Knowledge Exchange

NEWSLETTER

The University of Hong Kong April 2021 Issue 20

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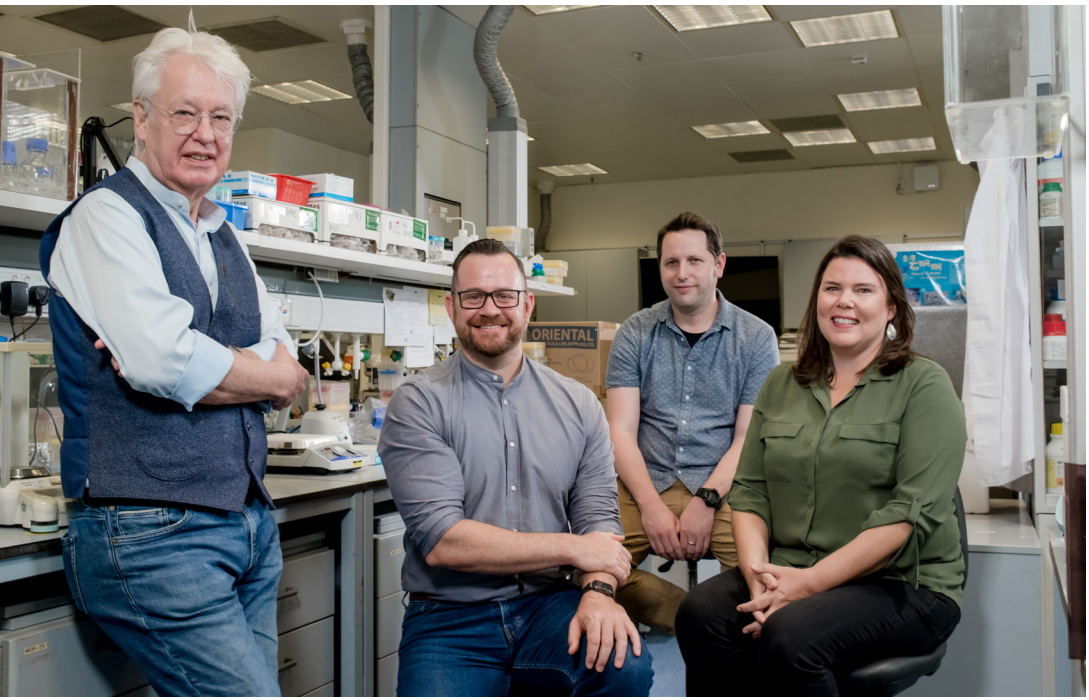
Using Data to Protect Wildlife



(From left) Professor David Dudgeon, Dr David Baker, Dr Timothy Bonebrake and Dr Caroline Dingle in the laboratory

As well as being an international financial and trading hub, Hong Kong has also earned the unwelcome title of being a major hub for the global trade in wildlife – much of which is illegal. Hong Kong is a major transportation hub and is geographically well located for the business as demand for the wildlife is mainly from Asia. It is a longstanding problem: Between 1997 and 2016, the city ranked 6th in the world based on the value of the trade per 'country', accounting for about US$250 billion.

The breadth and size of the trade makes it difficult to monitor and the number of species involved make monitoring by customs particularly complex. Furthermore, the value of traded wildlife increases as their populations decline and they become rarer, and this drives ever-greater exploitation of threatened species. A team from the School of Biological Sciences has been making substantial progress in reducing the trade through the use of data forensics and techniques such as barcoding, genomics, diet analysis and population genetics to track wildlife and traders. The team analyses trade networks to identify trade routes and trading hotspots for pangolins, for example, and analyses trends in the live trade of reptiles and birds in Hong Kong. Other research projects focus on identifying species using molecular techniques for juvenile eels and shark fins.

"You need to know which species is being traded," said Dr Caroline Dingle. "Some are legal to trade, and some are not."

The critically endangered Yellow-crested Cockatoo in Hong Kong Bird Market [photo credit: Astrid Andersson]

Hong Kong is a major hub for international wildlife trade. The Conservation Forensics team's research is providing data to support efforts to combat and reduce the illegal trade of wild species.

The data is shared with enforcement agencies to help them target their efforts. The team also collaborates with Faculty of Law to develop species impact statements that are used to give judges and prosecutors a deeper understanding of the impact of illegal trade, including the ecological impacts and market value of the animals.

The team also works with the Hong Kong Customs and Excise Department and organisations including the World Wide Fund for Nature (WWF), National Geographic and TRAFFIC, and the collaboration has had big results, including the arrest of a group of 40 people in the European Union involved in trading in eels from Europe. Their research has also helped increase protection for endangered species including freshwater turtles, pangolins and potentially songbirds. Songbirds, in demand as pets or for use in songbird competitions, are under threat due to lack of trade monitoring, said Dr Dingle. "Over 30 species in Asia are threatened with extinction due to this trade," she remarked, adding that the impact has left entire forests silent in Indonesia after all the birds have been hunted out.

The team also raises awareness of the threat to wildlife by hosting workshops and seminars, and giving interviews to local and international press.

In the meantime, she and her team continue to work on the data, bolstered by the knowledge that "the work we've done is helping enforcement efforts to reduce Hong Kong's role as an international wildlife trade hub," she added.

Members of the Conservation Forensics Lab, Ms Tracey Prigge and Miss Astrid Andersson, processing samples for genetic analysis

Dr Caroline Dingle, Dr David Baker, Dr Timothy Bonebrake, and Professor David Dudgeon of the School of Biological Sciences received the University's Knowledge Exchange Excellence Award 2020 for the project 'Reduction of Illegal Global Wildlife Trade through Novel Conservation Forensics Research'.

Pangolin, one of the world's most trafficked mammals

The Conservation Forensics team conducts analyses on different species including sharks, tokay geckos, helmeted hornbills, cockatoos and pangolins [photo credit: Chloe Hatten]

COVID-19: Uncovering the Secrets of the Sewers

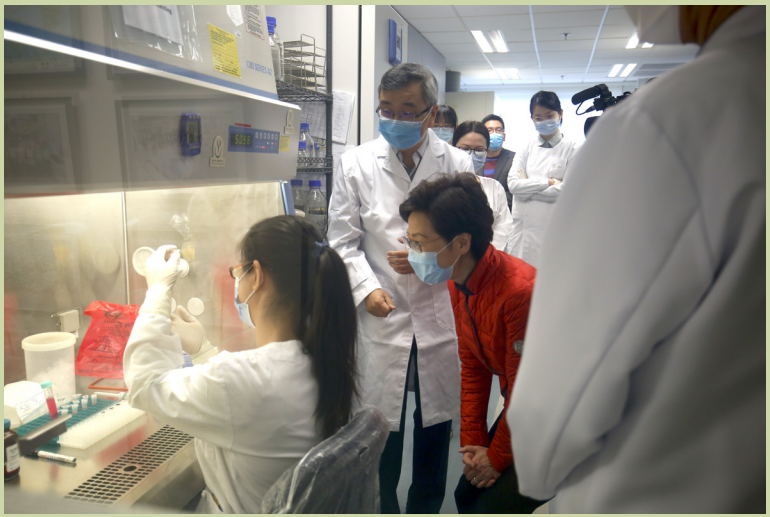
COVID-19 is largely an invisible threat, lurking inside the bodies of the infected where it is often undetected. Testing uncovers some, but not all of those infected, as sometimes the virus is present in a level that is too low to be detected by testing. But there is one place where the virus can be detected: Sewage.

Professor Tong Zhang of the Department of Civil Engineering tracks the virus in sewage as an advance information source. When the toilet is flushed, the water and all it contains is carried into the sewer system, which is shared by the entire building. A wider area can be tested by investigating the sewerage in a manhole where the sewage from multiple buildings ends up. By identifying the presence of the virus in the sewage of a building, the government can take action to test residents who may not know they are infected.

Sewage tells the health of a city.

The sewage surveillance project can provide early warning of the presence of a COVID-19 outbreak. Used in tandem with clinical testing, this can provide crucial early warning of an outbreak in the community. Changes in the sewage can also be used to track changes in the development of the virus in the community. Sewage monitoring also enables monitoring of building estates that have infection clusters and provides information that can help inform decision-making.

Investigating sewage to monitor diseases is a new though fast developing field of research. The sewage test protocol that has been adopted by the HKU team is a new method which has been used since April 2020. "After we communicated with Professor Gabriel Leung, Dean of the Li Ka Shing Faculty of Medicine, he believed this could be a supplementary information source for public health decision-making," explained Professor Zhang, adding that sewage monitoring can have an important impact outside Hong Kong as well.

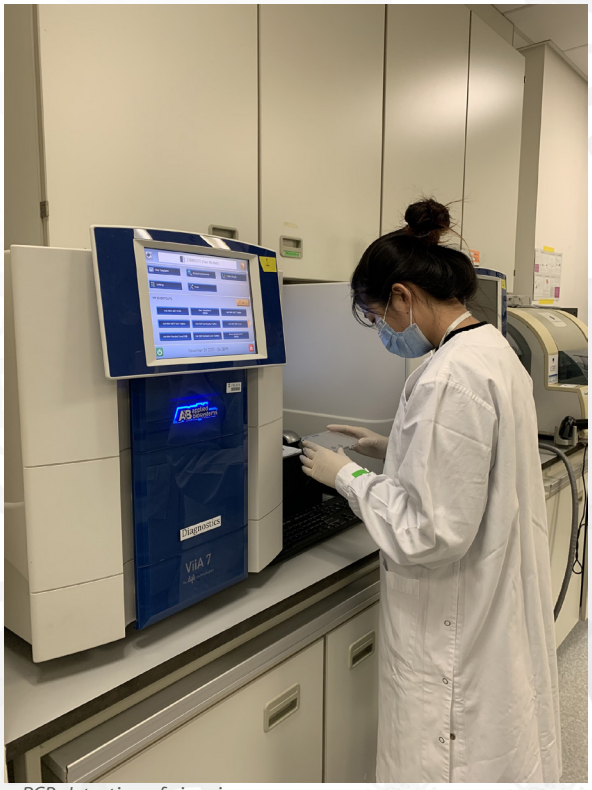


Professor Tong Zhang (second from left) introducing the sewage monitoring system to the Chief Executive Mrs Carrie Lam at HKU sewage testing laboratory

The Food and Health Bureau became involved, followed by the Environment Bureau, Environmental Protection Department and Drainage Services Department, who together provide full supports for the project. The government is keen to continue expanding the level of testing. "First we were doing about 26 samples a week. Now we are testing 24 to 26 samples every day, including weekends," Professor Zhang said.

Professor Zhang's work also shows the importance of fundamental research and technology for society. "Without this research and development, we may not have been able to invent this very successful application to identify hidden source of the virus in the environment," he added.

Sample pretreatment in the laboratory



qPCR detection of virus in sewage

Nano Solutions for Cleaner Air and Water

(From left) Professor Chuyang Tang's team: Professor Chuyang Tang, undergraduate students Ms Lydia Lo and Mr Junwei Zhang, and Dr Hao Guo, won the Gold Medal, the Top 20 Best Invention Award and the Special Award by Toronto International Society of Innovation & Advanced Skills in the 5th International Invention Innovation Competition in Canada for the reusable air filter invention

When a natural disaster strikes, one of the most immediate and crucial needs is clean water. Water is a basic requirement for human survival, but when an earthquake or tsunami hits, supplies of clean water are often affected and the water itself can be contaminated. Removing pollutants quickly and efficiently can now be done, thanks to the invention of new filters and membranes that can remove toxic heavy metals and pathogens from water instantly.

The filters invented by Professor Chuyang Tang's membrane research group at the Department of Civil Engineering, are a thousand times more permeable than conventional ultrafiltration membranes, meaning clean water can filter through quickly and easily under gravity force, leaving impurities behind in the filters. The removal efficiency of the filters is exceptionally high: Escherichia coli filtration tests showed a removal of more than 99.9999 per cent and more than 99.9 per cent removal of lead, cadmium, nickel, and zinc. More pollutants are now being targeted. "We are very excited that our latest novel water filters are highly effective for the removal of perfluorinated compounds (PFCs) at greater than 95 per cent," Professor Tang said.

> ***Our filter delivers safe drinkable water in less than one minute, simple and reliable, and no electricity is needed.***

The filters are fitted into compact and easily portable devices, such as foldable cups and jugs, which are fitted with highly porous nanofiber membrane filters. Requiring no electricity to operate, the filters are cost-effective to make, and can be washed and reused.

Professor Chuyang Tang (middle), and his team members Dr Hao Guo (left) and Dr Xianhui Li (right), won Gold Medal at the 47th International Exhibition of Inventions of Geneva for the rapid water filter invention

Professor Chuyang Tang is conferred the inaugural RGC Senior Research Fellow for his world-leading research and development works on membranes and filters

"After an earthquake or tsunami, there is often no reliable supply of clean water nor electricity, so you need something practical for disaster relief," Professor Tang said. "Our filter fits in very well. It delivers safe drinkable water in less than one minute, simple and reliable, and no electricity is needed."

A version of the filter has been developed for use in homes to filter lead from household tap water, and the small pocket-size of the products means that they will also be useful for travellers.

The filters and membranes are also used for cleaning the air, an issue that has become critical as the world grapples with COVID-19. Professor Tang's team has made a patented nanofibrous filter that can be used in reusable face masks and which have a high rate of removal of particulates compared to existing face masks. The diameter of the nanofibers in these filters are much smaller than those in the fibres used in typical face masks, making them more efficient at filtration. A double-layered filter can remove 99 per cent of nano-sized air particles, including virus-containing respiratory droplets. The masks comprise an inner layer for finer filtering and an outer layer with larger nanofibers which stop the filter from getting wet through its hydrophobic properties.

Compact foldable cups and tap water filter

The filters won Gold Medal at the 47th International Exhibition of Inventions of Geneva and have resulted in 10 publications, five patents, and several awards. They are now being prepared for commercial production.

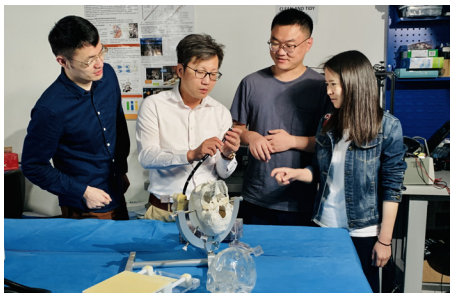
Professor Chuyang Tang of the Department of Civil Engineering received the HKU Innovator Award 2020.

Surgical Robots with New Eyes

Magnetic resonance imaging (MRI) is widely used in Hong Kong and around the world for diagnostic purposes, but the technology has huge and largely untapped potential for use in surgery. When coupled with new advances in robotics in the form of high-performance magnetic resonance (MR)-compatible actuation technology, it can provide surgeons with the means to perform highly precise surgeries while being guided by detailed views of the body, resulting in safer procedures, shorter operation times and lower costs.

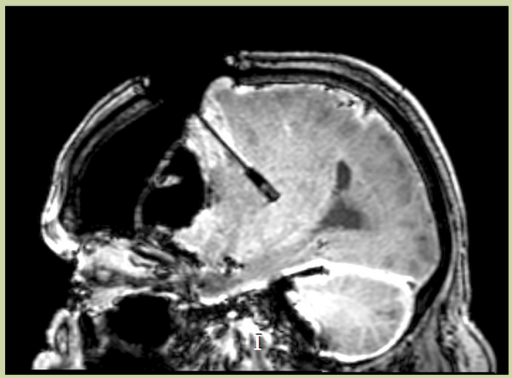
In laparoscopy, or keyhole surgery, for example, surgeons must rely on a camera. "Somehow, surgeons can't see very well the critical tissues underlying the surgical site," explained Dr Ka Wai Kwok, Associate Professor of the Department of Mechanical Engineering. "My research is to open up a new dimension with new eyes to see through the body and organs, pinpointing the specific part of the body for safer and more precise robotic surgery. I have a strong belief that MRI is a very unique medical imaging modality to do so."

One of the most difficult types of surgery is stereotactic neurosurgery, which is used to treat cases of Parkinson's disease, severe depression and essential tremor, among others or brain biopsy for gene therapy. The procedure involves the careful insertion of needles into deep parts of the brain. Precision is paramount: Perforating the wrong area of the brain can result in disastrous and irreversible consequences. It is particularly complex because the brain loses fluid and shifts during the procedure, which makes inserting the needles

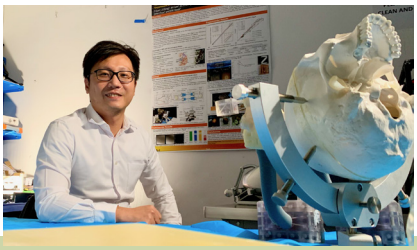


Members of Dr Ka Wai Kwok's group for Interventional Robotic and Imaging Systems (IRIS)

MRI-guided robotic system for bilateral stereotactic neurosurgery, which is designed for the precise positioning of needles in the deep brain region to treat cases such as Parkinson's disease



Intra-operative MR image showing precise needle positioning towards a target in the brain during a cadaver study



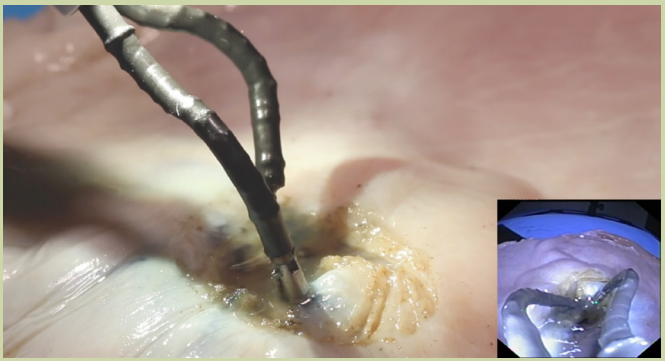
My research is to open up a new dimension with new eyes to see through the body and organs, pinpointing the specific part of the body for safer and more precise robotic surgery.

with precision even more difficult. Current procedures may take several hours since the stereotactic frame typically needs frequent manual adjustment but disrupts the workflow. To ease these conditions, Dr Kwok and his team have developed a small, high-performance MRI-guided robotic system that improves precision by leveraging MR-based tracking to provide real-time positional feedback directly in the MRI coordinates. The invention is safe for use in an MR environment as the robot actuators contain no metal, allowing for completely safe operation in the MRI without negative effect on imaging quality. The robot can be powered from the MRI control room at a distance of up to 10 metres.

Dr Kwok likens the use of imaging guidance to using GPS when driving a car, which allows for exact location precision as well as taking account of the online-updating map, compared with the pre-GPS era of asking a person for directions to a particular place.

The team is pressing on to develop more robots that can work in other minimally invasive procedures. His team has recently made a robot prototype in application of various endoscopies. "We have developed a robot arm in very small diameter that can pass through the conventional endoscope to resecting tumours such as in gastrointestinal (GI) tract," he said.

Dr Ka Wai Kwok of the Department of Mechanical Engineering received the HKU Young Innovator Award 2020.



Laboratory-based testing on ex-vivo tissue performed by robotic arms measuring less than 2.8 mm in diameter

Dexterous tasks can be carried out with the robotic arms even when channelled through a conventional endoscope greater than 1-metre in length

A New Approach to Autism Education

Almost 9,000 children in mainstream Hong Kong primary and secondary schools are known to have Autism Spectrum Disorder (ASD). The condition affects their learning ability, educational outcomes, social and emotional life and life prospects to varying degrees. The burden of care on their parents, caregivers and teachers can be heavy and unrelenting. Effective help is at hand in the shape of a new model called the JC A-Connect: Jockey Club Autism Support Network by two HKU researchers in the Faculty of Social Sciences and being rolled out across schools this year by the Education Bureau, which will spend HK$62 million a year to provide small group training for ASD students in schools.

"The key features of our model are to introduce the expertise of NGOs to schools by providing school-based services, and to provide supplemental training to students with ASD in a small group format using evidence-based methods," explained Dr Kathy Wong of the Department of Psychology.

The programme targets students' individual needs, training the key stakeholders – NGOs, teachers and parents – and educating the public to promote acceptance and understanding of autism. In schools, NGO professionals are trained to provide in-school support for the students. At home, parents are trained to help their children, and in the community, awareness-raising activities help make autism better understood and free from stigmatisation.

Dr Paul Wong (left) and Dr Kathy Wong (right) at the Launch Ceremony for Phase II of the JC A-Connect: Jockey Club Autism Support Network

The project was launched in 2015 and works with eight NGOs. So far, it has been implemented in 510 schools, reaching 6,800 students, which is approximately 55 per cent of all ASD students in mainstream schools. 27 training seminars have been run for more than 3,000 teachers, as well as nine training seminars reaching more than 780 NGO team leaders, advisors and coaches.

> ***Autism Spectrum Disorder is an individual, family, school, and community issue.***

Students have shown big improvements in areas from social communication and emotional control to executive functioning and problem-solving. Parents also report that their children have better relationships with classmates and teachers, participate more fully in school and are more confident. Teachers report a better understanding of their students' needs and problems, improved ability to manage ASD-related problems and positive feeling about mainstream education for ASD students.

"One school asked for materials so that they could continue to train even when the NGO was not in the school. Teachers wanted to do more because they could see the effect," Dr Kathy Wong said.

"Many people don't have a friendly perspective on ASD," said Dr Paul Wong of the Department of Social Work and Social Administration. The team has held 22 public education events including film screenings, family fun days and seminars reaching an audience of almost 17,000 people. Media stories, experiential videos and newsletters have reached number of views of about 27 million.

Dr Kathy Wong of the Department of Psychology and Dr Paul Wai Ching Wong of the Department of Social Work and Social Administration, and team members - Dr Sonia Man Kuen Chan, Mr Wan Hap Lui, Ms Elsa Lai Yi Chiu, Ms Sin Ting Ho, Ms Chui Ying Leung, Ms Lourdes Mei Oi Lam, Miss Tsz Wing Lee, Miss Conita Chi Ping Cheng, Dr Man Yan Tse, Ms Yu Wan Chan, Miss Ning Lee, Ms Evelyn Sin Kwan Mak, Miss Mei Ling Lo, Miss Sin Yi Ho, Miss Karen Kin Ching Wu of the Department of Psychology; and Dr Janet Siu Ping Lau, Ms Kylie Chiu Yee Lui, Mr Mong Yin Lau, Ms Carmen Ka Mun Wong, Miss Yan Yin Lam, Mr Wing Yip Lai, Miss Gi Gi Pui Chi Lau, Mr Chun Ming Tsui, Mr Wai Kei Leung of the Faculty of Social Sciences, received the Faculty Knowledge Exchange Award 2020 of the Faculty of Social Sciences for the project 'JC A-Connect: Jockey Club Autism Support Network'.

Engaging participants through different experiential workshops and fun activities at the Family Fun Day

Family Fun Day 2019 to promote better understanding of autism spectrum disorder and social inclusion in the community

Sharing Knowledge for the Benefit of All

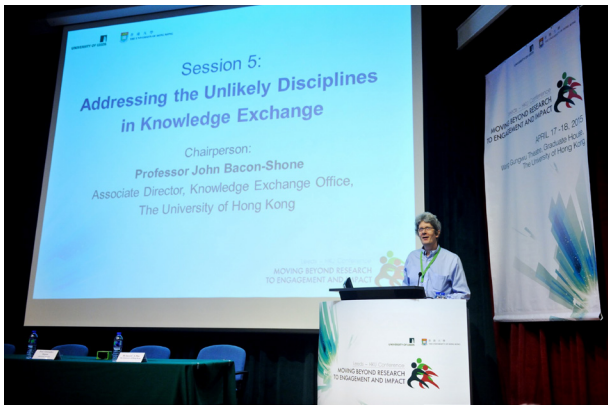
Universities are creators and repositories of vast amounts of valuable knowledge. Sharing this knowledge as widely as possible has been the unswerving aim of Professor John Bacon-Shone for the last 13 years. Since taking up the role of Associate Director of Knowledge Exchange Office in 2008, Professor Bacon-Shone – who will retire on July 1, 2021 – has been pushing the boundaries of knowledge exchange (KE) in different directions. His success in sharing access to knowledge beyond the walls of the University has enriched the lives of many people.

Since the beginning, his work looked at sharing knowledge instead of one way transferral of knowledge. Professor Bacon-Shone has sought to enable this exchange of knowledge through engagement and learning and to expand the scope of research shared to non-technical areas such as the arts and humanities. The community is enriched through cultural exchanges and policy improvements in addition to technological advances, while faculties benefit from funding and learning new ways to solve problems, in turn benefitting the community.

> ***I believe publicly funded research is a public good, and I hope Hong Kong can focus on how to maximise the benefits of that public good.***

He found that providing support to all faculties and competitive funding to support projects was the best way to maximise engagement and also to achieve impacts. Two of his key initiatives were working with the library, Graduate School and Research Services to ensure that students and researchers must submit their datasets for archiving and possible sharing and that all research postgraduate theses should be publicly accessible. A popular result was the sharing of the work of a well-known Cantopop lyricist, James Wong, whose work, which is free to access, has had the most downloads of any HKU thesis.

Professor John Bacon-Shone as the Chairman of the Adjudicating Panel at the HKU Three Minute Thesis (3MT®) Competition, an annual event jointly organised by the Graduate School and the Knowledge Exchange Office for the final-year research postgraduate and professional doctorate students



Professor John Bacon-Shone at Leeds-HKU Conference: Moving Beyond Research to Engagement and Impact in 2015

Professor John Bacon-Shone with Former TTO Director Professor Paul Cheung, and with the President and Vice-Chancellor Professor Xiang Zhang at the Long Service Awards Presentation Ceremony, where he received the 35-year and 40-year Long Service Awards in 2016 and 2020 respectively

The sharing of knowledge is university-wide. "One of the things I love about HKU is we agreed it's got to be across all faculties," he said. Every faculty was involved and the initiatives resulted in practical and tangible benefits, such as a legal website that was easy to use and helped spread understanding of Hong Kong laws. Another major success was the recent opening of the library's data repository, which will enable the public access to datasets, allowing re-analysis.

More can be done to widen the sharing of knowledge. Some meaningful projects, such as sharing information on the location of play areas for children with special needs and showing transport links to them, need approval from different government departments to obtain access to government data. Professor Bacon-Shone is hopeful that new laws under discussion, covering records and access to information for all public bodies, will enable more projects like this to be launched.

"I think there are a lot of great projects like that where a relatively small amount of money could make it happen," he said.

He hopes awareness of the impact of KE can continue to be raised throughout the University. "When you're doing the research, you need to be thinking about the impact," he remarked. Senior management can help by paying more attention to community impact rather than focussing solely on academic impact from publication in prestigious journals. This can tie in with the University's ranking, part of which is linked to the United Nations Sustainable Development Goals.

"I believe publicly funded research is a public good, and I hope Hong Kong can focus on how to maximise the benefits of that public good," Professor Bacon-Shone added.

Professor John Bacon-Shone at the KE Seminar on "How animals could help to enhance the work in education and social services settings?" in 2019

KE Excellence Award, HKU Innovator Award and HKU Young Innovator Award 2020

The Knowledge Exchange (KE) Excellence Award is a university-level award to recognise outstanding KE accomplishment that has made significant economic, social, environmental or cultural impacts to benefit the society.

Recognising innovations is equally important to spur sharing of innovations with the broader community. The new HKU Innovator Award and the HKU Young Innovator Award have been established to recognise outstanding Faculty members whose innovations demonstrate exceptionally high potential impact (legacy or projected legacy) with transformative results to foster development. In contrast with the KE Excellence Award which requires evidence that the impact already exists, evidence of potential impact is also considered for these awards. Research-led innovation may take many forms, including the creation of distinctive and new products or models; commercialisation activity; entrepreneurial activity; social enterprise; or policy change.

Warm congratulations are extended to the following colleagues who have won the awards:

KE Excellence Award 2020

Dr Caroline Dingle, Dr David Baker, Dr Timothy Bonebrake, and Professor David Dudgeon, School of Biological Sciences, Faculty of Science
'Reduction of Illegal Global Wildlife Trade through Novel Conservation Forensics Research'

Watch the KE video on their project:
https://www.ke.hku.hk/story/video/keea

(From left) Professor David Dudgeon, Dr Timothy Bonebrake, Dr David Baker, Dr Caroline Dingle, and Professor Richard Wong, Provost and Deputy Vice-Chancellor

Professor Chuyang Tang (left) and Dr Yiwu He, Chief Innovation Officer / Senior Advisor to the President

HKU Innovator Award 2020

Professor Chuyang Tang, Department of Civil Engineering, Faculty of Engineering

Watch the KE video on Professor Tang's project:
https://www.ke.hku.hk/story/video/hkuia

HKU Young Innovator Award 2020

Dr Ka Wai Kwok, Department of Mechanical Engineering,
Faculty of Engineering

Watch the KE video on Dr Kwok's project:
https://www.ke.hku.hk/story/video/hkuyia

Dr Ka Wai Kwok (right) and Dr Yiwu He, Chief Innovation Officer / Senior Advisor to the President

KE Corner

Virtual HKU Three Minute Thesis (3MT®) Competition 2021

The 3MT Competition is an academic competition that challenges research postgraduate students to explain their research within 3 minutes to a general audience, using only one static PowerPoint slide. The 3MT was developed by The University of Queensland, Australia in 2008. The HKU 3MT Competition has been an annual event jointly organised by the Graduate School and the Knowledge Exchange Office since 2011.

In view of the COVID-19 pandemic, increasing social distancing measures and restrictions on public gatherings and travel, HKU 3MT 2021 will be hosted in a virtual format (video submission).

Should you wish to get the latest information about the Competition, please "LIKE" KEO's Facebook (https://www.facebook.com/hkukeo), or visit the HKU 3MT website (https://www.ke.hku.hk/hku3mt) for details.

Faculty KE Awards 2021

Individual Faculties that wish to conduct an award exercise this year will call for nominations.
Please note the nomination deadline set by your Faculty.

Finding Experts

The **HKU Scholars Hub** is the University's online expertise directory, which makes HKU researchers and their research visible. It provides an expert finder for businesses, industries, social enterprises, the public sector, and interested student applicants to find HKU experts for contract research, consultancies, and postgraduate student supervision etc.
Please visit the HKU Scholars Hub at https://hub.hku.hk

Tech Ready

For a complete list of HKU technologies that are currently available, please visit: https://www.tto.hku.hk

Entrepreneurship Series

Visit https://www.dreamcatchers.hku.hk for the DreamCatchers programmes

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