Growing Human Capital through the Strategically Oriented Research Themes (SORTs)
The Place to Be ...

In early 2018, the University of Hong Kong (HKU) set out its Strategically Oriented Research Themes (SORTs) (hku.hk/research/strategic-research.html) as a blueprint for excellence, impact, collaboration and leadership as we prepare for the next decade.

At the heart of all research developments is our human capital, as diverse and gifted talents are the engine of our growth and aspirations. The original SORTs brochure highlights some of the key teams and senior leaders. In this publication, we focus on our new generation of academics whose works are inspirational and promising. Their research not only illustrates the rich dimensions of the SORTs, but also some of the future directions and impact.

Illustrative examples include a bioinformatics approach to detecting the origins and impacts of new infectious diseases (SmartBio & HealthTech (SH)); cutting-edge light-powered nanorobots with potential for wide medical application (Future Innovative Technologies (FIT)); engineering solutions for sustainable water resources (Smart Systems & Sustainable Society (SS)); and developing and applying computational methods to address legal questions (Intelligence, Data, E-Commerce & Automation (IDEA)).

These descriptions, both of the research and the talents behind, are representative, NOT comprehensive. We shall highlight other emerging talents as the University embarks on a new chapter to deepen the talent pool, extend the research realm, enrich the capability clusters, and, very importantly, challenge the frontiers of new knowledge and human wisdom.

The University is developing strategic research platforms to help tackle emerging social, scientific, technological and economic challenges. Our aspirations are witnessed in, for example, the establishment of an Institute of the Mind, through a generous donation by Dr the Honourable Lee Shau-kee, to study the quantitative and qualitative science at the interface of humans, machines and society; new research and clinical facilities for precision medicine funded by the Hong Kong Jockey Club, and an HKU x Cyberport Digital Tech Entrepreneurship Platform to co-develop an innovative FinTech ecosystem. We have been awarded another Area of Excellence platform in the Institute of Metabolic Medicine. We are also planning for Tech Landmarks on campus to promote interdisciplinary work in engineering and science. More grand plans are in the pipeline outside the campus, for example through the InnoHK world-class research clusters at the Hong Kong Science and Technology Park.

For those who are interested in global rankings, between 2016 and 2019 we rose from 30th to 25th in the QS World University Rankings, and from 44th to 36th in the Times Higher Education (THE) World University Rankings. In the same period, we jumped to 1st place from 3rd in the THE's rankings of the world’s most international universities. We also saw a rise in the QS Graduate Employability Rankings from 18th when it started in 2017 to 13th in 2019. Behind these rankings are our most valuable asset – the talents who fuel our growth.

These developments are just the beginning of a challenging but exciting journey ahead. We appeal for your support and partnership, and we welcome new members to join the family and share our belief that HKU is where human capital flourishes and is indeed the place to be for the best global minds.

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Harnessing DNA Repair

Dr Michael Shing Yan HUEN
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“My research goal is to understand how cells protect genome integrity by identifying the molecular determinants that orchestrate DNA repair. Through this, we can help guide diagnoses and prognoses of human diseases that arise from DNA repair deficiencies. Our work also lays the framework to develop new and personalised anti-cancer therapeutics by turning defective DNA repair against cancer cells themselves.”

Highlights
- Co-chair of the 2020 Gordon Research Conference on Genomic Instability, a series of prestigious international meetings on frontier research
- Competitive peer-reviewed external funding including Collaborative Research Fund projects:
  - A Study of Self-Repairing Mechanisms of DNA Damage Surveillance and Repair
  - Establishment of a Shared Live Cell Imaging Platform for Super-Resolution Microscopy (as Co-Principal Investigator)
  - Early Career Award and Early Career Scheme project: Role of ATM Signaling in PALB2 Dependent Homologous Recombination DNA Repair
  - Multiple General Research Fund projects, such as:
    - A Study of MRE11 in DNA Damage Response Control
    - A Study of TRAIL in Replicative Stress Responses
    - Role of USF1-RNF169 Axis in DNA Double-Strand Break Responses
- National Natural Science Foundation of China/Research Grants Council Joint Research Scheme project: Role of PCNA Binding Protein TRAP1 in Replicative Stress Responses and Tumor Suppression
- Outstanding Young Researcher Award, HKU

Humans cells have a highly efficient toolkit to protect their genetic material from everyday agents that damage DNA, such as sunlight, tobacco smoke and exhaust gas, but when this toolkit goes awry due to such events as genetic mutations, or when the DNA damage is too overwhelming such as prolonged exposure to tobacco, some cells die and others may develop into cancerous cells. Dr Michael Shing Yan Huen is working to address this issue by focusing on DNA repair control.

Dr Huen and his team cloned the RNF169 gene and showed that it encodes a DNA damage response protein. Subsequently, they showed RNF169 promotes efficient DNA repair and is important in genome integrity protection. His research has also shown that RNF169 functionality requires that its protein level be tightly regulated, which is consistent with observations that the gene is often not properly regulated in human cancers. Dr Huen and his collaborators are now establishing RNF169 animal models to study how the gene-encoded product suppresses tumourigenesis. Taken together, the findings suggest RNF169 and its protein network could be targets for drug treatments of cancer. “Understanding how cells can more efficiently protect their DNA may also provide new ideas to promote healthy living and longevity,” he said.

Dr Huen has been passionate about science since he was a youth. He decided to test how far he could go with this in 2006 when, after completing his PhD at HKU, he embarked on postdoctoral research training at Mayo Clinic and Yale University in the US and found himself working in highly competitive and demanding environments. He hopes to bring this same passion for knowledge to local students and help to nurture the next generation of scientists in Hong Kong.

His current research aims to understand how DNA repair is coordinated with other ongoing chromatin transaction activities, including gene transcription, in addition to determining epigenetic changes that may underlie transgenerational inheritance in cell resistance and tolerance to DNA damage. He noted: “At the end of the day, what does not kill you makes you stronger.”

What has shaped you as a researcher?
“I love what I have today to my curious nature, and my intrinsic motivation to solve puzzles, which is really what scientific research is all about.”

What challenges have you faced?
“Back in 2006, I left Hong Kong on a journey to the US as a postdoctoral research fellow not knowing where it would lead me. In retrospect, it was the biggest and perhaps most risky decision I have made as a young adult, but it was certainly a big step towards my career.”

Selected Publications

Immunolabelling of laser-induced DNA damage tracks to study transcription dynamics during DNA damage responses (Image from: Chan Gong)
Creating Urban Environments to Promote Health and Well-Being

Dr Bin JIANG
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“My research interest is to understand how and to what extent urban environments, especially urban green spaces, influence human health and well-being, including mental health, physical health, urban security, and environmental justice.”

Dr Bin Jiang studies the impacts on human health and well-being of urban environments, in particular green spaces. He conducts experiments in both virtual and real settings, with the former enabling him to record responses using instruments to measure physiological and psychological responses, and the latter enabling him to get input from respondents via mobile devices.

An example of his work is the Dose of Nature project, which examines the relationship between tree canopy coverage and mental stress status. The project demonstrated how to create a more restorative environment through an urban forest campaign that can help to prevent the accumulation of stress, anxiety and depression and the physiological problems associated with these.

Dr Jiang’s work is interdisciplinary by nature and it has been cited by scholars and organizations in many fields, such as public health, landscape and urban planning, environmental psychology and criminology. His work has also been reported globally in academic and professional publications and the mass media, such as ScienceDaily, Medical Xpress, the American Society of Landscape Architects, The Daily Telegraph, the Daily Mail and the South China Morning Post.

Dr Jiang is also applying his research methods in design studio courses to create healthier living environments for people from deprived communities, such as low-income and migrant workers, living in southern China.

What sacrifices have you made for your work?
“ In 2008, I resigned from a leading landscape architectural firm and went to the United States to chase my dream of becoming a scholar. I gave up my established life, but I feel that stupidity and hunger are precious lessons for an academic.”

Who has inspired you?
“I learned a lot from my family. My mother was a doctor, my father was a judge, and my grandfather was a hunter and neighbourhood leader. All of them earned a high reputation for their service to local citizens, especially those who were socially or economically deprived. Their stories inspire me a lot in investigating the impacts of the physical environment, especially nature, on public health and social equity.”

Highlights
• US Forest Service project: Dose of Nature
• Early Career Scheme project: Using Driving Simulation Technology to Measure Impacts of Freeway Green Landscapes on Drivers’ Mental Fatigue, Stress, and Negative Mood
• Cited by the World Health Organisation in its annual report to support its Urban Green Space and Health Campaign
• Member of the Healthy City Academic Committee and Landscape Architecture Committee of the China Society for Urban Studies
• Research Output Prize, HKU

Selected Publications
• Jiang B., Ma C.N.S., Larson L. and Zhong H., “Minimizing the gender difference in perceived safety: Comparing the effects of urban parkway interventions.” Journal of Environmental Psychology 2015, 41, 117-131
Origins and Impacts of New Infectious Diseases

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Emerging infectious diseases are a major global health concern in the 21st century and HKU has been at the forefront of research in this field, particularly since the SARS (Severe Acute Respiratory Syndrome) outbreak in 2003. Taking that expertise into the next generation, Dr Tommy Tsan Yuk Lam combines insights from microbiology, genomics, evolutionary biology and data science to shed new light on emerging pathogens and how to combat them.

His research on the genomic diversity and evolution of pathogens such as H7N9 avian influenza viruses and Middle East Respiratory Syndrome (MERS) coronaviruses has led to an important understanding of their animal reservoirs, interspecies transmission, evolutionary pathways and dissemination patterns. For example, Dr Lam was the lead author of a paper in Nature that identified chickens in live poultry markets as the main source of human infections of H7N9.

This research, which involved more than two dozen scholars, also revealed that domestic ducks play an intermediary role in the transmission of new subtypes of influenza viruses from wild birds to chickens, where they reassort into viruses that are infectious to humans. The work pointed to the urgent need for a change in poultry trading and marketing systems.

On the MERS coronaviruses, Dr Lam contributed to the discovery that they regularly infect domestic camels in Saudi Arabia and have diverged into five distinct lineages. One lineage was found to be the source of outbreaks in humans in both Saudi Arabia and Korea. As with H7N9, the report highlighted the need to prevent direct contact with animals that carry the virus, in this case camels.

Dr Lam is currently working on pathogen discovery and the ecology and evolution of influenza and other emerging viruses, as well as antimicrobial resistance. He is developing big data analytic methods including the use of artificial intelligence to help investigate these topics and produce wider and deeper insights.

What obstacles have you overcome?
“I was last before identifying my true interest in bioinformatics. Even then, when I was an undergraduate studying bioinformatics, my peers thought this subject had no future. But I stayed with it and now this is one of the hottest subjects in the era of big data.”

What qualities have helped you to succeed?
“Life and work go up and down. I find that passion and persistence are the keys to get me through the troughs.”

Highlights

- National Science and Technology Progress Award – Special Award from the State Council, People’s Republic of China
- Ranked in top 1% of scholars in his field by Clarivate Analytics Essential Science Indicators, 2016 to 2018
- General Research Fund project: Phylogeny-Guided Assembly of Short Reads from Deep Sequencing of Microbial Samples
- Newton International Research Fellowship from the Royal Society, UK
- Novartis Vaccines Award for Epidemiology of Infectious Diseases from the International Society of Infectious Diseases
- Research Output Prize, HKU

The phylogenetic tree of novel H7N9 influenza viruses

Selected Publications


“My research focuses on the ecology, evolution and epidemiology of emerging infectious diseases, particularly at the animal-human interface, using a ‘bioinformatics’ approach. My aim is to generate accurate and deep understanding of where, when, how and why novel pathogens emerge.”
Tapping into the Unconscious Mind

Professor Hakwan LAU
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“Conventional therapies for the treatment of anxiety disorders are aversive and, as a result, many patients terminate treatment prematurely. We have developed an unconscious method to bypass the unpleasantness in conscious exposure by directly rewarding certain brain patterns of activity.”

Professor Hakwan Lau has a background in both philosophy and cognitive science, which gives him a unique perspective for grappling with a topic that remains a contentious focus of debate in both fields: the nature of consciousness. Drawing on several theoretical and scientific insights that have emerged over the years, he has developed a technique to treat mental illnesses, such as anxiety disorders, by directly ‘re-programming’ certain brain functions. This involves combining neuroimaging with artificial intelligence to assess people’s brain states and, when a desired state is detected, rewarding the patient to promote its occurrence. Importantly, the treatment is done unconsciously so there is no unpleasantness involved.

A key area where Professor Lau has applied this technique is with phobias, which are known to be treatable in certain cases through exposure to the feared object. He and his collaborators carried out a double-blind placebo-controlled experiment that, first, involved mapping unconscious areas of the brain using functional magnetic resonance imaging while subjects were exposed to photos of creatures related to their phobia but not in themselves frightening (for example, photos of insects for people with a spider phobia). The subjects then played a game that rewarded these same brain areas when they were activated. Afterwards, when the subjects were shown photos of the actual feared objects, they were found to have lowered physiological responses, including less sweating and less activity in the associated brain regions.

This intervention was achieved unconsciously and without any adverse reactions.

The first clinical trials of this intervention procedure recently got underway for phobic patients in a project funded by the US National Institute of Mental Health. Professor Lau is now looking to extend the approach to other forms of psychopathologies, such as post-traumatic stress disorder, to see whether it can provide an alternative means of intervention for patients who have difficulty tolerating other kinds of exposure treatments.

Describe a formative experience.
“I was an undergraduate student right here at HKU, majoring in cognitive science. It set me up for life! Two decades later, it is wonderful to reflect on how my everyday work still benefits from the courses I took back then. In a way I am still working on extending my undergraduate thesis, which was on consciousness from a philosophical perspective.”

What does ‘impact’ mean to you?
“Increasingly I recognise that real scientific impact is about making people’s lives better. That is more important than the trends and competitions within academia.”

Highlights
- US-funded research projects:
  – National Institute of Mental Health project: Treating Phobia with Multivoxel Neuro-Reinforcement
  – National Institutes of Health project: The Neural Basis of Metacognition
- Janet Taylor Spence Award for Transformative Early Career Contributions from the Association for Psychological Science
- William James Prize from the Association of the Scientific Studies of Consciousness

Selected Publications
Chemical Biology Opens New Paths to Fight Disease

Dr Xiang David LI
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“Our genome is packaged around a class of proteins called histones, which help regulate gene expression so every gene is expressed at the right time to the right extent. Cancer often results when this gets away. Our research is helping to improve our understanding of the link between errors in these epigenetic processes and the development of human diseases, and hopefully will lead to new and improved therapeutic strategies.”

Dr Xiang David LI works at the interface of chemistry and biology to develop chemical approaches for addressing key questions in epigenetics. Errors in epigenetic processes are implicated in many human diseases, so a better understanding of these processes and errors offers potential for developing new treatments. His work focuses specifically on histones, a type of proteins around which DNA is packaged. Diverse modifications are found on histones and these ‘marks’ act as master switches for gene expression — they determine which sets of genes in a cell should be ‘on’ or ‘off’.

Dr LI has been deciphering histone marks using new chemical tools and methodologies, such as combining light-induced cross-linking chemistry and mass spectrometry-based quantitative proteomics approaches. One of his most important achievements has been to develop a chemical inhibitor against the trigger of acute myeloid leukemia (AML), a fast-growing cancer that attacks bone marrow and blood cells. The work centres on ENL, which has recently been identified as a leukemia-boosting protein. ENL contains a small domain called YEATS. Just as a scanner reads barcodes, the ENL YEATS ‘reads’ a histone mark known as acetylation on our genome, which causes faulty activation of cancer-promoting genes in human AML cells. Dr. LI worked with collaborators from different disciplines and institutions to develop the first ENL inhibitor that successfully turned down the cancer-promoting gene expression in human AML cells. They also showed the effect was enhanced when it was combined with experimental anti-leukemia drugs, suggesting a possible combination therapy strategy. Dr. LI’s current research goals include developing new chemical biology approaches to unravel unknown regulatory mechanisms and functions in novel histone modifications; identifying epigenetic regulators that could be new therapeutic targets for the treatment of human diseases such as cancer; and developing novel drug candidates to target misregulated epigenetic regulators.

Selected Publications

The first-class ENL inhibitor developed by Dr. LI’s group shows promise for leukemia treatment.
Targeting the Roots of Cancer

Dr Stephanie Kwai Yee MA
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Our team has a long-standing interest, proven track record and unique expertise in exploiting stemness as a cancer cell vulnerability in locally prevalent cancer types. Our work involves inhibiting cancer stemness to identify strategies for suppressing tumour initiation and recurrence and overcoming resistance to therapy. Ultimately, we hope to achieve direct bench-to-bedside translation, including innovative diagnostics, personalised medicine and clinical trials targeted at cancer stemness.

with chemotherapy or molecular targeted drugs could reduce the ability of HCC cells to initiate tumour growth or self-renew. The findings have had both academic and commercial impact, with the research being highly cited in high-impact journals and the antibody patented and licensed to Merck Millipore.

Dr Ma has been working on cancer research since her final year as an undergraduate student at the University of British Columbia, when she was given the opportunity to do research on prostate cancer – and she has not looked back. Her current goals are to establish new molecular signatures and markers for predicting occurrence, recurrence and drug resistance; to improve patient stratification and identify actionable targets for precision medicine; and to translate her basic research findings into pre-clinical/trial trials targeted at cancer stemness for novel cancer treatments.

What motivates your research?
“Cancer has always been a subject I take to heart. I lost all my grandparents to the disease and I don’t think there is anyone who doesn’t know someone affected by cancer.”

What is satisfying about your work?
“Making new discoveries and seeing my hypothesis turn into theory is both satisfying and rewarding.”

How can you inspire junior researchers?
“I strive to inspire other young scientists by getting involved in programmes targeted at primary and secondary school students and sharing my experiences with undergraduate and postgraduate students at the University.”

Highlights
- Ranked in top 1% of scholars in ‘clinical medicine’ and ‘all fields’ by Clarivate Analytics Essential Science Indicators since 2010
- Croucher Innovation Award
- Rising Star Award in Vietnam’s Top Duct Thang University Scientific Prize
- Member of the team that received the Second-Class Award in Science and Technology in China’s Scientific Research Outstanding Achievement Awards
- Competitive peer-reviewed local and national external funding including
  > Collaborative Research Fund projects:
    > Exploiting Stemness as a Cancer Cell Vulnerability Using Hepatocellular Carcinoma (HCC) as a Model System
    > A Multidisciplinary Study on CD133 Liver Cancer Stem Cells
    > Co-Principal Investigator of two further projects
    > Early Career Scheme project and multiple General Research Fund projects, National Natural Science Foundation of China projects, and Health and Medical Research Fund projects, such as A Study of the Role and Therapeutic Potential of Targeting Protein Tyrosine Kinase 7 (PTK7) in Liver Cancer
    > Theme-based Research Scheme project (as Co-Principal Investigator): Gastric Cancer Genomics and Beyond
    > Founding Member of The Young Academy of Sciences of Hong Kong
- Outstanding Young Researcher Award, HKU

Selected Publications
- Tsang A, Choy SM, Zhou L, Leung CM, Ma K, Ching VF, Lee TK and Ma S, “Efficiency of TNFrelated cytokine-1 and IGF1 response was able to inhibit cancer cell proliferation and migration”, Journal of Hematology, 2018, 19(1), 626-637

The publication is subject to two successful US patient applications for the use of the subunit annexin A3 (ANNX3) antibody for diagnosing hepatocellular carcinoma and specifically targeting the HCC subpopulation, as well as for sensitisation of currently used chemotherapeutic reagents.
Upending a Convention about Liver Cancer

Dr Carmen Chak Lui WONG
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“My research focuses on understanding the metabolism and microenvironment of liver cancer – in particular, the intrinsic metabolic network of liver cancer cells and the reciprocal interactions between cancer cells and different components within the microenvironment. I hope this will lead to therapies that can target liver cancer cells and awaken immune cells simultaneously.”

Liver cancer currently has no curative therapy, but groundbreaking work by Dr Carmen Chak Lui Wong has led to a new understanding of the disease and opened a pathway for exploring new treatments.

Inspired by the fact that cancer cells have an insatiable demand for nutrients, Dr Wong and her team have focused on identifying the metabolic requirements of liver cancer and unravelling the underlying molecular pathways. One of their key discoveries is that oxidative stress does not, as commonly assumed, drive cancer development but in fact causes liver cancer cells to die. They showed that liver cancer cells are able to survive oxidative stress by producing antioxidants through the pentose phosphate pathway, folate cycle and serine synthesis pathway, and thiol-redox system. The team also discovered that liver cancer cells use a special unit in the electron transport chain to decelerate electron transfer so they can survive hypoxia-induced oxidative stress. Moreover, they found that blocking antioxidant-producing pathways makes liver cancer cells more sensitive to targeted therapies.

More recently, Dr Wong has been focusing on the interplay of metabolisms and immunology in liver cancer to better understand the disease from a systemic angle, which should help in designing better therapeutic options. Using a genome-wide screening approach, she is studying the mechanisms that allow liver cancer to survive targeted therapies and metabolic stress. She is also studying the role of liver cancer metabolites on different immune cells and whether targeting these unmetabolizable/producing pathways could improve the efficiency and efficacy of immune therapies in liver cancer.

Liver cancer cells contained with a mitochondria marker and an antibody targeting a metabolic enzyme which is essential for survival in a low-oxygen environment

What inspires you?
“I have been very curious about science all my life. At the age of six, I read my cousin’s biology textbook. In secondary school, I would bring my science teacher a long list of questions after every class, which he answered patiently. The beauty of science which enchants me the most is you never run out of questions.”

What advice do you have for junior researchers?
“I am a great believer in following your passion and not losing sight of that even in moments of doubt. I strongly encourage all young scientists to swim against the current, never be afraid to court controversy, and create paradigm-shifting hypotheses and knowledge.”

What is your favourite motto?
“The more you know, the more you realise how much you don’t know.”

Selected Publications
Future Innovative Technologies (FIT)

Dr Paddy Kwok Leung CHAN (Mechanical Engineering)
Scaling-up Molecular Electronics

Dr Mingxin HUANG (Mechanical Engineering)
Steeled for Success

Dr Mike Yiu Yan LEUNG (Dentistry)
At the Vanguard of Dental Surgery

Dr Anderson Ho Cheung SHUM (Mechanical Engineering)
A Water-Based Solution with Many Applications

Dr Jinyao TANG (Chemistry)
A Pioneer of Light-Powered Nanorobots

Professor Wang YAO (Physics)
A New Spin in Materials Science
Scaling-Up Molecular Electronics

Dr Paddy Kwok Leung CHAN
BEng (HKU), MSc, PhD (Michigan)
Associate Professor, Department of Mechanical Engineering | pklc@hku.hk

“I am trying to develop organic chips using organic field effect transistor (OFET) building blocks that have comparable if not better performance than silicon especially for flexible smart sensor applications. This requires a large area of a highly uniform organic active layer, an accurate patterning technique, and high-quality contact interface. My team has made achievements in the first two areas and we are currently focusing on the last one. Once this is done, we expect the current dimensions of OFETs can be reduced by orders of magnitude.”

The team led by Dr Paddy Kwok Leung Chan is one of the world leaders in large area active organic field effect transistor (OFET) matrix fabrication. Their findings have demonstrated the enormous potential of organic electronics and the group is applying them to develop scalable flexible sensors and energy conversion devices.

The work on the OFET-based matrix is particularly significant because it overcomes the great challenge of working with a series of devices, rather than a discrete device, as a malfunction in one sensing element could affect the whole array. Dr Chan conquered this problem and developed a unique optical sensor with memory properties that allows for precise and conformal mapping information, such as temperature and light sensitivity, on the subject surface. The group is integrating these sensors onto clinical devices for health monitoring and biomedical applications.

Another important achievement has been the development of new processing methods of OFETs to enable large area mass production. This work led to a discovery that completely changes the conventional understanding of crystal growth by solution shearing. Single crystals are important because they provide the means to perform lithography patterning and develop sophisticated organic circuits, which makes it possible to have direct comparisons between molecular electronics and silicon devices down to the single transistor level. Dr Chan’s team developed a method that produces a single crystal on a large area, highly uniform organic thin film in which all grain boundaries inside the film are eliminated. This work provides a new direction for OFET materials and molecular electronics research.

Dr Chan believes molecular electronics are the future and that his findings will lead to new biomedical tools and appliances, electromyography, bacteria and protein sensors, and many other applications. His current projects include developing a new neurotransmitter sensor that can measure neural signals of neurons, and exploring the metal/molecular interface to enhance the sensitivity as well as selectivity of these sensors.

What important lessons would you like to pass on?
“During my graduate school studies in the US, I learned two important things from my supervisors. One was 'good work sells itself'—good work does not always need promotion especially in academic research where peers naturally appreciate excellent work. The second is that having momentum to work outside your comfort zone can drive you to develop new knowledge to overcome new challenges. This is also an important way to keep your thinking fresh.”

What do you find most satisfying about your work?
“I am most satisfied with the supportive atmosphere in our department especially among young colleagues. We look forward to each other and work together as a team to tackle challenging research problems.”

Selected Publications
Steeled for Success

Dr Mingxin HUANG
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“My aim is to generate new important science but also to transform inventions into industrial applications that are beneficial to society. For example, the lightweight steels developed by my team have been used in automobiles to greatly reduce fuel consumption and therefore greenhouse gases.”

Research by Dr Mingxin Huang has overcome one of the great challenges in materials science: how to increase strength without losing ductility (i.e., the ability to be bent or shaped). Dr Huang and his team have produced ‘Super Steel’, a material that circumvents the strength-ductility trade-off and that has excited both the scientific and industrial worlds.

Super Steel was developed using a novel deformed and partitioned (D&P) process that resulted in it being stronger than the conventional steel used in automotive, aerospace and defence applications, yet still flexible. The steel has an unprecedented yield strength of 2.2 GPa and large uniform elongation of 16 per cent, making it the best available through the open research literature. Moreover, it can be produced at a low cost using conventional industrial processing techniques. Several companies are now in discussion with the University about licensing this technology.

“Super Steel shows for the first time that high dislocation density not only increases strength but also improves ductility in alloys, which is the new science behind it,” Dr Huang said.

Dr Huang has also developed strong and ductile steel for lightweight automobile applications using a different method, quenching and partition (Q&P). The low-carbon, film-like austenite of this steel has been shown to be more stable than high-carbon blocky austenite. The steel also has improved mechanical properties and its light weight means it is easier on fuel consumption. China Baowu Steel Co Ltd, the largest steel company in China, has adapted the process to produce new Q&P steels that have been used by major car manufacturers worldwide, including General Motors, Nissan and several Chinese carmakers.

Dr Huang is currently working on developing novel lightweight steel, antibacterial stainless steel, and novel ductile magnesium alloys.

What other experiences do you bring to your research?

“I worked with the world’s largest steel company, ArcelorMittal, before I joined HKU in 2010. My research experience in the industry has helped me to see the links between fundamental research and industrial applications, which I think is very important for researchers in engineering science.”

What gives you the greatest joy?

“Exciting new research findings indeed bring me great joy. But, spending holidays together with my daughter, wife and parents also always brings me the greatest joy. I feel so lucky having a happy family and that, I think, is the most important source of joy.”

Selected Publications

At the Vanguard of Dental Surgery

Dr Mike Yiu Yen LEUNG
BDS, MDS, PhD (HKU), MOSRCS (Edin)
Clinical Associate Professor, Faculty of Dentistry | mleung04@hku.hk

“My key research area is the application of new technology in surgery of the maxillofacial region. One part involves using three-dimensional (3D) imaging and printing to improve accuracy and outcomes in the management of patients with dentofacial deformities and obstructive sleep apnoea. Another part involves a new technique for third molar (wisdom tooth) surgery called coronectomy. My research has proved coronectomy can minimise the risk of nerve injury in high-risk cases and is safe in the long term.”

Research by Dr Mike Yiu Yen Leung is offering fresh and safer alternative treatments for patients with dentofacial deformities and patients requiring third molar (wisdom tooth) surgery.

Dentofacial deformities can affect chewing function, respiratory function and general health. Many sufferers are bullied at school because of their abnormal faces and some suffer from obstructive sleep apnoea due to their deformities. Orthognathic, or corrective jaw, surgery may correct deformities, but the traditional approach has involved using stone models and lab work, with the outcome sometimes dependent on the experience and ‘art sense’ of surgeons. Dr Leung has applied 3D technology to the problem to improve both the accuracy and clinical outcomes of orthognathic surgery. 3D imaging improves prediction and planning so surgeons can better classify, plan and execute treatment, while 3D-printed surgical guides and titanium plates improve surgical accuracy and reduce surgical time.

Third molar-related diseases are more common in the population than deformities, but third molar surgery carries the risk of injury to the trigeminal nerve that supplies sensation to the lower lip, which may result in numbness or neuropathic pain. The traditional approach, particularly for lower third molar surgery, is total removal. Dr Leung has demonstrated that a new technique to remove the tooth crown only, called a coronectomy, is an effective alternative that minimises the risk of trigeminal nerve injury compared with traditional surgery and also has a minimal risk of infection and pain. Moreover, he showed that over the long term, few problems are caused by leaving a small part of the tooth root. Only a tiny percentage of patients in his randomised controlled clinical trial required a second minor surgery to remove the root and none suffered permanent nerve injury from the surgery.

Dr Leung believes that research should advance well-being in patients, not only in terms of improving treatment outcomes but also enhancing quality of life. His current goals are to develop an orthognathic surgery training platform for maxillofacial surgeons in Hong Kong and the Asia Pacific region, and a guideline for local dentists to perform safer third molar surgery.

How do you strike a balance between research, teaching and clinical service?
“My priority is always the patients who suffer from disease of the jaw and mouth. I try to focus on clinical research that would improve the treatment outcome and their quality of life. This helps me to maintain my motivation in research and balance all the responsibilities of my job.”

What is your greatest joy?
“The greatest joy of my work is seeing my patients leaving my clinic happy, and at times receiving their thank you cards or invitations to their life events when they come back for review appointments.”

Highlights
• Early Career Scheme project: Guided Bone Regeneration to Reduce Root Migration after Coronectomy of the Lower Third Molar: A Randomised Clinical Trial
• Oral Presentation Prize, 11th Asian Congress on Oral and Maxillofacial Surgery
• Gold Medal, Best Original Research by Trainee from The Hong Kong Academy of Medicine
• Young Lecturer’s Award, 13th Convocation of the Royal Australasian College of Dental Surgeons

Selected Publications
A Water-Based Solution with Many Applications

Dr Anderson Ho Cheung SHUM
BSE (Princeton), SM, PhD (Harvard)
Associate Professor, Department of Mechanical Engineering | ashum@hku.hk

Droplets that are delivered via tiny microchannels have great potential for drug delivery and biochemical reactions. However, the realisation of those applications has been limited by the need to use organic or oil-based liquids that often interfere with the activities of biomolecules such as proteins. The work of Dr Anderson Ho Cheung Shum, on the other hand, has been among the first to propose replacing these liquids with water-based liquids that do not have this confounding effect in microfluidics. Over the past few years, he has revolutionised the tools and theories for generating, processing, stabilising and utilising droplets. Among his achievements, he has developed a new type of protein-based capsule, introduced droplets that are capable of dividing into smaller droplets thereby mimicking biological cells, elucidated a new dynamic of electrowetting with potential impacts in printing and the formation of nanofibres, and devised a strategy to isolate, collect and culture single cells.

The research has attracted funding and industry collaborators, such as BASF and Shinshuike, to explore the application of his discoveries in biomedicine and cosmetics. Since December 2018, he and his team have filed patents for 11 inventions and licensed six of them. They have also attracted interest from overseas collaborators, which has enriched their research. “In our all-aqueous works, our overseas collaborator was a leading expert in the physical chemistry of the protein and shared their understanding and protein recipes with us, which we were able to successfully apply in our research,” Dr Shum said.

The droplet-based microfluidic platform that he and his team have developed is expected to revolutionise the next-generation droplet-based diagnostics of diseases and the screening of drugs. As such, Dr Shum has also initiated extensive collaborations with colleagues in such fields as clinical oncology, biomedical sciences and biological sciences. He expects this to result in world-class publications within the next few years and potential commercialisation of the findings within three to five years.

How do you make your work more impactful?
“The impact of many of my research platforms can be multiplied if suitably applied to a pressing problem that other researchers may be more familiar with. For example, HUSU has experts in a variety of fields, and through word of mouth I have found the right partners to work with. I have also found success with collaborators from other parts of the world.”

How do you connect across cultures?
“Most scientists have a common language that we can harness to come up with innovative and impactful solutions. Working with international scientists therefore feels like working with friends. We understand each other quickly and can get on with addressing a pressing issue.”

Highlights
• Ranked among the top 1% of scholars in his field by Clarivate Analytics Essential Science Indicators 2018
• Fellow of the Royal Society of Chemistry, UK
• New Innovator, IEEE 12th International Conference on Nano/Molecular Medicine and Engineering (NANOMED)
• Silver medal, 46th International Exhibition of Inventions, Geneva, Switzerland
• Competitive peer-reviewed external funding including—Early Career Scheme project and numerous General Research Fund projects, such as Fast Scaffold-Free Assembly of Cells into Compact Cell Sheets via the Organized Spreading of Air-Aqueous Droplets—Multiple Innovation and Technology Fund projects such as Next-Generation High Throughput Diagnostics-on-a-Chip System Based on Droplet Microfluidics—Health and Medical Research Fund project: An In Vitro Micro-Fluidic Device to Screen Silicone Oil Tampons Based on Resistance against Shear Emulsification in Eye—National Natural Science Foundation of China projects, such as Osmotic Effect in Droplet Formation—Based on Aqueous Two-Phase Microfluidics—Founding Member of The Young Academy of Sciences of Hong Kong• Outstanding Young Researcher Award, HKU

Selected Publications and Patents
• Chau Y, Matt S, Yuen Y, Lam C, and Shum H.C., “Generation of high-order all-aqueous emulsion drops by reverse-driven phase separation” Small, 2018, 14(8), 1-10.

“Droplet- and jet-based platforms are ubiquitously applied in technologies for food, drug delivery, cosmetics, environmental monitoring and beyond, and I want to enhance their functional precision. One way to do this is to minimise their structures— for instance, in disease diagnostics and environmental monitoring, smaller droplets not only mean smaller sample volumes, but also lead to enhanced sensitivity.”
A Pioneer of Light-Powered Nanorobots

Dr Jinyao TANG
BS (USTC), PhD (Columbia), PDF (Berkeley)
Associate Professor, Department of Chemistry | jinyao@hku.hk

“My research is targeted at achieving specific applications like the medical nanorobot, while also dealing with fundamental physical chemistry questions like how and why ions move in solutions.”

Dr Jinyao Tang seeks to address several fundamental scientific challenges in soft matter science, such as how light can be converted into a mechanical force, how to achieve versatile navigation with light, and how to deal with biotoxicity. These investigations have led Dr Tang and his team to develop cutting-edge nanorobots with a widely hailed medical application.

At the core of Dr Tang’s research is the discovery of an efficient and versatile method for converting photon energy into a mechanical force at the micrometre scale. In 2016, he and his team demonstrated the first light-controllable nanorobot made with nontoxic materials. This research was inspired by light-sensitive algae, which can sense the direction of light and navigate along it. By carefully designing the nanomachinery and choosing appropriate light-sensitive semiconductor materials, Dr Tang and his team were able to successfully encode programmable light navigation ability into artificial microswimmers. These micro-swimmers have scales smaller than human blood cells and can perform in similar ways as natural mobile algae. Their macroscopic migration behaviour is also visible to the naked eye. The discovery was widely reported by many local and international news outlets for the science-fiction-like potential of a nanorobot performing surgery or smart drug delivery.

Scientific American (Feb 2017, p15) reported: “This work is an early glimpse of medical robots that doctors could navigate through a patient’s body from the outside, with a focused beam of light.”

Dr Tang is currently trying to develop functional and biocompatible nanomaterials and molecular recognition materials for in-situ health diagnosis and new electronic analytical methods.

What motivates you?
“I want to understand the laws of mother nature and I want to find solutions to problems. It does not make any difference to my research if I am working on a hot new topic or an old classic one – both of them can provide background knowledge that will help me to find answers.”

Can you describe a risk you have taken?
“After starting work at HKU, I switched my field of research from the ‘hot’ topic of renewable energy to the smart nanorobot, which was a brand new area with few references that I believed had good potential. This was risky, but it has been rewarding, giving me a unique opportunity to tackle questions from a different perspective.”

Highlights

- Competitive peer-reviewed external funding including:
  - Early Career Award and Early Career Scheme project: High Efficiency Thermoelectric Graphene through Nanoeengineering and Chemical Modification
  - General Research Fund projects:
    > Experimental Study of Nana/Microwimmers in Strong Electrolyte Solution
    > Light-Powered Semiconductor Nanorobots
    > Nanofluidic System with Chemically Grafted Inorganic Nanotube for Biological Analysis
  - Outstanding Young Researcher Award, HKU

Selected Publications and Patents

A New Spin in Materials Science

Professor Wang Yao
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“Ours findings on valleytronics and spintronics in two-dimensional materials, and their heterostructures, point to exciting opportunities for engineering quantum materials and devices that have the potential to revolutionise microelectronics and information technology.”

Two-dimensional (2D) materials are an area of frontier research in physics and materials science. They have a wide range of material properties, from metals and semi-metals to semi-conductors and insulators, and from superconductivity to magnetism. They also have exotic physics associated with the ‘spin’ and ‘valley’ pseudospin of their electrons, which can be harnessed to store and process information more efficiently. Professor Wang Yao is one of the leaders in the field through his work in opening an important new research direction, valley optoelectronics in atomically thin 2D materials.

The energy of electrons in many crystalline solids disperses in the momentum space in the form of a degenerate set of ‘valleys’. Professor Yao and his collaborators have managed to harness this internal degree of freedom to carry information for electronics—a field known as valleytronics. Two of their predictions stand out. One is the valley optical selection rule, which makes possible valley-selective optical transitions by circularly polarised light. This has driven optoelectronic studies in semi-conducting 2D materials. The second is the valley Hall effect, in which the electrical field generates a transverse topological valley current; this has now been observed by researchers in several 2D material systems. The ground-breaking advances in achieving this effect have transformed valleytronics from a concept to an experimentally demonstrated reality, and become cornerstones in the burgeoning field of valleytronics research.

Professor Yao’s current research includes the exploration of valley and spin phenomena and topological properties in van der Waals heterostructures from the flexible stacking of different 2D materials.

What inspires you?
“The curiosity to understand the world.”
What has been your most satisfying moment as a researcher?
“Seeing our theory demonstrated by experiments.”

Highlights
- Highly Cited Researcher, Clarivate Analytics Essential Science Indicators 2018
- Croucher Innovation Award
- Competitive peerreviewed external funding including
  - Numerous General Research Fund projects, such as
  - Spintronic Manipulations of Layer Dependent Magnetism in Atomically Thin Chromium Trihalides and Their Heterostructures
  - More Superlattice Effects on Electronic, Optical, and Topological Properties in Heterolayers of 2D Semiconductors
  - Fine Structures of Exciton-Polaritons in Van der Waals Layered Materials Embedded in Microcavity – Collaborative Research Fund project (as Co-Principal Investigator): Two-Dimensional Transition-Metal Dichalcogenides and Beyond – From Materials, Physics to Devices
- Achievement in Asia Award – Robert T. Poe Prize from the International Organization of Chinese Physicists and Astronomers
- Outstanding Researcher Award and Outstanding Young Researcher Award, HKU
- Research Output Prize, HKU

Selected Publications
Smart Systems & Sustainable Society (S⁴)

Dr David Michael BAKER (Biological Sciences)
Oceans’ Advocate

Dr Ting Fong May CHUI (Civil Engineering)
Engineering Sustainable Water Resources

Dr Heming CUI (Computer Science)
Making Data More Secure

Dr Kyung-min NAM (Urban Planning and Design)
Big-Picture Perspectives in a Sustainable Society

Dr Pui Ling TANG (Chinese)
Smart Insights from Ancient Sources to Preserve Cultural Heritage

Professor Po Jen YAP (Law)
Socio-Political Influences on Judicial Behaviour in a Smart Society
Dr David Michael BAKER
BA (SMCM), MA (AmericanU), PhD (Cornell), PDA (Carnegie), PDF (Smithsonian)
Associate Professor, School of Biological Sciences | dbaker@hku.hk

“Our research is increasing awareness of the negative effects of coastal pollution on ecosystem health, and we are working with government to show that positive policy actions can enhance and restore those ecosystems. This ‘stressor-to-solution’ approach underpins our research philosophy.”

Marine waters receive all sorts of waste from land-based human activities, such as sewage, sediments and plastic. Few people realise these wastes end up on their dinner plates via the seafood extracted from the ocean. Biologist Dr David Baker, who is based in the Swire Institute of Marine Science, has been trying to address this situation by drawing links between the key impacts and the recommended solutions for enhancing marine water quality, which aim to protect both human and environmental health and future water security.

A focal area of work for Dr Baker and his team has been highlighting the impacts of nutrient pollution on ecosystems and forcing a rethink about how nutrients affect life in the oceans. For example, a recent study demonstrated how the symbiotic algae within corals become greener when the oceans are warm and polluted and thus share fewer resources with their coral host, which can worsen coral bleaching. The work implies that reducing pollution in oceans may make the corals more resistant to climate change. Another study has shown how excess nutrients from pollution reduce the carbon storage potential in coastal sediments, which means more carbon dioxide can accumulate in the ocean, causing acidification. Dr Baker and his collaborators have estimated that reducing nutrient pollution globally can increase the carbon storage potential of coastal sediments to a value equivalent to billions of US dollars in terms of climate change mitigation.

Dr Baker leads the Hong Kong node of the project Marine Global Earth Observatories (MarineGEO) co-ordinated by the Smithsonian Institution. The project aims to conduct a modern census of marine biodiversity in coastal seas using advanced DNA sequencing technologies. In Hong Kong, Dr Baker’s team aims to resolve the value of marine biodiversity in terms of mitigating human health risk factors, such as pathogens and antimicrobial resistance genes. Hong Kong is functioning as an important regional hub for this global study, and is helping to develop sites in Korea and India.

What advice do you have for young researchers?
“...In the current academic world, the pressure on young researchers to aspire for impact can be unbearable. This is especially true when one feels like their passions in research are not ‘buzzworthy’ hot topics in society. I once felt that my own early work was low impact, but I find it is now gaining more prominence in my field as science points us in a direction that says ‘this is important, too’. Scientists who are passionate, flexible and interdisciplinary naturally find impact in time. I think that’s the recipe for success.”

What motivates you?
“My motivations for science are simple. I want my science to stimulate new inquiries for generations, and thus serve as my professional legacy. I also hope my work helps to make the world a better place for my son and daughter.”

Highlights
- Competitive peer-reviewed external funding including
  - Early Career Award and Early Career Scheme project: A Stable Isotope Survey of Hong Kong’s Corals
  - General Research Fund projects, such as Sedimentary Records of Historical Coral Diversity and Distribution in the South China Sea
- Environment and Conservation Fund projects, such as MarineGEO-Hong Kong: Towards an Understanding of Marine Biodiversity and Ecosystem Function
- Collaborative Research Fund project (as Co-Principal Investigator): SIMS 2.0 – Establishing Asia’s Premier Stable Isotope Ratio Mass Spectrometry Laboratory in Hong Kong
- Pew Marine Conservation Fellowship Nominee

Selected Publications
Engineering Sustainable Water Resources

Dr Ting Fong May CHUI
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Associate Professor, Department of Civil Engineering | maychui@hkcu.hk

“My work has contributed to the sustainable management of stormwater and groundwater, facilitated the conservation of wetlands and rivers in the face of urbanisation, and advanced our understanding of the interactions between surface water, groundwater and ecology. I have also developed innovative numerical modelling techniques for coupled hydrological and ecological processes.”

Hydrology and sustainable water resources engineering are the research areas of Dr Ting Fong May Chui. Dr Chui aspires to develop engineering solutions that balance the needs of economic development against those of the environment in the face of global change and anthropogenic impacts. Her work is concentrated in three main areas: sustainable stormwater management, wetlands conservation, and river restoration.

On sustainable stormwater management, Dr Chui pioneered the design and optimisation of sustainable drainage systems (SuDS) under intense rainfall and shallow groundwater conditions, which has enabled these systems to be implemented in locations that traditionally have had problems in flood mitigation and stormwater drainage. If they opted for conventional drainage systems, urban water problems could arise such as runoff pollution and groundwater depletion. If they opted for more sustainable low-impact development practices and had shallow groundwater conditions, such as Hong Kong and Singapore, then additional risk could be posed to groundwater dynamics and contamination. Dr Chui overcame these challenges by striking a better balance between rainfall runoff control and groundwater protection. She has also guided the implementation of SuDS in Hong Kong through projects with the Hong Kong government and consulting work with industry.

On wetlands conservation, Dr Chui has developed modelling frameworks and generated ecologically insightful knowledge that has helped to guide wetland conservation strategies worldwide. One project involved a highly rigorous evaluation of the impacts of land reclamation on coastal wetlands using coastal hydrodynamic and Bayesian regression models. Another project provided insights on the subsurface lateral water and heat fluxes of wetlands, which had been little-studied before. Her work has highlighted the importance of considering hydrodynamic effects on coastal ecological processes and facilitated ecological impact assessments performed across different disciplines.

And on river restoration, Dr Chui has proposed innovative techniques that account for the conditions of stormwater drains in highly developed environments. This involved the use of groundwater modelling and genetic programming to develop a method that approximates river baselines based on groundwater fluctuations.

Dr Chui’s current projects include evaluating the hydrological and ecological responses of tidal marshes to environmental changes, developing modelling frameworks to facilitate the transition to green drainage systems via optimal low-impact development retrofits, and restoring the natural interactions between the surface and groundwater at drainage channels.

What helps you to succeed as a researcher?
“I have to attribute my success largely to my persistence and my eagerness to continuously learn and innovate.”

What are your thoughts as a woman in a traditionally male-dominated field?
“I do not find it ‘difficult’ to be a ‘woman in engineering’. I do not notice any difference most of the time. I feel I bring in different perspectives or contributions which are always appreciated.”

Highlights
• Invited to deliver “Early Career Researcher Distinguished Lecture in Interdisciplinary Geosciences” at the Asia Oceania Geosciences Society 13th Annual Meeting
• Competitive peer-reviewed external funding through multiple General Research Fund projects, such as – Hydrological and Ecological Responses of Tidal Marshes to Environmental Changes in Semi-Enclosed Bays – Transition to Green Drainage System via Optimal Low-Impact Development Retrofits
• Public Policy Research Funding Scheme project: Developing Sustainable Hong Kong through Low Impact Development – From Science to Innovation Policy
• Contract research project from the Drainage Services Department of the HK Government: Porous Pavement Hydrological Monitoring and Experiments

Selected Publications
Making Data More Secure

Dr Heming CUI
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Assistant Professor, Department of Computer Science | heming@cs.hku.hk

“I invent transparent and efficient software infrastructures that can effectively protect the reliability and security of real-world software applications, including a series of novel software systems that are being used by other researchers and by industry.”

Data security is a hot topic in this era of big data and artificial intelligence (AI), and Dr Heming Cui has provided important solutions that address both transparency and efficiency. The infrastructures he has developed can automatically capture the runtime features of software applications and inject reliability and security guarantees into them without affecting their implementation or performance. Examples of how Dr Cui and his students have combined these features include transparent big-data security systems that automatically and efficiently prevent sensitive data leakage, and transparent blockchain infrastructures that can deploy decentralized applications, such as databases, in a decentralized manner, thus offering much improved security and reliability.

An example of Dr Cui’s work is the Kakute system, which addresses the problem of data owners granting access of their data to third parties while retaining crucial data access rules (for instance, not leaking credit card details for online orders). Kakute is the first secure big-data computing engine to use a novel labelling approach that automatically labels sensitive data and tracks its computation based on the data owner’s configuration. If sensitive labels show up in results to be delivered to third parties, Kakute will automatically detect and prevent the delivery. The system has been evaluated extensively in real-world, big-data computing workloads and found to be efficient, secure and practical.

The work of Dr Cui and his students has attracted interest from the global IT industry. Recently, they built a big-data computing engine called Uranus that has been adopted and extended in two NSF projects in the US, providing greatly improved security for scientific computing. In addition, with the support of two major innovation research grants from Huawei, Dr Cui currently is building efficient distributed fault-tolerant infrastructures (e.g., FLOWER, published in the premier NSDI 2018 conference) for both data centres and the Internet. These infrastructures can make general data storage applications tolerate various reliability and security vulnerabilities in a transparent manner, with little or no modification to their implementation.

What advice do you have for young researchers?
“Tend to be an optimistic and open-minded guy. I always motivate my students to foresee the good aspects of research projects (such as impacts) no matter how tough these projects can be. I also proactively advise my students to find the areas that interest them most, so they can produce research results that are driven by their own passion and heart.”

What keeps you going?
“I am always energetic. I do lots of gym workouts during my spare time, which gives me ample energy to work in competitive, cutting-edge research areas.”

Highlights
• Croucher Innovation Award
• Best paper award, 22nd Annual Computer Security Application Conference
• Huawei Innovation Research Program flagship project: A Blockchain-Powered, Trustworthy Internet Layer (system) and its Decentralized and Efficient Applications
• Competitive peer-reviewed external funding including:
  – General Research Fund projects:
    > New Systems and Algorithms for Preserving Big-Data Privacy in Clouds
    > GAIA: Strengthening the Reliability of Datacenter Computing via Fast Distributed Consensus
  – Early Career Scheme project: FALCON: Modeling, Detecting, and Defending against Concurrency Attacks

Selected Publications
Dr Kyung-min NAM has a wide palette of expertise and experience in spatial planning, economic modelling, regional science and related fields, which he has combined to address some of the pressing issues of modern times. For example, he has combined economic modelling with environmental impact assessment and atmospheric chemistry models to explore the science and policy dimensions of climate change and urban air pollution. Dr Nam is also interested in international development, having been involved early in his career in projects that looked at Northeast Asia’s integrated transport infrastructure development as part of his involvement in Korea’s national territorial master plan. He is keen to explore why some regions are more economically prosperous than others and how their development models can be transplanted to other systems. “My partial answer is that local technological capabilities provide a key source of economic development, and nurturing these capabilities needs careful planning and policy under clear and consistent long-term strategies,” he said.

Putting that into practice, Dr Nam is currently working on a major project about China’s Belt and Road Initiative (BRI) and the China-Indochina Peninsula Economic Corridor. He and his team are among the pioneers in developing a comprehensive impact assessment tool, comprising a spatial network analysis model and a multi-region computable general equilibrium model, that they are applying to three arms. First, they want to assess the magnitude of economic impacts brought about by improved intra-regional trunk road networks along the corridor, by looking at factor productivity and trade promotion channels. Second, they want to estimate the distribution of these impacts by country and sector. And third, they want to explore how such BRI projects and China’s national development policy can be linked in favour of the country’s economically lagging western regions.

Dr Nam is also interested in expanding the focus and scope of the BRI project to include other proposed or potential economic corridors, such as Northeast China and the Korean Peninsula, and to include other industrial sectors such as energy. He has submitted a grant proposal for this work to China’s National Natural Sciences Foundation.

Who has inspired you?
“T he late Professor Alice H. Amsden, who was my PhD advisor at MIT, was my mentor, giving me the greatest academic inspiration. When I was a student, she always encouraged me to challenge the conventional wisdom if it disagreed with my own observation or reasoning, and to think big instead of aiming at small theories confined within the existing framework.”

What is the philosophy behind your approach to research?
“My research projects aim to add new perspectives to existing theories or offer alternative explanations. In my field, numerous competing theories exist even for the same phenomenon — as is often the case for many social science research areas — and it is never safe to focus on only part of the reality or be built on local specificity. I maintain caution against one-size-fits-all kinds of arguments and keep myself open to any possibility. This stance and philosophy have been very helpful in identifying topics for my research.”

Selected Publications

Highlights
• Associate Editor of Annals of Regional Science
• Editorial Board Member of International Journal of Urban Sciences, Journal of Economic Studies and Journal of Korean National Economy
• Early Career Scheme project: Cost of Excess Air Pollution in China and its Cross-Provincial Distribution – Focusing on the Health Effects
• Urban China Initiative Research Grant project: Domestic Migration Control and ‘M-Form’ Urban Hierarchy – A New Forecast Model for China’s Urbanization
• Research Output Prize, HKU
Smart Insights from Ancient Sources to Preserve Cultural Heritage

Dr Pui Ling TANG
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“...the uniqueness of my research stems from its successful integration of ancient sources – such as bronze inscriptions and bamboo manuscripts – that have been discovered or unearthed in contemporary China, with versions of these texts that have undergone generations of transmission and been subject to scribal changes and textual variations. My research applies the process of mutual verification to verify, supplement and/or rectify multiple records of transmitted texts.”

Where do you find inspiration?

“I frequently visit museums all over the world for my research to personally view and access archaeological objects, and these experiences have benefited my research in remarkable ways. I have been most fortunate in being able to collect extensive unpublished information on early Chinese bronze vessels, some of which can serve as a basis to correct the mistakes of previous research. As the Chinese saying goes, “it is better to travel ten thousand miles than to read ten thousand books”.

What is your greatest joy?

“Spending leisure time travelling and visiting museums, exhibitions and galleries. I like wandering casually around museums and taking the time to revel in the splendid collections of artefacts. I love Chinese art of all types, especially ancient Chinese paintings and calligraphy. Beyond aesthetic pleasure, they provide me with a lens to look into the past and understand the cultural pursuits of our ancestors.”

Selected Publications


Highlights

- Competitive peer-reviewed external funding through General Research Fund projects:
  - A Comparative Study of the Language of Shangshu and Bronze Inscriptions
  - A Contrasting Analysis of the Language between Shangshu and Bronze Inscriptions of the Pre-Qin Period
  - Early Career Scheme project: Research on Textual Patterns of Bronze Inscriptions of the Zhou Dynasty

An example of Dr Tang’s work is her monograph on the Shijing 詩經, also known as the ‘Book of Poetry’, which is one of the most important Confucian canons. The obscure language has aroused substantial issues because it has undergone prolonged textual transmission over the centuries. Dr. Tang’s work is the first study of the Shijing that utilises original bronze inscriptions and bamboo strips excavated in contemporary China, to provide an extensive and comprehensive study of their language and contents in comparison with transmitted versions of the text.

Dr. Tang’s current research goals include examining the nature of the language in classical texts by correlating their contextual styles with the bronze inscriptions, and developing her research on mutual verification to incorporate significant bamboo manuscript discoveries from the past few years.
Socio-Political Influences on Judicial Behaviour in a Smart Society

Professor Po Jen YAP
LLB (NUS), LLM (Harvard, UCL), PhD (Cambridge)
Professor, Department of Law | pjiyap@hku.hk

“The study of legal rules is incomplete without a fuller understanding of the socio-political forces that shape judicial behaviour. In my research – which focuses on Asian courts – I seek to integrate the study of comparative constitutional law with comparative politics, examining how law and politics constantly interact in the judicial construction of constitutional doctrines, and how Asian courts play an intentional and indispensable role in sustainable state governance.”

In today’s highly globalised and highly complex world, judges no longer simply interpret the law as written, but instead also make law that binds their governments and citizens. This phenomenon is prevalent in the West, and research by Professor Po Jen YAP shows that this is also happening in Asia.

Professor YAP integrate the study of comparative constitutional law with comparative politics in order to understand how socio-political forces shape judicial behaviour. His study on judicial behaviour has provided a new understanding of how judges can foster democratic deliberation and improve legislative performance by continuing the best practices in statecraft and adjudication.

In his sole-authored monograph Courts and Democracies in Asia, for instance, he shows how the strength of a country or jurisdiction’s democracy has a symbiotic relationship with the ability of its courts to address deficiencies in the electoral process. He identifies three different kinds of democracies. In the ‘dominant-party’ democracies, such as Singapore, Malaysia and Hong Kong, courts can only pursue ‘dialogic’ pathways to constrain a government’s authoritarian tendencies. In the ‘dynamic’ democracies, such as India, South Korea and Taiwan, courts are more successful at innovating and making systemic changes to the electoral system. Finally, in the ‘fragile’ democracies, such as Thailand, Pakistan and Bangladesh, which regularly oscillate between martial law and civilian rule, courts consistently tend to overreach, which often facilitates or precipitates a hostile takeover by the armed forces, leading to a demise of the rule of law.

Professor YAP’s work has had international impact, having been cited by national Courts of Appeal in Trinidad and Tobago, Singapore and New Zealand. He is also an Advocate and Solicitor of the Supreme Court of Singapore and Attorney at Law in New York state. His current research focuses on the role of courts as democracy-builders in the Asian context and how they craft doctrines and remedies that further or impede this goal.

What distinguishes your work?
“Very few comparative constitutional scholars in the world produce cutting-edge, sole-authored monographs that engage with the latest literature from the West whilst integrating Asian cases in a global discourse. It is my hope that my work has filled this lacuna.”

Where do you find your greatest joy?
“Professionally, I get the greatest joy from seeing how my work has significantly enhanced understanding of judicial behaviour in Asia and contemporary China among global law and political science communities.”

Selected Publications
Intelligence, Data, E-Commerce & Automation (IDEA)

Dr Esther Wai Yin CHAN (Pharmacology and Pharmacy)
Using Big Data to Monitor Drug Safety and Effectiveness

Dr Xiao HU (Education)
Computing Culture for Well-Being

Dr Daniel Taro POCH (Modern Languages and Cultures)
Challenging Notions of Emotion in Japanese Literature

Dr Shelley Xiuli TONG (Education)
Developing Intelligent Interventions for Language and Literacy Acquisition

Dr James Kit Hon TSOI (Dentistry)
Perfecting Dentistry with New Digital Technology

Dr Jessica Rae VALDEZ (English)
‘Fake News’ in the Victorian Age

Dr Jingqi WANG (Business and Economics)
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In Pursuit of Optimal Solutions
Using Big Data to Monitor Drug Safety and Effectiveness

Dr Esther Wai Yin CHAN
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“My research focuses on determining medication safety and effectiveness using big data as a platform for real-life population-based studies and interventional clinical study designs.”

Dr Esther Wai Yin Chan has helped to bridge the gaps in knowledge about the application of drugs – in particular, oral anticoagulation medications and their use in special patient groups, and sedating drugs for behavioral emergencies for which there were concerns about their adverse effects or scant post-marketing data on their safety. She and her collaborators have applied a variety of observational study designs, including cohort and self-controlled case series studies and randomised clinical trials, to gain a better understanding of these drugs.

For oral anticoagulation medications, the focus has been on dabigatran, apixaban and rivaroxaban, which are relatively new and increasing in prescription volume. In a population-based cohort study, Dr Chan found that patients taking dabigatran can reduce the risk of gastrointestinal bleeding by taking gastro-protective agents. This finding has led to changes in clinical practice. Her current focus is on investigating adverse events and bleeding risks using a broader range of anticoagulation drugs in special population groups, including elderly patients, to determine the impact on renal and hepatic function.

More recently, Dr Chan has found that newer oral anticoagulation medications could be a more effective and safer treatment option, particularly for women, when compared with the traditional drug warfarin. These medications are non-vitamin K antagonist oral anticoagulants (NOACs) and include rivaroxaban, dabigatran, apixaban and edoxaban. Dr Chan and her team studied 4,972 men and 4,834 women being treated for atrial fibrillation in the Hong Kong Hospital Authority and found that women treated with these NOACs had a lower risk of intracranial bleeding compared with those treated with warfarin. The same effect was not seen in men. The risks of ischemic stroke and gastrointestinal bleeding with NOACs versus warfarin were comparable for both sexes.

Dr Chan was also involved in a study of neuropsychiatric and sedating drugs that involved multi-centre randomised clinical trials and their choice of antipsychotic and sedating agents to manage acute agitation. Two trials were conducted in Australia and have been completed. They led to practice changes and new management recommendations in the Australian Therapeutic Guidelines. Two further studies are being conducted in Hong Kong and forthcoming research findings are expected to guide and improve the management of acute agitation and patient care in emergency settings in Hong Kong and abroad.

Highlights

- Competitive peer-reviewed local and national external funding including:
  - Early Career Scheme project: Intramuscular Olanzapine Versus Haloperidol or Midazolam for the Management of Acute Agitation in the Emergency Department – A Multicenter Randomized Clinical Trial
  - General Research Fund projects such as Pharmacoeconomics of Oral Anticoagulation Agents – A Comparison of Dabigatran Etxelax, Warfarin and Dual-Platelet Therapy in Patients with Atrial Fibrillation
  - National Natural Science Fund of China – Young Scientists Fund project: Preferences and Willingness to Pay for Novel Oral Anticoagulants in Patients with Atrial Fibrillation in China
  - Beat Drugs Fund project: Understanding Drug Abusers and Their Healthcare Pathways – Towards Better Management in Hong Kong
  - Inducted Fellow, Society of Hospital Pharmacists of Australia
  - DBL Hospira Young Pharmacist Award, Society of Hospital Pharmacists of Australia
  - Outstanding Young Researcher Award, HKU

Selected Publications

Computing Culture for Well-Being

Dr Xiao HU
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“I work in the domains of learning analytics, music information retrieval and cultural heritage digitisation. The goal of my research is to improve people’s learning and well-being by designing and developing intelligent systems based on the ever-growing amounts and complexity of user data.”

Dr Xiao Hu has expertise in both information science and engineering, which she has applied in major projects to improve student writing, enhance access to fixed cultural objects, particularly the Mogao Caves of Dunhuang, China, and provide music recommendation systems to improve well-being. Using learning analytics, Dr Hu has developed a web-based intelligent dashboard named Wizglass that collects and computes the online writings of primary and secondary school students to provide them with continuous feedback and facilitate teachers in doing formative assessment. The tool has been used by several schools in Hong Kong and Mainland China and Dr Hu is working closely with teachers to refine and improve its design.

For her second area of digitised cultural heritage, she has harnessed digital technologies to improve global access to the digitised murals and stone caves of the e-Dunhuang digital platform and design intelligent systems for annotation and enrichment of this heritage. In collaboration with the Dunhuang Research Academy, she has evaluated and updated two metadata schemes on immovable heritage from the user’s perspective, which have been submitted to the National Technical Committee on Cultural Relics Protection of the Standardisation Administration of China.

Finally, Dr Hu has produced influential work on music information retrieval by using computational systems that leverage the power of music in emotion modulation and consider the effects of music on human behavioural and physiological responses. She has developed two models that provide a framework for automatically recognising the mood of music, which have been widely cited by scholars around the world. Dr Hu is now looking to design music intelligent systems that can also incorporate user data from wearable technologies to detect the user’s mood and circumstances and recommend music to them accordingly, with the goal of enhancing well-being through music.

What moves you?
“When I listen to Puccini being performed, or look at murals more than 1,000 years old in the Mogao Caves, I feel closely connected with superior artists and their worlds, as if traveling across time and space. It has become my mission to make powerful heritage better integrated into people’s everyday lives, in intelligently optimised ways that can benefit human well-being.”

What is an everyday challenge you face?
“Being a female researcher can be extra challenging in the interdisciplinary arena where I strive to bridge humanities, social sciences, computing and signal processing. At difficult times, I have found help by looking to idols such as Marie Curie and to supportive colleagues at HKU.”

Highlights
• Competitive peer-reviewed local and national external funding including
  – Early Career Scheme project: Learning Analytics for Wiki-based Learning Environments in Primary and Secondary Schools
  – General Research Fund project: Leveraging Background Music for Learning – An Interdisciplinary Approach
  – National Natural Science Foundation of China – Science Fund for Young Scholars project: Music Recommender Systems Based on Physiological Signals
• Women in Music Information Retrieval Award from the International Society for Music Information Retrieval

Selected Publications
Challenging Notions of Emotion in Japanese Literature

Dr Daniel Taro POCH
MA (Heidelberg), MA (Waseda), MPhil, PhD (Columbia)
Assistant Professor, School of Modern Languages and Cultures | dpoch@hku.hk

“Investigate the role of notions of emotion and desire in shaping the canon of the 19th-century Japanese novel. My interdisciplinary approach crosses borders of traditional academic divides in my field (Japanese literature and culture), reaching out to a broader community of scholars, readers, and students and sharpening their understanding of the dynamics of literature and culture.”

The research on 19th-century Japanese literature by Dr Daniel Poch challenges traditional disciplinary divides. This includes challenging the divide between modern and pre-modern studies, which is important to understand the tremendous historical transformations of the period and the important continuities between Japanese literature and Chinese literary discourse and fiction that marked cultural production in Japan well into the 20th century. Dr Poch integrates all these elements to highlight the importance of emotion, and traditional assumptions about emotion as a quality of intelligence, in shaping the modern literary canon of Japan and, more broadly, East Asia.

A key publication looks at the complexity of the modern Japanese literary field in early 20th-century Japan, where new Western-inspired genres like the novel clashed with more traditional forms of literary, including poetry in the classical Chinese style. Dr Poch focuses on the writings of Natsume Soseki (1867-1916), often seen as the most important modern Japanese novelist, who was in fact highly suspicious about the novel as a genre. Dr Poch demonstrates how Soseki was faced with the difficult task of defining ‘literature’ as a universal category that could potentially include different and seemingly incommensurable literary forms, for instance the novel and classical poetry. Dr Poch shows how Soseki pulled all these strands together by placing emotion — a quality inherent in all literary forms — at the heart of his critical reflection on literary writing.

Dr Poch plans to next focus on cross-disciplinary research in literary modernism that will also involve a European perspective.

What inspires you?
“My ability to pursue my passion for literature, and Japanese literature in particular, has helped and will help me inspire my students and my readers. I believe that passion is truly inspirational and that any research should, at some level, be informed by this energy.”

What gives you the greatest joy?
“To critically reflect about what I read and to engage in a dialogue about my ideas with my readers and students; to see my students intellectually grow in this process.”

Selected Publications
Developing Intelligent Interventions for Language and Literacy Acquisition

Dr Shelley Xiuli TONG
BSc (NENU), MEd (SCNU), PhD (CUHK), PDF (Dal, WSU)
Associate Professor, Faculty of Education (Division of Speech and Hearing Sciences) | xtong@hku.hk

“Children with special educational needs require a dynamic integration of cognitive and language tools to assist their acquisition of language and literacy skills. My research has uncovered key neurocognitive and statistical learning mechanisms that can inform novel intervention programmes that leverage the children’s strengths in order to improve their academic abilities.”

Dr Shelley Xiuli TONG has made important discoveries about language learning, including the neurocognitive mechanisms by which Chinese children can recognise a large number of characters and the way that bilingual children process two different languages to form associations between speech and the written word. Her findings have important implications for assessment, interventions, and remedial practices for children with special educational needs, such as developmental dyslexia, poor reading comprehension, and hyperlexia.

Dr Tong is the first to show that Chinese children recognise characters through statistical learning, in which the learner extracts the frequency, variability, distribution, and co-occurrence probabilities of Chinese character units from character input. This finding has revolutionised the theoretical understanding of the source of reading difficulties in Chinese by demonstrating that increasing repeated exposure to Chinese characters can improve the effectiveness of reading intervention programmes. “Chinese children with developmental dyslexia can statistically learn repeated sequences, but they learn much slower and need more repeated exposures than their typically developing peers,” Dr Tong says.

On bilingualism, Dr Tong has uncovered a neurocognitive mechanism that enables bilingual children to crack sub-segmental speech (such as Chinese lexical tone and English lexical stress and tone) and orthographic codes (i.e., the conventions of written language) in two different languages to formulate speech-print associations that lead to literacy. She has also found that the long-term formal language experience of Cantonese-English bilingual learners not only facilitates their musical pitch perceptions but enhances their performance on English stress perception, where English is their second language.

Furthermore, Dr Tong’s work has revealed that approximately 10 per cent of typically developing Hong Kong school-age children are poor comprehenders who can recognise words appropriate to their age but have difficulties in text reading comprehension, either in Chinese or English or both. Dr Tong is now developing assessment and intervention tools to help these children, who are not often officially diagnosed as having specific learning difficulties. Her other current goals include developing effective neurocognitive intervention programmes by leveraging the creativity and cognitive strengths of children with developmental dyslexia, poor reading comprehension, and/or autism spectrum disorders.

Where have you found inspiration?
“My inspiration often comes from people within my field, but not always. Sometimes I gain insight from the most unlikely or unexpected sources. For example, when traveling in Amsterdam last year, I noticed that a neglected public rose garden had improved dramatically from the year before thanks to a dedicated group of volunteers who enabled the garden to flourish. Children with special educational needs are like these roses - they need dedicated supervision and sustained support to grow and blossom. I hope my research can help people better understand the diverse and complex learning needs of these children and provide better support for their development.”

What qualities have helped you to succeed?
“I am quite creative and have strong logical reasoning skills. I can quickly and easily see hidden patterns or links when reading papers or listening to talks, which can lead to some novel research projects. Additionally, I have a clear understanding of the research agenda in my field, and I am very persistent about maintaining high standards in my work.”

Selected Publications

A typically developing schoolchild performing a prosodic reading experiment
Perfecting Dentistry with New Digital Technology

Dr James Kit Hon TSOI
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Assistant Professor, Faculty of Dentistry | jkhtsoi@hku.hk

"As a non-clinical member of the Faculty of Dentistry, with training in analytical and computational chemistry and work experience in pharmaceutical R&D, my goal is to solve dental problems by using and developing suitable algorithms and trying to reduce human error."

Dr James Kit Hon Tsoi approaches dental materials and biomaterials from an interdisciplinary approach that involves other clinical disciplines as well as non-clinical ones, such as mechanical engineering and chemistry. He uses various digital modelling techniques, such as atomistic simulation, cloud-based analytics and machine learning, to analyse and produce data on three-dimensional (3D) teeth objects, bond strength tests, bacterial material interactions and other dental-related topics. This enables him to develop a proper understanding of the mechanisms involved in fractures, develop better and clinically relevant test methods, and automate dental procedures.

A rundown of his key outputs includes testing various ceramic crowns on extracted human pre-molars using a finite element technique that he and his collaborators developed. From this, they conducted numerical analyses and established the longevity of their ceramic prostheses. They also simulated the best design for tooth preparation. More recently, they have taken their explorations to a new level by using artificial intelligence (AI) to simulate the bacterial-material interaction. This method was integrated with the numerical/mechanical analyses of dental prostheses and will soon become a cloud-based algorithm for the automatic design of dental prostheses.

An example of the application of this research is the start-up DigiDent AI Ltd, which was led by one of Dr Tsai’s PhD students. Dr Tsai is an advisor and the company uses an algorithm his group has developed to automate the design of functional dental prostheses, such as crowns, veneers and bridges, using digitally scanned 3D images uploaded from dentists locally and around the world. These prostheses are expected to have extended lifespans without compromising function. Once the technology is fully developed, dentists will be able to simply scan the oral cavity, get the design at chairside and use CAM milled/3D printing to produce the prostheses.

Dr Tsai is currently working on developing test methods for dental materials, developing standards for dentistry, and developing research results into theories about the interfaces of different materials.

Numerical simulation of maximum principal stress distribution of two dental ceramics for full-coverage crown restoration of human premolar with (left) lithium disilicate and (right) polymer infiltrated ceramic (both highest tensile stress in red)

What previous experiences do you bring to your research?
"I was fortunate to work in pharmaceutical R&D and run my own business for a few years before I became an academic. These experiences were very useful in establishing my network and exposing me to the private, public and government sectors locally and internationally. As such, I understand the need for interdisciplinarity, internationalism and innovation to drive research forward and achieve impact."

How do you inspire young researchers?
"The future is a hypothesis: it’s your choice to make or not to make a significant difference."

Highlights
- Awards for co-authored papers at the 9th General Session of the International Association for Dental Research (IADR), London – The Jonathan Ship Award for abstract: Do Economic and Dental Resources Affect Older Persons’ Oral Health?
- IADR Lion Dental Research Award for abstract: Salivary Mpg Promotes the Progression of Head and Neck Cancer Via TRPM7
- Awards for co-authored papers at the IADR South East Asia Division Scientific Meetings, for Anatomical and Mechanical Properties of the Midpalatal Suture, and What is the Optimal Angle and Distance to Grit-Blast Zirconia
- Member of the British Computer Society and the Royal Society of Chemistry

Selected Publications
‘Fake News’ in the Victorian Age

Dr Jessica Rae VALDEZ
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Assistant Professor, School of English | jvaldez@hku.hk

“Many people today think we are in a period of unparalleled communication and connectivity, but Victorians felt similarly about their period. Through exploring 19th-century literature and culture, my research offers new insights to the challenges faced in modern society brought about by new media, as well as contributing to debates on political representation and ideas of nation.”

Dr Jessica Valdez explores the significance of art, literature and the media in shaping visions and perceptions of society. Her focus is on the novel, 19th-century literature and culture, and literary theory and criticism, in particular the writings of such authors as Charles Dickens, Anthony Trollope, Mary Elizabeth Braddon, Wilkie Collins, George Eliot and the Anglo-Jewish writer Israel Zangwill. Through these works, she has found ‘important parallels with today over the unease provoked by new media – which in the 19th century meant newspapers and print culture.’

Her major work in this area argues that Victorian novels and serial publications continually tell stories about newspapers in order to interrogate and contrast journalistic representations with those of the novel form. Newspapers are constantly found to be lying in the worlds of Victorian novels, yet characters continue to assume that what they report must be recent, relevant and true. This reveals the contradictory logic of news and journalism in which claims of journalistic reality sit uneasily alongside unrepresentative, malicious or even false news. The newspaper is also a means by which Victorian writers experiment with stylistic and formal techniques to foster their versions of communal and national imaginings. “Victorian novelists are early media theorists, thinking through the contrasting systems of reality offered by newspapers and novels,” Dr Valdez said.

Dr Valdez also researches debates on aesthetic and political representation in literary form and ideas of nation and cosmopolitanism. Her current projects include an article on style and affect in the novels of Anthony Trollope as well as a new project that argues that 19th-century British debates surrounding democratic reform drew upon the intersecting cultural imaginings of America and China. This project is tentatively called, “Despots and democrats: China and America in the 19th-century British literary imagination.”

What role does teaching play in your research?
“I deeply value teaching and I work hard to be a good mentor to undergraduate and postgraduate students at HKU. I find that teaching helps me develop ideas for new research projects. My work on the late-19th century Anglo-Jewish writer Israel Zangwill came out of a class on Victorian novels and the ‘Jewish Question’ at Johns Hopkins University. Some of my students knew Hebrew or Yiddish, and they drew my attention to Zangwill’s use of transliterated Yiddish in his English-language novel, Children of the Ghetto. This discussion inspired me to write an article on the novel and also to begin learning Yiddish.”

What has been your biggest challenge?
“The biggest challenge in humanities research is that it can be isolating. Much of my work happens alone in the library or the office, and the writing process is slow and frustrating with a lot of ups and downs. I am lucky at HKU to have a wonderful mentor (Professor Julia Kuehl) and a rich intellectual environment in the School of English, thanks to my thoughtful colleagues and our postgraduate students.”

Highlights

• Early Career Scheme project: Mediating Englishness - Newspapers and National Identity in the Victorian Novel
• Visiting Research Fellowship, School of Literature, Art and Media, University of Sydney
• Denis Zimmer HKU-Cambridge Hughes Hall Fellowship

Selected Publications

• Valdez J.R., "Plotting the Novel: Nation and Newspaper in the Victorian Novel,” [under review].
Improving Queues and Other Systems with Data

Dr Jingqi WANG
BS (Tsinghua), MS, MA, PhD (Northwestern)
Associate Professor, Faculty of Business and Economics | jingqi@hku.hk

“Research impact has two aspects. One is to deepen our understanding of the world, which is within the realm of academia. The other is to impact practice. In my field, this means changing management practice. I hope my research will help us gain a better understanding of how firms should run their operations, and help management make better decisions by using data to answer various questions.”

Dr Jingqi Wang applies data to investigate issues in the operations management field that range from evaluating policy impacts to assisting firms to make better decisions. He also applies mathematical models to find optimal business decisions.

In one key study, he looked at the queue configuration in a supermarket and the impact on service time by combining the supermarket’s sales data with corresponding data from video records of the checkout area. He found that when many servers shared a single queue, they tended to slow down, a phenomenon related to the social loafing effect. Dr Wang concluded that the service rate of human servers was endogenous and affected by the queue configuration, and that pooling queues therefore may not always be beneficial – a finding that challenges traditional operations management teachings. He also showed how the service rate could be modelled in queues to better reflect the reality of the queuing situation.

Dr Wang has also looked at how competition affects the provision of trade credit in supply chains and how trade credit affects firms’ profits. He showed that competition in buyers’ markets and competition between supply chain partners result in different impacts on trade credit. Moreover, when suppliers are more aggressive than the industry average in their trade credit strategy, there is a negative impact on buyer performance. The upshot is that buyers should be cautious about trade credit that far exceeds the industry-average level.

A third major study involved developing a mathematical model for ‘bespoke’ services, motivated by an online service offered by fashion firm Burberry that allows customers to design and purchase their own product. This mass customisation system combines demand learning and preference learning. Dr Wang investigated the interaction between the two to come up with guidelines on when to use mass customisation systems.

Currently, Dr Wang’s projects include a working paper on how retailers can use sales data to help determine extended warranty prices, and an empirical analysis of the impact of a bundled payment policy on healthcare operations.

How did you launch your career as an academic?
“After finishing my PhD, I started to explore new research topics, actively collaborate with colleagues within and outside of HKU, and conduct research independently from my PhD advisors. I was also willing to step out of my comfort zone to research interesting topics that were not within the small area of my existing research, such as the paper on supermarket queue configuration, which I found quite interesting and relevant.”

What is the source of your greatest joy?
“I enjoy the moments when I make achievements, such as finding interesting results in research. In my personal life, I like hiking, badminton, and playing Texas hold’em.”

Highlights

- Competitive peer-reviewed external funding through General Research Fund projects:
  - The Impact of the Bundled Payment Policy Scheme on Operational Performance in Health Care
  - Optimizing Reliability and Extended Warranty Pricing Decisions in a Supply Chain
  - Models and Analysis of Dual-Channel Supply Chain Strategies
- Behavioral Operations Management Section Best Working Paper Competition 2nd Prize, 2016 INFORMS International Conference

Selected Publications

Dr. Ryan Seamus McGrath WHALEN
BA (SMU), MA (NCCU), JD, PhD (Northwestern)
Assistant Professor, Department of Law | whalen@hku.hk

“...if my work stands out for any single trait, it is the consistent interdisciplinary approach I take. Unlike many legal academics, I received a PhD not in law but in social science, with most of my time spent in a computational social science laboratory that brings together researchers from diverse disciplines. I hope to influence the way innovation policy is developed and assessed, and the way research into legal questions is performed.”

Legal Research for the Innovation Age

Dr. Whalen is taking his research forward by looking at artificial intelligence and the administration of the patent system, computer-assisted legal decision making, and computational legal studies more generally.

What are your greatest challenges?

“As an interdisciplinary, I have more research to follow. I need to be able to translate between fields and I need to be able to convince colleagues of the value in work that may appear foreign to them. Having encountered these challenges, I can confidently report to other aspiring interdisciplinary that it is worth it.”

What inspires you?

“As someone whose research often focuses on the scientific process, I spend a lot of time thinking about science and research more generally. I find it both humbling and inspiring when I reflect on the nature of the scientific enterprise and its impact on humanity. The human drive to pursue knowledge and generate new ideas and information enriches our lives, and indeed is an important aspect of my identity not only as a scholar but as a person.”

Highlights

- Fellowship at the Becker Friedman Institute for Economics at the University of Chicago
- Editor-in-Chief of the Northwestern University Law Review in 2016
- Glasgow/KU Early Career Mobility Fund to visit Glasgow’s RCUK Centre for Copyright and New Business Models in the Creative Economy

Selected Publications

In Pursuit of Optimal Solutions

Professor Xiaoming YUAN
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Professor, Department of Mathematics | xmyuan@hku.hk

“My goal is to have a solid and complete understanding of optimisation and to make more substantial contributions to the development of this field. I am also committed to enhancing the interaction of optimisation with other disciplines to find novel research results.”

The work by Professor Xiaoming Yuan has solved some challenging problems in mathematics and produced insights that have application across a wide range of fields, such as optimisation, numerical analysis, image processing, machine learning, computer vision and statistics. His work on optimisation has been particularly important and influential.

Optimisation entails designing efficient numerical algorithms that can select the best elements from a set of available alternatives and it is fundamental to data science, artificial intelligence and engineering. Professor Yuan’s work has fundamentally contributed to understanding several important topics in optimisation.

One area where he has had great success is in ADMM, which stands for alternating direction method of multipliers and is a benchmark algorithm in many fields. ADMM can be used to solve separable convex optimisation problems by breaking them down into smaller, easier-to-handle processes. Professor Yuan was the first to be able to quantitatively measure the speed of ADMM by establishing its convergence rate; his method of proof was completely new and proved to be a powerful analytical approach to analysing the convergence of many other algorithms. He was also the first to solve an issue that researchers had been grappling with for a long time, by demonstrating that it is not trivial to extend ADMM to more complicated models (i.e., the direct extension of ADMM to multi-block convex minimisation problems is not necessarily convergent).

In addition, Professor Yuan was one of the first researchers to systematically study how to develop operator splitting methods for multi-block convex programming problems. The algorithms and analytical frameworks for convergence analysis he proposed have become benchmarks in this area.

Some of the algorithms developed by Professor Yuan and his collaborators can be potentially transferred to software packages and commercialised to solve an even wider range of application problems in industry and society.

Professor Yuan’s current research goals include understanding fundamental optimisation problems in machine learning, deep learning, artificial intelligence and other data science areas more deeply; designing efficient algorithms for challenging optimal control problems; and establishing new theory for conducting convergence analysis for various first-order algorithms.

Have you ever had a moment of doubt?
“When I was in graduate school, I found that there was little interest in ADMM and it was very hard to publish my findings, even in very average journals. I was upset by this and often hesitated about delving into this topic. But I strongly believed in its mathematical beauty and potential and stayed with this research route. Everything changed in 2008-09, when it was found that the so-called compressive sensing problem and other scientific computing problems can be efficiently solved by ADMM. I was immediately able to show my accumulated research results and get credit. So never give up easily, be confident and work hard.”

What inspires you?
“I am mainly inspired by beauty and curiosity in mathematics, the excitement of finding new results, the responsibility of educating students, and the influential impact of high-quality research to civilisation and social development. I feel special gratitude to Professor Bing sheng He, who was my MPhil supervisor and is my closest collaborator. He has given me a lot of inspiration, encouragement and help when I faced difficulties in research and my career, and he has taught me to persist in research and enjoy the beauty of optimisation, and be humble as a researcher.”

Highlights

- Highly Cited Researcher, Clarivate Analytics Essential Science Indicators 2017 and 2018
- Higher Education Outstanding Scientific Research Output Award (Second Prize) from the Ministry of Education, China
- Competitive peer-reviewed external funding including through numerous General Research Fund projects (awarded consecutively for a decade), such as
  - Mathematical Study of First-Order Algorithms for Big Datasets
  - Splitting Algorithms via Positive-Indefinite Proximal Regularization for Convex Programming
  - Black-Wise Splitting Algorithms for Convex Programming
- Founding Member of The Young Academy of Sciences of Hong Kong
- Postdoctoral Fellow awarded by the Pacific Institute of Mathematical Sciences in Canada

Selected Publications