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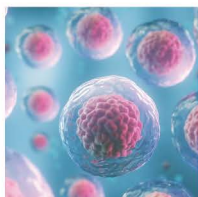


MAKING BABIES

How Science, Politics and Social Change Affect Human Reproduction



**Major Breakthrough
for Tissue Engineering**
Investigating
the mechanics of
cell adhesion



Play&Grow
Pre-schoolers
learn to play
in the mud





Contents

Cover Story

- 01 Making Babies
How Science, Politics and Social Change Affect Human Reproduction
- 03 The Labour of Giving Birth
- 05 Birthing in Hong Kong
- 07 Raising the Odds of Conception
- 09 The Limits of Artificial Reproduction and Surrogacy
- 11 Bringing Hope for Congenital Disorders

Research

- 15 Data Wizard Advances Precision Medicine
- 17 A Saucy Take on History
- 19 Fast Track to Healthy Teeth
- 21 Circulation Problem
- 23 Learning to Play in the Mud
- 25 Summertime, and the Living Is Deadly
- 27 Tissue of Lives
- 29 Turning Tent to Townhouse? Ulaanbaatar's Ger Sprawl
- 31 Wake-up Call for Construction

Teaching and Learning

- 33 Teaching the Science of Heritage Conservation
- 35 Clarity Comes with the Click of a Mouse
- 37 Investigating Human Rights Abuses
- 39 A 360-Degree Take on a Dynamic Hong Kong Community
- 41 Nourishing the Middle Ground

Knowledge Exchange

- 43 The Business of 'Best before'
- 45 Law Scholars Provide Inspiration for Special Needs Trust
- 47 Student Visions for Coral Reefs and the Blind
- 49 A Global Voice on Sustainability Policy

Books

- 51 Chinese Art in the Modern Era
- 53 Journey of Hope

MAKING BABIES

The rapid changes in technology and society over the past 40 years are affecting how and whether couples can conceive. HKU researchers have been studying the impact of social and political transformations in China and Hong Kong, and of non-natural births. They are also producing research to improve the odds of conception and to identify and treat congenital diseases, so more babies have a chance of a healthy life.

THE LABOUR OF GIVING BIRTH

China's transformation into an economic superpower is often framed in terms of production output, technological advancement and infrastructure. What is often missing is another kind of production – that of workers. Dr Gonçalo Santos has been tracing the transformation of birth in China as it moved from the home to the hospital and became increasingly subject to biomedical interventions.



“For most women working in the new China, reproduction is a chore and it's often perceived as a burden – as something to be afraid of.”

Dr Gonçalo Santos

It's not called labour without reason. The effort of pregnancy and giving birth, and then raising children, has been termed 'reproductive labour' by social scientists like Dr Gonçalo Santos of the Department of Sociology and Hong Kong Institute for the Humanities and Social Sciences, who is leading a research group on the technologies of reproductive labour in East Asia with colleagues at the University of Chicago and Smith College.

“The work of reproductive care doesn't get the attention of something like the One Belt One Road project. But workers are the foundations of those projects, and as feminists have long noted, in addition to asking questions about workers, we also have to ask questions about the work that is involved in producing workers,” he said.

In China, that work has undergone profound changes in a very short time period. As recently as the 1980s, half of all babies were still born at home. Today, most are born in hospitals – and fully one-third by caesarean section (C-section).

Dr Santos has been a witness to the transformation, which has been driven by government policy, technology, and changing moral and social dynamics.

His work started in the late 1990s, when he undertook fieldwork in rural areas where most people still delivered at home. He saw villagers grapple with the one-child policy, which was also pushing people towards hospital births where it was easier to keep track of numbers.

“Women were giving birth in secret places and relying on village midwives. Birth became heavily politicised and people tried to negotiate with the state at various levels over the right way to give birth, where to give birth, whether to follow state prescriptions,” he said.

Not strictly a medical issue

The state prevailed, marking a dramatic shift in how babies were born and who was involved in the process. Birth was no longer managed by local networks of midwives and female relatives, but shifted to hospitals and biomedical professionals, including obstetricians who, until the past decade or so, were mostly men.

“However, birth is not strictly a technical, medical issue. It should be seen from a holistic perspective that allows for the social and cultural dimensions to be taken into consideration, too,” Dr Santos said.

These dimensions are evident in China's high caesarean rate of at least 35 per cent of all births, one of the highest in the world. Doctors and hospitals, pregnant women and their families each have their own reasons for favouring C-sections. (And note: all three are involved in providing informed consent for birthing procedures in China – it is not just a matter between a woman and her doctor.)

Hospitals are more likely to favour C-sections because they are more profitable and can be planned – an important consideration given many hospitals are understaffed. Doctors are more likely to favour them because their training is in handling complications and applying the techniques they learn, rather than waiting out the unpredictability of a natural birth.

Many women regard C-sections as easier than natural delivery. Their mothers and grandmothers were better prepared for the physical trials of labour because they often engaged in hard physical work, but people today live more sedentary lives, particularly in urban areas. “For most women working in the new China, reproduction is a chore and it's often perceived as a burden – as something to be afraid of.

There's a sense that they want to escape the natural birth experience,” Dr Santos said, “and there is nothing wrong with that.”

From zero to 100 in a generation

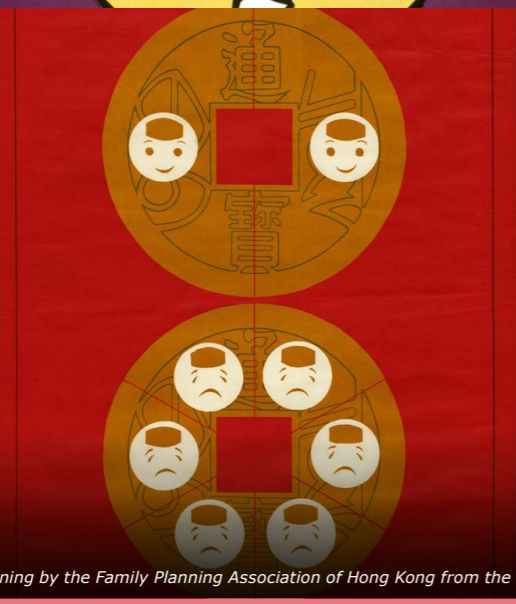
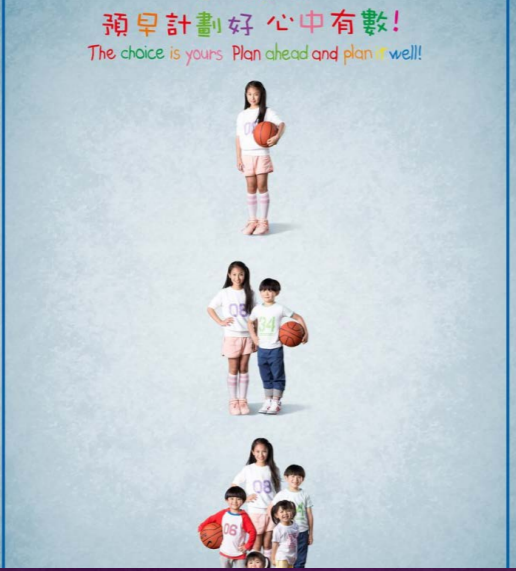
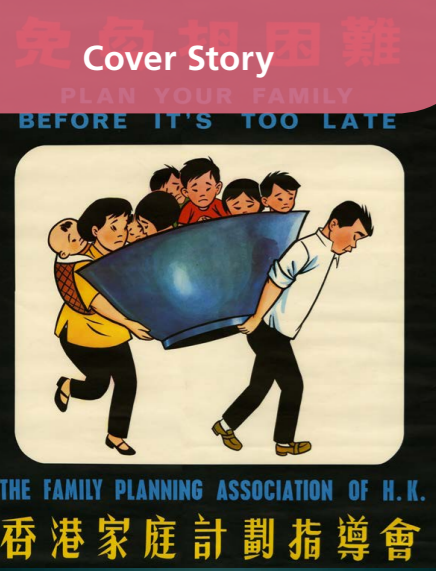
Women are also giving birth at a later age, sometimes with the help of assisted reproduction technology – factors that increase risk and thus lead doctors to advise C-sections.

Families have reason not to oppose C-sections, too. Although they must pay for births even in public hospitals, the government subsidises at least half the cost.

Dr Santos believes these subsidies will become unsustainable in the long run and, for this reason, the government is curbing the growth in C-section rates through investment in maternal care and punitive measures against hospitals. A 'wellness culture' that favours natural birth is also on the rise among the urban middle classes, although not yet to the extent seen in Japan, where it started much earlier.

“In China and some East Asian societies, there has been a compressed modernity – a story of emerging economies that went from zero technology in a biomedical sense to benefitting from all these highly-sophisticated technologies within practically the space of one generation. They have leapfrogged without the middle layer and didn't form a culture of natural birth in the process,” he said. Such a culture is only now starting to take hold under the influence of global discourses of 'wellness' and traditional Chinese medical wisdom.

Women should have as much choice and information as possible about giving birth, he added – something that scholars can contribute to through research. ■



BIRTHING IN HONG KONG

Colonialism and modernisation have both brought changes to reproduction and birth control practices in Hong Kong. But some attitudes are proving to be immutable.



“What interested me was how the Family Planning Association of Hong Kong and the Government used Chinese family values to promote birth control. This was totally different from Europe and America where birth control was tied closely with the women’s movement and sexual liberation.”

Dr Carol Tsang

The more things change, the more they remain the same, as Dr Carol Tsang of the Department of History has discovered. Her area of research is women’s health and reproduction in Hong Kong and China, and her female students and acquaintances keep reminding her that while they have plenty of opportunities in career and education, in the home, not much has changed.

“I have met a lot of women from different walks of life who feel the social expectations of marriage and motherhood limit their capacity. They feel pressured to get married by a certain age and to have children, especially a male heir. And after having children and marriage, they feel their careers stall. These social expectations haven’t changed much over the decades,” she said, as her 15 years of research has shown.

Dr Tsang’s first major project was a history of the Family Planning Association of Hong Kong (FPAHK), an organisation founded in 1950 to promote birth control to ordinary Chinese families in the context of traditional values. The Government wanted to contain population growth and the FPAHK supported that goal through promotions such as the ‘Two is Enough’ campaign featuring a smiling family with just two children – the message being that birth control was a path to a cordial family life.

“What interested me was how the FPAHK and the Government used Chinese family values to promote birth control. This was totally different from Europe and America where birth control was tied closely with the women’s movement and sexual liberation. In Hong Kong, it was about Chinese values and being an ideal Chinese nuclear family,” she said.

Colourful debate

Birth control was a more contentious topic in the pre-war era. American Margaret Sanger, an activist for birth control who was popular in China, was invited to Hong Kong in 1936, where she gave a talk on such methods as sterilisation

and the diaphragm. Non-Catholic Christians welcomed her message because they thought birth control could help ordinary people and deter abortion, but there was strong opposition from Catholics.

“It was a very colourful debate. Hong Kong people were pretty split in terms of accepting or rejecting artificial birth control, but at the same time, many were already practising it by taking different patented medicines or visiting Chinese abortionists,” Dr Tsang said. The talk had a lasting effect, though: the FPAHK links its heritage to Sanger’s visit because she inspired the establishment of FPAHK’s predecessor, the Hong Kong Eugenics League.

Abortion was an accepted form of birth control within Chinese society, especially in the chaotic period before the Second World War but, as today, it exposed rifts in society. The Government was keen to curtail abortionists, many of whom came from Mainland China and were regarded as charlatans by officials, and it wanted to establish the legitimacy of Western midwifery. “A lot of hidden stories in reproduction show clashes between Western and Chinese practitioners,” Dr Tsang said.

Women’s voices in these debates were often muted. In the first half of the 20th century, for instance, there were numerous newspaper articles and advertisements on women’s fertility, but they were written with male readers in mind as most women were illiterate.

Same discourses today

“Some of the advertisements were presented as stories. There was one that featured a man who didn’t have a male heir, but after buying a patented medicine for his wife, she gave birth to a son. Their success and happiness were said to be due to this medicine,” she said. She sees echoes of that thinking today in television commercials for medicines to restore health that are set against images of a happy family.



An advertorial portraying a happy family in which the wife gave birth to a son after taking a patented medicine published on Wah Kiu Yat Po in March 1926.

“It surprises me that 100 years on, we still use the same discourses to market these things. It may be repackaged as modern science today, but in the early 20th century it was also packaged as science.”

Dr Tsang brings these insights to the classroom, too, where she teaches the global history of reproduction and birth control and Common Core courses on women’s roles across time and culture, motherhood in China, and masculinity studies. The latter includes discussions on the role of men in the history of gender, reproduction and birth, an area that has been neglected in much scholarship and which will be a focus of her research moving forward.

In the meantime, Dr Tsang has a more pressing and pertinent task, having recently given birth to her first child, a girl. “People ask me if it’s a first child and when I tell them it’s a girl, they ask, so do you want a boy for the second child? It’s affirming what I read in history,” she said. ■



RAISING THE ODDS OF CONCEPTION

About 10 to 15 per cent of couples have difficulty conceiving babies. Research at HKU on sperm and eggs is aiming to improve their chances of success.

“Better have your baby before you’re 37” is advice that Professor Kui Liu of the Department of Obstetrics and Gynaecology likes to give his students in a light-hearted manner. The line draws a laugh but everyone in the room knows that this statement is no joke.

A woman’s eggs start to deteriorate in both quantity and quality at age 37, regardless of her ethnicity. Sperm quality also deteriorates as men age, particularly the quality of the DNA they pass to their offspring, although this process has not been pinned to a particular age.

Professor Liu and his colleague, Dr Philip Chiu Chi-ngong, have been researching the problem of egg and sperm quality in human reproduction and their findings offer new insights that

point to paths of artificial insemination and other benefits.

Professor Liu’s work is focussed on egg quality. He has been looking at the cell-cycle regulation of eggs, in particular the primordial follicles that produce eggs. One problem in infertility is that the ovarian follicles are not big enough and cannot respond to the hormone stimulation provided by *in vitro* fertilisation (IVF). In fact, IVF usually only results in conception for about 25 to 30 per cent of women.

“Our approach has been to look inside the molecular network and, instead of hormones, apply chemicals or drugs downstream at the lower molecular factors and try to trace the growth of a normal egg,” he said.

Moment of conception

This work led to Professor Liu identifying signalling pathways involved in activating primordial follicles and developing a new treatment for female infertility called *in vitro* activation (IVA). So far, the method has resulted in 27 babies being born to infertile women but he said the success rate is still low – one study in Tokyo resulted in two babies from 36 women. Other trials are underway in China, Spain and the US.

“Theoretically we are targeting the correct pathway but I believe the right drug has not been found yet. I hope we can do this within the next 10 to 15 years,” he said. Professor Liu recently joined HKU from Umeå University in



“Our approach has been to look inside the molecular network and, instead of hormones, apply chemicals or drugs downstream at the lower molecular factors and try to trace the growth of a normal egg.”

Professor Kui Liu

Sweden and finding the right drug will be the major focus of his research here.

Dr Chiu has been studying sperm quality and the actions of the sperm at the moment of conception. For sperm to successfully fertilise an egg, they must bind with the matrix that surrounds the egg which is made up of carbohydrates and proteins. Dr Chiu was the first to identify the carbohydrate chain that mediates the interaction between the sperm and egg, called the sialyl-Lewis X (SLeX) – a finding that has spurred research on male contraception, sperm quality and forensic evidence collection for sexual assault cases.

On male contraception, Dr Chiu has collaborated with the University of Georgia in the US to synthesise a glycan that can carry SLeX and bind with sperm. “This molecule has very high affinity with the sperm and we are now looking at whether we can develop it into a male

contraceptive that would block the binding of SLeX on the human egg surface with the sperm,” he said.

Services in demand

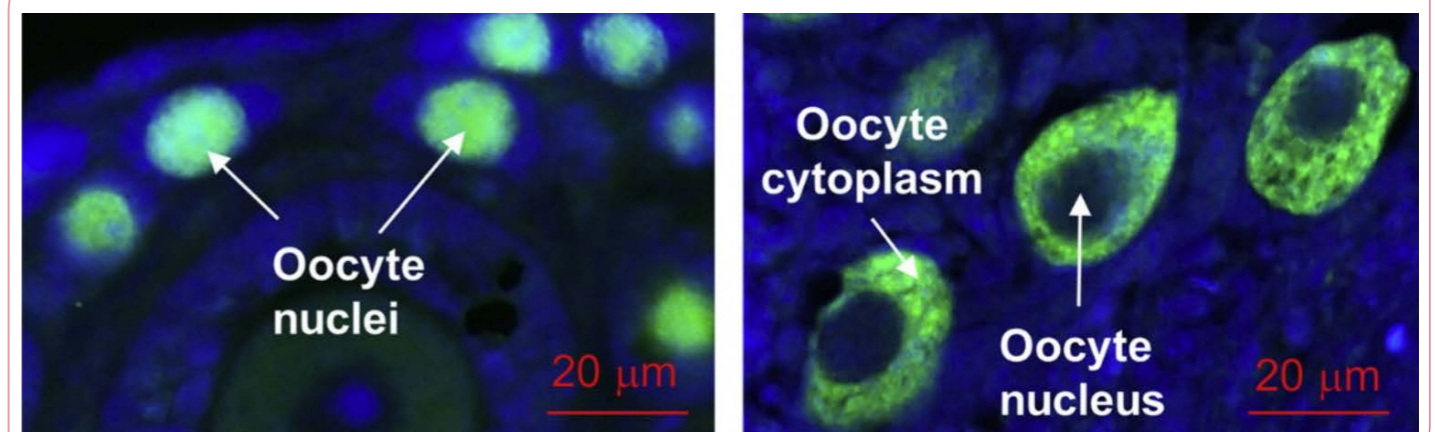
He is also working with large IVF centres in China to collect a large number of semen samples, both normal and pathological, to identify markers that can predict the fertilising ability of sperm before they are used for IVF. This work could potentially also identify the quality of the sperm in terms producing healthy babies.

The research on forensic evidence collection has come from an independent study at Stanford University that used Dr Chiu’s finding on SLeX to drastically reduce the time needed to collect sperm for sexual assault cases from eight hours to 80 minutes. The sperm can provide the DNA of male attackers but it must be of very high

quality and can become easily contaminated with the existing procedures.

Professor Liu and Dr Chiu see growing demand for studies like theirs because couples are starting their families at older ages. In Hong Kong, for instance, the median age of women at first childbirth was 31.4 in 2015, according to the Census and Statistics Department – up from 29.4 in 2001 – meaning half of all women had children older than that age. Leaving pregnancies until later in life will only increase fertility problems. In addition, the change in Mainland China’s one-child policy in 2016 to allow couples to have two children has enticed older couples to try for another child.

“Many older women are thinking of having other children and we hope to help them,” Dr Chiu said. ■



Upon activation from small primordial follicles (left) to primary follicles (right), the transcription factor FOXO3a shuttles from the nuclei of the oocytes (left, green signal) to the cytoplasm of the oocytes (right, green signal).

THE LIMITS OF ARTIFICIAL REPRODUCTION AND SURROGACY

Couples that cannot conceive naturally have other options in Hong Kong, but they can face restrictions in accessing them. HKU scholars have been looking at the psychological and legal issues involved.



“Infertility becomes a blockage to their life development. They don't know how to move on because they are childless.”

Dr Celia Chan Hoi-yan

When the world's first 'test-tube' baby, Louise Brown, was born in 1978, it was heralded as the dawn of a new era for infertile couples. By using donated eggs, sperm and/or surrogates, they could at last become parents.

But the new era has not been such a simple matter for many couples, particularly in Hong Kong.

For one thing, artificial reproduction technology (ART), such as the *in vitro* fertilisation (IVF) used to conceive Louise Brown, has a high fail rate of 70 to 75 per cent. For another, only married heterosexual couples in Hong Kong can access ART or surrogates. And if parents opt for a surrogate, they are not allowed to use donated eggs or sperm or pay for the service.

All of this takes a heavy emotional toll on couples who are keen to have a baby, says Dr Celia Chan Hoi-yan of the Department of Social Work and Social Administration, who has been studying the impact and provides infertility counselling and psychological assessments.

“People have high expectations of ART and they experience psychological impacts during and after the process,” she said. Moreover, IVF is invasive because it involves extracting eggs and implanting embryos in women.

Dr Chan's previous studies have shown that women's anxiety ahead of IVF treatment can be eased through mind-body relaxation techniques, and their worries after treatment – while they wait to find out if they are pregnant – can be mitigated through self-reflection and better knowledge about the process.

She is now looking at grief, a common response for ART users given the low success rate. Some women undergo 10 or even 20 IVF cycles and pay millions of dollars for the service because couples are only entitled to three subsidised cycles in public hospitals.

“It can be an emotional rollercoaster of hope and disappointment for couples,” she said. “Infertility becomes a blockage to their life development. They don't know how to move on because they are childless.” Dr Chan has

written a booklet on perinatal bereavement for these couples and anyone suffering a miscarriage.

Surrogacy and 'parenthood'

Surrogacy is also complicated for couples. Some women turn to this because they cannot carry babies in their uterus even if they can conceive. Hong Kong technically allows married heterosexual parents to arrange surrogacy for altruistic reasons, but they cannot pay for it even if it is conducted in another country, according to Ms Daisy Cheung of the Faculty of Law, who has written about surrogacy in Hong Kong.

Parents who use a surrogate here or abroad must get a parental order within six months of the birth of the child. Until the court issues this, the surrogate mother is recognised as the legal mother and her husband as the legal father. “So even if the genetic material of the baby is yours and your husband's and you give it to your sister to carry and she has a husband, they would be named as parents in the first place,” Ms Cheung said.

Strangely, none of the centres licensed under the Council on Human Reproductive Technology are listed as providing surrogacy services, but there are anecdotal cases of parents using surrogates in Hong Kong. Others have looked abroad, such as Peter Lee Ka-kit, the son of Henderson Land Development Chairman Lee Shau-kee, who reportedly hired a California-based surrogate mother to give birth to his triplet sons. The case was referred to the police but no charges were made.

“If commercial surrogacy is carried out abroad, it's very difficult to enforce because you need clear evidence. There is also an argument that it's not correct to apply extra-territorial criminality to situations that have a moral component to them – where the society may have different views on the morality of these actions,” she said.

Better fertility awareness needed

Ms Cheung also noted that there may be human rights implications regarding the denial of reproductive technology procedures,

including both ART and surrogacy, to same-sex and cohabiting couples. However, this has never been tested in the courts.

Even if couples conceive through non-natural means, there is the question of what to tell the child. In Hong Kong, children have a right to know if they are conceived through non-natural means but not to know the identity of the donors or surrogate. Dr Chan said men she has counselled tend to have more issues with donated sperm than women do for donated eggs.

Dr Chan would like to see better fertility awareness among young people so they can make informed choices about when and whether to have a baby. “Young people are not very aware of the fertility clock and their own fertility ability. We want to raise their awareness because after 35, their fertility will drop. Media stories of women giving birth in their 40s are a distortion because those will still be high-risk pregnancies,” she said. ■



BRINGING HOPE FOR CONGENITAL DISORDERS

Discovering your baby has an incurable inherited disorder can have a lifelong psychological, social and economic impact on families. But new insights into the molecular genetic bases of two such disorders – Hirschsprung disease and dwarfism – hold promise for developing therapies to lessen the impact. Moreover, the findings may have implications for understanding common disorders that affect millions of people globally.



“ We overlooked these hidden disabilities in the past and the parents were usually just very grateful that we saved the life of their baby. But if you dig deeper, you can see they need more help. Their child’s long-term survival has come at some cost. ”

Professor Paul Tam Kwong-hang

Hirschsprung disease is a congenital affliction in which babies are born with a bowel that lacks nerve cells to control movement along the gut. The only option for treatment is to surgically remove the affected part of the bowel. But about one-third to one-half of these babies will then suffer lifelong residual problems such as enterocolitis (a potentially life-threatening infection of the bowel), chronic constipation, incontinence and, for a small number, the inability to absorb nutrients.

Professor Paul Tam Kwong-hang, Li Shu-Pui Professor in Surgery and Chair Professor of Paediatric Surgery, is a world-leading expert on the disease and has received multiple honours for his work, most recently becoming the first Asian recipient of the Rehbein Medal from the European Paediatric Surgeons’ Association. He has studied

the disease for more than three decades, motivated by the impact of the disease itself as well as by its prevalence in Asian populations, where it affects one in 3,000 births against the global average of one in 5,000 births.

“The problem with Hirschsprung disease and its treatment is that it can affect patients’ future social behaviour, their educational accomplishments and other activities throughout their lives,” he said. “We overlooked these hidden disabilities in the past and the parents were usually just very grateful that we saved the life of their baby. But if you dig deeper, you can see they need more help. Their child’s long-term survival has come at some cost.”

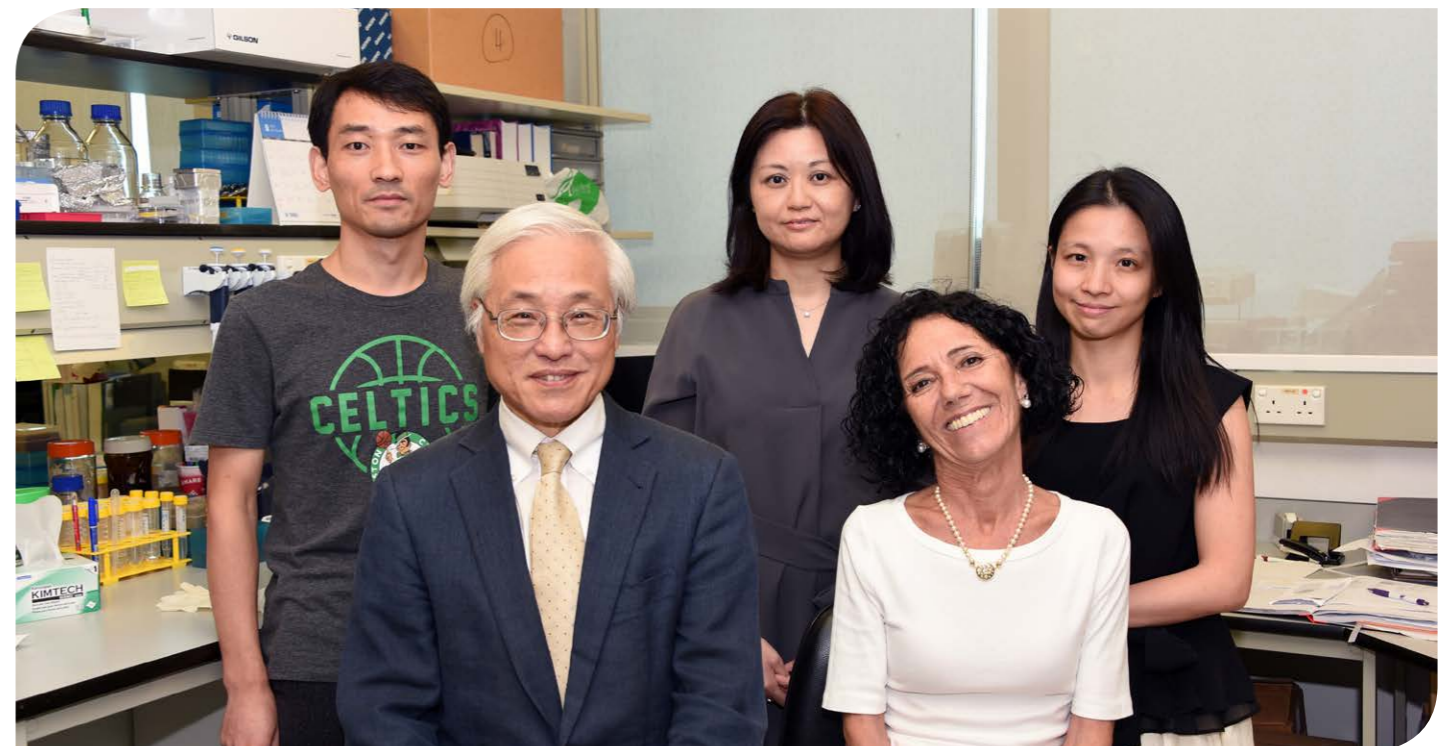
In order to improve that situation, better understanding of the disease is needed so better

treatments can be developed. Professor Tam and his colleagues have focussed on genetic studies and stem cell investigations to find answers.

Alzheimer’s link

Over the past decade, they conducted the first whole-genome genetic screening of Hirschsprung disease and identified a single gene that can cause the disease in 10 per cent of cases. They also unravelled some of the genetic complexities involved in the other 90 per cent of cases.

“We have come to realise that it’s not just one gene but a constellation of changes in different genes that can cause this disease, and that the disease will be different in different patients,” said Dr Maria Mercedes Garcia-Barcelo, Associate



Team members for the research include (back row from left) Dr Li Peng, Dr Elly Ngan, Dr Clara Tang, (front row from left) Professor Paul Tam and Dr Maria Mercedes Garcia-Barcelo.



“ Our work shows why it’s important to do fundamental research and understand the mechanisms of disease because this is how we find potential routes for treatment. ”

Professor Kathryn Cheah

Professor of Surgery. “This means that a group of genes that lead to the disorder in patient A are going to be different from the group affecting patient B, and they will have different outcomes. Nonetheless, we know there is usually going to be more than one gene involved.”

The team has also showed that mutations can affect the different pathways involved in bowel development. One pathway tells cells to migrate down the spinal cord to the gut, another tells the gut cells to differentiate into neurons, and a third tells these cells to divide and multiply.

Last year, they also identified an additional pathway related to cell survival: even if cells reach their destinations and become neurons, they can still die due to an abnormal build-up of protein that suffocates the cell. The genetic basis of this action was discovered by Dr Clara Tang, Research Assistant Professor in the Department of Surgery, who also found it had wider implications beyond Hirschsprung disease.

“This is a similar, overlapping mechanism to what we see in Alzheimer’s disease. Interestingly, Alzheimer’s patients can also have intestinal problems that cause constipation,” she said.

Stem cell potential

The team’s work has pointed to possible options for treatment, particularly with stem cells. If a patient’s own cells can be re-engineered through induced pluripotent stem cell treatment and placed back in the patient, this conceivably could address the genetic defects. However, further research will be needed first.

The genetic studies of Hirschsprung disease are also uncovering other disease susceptibilities in patients with the disease, which could improve their outcomes from those diseases. For instance, the researchers found that a tiny percentage of Hirschsprung patients carry another genetic defect that makes them more susceptible to thyroid cancer. Already, they have identified an early-stage tumour in a patient who otherwise had no symptoms.

More genetic information will enable more such links to be found and enable researchers to identify targets for treatment. The team already has whole genome sequences of hundreds of Hirschsprung patients, which have been developed through collaborations with overseas scholars and hospitals in Hong Kong, Mainland China and Vietnam, and they are continuing to add to that pool.

“The lessons we learn from this rare disease can apply to the study of other diseases. Studying rare diseases can provide shortcuts for investigating other more common problems. It is a win-win situation,” Professor Tam said.

A potential therapy for dwarfism

Our skeletons provide the essential structural framework to support and protect our bodies from the repeated impact of walking, running and bearing weight. But skeletal disorders are the most frequent causes of severe long-term pain and physical disability. Apart from acquired disorders such as osteoporosis, there are more than 400 types of congenital disorders, many of

which may result in malformed bones or dwarfism. Current treatment options for dwarfism are extremely limited, but new research at HKU has highlighted a potential new path of therapy for some patients.

Chair Professor of Biochemistry and Jimmy and Emily Tang Professor in Molecular Genetics, Kathryn Cheah, and her team have discovered the mechanism behind a genetic mutation that causes a certain kind of dwarfism, Metaphyseal chondrodysplasia, Schmid type (MCDS), which is characterised by short limbs and bowed legs, leading to a waddling gait and joint pain. Through this understanding, it may be possible in future to develop effective treatments for dwarfism caused by similar mechanisms.

“Underlying all studies trying to develop drugs for diseases is the fact that you need to know the fundamental mechanism – why a genetic alteration results in that phenotype. Although just one gene is altered, it probably has a ripple effect, so that at the end of the day what you see in the patient is the sum total of all the changes that resulted from that first initiating event,” she said.

With MCDS, the body produces an abnormal form of collagen X, which results in the dwarfism. Professor Cheah’s team showed how this happened.

Integrated Stress Response

Collagen X needs to fold so it can be transported to the matrix outside cartilage cells, where it normally would provide structural support. But

sometimes the cells cannot fold properly and instead accumulate inside the cells. This causes a kind of ‘constipation’ that triggers the Integrated Stress Response (ISR), which ultimately ends up affecting the growth plates that control bone formation.

This happens because the ISR causes a potent factor called SOX9, which controls the ways cartilage cells differentiate, to activate in the late stages of the bone development process when it should be shut off. As a result, bones do not form properly.

Understanding the molecular development of MCDS meant that Professor Cheah and her team could start exploring whether the ISR could be inhibited. They treated pregnant mouse models that reproduced the same MCDS abnormality with a readily-available small molecule known to inhibit the ISR, and found it had a therapeutic effect: the dwarfism was prevented by inhibiting the ISR pathway without other side effects.

“To our delight, when the babies were born, their dwarfism was about 95 per cent corrected and their bones were more normal,” she said.

This offers a potential new pathway for future drug development for human patients who would benefit significantly from even some amelioration of dwarfism. A patent has been filed for the treatment, although this will need more refinement and research before it can be applied in humans.

Little people need help

Nonetheless, after eight years of genetic investigations and deep mechanistic studies using mouse models, there may be hope of treating congenital dwarfism associated with the stress response such as that seen in MCDS.

“For people who are dwarfs, being able to grow an extra inch or two will be incredibly important for them. Little people are teased by other children and in MCDS patients, because their bones are not formed properly, they also have pain from abnormal weight-bearing on their joints,” Professor Cheah said.

Moreover, because activation of the ISR is the hallmark of many common diseases, such as osteoarthritis, spinal disc degeneration and

fibrosis in other tissues that involve abnormal synthesis of matrix proteins, the impact of these findings extends beyond congenital dwarfism disorders.

“Our work shows why it’s important to do fundamental research and understand the mechanisms of disease because this is how we find potential routes for treatment,” Professor Cheah said. “It’s like fixing a car – if we don’t know how things work, how can we fix them? And if we only did translational research, we could not acquire this basic knowledge and develop our own intellectual property. It can take many years to reach fruition, but basic research has the power to form a good foundation for future translation. The joy of seeing that the MCDS mouse pups were near normal was beyond description!” ■



An HKU-led international team of scientists – (from left) Professor Danny Chan, Dr Maggie Wang, Professor Kathryn Cheah and Dr Tommy Tan – has uncovered why cellular stress can cause dwarfism and provided a therapeutic lead that can be exploited to develop drugs to treat such bone disorders.



Dr Luo uses sequencing technologies to shorten the time required for cancer and rare disease diagnosis.

DATA WIZARD ADVANCES PRECISION MEDICINE

Ten years ago, it took a month to map the genome of a person using a huge computational server. Now this can be done in less than a day with a desktop computer, thanks to up-and-coming scientist Dr Luo Ruibang, who has also led the way in applying big data and artificial intelligence to genetic analysis.

Precision medicine is the new goal in medicine, as doctors seek to harness genetic information to provide patients with more effective diagnoses and treatments. But a key stumbling block has been the enormous quantity of this information. Each person's chromosomes contain more than three billion characters. Until the work of Dr Luo Ruibang, sifting through that information was a laborious process.

Dr Luo developed a new algorithm that greatly speeds up the process by quickly matching groups of characters called 'reads' to their chromosomes, so doctors and scientists can more readily detect mutations. Whereas previously it took one month to do this using

a large powerful computer, at a cost of about HK\$100,000, Dr Luo's algorithm was able to reduce the time to less than a day using a laptop.

The algorithm was developed with his former teacher and the current head of Computer Science at HKU, Professor Lam Tak-wah, in 2009 when Dr Luo was only 20 years old. It is now a global standard for genome alignment, having been downloaded more than 300,000 times.

"It was not rocket science but there was a 'eureka' moment," he said. "We were able to lower the complexity of the previous algorithm to reduce the time it takes to align the reads

back to the chromosomes. That's important for patients because they are awaiting their results."

The discovery was a first step in a career that, to date, has seen Dr Luo named by MIT Technology Review as one of the top 10 innovators in Asia Pacific in 2019, and by Forbes as one of the top '30 Under 30' in Asia in 2017 in healthcare and science.

Platform launches a start-up

The next step was to apply big data analytics to provide better and faster interpretations of whether the genetic mutations detected by his



“ There is still a lack of knowledge about human genomics – we are dealing with three billion characters. I hope to boost the matching rate to 40 or 50 per cent in future, leveraging artificial intelligence. ”

Dr Luo Ruibang

algorithm are pathogenic. This requires comparing a patient's mutations with multiple databases that do not completely agree with each other.

Previously, doctors had to cut and paste their patient's mutations into a search window for each database and write or type out the results manually for comparison, a process that took five hours per patient and was typically limited to about 10 databases. Dr Luo and his team vastly improved the process.

After working with doctors for two years to understand how they used the databases, Dr Luo developed a platform that can search 31 databases within one hour – two hours in a worst-case scenario. Most importantly, it includes sophisticated rules for deciding when there is a conflict in the results from the search and how to present this to doctors.

The platform was developed into a highly-successful start-up, L3 Bioinformatics Ltd, that was launched in 2014 with support from the Hong Kong Government, angel investor Beijing

Genomics Institute and HKU's Technology Transfer Office, and has generated more than HK\$60 million in revenue. The platform has been used to diagnose more than 5,000 cancers and rare diseases at the Hong Kong Sanatorium Hospital and Hong Kong's Department of Health, as well as thousands more cases in Mainland China.

Dr Luo worked with L3 Bioinformatics for two years but returned to academia in 2016 because there were still important research questions to tackle – particularly, how to improve the matching rate of DNA mutations to databases. No technology has achieved a better actionable rate than 30 per cent which means no diagnostic or therapeutic match can be found for genetic mutations in 70 per cent of cases.

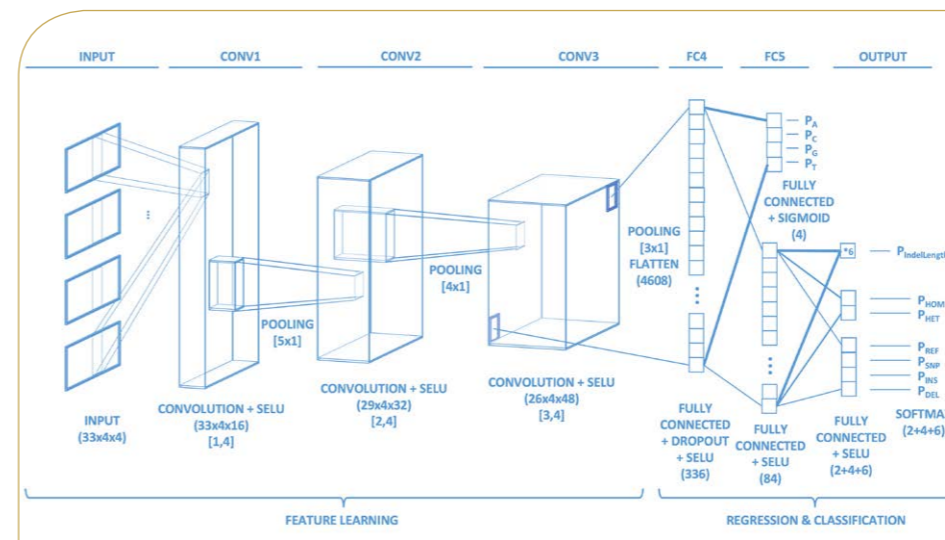
Pulling signals from the noise

"There is still a lack of knowledge about human genomics – we are dealing with three billion characters. I hope to boost the matching rate to 40 or 50 per cent in future, leveraging artificial intelligence," he said.

Already, he has applied machine learning to reduce the number of errors in reads, which is especially problematic for smaller DNA readers. "I'm the first to directly pull out the useful mutation signals from the noise in single-molecule sequencing [also known as third-generation sequencing]," he said. This opens the possibility of doctors being able to pipe a patient's DNA sample into a USB-sized device and get results within a couple of hours.

This discovery has also been found to be efficient at detecting pathogens, such as viruses, and he is working with Johns Hopkins University to develop that avenue further.

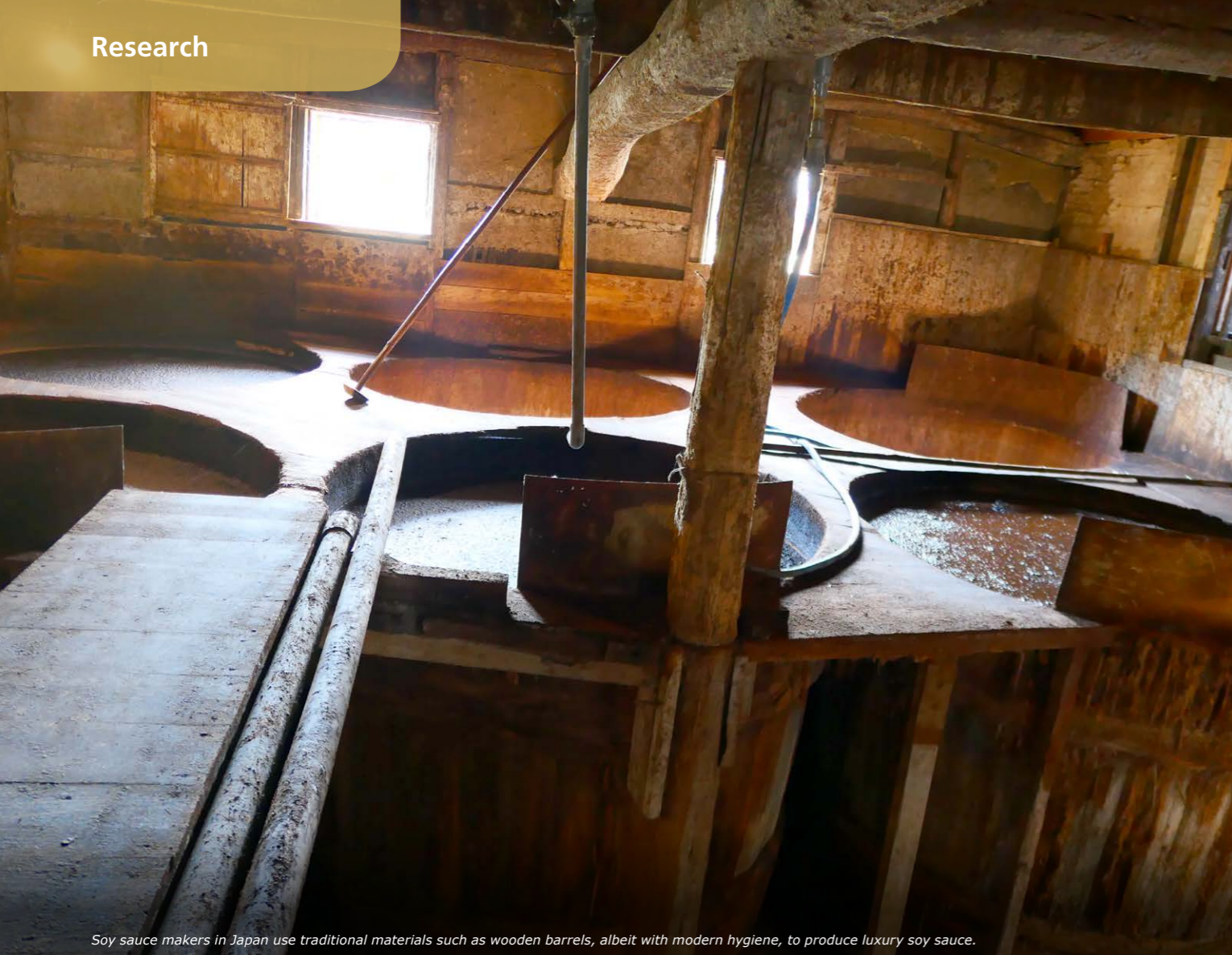
Dr Luo is keen to do more technology transfer and stay at the frontier of science. He hopes more young people will join him. "I was not a typical top-student but after all these years, I find teaching students is fun, especially about cutting-edge technologies that they can't find in textbooks. Hong Kong lacks experts in precision medicine and bioinformatics so one of my ambitions is to raise some good experts in this field for Hong Kong and globally." ■



The deep neural network architecture published in the paper named 'Clairvoyante' for extracting weak variant signals from very noisy single molecule sequencing data.



The miniaturised MinION® single molecule sequencing device used in the paper for reading out DNA.



Soy sauce makers in Japan use traditional materials such as wooden barrels, albeit with modern hygiene, to produce luxury soy sauce.

A SAUCY TAKE ON HISTORY

The maxim, you are what you eat, could very well apply to the history of soy sauce. Although soy sauce is ubiquitous across East Asia, it has taken hold in each region in different ways that are revealing about cultural and political currents.

Soy sauce is widely seen as a traditional part of East Asian cuisine. But research by Professor Angela Ki Che Leung, Joseph Needham – Philip Mao Professor in Chinese History, Science and Civilization and Chair Professor of History, and Dr Izumi Nakayama of the Hong Kong Institute for the Humanities and Social Sciences is finding that the condiment illustrates the region’s response to modernity.

In the 19th and 20th centuries, soy sauce was transformed by industrialisation and colonisation into a dining table staple across the region and even globally. More recently, it has been caught up in the fashion for artisanal products, with handmade, luxury brands for sale.

“Our research is part of a larger project looking at how technology is not autonomous but embedded in specific social, economic and political set-ups, and how it is used in East Asian societies to imagine and desire modernity. Soy sauce is a very good example,” Professor Leung said.

The origins of soy sauce are murky but there is consensus that it originated in China, where it was considered to have medicinal properties, and was brought to Japan in about the 12th century.

Japan was a trailblazer in expanding consumption, although this took a few hundred years.

Conglomerates were organised in which families worked together to produce the ingredients and undertake different aspects of the manufacturing, such as fermenting soybeans to make the *koji* that is the base of the sauce. Noda city north of Tokyo was one such centre, where the brand Kikkoman has roots going back to the 17th century.

From modern to postmodern

In China, soy sauce was more confined to the literati class who produced it at home. It did not become a popular condiment until the mid-18th century when Manchuria, the main source of soybeans, was fully integrated into the Chinese



“ Our research is part of a larger project looking at how technology is not autonomous but embedded in specific social, economic and political set-ups, and how it is used in East Asian societies to imagine and desire modernity. Soy sauce is a very good example. ”

Professor Angela Ki Che Leung

empire – before then it was not a common item in the diet of southern Chinese. Even then, its popularity was concentrated in major urban centres. “Most peasants rarely had a taste of it,” Professor Leung said.

Industrialisation was introduced to soy sauce making in the late 19th century, spearheaded by Japan. The country was keen to be seen as an equal to Western powers and brought in chemical fermentation and mass production methods. “Industrial meant modern, it meant it was better than handmade,” Dr Nakayama said.

The Japanese also took their soy sauce to the places they colonised and invaded in the first half of the 20th century. In Taiwan, soybeans were under the control of the Japanese Government and commercial soy sauce was mostly made from yellow soybeans instead

of the black beans traditionally used by native Chinese. Conglomerates like Kikkoman followed the army or even led the way as they searched for new markets.

China was not immune to this influence. Manufacturers started following the Japanese model and introduced chemical fermentation. However, the Chinese product could not compete with the Japanese industrial products in terms of price and quality. “Chinese manufacturers did not work together like the Japanese – China was very far behind,” Professor Leung said.

In recent decades, the focus on modernisation and chemical processes has shifted. Consumers want products made without chemicals – organic, additive-free, handcrafted, gluten-free, low-sodium and so on. “It’s the beginning of the post-industrial story. People ask, what is

tradition? Do we really need to rely on chemical products? In Taiwan and Japan, we can see people not imagining modernity anymore, but imagining tradition,” Professor Leung said.

Selling a new idea of tradition

In Taiwan, soy sauce makers have returned to the traditional black beans and kept their business as smaller, family-run affairs – they are not very interested in reaching out to other markets. “We worry about their sustainability because their products are relatively expensive and they produce relatively few bottles. It’s quite different from Japan, where they are more enterprising,” Professor Leung said.

In Japan, the scholars found producers who used traditional materials such as wooden barrels, albeit with modern hygiene standards (traditional fermentation is dirty and smelly), to produce luxury soy sauce. These entrepreneurs are selling a new idea of tradition that includes different varieties of soy sauce and even soy sauce sommeliers.

Hong Kong and China, though, are still in the modernity loop. “The companies I interviewed don’t talk about preserving tradition, they talk about market share and the technological advances they’ve developed,” Professor Leung said.

The scholars have also started looking at soy sauce in Vietnam and Korea and digging deeper into the story of soy sauce in China, to provide a fuller picture of the condiment’s place in East Asia.

“Tradition is a moving target. What we think of as traditional in 2019 is very different from what traditional meant in 1905. Yet we have this constant process of re-imagining what soy sauce is supposed to be that’s a reflection of not just our times, but our social and cultural values,” Dr Nakayama said. ■



Professor Leung’s visit to soy sauce makers in Taiwan.



HKU dental professionals have invented the 'NJ Toothbrush' – a revolutionary new concept in toothbrushing.

FAST TRACK TO HEALTHY TEETH

A high-speed train was one of the inspirations behind the NJ Toothbrush, a new concept in brushing which targets all dental surfaces and niches, and enables users to brush more effectively.

The Global Burden of Disease (GBD) study (1990–2010), the largest and most systemic worldwide health study which keeps track of 291 diseases across the globe, includes in its top 10 most prevalent afflictions the two most common oral diseases.

"Number One on the GBD study is Untreated Decay in Adults; Number Six is Severe Gum Disease (severe periodontitis) and Number 10 is Untreated Decay in Children," said Professor Jin Lijian, Modern Dental Laboratory Professor in Clinical Dental Science and Professor in Periodontology at the HKU Faculty of Dentistry.

"Oral diseases cause a great deal of suffering, and have huge socioeconomic impacts worldwide in terms not only of money spent treating and researching them, but also in

school and work hours lost," he continued, citing too a survey of 27 European Union countries showing that 79 billion euros was spent on treating oral problems on annual average from 2008 to 2012, a figure predicted to reach 93 billion euros by next year. Further, the GBD study 2010 indicates that over half the world's population (3.9 billion) has been affected by common oral diseases including decay, severe gum disease and tooth loss.

There is much discomfort, suffering and money spent, and these were the factors which inspired Professor Jin, together with Dr TC Ng, a local dentist and pioneering designer of precision tools for space exploration, to invent the NJ Toothbrush, named using the initials of both their last names. Their toothbrush was awarded a Gold

Medal at the 47th International Exhibition of Inventions of Geneva in April this year.

"For oral health, proactive prevention is the key," said Professor Jin. "One of the reasons these oral diseases are so prevalent is often lower awareness of oral health and lack of knowledge about basic oral health care. Other reasons may include fear of going to see the dentist and the common attitude problem that says, 'I won't seek help until I'm actually in pain.' In Hong Kong, there is often a saying 'mou tung, mou beng', meaning 'no pain, no disease!'"

Hence, people frequently ignore decay, until it really hurts. Gum disease often creeps up unnoticed, as it can develop and progress without any warning pain.



“Inspired by the high-speed train, the NJ Toothbrush literally stays on track. It follows the curving line of the teeth and couples precisely over the upper and lower dental arches.”

Professor Jin Lijian

"We may call gum disease a 'silent disease', and many patients wait too long," he said. "Periodontitis has actually been associated with major life-threatening afflictions such as diabetes, heart disease and some forms of cancer, and most recently *Porphyromonas gingivalis* – the major pathogenic bacteria of periodontitis, has been found to be directly involved in Alzheimer's disease/dementia."

Professor Jin and Dr Ng first met a couple of years ago, and started discussing the problem of low public awareness of oral health, oral hygiene challenges and potential ways to improve how people brush their teeth.

"TC has a very inventive mind," commented Professor Jin. "He did work with NASA and the European Space Agency some years ago, notably inventing the 'cosmic' drill that dug into the surface of Mars and collected the samples from the red planet in 2003 through the Beagle 2 lander."

The pair looked at the limitations of conventional toothbrushes, as well as at the physiognomy of the mouth and different sizes of front and back teeth.

Targeting 'dead corners'

What they came up with is a novel product specifically designed to target all dental surfaces and niches, in particular the interdental, retromolar and sub-gumline niches, the so-called 'dead corners' where current toothbrushes may not reach effectively.

They developed it using precise computer-mapping of six types of purpose-built bristle-bundles that reach all dental-gingival surfaces and niches, with the aim of maximising control of plaque biofilms and thereby reducing the likelihood of oral inflammation.

"Inspired by the high-speed train, the NJ Toothbrush literally stays on track," said Professor Jin. "It follows the curving line of the teeth and couples precisely over the upper

and lower dental arches. The tracking does the work for you – it guides the toothbrush and the hinged head means you don't even have to turn the brush round to reach the other side of your mouth.

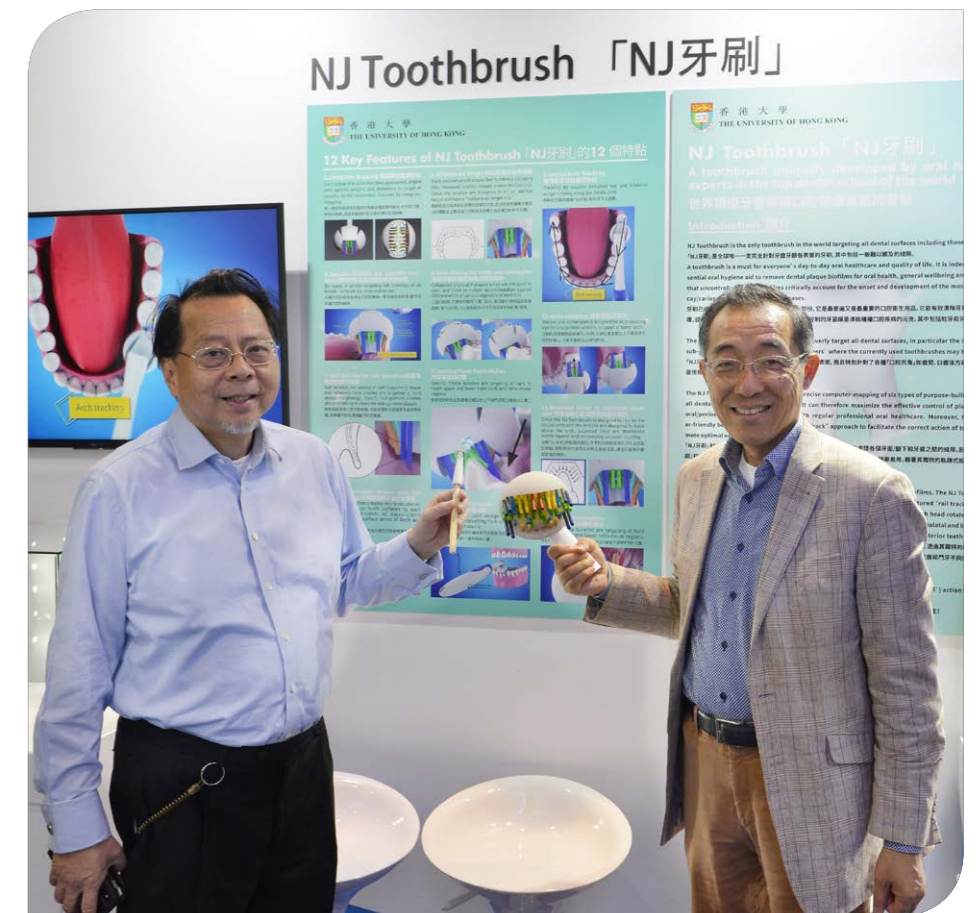
"Another featured function is 'automatic coupling', whereby the head expands and contracts so that it always fits snugly round the tooth, whether a fat molar or thin incisor."

HKU's Technology Transfer Office (TTO) gave the two inventors seed funding and encouragement, and has secured the patent for this new product.

Professor Jin said: "HKU has many patents every year, but relatively few will go directly

to lay people so we are very happy with this achievement. The patent was granted quickly as there is nothing similar on the global market. The TTO has already had meetings with potential developers, and we hope the NJ Toothbrush will be available on the market in 18 months or so."

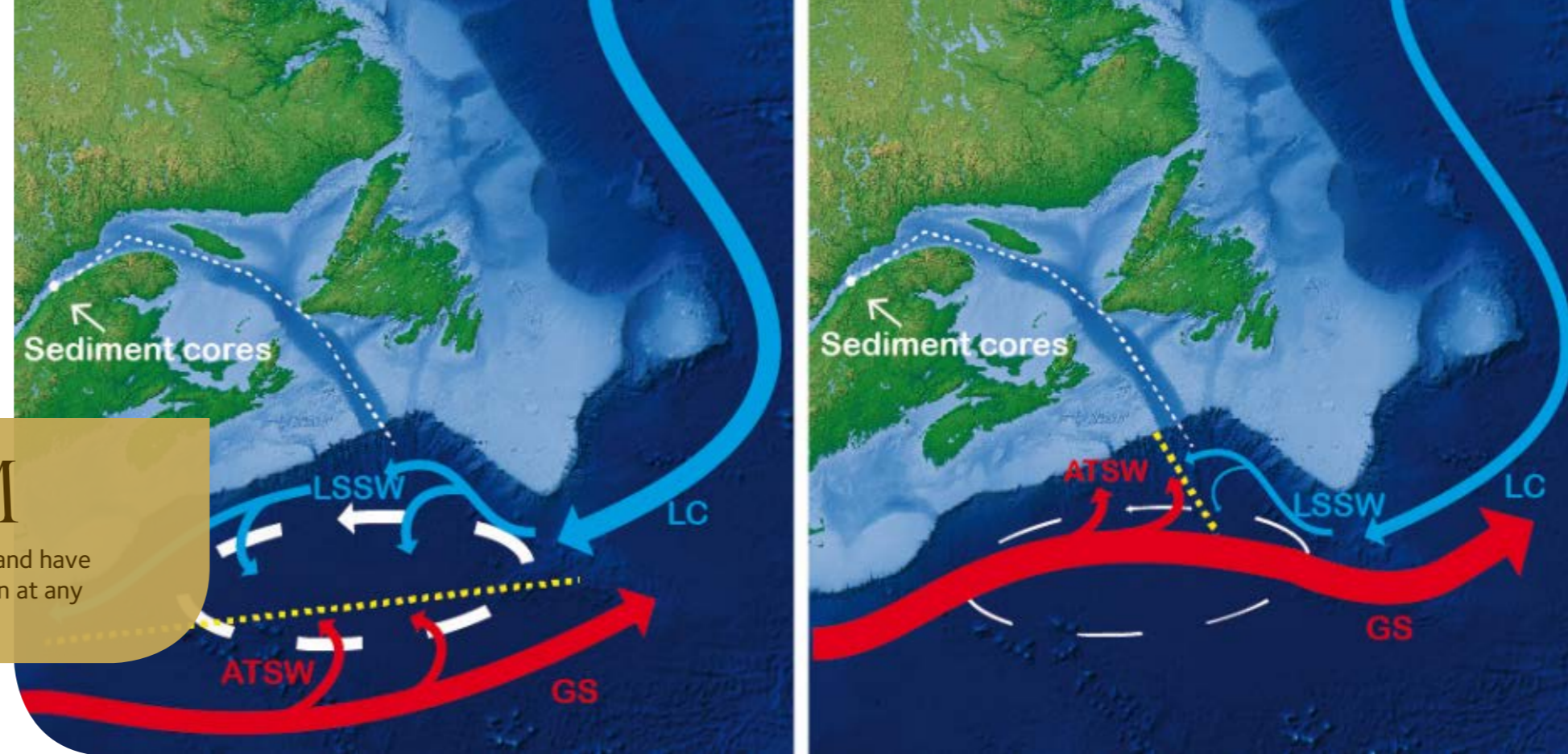
In the future, it will also be possible to customise the NJ Toothbrush to individual needs. "You will be able to have a toothbrush tailor-made to fit your mouth precisely," said Professor Jin, "thereby improving your teeth cleaning ability for better oral health and general health." ■



Dr TC Ng (left) and Professor Jin Lijian (right) showcasing the NJ Toothbrush at the InnoCarnival 2018.

CIRCULATION PROBLEM

Two scientists are looking at climate change from the perspective of marine geology, and have uncovered evidence that the North Atlantic ocean circulation is weaker than it has been at any time in the past 1,500 years.



Schematics of the circulation in the western North Atlantic during episode of strong (left) and weak (right) westward transport of the Labrador Current (LC).



“ This specific change in circulation points towards a major reorganisation of the intermediate currents in the western part of the North Atlantic that is driven by something much larger. ”

Dr Benoit Thibodeau

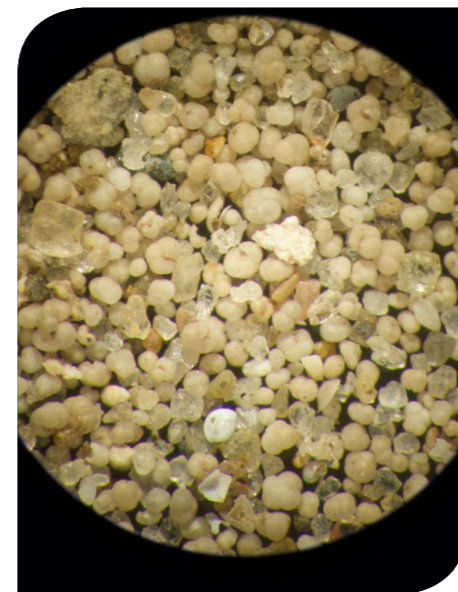
The work of Dr Christelle Not and Dr Benoit Thibodeau from the Department of Earth Sciences is focussed on a dramatic weakening of the circulation within the past 100 years, which they believe has been directly caused by global warming and the melting of the Greenland Ice Sheet.

“We have concentrated our research on a sediment core of the Laurentian Channel on the Canadian coast, where two important currents meet,” said Dr Not. “The significant finding is that at this location a warm current has replaced a cold current. It is not a change in the temperature of the water, it is a change in the water that is reaching this location. We interpret this weakening as a direct consequence of global warming, and that it has been driven by climate change in last century.”

Dr Thibodeau added: “This specific change in circulation points towards a major reorganisation of the intermediate currents in the western part of the North Atlantic that is driven by something much larger.”

The currents affected are part of the Atlantic Meridional Overturning Circulation (AMOC), which takes warm surface North Atlantic water from the equator to the sub-polar ocean where cold deep water is formed and returned toward the equator. This change in its strength could affect the climates of North America, Europe, Africa and Asia.

“The discovery of this new record of AMOC will enhance our understanding of its drivers and ultimately help us better comprehend potential near-future change under global warming,” said Dr Thibodeau. “This warming will have a localised as well as global climatological impact. It is already being felt on the Canadian coast where it has contributed to the formation of a hypoxic zone in which there is not enough oxygen to sustain most marine life. That is already having a tremendous impact on biodiversity, tourism and the local economy.”



Picture of the microfossils used in the study.

First real evidence

Scientists know the AMOC plays an important role in regulating global climate but have been unable to validate signs of its intensity. While the weakening was predicted by climate modelling, this is the first real piece of evidence that in the past 1,500 years the ocean circulation in the North Atlantic has never been as weak as it is now. Dr Not and Dr Thibodeau were able to estimate past temperatures of the circulation by studying foraminifer, or microfossils, from a sediment core in the Laurentian Channel.

“The microfossils we studied are from small organisms living at the surface of the ocean,” said Dr Not. “When the organisms die, the shell remains and sinks to the bottom of the sediment where they are preserved through time, and so we looked at the chemistry of the shell. During its formation, the isotopic chemistry changes depending on water temperature.”

“We show that the temperature of the water at the coring site is controlled by the strength of the AMOC, which implies that the temperature reconstructed from this core is indicative of one of the most significant drivers of global climate. Discovering a proxy for such an important feature of our climate system is a major step towards a better understanding of that the future climate will be.”

“The novelty of our study is the interpretation and the validation we performed using high-end numerical modelling, which allowed us to prove that our isotopic record of temperature could be used as proxy of the AMOC. No one else has looked at this kind of data using this optic,” explained Dr Thibodeau.

After studying the sediment core, the two scientists then looked for collaborators to further the investigations and validate their results. They worked with scientists from US using numerical models to simulate the climate and the ocean. With these, they recreated currents and could see what would happen, enabling them to connect their local data to a much larger, global phenomenon.

“Modelling helped us validate the hypothesis: it is the weakening of the AMOC that is causing change in temperature,” said Dr Thibodeau. “You can take a core at the end of the St Lawrence and register what is happening in the Atlantic Ocean. We captured the long-term and the short-term variability, and we can see that it is recent conditions of Earth that are effecting the circulation. Physical oceanographers have only been able to quantify the AMOC for a couple of decades. What we bring is a new, much longer perspective.”

There is a lot of debate about the state of the AMOC within the oceanography community, mostly because records only span a couple of

decades. This new, high-resolution record of AMOC (each sample represents about two years) over a long period of time will bring a new perspective on the issue and confirm that the decreasing trend now being seen in the instrumental data, despite its variability, is real and significant over the past 1,500 years.

The next step in the research is to go even further back. Pending more funding, Dr Not and Dr Thibodeau would like to analyse the same sediment core but over the last 7,000 years to produce the first complete reconstruction of the AMOC since the inception of the convection in the Labrador Sea about 6,000 to 7,000 years ago.

They are looking at the past to better understand the future. “We will try to locate conditions in the past that are close to what we expect to happen 30 years from now,” said Dr Thibodeau. “We know the circulation is weakening, the next questions are will that continue, will there be equilibrium, and will it stop?”

Dr Not added: “400,000 years ago the position of the Earth and the Sun were similar to today but temperatures were slightly warmer, similar to what we expect 20 to 30 years from now, so we’re trying to look at circulation then and compare it to today’s circulation. We are looking for similar conditions in Earth’s history and hoping to use this information as an analogue for the future of the ocean.” ■



Children enjoying themselves in rain puddles. Play&Grow lets children and families embrace different weather conditions positively.

LEARNING TO PLAY IN THE MUD

Play&Grow is a research and community programme that aims to instil healthy habits among Hong Kong's urban-dwelling pre-schoolers by encouraging them to connect to nature.

When Dr Tanja Sobko of the School of Biological Sciences introduced her healthy living programme for pre-schoolers in Hong Kong, she encountered an unanticipated problem. She had developed an obesity prevention programme in her native Sweden and brought it to Hong Kong, but when she asked Hong Kong children to join her in taking off their shoes and walking outside on the grass, they would not budge.

"It was like a magic border," she said. "They said they could not go on the grass without their shoes because it was dirty. This was something very different from what I was used to in Scandinavia. I realised I had to redo the whole programme for Hong Kong."

There are many sound developmental reasons for children to go barefoot in the grass, including, for example, promoting their sense of balance. But as Dr Sobko looked deeper at the children's behaviour, she realised there was another problem. They were also exhibiting a disconnectedness from nature – a fairly recent concept but one that is suspected to have an impact on child development.

With that understanding, she revised her programme into Play&Grow, which promotes contact with the natural world to help instil healthy living habits in children aged two to five. That natural world does not need to be a country park. Many of the sessions have been conducted in a small grassy courtyard in HKU's Main Building – the kind of tiny green patch found in or near most residential blocks in the city.

Hug a tree

The programme consists of ten 45-minute sessions in which children do physical activities, such as hugging a tree (they are reluctant at first but do so spontaneously by the tenth session), walking like a crab or hunting for a vegetable that has been buried in the ground to teach about where the vegetables come from and to reinforce the idea that soil is good and useful.

Each session also has a section on healthy eating where the children taste the raw vegetables and do other activities, such as using them for making art. They are also encouraged to make a dish using the vegetable at home with their caregiver and to grow beans.

The activities are based on research evidence about the developmental needs of pre-schoolers, but the sessions also provide Dr Sobko with new research material. At the start and end of each programme she administers validated questionnaires to measure motor skills and the like of the children. She has

also developed the world's first validated questionnaire of 'connectedness to nature' in young children, with Professor Gavin Brown of the University of Auckland, which was the basis of a recent study published in *PLOS ONE*.

Some 493 Hong Kong families participated in that study in which the parents responded on 16 items under four themes: enjoyment of nature, empathy for nature, responsibility towards nature and awareness of nature. They also completed a questionnaire on their child's psychological well-being and behaviour. A comparison of the results showed significant correlations. Children who displayed more connection to nature exhibited less overall distress, less hyperactivity, fewer behavioural and peer difficulties, and improved pro-social behaviour.

Promoting the value of outdoor play

The questionnaire has attracted interest from other scholars, including Western Australia University which has already adapted it to test children there. "Everyone wants a validated measurement tool and that's what we have produced," she said. "The Australians have the same problem that we have here. The kindergartens' outdoor playgrounds are often made of concrete and people are losing their connection with nature. Parents are stressed and busy. It's not like the past when children used to run outside."



“It's important that our work is evidence-based so we can convince people of its value.”

Dr Tanja Sobko

Hong Kong faces two additional obstacles in that parents often do not see value in free play or outdoor play – they prefer their children learn to study or learn a musical instrument – and they consider the outdoors to be dirty, she said.

Play&Grow is trying to change their attitudes and the evidence-based approach helped Dr Sobko secure HK\$1.3 million from the Government's Environment and Conservation Fund in 2017 to set up nine centres around the city.

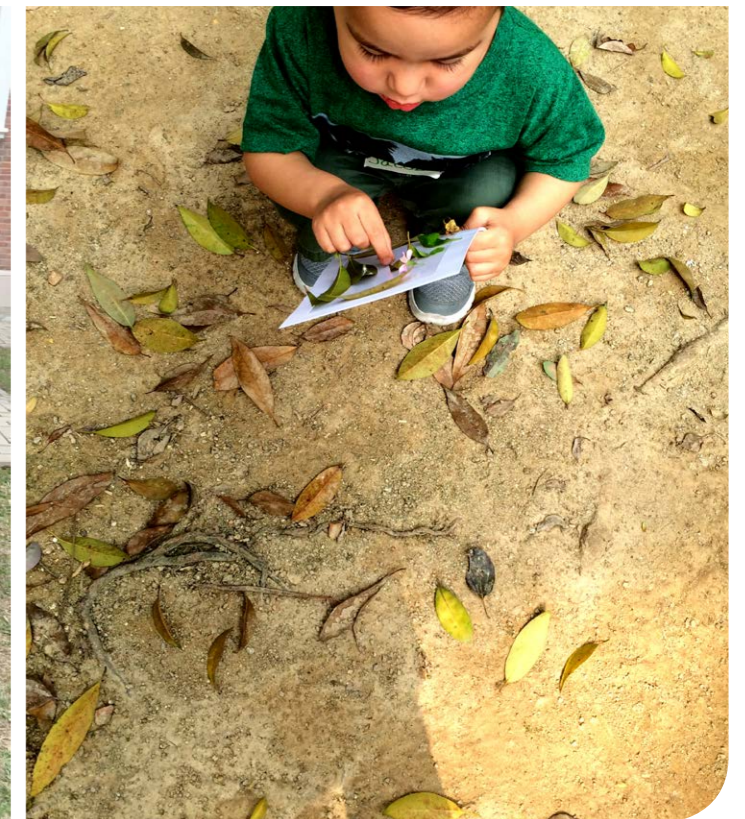
She is also continuing to offer the programme at HKU, which serves as the base for research. Recently, she and her team have studied the impact of connectedness with nature on feeding habits in young children and on their gut

microbiome, and they will publish the results of both studies in the near future. She has also recruited a psychologist to study the impact of nature connectedness on children's mental health.

"My PhD was in gut pharmacology and my colleagues in Sweden used to say, why are you doing this tree-hugging thing, it's very far from science. But now they understand it better because they see the science behind it. It's important that our work is evidence-based so we can convince people of its value," she said. ■



Dr Sobko and a group of children hugging a tree and listening to the 'sound of the tree'.



Children learn to appreciate different forms of nature via the Play&Grow programme.



SUMMERTIME, AND THE LIVING IS DEADLY

Heat is killing people in cities. The world's first international forum devoted to heat and health was held at HKU in late 2018, and scientists from around the globe have launched an initiative to reduce the deadly impact of heatwaves and rising city temperatures.

In some areas, heatwaves kill more people than any other natural phenomenon. In Hong Kong, this most densely populated of urban sprawls, recent research has shown that every 1 degree Celsius increase in maximum daytime temperature above 28.2 degrees Celsius results in a 1.8 per cent increase in mortality. Furthermore, experts note that the world could reach a level of more than 80 to 90 per cent urbanisation by the last quarter of the century, meaning large populations will be at risk.

Statistics like these have brought issues with city heat to the public eye. "Urban climate is

an emerging research field," said Dr Ren Chao, Associate Professor in the Faculty of Architecture, and prime mover in setting up the First Global Forum on Heat and Health in December 2018, which was supported by the joint office of World Meteorological Organization and the World Health Organization.

"Often heat and health studies focus on the outside temperature only, but people die inside. We are linking outside and inside, and setting out to engage the community in our research. Hong Kong is ahead in this field – we know how to manage the physical setting

of a crowded city via design and planning, so others are looking to learn from us."

Her research concentrates on climatic applications in urban planning, as well as sustainable urban design. She has worked in China, Taiwan, Singapore, the Netherlands and France in this field and over the past 10 years has helped the government with guidelines on urban climatic application.

"It is interesting that at present there is no official heatwave definition in Hong Kong, only hot weather warnings, and there is little



“ Often heat and health studies focus on the outside temperature only, but people die inside. We are linking outside and inside, and setting out to engage the community in our research. Hong Kong is ahead in this field – we know how to manage the physical setting of a crowded city via design and planning, so others are looking to learn from us. ”

Dr Ren Chao

public awareness about the problem," she said. "That is not limited to this city though – the impact of rising global temperatures on the built environment is still being overlooked in most parts of the world."

Dr Ren revealed her findings at an American Meteorological Conference in Seattle in 2017, and was surprised to find she was unique on the Heat and Health network as the only delegate with a background in town planning and architecture. She expects that to change soon, as the importance of urban design as long-term action on heat-health becomes better known.

"Talking with delegates there, we discussed the need to go back to the fundamentals and build a better quality living environment to help alleviate the effects of urban heat," she said. "We also need to rethink urban planning."

It was those discussions and a realisation of the extent of the problem that sparked the idea for a heat and health conference to be held in Hong Kong. It was attended by 120 climate and health experts from 33 countries, who pledged to build the capacity of governments, organisations and professionals to protect populations from the avoidable risks of extreme and ambient heat.

Within Hong Kong, Dr Ren hopes her research will benefit policy change. "Hong Kong is a high-density urban environment, an artificial environment. We local researchers have been working with the Planning Department to build up an Urban Climate Map for the city. The Government needs a comprehensive picture of urban climate conditions in places that are already developed and those where there are major development projects.

"There are plans afoot to build mega developments, including the East Lantau Metropolis, which will house more than a million people, and the Greater Bay Area, a massive scheme by the Chinese Government

to link the cities of Hong Kong, Macau, Guangzhou, Shenzhen, Zhuhai, Foshan, Zhongshan, Dongguan, Huizhou, Jiangmen and Zhaoqing into an integrated economic and business hub. Proper planning to ensure a healthy urban climate in the near future will be crucial."

Heat-health warning system

Her team has also initiated a collaboration with the Hong Kong Observatory to develop and promote a heat-health warning system.

The current problem with urban heat in Hong Kong is exacerbated, in some cases, by local beliefs. Dr Ren said: "Some older people believe night-time temperature is naturally lower. This is simply not true – the way Hong Kong's city climate is going now, there could

be a time when we will have no real winter, only summer here. Also, they won't turn on a fan or air-conditioner because traditional Chinese medicine says machines are not good for your health."

On the positive side, the Government is now aware of the problem: the Research Council has granted HK\$6.7 million in funding over the next three years, and local researchers from four universities have been teamed up to work together. The HKU team will be cross-disciplinary, spanning the Engineering Building Department and Faculty of Architecture, as well as partnering with the Hong Kong Planning Department, the Observatory and several NGOs. ■



The First Global Forum on Heat and Health held at HKU in December 2018 brought together over 120 climate and health experts from 33 countries to strengthen cooperation in science.

TISSUE OF LIVES

Discovering the role of viscosity in regulating the behaviour of living cells is major breakthrough for tissue engineering and could lead to better cultivation of human tissue and organs.



“ This research falls at the interface of cell biology, engineering and physics, so is very interdisciplinary. ”

Dr Lin Yuan

Scientists have long researched ways to direct cell behaviour and functioning in the hope of furthering their understanding of how to cultivate and regenerate human tissue. Now Dr Lin Yuan, from the Department of Mechanical Engineering, working alongside an international team, has revealed for the first time how material viscosity influences the different behaviours of cells. This marks a significant breakthrough in the profound understanding of how cells operate *in vivo*.

“There has been significant work in this area for the past two decades,” said Dr Lin, who was among the first scientists to investigate cell adhesion from a mechanics viewpoint during his PhD study some 15 years ago. “It falls at the interface of cell biology, engineering and physics, so is very interdisciplinary.”

The new discovery could significantly advance regenerative medicine, or tissue engineering, which uses living cells to cultivate living tissue such as skin, blood, joints and major organs including hearts, which can then be used for transplant or repair.

Dr Lin, along with his student Dr Gong Ze, collaborated with researchers from the Universities of Pennsylvania, Virginia and Stanford, and showed how the surrounding viscosity of cells affects their response across a wide range of material parameters.

Their findings have been published in the noted academic journal *Proceedings of the National*

Academy of Sciences of the United States of America.

Dr Lin said: “A vital factor in the successful cultivation of living cells is providing a proper and effective extracellular matrix [ECM] which mirrors the natural environment of the body as closely as possible. Almost all synthesised or natural ECMs have substantial viscosity – in addition to elasticity – but until now we did not know exactly what role material viscosity played in regulating cell behaviour.”

Dual approach

Dr Lin’s team utilised a combination of experimental and theoretical approaches. “We used both a stochastic model, describing the dynamics of motor clutches formed between the cell and outside in a probabilistic sense, and actual experiments, and we revealed how the viscous response of the micro-environment regulates the adhesion and spreading of cells, as well as the physical mechanisms behind.”

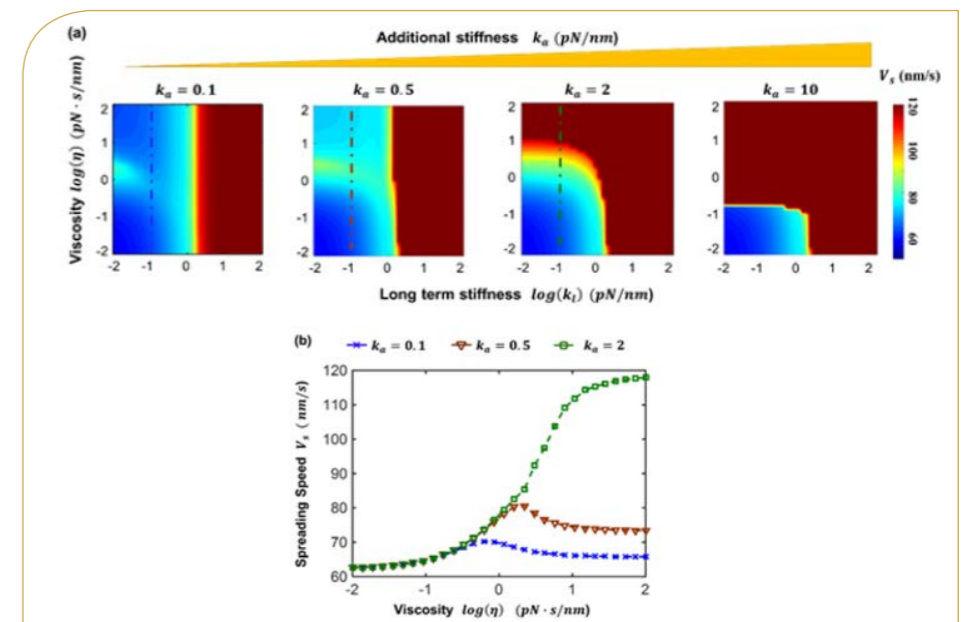
Specifically, their findings show that for substrates that are stiff, viscosity does not influence cell spreading since the bound clutches are saturated by the elevated stiffness. However, viscosity does stiffen soft substrates on a timescale faster than the clutch off-rate, and this enhances cell-ECM adhesion and cell spreading. “In short,” said Dr Lin, “on soft ECMs, maximum cell spreading is achieved at an optimal level of viscosity.”

The research team’s goals now concentrate on how to use their knowledge to design and make biomaterials to achieve desirable cell responses in different applications. They are already working with professors in the Li Ka Shing Faculty of Medicine on possible applications for Biliary Atresia, a liver disease which occurs in infants.

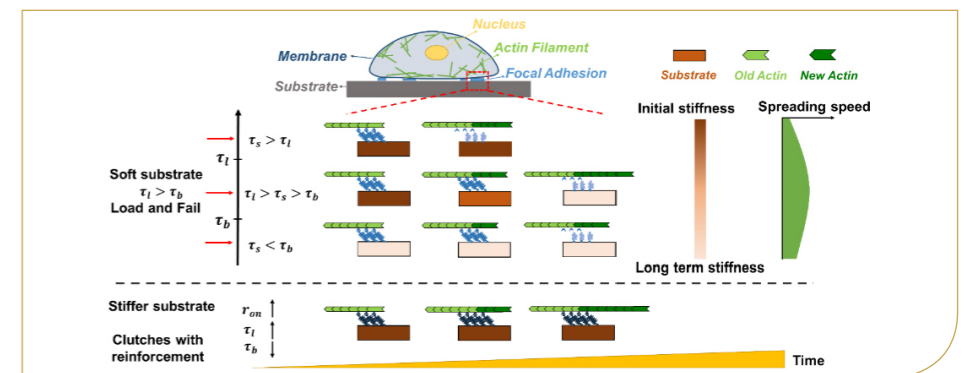
Abnormal tissue

“With this disease, the live tissue becomes increasingly abnormal,” said Dr Lin. “We seek initially to delineate the correlation between the progression of the disease and changes in the physical characteristics of the tissues, as well as related cellular activities. Hopefully, this can provide clues for the development of better treatment strategies in the future.”

Asked about the ongoing collaboration with the University of Pennsylvania on this work, Dr Lin underlined the importance of such cooperation. “We have been working with Pennsylvania extensively for the last four or five years,” he said. “We also sent postgraduate students on extensive exchange programmes with the University, and this is absolutely key for this work – scholars need to spend time learning before they can produce good work.”



Cell spreading speed is significantly influenced by the elastic and viscous parameters of the material.



A schematic illustrating the effects of material viscoelasticity on cellular behaviour based on the comparison of the clutch binding timescale, substrate relaxation timescale and adhesion lifetime scale.



TURNING TENT TO TOWNHOUSE? ULAANBAATAR'S GER SPRAWL

The Faculty of Architecture is leading a project to transform Mongolian gers for urban living to help solve a housing problem brought about by mass migration to Ulaanbaatar.

Urban evolution on the outskirts of Mongolia's capital Ulaanbaatar is undergoing a crisis. Economic reforms, coupled with harsh winters that wiped out livestock and destroyed crops, and a government ruling that native Mongolian adults are entitled to a plot of land, have sparked a mass exodus from the countryside by nomadic herders heading to the city in search of a better life. Since 1989, Ulaanbaatar's population has doubled, and the result has been an urban sprawl that has exploded the city's size from 130 square kilometres to 4,700 square kilometres.

Joshua Bolchover, Associate Professor in the Department of Architecture, said: "The speed of this urban evolution has been remarkable because you can simply pack up a ger [traditional felt tent], claim the land on which to put it, and set it up. The ger sprawl is also unique because

unlike other informal settlements in developing countries, these districts are not illegal. However, that has not prevented them from being stigmatised as problem areas – effectively slums."

"The tents are connected to the power supply," said Senior Research Assistant Jersey Poon, "but infrastructure such as roads, sewerage and waste disposal is lagging far behind. Further, everyone is burning raw coal, so the air pollution is diabolical."

Describing the enormity of the change of life for these migrants, Mr Bolchover said: "This is all new to them. Before they were solitary and nomadic and they have no prior experience living amongst others. Tellingly, there is no word for community in Mongolian."

The team's initial aim was to understand the spatial characteristics of how this unique rural-urban fringe evolved, and then to develop innovative architectural prototypes that could contribute to the integration of the ger districts into a viable urban construct. Using the humble ger as the basis for the concept made sense – they are readily available at the market, and many migrants already have one.

Mr Bolchover and team first went to Ulaanbaatar in 2014 with basic seed-funding and some ideas. The initial project, funded by the Asian Foundation, was a scheme for solid waste collection in the ger district.

Despite problems that included trying to pour concrete in minus 30 degrees, the project was successful, and inspired more ideas. "We asked



“ The ger sprawl is unique because unlike other informal settlements in developing countries, these districts are not illegal. However, that has not prevented them from being stigmatised as problem areas – effectively slums. ”

Mr Joshua Bolchover

ourselves if we could provide buildings for child care, a community centre, library, a shop," said Ms Poon. "That was also when we started to develop ideas for modifying and improving the ger."

The ideas took shape when the Architecture Department was commissioned to go to the Venice Biennale – and made gers the focus of their exhibit. "We thought the Biennale was a great platform to tell people about the problems in Ulaanbaatar," said Mr Bolchover.

"For Venice we did modified gers," said Ms Poon. "One was wooden, another felt, and a third was wrapped in Lycra. We also showed videos of our projects, described our incremental strategy and held an exhibition of portraits of ger district residents."

One of the couples interviewed for the exhibition agreed to the team using their plot of land for the ger prototype. The architects worked on design, the Lorinet Foundation got involved on the funding side and Ger Hub, an NGO, became their local partners in Ulaanbaatar.

Ger Plug-In

The resulting prototype is the 'Ger Plug-In', an infrastructural spine which attaches to the ger and contains a kitchen area, shower, toilet and

septic tank. "You can hang the whole ger from our new structure, so we were able to remove two supporting columns then take out a quarter of the ger circle which is where the plug-in goes," said Ms Poon.

Traditionally the stove is in the centre of the ger, but this means it is smoky and dangerously hot, so they moved it to the side. They also included a solar trombe wall, made of black PVC pipes filled with sand. The sun heats the sand in the day, and at night the stored heat is released into the ger. Under-floor heating set in a concrete floor adds thermal stability and a central brick wall makes the temperature more constant.

Mr Bolchover said: "We threw in as many ideas as we could because this was the pilot and we wanted to see what works. The couple have now been living here for 18 months, and we are constantly monitoring it to see how to make it better."

Cost is an issue: the Ger Plug-In costs US\$13,000 to build and the Architecture team is now working to find ways to help residents fund the housing. "The Asian Development Bank has huge projects in Ulaanbaatar – around US\$60 million in loan strategies are available over the next five years, but these are not reaching people at the lower end of scale," said Mr Bolchover. "We are working within

Ulaanbaatar's financial infrastructure to enable people to get loans at lower interest rates."

"Our involvement is long-term," said Ms Poon. "We will evolve the structure and find ways to cut costs further. At present we are working on a plug-in with a shared-wall structure, allowing up to four gers to share the same infrastructure."

They are also building a community centre in Ulaanbaatar, sponsored by the Hong Kong Jockey Club and working again with Ger Hub. The centre is being built in an area known as Eco-Town, and around 40 architecture students have been on-site working on its construction.

"The design is inspired by the different layers found in a traditional ger, but this time we have pulled the layers apart to create different temperature zones," said Mr Bolchover.

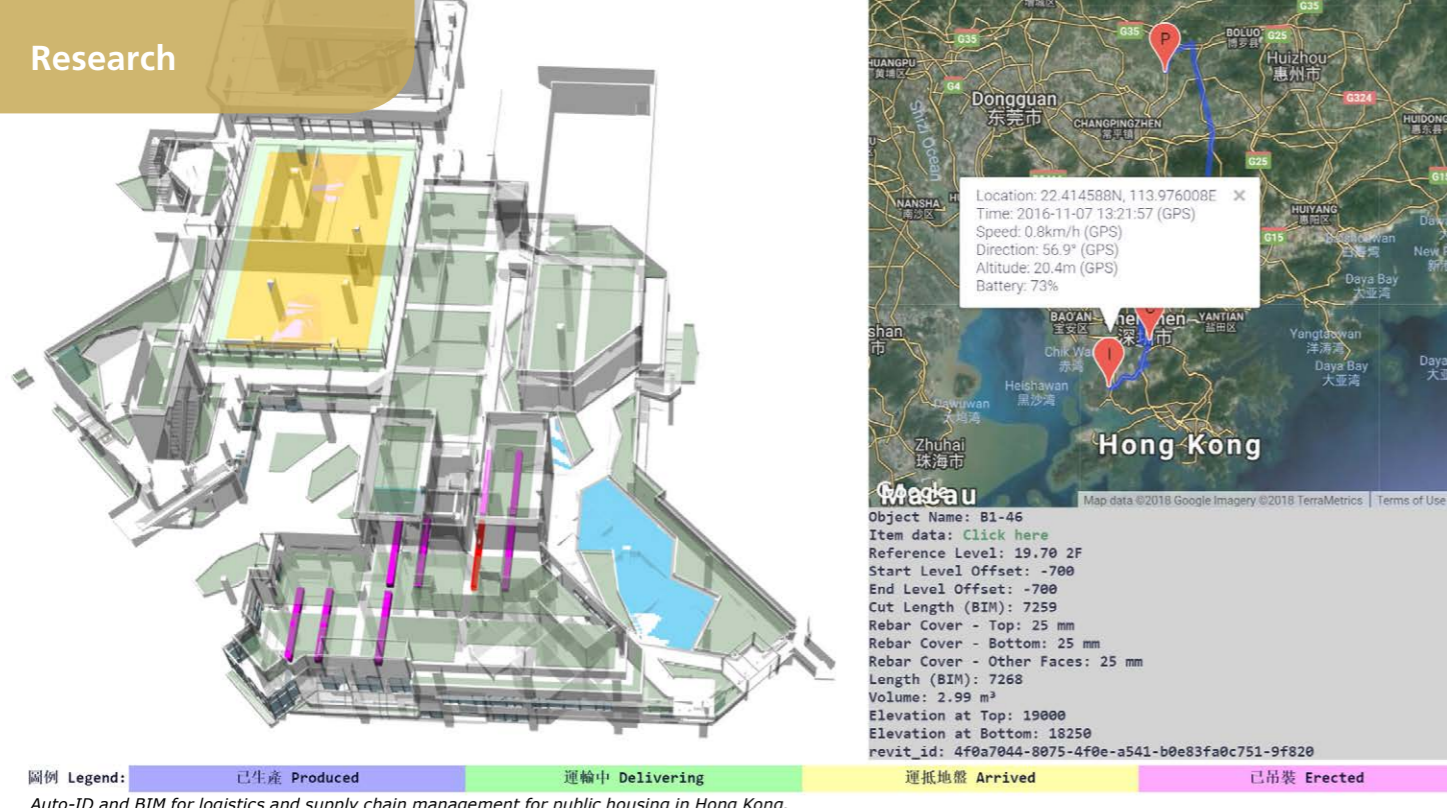
"We have had a large team of students working alongside Mongolian carpenters and translators – it has been an amazing experience. The electricity would go on and off all the time, and there have been numerous challenges but as a hands-on opportunity for experiential learning it is second to none." ■



The interior of the Ger Plug-In.



Architecture students building Ger Plug-In.



圖例 Legend: 已生產 Produced 運輸中 Delivering 運抵地盤 Arrived 已吊裝 Erected
Auto-ID and BIM for logistics and supply chain management for public housing in Hong Kong.

WAKE-UP CALL FOR CONSTRUCTION

The way the construction industry operates has changed little over the centuries, and major projects are regularly completed late and over-budget. Now, Building Information Modelling (BIM) is dragging the industry into the technology age, and HKU is at the forefront of the change.

The construction industry worldwide is going through a paradigm shift and, according to Dr Wilson Lu Weisheng, Associate Professor in the Faculty of Architecture's Department of Real Estate and Construction, the change is long overdue.

Famously, or perhaps infamously, a Diagram of Productivity, put together by the McKinsey Global Institute, shows the construction industry having the lowest productivity gains of any industry over the past 20 years. By contrast, all other industries – including those such as



Core members of the HKU BIM team – (from left to right) Dr Wilson Lu, Professor Steve Rowlinson and Professor Chris Webster.

agriculture which people view as unchanged and traditional – have improved productivity through the development and use of technology. The only odd one out is construction, which, according to Dr Lu, “basically still starts with a couple of joists!”

“The advent of Building Information Modelling (BIM) will change all that by using digitised drawing tools to work with 3D design files,” he said. “Under BIM regulations, before constructing an actual building you must construct a virtual building – a digital manifestation of the intended building that includes lifecycle information of all its components. This makes every aspect of the planned building visible, and enables architect, construction contractors, engineers, interior designers, facilities managers etc to sit together and consider the building before a single sod of earth has been turned.”

Using BIM avoids the need for repetitive two-dimensional shop drawings, which, Dr Lu pointed out “astoundingly are still often

rendered in pencil on paper”. It will revolutionise the construction industry, and currently everybody is looking for experts.

The controversy over BIM comes from the lack of know-how and uncertainty within the industry – and of course a suspicion of anything new. This is where Dr Lu and his faculty colleagues Professor Steve Rowlinson and Ir Dr Llewellyn Tang, come in. Having done extensive research into research and development about BIM in Hong Kong, Mainland China and Australia, they have become the go-to people for an industry which is clamouring to know more about how to implement BIM and the regulations governing it.

Dr Lu’s area of expertise is BIM for public housing, in particular its logistics and supply chain management, while Professor Rowlinson concentrates on BIM for integrated project delivery and project procurement through VR (Virtual Reality) visualisation of the constructed facility, as well as the construction process.



“ Under BIM regulations, before constructing an actual building you must construct a virtual building – a digital manifestation of the intended building that includes lifecycle information of all its components. This makes every aspect of the planned building visible. ”

Dr Wilson Lu Weisheng

Dr Tang’s focus is BIM certification using the BIM Level 2 suite from the UK and BS EN ISO 19650, with the first successful implementation and talent development for China’s largest asset management company the Wanda Commercial Management Group.

“The clear value of getting an international standard is not just helping an enterprise reduce costs with an internationally recognised documented management system, it also helps differentiate the architecture, engineering and construction (AEC) industry and to maximise the value of sharing best practice globally,” said Ir Dr Tang.

The team has sought and received HK\$30 million in research funding for BIM in Hong Kong and beyond, and they also played a role in allocating around a quarter of the Government’s HK\$1-billion Construction Innovation and Technology Fund given to the construction industry.

The expected impact this breakthrough is having can be measured by the fact Chief Executive Carrie Lam mentioned BIM in her Policy Address in 2017, and for the first time last year it was mandated in Hong Kong law for any construction project valued at HK\$30 million or more.

“At the moment, the resources are there, but the expertise is not,” said Dr Lu. “Major construction companies in the region are keen to adopt BIM. For example, the CEO of AECOM – which has 87,000 employees across the globe – recently said his company wants ‘100% exposure to BIM’. Hong Kong-based Gammon Construction, which has around 8,000 staff across Southeast Asia, wants the same.”

The demand for information stretches across the globe. Dr Lu was recently in Australia giving talks on BIM and the message he was receiving from many of the delegates there was ‘if you know anything about BIM we will hire you’, which he sees as good news for architecture, real estate and construction students looking to focus on this field.

BIM and GIS

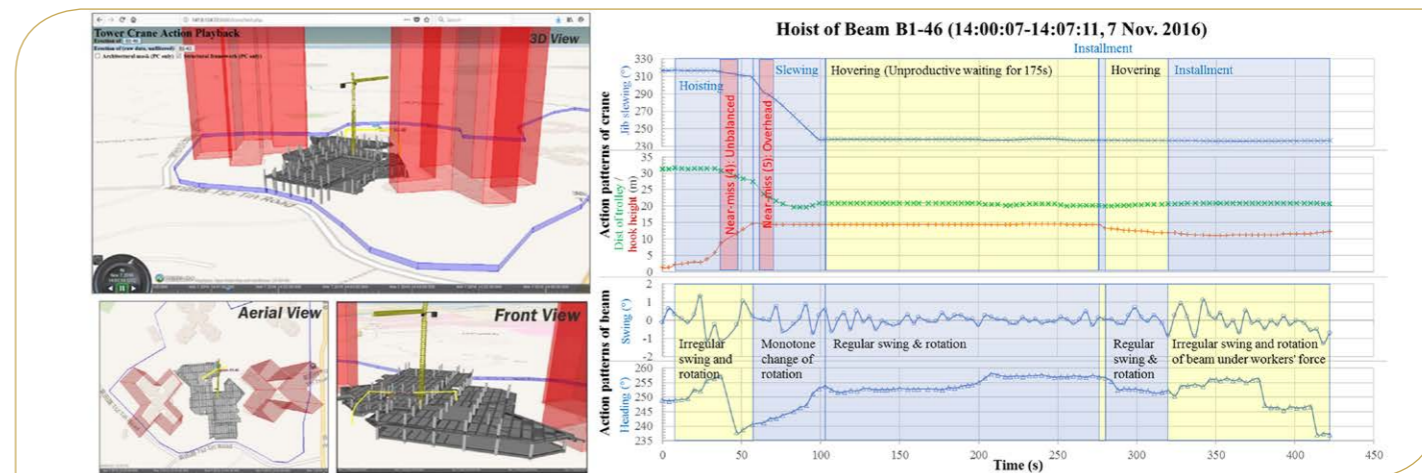
Looking to the future, the possibilities for BIM go well beyond the construction stage. By linking BIM to GIS, for example, the digital models of buildings, roads and pedestrian networks can be synergised at an urban scale.

Professor Chris Webster, Dean of the Faculty of Architecture, commented: “It could form an urban digital platform to provide ‘all-round’ data relating to urban Hong Kong, from sky to

ground, and from indoor to outdoor. Based on the platform, subsystems such as the building rooftop inventory subsystem, the 3D pedestrian network subsystem, or the planned urban morphometric subsystem will support studies and collaborations on urban planning and the overarching realm of ‘smart city’.

“Subsystems in the urban digital platform can also address a series of socioeconomic problems concerning Hong Kong’s unique construction needs,” he continued. “For example, the building rooftop inventory subsystem contains information-rich elements that could support heat island effect analyses in densely populated areas and investigations on unauthorised building works; the 3D pedestrian network subsystem allows the modelling of pedestrian routes across the city for navigation, pedestrian footfall analysis and many other uses.”

Pioneered in the US at institutions such as Stanford and Georgia Tech, BIM has already been adopted in countries such as the UK, Singapore and recently Hong Kong. “Now other countries are rushing to keep up,” concluded Dr Lu. “BIM will revolutionise the construction industry and we at HKU want to be a driving force in that revolution.” ■



Smart core technologies and BIM for construction safety management in Hong Kong.



Dr Schwantes with students at Pun Uk Mansion, learning first-hand about the real-life challenges in building preservation and the techniques involved in analysing buildings. (Courtesy of Alison Trachet)

TEACHING THE SCIENCE OF HERITAGE CONSERVATION

HKU's Architectural Conservation Laboratory is educating students and the community about the nitty-gritty of preserving heritage buildings in Hong Kong. It also provides scientific analysis for heritage projects in the community.

Most people would agree it is important to protect Hong Kong's few remaining heritage buildings. But even among conservation managers and students, there can be limited understanding of what this means in practice.

Dr Gesa Schwantes, Director of the Architectural Conservation Laboratory (ACLab) in the Faculty of Architecture, has had fourth-year students who cannot tell the difference between concrete and lime plaster, and seen clients ignore her advice to use mineral-based paint, not latex paint, resulting in damage to historic plaster.

It was situations like these that inspired the Faculty to launch the ACLab and recruit

Dr Schwantes to lead it. The ACLab provides contract research and a springboard for teaching students the basics about the science of conservation.

"Conservation students learn a lot about heritage values and the significance and history of a building and this is all very important. But they also need to understand how important it is to look at the materials and building fabric in order to understand defects and how to fix them," she said.

An opportunity to demonstrate the problems was recently handed to Dr Schwantes when her laboratory was contracted to do preliminary analysis of paint and plaster finishes at Pun Uk

Mansion, a 1930s Hakka building, which she extended into a teaching and knowledge exchange activity.

Proportionate to the task

She was brought into the project by consultant MSc(Conservation) graduate Curry Tse, whose client wants to restore the 600-square-metre structure and build a columbarium next to it. The mansion includes an ancestral hall, courtyards and side buildings, and it has a good variety of decoration styles, including wood, carved wood, plaster and plaster relief.

However, the building has major damp problems due to a hole in one of its roofs and poor



“ We are the only laboratory doing this kind of materials analysis and interpretation in Hong Kong outside of government. Other laboratories can tell you about the materials, but we will provide information on how to conduct repairs and treat the building better. ”

Dr Gesa Schwantes

drainage that means it can be standing in 30 centimetres of water for days after a heavy rain.

Dr Schwantes brought fourth-year BA(Conservation) students there in autumn 2018 to expose them to real-life challenges in building preservation and the techniques involved in analysing buildings.

The students were put to work investigating and drawing details of the building. They were taught how to collect samples and where to collect them and shown how to use specialist equipment to analyse the results. The work was carefully supervised because of the need to avoid causing damage and to be proportionate to the task at hand – for some tasks, such as infrared testing, a tiny sample the size of a couple of sesame seeds is sufficient, while others, such as mortar analysis, require a sample of up to 500 grams.

In the laboratory, she showed them how to prepare samples for cross-sectional analysis. For instance, one process involves pouring liquid

resin into a silicone cube, adding the sample, letting it harden, then cutting and polishing it before looking at it under a microscope. "The idea is that students see every step of the process – what liquid resin is, how we mix it, how long the process takes. This will help them later if a client says the analysis is too expensive – the student will know it takes a day to do this in the laboratory which justifies the price. That's important information for them," she said.

Reporting to clients and the community

The class were also fortunate to have access to a similar building for comparison, the ancestral home of student Kitty Lam Pui-ye, who found the course personally and professionally enriching. "It has allowed me to understand my family heritage by comparing Pun Uk with my grandma's Hakka house and it really raised my interest in traditional Hakka decorations. I am developing my thesis on this," Kitty said.

The students' work has helped provide input to a report on the Pun Uk Mansion by the ACLab

that recommends the client repair drainage and the roof and provides specific analysis of the building's materials and how to restore them.

"We are the only laboratory doing this kind of materials analysis and interpretation in Hong Kong outside of government. Other laboratories can tell you about the materials, but we will provide information on how to conduct repairs and treat the building better," Dr Schwantes said, a lesson also imparted to tomorrow's architectural conservationists.

She also hopes to educate the public on the value of this approach to conservation through a knowledge exchange project centred on Pun Uk Mansion. A website is under construction that will provide information on built heritage conservation and 3D drawings of the mansion, with text and photos and videos explaining the work done by Dr Schwantes and her students. Students are involved in providing drawings for the website, which will be launched in summer 2019. ■



One group mixing lime plaster with red pigment and brick powder in the laboratory to compare the visual differences between these stained plaster dummies in comparison with the plaster at Pun Uk.



A group of students studying traditional Hakka roofing techniques and documenting the defects at the roof of Pun Uk Mansion. (Courtesy of Yumi Li Yeung-shin)



Presentation



Interaction



Discussion

CLARITY COMES WITH THE CLICK OF A MOUSE

Technology developed at HKU is making video learning more interactive.



“Videos are useful because for certain things they can provide much more information, such as how to perform a skill.”

Professor Michael Botelho

In a traditional classroom, when a student has a question about the content or is confused, she or he simply has to raise their hand and the teacher can answer immediately. But in online learning, the process has been a lot more laborious.

“There’s a huge transaction cost involved in going to a forum, typing in a message and waiting for a response. And even then, the feedback is based on recall, not the immediate context of the moment when the student needs the answer,” said Professor Ricky Kwok,

Associate Vice-President (Teaching and Learning) and a member of HKU’s Technology-Enriched Learning Initiative (TELI).

But a new tool designed and inspired by Professor Michael Botelho of the Faculty of Dentistry and developed by TELI is changing that situation by bringing immediacy to the feedback students give and can obtain from online videos. It is coming not a moment too soon as videos are increasingly becoming a mainstay of teaching and learning at HKU, within both specific disciplines and the Common Core.



Professor Botelho’s initiative has been supported by colleagues in HKU’s Technology-Enriched Learning Initiative (TELI).

“Videos are useful because for certain things they can provide much more information, such as how to perform a skill,” Professor Botelho said. Until now, online learning platforms have not allowed for real-time feedback on the content – not even big providers such as edX and Coursera.

Introducing the VideoVox

Professor Botelho’s innovation, the VideoVox, addresses that gap by allowing for timestamped questions, comments or feedback on videos. Students can pause a video and type in a question, and later the teacher can click on the question and be taken to the exact moment in the video to contextualise the question before replying.

In addition, keyword tags or colour buttons can be created by the teacher to allow interaction with the video content for specific tasks. For instance, students can click on a red, yellow or green button to indicate if the procedure they are watching is being done incorrectly, correctly or somewhere in the middle. Or they can use tags to give feedback on how well they understand the content.

“Let’s say there’s a video of someone performing CPR [cardiopulmonary resuscitation]. This has to be done in a set order, so if the person in the video checks the pulse before checking the breathing and airway, the student would be expected to click ‘incorrect’ and the teacher would see that the student understood what was wrong there,” Professor Botelho said.

“This interaction allows students to discriminate and use their judgement. Whether they are watching someone perform CPR, teach a class, give a presentation in a law court or give an arts performance, to name a few examples, they can give timely feedback.”

Importantly, teachers can receive a visualisation of the data analytics connected to the video, such as student feedback, whether and when they watched the video, when they paused,



Professor Botelho (right) receiving the Teaching Innovation Award from Vice-President and Pro-Vice-Chancellor (Teaching and Learning) Professor Ian Holliday (left) for the interactive online video platform he designed.

how frequently they accessed the system and other useful behavioural data. This kind of information is not easily accessible on other platforms teachers might use, such as YouTube.

Professor Botelho’s efforts were supported by TELI staff including Dennis Wong, a recent HKU computer science graduate, and Victor Wong and Bob Kung, and they helped earn him the 2018 University Teaching Innovation Award.

Leading to other innovations

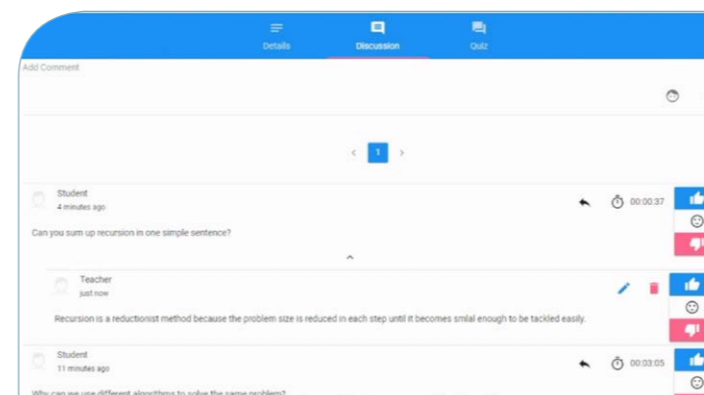
Professor Kwok has already used the data analytics to improve teaching in his Common Core class on algorithms. In one of his videos, there was a spike of red clicks when he discussed how to use algorithms to solve Rubik’s cube. “I checked the video and discovered that I had not explained one step very well so the students didn’t understand it. It was a tricky step, so the next day in the classroom I explained it to them more clearly in person,” he said. “I wouldn’t be able to do this without Mike’s platform.”

The platform is also leading to other innovations. Professor Kwok noticed that a lot of students were accessing videos in the early hours of the

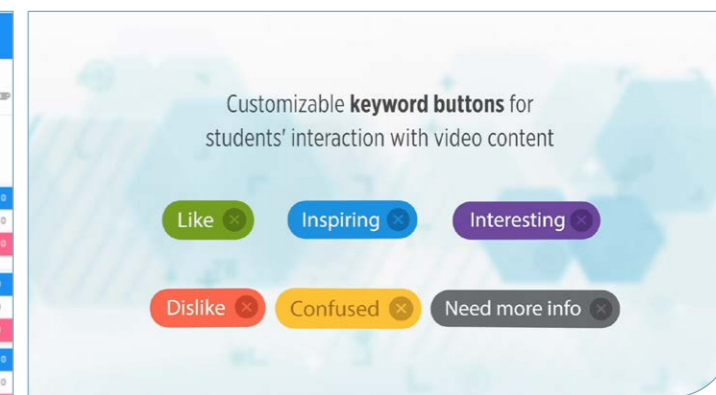
morning, when professors and tutors would be asleep and unable to answer their queries. So he and the TELI team are developing a chatbot that could address their queries.

In the meantime, VideoVox is moving from a soft launch to wider use. Several teachers besides Professor Kwok have pioneered its use at HKU, including Mr Mathew Pryor of the Faculty of Architecture and Miss Nicole Tavares of the Faculty of Education. The Common Core programme is also promoting it.

Miss Tavares said she found it useful for engaging students in joint reflections. She filmed student teachers in action so she and peer students could provide feedback tagged to the actual moments of teaching, a process that created more opportunities for interaction on specific aspects of each lesson and allowed for more concrete feedback to be provided. “I see enormous value in these dialogues among us in promoting deeper and more critical reflections, peer learning and teamwork,” she said, adding the technology also has great potential for other teaching purposes, such as flipped classroom teaching. ■



VideoVox allows students to enter questions or comments, which can be timestamped to a particular context in the video, into an integrated discussion board and hence facilitates online asynchronous dialogue.



Course designers can create keyword buttons underneath a specific video. When learners are watching, they can click on the keyword buttons to tag and timestamp the video for a particular task.



Sam Dubberley (first from right), Manager of the Digital Verification Corps (DVC) presenting certificates to the HKU DVC team members on the last day of the training.

INVESTIGATING HUMAN RIGHTS ABUSES

Law students are working with Amnesty International and other organisations to investigate human rights abuses in such places as Syria and the Democratic Republic of Congo, using open-source intelligence and digital technology.

When videos of police firing teargas at protestors start doing the rounds online, most viewers react with concern or horror. But for human rights investigators and defenders such as Amnesty International, these videos are just the beginning of a much deeper investigation.

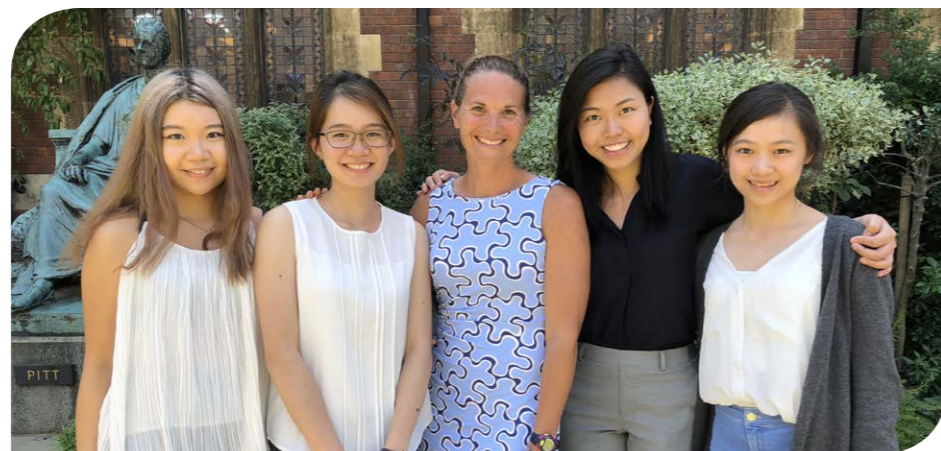
Given the advent of fake news, fake videos and huge quantities of online reports, investigators must continuously question if the content is real. To seek answers, Amnesty set up the Digital Verification Corps (DVC) through which academics, world-renowned experts and student leaders from human rights centres around the globe, including HKU, are developing innovative approaches to human rights research and investigations.

A key aspect of that work involves digging deep into online content to find hard evidence of human rights abuses. Recently, HKU students have been trained in gathering evidence from such sources as open-source media, user-generated content, social media sites, and court and government websites.

HKU Law lecturer Lindsay Ernst has coordinated the effort with Amnesty as part of her undergraduate 'Human Rights in Practice' course, where students examine such issues as the use of user-generated content in international criminal tribunals and courts and the ethics involved in gathering evidence for human rights investigations. Her students work

on the DVC investigations outside class time and other students are welcome to help them.

"Students in the DVC must think beyond a reading list. They have to take ownership to investigate and discover the material – for example, evidence of instances of teargas in Baghdad on a given day – and develop critical



Ms Lindsay Ernst (centre) and the HKU Digital Verification Corps team members at the University of Cambridge.



“ Students in the Digital Verification Corps must think beyond a reading list. They have to take ownership to investigate and discover the material – for example, evidence of instances of teargas in Baghdad on a given day – and develop critical questions about the data. ”

Ms Lindsay Ernst

questions about the data. Is the evidence strong enough to stand up in a tribunal? Which tribunal? Should evidence have any less rigour just because it's being reported in the media?" Ms Ernst said.

"At times, the evidence does not stand up. It can be frustrating for the students, but pedagogically it's valuable because they learn to challenge assumptions and question what they are reading and seeing."

'There might not be answers'

The first DVC training was held in January 2018 led by Sam Dubberley of Amnesty. The students subsequently started investigating a 2014 chemical attack in Kafr Zita in Syria and police brutality in a 2017 protest in the Democratic Republic of Congo (DRC).

For the Syria attack, they compared footage, researched hospital interiors, read NGO reports and reviewed landscapes to pinpoint which hospitals were impacted by the attack. For the DRC project, they found videos online and were able to identify police brutality and the locations and weapons that appeared in the videos. Their findings contributed to a larger Amnesty report.

Areon Chan Yee-tak, a recent BSocSc(Government and Laws) & LLB graduate and currently PCLL

student, was involved in the research. "What struck me was that there might not be the answers out there that students are used to. We could spend hours on a video that does not lead anywhere. This realisation prompted me to change my mindset so that I persevere in my research approach."

The students also had to figure out how to handle incomplete materials and to systematically deal with massive numbers of open-source videos, said Year-5 BBA(Law) & LLB student, Mathilda Kwong Yuan-shang. For example, for the Syria attack they sifted through many similar videos of hospital interiors to determine which hospitals they were looking at. Google satellites did not help because most of the buildings no longer exist, so they had to turn to other sources and reports.

"My most important takeaway is that information is flowing more quickly and there are more risks of manipulation. We must always be aware of critically analysing the information we obtain. We cannot just accept something because we believe it to be true," she said.

Skills for the digital age

Moving forward, the Faculty of Law is ramping up its human rights investigations. Two international scholars have been recruited to

help develop projects with the DVC and Ms Ernst, while the LLM programme has launched three of its own projects. These include working with an NGO in the Philippines to map remote areas so human rights abuses can be investigated and humanitarian organisations can identify areas of need; investigating human trafficking with the NGO Liberty Shared; and probing enforced disappearances in Sri Lanka.

HKU will host the annual DVC Summit in June. Students from all DVC-participating universities in the US, UK, Canada and South Africa, as well as staff from Amnesty, will attend. One of the students helping to organise the Summit, Yuki Lok Chi-yu, Year-5 BSocSc(Government and Laws) & LLB student, found the lessons from the DVC training could apply to anyone in the digital age.

"Learning digital methodologies, including open-source research and investigation, is helpful in verifying the authenticity of information and data circulating on social media platforms. Promoting the wide use of these methods and skills could help reduce the spread of fake news and information," she said. ■



Summit participants attending an expert speaker's sharing session.



At the 'Verification-athon', students collaborate across universities to verify content for a given potential human rights violation.



Tiffany Tse (left), a fourth-year Bachelor of Arts student interviewing Mr Ho (right), the spokesperson of the Sham Sui Po Textile Market, which was established in the 1970s and is scheduled to be demolished soon.

A 360-DEGREE TAKE ON A DYNAMIC HONG KONG COMMUNITY

A collaborative project involving students, HKU staff and community partners has shone a positive light on the ever-changing Sham Shui Po District and resulted in a drama performance and an award-winning film.

“Cheap local eats, low income, subdivided flats – this was my flat, stereotypical and almost depressing image of Sham Shui Po,” said fourth-year Bachelor of Arts student Tiffany Tse Tin-lam. But when an opportunity arose to go into the district and speak to ethnic minorities, new immigrants and local business owners, she was curious. What lay beneath the surface of that image?

The opportunity was the 360 Diversity Programme, a pilot project that started with

a 360-degree screen and evolved into a broader community project.

Dr Nicol Pan, Associate Director of the Common Core Curriculum, was the instigator. Dr Pan introduced the screen last summer in the Global Lounge to let teachers and students experiment with the learning possibilities of this planetarium-like tool. Shortly after, she was approached by Sham Shui Po florist, Rinato Eco Floral, a social enterprise managed by the Tung Wah Group of Hospitals (TWGH) that had space

it wanted to use to promote science and technology education in the district. She thought, why not combine the two?

“A 360-degree screen is immersive and the technology is accessible – you need a 360 camera but you don’t need special skills creating 3D models,” Dr Pan said. “When I suggested they try this, they were interested but they wondered where the content could come from. That’s where we came up with the idea of a collaboration with the Common Core, where



“ This was the first time the Tung Wah Group of Hospitals had worked with university students on this kind of creative project and they gave us a lot of positive feedback about the quality of our students. ”

Dr Nicol Pan

students could help create programmes for that space.”

Story-telling skills

TWGH provided contacts in the community and Dr Pan recruited a team of six students, including Tiffany, who were interested in exploring the culture of Sham Shui Po and telling people’s stories. She also brought in experts to train students in story-telling skills.

HKU’s Digital Literacy Laboratory provided workshops on making videos and loaned the students equipment, including 360-degree cameras. The founder of the community-based Theatre in the Dark, Comma Chan Yin-wang, trained the students in creating a drama performance. And the TWGH assigned a social worker to work with the students and brief them on the dynamics of the Sham Shui Po community.

Dr Pan also brainstormed ideas with the students about the kinds of stories they wanted to tell and led them through mock interviews so they could practise ahead of the real thing.

The stories focussed on a Pakistani family, new immigrants and hawkers at the Yen Chow Street

fabric market, which has been earmarked for demolition. The students discovered a vibrant, proud community that, despite being the poorest in Hong Kong, defied the negative portrayals seen in the media.

“I was surprised by how optimistic a lot of the interviewees were about the future and ashamed of myself for prescribing to a negative view of their lives,” Tiffany said. “The most important takeaway for me is that you can never know what others are thinking unless you step up, reach out and talk with them.”

Diverse and tolerant

Gabriel Fung, a first-year Bachelor of Journalism student, said the project gave him an opportunity to develop story-telling skills and explore a community that he had little previous exposure to. He was particularly struck by the strong sense of neighbourhood identity, even in the crowded, dusty fabric market.

“It’s extraordinary that people still want to keep that place, but it’s an integral part of their cultural identity,” he said. “We wanted to capture these views and leave the audience with the message that Sham Shui Po is a diverse community, it embraces people from different

places and is constantly changing and adapting, but at the same time it wants to retain the culture that is there now.”

Ma Guolei, a Master of Education student originally from Xinjiang province who previously worked as a journalist, was also struck by the diversity. “Many people in Mainland China think Hong Kong is a very modern and rich city. But you can find poor people living in Sham Shui Po,” she said. At the same time, she was surprised to find the Pakistani family talking about the friendliness shown to them and how they enjoyed their life in Hong Kong. “Hong Kong is very tolerant of all kinds of cultures and people, I like this about the city.”

The students’ video produced won the first Common Core x U-Vision Video Contest held in February, in the category ‘Learning on the Go’. They also created and performed a drama based on their interviews which was staged on campus in April.

“This was the first time the TWGH had worked with university students on this kind of creative project and they gave us a lot of positive feedback about the quality of our students. I also learned how to collaborate with local non-profit organisations,” Dr Pan said. ■



HKU students learned to tell stories and express their emotions through body movement under the instruction of Comma, the Drama coach from the Theatre in the Dark.



The video produced by Gabriel Fung (right) and teammates won the first Common Core x U-Vision Video Contest in the ‘Learning on the Go’ category.



A Student Induction Instructor leading her group of freshmen during CEDARS Non-academic Induction Programme.

NOURISHING THE MIDDLE GROUND

While top students receive opportunities and attention and struggling students receive help and support, the more average student may be left feeling ignored. HKU's Centre of Development and Resources for Students (CEDARS) is striving to ensure the people in the middle get their time in the sun too.

CEDARS is HKU's Centre of Development and Resources for Students, a body which aims to enrich students' time at university and to ensure they get a well-rounded learning experience inside and outside of the academic environment. Dr Eugenie Leung, Dean of Student Affairs and

head of CEDARS, looks upon it as preparing them for life, as well as learning, and she wants all students to be able to take advantage.

"It is undeniable that the good opportunities tend to go to top-performing students," said

Dr Leung, "particularly when it comes to scholarships, exchanges to top overseas universities and being asked to MC large-scale University events. By the same token, students in the bottom end of the spectrum in terms of academic ability also get a lot of support. But that leaves the majority in the middle who may think these opportunities are not for me.

"We feel there should be more opportunity across the board. HKU has always striven to create opportunity for all, but now we are actively concentrating on doing more to empower every student, by introducing activities to foster confidence and skills."

One such project offers undergraduates the chance to act as student hosts at events designed to put them in the limelight. CEDARS' aim is to work not for but with students, and this project gives them the opportunity to co-host and co-organise CEDARS events. They can be MCs, stage-hands and panelists, and they can act as tour guides for visitors to the University, and coaches to other students.



Student hosts serving as MCs and facilitators in Head Table during the High Table Dinner of CEDARS Non-academic Induction Programme.



“ HKU has always striven to create opportunity for all, but now we are actively concentrating on doing more to empower every student, by introducing activities to foster confidence and skills. ”

Dr Eugenie Leung

Social mentors

Another opportunity invites undergraduates to become Student Induction Instructors (SIIs) in the Orientation and Non-academic Induction Programmes for new students. "Each SII is responsible for 10 to 15 new students," said Dr Leung, "and will be on-hand to help them adjust to university life, show them how it all works and how to get the best out of their time at HKU. Our colleagues on the academic side are already looking after educational mentoring, but SIIs are there to look after the social side. We train them how to lead, how to facilitate discussions and how to organise activities."

As well as looking after the freshmen, CEDARS also takes care of the parents of first-year students, and undergraduates are given the chance to help here too. "Volunteers were invited to come to an event called the University Life Trio and chat to parents of new students, advising them on letting their child embrace university life," said Dr Leung. "They also talked over some of the more difficult areas for parents, such as how their children are now young adults and it's time to let them make their own decisions and grow."

For the volunteer's own benefit, CEDARS' careers section focusses on helping them

prepare for life after HKU, by helping them improve their CVs and coaching them on how to present themselves at a job interviews.

CEDARS has also found a creative way to give them confidence in their English-speaking capabilities through a project called Survival Cantonese, which is aimed at helping foreign students new to Hong Kong. Volunteers teach them about 30 Cantonese phrases to help them get around in Hong Kong.

"This scheme is particularly good for building the student volunteer's confidence, as it enables them to mix with non-Cantonese speakers in a useful capacity. They tend to forget their doubts about their own English language skills and concentrate instead on teaching someone who is new to town and has no Cantonese skills at all."

As an added incentive, CEDARS not only recognises students' achievements in outside non-academic services, competitions and events, but also those who help out voluntarily at university activities. Less visible tasks include helping other students with disabilities, such as note-taking for those with hearing needs, editing for those with visual impairment and social coaching for those with communications challenges.

"These are not grand tasks, they are small things and they do them in a low-key manner," said Dr Leung. "To show our appreciation, we now feature student stories on the CEDARS webpage, we have developed a Reward Scheme and we hold an annual Recognition Ceremony in April. These serve as recognition of their altruism, and also work as incentives to other students to get involved."

There are countless ways to do so: On the more practical side, CEDARS recruits and trains them to be student technicians for productions in the campus Chong Yuet Ming Cultural Centre, and they also engage students as writers, designers, photographers, etc.

Dr Leung said: "It is about involving them in all areas – they can help out when they have time but it won't interfere with their studies. They are not just learning from us skills they can use in later life, they are working with us."

She emphasised: "Don't read me wrong – all our students are top students, they just see themselves as average among their outstanding peers. We do have top students in the above programmes, as they pool together students of different abilities and interests to work together!" ■



Student hosts sharing in the panel discussion of University Life Trio for Parents of First Year Students.



Student hosts chatting with parents at the University Life Trio.



THE BUSINESS OF 'BEST BEFORE'

A student-led social enterprise is addressing the problem of food waste by selling products that have passed the 'best before' date but are still safe to eat.

Hong Kong throws away more than 3,600 tonnes of food waste every day, amounting to one-third of all domestic waste according to the Environmental Protection Department. Yet a lot of that food is still edible. One of the reasons it ends up in landfills is the confusion between 'best before' and 'use by' labels. BBA student Terence Hon and his colleagues saw this as both a business opportunity and a chance to contribute to sustainability.

'Use by' dates refer to food safety and generally apply to perishables such as meat and dairy, while 'best before' dates are about optimum quality – the food is still safe to eat, although the texture or other features might become a little different. Supermarkets (and households) typically remove both kinds of products from their shelves when they are near or past the date.

"It's very wasteful," said Terence, "so we decided to start a company that takes back 'best before' goods that are ready to be

disposed of. We sell them in a hurry, at a bottom price, to maintain market efficiency and reduce waste."

The company, GreenPrice, was launched in December 2016 with a pop-up stall at a weekend market that sold 'best before' products sourced from a distributor who was planning to send them to a landfill. The goods were within three months before or after their 'best before' date and sold for around 50 per cent of the supermarket retail price. The venture was reported on in the *Apple Daily* newspaper in early 2017, which created a buzz around the business and led to distributors contacting the students.

Shop openings

Things ramped up further after Terence took the course 'Creativity and Business Innovation' taught by Dr Ernest Lo, Lecturer in the Faculty of Business and Economics. Dr Lo was explaining the circular economy and mentioned that

European countries had entire supermarkets wholly devoted to 'best before' foods. "It made me wonder why Hong Kong didn't have this kind of business since it is good for society," said Terence.

The students subsequently applied to funding programmes and competitions for support in growing their business and in 2018 opened two full-time shops – one in a revitalised industrial building in Kwun Tong and another in Kwai Fong – with plans to open a third shop in 2019.

An important part of the firm's success has been its effort to educate customers about the GreenPrice concept. Terence and his co-founders were heavily involved in this in the beginning, talking directly to customers and giving talks at schools and universities.

"But most of our education is done inside the shop. Our stores are located in places with high traffic and the shop staff will



“ Even if people don't purchase from us, we hope they will understand the concept that you shouldn't throw away food that is still edible but past the 'best before' date. We want to cut down waste. ”

Mr Terence Hon

explain the concept of 'best before' to customers and let them taste the products to gain their confidence," Terence said. Currently there are about 20 full- and part-time staff. The enterprise also has about 200 distributors who supply inventory, which continually changes according to the goods available. Most of the goods are imports from Europe and North America and appeal mainly to an educated, middle-class customer base.

A learning experience

Apart from being a sound business idea, GreenPrice has also been a learning experience. Terence has been closely involved in GreenPrice's growth despite the demands of full-time studies (he is in his final year) and sees the

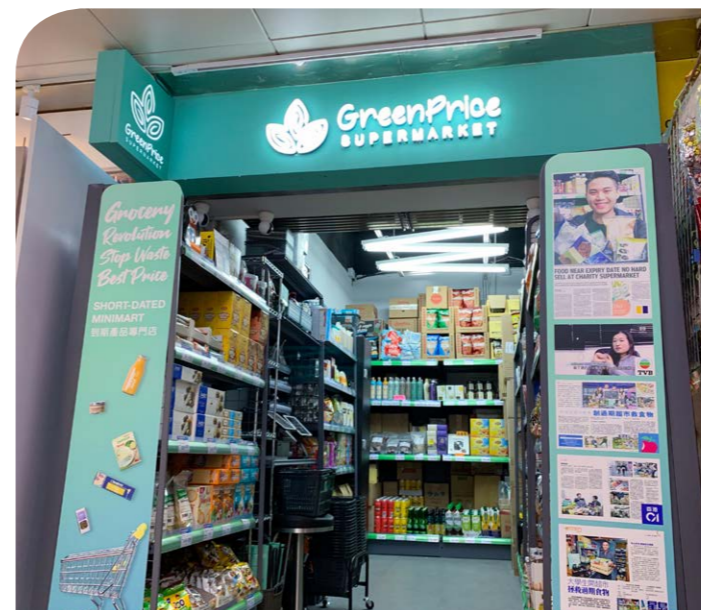
enterprise as an important opportunity to apply his learning. He had no previous experience in running a business.

"It's very difficult to start from scratch with no business or industry knowledge, especially an industry new to Hong Kong. You need really good people to support you. You need professors who are industry experts, like Ernest who has started several companies and knows how partnerships work," he said. "I've learned that in order to have a successful business, you need to try to do things in a different way. You need to be bold and go out and talk to people."

Dr Lo for his part said Terence was putting into practice what his course intended: to learn by

doing. The course brings in speakers from the business world to share their experiences and encourages students to think creatively about potential business ideas. "Terence is a very successful case. He is passionate and wants a more sustainable planet. He also has a sharp eye and saw a business opportunity."

Terence plans to continue developing GreenPrice when he graduates, including its higher aims. "Even if people don't purchase from us, we hope they will understand the concept that you shouldn't throw away food that is still edible but past the 'best before' date. We want to cut down waste." ■



The GreenPrice Supermarket in Kwai Chung Plaza, Kwai Fong.



The GreenPrice team and Dr Ernest Lo (first from right) at the Hong Kong Social Enterprise Challenge.



LAW SCHOLARS PROVIDE INSPIRATION FOR SPECIAL NEEDS TRUST

Parents of special needs children have long worried about how to ensure the assets they bequeath to their children will be managed in their best interests. Now there is a solution thanks to the work of Professor Lusina Ho and Ms Rebecca Lee of the Faculty of Law: a government-managed Special Needs Trust.

The parents of more than 225,000 Hong Kong individuals with cognitive impairment have long faced a dilemma: after they pass away, who will manage the assets they leave their children in their children's best interests? Their main option had been to set up a private trust, which typically requires a capital threshold of HK\$40 million and annual fees of about HK\$200,000 – well beyond the means of most families. But on December 28, 2018, the Hong Kong Government launched a Special Needs Trust (SNT) that is unique in the world because the Government is both the trustee and manager.

Parents can set up accounts today and the fees will not apply until after they pass away and payments start being made to their child's designated caregiver. These fees are currently set at HK\$1,750 per month.

The inspiration for the SNT came from two HKU law scholars, Professor Lusina Ho, Harold

Hsiao-Wo Lee Professor in Trust and Equity, and Associate Professor Ms Rebecca Lee, who proposed the government-managed format after two NGOs approached them in 2015 about the feasibility of managing such a trust themselves. The two scholars, who had

expertise in guardianship and enduring power of attorney, concluded that the NGOs could not afford to do this on their own.

"We crunched the numbers and found that it would not work without government



Professor Lusina Ho (left) and Associate Professor Ms Rebecca Lee (right) presented the survey report at the press conference in 2017.



“ Even Hong Kong Government officers have said it's a perfect example of civil society working with academics and professionals on something that consolidates into government policy. ”

Professor Lusina Ho

participation. As a result, we wrote an informal paper to the Government that year and started discussing with them the idea that they establish and run the SNT," Ms Lee said.

Rapid response

The idea received a welcome and rapid response. In January 2016 the Chief Executive's Policy Address announced that a working group would be set up to explore the feasibility of setting up a public SNT and Professor Ho was among those appointed to the group. She provided expert input on such details as the market fee and the drafting of the trust deed.

Professor Ho and Ms Lee also surveyed parents on the need for an SNT and fed the results back to the Government. Working with the NGO, the Concern Group of Guardianship System and Financial Affairs, they questioned 2,500 parents of cognitively-impaired individuals about their preferences. The majority wanted a government-operated SNT that charged annual fees of no more than one per cent of the entrusted assets. The survey results were released in February 2017. Within a year of that date, the Government committed to set up the SNT and allocated HK\$50 million towards it.

The SNT keeps administrative costs low by pooling the contributions of parents but segregating the amounts designated to each beneficiary, much like Hong Kong's mandatory provident funds. The trusteeship is managed through the Department of Social Welfare, which also monitors caregivers appointed by parents. If no caregiver is appointed, it will also take up this role.

This arrangement is unique in the world, although Singapore has an SNT that is managed by an NGO and closely monitored by the government.

Leading the world

"People in other countries have told us how hard it is to convince their governments to do this and we feel really proud that we were able to convince the Hong Kong Government to listen to our proposal. Hong Kong is leading the world and showing that a government-managed SNT is feasible and affordable," Professor Ho said.

The two scholars have also played an active role in explaining the SNT to the Hong Kong community. They delivered eight talks to NGOs that attracted nearly 1,800 participants in total,

and Professor Ho participated in government outreach forums. They also trained students to deliver 23 talks to special schools and NGOs in the summer of 2018.

Overseas NGOs and experts have taken notice and have consulted the scholars on how to set up government-managed SNTs in their countries, with Korea leading the way. After Ms Lee presented their research to the Korean National Assembly in February 2018, NGOs there began to push for a similar scheme in their country and by September, the Korean Government announced it would establish a public SNT scheme.

"Our efforts have succeeded because we work in partnership with the special needs community. Even Hong Kong Government officers have said it's a perfect example of civil society working with academics and professionals on something that consolidates into government policy. We provided the expertise and the Government responded to the needs of the community," Professor Ho said. ■



The Hong Kong Government launched the Special Needs Trust in December 2018. This is unique in the world because the Government is both the trustee and manager.



Professor Ho (left) and Ms Lee (centre) being presented with the Knowledge Exchange Excellence Award 2018 for the winning knowledge exchange project titled 'Introducing the Special Needs Trust to Hong Kong'.



Initiated by computer engineering students Sidhant Gupta and Rohak Singhal, MindoroBots is an initiative to build open-source robots which aim to reliably and effectively replace humans in coral reef surveying.

STUDENT VISIONS FOR CORAL REEFS AND THE BLIND

Engineering student Sidhant Gupta has led fellow students to apply their learning to solve difficult problems in the real world, including mapping coral reefs and devising an affordable braille reader that works with smartphones.

Tracking the bleaching of coral reefs is a labour-intensive process. Divers descend to the seafloor with a PVC frame, swim up, take a photo, then descend again to move the frame and start the process over. But now, thanks to technology developed by HKU students, that task has been made much easier. They invented an autonomous robot that sits on the surface of the water, projects a virtual frame on the reef surface and generates 3D maps.

The MindoroBots was developed by BEng student Sidhant Gupta and his classmate Rohak Singhal,

who learned about the mapping problem through MakerBay, a Hong Kong maker community. They recruited 10 other HKU students from engineering, business and biological sciences and secured funding from the Gallant Ho Experiential Learning Fund to devise their camera-robot prototype and test it in HKU's ponds. In early 2018 they completed a trip to Mindoro Island in the Philippines to do live ocean testing and after a few tweaks – bamboo pipes replaced plastic pipes – they successfully launched the MindoroBots, which can produce maps of the ocean's surface up to eight metres in depth.

The project attracted attention from the media and scholars in the Philippines, who have adopted it for distribution among fishermen. Sidhant also presented a paper on the MindoroBots at a coral reef conference in the UK, where it sparked interest in their technology.

"In class, we have good budgets for our projects, a lot of expert support and all the machinery we need. But in the real world working with real problems, it's a lot harder. This project taught us how to build things,



“Because we had little funding and limited knowledge and expertise, we had to think within the realms of what we know. We were able to use simple stuff to create this impact by understanding the value of what we study in class.”

Mr Sidhant Gupta

recruit and handle teams, and work together. It also taught us how to find problems and create impact,” Sidhant said.

Opportunity to innovate

That experience inspired him to seek out other opportunities. He and another classmate, Tejasvi Mehra, started the Open Source Remote Education Initiative, which has brought tablets and teaching software to remote communities in the Philippines, India and Vietnam (see *HKU Review 2018*). More recently, Sidhant led a team to develop an affordable braille keyboard and reader that connects to smartphones and laptops. The project turned out to be a successful test of their innovation skills and their ability to work within a tight budget of HK\$3,000, which was provided by the alumni-supported HKU 81 Inclusion Fund.

Braille readers on the market cost a minimum US\$600 and the initial aim of Sidhant and his team was to produce a cheaper version by sourcing materials in Shenzhen. However, this proved impossible because there was no way to reduce the cost of a key feature of braille keyboards, the piezos – pins that expand and

contract to create characters similar to braille on paper. Piezos cost a minimum US\$30–40 each and each reader needs at least six of them.

Realising the futility of this approach, the students decided to innovate instead. Sidhant had been working on his final-year research project to develop a prosthetic hand using vibration technology and he decided to apply this to the reader.

“Since we couldn’t substitute the piezos, we decided to replace it with something else that a visually-impaired person could still understand. The underlying system is called Vibrate and instead of sticking in and out, the pins just vibrate,” he said. The best part is that each vibrating pin costs only HK\$3 (less than 50 US cents).

Seeking expert input

The prototype was developed in Shenzhen and the students also sought external advice. They visited organisations in Japan that promote inclusivity and learned that eight pins were needed to accommodate Japanese braille, so they added two more pins. They also got user

input from a visually-impaired friend at the Hong Kong Polytechnic University, who told them they were designing from the perspective of a sighted person and advised them how to change.

“We originally planned to attach the device to the back of the phone but he said that he didn’t need to have the phone in his hand because he wouldn’t be reading off it. So we came up with a handheld device that can be used separately from the phone. The phone can be kept in your pocket,” he said.

The drawings and other information about the technology are available for free through open-source platforms and anyone is welcome to develop software and apps for it.

“Because we had little funding and limited knowledge and expertise, we had to think within the realms of what we know. We were able to use simple stuff to create this impact by understanding the value of what we study in class,” he said. “And over the time I have been at HKU, it has really grown. There are a lot of opportunities for students.”



The prototype of the braille keyboard and reader developed by Sidhant Gupta and his teammates.



Sidhant and his team on a visit to organisations in Japan that promote inclusivity to modify and finetune the braille keyboard.

A GLOBAL VOICE ON SUSTAINABILITY POLICY

A place on United Nations body gives University's Policy for Sustainability Lab a voice in global discussion on the environment.



Aerial photo of Lai Chi Wo in 2018 showing the rehabilitated farmland.

HKU's Policy for Sustainability Lab, which is a pillar of the Centre for Civil Society and Governance, has been recognised by the United Nations as a new member of the International Partnership for the Satoyama Initiative (IPSI), a programme begun in 2010 with the aim of 'promoting collaboration in the conservation



“ I am a strong believer that actions speak louder than words. HKU is known for its academic excellence, but we want to make sure that excellence is put to good, practical use. ”

Professor Danny Lam Wai-Fung

and restoration of sustainable human-influenced natural environments through broader global recognition of their value'.

IPSI, which was established at the Tenth Meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD COP10), now has 240 member organisations from over 60 countries.

Director of the Policy for Sustainability Lab (PSL) Professor Danny Lam Wai-Fung, who is also Professor of Public Administration, said: "The Satoyama Initiative is a model which emphasises harmony between human and environment in a sustainable way. It's a collective platform to promote our approach to conservation.

"Joining it will put us on the map of the global sustainability movement, enabling us to engage in discussions with bodies around the world doing similar work."

Rural rejuvenation

The Lab is being recognised by IPSI for its contribution to rural rejuvenation through its Sustainable Lai Chi Wo initiative, a project to revitalise an abandoned 300-year-old rural village into a working farm and co-operative.

The announcement of the Lab's accession to IPSI came with a number of other firsts. The PSL is the first IPSI member from the Greater Bay Area, and the event was announced at the launch ceremony for HKU's Academy for Sustainable Communities, a PSL initiative started in 2018 with "a vision to become a regional

knowledge exchange platform to disseminate knowledge of sustainability and incubate a new generation of change agents for sustainability." The Academy offers curriculum-based courses, seminars, forums and field-based activities covering sustainability-related knowledge.

Professor Lam is keen to emphasise that while one of the themes of PSL is rural revitalisation, the focus is very much on doing as well as thinking. "We are a unit doing academic and action research – that is not only learning but applying what we have learned. I am a strong believer that actions speak louder than words. HKU is known for its academic excellence, but we want to make sure that excellence is put to good, practical use."

Asked how PSL came to pay attention to rural renewal, he explained that about 40 per cent of Hong Kong's total land area is protected from development by the Country Parks Ordinance. While this is great for the most part, the down side is that basic infrastructure development in villages, or enclaves, surrounded by country parks is also bound by these rules. The result is that many villages are abandoned.

The Lab cooperated with HSBC, which provided funding, to help revitalise such enclaves, the first of which was Lai Chi Wo, a Hakka village that had been completely abandoned since 1990. The first two phases, from 2013 to 2017, focussed on the basic work, such as reintroducing agriculture, examining biodiversity and researching the river water. In 2018, the third phase kicked in, shifting the emphasis to the social and economic aspects.

Building a community

"You can't just preserve the environment, you need to build a community," said Professor Lam. "And we defined community in the broadest sense – not just villagers and farmers but the broader community of Hong Kong."

They developed socioeconomic models for Lai Chi Wo, including moving away from fresh produce since perishable harvests are not practical because of its remoteness, and into processing products such as turmeric powder.

"We're setting up a co-operative kitchen, with residents from Lai Chi Wo and nearby Sha Tau Kok taking part to work on food processing," said Professor Lam. "We are also developing co-creation programmes whereby outside groups do activities in villages with villagers."



Art and cultural activities are effective means for community revitalisation.

One of the co-creation activities was an experiential workshop showing how to make bricks in the style of integral Hakka culture. There is also a Village-to-Table (DIY) Series, jointly presented by the Academy and PMQ's Taste Library, in which participants make traditional Hakka food under the guidance of villagers or farmers.

For Professor Lam, this is what Lai Chi Wo is all about – sustaining an old community and engaging a new, wider community within the process.

"The Research Assessment Exercise (RAE) effects funding, but the emphasis is always on academic not on action research," he said. "We think that having an impact is important too. It helps the community see what we are doing and as a social scientist I believe

knowledge should be useful and should be shared. IPSI will help us get our message across to a wider audience and will help us reach out to the Hong Kong community too. Lai Chi Wo is for the people, the social fabric of the community." ■



A variety of Lai Chi Wo products were developed for sale locally and at supermarkets and have received overwhelming support from the wider community.



Different community groups and individual citizens outside the village engaged in farmland rehabilitation at Lai Chi Wo.

CHINESE ART IN THE MODERN ERA

The story of modern art has typically been framed as a Western story that began when European artists started challenging realism in the mid-19th century. But modernity is not a preserve of the West, as Professor David Clarke shows in a new book that maps the transformation of Chinese art over the past century to the country's main historical events.



Yue Minjun's 1995 painting *The Execution* featuring his trademark smiling/grimacing faces is based on a painting by 19th-century French artist Edouard Manet.

When modern art took hold in the West over a century ago, the flat, disjointed surfaces and obvious brush strokes that characterised cubism, impressionism, expressionism, abstraction and other movements were considered a breath of fresh air against the realistic painting of the day. But when artists in China turned to modernism, it became something else entirely. Traditional Chinese ink painting and landscapes already had flat surfaces and visible brush strokes, so for some painters, embracing realism was itself an act of rebellion.

As David Clarke, Honorary Professor in the Department of Fine Arts, shows in his book *China—Art—Modernity*, there was a profound awareness among Chinese artists of different ways of defining modernity. These artists were not only reacting against tradition but also deciding whether to look to Western or Chinese materials and sources, and whether to work in a realist or a modern style.

Artists began to experiment with modernity in the republican era of 1911–1949. Some, like Xu Beihong, adopted a realist style that challenged traditional styles. Others like Lin Fengmian favoured a more obvious modernist style. Still others, like Gao Jianfu, blended traditional Chinese painting with modern images, such as a rainy landscape with biplanes flying

overhead – an example of using tradition to try to modernise Chinese art, Professor Clarke said.

Testing the waters in the Mao era

During the Maoist era of 1949–1976, realist painting's association with modernity made it the accepted way of depicting the state and its goals. But the art of that period was not just a mass of socialist-realist propaganda. Ink painting, a highly expressive medium, also came into its own. Although artists did not go so far as to create subversive works – that would not have been tolerated – they did appear to test the waters.

Fu Baoshi, for example, produced an ink painting in 1961 called *Heavy Rain Falls on Youyan*. It is a depressing picture with the rain seeming to obscure the landscape, but it was based on the first stanza of a poem that Mao Zedong himself had written during the civil war. The poem ends optimistically, but this is not evident in the painting.

In the post-Mao era, starting with his death in 1976, realism still endured but in a new format as artists pushed realism into new realms. For example, He Duoling's 1982 painting *The Spring Breeze Has Returned* shows a young woman

staring into space. This is an expression of modernism because the viewer does not know what she is thinking – she has private thoughts, whereas in the Cultural Revolution the state had all the answers, Professor Clarke said.

The state is not the only outlet for art

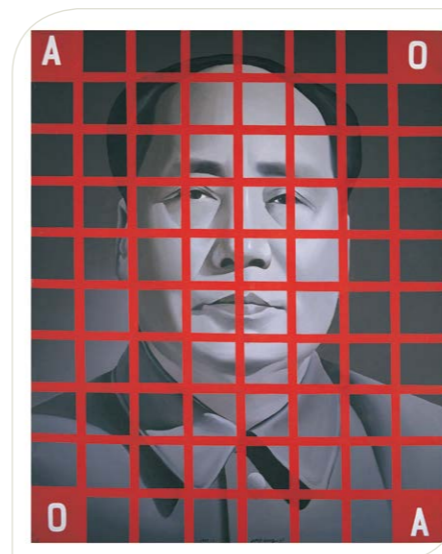
With the open-door policy, more influences from the outside world started to re-enter the country and artists began to embrace newer art forms such as installation art. The printmaker Xu Bing used the format to create *Book from the Sky* in 1988, which offered a striking take on a changing country. Viewers entered a room



He Duoling's *The Spring Breeze Has Returned* created in 1982.

filled with pages and pages of Chinese characters that do not actually exist – Xu made them up. Professor Clarke noted that when the work was first shown, many viewers found it disorientating to be surrounded by something seemingly familiar – national writing – only to find it was meaningless.

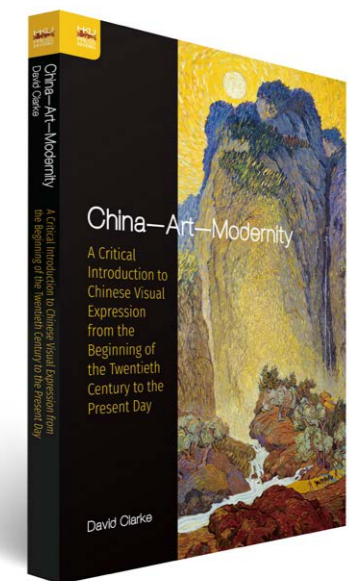
Other artists also started blending Western styles and Chinese themes in striking formats.



Wang Guangyi adopted pop art influences in Mao Zedong: *Red Grid No. 2*, which is a portrait of Mao with a red grid super-imposed.

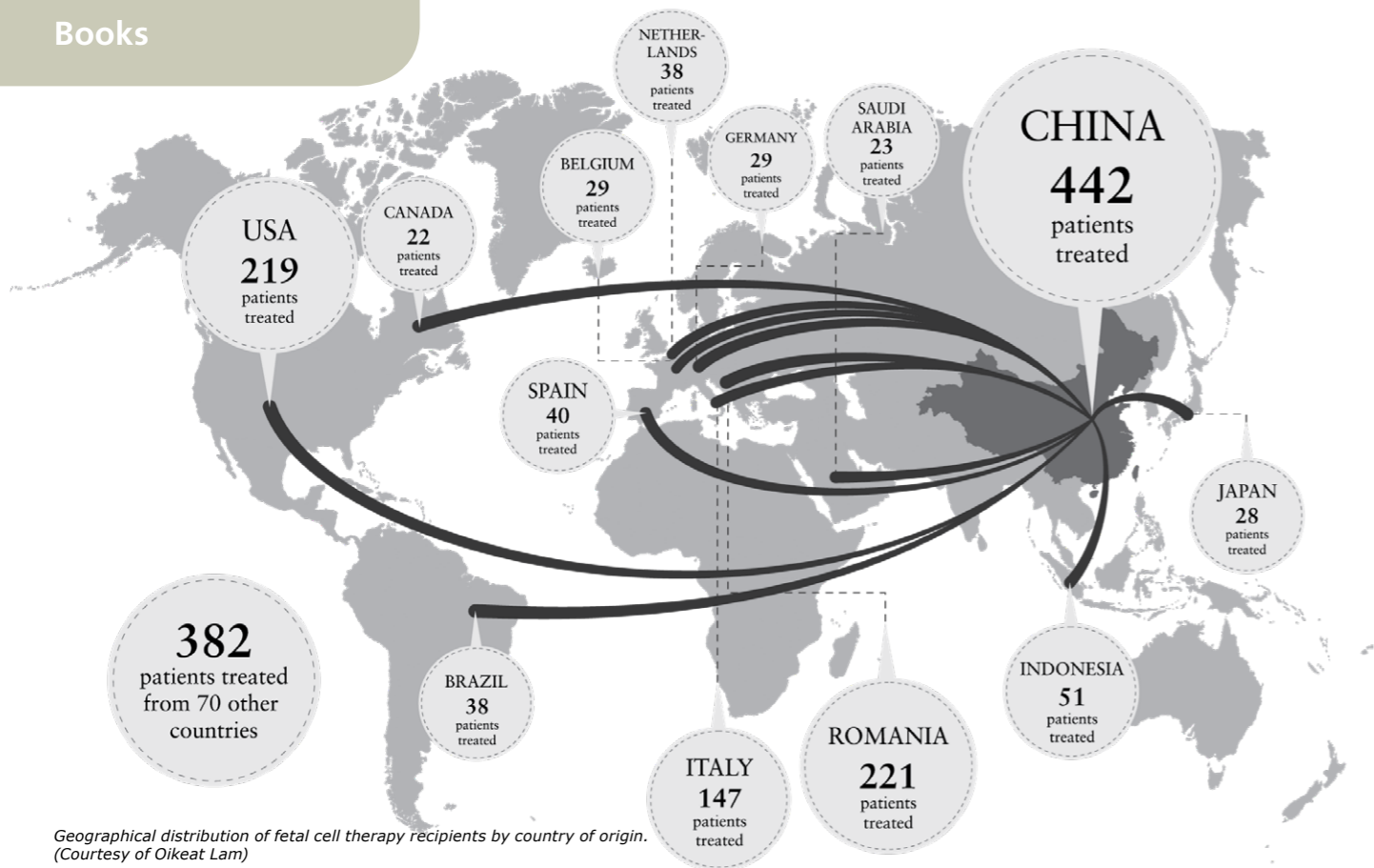
For example, Yue Minjun's 1995 painting *The Execution*, which features his trademark smiling/grimacing faces, is based on a painting by 19th-century French artist Edouard Manet. Wang Guangyi adopted pop art influences, such as 1988's *Mao Zedong: Red Grid No. 2*, which is a portrait of Mao with a red grid super-imposed. Viewers in the West might see that as making fun of Mao but Professor Clarke said Wang was analysing Mao's image and working through complex feelings about the leader he grew up with. In fact, pop art became a useful format for deconstructing the images of the Cultural Revolution which, like pop art itself, were mass-produced and repeated over and over.

There is a key difference between Chinese art today and that of the Mao era, though, in that today's art has an international audience and can sell for tens of millions of dollars. Even though President Xi Jinping has put nationalism under the spotlight again, the state is not the only outlet for art. Professor Clarke said he hoped his book – which is unusual for covering the sweep of Chinese modern and contemporary art in an accessible format – will help people learn about not only Chinese art but China itself. ■



China—Art—Modernity: A Critical Introduction to Chinese Visual Expression from the Beginning of the Twentieth Century to the Present Day

Author: David Clarke
Publisher: Hong Kong University Press



Geographical distribution of fetal cell therapy recipients by country of origin. (Courtesy of Oikeat Lam)

JOURNEY OF HOPE

Increasing numbers of people suffering from terminal illnesses are heading to China in the hope of a cure. An award-winning new book examines how internet global communication, coupled with market-driven healthcare reforms in China, has given rise to these controversial medical pilgrimages.

Last year, a Chinese scientist hit world headlines when he claimed to have made the world's first gene-edited babies by disabling the genetic pathway HIV uses to infect cells. That Dr He Jiankui made his initial claim via a YouTube video, is viewed as both fitting and ironic by Dr Priscilla Song, Assistant Professor in the Centre for the Humanities and Medicine. Her book, *Biomedical Odysseys: Fetal Cell Experiments from Cyberspace to China*, focusses on how online communications have stoked the growth of experimental medical therapies.

Bringing together a decade of ethnographic research in hospital wards, laboratories and online patient discussion forums, and funded by the US National Science Foundation, Dr Song's book won the American Anthropological Association's Society for East Asian Anthropology's 2018 Francis LK Hsu Book Prize for the book judged to have made the most significant contribution to the field.

"Media headlines tend to assume that people desperate for a cure are heading to China only

to be met by snake-oil salesmen," said Dr Song. "I wanted to challenge the easy story – that desperate patients are easily duped. Many of the patients and families I worked with were very savvy, they knew the data and often



Chinese neurosurgeons performing fetal cell transplantation. (Courtesy of Doug Kanter)

challenged their skeptical clinicians back home from a position of knowledge.

"Diagnosed with terminal illness, these patients were told by their local general practitioner to



“The people I studied are making arduous journeys to seek a transformation – a cure for what is currently incurable – to change their life prospects and to revolutionise medical science.”

Dr Priscilla Song

go home and prepare for the worst. But as an ALS [motor neuron disease] patient from Texas asked: 'What do you want me to do? Buy a coffin?'. Instead, he went online to search for options. And I'm not talking 'Dr Internet'. Instead, this is careful and rigorous research."

Such patients meet virtually in internet chat rooms, where they evaluate current research, share data about their own symptoms and compare possible treatments. Dr Song gives as an example a patient forum called CareCure Community for victims of spinal cord injuries. She is donating all royalties from sales of the book to this forum.

Dr Song was particularly interested in what motivates a person to make the trip to China. Since many have never left their own state, let alone their country, China is a major reach for them. One important factor is the mismatch between patient and researcher timelines: a patient with a serious fatal illness may not have long to live, while biomedical research takes many years of testing and trials to go from laboratory bench to hospital bedside. Patients also challenged the ethics of placebo-controlled clinical trials, asking online: "Is it ethical to drill holes in their heads and inject them with saline water for the sake of science, if people in that control group are seriously ill?"

"In chat rooms, these people discuss their willingness to become (in their own words!) laboratory rats," said Dr Song, drawing a parallel with the early years of the HIV epidemic when people wanted access to experimental drugs and patient activism changed the way medical research was done. "The difference today is that, enabled by the internet, this is happening on a global scale. However, that also means it is complicated by the laws and regulations in different countries. I wanted to know why CareCure users from the US and Europe decided to entrust their lives to Chinese neurosurgeons?"

This question led Dr Song to investigate the transformation of the medical profession in

Mainland China – from a state-run system focussed on primary care to an unevenly privatised sector rewarding technological innovation. Put simply, the equation is: the government is trying to make healthcare accessible to all, so keeps the price of essential medical services unrealistically low. This in turn has encouraged medical professionals to develop non-essential healthcare – using the latest technology and experimental medical procedures – in order to survive in the new socialist market economy.

"Ironically, this industry is an unintended consequence of government efforts to safeguard basic healthcare," she said. "As a result, China has become a world leader in what is often termed concierge medicine. This 'healthcare with Chinese characteristics' has led to worrisome inequalities."

Rise of 'technonationalism'

The situation has been exacerbated by what Dr Song terms 'technonationalism'. Embracing "state efforts to promote scientific and technological modernisation to increase China's standing in the world", clinicians want to make breakthroughs, to be pioneers in medical science. "The Chinese neurosurgeons I studied want to operate at the cutting edge of regenerative medicine," said Dr Song. "As a result, stem cell and fetal clinics have proliferated across the country."

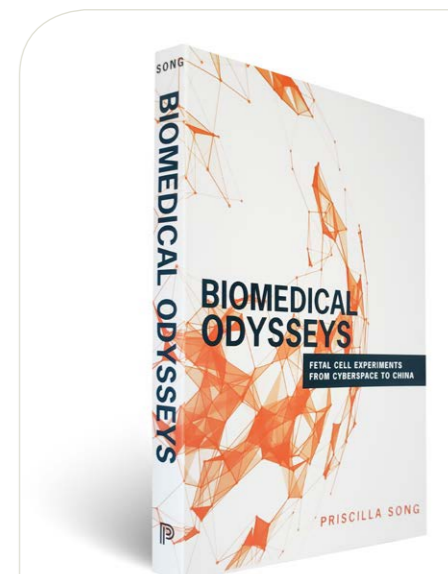
These new biomedical technologies are opening up new horizons of hope which drive international journeys by overseas patients. The press has termed it medical tourism, but Dr Song has challenged this term as too flippant. "I think 'medical pilgrimages' is more accurate. The people I studied are making arduous journeys to seek a transformation – a cure for what is currently incurable – to change their life prospects and to revolutionise medical science."

The big questions remain: do these pilgrims find what they are seeking? Dr Song noted:

"This experimental therapy ultimately was no magic bullet. But even though paralysed patients are not miraculously walking again, this doesn't mean we should dismiss what is happening in China.

"Patients are trying to challenge medical dogma and mobilise clinicians to do something. The message they want to convey is that we are not dupes, we are participating in this experimentation willingly, and even if it does not help me it may help further the work."

As Dr Song shows in her book: "Their medical odysseys to China offer a powerful corrective to over-simplified narratives of exploitation and quackery that characterise media coverage of experimental fetal cell therapies. Their experiences show us what it means to live in the wake of neurological catastrophes and the ways we can continue to care for those whom afflictions have been deemed incurable." ■



Biomedical Odysseys: Fetal Cell Experiments from Cyberspace to China
Author: Priscilla Song
Publisher: Princeton University Press

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