

Overview of Research Activities of The University of Hong Kong 2018–19

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) Raise competitiveness towards external funding and strategic partnership,
- (c) Foster outcome-based, cross-disciplinary, and inter-institutional collaboration,
- (d) Promote social and technological innovation, entrepreneurial incubation and public-private partnership, and drive innovation and entrepreneurship through research and talent development,
- (e) Foster research collaboration within HKU and with partners in Hong Kong, mainland China and the world, and
- (f) Build core capabilities for sustainable growth.

4. In early 2018, the University set out its Strategically Oriented Research Themes (SORTs) as a blueprint for excellence, impact, collaboration and leadership as we prepare for the next decade. During the reporting year, a new SORTs brochure has been published highlighting our new generation of academics whose works are inspirational and promising. (See paragraph 10 for more information.)

5. To support its 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 2018–19 around 39% of professoriate staff were from overseas, 23.5% from mainland China and the remaining 37.5% from Hong Kong. In the reporting year, a new Presidential Postdoctoral Fellowship was introduced with the aim of attracting outstanding early career researchers from around the world.

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. 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 early 2018, the University’s 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 was published in 2018 titled *Strategically Oriented Research Themes* that describes HKU's research strategy and outlines the themes, capturing past achievements, present activities, current plans and future targets.

10. In the reporting year, a second brochure was published (April 2019) titled *Growing Human Capital through the SORTs*. This publication focuses on our new generation of academics whose works are inspirational and promising. Their research illustrates the rich dimensions of the SORTs, and also highlights future directions and the potential impact of research at HKU (www.hku.hk/research/strategic-research).

11. The University continues to provide 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

12. 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.

13. 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.

14. 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 2,840 academics at all grades – from Post-doctoral Fellows to Chair Professors, including Heads of academic departments – have attended the 23 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 October 2018 and June 2019.

15. 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 33 proposals were funded in the past seven rounds.

16. 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 co-hosted (with RMIT, Melbourne, Australia) the 6th World Conference on Research Integrity, which was held at HKU on June 2–5. This was the first conference of its kind in Hong Kong in its history, and it was attended by more than 700 participants from around 60 countries. The conference brought together researchers, teachers, funding agencies, government officials, journal editors, senior administrators and research students, providing 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/.

Research Data and Records Management Policy

17. HKU recognises the importance of good practice in research data and records management and seeks to promote the highest standards. The University's *Policy on the Management of Research Data and Records* 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. HKU has 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 infrastructure for depositing their research data. 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 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.

New Schemes for Presidential Post-doctoral Fellowships and PhD Scholarships

18. The University has launched a new Presidential Post-doctoral Fellowship (HKU-PPF) scheme, with the objective of hosting the world's finest post-doctoral talents to undertake frontier research at HKU. Typical candidates are fresh PhD graduates (within two years of graduation) of leading global universities with highest distinction, awards and research credentials. Each HKU-PPF fellow is funded centrally for three years and will receive an attractive stipend with additional accommodation, research and conference grants as well as other appointment benefits. This scheme – which is supplementary to the current Post-doctoral Fellowship (PDF) scheme under the URC – is applicable to all research disciplines and Faculties. The first call for applications was made in July 2019.

19. To attract the best and brightest candidates to pursue PhD studies at HKU, the University has launched a Presidential PhD Scholarship Scheme starting from admission year 2020–21. Details of the scheme have been advertised at:

<https://www.gradsch.hku.hk/gradsch/prospective-students/scholarship-funding-and-fees>.

Preparations for the Research Assessment Exercise (RAE) 2020

20. In preparation for the Hong Kong-wide assessment of research by the University Grants Committee (“RAE 2020”), HKU has undertaken a range of measures and activities, including a mock exercise in 2017 with the objective of self-assessment and improvement.

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.

21. The University continued its RAE Colloquium series – launched by the Office of the VP(R) in 2016 – 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 following sessions were held in 2019:

- May 22, 2019: “Interdisciplinarity and Impact, from Sciences to Social Sciences: Artificial Intelligence, Reflection, Governance and Accountability”, given by Professor Emiliós Avgouleas, International Banking Law and Finance Chair, University of Edinburgh.
- July 11, 2019: “Evolving Cambridge Strategy and Guidance for REF 2020”, given by Professor David Rowitch, Head of the Department of Paediatrics in the clinical school at the University of Cambridge.
- October 23, 2019: “RAE to REF: The Evolving Challenges Faced by UK Research-led Universities”, given by Professor David Cardwell, Pro-Vice-Chancellor for Strategy and Planning, University of Cambridge.

22. 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. The international advisors visited the University in May 2019 for a series of meetings, workshops and individual consultations.

23. 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. The workshops offer useful insights for HKU researchers in preparing evidence of research impact for RAE 2020.

Meeting of Minds

24. Held in October 2019 and organised by the Office of the Vice-President (Academic Staffing and Resources), the Meeting of Minds@HKU Forum for Outstanding Young Scholars is a 2-day forum to discuss grand challenges through the lens of advanced knowledge, discovery and innovation across science, the humanities, and social sciences. This forum engages participants in intellectually stimulating and creative dialogue to explore how to ignite collective will, wisdom and innovation to improve the human condition. Participants interested in joining HKU as assistant professors were also invited for recruitment interviews.

2. Collaborative Research

25. 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 through initiatives at the University, including the following examples:

- (a) Seed Funding for Strategic Interdisciplinary Research Scheme to support the development of large-scale and competitive research projects involving interdisciplinary collaboration.
- (b) 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, bringing together researchers from Medicine, Science and Social Sciences.
- (c) Cross-discipline research centres, such as the Centre for the Humanities and Medicine and the Law and Technology Centre, which aim to encourage productive relationships across fields.
- (d) New interdisciplinary initiative "Research & Impact Initiative on Communication in Healthcare" (HKU RIICH) – launched by the Faculty of Arts in June 2019 – which brings together internationally recognised experts from different disciplinary fields, including linguistics and medical education, with the aim of transforming healthcare practices and healthcare education through evidence-based, translational research.
- (e) Interdisciplinary Research Competition co-organised by Graduate House, the Postgraduate Student Association and the Graduate School to promote interdisciplinary research amongst postgraduate students. In 2019, the champion award went to the project "Breast Cancer Pre-screening: Image-based Circulating-tumour-cell Detection in Blood". The winning team comprised 3 PhD and 1 MPhil candidates from Electrical and Electronic Engineering, Mechanical Engineering and Surgery.
- (f) Interdisciplinary Quick Talks, an HKU Knowledge Exchange series to promote interdisciplinarity and to share evidence-based knowledge on challenging issues from multiple perspectives with the community (see paragraph 43).

26. Researchers of the University are also heavily involved in large-scale collaborative projects with local institutions and international partners. For example, of the 69 Areas of Excellence (AoE) and Theme-based Research Scheme (TRS) projects awarded to date, HKU is co-ordinating 29 and participating in a further 32. Such projects thrive on local and international collaboration; for example, the newly funded AoE project (see paragraph 70), which plans to integrate the existing platforms in Hong Kong, forming a transdisciplinary consortium to combat the epidemic of these chronic diseases, involves collaborators from Hong Kong, Mainland China, Germany and the USA. As outlined below, partnership between the University and industry is also an ongoing focus to promote the application of research results.

27. 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 convener of the Research Leaders of U21.

28. 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.

29. 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). In the reporting year, three of the joint laboratories secured total funding of HK\$8.128 million through the Joint Laboratory Funding Scheme, a one-off scheme that aims to enhance the research infrastructure of the joint laboratories between the CAS and Hong Kong universities (see paragraph 85 for more information).

30. 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 and 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.

31. In 2018, three research projects led by PhD candidates or supervisors from HKU 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 teams consisted of doctoral candidates and advisors from 5 U21 member universities (HKU, Shanghai Jiao Tong University, the University of Auckland, the University of British Columbia and the University of Melbourne) with multidisciplinary expertise.

32. 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 (81.9%) of RPg students at completion in 2017/18 had industry or international (including Mainland) experience.

33. 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's Faculty of Engineering and the Harvard John A. Paulson School of Engineering and Applied Science (Harvard SEAS) to set up a Laboratory for Instrumentation for Precision Medicine. HKU Faculty of Engineering and Harvard SEAS aim to establish a laboratory focused on medical instrumentation for microfluidic-based diagnostics, drug delivery and sensor development in the age of precision medicine, in response to the HKSAR Government's initiative to turn Hong Kong into a global hub of innovation and technology, particularly in the areas of healthcare technologies. The Laboratory will be organised into themes based on technologies that HKU and Harvard SEAS are pioneering and share interests and competitive edge in, such as microfluidics, drug formulations, sensors and detectors. It will provide a platform for translating fundamental breakthroughs and advances into commercialisable ideas. The strengths of Harvard SEAS and HKU will be harnessed to breed innovation, creativity, new translational developments and new high tech jobs in Hong Kong.
- (b) HKU has established an Institute of the Mind to take on the grand challenge of studying the science and art of human wisdom, and harness it in the form of mind technology and neuromorphic computation. The Institute has been made possible thanks to a generous donation of HK\$150 million by Dr the Honourable Lee Shau-Kei, GBM, Chairman of Henderson Land Group, through the Lee Shau Kee Foundation. HKU President and Vice-Chancellor Professor X. Zhang signed an MoU with Dr Lee at a ceremony today in December 2018. Professor Zhang expressed his gratitude for Dr Lee's generosity and foresight towards research that will extend the boundaries of brain studies and neuro-science. "The Institute will establish a technology platform with a human-society-machine interface. Cross-faculty and inter-disciplinary research teams can be assembled to study qualitative and quantitative human wisdom. It will lead to the next generation's information technology, and re-define multiple core industries including automobile, internet, medical diagnosis, energy, etc., and foster social advancement," Professor Zhang said.
- (c) HKU and the MTR Corporation (MTR) signed an MoU to identify and collaborate in research issues of mutual interest on railway operation and maintenance engineering. MTR is looking for leading technologies to advance its capabilities in data collection and analysis, predictive and prescriptive maintenance, condition-based monitoring systems, artificial intelligence and robotics for the operation of its railway network. HKU will be using its technologies and other facilities in collaboration with MTR for the purpose. MTR and HKU will collaborate in developing possible solutions that will enhance railway operation and maintenance engineering using methodologies including image analysis, forecasting, image and data visualisation and big data analytics, involving academics and professionals from the Faculties of Engineering and Science, and the Information Technology Services of HKU.
- (d) HKU and Ocean Park have signed an MoU to deepen the collaboration of the two entities in innovative education and research initiatives. These include the inaugural Ocean Park International STEAM Education Conference (held 21-22 June 2019) and a hackathon that empowers students to design guest experience solutions for the Park. Ocean Park will work with HKU's School of Biological Sciences on zoology, wildlife and environmental conservation research. The Park will also work on a new Summer Adventure camp with the Faculty of Engineering to help educate and

develop secondary students' interest in science; and work with the Faculty of Education on the joint creation of experiential learning education programmes for future education professionals.

- (e) The University signed an MoU with Tencent Finance Academy (Hong Kong) (TFAHK), under Tencent, to promote the development of FinTech in Hong Kong. By combining HKU's outstanding academic foundation in FinTech with Tencent's practical experience in the industry, the two parties will join hands in cultivating local FinTech talents. The FinTech & Blockchain Lab of the Department of Computer Science of HKU will collaborate with TFAHK on joint FinTech-related research and development projects.
- (f) HKU is collaborating with Tohoku University, Japan, on general academic exchange, as well as research of transformative artificial intelligence (AI) and robotics technologies. The partnership will transform and upgrade AI and robotics technology with the outstanding research and academic achievements of the two universities. This collaboration brings together top researchers from both universities to focus on cutting-edge research and application development and is aimed at opening up new technologies for the transformation of the manufacturing industry and of mega cities.
- (g) HKU is part of a key alliance that has been set up to promote innovation and technology as well as entrepreneurship in the Guangdong-Hong Kong-Macao Greater Bay Area. The alliance brings together top scientists and engineers from Guangdong province and the HK and Macau SARs. The institutions in the alliance include six leading Hong Kong universities, nine universities in Guangdong and four science and research institutions from both places.
- (h) HKU is partnering with TCL Corporation (TCL) to set up the "HKU-TCL Joint Research Centre for AI", fostering research development in AI. HKU's Faculty of Science and Faculty of Engineering received HK\$30 million from TCL, which will be used to support AI research undertaken at the joint centre for five years. This collaboration aims to synergise top-notch research and strength of enterprise, foster mutual exchange and translate research knowledge to creative and pioneering applications. The agreement echoes TCL's mission to transform creativity into cutting-edge technology; it also demonstrates the determination of HKU to enhance its competitiveness in the global realm of research.
- (i) HKU's collaboration with Qatar University in the area of FinTech/RegTech has led to a new project under the Qatar National Priorities Program on "FinTech and RegTech – Building a Resilient, Inclusive and Competitive Legal and Regulatory Framework for 21st Century Finance in Qatar". Professor D.W. Arner – Kerry Holdings Professor in Law at HKU – is a principal investigator (PI) of the project alongside PIs from Qatar University and the University of New South Wales and Curtin University in Australia. The four-year project has attracted total funding of nearly US\$600,000.

34. 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, www.mrpo.hku.hk).

35. 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.

36. As part of the innovation drive, a new policy on granting science and technology funding for Hong Kong universities and research institutions was announced in May 2018. Under the new policy, Hong Kong universities can now bid for Mainland funding and the funds can be remitted directly to and used in Hong Kong. Since late 2018, principal investigators from the University are eligible to apply for designated programmes from the Ministry of Science and Technology (MoST), National Natural Science Foundation of China (NSFC), Guangdong Provincial Department of Science and Technology, and Shenzhen Science and Technology Innovation Commission, and use the funds for research that takes place in Hong Kong.

37. 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 NSFC (國家自然科學基金), and the Shenzhen Science and Technology Program. In 2018-19, HKU-SIRI received total funding of RMB2.6 million for 2 projects under the National Key Research and Development Program, over RMB16.17 million for 20 projects under NSFC, and around RMB7.49 million for 5 projects under the Shenzhen Science and Technology Program. To date, there have been about 170 research projects funded, 6 patents granted and 2 filed, and nearly 330 papers published.

38. 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 (3+1) Is framework. 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), Zhejiang Natural Science Foundation (浙江省自然科學基金) and the NSFC. To date, nearly 120 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.

39. An HKU-ZIRI Innovation Forum 2019 was held in May 2019. The Forum has attracted more than 300 people, including researchers and scholars from over 20 colleges and institutes inside and outside Zhejiang Province and representatives from more than 40 enterprises. The success of the Forum is of great importance in promoting advanced science

and technology expansion, translation and landing in Zhejiang, enhancing the communication and connection between HKU-ZIRI and the research institutes inside and outside Zhejiang, and accelerating the industrial transformation and upgrade in Zhejiang. To encourage on-site academic exchanges and communications, HKU-ZIRI initiated a “HKU-ZIRI Innovation Seminar” series, which are held on a biweekly basis. It has provided a platform for all researchers at HKU-ZIRI to interact and collaborate, and share ideas and experiences. Scholars and delegates from other universities and research institutions have also been invited to HKU-ZIRI seminars, and researchers can use the opportunities to seek potential collaborations. Given the diversity of research subjects, each presentation aims to be appealing but also insightful for a general audience.

40. 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.

41. To help increase research competitiveness and international collaboration, HKU has introduced a number of initiatives. Details are given below for the application rounds for these initiatives during the reporting period.

- (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 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

42. 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 2018–19 reporting year.

Deepening institutional capacity for realising and corroborating impactful research

43. In 2018–19, the University continued to encourage interdisciplinarity in KE. A new series of KE seminars, Interdisciplinary Quick (IQ) Talks, was launched to promote interdisciplinarity and to share evidence-based knowledge on challenging issues from multiple perspectives with the community. The inaugural event of IQ Talks in February 2019 was well attended with over 200 participants from government departments, institutions, secondary schools and technology companies.

44. The University also allocated \$2 million to conduct the Interdisciplinary KE Project Fund Scheme (originally introduced as a one-off scheme in 2015–16). The Fund aims to facilitate interdisciplinary KE projects that have the potential to create social, economic, environmental or cultural impacts for industry, business or the community by building on interdisciplinary research in the University, with priority given to cross-Faculty collaboration. The funding has successfully encouraged cross-Faculty KE projects, attracting 31 quality proposals, of which 16 were supported.

45. To recognise and reward the significant impact that our academic staff are making in harnessing and translating knowledge to benefit society, the University presented the eighth year of the Faculty KE Awards and the fourth year of the university-level KE Excellence Award in 2018–19. The awarded projects demonstrate the continuous effort of HKU researchers to engage in work that responds to social needs and to enrich the community with their expertise and discoveries in partnerships with government departments and external organisations. For example, HKU Law academics, in collaboration with parents' support groups, proposed a Special Needs Trust that has been adopted by the Government. The Trust lets parents or caregivers of Hong Kong individuals with cognitive impairment leave funds from their estate to care for their offspring, while the Government acts as trustee to manage the trust fund. Other examples include a building information modelling system for housing production, contextually appropriate assessment of early child development, bioinformatics algorithms and next-generation-sequencing data analysis, and working conditions in factories in China.

46. 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, 98 proposals were received, of which 74 were supported.

47. The full list of projects supported through this Scheme is available at https://www.ke.hku.hk/assets/doc/Impact_Project_Summary_201819_online_eng.pdf. Examples of completed projects include a "E-package of DIY Residential Tenancy Agreement", a bilingual package developed by an academic in the Faculty of Law to provide the public with a free and easy access template and guidance notes; and "Promoting Friendly Outdoor Lighting Fixture Against Light Pollution", a project by a team in the Department of Physics that included a competition for secondary schools, seminars and workshops, and a bilingual education booklet.

Commitment to Knowledge Access and Community Engagement

48. All Faculties are committed to public engagement to share knowledge and raise awareness on important issues facing society. A wide variety of activities were conducted in the reporting year, including public seminars, press briefings/conferences, publications on mass media, international competitions, and two-way KE through the new media. For example, the Faculty of Business and Economics organised a number of public KE lectures and seminars covering topics such as new geo-politics and geo-economics amidst the US-China conflicts to enhance the public understanding on timely and important business and economics issues.

49. Faculties also continue to pursue achievement in community impact, engagement and collaboration with external partners beyond the University to leverage the synergy between different stakeholders for social good in Hong Kong. For example, the Faculty of Social Sciences jointly organised a two-week Water Fun Fest with Ocean Park to enhance the public's consciousness on water sustainability and multiple values of freshwater. The 2-week Water Fun Fest successfully attracted over 130,000 people with publicity materials reaching out to the entire Hong Kong population.

50. Another example is the development of websites and mobile apps. Faculties of Dentistry, Education and Engineering completed website revamps in the reporting year, facilitating users to easily search for information, access the Faculties' knowledge, and learn about the KE contributions and achievement of the Faculty members. To reach out to the public in a more effective way, Faculties also developed mobile apps such as 'HKcBirds: Common Birds of Hong Kong' jointly developed by the Department of Computer Science of the Faculty of Engineering and the Hong Kong Bird Watching Society and 'Newssary', a free Chinese-English news glossary app, developed by the Faculty of Arts. Both apps were awarded as the 'Healthy Mobile Phone / Tablet Apps' of the year at the '2018 Meritorious Websites Contest and Healthy Mobile Phone / Tablet Aps Contest' organised by the Office for Film, Newspaper and Article Administration, HKSAR Government.

51. In the reporting year, the KT funding provided to the University by the UGC was also used to support 32 student KE projects, while the University also makes use of other funds to encourage students to undertake community projects, for example, the Service 100 Fund and the We Are With You Project Scheme that are administered by the Centre of Development and Resources for Students. Examples include 'Experiencing Life in Phayar Taung Monastery' organised by Social Sciences students to provide diverse learning opportunities and improve learning environments for the students in Myanmar; and 'Promoting Mental and Physical Development through Playing and Active Learning at Samart School' organised by a team of students from Arts and Science to facilitate the physical and social competency of the children in Cambodia by constructing a safe, multi-functional playground for them.

Technology Transfer and University–Industry Partnership

52. 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.

53. To strengthen the engagement with our industry partners, TTO organised the first HKU-Industry Forum on Display Technologies in January 2019. The forum served as a platform for

exchanging ideas and fostering deeper connections between HKU researchers and industry. Eight display companies and market intelligence companies participated in the event: IHS Markit, Clarivate Analytics, BOE Technology Group Co., Ltd, China Star Optoelectronics Technology Co., Ltd., TCL Electronics, Guangzhou ChinaRay Optoelectronic Materials Co., Ltd, PlayNitride Inc., and Tianma Micro-electronics. Six HKU research teams showcased their innovative display technologies on OLED emitter materials, optoelectronic materials and devices, transparent conductive films and innovative LEDs. A concurrent showcase zone was also arranged to present HKU display technology offerings to the attendees. Moreover, one-on-one meetings were also held between industrial companies and HKU research groups to discuss possible collaboration opportunities.

54. In February 2019, the Chief Executive, Mrs Carrie Lam, and the Chairman of Hong Kong Cyberport Management Company Limited, Dr George Lam, visited HKU x Cyberport FinTech Nucleus, which is located at Cyberport's Smart Space FinTech and is a platform for promoting HKU technologies and innovations in FinTech to the Cyberport Centre of Global FinTech Innovation. FinTech Nucleus provides live technology showcases developed by HKU startups for engaging with potential customers, and facilitates collaborations among HKU and other FinTech stakeholders in the region. Since its inception in 2017, FinTech Nucleus has received hundreds of delegations from different part of the world and they were presented i) the cutting-edge HKU technologies for best supporting FinTech business, ii) HKU's rapid-growing FinTech startups, and iii) HKU FinTech courses designed for financial institutions, private investors and government representatives, with the ultimate purpose of accelerating the adoption of financial and AI (artificial intelligence) technologies for better products and services.

55. 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 2018–19 reporting year:

- (a) *International Meeting on Information Display ("IMID")*: This event was held in Busan, South Korea from August 27-31, 2018. IMID is an annual conference on the latest display technologies for academia and industry. TTO took part in IMID 2018, which was a 4-day programme with (i) technology and product showcases by industry and academia; (ii) a Display Industry Forum on current technology/market trends and future outlook of the display supply chain; and (iii) parallel conference tracks on the latest technology research topics and product announcements. At the HKU Exhibition Booth at the conference, TTO showcased five prototypes from Dr A.H.W. Choi, who is the inventor of our portfolio of LED device inventions. We also distributed our booklets showcasing a total of 24 inventions for exhibition and promotion to our target industrial partners. We were greeted by visitors from the display industry such as Samsung Display, LG Display and Merck KGaA, as well as academics from Korean universities including Seoul National University and Kyung Hee University. Many of the visitors showed interest in our showcased prototypes.
- (b) *China High-Tech Fair (CHTF)*: HKU showcased innovations and technologies developed at HKU in the Hong Kong Pavilion of the 2018 China High-Tech Fair (CHTF) from 14-18 November 2018 at the Shenzhen Convention and Exhibition Centre. Highlights included (i) nano-LED technologies developed by Dr A.H.W. Choi of the Department of Electrical and Electronic Engineering; and (ii) NJ Toothbrush developed by Professor L. J. Jin and Dr T.C. Ng of the Faculty of Dentistry. The exhibition attracted more than 550,000 visitors from 103 countries around the world.

(c) *InnoCarnival 2018*: HKU was one of the co-organisers for this major 9-day event that was organised by the Innovation and Technology Commission and held from November 3-11, 2018 at the Hong Kong Science Park. Under the theme of “Innovate for a Smart Future”, HKU showcased 4 research projects and 2 interactive games related to healthcare, environmental and robotic technology to illustrate how innovative research can contribute to smart living.

(d) *The 47th 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 won one Gold Medal with the Congratulations of Jury, four Gold Medals and five Silver Medals at the event, held from April 10–14, 2019. HKU’s award-winning inventions include:

Gold Award with the Congratulation of Jury

Transparent Conducting Film

An embedded metal mesh transparent conductive film for emerging electronics developed by HKU spin-off optoelectronic company Flectrode Ltd.

Gold Medals

1. Portable Water Filter

A high throughput filter product that can efficiently remove heavy metals and microorganisms from contaminated waters, developed by the research team of Professor C.Y. Tang, Department of Civil Engineering.

2. NJ Toothbrush

A toothbrush designed to target all dental surfaces in particular the inter-dental, retromolar and sub-gumline niches, so called the “dead-corners” where other toothbrushes have difficulty cleaning, jointly developed by Professor L.J. Jin and Dr T.C. Ng, Faculty of Dentistry.

3. Methods and Compositions for Use of Neutrophil Elastase and Proteinase 3 as Diagnostic Biomarkers

A novel method for risk predication and accurate diagnosis of autoimmune diabetes by measuring enzymatic activities and protein concentrations of neutrophil elastase and proteinase 3 in human plasma, developed by the research team of Professor A. Xu Aimin, Department of Medicine.

4. A novel probiotic mixture “Prohep” for potential treatment of hepatocellular carcinoma

A probiotic composition named “Prohep” that has potential therapeutic effects on Hepatocellular carcinoma, developed by the research team of Dr H.S. El-Nezami, School of Biological Sciences.

Silver awards

1. Paper Battery

Innovative paper-based aluminium-air batteries developed by the research team of Professor D.Y.C. Leung, Department of Mechanical Engineering.

2. Soft Robotic Glove for Rehabilitation

Soft robot hand for neutral rehabilitation of degenerative neurological diseases and strokes developed by the research team of Dr Y. Hu, Department of Orthopaedics and Traumatology.

3. Project ADEN: Affordable Automated Diversified Encapsulation

Encapsulation machine for making edible bubbles with different ingredients for

archiving a wide variety of textures and tastes, developed by the research team of Dr A.H.C. Shum, Department of Mechanical Engineering.

4. The Real Virtuality for Aircraft Inspection (ReVAI) Training System

An immersive VR-empowered training system for cost effective and authentic aircraft maintenance operation training and performance qualification. The innovation makes use of the imseCAVE technology developed by the Department of Industrial and Manufacturing Systems Engineering. The exhibiting partner is LSCM (Logistics and Supply Chain MultiTech R&D Centre).

5. SmartEat

SmartEat education app helps kids in diet planning and obesity prevention by turning lunch visual content to nutritional values. It is developed by students at St Paul's Primary Catholic School under the guidance of a research team led by Dr V.W.L. Tam, Department of Electrical and Electronic Engineering.

- (e) *The BIO International Convention (BIO) 2019*: HKU showcased innovations and technologies at BIO 2019 in Philadelphia from June 3–6, 2019. BIO attracts biotechnology and pharma leaders from more than 8,400 companies for one week of intensive networking to discover new opportunities and promising partnerships. Four technologies from HKU were showcased: (i) a novel method for risk predication and accurate diagnosis of autoimmune diabetes developed by Professor A. Xu from the Department of Medicine; (ii) a delivery and expression system for anti-viral therapeutic molecules developed by Professor K.Y. Yuen from the Department of Microbiology; (iii) an immune-oncolytic method to treat solid tumours developed by Professor Z. Chen from the Department of Microbiology; and (iv) a novel diagnostic biomarker and therapeutic target for treating hepatocellular carcinoma developed by Dr S.K.Y. Ma from the School of Biomedical Sciences. Additionally, TTO also prepared a brochure for marketing other biotech related technologies from HKU and arranged private meetings with companies through the partnering systems to discuss possible collaboration and licensing opportunities.

HKU Innovation and Entrepreneurship Hub – iDendron and DreamCatchers

56. 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 startups and for establishing interdisciplinary cooperation, as well as funding support for HKU startups through the DreamCatchers programme.

57. So far, iDendron has been hosting over 50 HKU students and alumni startup teams and organised more than 80 events, workshops, and sharing by founders with partners in the innovation, technology, and entrepreneurship sector including Facebook, Google, Startup Weekend and Cocoon, Amazon Web Services, etc.

58. As the signature programme under iDendron, DreamCatchers covers a series of programmes including the Hackathons, Entrepreneurship Academy and other events for our students, staff and alumni.

- (a) *Entrepreneurship Academy 2019*: This popular workshop on entrepreneurship was offered again in October 2019. 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) *DreamCatchers MedTech Hackathon 2019*: 50 students from local universities 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.
- (c) *Ocean Park x HKU Hackathon*: This was the first experiential learning opportunity co-organised by Ocean Park and HKU, where 25 HKU students and graduates from all disciplines and professionals developed innovative solutions for Ocean Park in the fields of education, entertainment and conservation in the real setting of Ocean Park. The theme of the hackathon was Edutainment with Innovation.

59. The iDendron Incubation Programme (iIP), launched in late July 2019, is a high-impact 6-month programme designed to help early-stage startups gain momentum through deep mentor engagement, investor relation building and exposure outreaching. We aim to create a community connecting potential elite founders from a wide spectrum of fields who have a common vision to create an impact for the future. A total of 12 startups have been selected to participate in the first cohort. The participating companies will gear up with first-hand market intelligence, industry and investor relations, as well as support and entrepreneurial resources from HKU and its network.

60. iDendron has been supporting students to join various local and overseas innovation and entrepreneurship activities to help realise their ideas. Our students performed well in various technology startups and social innovation competitions. Some examples of the awards include:

- (a) Hult Prize Regional Winner in Ho Chi Minh City;
- (b) Champion of Hong Kong Social Enterprise Challenge;
- (c) 16 awards at the 5th Hong Kong University Students Innovation and Entrepreneurship Competition, including Grand Prize in the startup category, First Class Award in the Entrepreneurship Category (Cultural & Creative Service) and First Class Award in the Innovation Category (Energy, Environmental and Chemical Engineering); and
- (d) 2 Finalists in the HKXF FYP+ Supporting Scheme.

TSSSU@HKU

61. In the reporting year, the TSSSU@HKU funding scheme entered its sixth application. A total of 33 applications were received in November 2018 for new and existing startup companies, and 25 startups were awarded (12 of which are commercialising HKU technologies), with total funding of HK\$8 million. The overall performance of the TSSSU awardees is good, with four in particular being outstanding. High Performance Solution Limited, Ossfila Technology Limited and Serinno Holdings Limited competed at “Hello Tomorrow Regional Summit” in Singapore in November 2019. They have been listed as “Hello Tomorrow Deep Technology Pioneers” and been invited to the Investor Day of the “Hello Tomorrow Global Summit” in Paris in March 2020. Another outstanding TSSSU awardee is Lifespans Limited.

- (a) *High Performance Solution Limited*: The company invented a Direct Thermal Charging Cell (DTCC) that can effectively convert heat to electricity, creating a huge potential to reduce greenhouse effects by capturing exhaust heat and cutting

down primary energy wastage. DTCC can be used in HVAC (heating, ventilation, and air conditioning) systems to recycle low-grade heat from the compressor and condenser into electricity for use in electrical devices. It can be integrated with the window frame to harvest solar thermal energy to power electrochromic windows, or used as portable devices to power smartphones or life-saving equipment in the wilderness. With the increasing popularity of wearable technology, this system may one day harness body heat to power wearable electronic devices or medical devices for monitoring body health. The invention has been published in *Nature Communications* and the research has been featured in the *Nature Communications* Editors' Highlights webpage. HKU's TTO has filed for the invention's US provisional patent and PCT (Patent Cooperation Treaty) patent.

- (b) *Ossfila Technology Limited*: The company deploys 3D printed bone implants with their very own novel 3D printing filament. The company anticipates transforming traditional metal moulding with its 3D printing technology. Driving this technology forward improves patient accessibility, implant compatibility and post-surgery quality of life. The new bone implants outcompete current alternatives of human bone implants at a much lower cost while maintaining comparable mechanical strength and durability. The novel characteristics in the 3D printing filament also encompass superior biocompatibility, and the 3D bone printing technology sidesteps the conventional manufacturing constraints and thus offers a more functional and personalised solution for patients. The aim is to positively reshape the quality of life and minimise the repercussions post bone implant surgery, and take advantage of the 3D printing filament and 3D printing technology to replace the natural bone at a much lower cost.
- (c) *Serinno Holdings Limited*: The company has been focusing on the design and synthesis of different ortho-phthalaldehyde (OPA)-based bifunctional linkers and the optimisation of the conjugation conditions. It collaborates with Wuxi Biologics in developing OPA-based ADC drug (Hecceptin-OPA-DM1) for cancer treatment and a joint patent application has been filed. Based on the unique biophysical, biochemical and pharmacological characteristics, heavy chain antibodies (HcAb) become increasingly important in antibody drug discovery. But due to the small size and lack of lysine residue in HcAb, it is hard to obtain high drug-antibody ratio for ADC using the traditional NHS ester containing linker-payload (e.g., SMCC linker). Using Hecceptin-linker-DM1 as the testing model, conjugations via OPA linkers showed advantages over traditional SMCC linkers in different aspects. The results showed that OPA conjugation conditions are more biocompatible and efficient.
- (d) *Lifespans Limited*: The company has developed three innovative implants that are shown in laboratory conditions to provide superior performance for repairing fractures in the elderly: the Lifespans Soft Hip, Soft Shoulder, and Soft Spine. It is presently completing the final safety and efficacy testing required to bring these three innovative orthopaedic devices through the regulatory approval processes in the US and EU, followed by Asian countries, with patents filed in the US, EU, and China. (See 87(a) below for this company's latest developments.)

Contract Research Projects and Licensed Inventions

62. A number of examples of successful university-industry partnerships took place during the reporting year. Versitech Ltd undertook a total of 5 contract research projects within 2018–19 with various industrial sectors.

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

- (a) *Anti-Penetration Bone Implant Devices*: Lifespans Limited, an HKU startup company founded in Hong Kong in 2015, has licensed a technology related to anti-penetration bone implant devices developed by researchers in the Department of Orthopaedics and Traumatology. This technology uses a polymer tip that expands upon implantation to resist implant migration and allows for load sharing with the host bone to minimise stress at the bone–implant interface. It was awarded a silver medal at the 46th edition of The International Exhibition of Inventions of Geneva (IEIG) 2018. The company is currently working on the regulatory approval for the implants featuring this technology and is targeting to launch the product in 2020.

Over the past few years, Lifespans was supported by TSSSU funding and the company has leveraged on this to raise sizeable private investment for the commercialisation of their technology and the development of the company. Furthermore, the company received multiple awards and prizes last year. In September 2018, Lifespans won a silver medal in Hangzhou (Gongshu) startup competition, with US\$5,000 immediate cash prize and automatic entry into the application process for a US\$500,000 grant. In November 2018, the company was awarded the grand prize at the ASEAN Finals of the Hello Tomorrow startup pitch competition for companies, with over 200 regional applicants. It also took first runner up and audience choice awards at the finals of the Cocoon Hong Kong startup pitch competition in December 2018.

- (b) *New Biomarkers for Autoimmune Diabetes*: Professor A. Xu’s team in the Department of Medicine developed a technology related to two novel biomarkers for diagnosis of autoimmune diabetes. This technology provides a simple, cost-effective and user-friendly method for rapid, high-sensitive and accurate diagnosis of autoimmune diabetes that can be done anytime, anywhere. The technology was awarded a gold medal in the 47th edition of IEIG in 2019.

ImmunoDiagnostics Limited, an HKU spinoff company, licensed this technology in 2017. The company generated and optimised the enzyme-linked immunosorbent assays for Human Neutrophil Elastase and Human Proteinase 3 based on the licensed technology. The company further performed validation studies for the use of these assays in the diagnosis of autoimmune diabetes. These two assay kits were launched for research use in 2018. The company plans to establish the GMP facility in mainland China and will further work on the regulatory approval for the diagnostic use of the assay kits.

4. Undergraduate Research

64. The eighth 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 7 rounds, over 480 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 2019, 112 students from all

ten Faculties were selected in the eighth round for enrolment, of which 32 were granted awards to undertake internships. These students are expected to complete their research study within the 2019–20 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 2019, 4 Warwick students from economics, law and life sciences visited HKU.

65. The annual URFP poster session was held in April 2019 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

66. Research highlights for HKU in 2018–19 include the following:

Theme-based Research Scheme (TRS)

67. The Theme-based Research Scheme (TRS) was introduced to support themes of strategic importance to the long-term development of Hong Kong. In the ninth round of the scheme – the results of which were announced in July 2019 – two HKU-led projects received a total budget valued at HK\$105.56 million (including on-costs) for a period of 5 years. The Project Coordinators are Professor B.J. Cowling of the School of Public Health and Professor C.M. Lo of the Department of Surgery and their projects both represent a collaborative effort by researchers from local and overseas institutions. The former aims to study human immunity to influenza with the aim of improving vaccines and to achieve more effective and efficient control of the disease, while the latter aims to improve the long-term outcomes of liver transplantation by tackling disease recurrence. HKU is also collaborating in another two projects funded in this round.

68. In the 9 rounds of TRS, the RGC has awarded funding to a total of 45 projects. HKU is the co-ordinating institution of 19 awarded projects, which have received total funding of HK\$876 million, with HKU researchers also involved in a further 22 projects.

Areas of Excellence (AoE)

69. To nurture areas of international excellence through high-quality research and inter-institutional collaboration, the Areas of Excellence (AoE) scheme has provided support for 24 projects over 8 funding rounds since its inception. HKU is the co-ordinating institution of 10 of these 24 AoE projects, representing total funding of HK\$767 million. The University is also participating in a further 10 co-ordinated by other institutions.

70. HKU-led AoE projects include one project funded during the reporting year in the 8th round of scheme. The project is titled “Institute of Metabolic Medicine”, with an approved budget of \$77.803 million, and the Project Coordinator is Professor A. Xu of the Department of Medicine.

2019–20 General Research Fund / Early Career Scheme (GRF/ECS) Exercise

71. HKU was awarded total funding of HK\$162.521 million (excluding on-costs) for 217 projects in the 2019–20 General Research Fund (GRF) exercise, with over a fifth (21.6%) of the supported projects being those of HKU Principal Investigators. HKU submitted 664 applications in this round, giving a success rate of 33%. The University secured the largest amount of funds for projects under the Biology and Medicine Panel and the Humanities and Social Sciences Panel. HKU has competed and secured the largest number of projects and share of funding in 16 of the last 17 GRF rounds, including in the 2019–20 round, which also saw an increase compared with last year in funding awarded to HKU (up from HK\$142.251 in funding in 2018–19).

72. In the 2019–20 funding round of the Early Career Scheme, RGC supported a total of 166 projects. HKU submitted 61 applications, of which 30 were approved, securing HK\$17.942 million in funding (excluding on-costs).

2018–19 Collaborative Research Fund (CRF) Exercise

73. Of the 20 projects funded in the 2018–19 round of RGC’s Collaborative Research Fund, HKU is the coordinating university of 1 Equipment Grant and 7 Group Research Grants. The University is participating in a further 9 projects (Group Research and Equipment) as a collaborating institution. The awarded amount to HKU is HK\$44.9 million (excluding on-costs). The 8 projects with HKU as lead institution are as follows:

- (a) “SIRMS 2.0: Establishing Asia’s Premier Stable Isotope Ratio Mass Spectrometry Laboratory in Hong Kong”, HK\$3.8 million, Project Coordinator: Professor K.M.Y. Leung (School of Biological Sciences), in collaboration with CityU, HKBU, CUHK and PolyU;
- (b) “Development of the Glycosylated Adiponectin Collagenous Domain as Potential Therapeutic Agents for Cancer and Non-Alcoholic Fatty Liver Diseases”, HK\$3.74 million, Project Coordinator: Professor. X.C. Li (Department of Chemistry);
- (c) “Exploiting Stemness as a Cancer Cell Vulnerability Using Hepatocellular Carcinoma (HCC) as a Model System”, HK\$6.99 million, Project Coordinator: Dr S.K.Y. Ma (School of Biomedical Sciences), in collaboration with CUHK and PolyU;
- (d) “Exploiting the True Joint Progenitor Cell for Articular Cartilage Repair”, HK\$7.37 million, Project Coordinator: Professor D. Chan (School of Biomedical Sciences), in collaboration with CUHK;
- (e) “Infrastructures of Faith: Religious Mobility on the Belt and Road”, HK\$6.25 million, Project Coordinator: Dr D.A. Palmer (Hong Kong Institute for the Humanities and Social Sciences), in collaboration with CUHK and EdUHK;
- (f) “Elucidating the Mechanism of De Novo Centromere Formation”, HK\$5.02 million, Project Coordinator: Dr K.W.Y. Yuen (School of Biological Sciences), in collaboration with CUHK;
- (g) “Next-Generation Air Pollution Physics and Chemistry Model for Urban Areas”, HK\$7.28 million, Project Coordinator: Dr C.H. Liu (Department of Mechanical Engineering), in collaboration with PolyU and HKUST; and
- (h) “Identification and Characterization of Genes and Microenvironment Factors

Driving the Metastasis of Upper Gastrointestinal Tract Cancers”, HK\$4.42 million, Project Coordinator: Professor X. Guan (Department of Clinical Oncology), in collaboration with CUHK and HKUST.

74. Over the past 10 years, HKU has received the largest share (31%) amongst institutions of projects (50) and funding (HK\$293.84 million) through the CRF.

Humanities and Social Sciences Prestigious Fellowship Scheme (HSSPFS)

75. In the 2019–20 funding round of the HSSPFS, of the 9 applications funded HKU received the largest share (as with last year), with 4 successful projects awarded a total of HK\$1.901 million (excluding on-costs):

- (a) “Intervention and Prevention of Neurodegenerative Disease in the Greater Bay Area (GBA)”, Professor B.S. Weekes (Faculty of Education);
- (b) “The Extraterritorial Print Adventures of Early American Missions to China: The Cultural Origin and Diplomatic Legacies of American Evangelism during the Opium Wars”, Professor K.A. Johnson (School of English);
- (c) “Constitutional Review and Judicial Independence under One Country, Two Systems: Convergence or Divergence?”, Professor J.M.M. Chan (Department of Law); and
- (d) “Gendered Divorce Litigation in China”, Professor X. He (Department of Law).

76. Since the scheme began in 2012–13, HKU has the highest cumulative number of fellowships and largest funding amount of any UGC-funded institution: 20 fellowships (total value HK\$12.059 million) out of a total of 50 awarded (total value HK\$32.22 million).

Research Impact Fund (RIF)

77. The RIF was launched in 2018–19 to encourage local academics to consider and articulate the potential of research to deliver benefit for the wider community, encourage more impactful and translational research projects, and encourage a greater volume of collaborative research beyond academia. A total of HK\$193 million (excluding on-costs) was awarded to 30 projects in 2018–19. HKU submitted 46 initial applications, of which 11 were shortlisted and the following 7 projects were supported receiving total funding of HK\$45.839 million:

- (a) “Tools to Inform Policy: Chinese Communities’ Action in Response to Dementia (TIP-CARD)”, Dr G.H.Y. Wong (Department of Social Work and Social Administration);
- (b) ““Modular Integrated Construction 2.0+’ for Quality and Efficient Tall Residential Buildings through Advanced Structural Engineering, Innovative Building Materials and Smart Project Delivery”, Dr W. Pan (Department of Civil Engineering);
- (c) “Antimicrobial Resistance Comprehensive Etiology Study (ACES)”, Professor K. Fukuda (School of Public Health);
- (d) “Balancing the Opportunities and Risks of Financial Technology: FinTech Regulation and Policy”, Professor D.W. Arner (Department of Law);
- (e) “Novel Ultra-strong and Ductile Steel at Low Cost”, Dr M. Huang (Department of Mechanical Engineering);
- (f) “Combination Approach to Combat Metallo- β -lactamase Positive Superbugs”, Professor H. Sun (Department of Chemistry); and

- (g) “Multiphase Materials by All-aqueous Microfluidics for Biomedical Applications”, Dr H.C. Shum (Department of Mechanical Engineering).

78. Initiatives have been introduced at HKU in recent years to actively incubate projects with a focus on translation and impact. For example, Dr Huang received a Seed Fund for Translational and Applied Research award in 2016–17 for his work on ultra-strong steel, and Dr Shum received the same internal seed funding in 2017–18 for his work on microfluidics, as well as Platform Technology Funding in 2016–17.

NSFC/RGC Joint Research Scheme

79. Through the National Natural Science Foundation of China/Research Grants Council (NSFC/RGC) Joint Research Scheme in 2018–19, funding of HK\$26 million was awarded to 23 research projects from 6 UGC-funded institutions. HKU submitted 52 initial applications, of which 14 were shortlisted and 3 funded. HKU received total funding of HK\$3.6 million for the following projects:

- (a) “A Mechanistic and Clinicopathological Study on the Impact of Invadosomes in Promoting Nasopharyngeal Carcinoma (NPC) Metastasis under the Interplay of Stromal Macrophages and EBV Infection”, Professor G.S.W. Tsao (School of Biomedical Sciences);
- (b) “Investigation on the Immunological Cross-Protection between Different Human Coronaviruses”, Professor J.S.M. Peiris (School of Public Health); and
- (c) “Analysis of Lipid Metabolic Pathways and Gene Regulatory Networks in Anther Development in Arabidopsis and Rice”, Professor M.L. Chye (School of Biological Sciences).

80. In addition, Dr Y. Chen (Department of Mechanical Engineering) was awarded a conference grant of HK\$0.25 million for the “Conference on Advanced Materials for Energy Related Applications” held in June 2019.

EU (European Union)-HK Research and Innovation Cooperation Co-funding Mechanism by the RGC

81. The EU-HK Research and Innovation Cooperation Co-funding Mechanism by the RGC (formerly European Commission (EC)/ RGC Collaboration Scheme) was launched in 2016–17 to foster European–Hong Kong collaboration in academic research. A total of HK\$5.638 million was awarded to 2 projects from 2 UGC-funded institutions in 2018–19, including a project from HKU on “Induced Pluripotent Stem Cell-based Therapy for Spinal Regeneration (iPSpine)” carried out by Professor D. Chan (School of Biomedical Sciences) securing funding of HK\$ 2.996 million (excluding on-costs).

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

82. HKU-SIRI and HKU-ZIRI members are eligible to apply for funding through the NSFC. HKU-SIRI received total funding of RMB16.17 million for 20 projects and HKU-ZIRI received total funding of RMB0.63 million for 1 research project under the NSFC in 2018–19.

Innovation Technology Support Programme (ITSP)

83. Up to the end of June 2019, HKU has had 228 projects approved under the Innovation and Technology Fund’s ITSP, which was introduced in 1999. This represents 17% of the 1,346

projects approved under ITSP, and HKU has received total funding of HK\$564.46 through this scheme.

84. In the reporting year, 17 HKU projects were awarded total funding of HK\$30.27 million (14 projects with funding of HK\$38.42 million in 2017–18). A further 4 projects were funded HK\$4.85 million under the University-Industry Collaboration Programme, and 2 projects were funded HK\$7.07 million under the Innovation and Technology Fund for Better Living.

Joint Laboratory Funding Scheme (JLFS)

85. The JLFS, set up on a one-off basis, aims to enhance the research infrastructure of the joint laboratories between the Chinese Academy of Sciences and the Hong Kong universities. Twenty eligible joint laboratories in Hong Kong applied and the RGC supported 11 applications at a total amount of HK\$30 million. HKU submitted 4 applications, of which 3 were approved, securing funding of HK\$8.128 million:

- (a) “Upgrading of Laser Ablation–Multiple Collector–Inductively Coupled Plasma–Mass Spectrometer (LA-MC-ICP-MS) for Simultaneous Measurement of U/Pb and Hf Isotopes”, Professor M. Sun (Department of Earth Sciences);
- (b) “A Technology R&D Platform for the Development and Evaluation of Bioactive Biomaterials for Ageing Osteoporotic Bone Fractures Treatment”, Professor W.W. Lu (Department of Orthopaedics and Traumatology); and
- (c) “Photo-Functional Molecules and Materials. Photophysics, Photo-Catalysis and Renewable Energy Schemes”, Professor C.M. Che (Department of Chemistry).

NSFC 2019 Excellent Young Scientists Fund (Hong Kong and Macau)

86. Researchers at HKU achieved excellent results in the inaugural round of the 2019 Excellent Young Scientists Fund (Hong Kong and Macau). Seven young scientists from HKU – the largest number in any institution in Hong Kong and Macau – have been awarded the prominent fund under the National Natural Science Foundation of China (NSFC), an organisation directly affiliated to the State Council for the management of the National Natural Science Fund. In the first round, only 25 projects were funded for Hong Kong and Macau, and HKU was funded the highest number of projects. Each project will receive funding of RMB1.3 million (HK\$1.5 million) for a maximum period of 3 years, in the form of cross-border remittance to directly support researchers’ work in Hong Kong. HKU’s winning scientists are Dr X. Hu (Psychology), Dr X. Hui (Medicine), Dr T.Y. Lam (Public Health/Civil Engineering), Dr X.D. Li (Chemistry), Dr A. Shum (Mechanical Engineering), Dr J. Wu (Biological Sciences), and Dr B. Zhang (Earth Sciences).

Public Policy Research Funding Scheme

87. In 2018–19, the University was awarded total funding of HK\$3.821 million for 6 projects under the Public Policy Research Funding Scheme:

- (a) “Re-establishing Ferry’s Key Position in the Sustainable Transport System of Hong Kong”, Professor B.P.Y. Loo (Department of Geography);
- (b) “Ambient Ozone Levels in Hong Kong: The Lower The Better?”, Dr. L. Tian (School of Public Health);
- (c) “Hong Kong Youths’ Attitudes Towards Suicide, Coping Strategies and Online Help-seeking”, Professor T.P. Lam (Department of Family Medicine and Primary Care);

- (d) “Defining Sonhood: The Exploration of Lived Experience of the Caregiving Sons in Their Late Adulthood in Hong Kong”, Dr V.W. Lou (Department of Social Work and Social Administration);
- (e) “Promoting Science, Technology, Engineering, and Mathematics Education in Hong Kong: Using Analytics-supported E-learning to Enhance Student Attitudes and Achievement in Science”, Dr. G. Chen (Faculty of Education); and
- (f) “‘Finding the Needles in a Haystack’: Identification of the Illegal Dumping of Construction Waste Using Big Data”, Professor W.W. Lu (Department of Real Estate and Construction).

Strategic Public Policy Research Funding Scheme

88. The Policy Innovation and Co-ordination Office awarded funding of HK\$2.902 million to one project in 2018-19 under the Strategic Public Policy Research (SPPR) Funding Scheme, titled “Boosting Construction Waste Material Sharing in the Guangdong-Hong Kong-Macao Bay Area”, which is led by Professor W.W. Lu (Department of Real Estate and Construction).

Croucher Foundation: Fellowships and Innovation Awards

89. HKU has been awarded more Croucher Foundation Senior Research Fellowships (55 out of a total of 119 fellowships awarded since 1997, including Senior Medical Research Fellowships) than any other local institution. In the reporting year, 1 of the 4 fellowships was to HKU: Professor S.C.W. Tang was awarded the Senior Medical Research Fellowship (see paragraph 103(q)).

90. 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 19 awards given since the inception of the Innovation Awards in 2012, 8 have been awarded to HKU researchers. In 2018–19, Dr Y. Wang (Department of Chemistry) was awarded HK\$5 million over 5 years through the Innovation Awards for his research project “Low-Symmetry Patchy Particles (LSPPs): Precision in Colloidal Bonding, Assembly, and Locomotion”.

Other Croucher Foundation Funding

91. Support for doctoral and postdoctoral research is also provided by the Foundation through studentships and fellowships. For example, in the reporting year, Mr C.H. Lee (a PhD student in the Department of Pathology) received a Butterfield-Croucher Studentship to support his research at HKU, and 3 HKU PhD graduates received Croucher Fellowships for Postdoctoral Research to undertake their research overseas: Dr T.M.W. Choi (a PhD graduate of the Faculty of Education) to undertake research at University College London; Dr Y. Wang (a PhD graduate of the School of Biological Sciences) to undertake research at Harvard Medical School; and Dr S.K. Fung (a PhD graduate of the Department of Chemistry) to undertake research at the University of California, Berkeley.

92. 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 ageing and longevity was held in May 2019. Two grants of HK\$0.6 million each were awarded to the University in May 2019 for 2 ASIs on “Emerging and enabling

technologies for understanding development and disease”, and “Metals in biology and medicine: from molecular image to drug resistance”.

93. 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 2 summer courses in August 2019 on computational genomics and advanced imaging.

94. Sponsorship is also provided through the Croucher Foundation for international conferences and seminars. During the reporting period, HKU organised the 6th World Conference on Research Integrity with support of \$0.5 million, and 2 conferences in the areas of electronic materials and devices, and marine pollution and ecotoxicology, each with funding of \$100,000. For conferences in the coming year, the Foundation approved in May 2019 sponsorship of \$100,000 for a conference to be held in partnership with the American Chemical Society (ACS) Publications on inorganic and synthetic chemistry.

Hong Kong Jockey Club

95. The University received significant and generous donations and funding for research projects from the Hong Kong Jockey Club. Examples during the reporting year included HK\$30.82 million for a 30-month project led by Professor N.W.Y. Law (Faculty of Education) for “Jockey Club Self-directed Learning in STEM Programme”, HK\$29.81 million for a 3-year project led by Dr A.Y.M. Chow (Department of Social Work and Social Administration) for “Jockey Club End-of-Life Community Care Project (Phase II)”, and HK\$27.77 million for a 44-month project led by Professor S.F. Lam (Department of Psychology) for “The Hong Kong Jockey Club Mindful School Culture Project”.

HK Scholars Program

96. 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 2019 exercise year of this initiative, 9 HKU researchers from the Faculties of Engineering (5), Medicine (1) and Science (3) were granted with support for PDFs for a period of 2 years.

Overseas Funding Sources

97. 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 that has a yearly award to HKU of ~HK\$8 million. In 2019, HKU received ~HK\$5.5 million from the Templeton World Charity Foundation, Inc. to carry out a project by researchers in the Department of Social Work and Social Administration. A total of HK\$1.75 million has been awarded from the AXA Research Fund for a project entitled “Earthquake and Typhoon Vulnerability Asia Pacific”.

Published Research

98. 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 2017–18). For 2018–19, HKU had 5,276 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 618,256 citations to 34,685 HKU papers in journals tracked by Clarivate Analytics in Essential Science Indicators between January 2009 and April 2019. This was the highest number of citations of any UGC-funded institution. In 2018, the University had 5,636 publications in journals tracked by Clarivate Analytics, again more than any other UGC-funded institution, attracting 24,073 citations to date (data collected from Web of Science on December 3, 2019). Clarivate Analytics also ranked 119 HKU professoriate staff among the world's top 1% of scientists, based on the number of citations recorded for their publications (July 2019). In addition, 13 HKU academics have been named among the world's top scientists in the 2019 Highly Cited Researchers from Clarivate Analytics, based on the number of papers officially designated by Essential Science Indicators as Highly Cited Papers (November 2019) – detailed below in paragraph 103(j).

Prestigious Publications

99. HKU has an excellent record of published research, both in discipline-specific journals and in more high-profile publications such as *Science* and *Nature*. Examples from 2018–19 include the following journal publications:

- (a) Tsang T.K., Fang V.J., Ip D.K.M., Perera R.A.P.M, So H.C., Leung G.M., Peiris J.S.M, Cowling B.J. and Cauchemez S., “Indirect protection from vaccinating children against influenza in households”, *Nature Communications*, 2019, 10, 106, 1-7.)
- (b) Luo R, Sedlazeck F.J., Lam T.-W. and Schatz M.C., “A multi-task convolutional deep neural network for variant calling in single molecule sequencing”, *Nature Communications*, 2019, 10, 998, 1-7.)
- (c) Scicluna, N. and Auer, S., “From the rule of law to the rule of rules: technocracy and the crisis of EU governance”, *West European Politics*, 22 Mar 2019, DOI: 10.1080/01402382.2019.1584843, 1-23.
- (d) Chiribella G. and Ebler D., “Quantum speedup in the identification of cause-effect relations”, *Nature Communications*, 2019, 10, 1472, 1-8.)
- (e) Li L.K., Tang M.C., Lai S.L., Ng M., Kwok W.K., Chan M.Y. and Yam V.W.W., “Strategies towards rational design of gold(III) complexes for high-performance organic light-emitting devices”, *Nature Photonics*, 2019, 13, 185-191.
- (f) Gao J., Leung H.K., Wu B.W.Y., Skouras S. and Sik H.H., “The neurophysiological correlates of religious chanting”, *Scientific Reports*, 2019, 9, 4262.
- (g) Gao X., Nowak-Imiale M., Chen X., Chen D., Herrmann D., Ruan D., Chen A.C.H., Eckersley-Maslin M.A., Ahmad S., Lee Y.L., Kobayashi T., Ryan D., Zhong J., Zhu J., Wu J., Lan G., Petkov S., Yang J., Antunes L., Campos L.S., Fu B., Wang S., Yong Y., Wang X., Xue S.G., Ge L., Liu Z., Huang Y., Nie T., Li P., Wu D., Pei D., Zhang Y., Lu L., Yang F., Kimber S.J., Reik W., Zou X., Shang Z., Lai L., Surani A., Tam P.P.L., Ahmed A., Yeung W.S.B., Teichmann S.A., Niemann H. and Liu P., “Establishment of porcine and human expanded potential stem cells”, *Nature Cell Biology*, 2019, 21, 687-699.
- (h) Ling Y.H. and Yuen K.W.Y., “Point centromere activity requires an optimal level of

centromeric noncoding RNA”, *Proceedings of the National Academy of Sciences of the USA*, 2019, 116 (13) 6270-6279.

- (i) Law N. and Liang L., “Sociotechnical co-evolution of an e-Learning innovation network”, *British Journal of Educational Technology*, 2019, 50 (3), 1340-1353.
- (j) Bao X., Liu Z., Zhang W., Wong J.W.H., Yuen K.W.Y and Li X.D., “Glutarylation of Histone H4 Lysine 91 Regulates Chromatin Dynamics”, *Molecular Cell*, 2019, 76 (4), 660-675.

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

- (a) Dikotter F., *How to Be a Dictator: The Cult of Personality in the Twentieth Century*, 2019, London, UK: Bloomsbury.
- (b) Clarke, D., *China-Art-Modernity: A Critical Introduction to Chinese Visual Expression from the Beginning of the Twentieth Century to the Present Day*, 2019, Hong Kong: Hong Kong University Press.
- (c) Ng, E.N.S., *Common Law in an Uncommon Classroom: Judicial Interpreting in Hong Kong*, 2018, Amsterdam, Netherlands: John Benjamins Publishing Company.

Patents

101. In 2018–19, HKU filed 207 patent applications, and 67 patents were granted and 2 patent applications were abandoned. HKU has filed 2,215 patents since 1998 in various parts of the world, mostly in the United States (952), the European Union (274) and Greater China (416 in China, including Hong Kong, and 29 in Taiwan). Within the same period, 791 patents were granted, 34% of which were in the United States (272).

Agreements/Legal Documents

102. The University handled 875 technology/knowledge transfer related agreements/ legal documents in 2018–19 – such as licensing, consultancy and materials transfer agreements – with counter signing parties in Hong Kong (317), the People’s Republic of China (263), North America (135), the European Union (71) and the rest of the world (89).

External Academic Honours

103. 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 2018–19, including the following examples:

- (a) Professor G. Zhao, Professor of the Department of Earth Sciences, has been elected as Member of the Chinese Academy of Sciences (CAS) in recognition of his distinguished achievements in earth sciences research, in particular his contribution in the research of metamorphic petrology, Precambrian geology and supercontinents. Of the 11 Members elected this year under the Geographic Science Section, Professor Zhao is the only academic from Hong Kong bestowed with this honour. He was presented an academician certificate at a ceremony in November.
- (b) Seven HKU scientists have been awarded through the 2019 Excellent Young Scientists Fund (Hong Kong and Macau) under the National Natural Science

Foundation of China (NSFC). HKU's winning scientists are Dr X. Hu (Psychology), Dr X. Hui (Medicine), Dr T.Y. Lam (Public Health/Civil Engineering), Dr X.D. Li (Chemistry), Dr A. Shum (Mechanical Engineering), Dr J. Wu (Biological Sciences), and Dr B. Zhang (Earth Sciences). (See paragraph 86 for more details).

- (c) Professor S.Y.R. Hui – Philip K.H. Wong Wilson K.L. Wong Professor in Electrical Engineering, Chair Professor of Power Electronics of the Department of Electrical and Electronic Engineering – has been named a Fellow of the US National Academy of Inventors (NAI). Election to NAI Fellow status is the highest professional distinction accorded to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible impact on quality of life, economic development and the welfare of society. The 2018 class of 148 Fellows represent 125 research universities and governmental and non-profit research institutes worldwide and are named inventors on nearly 4,000 issued U.S. patents. They include Nobel Laureates, recipients of the U.S. National Medal of Technology & Innovation and U.S. National Medal of Science, and presidents and senior leaders of research universities and non-profit research institutes. Professor Hui is the only Fellow named from an HK university.
- (d) Professor Andy Hor, Vice-President (Research) and Chair Professor of Metallic Chemistry and Material, was elected a fellow of the European Academy of Sciences (EurASc). EurASc is a non-profit, non-governmental and independent organisation established in 2003 in Brussels, aiming to promote excellence in science and technology. It awards prestigious prizes including the Leonardo da Vinci Award and the Blaise Pascal Medal. It currently has about 600 fellows, over 10% of whom are Nobel Laureate and Fields Medalists from over 40 countries. Professor Hor is honoured for his achievements and contributions to academia in the area of structural metallic chemistry. He specialises in the design, synthesis and structural analysis of novel molecules. His research lies at the fundamentals of molecular science – to analyse the molecular composition and structure as a means to understand the properties and activities of a molecule or molecular materials, and from such knowledge, design new molecules, as well as develop new functions and applications.
- (e) Professor P.K.H. Tam, Chair of Paediatric Surgery and Li Shu-Pui Professor in Surgery, received the Rehbein Medal for 2020 from the European Paediatric Surgeons' Association (EUPSA) in recognition of his outstanding contribution to the advancement of paediatric surgery. EUPSA is the largest association of paediatric surgeons worldwide. The Rehbein Medal is presented on the occasion of the EUPSA annual congress to a distinguished paediatric surgeon for outstanding lifetime achievements in paediatric surgery, and for his/her significant contribution to the progress and international acknowledgment of the field. Since its inception in 2005, the Rehbein Medal has been awarded to ten surgeons in Europe and five in the US. Professor Tam is the first surgeon in Asia to be presented with this prestigious award.
- (f) Professor F.K.S. Leung, Dean of the Graduate School and Chair Professor and Kintoy Professor in Mathematics Education, Faculty of Education, was elected an Honorary Member of the International Association for the Evaluation of Educational Achievement (IEA) at the Association's General Assembly Meeting held in Ljubljana, Slovenia. Professor Leung is the first Asian recipient of this honour. IEA is the largest international cooperation of national research institutions, governmental research agencies, scholars, and analysts working to research,

understand, and improve education worldwide. Since IEA's establishment more than 60 years ago, the Association has appointed a small number of individual honorary members, whose election is based on their excellent contributions to the work and mission of the IEA over the years. The honorary membership serves as a recognition of Professor Leung's outstanding contributions to the Association.

- (g) Dr R. Luo, Assistant Professor of Computer Science, was named as one of the top 10 young innovators under the age of 35 in Asia Pacific by MIT Technology Review 2019. Close to 200 nominations from talented researchers, inventors and entrepreneurs from the region were received, and this was the first year that innovators from HK were able to apply. Dr Luo's research covers a diversity of topics in computational biology, and his interdisciplinary research results have been published in peer-reviewed journals such as *Nature*, *Nature Biotechnology*, and *Bioinformatics*. He is currently working on extending the role of artificial intelligence in a localised version of precision medicine.
- (h) Dr J. Jia, Assistant Professor of Marketing, became a Marketing Science Institute (MSI) Young Scholar 2019 – a distinguished accolade to recognise young marketing scholars worldwide with great potential to be the 'leaders of the next generation of marketing academics'. Dr Jia's research focuses on consumer behaviour and digital experimentation. His recent work involves combining social experiments with individual-level mobile telecom metadata to study what drives people to respond to strangers online. He also studies the psychological recovery of earthquake victims by analysing mobile app usage data and earthquake data. These and other related projects, combined with big data and psychological theory, will help us understand human dynamics and consumer behaviour. MSI is a non-profit research organisation dedicated to bridging the gap between academic marketing theory and business practice. This year, the biennial MSI Young Scholar Program recognised 35 promising marketing academics from around the world.
- (i) Two academic staff from the Faculty of Engineering were elected IEEE Fellows 2019. Professor Y. Yu of the Department of Computer Science was awarded for his contributions to geometric and image-based modelling, and Dr L. Jiang of the Department of Electrical and Electronic Engineering was awarded for his contributions to broadband computational electromagnetic methods. Professor Yu is an outstanding researcher in computer vision and computer graphics, whose work has significant impact in both the research community and the film visual effects industry. Innovative technologies that he has co-invented, such as image-based modelling and geometry-guided fluid simulation, have been widely adopted by the film visual effects industry. Dr Jiang has made distinctive contributions in large-scale heterogeneous electromagnetic modelling, EMC/EMI for VLSI and packaging, and multiphysics characterisation methodologies. He is a frontier scholar in broadband fast multipole algorithms and low frequency integral equations and in solving practical heterogeneity with linear/nonlinear, explicit/measured, and deterministic/stochastic properties in electromagnetic analysis.
- (j) Thirteen 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 2019 are Professor Y. Guan and Professor J.S.M. Peiris (School of Public Health); Dr K. Huang (Department of Electrical and Electronic Engineering);

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); Dr S.M. Yiu (Department of Computer Science); 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).

- (k) Dr T. Ng, Associate Professor of Management and Strategy, Faculty of Business and Economics, co-written article, "Employee perceptions of corporate social responsibility: Effects on pride, embeddedness, and turnover" with Kai Chi Yam and Herman Aguinis (2019, *Personnel Psychology*), is a Winner of the 2018 IACMR-RRBM Award for Responsible Research. The award, co-sponsored by the International Association for Chinese Management Research, and the Community for Responsible Research in Management, recognises "excellent scholarship that focuses on important issues for business and society using sound research methods with credible results." A committee of 46 highly accomplished scholars reviewed 106 nominations, judging each work on its credibility and usefulness based on the 7 principles of responsible science—service to society; stakeholder involvement; impact on stakeholders; valuing both basic and applied contributions; valuing plurality and multidisciplinary collaboration; sound methodology; and broad dissemination.
- (l) Professor T.M.C. Lee, May Professor in Neuropsychology and Chair Professor of Psychology, and her team won the 2019 State Scientific and Technological Progress Award (Second Class) for their project on "Neurorehabilitation Techniques for Clinical Application Developed through the Integration of Traditional Chinese and Western Medicine". The work was undertaken collaboratively with universities in Mainland China and Hong Kong, as well as an industrial collaborator. Professor Lee and her team also received the 2018: Chinese Association of Rehabilitation Medicine – Science and Technology Award (First Class) for their "Research on Key Technologies and Evaluation for Post Stroke Cognitive Impairment Rehabilitation", a collaborative project with universities in Mainland China and Hong Kong.
- (m) Professor Z.Q. Yue from the Department of Civil Engineering and his team won the second class award of the 9th Science and Technology Award from the China Society for Rock Mechanics and Engineering for the study of the "Science and Technology of the Large-scale Underground Engineering of the Longyou Grottoes in Zhejiang Province" in the category of Natural Science. Professor Yue's team included members from the Institute of Geology and Geophysics of the Chinese Academy of Sciences, China University of Geosciences and Longyou Grottoes Institute. The team conducted the research study on "why the large ancient underground rock caverns (Longyou Grottoes) in Longyou City, Zhejiang Province remained intact for thousands of years".
- (n) Professor A.H.Y. Chen, Cheng Chan Lan Yue Professorship in Constitutional Law, received the Li Buyun Law Prize 2018 at the Guangdong University of Finance and Economics. He is the first Hong Kong law academic to receive this prize. Established in 2013, the Li Buyun Law Prize recognises organisations and individuals who have made "eminent contributions" to Chinese and foreign law research, and legal education exchange. Professor Chen was awarded for his contributions to the rule of law construction and the important role he has played in promoting the rule of law exchange between China and the world.

- (o) Dr W. Pan, Associate Professor of the Department of Civil Engineering, was awarded “Distinguished Young Investigator of China Frontiers of Engineering” by the Chinese Academy of Engineering (CAE). Dr Pan was awarded at the 2019 China-America Frontiers of Engineering (CAFOE) Symposium held in San Diego, California, USA from June 20 to 22, 2019, jointly organised by the CAE and the US National Academy of Engineering. Through participation in the 6th China Youth Symposium of Frontiers of Engineering by CAE last December, Dr Pan was selected, together with a group of distinguished young engineers, to represent China to take part in the CAFOE Symposium, in which 60 of the most promising young engineers from China and the US were invited to attend. At the Symposium, Dr Pan delivered a presentation entitled “Modular Integrated Construction (MiC) for Smart City”.
- (p) Two HKU projects were conferred Higher Education Outstanding Scientific Research Output Awards (Science and Technology) by the Ministry of Education (MOE). A First Class award was given to the project “Paleoproterozoic Tectono-thermal Evolution of the Jiao-Liao-Ji Belt and Early Precambrian Transition of Tectonic Regimes” by Professor G.C. Zhao and Professor M. Sun (Department of Earth Sciences) in collaboration with the Ocean University of China and Chinese Academy of Geological Sciences. A Second Class award went to the project “Stochastic Optimization Theory and Technique for Next-Generation Wireless Systems” by Professor K. Huang (Department of Electrical and Electronic Engineering) in collaboration with HKUST and Zhejiang University.
- (q) Professor S.C.W. Tang – Chair of Renal Medicine and Yu Professor in Nephrology, Department of Medicine – was among the seven awardees honoured by The Croucher Foundation for their excellent scientific research achievements for 2019–20. His research focuses on understanding the cellular and molecular mechanisms of chronic progressive kidney disease that universally heralds the development of end-stage kidney failure. He has made seminal observations on the role of the kidney tubule cell in orchestrating kidney inflammation and fibrosis in proteinuric nephropathies and diabetic kidney disease, the commonest causes of kidney failure worldwide. The Croucher Senior Medical Research Fellowship will enable Professor Tang to utilise high-throughput platform technologies to further dissect the role of innate immunity in different resident and myeloid cells during renal inflammation, a critical step leading to kidney fibrosis and ultimate organ failure. Novel therapeutic targets identified from these investigations could pave the way for future drug development to advance treatment of chronic kidney disease that currently lacks specific therapy.
- (r) A civil engineering team of MSc students from HKU won a total of six awards at “Introducing and Demonstrating Earthquake Engineering Research in Schools” (IDEERS2018), including the Championship (First Prize) of the Postgraduate Division, Structural Design Awards, Aesthetic Architecture Award, Design-Concept Exhibition Awards, Best Presentation Award and Innovation Award of Seismic Isolation and Energy Dissipation. The winning team consisted of 4 MSc Civil Engineering students – Peter Choi Siu Kwan, Tommy Wong Po Hon, Michael Cheng Chun Ho and Andy Tang Hing Ka – and was supervised by Dr R.S.K. Leung, Associate Professor of Department of Civil Engineering. They participated in the postgraduate division of the competition and joined a 3-day competition at the Taiwan National Center for Research on Earthquake Engineering.
- (s) One of the eight awards in the Fulbright-RGC Hong Kong Research Scholar Award

Programme 2019-20 went to Miss H.F. CHAN, a PhD student in the Division of Speech and Hearing Sciences. With the funding support of HK\$74,880, Miss Chan will conduct dissertation research on the topic “Evaluation of Speech-Specific Quality of Life and Analysis of Risk Factors in Patients after Total Laryngectomy Based on Subjective and Objective Outcomes” at the University of California, San Francisco, USA.

- (t) Two HKU PhD candidates won awards at the Hong Kong Institution of Science Annual Conference held in 2018. In the field of Life Sciences, Angel Yun Sum Wong (Department of Pharmacology and Pharmacy) won the HKIS Towngas 2018 Young Scientist Award, while David Kung Chun Chiu (Department of Pathology) received an Honourable Mention.
- (u) In 2019, HKU students won 16 awards at the 5th Hong Kong University Student Innovation and Entrepreneurship Competition 2019. RPg students received one First Prize and two Second Prizes under the ‘Innovation’ section (for “Paper-based aluminium-air green battery: Mechanically rechargeable, flexible and printable”, “Tail domains of myosin-1e regulate phosphatidylinositol signalling and F-actin polymerization at the ventral layer of podosomes” and “Smart investment portfolio management system based on advanced artificial intelligence and blockchain techniques”); and a First and Second Prize under the ‘Entrepreneurship’ section (for “AI Academy” and “AI-enabled full-automatic dental prosthesis design”).
- (v) A team of HKU students was awarded 1st runner-up at the Student Competition of 2019 Global Grand Challenges Summit (GGCS) in London, where 15 student teams from around the world competed on solutions that address the world’s grand challenges in engineering. The winning work was “ClearBot”, an AI-powered, autonomous plastic-collecting robotic solution that took aim at the global ocean plastic epidemic. The HKU team comprised Angel Woo Chung-yu (BEng(CompSc)), Utkarsh Goel (BEng(CompSc)), Ahmed Abbas Alvi (BEng(ME)), Ma Jiacheng (BSc(ActuarSc)) and Sidhant Gupta (BEng(CE)), coached by Dr H.K.H. So of the Department of Electrical and Electronic Engineering,

Outstanding Researcher Award Scheme

104. HKU’s annual Outstanding Researcher Award Scheme recognises the excellent work of the University’s researchers. At a ceremony on March 29, 2019, the following awards, for research achievements during and prior to the report period, were presented:

- (a) *Outstanding Researcher Award*
Professor X.C. Li, Department of Chemistry
Professor N. Rao, Faculty of Education
- (b) *Outstanding Young Researcher Award*
Miss C.S.W. Chan, Department of Law
Dr E.W.Y. Chan, Department of Pharmacology and Pharmacy
Dr W. Gu, Department of Law
Dr M. Huang, Department of Mechanical Engineering
Dr B.R. Kane, Department of Mathematics
Dr V.H.F. Lee, Department of Clinical Oncology
Dr J.H.C. Leung, School of English
Dr C.K. Quek, Department of Politics and Public Administration

- (c) *Outstanding Research Student Supervisor Award*
 Professor A.Y.H. Leung, Department of Medicine
 Professor Y.C.D. Leung, Department of Mechanical Engineering
 Professor A.G.O. Yeh, Department of Urban Planning and Design

105. 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:** “Association between adiposity outcomes and residential density: a full-data, cross-sectional analysis of 419 562 UK Biobank adult participants”, *The Lancet Planet Health*, 2017, Vol. 1, Issue 7, e277–288 by Chinmoy Sarkar, Chris Webster, John Gallacher.
- **Faculty of Arts:** *Beethoven and Freedom*, Oxford University Press, 2017, 288pp. by Daniel K L Chua.
- **Faculty of Business and Economics:** “Aspiring for change: A theory of middle class activism”, *The Economic Journal*, 2017, Vol. 127, Issue 603, pp. 1318–1347 by Heng Chen, Wing Suen.
- **Faculty of Dentistry:** “Nanoparticle-encapsulated baicalein markedly modulates pro-inflammatory response in gingival epithelial cells”, *Nanoscale*, 2017, 9, pp. 12897–12907 by Xuan Li, Wei Luo, Tsz Wing Ng, Ping Chung Leung, Chengfei Zhang, Ken Cham-Fai Leung, Lijian Jin.
- **Faculty of Education:** “Does growth rate in spatial ability matter in predicting early arithmetic competence?”, *Learning and Instruction*, June 2017, Vol. 49, pp. 232–241 by Xiao Zhang, Dan Lin.
- **Faculty of Engineering:** “High dislocation density-induced large ductility in deformed and partitioned steels”, *Science*, September 2017, Vol. 357, Issue 6355, pp. 1029 – 1032 by B.B. He, B. Hu, H.W. Yen, G.J. Cheng, Z.K. Wang, H.W. Luo, M.X. Huang.
- **Faculty of Law:** *Chinese Small Property: The Co-Evolution of Law and Social Norms*, Cambridge University Press, 2017, 230pp. by Shitong Qiao.
- **Li Ka Shing Faculty of Medicine:** “The FGF21-CCL11 axis mediates beiging of white adipose tissues by coupling sympathetic nervous system to type 2 immunity”, *Cell Metabolism*, September 2017, Vol. 26, Issue 3, pp. 493–508 by Zhe Huang, Ling Zhong, Jimmy Tsz Hang Lee, Jialiang Zhang, Donghai Wu, Leiluo Geng, Yu Wang, Chi-Ming Wong, Aimin Xu.
- **Faculty of Science:** “Ancient hydrothermal seafloor deposits in Eridania basin on Mars”, *Nature Communications*, July 2017, 8: 15978 by Joseph R. Michalski, Eldar Z. Noe Dobrea, Paul B. Niles, Javier Cuadros.
- **Faculty of Social Sciences:** “Expanding moral panic theory to include the agency of charismatic entrepreneurs”, *The British Journal of Criminology*, September 2017, Vol. 58, Issue 4, pp. 993–1012 by Paul Joosse.

Major International Research Events

106. A range of important international research conferences were organised by HKU in the

2018–19 reporting period, including the following:

- (a) September 21-22, 2018 – the 6th Asian Historical Economics Conference (AHEC) was hosted by Asia Global Institute and the Faculty of Business and Economics at HKU, in collaboration with the International Society for Quantitative Society. AHEC is held biennially, and aims to bring together researchers working on the economic history of all regions of Asia, as well as those comparing Asia with other regions.
- (b) October 18-20, 2018 – the International Conference on Smart Mobility and Logistics in Future Cities was co-organised by the Institute of Transport Studies at HKU, the Chartered Institute of Logistics and Transport in HK, and the Transport Department of the HK SAR Government. The conference was held at the HK Conference and Exhibition Centre. Keynotes speakers came from Europe, the USA, and Hong Kong.
- (c) December 13-14, 2018 – an international conference on “Histories and Ecologies of Health” was held at HKU, hosted by the Centre for the Humanities and Medicine. Disease and health are increasingly understood in relation to complex human, environmental, and inter-species interactions. The conference sought to explore this human non-human entanglement, tracing histories of ecological thought to show how conceptualisations of “ecology” have shaped scientific, medical and health practices, and more broadly, the management of “nature”.
- (d) April 13–14, 2019 – the 16th Hong Kong International Orthopaedic Forum was held in April 2019 at HKU. The main theme was “Repair, Replace and Recovery”, with a focus not only on surgical repair and replacement for orthopaedic diseases, but also on rehabilitation and recovery.
- (e) June 10–14, 2019 – The “International Conferences on Marine Pollution and Ecotoxicology” has over 24 years of history, and this conference series is a signature event in the international arena of marine pollution research. This 9th conference was jointly organised by the Swire Institute of Marine Science and School of Biological Sciences, HKU and the State Key Laboratory of Marine Pollution (CityU). More than 30 world-renowned experts were invited to share their knowledge, experience and latest advancements in the field with some 270 scientists, environmental professionals and environmental regulators from 18 different countries. The Conference aims to provide a forum for experts all over the world to meet and discuss their frontier research, and the latest scientific and technological advancements in relation to marine pollution and ecotoxicology; and to advance participants' understanding of local, regional and global marine pollution problems and jointly explore their solutions, hoping that such problems can be more easily solved in the future.

International Rankings

107. The University stands among the world’s top universities, ranking 25th and 35th in 2020 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.

108. In the QS 2019 subject rankings, HKU was ranked in the top 50 worldwide for 32 subjects (10 of which were in the top 20); 18 subjects ranked among the top 5 in Asia and 18 subjects were No. 1 in Hong Kong. HKU was the only institution in Asia to rank in the top 10 for Education. In the THE World University Rankings by Subject 2020, for Education HKU is ranked 3rd globally (behind Stanford and Harvard) and remains the only university in Asia to be ranked in the top 10 in this subject.

109. In 2019, HKU was ranked the most international university in the world by THE, moving up from third place to first place. The ranking is compiled using the international student score, international staff score, international co-authorship score and international reputation metrics collected for the THE World University Rankings 2019. In the THE's University Impact Rankings 2019 – the first year for this ranking – HKU ranked 10th and was the only institute from Asia in the top 20. In the 2019 THE World Reputation Rankings – based on an invitation-only survey of leading academics – HKU was placed 44th in the world.

6. Conclusions

110. HKU researchers have continued to demonstrate excellence and quality in research as well as impact locally, regionally and globally. Guided by the '[3+1] Is' 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.

111. 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 transformation of knowledge. Continuing investments in promoting innovation and entrepreneurship are reaping returns.

112. 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, industry and business 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 the following:

- (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) so that they can form the basis of major projects (such as InnoHK and MOST themes),
- (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 global hub for innovation and entrepreneurship, with the University's Innovation and Entrepreneurship Hub, iDendron, serving as the key enabling platform for fostering holistic development engaging students, staff and alumni,
- (d) To use the research platforms of HKU in the mainland, notably HKU-ZIRI in Hangzhou, HKU-SIRI and HKU Shenzhen hospital in Shenzhen as well as the Innovation Platform in Zhongshan, 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,
- (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, and
- (h) To establish HKU as a major global powerhouse in research, innovation and talent development.