience in training RPg students. In the first 6 rounds, over 400 academically outstanding undergraduate students enrolled in the programme, over 200 of whom were granted awards to undertake internships locally, in the Mainland or overseas. In March 2018, 83 students from 9 Faculties were selected in the seventh round for enrolment, of which 34 were granted awards to undertake internships. These students are expected to complete their research study within the 2018–19 academic year. To provide more research learning opportunities to students, the University has partnered with the University of Warwick to allow undergraduate students participating in HKU's URFP and Warwick's Undergraduate Research Support Scheme to carry out a non-credit bearing summer research project under the guidance of an allocated supervisor at the other university; in 2018, an HKU student in biological sciences visited Warwick, and 3 Warwick students from chemistry, law and life sciences visited HKU.

60. The annual URFP poster session was held in April 2018 for recipients of the research internship awards from different Faculties to present their research findings and share their experience, as well as to promote the URFP to undergraduates and the wider community at HKU. The event, which ran for a week, opened with a welcoming session hosted by the Vice-President (Teaching and Learning) and was attended by students, academics and senior management.

5. Research Highlights

61. Research highlights for HKU in 2017–18 include the following:

Theme-based Research Scheme (TRS)

62. The Theme-based Research Scheme (TRS) was introduced to support themes of strategic importance to the long-term development of Hong Kong. In the eighth round of the scheme – the results of which were announced in July 2018 – one HKU-led project received a total budget valued at HK\$47.13 million (including on-costs) for a period of 5 years. The Project Coordinator is Professor Z. Chen of the AIDS Institute in the Department of Microbiology. The project represents a collaborative effort by researchers from local and overseas institutions and aims to develop a combination immunotherapy of potentiating host immunity to achieve a functional cure for HIV/AIDS patients. HKU is also collaborating in all 4 other projects funded in this round.

63. In the 8 rounds of TRS, the RGC has awarded funding to a total of 40 projects. HKU is the co-ordinating institution of 17 awarded projects, which have received total funding of HK\$771 million, with HKU researchers also involved in a further 19 projects.

Areas of Excellence (AoE)

64. To nurture areas of international excellence through high-quality research and inter-institutional collaboration, the Areas of Excellence (AoE) scheme has provided

support for 21 projects over 7 funding rounds since its inception. HKU is the co-ordinating institution of 9 of these 21 AoE projects, representing total funding of HK\$689 million. The University is also participating in a further 8 co-ordinated by other institutions. In the most recently awarded AoE round (7th round, awarded in December 2016), HKU secured a project as coordinating institution.

2018–19 General Research Fund / Early Career Scheme (GRF/ECS) Exercise

65. HKU was awarded total funding of HK\$142.21 million (excluding on-costs) for 220 projects in the 2018–19 General Research Fund (GRF) exercise, with over a fifth (22.2%) of the supported projects being those of HKU Principal Investigators. HKU submitted 646 applications in this round, giving a success rate of 34%. The University received the largest amount of funds for projects under the Biology and Medicine Panel and the Humanities and Social Sciences Panel. HKU has secured the largest number of projects and share of funding in 15 of the last 16 GRF rounds, including in the 2018–19 round, which also saw an increase compared with last year in projects and funding awarded to HKU (up from 198 projects and HK\$138.16 in funding in 2017–18).

66. In the 2018–19 funding round of the Early Career Scheme, RGC supported a total of 153 projects. HKU submitted 62 applications, of which 25 were approved, securing HK\$12.581 million in funding (excluding on-costs).

2017–18 Collaborative Research Fund (CRF) Exercise

67. Of the 18 projects funded in the 2017–18 round of RGC’s Collaborative Research Fund, HKU is the coordinating university of 4 Group Research Grants. The University is participating in a further 8 projects (Group Research and Equipment) as a collaborating institution. The awarded amount to HKU is HK\$25.7 million (excluding on-costs). The 4 projects with HKU as lead institution are as follows:

- (a) “A Study of Self-Restraining Mechanisms of DNA Damage Surveillance and Repair”, HK\$6.27 million, Project Coordinator: Dr M.S.Y. Huen (School of Biomedical Sciences), in collaboration with CityU and HKUST;
- (b) “Two-Dimensional Transition-Metal Dichalcogenides and Beyond – From Materials, Physics to Devices”, HK\$6.29 million, Project Coordinator: Professor M.H. Xie (Department of Physics), in collaboration with PolyU and HKUST;
- (c) “Conversion of White into Brown Adipocytes as a Therapeutic Strategy for Obesity-Related Metabolic and Vascular Complications”, HK\$7.44 million, Project Coordinator: Professor A. Xu (Department of Medicine), in collaboration with CUHK and PolyU; and
- (d) “Energy-Efficient and Environmentally-Friendly Smart Seawater Desalination System”, HK\$5.73 million, Project Coordinator: Dr C. Tang (Department of Civil Engineering), in collaboration with CUHK and HKUST.

68. Over the past 10 years, HKU has received the largest share (29%) amongst institutions of projects (45) and funding (HK\$263.86 million) through the CRF.

Humanities and Social Sciences Prestigious Fellowship Scheme (HSSPFS)

69. In the 2018–19 funding round of the HSSPFS, of the 7 applications funded HKU received the largest share (as with last year), with 3 successful projects awarded a total of HK\$1.09 million (excluding on-costs):

- (a) “Bioprospecting Asia: Laurent Garcin (c. 1681-1751) and the Circulation of Natural Knowledge”, Professor G.A. Cook (School of Humanities);
- (b) “Daoist Ritual, Local Society and the State: Ethnography, Text and Theory”, Dr D.A. Palmer (Department of Sociology); and
- (c) “Money, Culture and Social Ascendancy: Learned Women in Mercantile Lineages from Huizhou, 1700-1850”, Dr B. Yang (School of Chinese).

70. Since the scheme began in 2012–13, HKU has the highest cumulative number of fellowships and largest funding amount of any UGC-funded institution: 16 fellowships (total value HK\$10.16 million) out of a total of 41 awarded (total value HK\$27.71 million).

NSFC/RGC Joint Research Scheme

71. Through the National Natural Science Foundation of China/Research Grants Council (NSFC/RGC) Joint Research Scheme in 2017–18, funding of HK\$25.48 million was awarded to 21 projects from 5 UGC-funded institutions. HKU submitted 34 initial applications, of which 6 were shortlisted and 2 funded. HKU received total funding of HK\$2.5 million for the following projects:

- (a) “Construction of a Long Cycle-life Na-O₂ Battery and Study of Its Reaction Mechanism”, Professor G.K.Y. Chan (Department of Chemistry); and
- (b) “Microscopic Studies of Polymorphic Structured Transition-metal Dichalcogenide Epifilms: Defects, Domain Boundaries and Interlayer Coupling”, Professor M.H. Xie (Department of Physics).

National Natural Science Fund—National Natural Science Foundation of China (NSFC)

72. HKU-SIRI and HKU-ZIRI members are eligible to apply for funding through the NSFC. HKU-SIRI received total funding of RMB14.465 million for 23 projects and HKU-ZIRI received total funding of RMB1.45 million for 3 research projects under the NSFC in 2017–18.

European Commission (EC)/Research Grants Council (RGC) Collaboration Scheme

73. The EC/RGC Collaboration Scheme was launched in 2016–17 by the EC and RGC to foster European–Hong Kong collaboration in academic research and support the participation of Hong Kong researchers in joint research projects conducted under the framework of Horizon 2020. Applications are invited twice per year, and a total of HK\$9.995 million was awarded to 6 projects from 4 UGC-funded institutions in 2017–18. HKU received the largest share, with 2 successful projects awarded a total of HK\$3.531 million (excluding on-costs):

- (a) “Highly-sensitive Multimodal Optical Microscopy and Spectroscopy by Wavelength-Idler-signal-Enhancement (WISE)”, Professor K.K.Y. Wong (Department of Electrical and Electronic Engineering); and
- (b) “Understanding Extreme Heat Events in and around a Dense High-rise City”, Professor Y. Li (Department of Mechanical Engineering).

Innovation Technology Support Programme (ITSP)

74. Up to the end of June 2018, HKU has had 212 projects approved under the

Innovation and Technology Fund's (ITSP), which was introduced in 1999. This represents 17% of the 1,230 projects approved under ITSP, and HKU has received total funding of HK\$537.09 through this scheme.

75. In the reporting year, 14 HKU projects were awarded total funding of HK\$38.42 million (up from 11 projects and HK\$14.05 in 2016–17). A further 4 projects were funded HK\$8.93 million under the University-Industry Collaboration Programme, and 3 projects were funded HK\$17.79 million under the Midstream Research Programme for Universities.

Built Heritage Conservation Fund (BHCF)

76. The Built Heritage Conservation Fund (BHCF), established in 2017, allows each institution to submit up to 2 nominations. HKU had 2 projects approved in this first round, with total funding of HK\$3.86 million:

- (a) "Divine Powers: Historic Ecclesiastic Buildings in Central, Hong Kong", Professor K.W. Chau (Department of Real Estate and Construction); and
- (b) "Harmonious Integration: The Community with Pok Fu Lam Village, Dairy Farm Company and Society of Foreign Missions of Paris in Pok Fu Lam", Dr H.Y. Lee (Department of Real Estate and Construction).

Public Policy Research Funding Scheme

77. The Central Policy Unit has been re-organised into the Policy Innovation and Co-ordination Office (PICO) with effect from April 1, 2018. In 2017–18, the University was awarded total funding of HK\$1.773 million for 4 projects under the Public Policy Research funding scheme:

- (a) "Exploring the Motivations, Incentive Designs, and Performance of Open Innovation in Hong Kong", Dr H.K. Liu (Department of Politics and Public Administration);
- (b) "Associations between Emerging Political Ideology, Political Participation and Social Media Use: Making Sense of the Connections between 'Localism', 'Populism', and Post-materialism in Hong Kong", Dr K.W. Fu (Journalism and Media Studies Centre);
- (c) "Opening Doors, Creating Pathways – A Qualitative Study of Social Harms and Service Access of Young People from Ethnic Minority Backgrounds in Hong Kong", Professor K.A. Laidler (Centre for Criminology); and
- (d) "Financial Inclusion and Bank Account Opening: Deploying Financial Technology and Regulatory Technology for Improving Banking Services Accessibility Inside Hong Kong's Anti-Money Laundering Law", Dr E.H. Lee (Department of Law).

Strategic Public Policy Research Funding Scheme

78. Out of the 3 projects supported by PICO in the Strategic Public Policy Research (SPPR) Funding Scheme 2017–18, 2 are led by HKU researchers, receiving a total of HK\$7 million:

- (a) "Antimicrobial Resistance Policy Framework in Big Bay Area (Guangdong – Hong Kong – Macao)", Professor K. Fukuda (School of Public Health); and

- (b) “In Search of New Economic Cooperation Models between Hong Kong and the Big Bay Area”, Professor A.G.O. Yeh (Department of Urban Planning and Design).

Croucher Foundation: Fellowships and Innovation Awards

79. HKU has been awarded more Croucher Foundation Senior Research Fellowships (54 out of a total of 115 fellowships awarded since 1997, including Senior Medical Research Fellowships) than any other local institution. In the reporting year, 2 of the 3 fellowships awarded by Croucher were to HKU scholars: Professor G. Chiribella (Department of Computer Science) and Dr X.C. Li (Department of Chemistry) were awarded Senior Research Fellowships (see paragraph 94(c)).

80. The Croucher Foundation also offers substantial support through the Innovation Awards to a small number of exceptionally talented scientists at a formative stage in their careers, in order to enable them to pursue their own scientific, intellectual and professional inclinations. Of the 15 awards given since the inception of the Innovation Awards in 2012, 7 have been awarded to HKU researchers.

Other Croucher Foundation Funding

81. Support for doctoral and postdoctoral research is also provided by the Foundation through studentships and fellowships. For example, in the reporting year, Miss Y.L.B. Cheng (a PhD student in the Department of Medicine) received a Butterfield-Croucher Studentship to support her research at HKU, and Dr X. Lu (a PhD graduate of the Department of Mechanical Engineering) received a Croucher Fellowship for Postdoctoral Research at Yale University.

82. The Foundation offers a start-up allowance for recipients of the Croucher Fellowship for Postdoctoral Research upon their return to Hong Kong to take up tenure-track faculty positions in UGC-funded institutions. Dr Y.W. Sin (School of Biomedical Sciences) and Dr C.M.E. Tse (Department of Chemistry) were each awarded HK\$0.5 million to be used over 5 years for their research.

83. To enable experts in a particular field to meet and conduct advanced tuition on a defined topic, the Croucher Foundation sponsors a number of Advanced Study Institutes (ASIs) each year. An ASI on genetic variation and genome architecture was held in May 2018.

84. The Croucher Foundation also provides funding for summer courses to help educate and inspire promising postgraduate students and early career researchers from Hong Kong and the wider region. Successful applicants receive HK\$0.6 million per course for 3 courses to be held once every 2 years over a period of 6 years. HKU held 5 summer courses in July and August 2018 on vaccinology, viral infections, immunology, precision genome engineering and performance aware programming.

85. Sponsorship is also provided through the Croucher Foundation for international conferences and seminars. During the reporting period, HKU researchers organised 3 conferences in the areas of coordination chemistry, VIP, PACAP and related peptides, and smart transportation, each with funding of \$100,000. Funding of \$200,000 was also provided by the Foundation to support a conference on molecular medicine held in March 2018. For conferences in the coming year, the Foundation approved in May 2018 sponsorship of

\$100,000 each for 2 conferences on electronic materials and marine pollution, and \$500,000 for a conference on research integrity (more information on the latter in paragraph 15).

Hong Kong Jockey Club

86. The University received significant and generous donations and funding for research projects from the Hong Kong Jockey Club (HKJC). Examples during the reporting year include a 4-year project led by Professor T.H. Lam (School of Public Health) and Professor Y.K. Kwok (Department of Electrical and Electronic Engineering) on “Advancing Information and Communications Technology in Family Services”; and a 3-year project led by Dr P.W.C. Wong (Department of Social Work and Social Administration) on the “JC A-Connect: Jockey Club Autism Support Network (Phase II)”.

HK Scholars Program

87. The HK Scholars Program is a cross-border initiative (introduced by the Society of Hong Kong Scholars and the Office of the National Administrative Committee of Postdoctoral Researchers under the Ministry of Human Resources and Social Security) that aims to nurture outstanding postdoctoral fellows (PDFs) from the Mainland in Hong Kong. In the 2018 exercise year of this initiative, 8 HKU researchers from the Faculties of Engineering (4), Medicine (3) and Science (1) were granted with support for PDFs for a period of 2 years.

Overseas Funding Sources

88. Funding also comes from a wide range of overseas funding bodies in Asia, Australia and New Zealand, Europe and North America. Examples include the National Institutes of Health (NIH), the European Commission, and the Australian Research Council. For example, HKU academics from the School of Public Health are engaged in an ongoing collaboration with the St. Jude Children’s Research Hospital for the NIAID Centers of Excellence for Influenza Research and Surveillance funded by NIH. In 2017, HKU received funding from the John Templeton Foundation to carry out 2 projects by researchers in the Department of Computer Science and the Department of Psychology. Funding has also been awarded from the Henry Luce Foundation for “China Made: Asian Infrastructures and the ‘China Model’ of Development”, a collaborative three-year project between the University’s Hong Kong Institute for the Humanities and Social Sciences and the University of Colorado Boulder’s Center for Asian Studies.

Published Research

89. The University recorded the highest number of refereed publications, both in absolute and per capita (publications per staff member) terms, of any UGC-funded institution (CDCF data mart website – most recent data is for 2016–17). For 2017–18, HKU had 5,146 peer-reviewed refereed publications or 3.2 per member of staff. The University has done particularly well in scientific publications. There were a total of 538,317 citations to 32,615 HKU papers in journals tracked by Clarivate Analytics in Essential Science Indicators between January 2008 and April 2018. This was the highest number of citations of any UGC-funded institution. In 2017, the University had 5,445 publications in journals tracked by Clarivate Analytics, again more than any other UGC-funded institution, attracting 19,156 citations to date (data collected from Web of Science on November 5, 2018). Clarivate

Analytics also ranked 114 HKU professoriate staff among the world's top 1% of scientists, based on the number of citations recorded for their publications (July 2018). In addition, 15 HKU academics have been named among the world's top scientists in the 2018 Highly Cited Researchers from Clarivate Analytics, based on the number of papers officially designated by Essential Science Indicators as Highly Cited Papers (November 2018) – detailed below in paragraph 94(n).

Prestigious Publications

90. HKU has an excellent record of published research, both in discipline-specific journals and in more high-profile publications such as *Science*, *Nature*, and *The Lancet*. Examples from 2017–18 include the following journal publications:

- (a) Sarkar C., Webster C. and Gallacher J., “Association between adiposity outcomes and residential density: A full-data, cross-sectional analysis of 419 562 UK Biobank adult participants”, *The Lancet Planetary Health*, 2017, 1 (7), e277–e288.
- (b) He B.B., Hu B., Yen H.W., Cheng G.J., Wang Z.K., Luo H.W. and Huang M.X., “High dislocation density–induced large ductility in deformed and partitioned steels”, *Science*, 2017, 357 (6355), 1029-1032.
- (c) Michalski J.R., Onstott T.C., Mojzsis S.J., Mustard J., Chan Q.H.S., Niles P.B. and Johnson S.S. “The Martian subsurface as a potential window into the origin of life”, *Nature Geoscience*, 2018, 11 (1), 21-26.
- (d) Lai H.M., Liu A.K.L., Ng H.H.M., Goldfinger M.H., Chau T.W., DeFelice J., Tilley B.S., Wong W.M., Wu W. and Gentleman S.M., “Next generation histology methods for three-dimensional imaging of fresh and archival human brain tissues”, *Nature Communications*, 2018, 9 (1), article no: 1066.
- (e) Hui C.L.M., Honer W.G., Lee E.H.M, Chang W.C., Chan S.K.W, Chen E.S.M., Pang E.P.F, Lui S.S.Y., Chung D.W.S, Yeung W.S., Ng R.M.K, Lo W.T.L., Jones P.B., Sham P. and Chen E.Y.H., “Long-term effects of discontinuation from antipsychotic maintenance following first-episode schizophrenia and related disorders: A 10 year follow-up of a randomised, double-blind trial”, *Lancet Psychiatry*, 2018, 5 (5), 432-442 .
- (f) Li X., Li X.M, Jiang Y., Liu Z., Cui Y., Fung K.Y., van der Beelen S.H.E., Tian G., Wan L., Shi X., Allis C.D., Li H., Li Y. and Li X.D., “Structure-guided development of YEATS domain inhibitors by targeting π - π - π stacking”, *Nature Chemical Biology*, 2018, 14, 1140-1149.

91. The University's researchers are also publishing their work through renowned international publishers, with recent examples of books including

- (a) Chua D.K.L., *Beethoven and Freedom*, 2017, Oxford, UK: Oxford University Press.
- (b) Qiao S., *Chinese Small Property: The Co-Evolution of Law and Social Norms*, 2017, Cambridge, UK: Cambridge University Press.
- (c) Palmer D. and Seigler E., *Global Daoism and the Predicament of Modern Spirituality*, 2017, Chicago, IL: University of Chicago Press.

Patents

92. In 2017–18, HKU filed 134 patent applications, and 72 patents were granted (up from the 64 granted in 2016–17) and 12 patent applications were abandoned. HKU has filed 1,993 patents since 1998 in various parts of the world, mostly in the United States (863), the European Union (262) and Greater China (347 in China, including Hong Kong, and 28 in Taiwan). Within the same period, 707 patents were granted, 35% of which were in the United States (248).

Agreements/Legal Documents

93. The University handled 760 technology/knowledge transfer related agreements/legal documents in 2017–18 – such as licensing, consultancy and materials transfer agreements – with counter signing parties in Hong Kong (295), the People’s Republic of China (219), North America (120), the European Union (59) and the rest of the world (67).

External Academic Honours

94. The University is proud of its record of academic recognition. A number of important academic awards and honours have been bestowed on HKU researchers in 2017–18, including the following examples:

- (a) Professor C.M. Che – Zhou Guangzhao Professor in Natural Sciences, Dr Hui Wai Haan Chair of Chemistry, and Chair Professor of Chemistry – was selected as the first-ever recipient of the Ryoji Noyori ACES Award, recognising his distinguished research achievements in bioinorganic chemistry, catalysis and luminescent materials. This biannual award is given by the partners of the Asian Chemical Editorial Society (ACES) to honour Professor Noyori and his instrumental role in nurturing the collaborative ACES spirit. The award recognises outstanding scientists who have made exceptional contributions to the development of chemistry in general, as well as to the ACES journals in particular. Professor Che was presented his award at the 2017 ACES & GDCh Symposium, where he also gave a talk.
- (b) Professor K.M.Y. Leung of the Swire Institute of Marine Science and School of Biological Sciences was conferred as a Fellow of the Society of Environmental Toxicology and Chemistry (SETAC), which currently has about 6,500 professional members from over 100 countries. The conferment of SETAC Fellow status aims to recognise excellence and contributions of SETAC members to ecotoxicology, environmental chemistry, risk assessment and/or life cycle assessment. No more than 2% of the memberships of SETAC hold this prestigious recognition, with only 57 SETAC Fellows to date around the world.
- (c) Two distinguished HKU scholars – Professor G. Chiribella (Associate Professor, Department of Computer Science) and Dr X.C. Li (Associate Professor, Department of Chemistry) – were among the three recipients of the Croucher Senior Research Fellowships for 2018–19. Professor Chiribella is a leading expert of quantum information science and of the foundations of quantum mechanics. He investigates how the counterintuitive laws of the quantum world can be turned into working principles for future information technologies. With the Croucher Senior

Research Fellowship he will explore a new paradigm of communication, in which multiple transmission lines are combined in a quantum superposition. Dr Li and his team have been pioneering globally both in the new Ser/Thr ligation technology they developed and in chemical synthesis of antibiotics analogues for the development of new generation antibiotics to address the ever-increasing antimicrobial resistance that has become a serious threat to human health. The team developed the first chemical synthesis of an antibiotic drug – daptomycin – in 2013, and completed the chemical synthesis of teixobactin in 2016.

- (d) Professor N. Mok, Edmund and Peggy Tse Professor in Mathematics and Chair of Mathematics, was elected a member of the Academy of Sciences of Hong Kong. He is the first and only member elected since the Academy's inauguration in 2015. The election was held at the Academy's annual general meeting in December 2017. Professor Mok is a renowned mathematician specialising in several complex variables, complex differential geometry and algebraic geometry. He is well-known in the mathematical community for his global perspective in pure mathematics and for having solved a series of important conjectures and problems using a combination of analytic, algebraic and geometric methods.
- (e) Professor G. Zhao, Professor in the Department of Earth Sciences, was awarded the 2018 The World Academy of Science (TWAS) Prize in Earth, Astronomy and Space Sciences for his contributions to our understanding of continental collisional tectonics in Earth's early history and the assembly of the supercontinent Columbia (Nuna) ~1.8 billion years ago. Professor Zhao is the first Hong Kong scholar to be chosen for this award in Earth, Astronomy and Space Sciences. Professor Zhao's main research fields are metamorphic petrology, Precambrian geology and supercontinents.
- (f) Dr S.K.Y Ma, Assistant Professor in the School of Biomedical Sciences, was awarded the Rising Star Award of the Ton Duc Thang University (TDTU) Scientific Prize, in recognition of her outstanding contributions to cancer research. It was presented at an award ceremony in January 2018. The prize was initiated by TDTU in 2016 and the first prize was awarded for 2017. It aims to recognise and honour the world's eminent scientists for their outstanding achievements and research, for contributing actively in the development of science and technology for humankind, and for their volunteer activities to serve people and society all over the world.
- (g) An MRI-guided surgical robot project by an HKU engineering team won the Best Conference Paper Award in the IEEE International Conference on Robotics and Automation 2018. The team, led by Dr K.W. Kwok of the Department of Mechanical Engineering, has developed a robot capable of performing stereotactic neurosurgeries inside the MRI scanner. One of the surgical procedures is deep brain stimulation, an effective treatment for many movement disorders, e.g. Parkinson's disease and essential tremor. The team co-authored with surgeons from The Chinese University of Hong Kong.
- (h) Professor E.X. Wu, Chair Professor of Biomedical Engineering and Lam Woo Endowed Professor in Biomedical Engineering, was awarded the Twelfth Guanghua Engineering Science and Technology Prize by the Chinese Academy of Engineering. The prize, awarded biennially, is considered the highest national honour in the field of engineering and

technology. It aims to recognise outstanding Chinese engineers and scientists who have made outstanding achievements and significant contributions to the field of engineering technology and engineering management. The award presentation in 2018 was held in Beijing.

- (i) An HKU team led by Professor V.O.K. Li – Chair of Information Engineering and Cheng Yu Tung Professor in Sustainable Development in the Department of Electrical and Electronic Engineering – won the prestigious international award “The Facebook Low Resource Neural Machine Translation Award”. The selection panel said this proposal was chosen because of its innovativeness, potential for impact and overall quality. This award is open to all universities, and only four awards have been granted worldwide. As one of the four global winners, the HKU team will be invited to present their work at the Facebook Headquarters in early 2019, and they will take this opportunity to showcase their research strengths in Natural Language Processing (NLP). Other team members include J. Gu and Y. Chen (both PhD students supervised by Professor Li on AI-driven NLP) and Dr L. Cheung, Associate Professor in Linguistics at The Chinese University of Hong Kong.
- (j) Professor G.M. Leung, Dean of Medicine, inaugural Helen and Francis Zimmern Professor in Population Health and Chair Professor of Public Health Medicine, has been elected a Member of the US National Academy of Medicine. He was elected for “leadership in global health and medical education, and contributions to infectious disease epidemiology and control”. Election is considered one of the highest honours in the fields of health and medicine and recognises individuals who have demonstrated outstanding professional achievement and commitment to service.
- (k) Professor X. Zhang – HKU President and Vice-Chancellor – was awarded the 2017 A.C. Eringen Medal from the Society of Engineering Science (SES) in recognition of his contribution in micro-nano scale engineering for microelectronics and photonics. The Eringen Medal is the highest award from SES, and it is awarded annually to an individual in recognition of sustained outstanding achievements in Engineering Science. Former awardees include five Nobel Laureates.
- (l) HKU teams won two top prizes at the 18th Asia Pacific Information and Communication Technology Alliance Awards held in Guangzhou. Fano Labs, an HKU artificial intelligence (AI) spin-off company specialising in speech and natural language processing (NLP) technologies, won the top award in the “Business Services - ICT Solutions” category. Tale, a three-student team project on an AI-enabled solution for the coaching of presentation skills, won the top award in the “Student – Tertiary Students Project” category. The Awards are dubbed as the Oscars of the ICT arena in the Asia Pacific region.
- (m) Two HKU academics have been named among the 10 “Science Stars of East Asia” by leading medical journal *Nature*: Professor J.S.M. Peiris, Tam Wah-Ching Professor of Medical Science and Chair Professor of Virology of the School of Public Health, and Professor V.W.W. Yam, Chair Professor and Philip Wong Wilson Wong Professor in Chemistry and Energy. The list featured outstanding scientists from Hong Kong, Malaysia, Singapore, South Korea and Taiwan.

- (n) 15 HKU academics have been named among the world's top scientists whose work has been highly cited by fellow academics and are hence making a significant impact in ongoing research in their respective fields of study. The HKU academics featured in Highly Cited Researchers from Clarivate Analytics – an annual list recognising leading researchers in the sciences and social sciences from around the world – in 2018 are Professor W.C.H. Choy (Department of Electrical and Electronic Engineering); Professor Y. Guan, Professor J.S.M. Peiris and Professor L.L.M. Poon (School of Public Health); Professor J. Lam and Professor D.Y.C. Leung (Department of Mechanical Engineering); Professor N.P. Shah (School of Biological Sciences); Professor M. Sun and Professor G. Zhao (Department of Earth Sciences); Professor W. Yao (Department of Physics); Professor K.Y. Yuen (Department of Microbiology); Professor T. Zhang (Department of Civil Engineering); Professor X. Zhang (President's Office/Faculty of Engineering); and Professor K.Z. Zhou (Faculty of Business and Economics).
- (o) Two of the eight awards in the Fulbright-RGC Hong Kong Research Scholar Award Programme 2018–19 went to HKU RPs, who received total funding of HK\$150,000. K.M. Leung (of the Department of Real Estate and Construction) is studying the safety of sub-divided units, while the research of H. Liu (of the Department of Social Work and Social Administration) is on how social engagement affects the psychological and physical health of the elderly. The programme enables PhD candidates to conduct research in elite institutions in the US. Over the past 5 years, HKU RPs have received 16 of the 38 awards, with HK\$1.57 million of the HK\$3.7 million funding, more than any other local institution.
- (p) In 2018, HKU again won the Outstanding Organisation Award in the 'Challenge Cup' National Competition Hong Kong Regional Final – Hong Kong University Student Innovation and Entrepreneurship Competition. HKU RPs students received three Second Prizes (for "Targeting ovarian cancer stemness and metastasis with dendrimer nanovector-mediated siRNA delivery", "Anti-interference technology: On-demand and tunable band-rejected UWB antenna based on peelable resonator membrane", and "Digital electro-microfluidics platform for manipulating liquid marbles and its applications") and two Third prizes under the 'Innovation' category (for "Neuroplasticity of visual perception in balance control of spinal cord dysfunction patients" and "A low-cost portable cotton-based aluminium-air battery with high energy density"), and one Merit prize in the 'Entrepreneurship' category (for "Project ADEN" on the development of affordable, automated and diversified encapsulation machines).
- (q) Two HKU PhD candidates won awards at the Hong Kong Institution of Science (HKIS) Annual Conference held in 2017. Daniel Ebler (Department of Computer Science) won the HKIS-Towngas 2017 Young Scientist Award in the field of Physical/Mathematical Science, while Wallis Cheuk Yin Lau (Department of Pharmacology and Pharmacy) received an Honourable Mention in the field of Life Science.
- (r) Year 6 medical student H.M. Lai, from the Li Ka Shing Faculty of Medicine, won the 11th China Adolescents Science and Technology Contest with his breakthrough in the visualisation of human brain tissue at the microscopic level. He is one of the 100 young researchers in China to win

the award in this round, and Hong Kong's only winner. Under the supervision of Honorary Professor W. Wu from the School of Biomedical Sciences, Mr Lai and a team of scientists from Imperial College London developed a new tissue clearing solution OPTIClear that can turn specimen human brain tissue transparent, enabling high-resolution and deep imaging of neuronal circuitries without the need of sectioning the tissues. This study has won Mr Lai two awards and has been published in various academic journals, including *Nature Communications*.

- (s) Two teams from HKU's Faculty of Engineering won top prizes at the "2018 China Collegiate Computing Contest – 3rd Mobile Application Innovation Contest" contest co-organised by Apple Inc. and Zhejiang University. The event attracted over 820 teams from colleges and universities in the Mainland, Taiwan, Hong Kong and Macau, with 591 submissions received. BEng (Computer Engineering) students Lam Wun Yin Will, Kwok Ching Fung Daniel and Teoh Jian Ning Alex won a First Class Award with their motion activated iOS app "Air Guitar". BEng (Computer Engineering) students Wong Chi Ping Desmond and Wong Kwong Yat Felix and BEng (Computer Science) student Yeung Tsz Lok Enoch won a Second Class Award with their design "Luminosite". They are the first two teams from Hong Kong to win prizes at the competition.

Outstanding Researcher Award Scheme

95. HKU's annual Outstanding Researcher Award Scheme recognises the excellent work of the University's researchers. At a ceremony on March 26, 2018, the following awards, for research achievements during and prior to the report period, were presented:

- (a) *Outstanding Researcher Award*
 Professor B.J. Cowling, School of Public Health
 Professor X. Cui, Department of Physics
 Professor L.M.L. Poon, School of Public Health
 Professor B. Young, Department of Civil Engineering
- (b) *Outstanding Young Researcher Award*
 Dr W.K.W. Seto, Department of Medicine
 Dr H.C. Shum, Department of Mechanical Engineering
 Dr J. Tang, Department of Chemistry
 Dr C.C.L. Wong, Department of Pathology
 Dr S. Zhang, Department of Physics
- (c) *Outstanding Research Student Supervisor Award*
 Dr J.A. Tanner, School of Biomedical Sciences
 Professor T. Zhang, Department of Civil Engineering

96. The Faculty-level Research Output Prize, part of the Outstanding Researcher Award Scheme since 2006, rewards the author (or team of authors) for a single outstanding item of research output (such as a publication, artistic production or patent). An output item is selected by each Faculty annually for the prize, and Faculties can determine the research output form that best represents their research achievement. The following 10 Research Output Prizes were awarded in the reporting year:

Faculty of Architecture: "Remotely-sensed imagery vs. eye-level photography: Evaluating associations among measurements of tree cover density", *Landscape and Urban Planning*, (2017), 157, 270–281, (published online on July 27, 2016), by Bin Jiang, Brian Deal, HaoZhi Pan, Linda Larsen, Chung-Heng Hsieh, Chun-

Yen Chang, William C. Sullivan.

Faculty of Arts: *Situated Listening: The Sound of Absorption in Classical Cinema*, (2016), Oxford University Press, 264pp. by Giorgio Biancorosso.

Faculty of Business and Economics: “Endogenous entry to security-bid auctions”, *American Economic Review*, (2016), 106(11), 3577–3589, by Takeharu Sogo, Dan Bernhardt, Tingjun Liu.

Faculty of Dentistry: “The nanotipped hairs of gecko skin and biotemplated replicas impair and/or kill pathogenic bacteria with high efficiency”, *Nanoscale*, (2016), 8, 18860–18869, by Xin Li, Gary Cheung Shun Pan, Gregory Shaun Watson, Jolenta Anna Watson, Shi Lin, Lin Schwarzkopf, David William Green.

Faculty of Education: “Tone matters for Cantonese–English bilingual children’s English word reading development: A unified model of phonological transfer”, *Memory and Cognition*, (2017), 45(2), 320–333 (published online on October 13, 2016), by Xiuli Tong, Xinjie He, S. Hélène Deacon.

Faculty of Engineering: “Fabrication of fibrillosomes from droplets stabilized by protein nanofibrils at all-aqueous interfaces”, *Nature Communications*, (2016), 7, 12934, by Yang Song, Ulyana Shimanovich, Thomas C.T. Michaels, Qingming Ma, Jingmei Li, Tuomas P.J. Knowles, Ho Cheung Shum.

Faculty of Law: *Masculinity and the Trials of Modern Fiction*, (2016), Routledge, 177pp., by Marco Wan.

Li Ka Shing Faculty of Medicine: “Fractional dosing of yellow fever vaccine to extend supply: A modelling study”, *The Lancet*, December 2016, Vol. 388, No. 10062, pp. 2904 – 2911 by Joseph T Wu, Corey M Peak, Gabriel M Leung, Marc Lipsitch.

Faculty of Science: “Probiotics modulated gut microbiota suppresses hepatocellular carcinoma growth in mice”, *Proceedings of the National Academy of Sciences*, (2016), 113(9), E1306–E1315, by Jun Li, Cecilia Ying Ju Sung, Nikki Lee, Yueqiong Ni, Jussi Pihlajamäki, Gianni Panagiotou, Hani El-Nezami.

Faculty of Social Sciences: “Weapons of the powerful: Authoritarian elite competition and politicized anticorruption in China”, *Comparative Political Studies*, (2017), 50(9), 1186–1220 (published online on October 10, 2016), by Jiangnan Zhu, Dong Zhang.

Major International Research Events

97. A range of important international research conferences were organised by HKU in the 2017–18 reporting period, including the following:

- (a) October 19, 2017 – the first international lighthouse symposium, titled “Saving Our Maritime Icons – A Regional Overview of Historic Lighthouses”, was held by the Department of Real Estate and Construction, presenting an overview of the history of modern lighthouses development in the region in the 19th and early 20th century. The symposium sought to re-enliven the region’s historic lighthouses, reconnect the historic Maritime Silk Route and reinforce the regional relationships among port cities. Eminent speakers and scholars who have been engaged in the management and conservation of historic lighthouses were invited from Hong Kong, Guangzhou, Macao, Taiwan, Singapore and the UK.
- (b) October 25–26, 2017 – HKU and the University of Zurich jointly held a series of events including a public forum on “Working together towards the WHO

Decade of Healthy Ageing 2020–2030”, which highlighted the opportunities open to the two universities of combining high-level expertise on big health data with state-of-the-art conceptual frameworks, helping to determine how our environments can be designed to maximize opportunities for healthy ageing in both regions and worldwide. Two workshops jointly organised by the Center for Information Technology, Society, and Law of the University of Zurich and the Asian Institute of International Financial Law and the Law and Technology Centre of HKU were held on FinTech and data ownership and the future of privacy.

- (c) January 10–12, 2018 – the International Mental Health Conference: Recovery-oriented Services and Policy Framework in Mental Health (RSP 4.0) was held at HKU in 2018. Renowned scholars on mental health, including Professor Larry Davidson, and Professor Mike Slades, spoke at the conference. The programme included free public seminars and practice-oriented master classes, as well as a two-day conference with keynote speeches, plenary presentations, panel discussions, concurrent sessions, poster presentations and interactive workshops.
- (d) March 11–13, 2018 – the Association of Pacific Rim Universities Provosts’ Forum 2018 was held at HKU, and included many useful discussions on research matters and provided opportunities for academic networking with fellow universities. The forum theme was “The Future of the University and the University of the Future”, and it addressed immediate and future challenges that face research universities, particularly with respect to changing student profiles; rapid, and often seismic developments in technology; and also the continuing demands placed on universities to better prepare graduates for employability.
- (e) March 29–April 1, 2018 – palaeontologists from seven countries gathered at HKU for the International Pennaraptoran Dinosaur Symposium to present the current state of knowledge on avian and flight origins. In the last 20 years, understanding of how dinosaurs took to the skies has expanded dramatically. The symposium aimed to push frontiers further through discussions with leading experts as well as early career researchers, including PhD students. The symposium provided an invaluable opportunity to make progress in several key areas and to set the agenda for future efforts.
- (f) April 12–14, 2018 – the 2018 Symposium of C9+1 Universities in China was held at HKU, and HK’s Chief Executive Mrs Carrie Lam Cheng Yuet-ngor and China’s Minister of Education Mr Chen Baosheng officiated at the event. The theme was “Innovation and Excellence in Teaching and Learning in Research Intensive Universities in China”. The Symposium demonstrates the strong relationship HKU has with nine key universities on the Mainland and provides an opportunity for the universities to encourage engagement with stakeholders at all levels, including senior management, teachers and students to discuss innovation and excellence in teaching and learning.
- (g) June 25–27, 2018 – HKU hosted the 2018 Annual Conference of the International Society of Public Law. The conference is a leading global forum for public law discourse, and it attracts hundreds of participants globally, including distinguished scholars, jurists and policy-makers, younger researchers and graduate students, in all areas of public law. This was the first time that the event has been held in Asia, and it marked the beginning of the celebration of the 50th anniversary of HKU’s Faculty of Law.

International Rankings

98. The University stands among the world's top universities, ranking 25th and 36th in 2019 by Quacquarelli Symonds (QS) and Times Higher Education (THE), respectively. In the QS Asia University Rankings 2019, HKU moved up to second place (after the National University of Singapore), making it the highest ranked institution in the Greater China region.

99. In the QS 2018 subject rankings, HKU was ranked in the top 50 worldwide for 32 subjects; 23 subjects ranked among the top 5 in Asia and 20 subjects were No. 1 in Hong Kong. For the third consecutive year, HKU's Faculty of Dentistry was ranked first in the scholastic ratings of dental schools around the world. In the THE World University Rankings by Subject 2019, HKU remains the only university in Asia to be ranked in the top 10 for Education (ranked 4 after Stanford, Harvard, and UC Berkeley).

100. In 2018, HKU was again ranked the third most international university in the world – and the highest in Asia – by THE, compiled using the international student score, international staff score, international co-authorship score and international reputation metrics collected for the THE World University Rankings 2018. In the 2018 THE World Reputation Rankings – based on an invitation-only survey of leading academics – HKU was placed 40th in the world.

6. Conclusions

101. HKU researchers have continued to demonstrate excellence in research and they are making their mark locally, regionally and globally. Guided by the [3+1] vision and purposeful strategies, the University aims to support their vital and cutting-edge work in an environment that promotes internationalisation, innovation and interdisciplinarity and a commitment to making a positive impact on technology and society.

102. Whilst the University is proud of its achievements to date, it remains committed to enhance and expand its research strengths and foster a robust culture for the creation, application and transfer of knowledge. The University has injected an extra sense of dynamism in developing an innovative culture in its research system.

103. The University's strategic intent is to build peaks of excellence, develop synergistic partnerships and deliver community value. An integrated set of mechanisms – including competitive and prestigious grants, diverse funding sources, international alliances, community projects, local and global internships, mainland collaboration, corporate partnerships, and strategic themes in key emerging areas – will enable HKU to form a competitive edge. Key goals in the University's research development include

- (a) To grow and sustain fundamental research at the level among the world's best and to incubate those that are of strategic importance to Hong Kong (such as Smart City, Biomedicine, FinTech, and Active Ageing),
- (b) To strengthen the translational capabilities of the research in HKU in areas of needs and opportunities, such as FinTech, HealthTech, Robotics and Big Data,
- (c) To develop HKU as a major hub in Asia for innovation and entrepreneurship, with the University's new Innovation and Entrepreneurship Hub, iDendron, serving as the key enabling platform for fostering holistic development,
- (d) To use the research platforms of HKU in the mainland, notably HKU-ZIRI in

Hangzhou as well as HKU-SIRI and HKU Shenzhen hospital in Shenzhen, to fully develop translational research and our innovation potential,

- (e) To provide global opportunities for all HKU graduate students through academic, research, industry and cultural immersion,
- (f) To enhance strategic collaboration with major universities, public bodies, private enterprises and research bodies (in Hong Kong, mainland China and the international community) to open new research fronts, co-develop deep capabilities and strive for sustainable impact, and
- (g) To develop distinctive and world-leading science and technology research clusters on campus with state-of-the-art central facilities with new physical provisions.