I in this issue of Faculty Newsletter, the Spotlights Column will bring you excitement by taking a sneak peek at the pioneering work from some of our young faculties. These young scientists will share with us their significant research accomplishments and subsequent societal impacts upon successful downstream translation of their newly developed technologies. In addition to giving us a taste of their research directions, these up-and-coming scientists will reflect on the important scientific questions to be addressed and where they see themselves in five to ten years.

The Newsletter also includes multiple Research Stories ranging from designer peptides to counter obesity and ant-inspired allergy-safe drugs to new insights into magnetism at the 1D level and Al-assisted radiation cancer therapy. Our Faculty also addresses global wildlife trade inequality, explores the atmosphere of early Mars, and identifies oyster reefs as coaster water purifiers. On the subject of marine ecology, one of our PhD students steps up to bridge the gap between designing 3D-printed biocompatible tiles and real-life coral reef restoration. Beyond advances in research, our Faculty recently launched two research laboratories led by two top-notch researchers from the Department of Chemistry have been admitted to the InnoHK programme launched by Innovation and Technology Commission, HKSAR, aiming to conduct collaborative research projects that will change our lives. Interviews of these two Principal Investigators are included in this issue to give an overview of their mission and vision.

Beneath advances in research, our Faculty recently launched a new Double Degree in Science and Laws to nurture next-generation legal professionals equipped with a sound scientific background as Hong Kong aims to become a STEM-driven society and an innovation hub. With new inventions, patents need to be filed in a timely fashion, while policies need to be updated for regulation purposes. This fresh fleet of academic talents with legal mindsets and scientific knowledge will be key for science and engines of impactful projects with great potential, developing collaborative projects with experts from all over the world, and being recognised by awards and honours in the research community.

You may get a glimpse of what the future will look like by reading through their self-introductions which reflect their visions beyond our imaginations.

When I worked as an undergraduate in an ecology lab, I realised my calling and never looked back."

Though trained as a butterfly biologist, I have expanded my research programme to cover a wide range of plants, snakes, birds, and mammals. The mission of my research group, the Global Change and Tropical Conservation Lab, is to conserve tropical biodiversity and bring together quantitative modelling tools and on-the-ground fieldwork. In the past couple of years, my group has done a lot of research on pangolins. All eight species globally are threatened by demand for their scales in Traditional Chinese Medicine (and other threats). So, my group is applying a wide range of conservation forensics tools (genomics, stable isotopes, etc.) to characterise trade dynamics and assist in making trade regulations. We also have close collaborative links with the School of Public Health to determine what links there are between trade and pathogen emergence. Most of the work I do is translational in some way. I got into science initially because I wanted to change policy and conserve biodiversity. Getting science into the hands of practitioners and policymakers takes a lot of work. My lab spends a lot of time meeting with government officials, NGOs, and corporations—we talk about the science we are currently doing and make recommendations for conserving biodiversity. Sometimes this comes to highlighting simple facts. For example, most people do not know that we have corals living in Hong Kong! Other times, this is more complex, examining laws or administrative procedures that may require change or updating. But the work is important, and publishing papers is certainly not itself sufficient to make an impact.

In five to ten years, I see myself continuing to run models for a better understanding of biodiversity responses to environmental change, and I will probably still be exploring wild places, overseas and in Hong Kong.
Spotlights

Dr Jin WU
Assistant Professor of School of Biological Sciences

I have worked on a variety of research topics, from the nature of marine symbioses to wildlife trade and environmental restoration. My team has shown that climate change can turn a coral’s symbiont into a parasite. This knowledge tempers our hopes that corals can be ‘engineered’ to withstand climate change. A symbiotic partner could be a ‘fair weather friend’—meaning they are only cooperative with their host when the environment is just right. There are many parallels to explore across the kingdoms of life, from forests to the human gut.

We conducted a preliminary survey of Hong Kong’s marine areas with an emphasis on Tolo Harbour. Through that work, we discovered new species and new records for Hong Kong, as well as detected an alarming array of human pathogens and health risk factors like antimicrobial resistance genes.

With exciting technologies developed at HKU, which led to the spin-off company archREEF Ltd., we are excited to discover how 3D printing eco-friendly structures can enhance biodiversity and ecosystem functioning as we prepare Hong Kong and China for a warmer and wetter future.

One of the most important questions I want to address is: ‘If you build it, will they come?’ We want to know how structural complexity enhances marine biodiversity—the totality of living organisms in a habitat. We predict that there will be an optimal level of complexity that fosters the ‘best’ diversity under a given condition. Ultimately, we aim to provide insights as to the cost-benefit of environmental protection and ecosystem restoration; such information is essential knowledge for our local policymakers to make informed decisions about the future management of our natural resources, and so that our environment has a holistic accounting of its inherent value in terms of genetic wealth and ecosystem services.

Dr David BAKER
Associate Professor of School of Biological Sciences

My research covers a wide range of topics in global ecology and remote sensing, including developing novel space technology for plant ecology, exploring mechanisms of plant-climate interactions, improving math representations of these mechanisms in computer models, and leveraging cutting-edge sensor technologies and models to advance both real-time Earth’s surface monitoring and longer-term projection of climate change impacts.

One of the most important questions I want to address is: ‘If you build it, will they come?’ We want to know how structural complexity enhances marine biodiversity—the totality of living organisms in a habitat. We predict that there will be an optimal level of complexity that fosters the ‘best’ diversity under a given condition. Ultimately, we aim to provide insights as to the cost-benefit of environmental protection and ecosystem restoration; such information is essential knowledge for our local policymakers to make informed decisions about the future management of our natural resources, and so that our environment has a holistic accounting of its inherent value in terms of genetic wealth and ecosystem services.

Dr Louise A ASHTON
Assistant Professor of School of Biological Sciences

2019-20 Faculty Research Output Prize, HKU
2021 NSFC Excellent Young Scientists Fund (Hong Kong & Macau)

I believe that basic, fundamental research in understanding how nature works should precede or be done in parallel with translational research.

We exist in human-modified landscapes, so there are lots of interesting questions about how human impacts shape biodiversity. Most of my research has been on insects in tropical rainforests. I have worked on a range of insect groups, including termites, moths and ants, to understand the importance of insects in ecosystem function and how humans are altering biodiversity.

At the moment, I am working on understanding climate change impacts on insects across a range of ecosystems. We still have a poor understanding of how many species there are in tropical rainforests, let alone how this biodiversity is responding to multiple human impacts such as climate change, habitat loss and light pollution. My ongoing research projects seek to describe tropical insects, their functions and the threats to them. As we live in landscapes disturbed by humans, it is important to understand insect biodiversity across different ecosystem types. I am currently investigating insects across a range of disturbance levels from untouched primary forest to logged forest, oil palm and rice ecosystems.

I will continue to work on aspects of insect biodiversity and environmental change. Nature is the life support system that all humans rely on for our existence, but we are pushing nature beyond the boundaries of ecological function. I want to teach this at levels from primary school to university courses and communicate my work as widely as possible. I hope to train young scientists to have a passion for the natural world and a shared goal of understanding and conserving biodiversity and tropical ecosystems.

I want to increase our understanding of the importance of insect biodiversity and ecosystem function in tropical regions, and help inform policy and conservation to protect nature in the future.

Dr Karen Wing Yee YUEN
Assistant Professor of School of Biological Sciences

2016 Second Prize for the Best Research Output, Strategic Research Theme – Development and Reproduction, HKU
2012 Early Career Award, Research Grants Council

I believe that basic, fundamental research in understanding how nature works should precede or be done in parallel with translational research.

My most significant research accomplishments are contributing to the understanding of how centromere functions. The centromere is the unique region on each chromosome that tends to microtubules emanated from the opposite spindle poles to orchestrate chromosome movement and segregation in every cell division. My lab has provided insights into the epigenetic regulation of centromere function and elucidated the centromere formation process in vivo. Our results also have implications for cancer research, as chromosome instability (CIN) is one of the underlying hallmarks of many solid cancers. However, the molecular causes and consequences of CIN are still understudied.

Centromere inactivation or new centromere formation could initiate CIN. If we understand the mechanism of centromere formation, then we can engineer more stably propagating artificial chromosomes to carry any gene of interest for studying specific gene functions or for gene therapy. Therefore, the most important question I want to address is how the centromere maintains its stability through mitotic cell cycles and through multiple generations. This can be achieved by studying how different genetic and epigenetic pathways contribute to maintaining centromere identity. On the flip side, by understanding how centromeres are inactivated or how new centromeres are formed in pathological conditions, we can get a peek at how normal cells cope with the situation faithfully day after day.

I see myself continue to contribute and lead in the field of centromere regulation and chromosome stability. I believe that basic, fundamental research in understanding how nature works should precede or be done in parallel with translational research or biomedical engineering. Researchers can first humbly learn how existing organisms tackle the problem before engineering and improving our designs, as nature may already have the best solutions waiting for us to discover. Our lab projects will still focus on the conserved, important cellular mechanisms but will also expand to have synthetic biology and translational components.

Visit the website of Biodiversity and Environmental Change Lab:
https://louiseashton.net

Visit the website of Xue Lab:

Visit the website of Yuen Lab:

Visit the website of Global Ecology and Remote Sensing Lab:
http://www.thelifesisotopic.com
I have been working on the genetic mechanisms that regulate the differentiation of neurons in the nervous system for the past 13 years. I think one of the most important questions in neuroscience is how the nervous system is formed. The brain has over 80 billion neurons and 100 trillion synaptic connections. It is a super complex structure that is difficult to study. One possible way out from the challenge is to study something simple first. This is why my research team chose to work on this nematode, C. elegans, which has only 302 neurons. The research community has made a lot of progresses in understanding the development of the nervous system in this model organism. For example, we have the complete connectome, which provides an excellent platform to study the assembly of neural circuits. Once we understand the organizing principles for neuronal development at the system level, there may be a chance to tackle the daunting questions about the formation of the human brain. I also think understanding the organization of the brain can help other fields, such as computer science and artificial intelligence. My specific contribution to the field would be a series of studies that illustrates the genetic control of the differentiation of mechanosensory neurons (called Touch Receptor Neurons) from cell fate determination to subtype diversification to the growth of axons, at the single-cell resolution. We found that the organizing principles for neuronal differentiation in this type of neurons appeared to be conserved in other neurons, including mammalian neurons. In the next few to ten years, I hope to make some contributions in three areas, including 1) the mechanisms of neuronal differentiation and neural circuit assembly, 2) microbe-host interaction in understanding the nervous system, and 3) the genomic basis for the evolution of neuronal diversity.

Once we understand the organizing principles for neuronal development at the system level, there may be a chance to tackle the daunting questions about the formation of the human brain.
I am a colloidal scientist working on colloids, tiny particles 1/1000th the size of the human hair. Colloidal particles not only can be found in everyday items such as paint, milk, glass and porcelain but are also crucial building components for constructing functional materials with advanced photonic, optical and mechanical properties. Unlike atoms and molecules, which have a predictable way of arranging themselves, colloids are uniformly sticky across their spherical surfaces. They assemble in nonspecific ways, making it difficult to design and assemble three-dimensional structures from these particles. To tackle this problem, I have developed a strategy to create colloids with valence, which are particles with surface patches so that they assemble into predictable structures comparable to how atoms combine to form molecules. This work gives scientists tremendous flexibility to design three-dimensional structures and materials, for example, light-weighted materials with open structures.

In five years, my goal is to establish a series of new colloidal platforms that allow us to tackle the most pressing challenges in colloidal science or materials science in general. In the longer term, we wish to explore the real applications of the colloidal materials we develop. These include colloidal painting that shows tunable colour without organic dyes, colorimetric technologies that carry therapeutic agents to treat diseases, colloidal crystals that reconfigure, or even microchips based on colloids and light. Because colloids have been employed as models to study fundamental physics, our systems will also help elucidate the crystallisation process and phase transitions.

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"Most of the work of a mathematician is basically being stuck and banging makes it seem like the hard problem you've been working on is obvious. It's all worth it for the excitement of realising something new and stretching your mind in a new direction, though."

Dr Zhiwen ZHANG
Associate Professor of Department of Mathematics

2011 Best PhD Thesis Award, Tsinghua University
2016 HKU Overseas Fellowship Award
2018 Outstanding Young Researchers Award, HKU
2018 Croucher Innovation Award, The Croucher Foundation

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"I am interested in studying deep learning methods for solving high-dimensional PDEs and stochastic dynamical systems in the next five years."

Since I joined HKU, I have built my own research programme and made significant progress in several new areas, including structure-preserving schemes for computing effective diffusivity and computational methods for Schrodinger equations in the semi-classical regime. Computing effective diffusivity for particles moving in chaotic and stochastic flows is a fundamental problem in studying the diffusion enhancement phenomenon in fluid advection, which is of great theoretical and practical importance. Many existing works use numerical methods (e.g. finite element methods and spectral methods) to solve a convection-diffusion type corrector problem to compute effective diffusivity but this becomes extremely expensive when the diffusion coefficient is small and/or flows are in 3D space.

I developed robust structure-preserving schemes (which are Lagrangian particle methods) to compute effective diffusivity for chaotic flows (including 3D ABC flow and Kolmogorov flow) and provided a sharp and uniform-in-time error estimate for the numerical schemes. My work is the first one in the literature to develop Lagrangian particle methods to compute effective diffusivity in 3D chaotic flows. I also developed stochastic structure-preserving schemes to compute effective diffusivity for stochastic flows, which is more challenging and interesting. In recent years, deep learning methods have achieved unprecedented successes in various application fields, including computer vision, speech recognition, natural language processing, audio recognition, social network learning, and biocomputation, where they have produced results comparable to and in some areas superior to human experts. Motivated by this exciting progress, there is increased new research interest in the scientific computation community, where researchers apply deep neural networks (DNNs) based methods for scientific computation, including approximating multivariable functions and solving differential equations using the DNNs. This is a fascinating research area where new and exciting results come out every day. However, there are several issues that remain open. For instance, we do not get the convergence rate for the DNN method and we have little understanding of the parameter space of the DNN. In addition, the issues of local minima and saddle points in the optimisation problem are highly non-trivial.

In the next five years, I am interested in studying these issues about deep learning methods for solving high-dimensional PDEs and stochastic dynamical systems.

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"I am mainly working on black hole astrophysics and, in the past few years, focusing on an astronomical phenomenon called 'tidal disruption events'. In these events, stars are torn apart by the gravity of black holes, and very luminous flares are produced as the stellar materials are swallowed by them. Aromonories are very interested in these events since they can give us precious chances to observe the supermassive black holes, which are usually too dark to be seen. I have been developing theories and conducting numerical simulations to explain these events. I have proposed a 'unified model' giving a solution to one of the biggest puzzles in the field – why some such events shine brightly in optical wavebands while the others only shine in X-rays."

Dr Benjamin Robert KANE
Associate Professor of Department of Mathematics

2018 Outstanding Young Researchers Award, HKU
Research areas:
- Representations of integers by polygonal numbers
- Applications of regularised inner products for meromorphic modular forms
- Number theory and combinatorics

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"In reality, after sweat and tears, any theoretical research might just turn out to be flat wrong. But I believe that not all is lost. It is just a part of the process where one gains new and deeper understanding of the subject."

Dr Jane Lixin DAI
Assistant Professor of Department of Physics

2015 Croucher Innovation Award, The Croucher Foundation
2018 Outstanding Young Scientists Fund (Hong Kong & Macau)
Research areas:
- Experimental nuclear physics for the studies of the nucleus-nucleus and nucleus-proton interactions
- Development of nuclear physics instrumentation
- Experimental techniques include direct reactions, in-beam gamma spectroscopy and beta-decay spectroscopy

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"We aim to understand the novel features of nuclear forces and the synthesis of heavy elements; such knowledge is essential to elucidate the nature of many-body interactions and the origin of elements in our universe."

Dr Benjamín Hua Chiang LEE
Assistant Professor of Department of Physics

2011 NSFC Excellent Young Scientists Fund (Hong Kong & Macau)
Research areas:
- Experimental nuclear physics for the studies of the nucleus-nucleus correlations and the nuclear shell structure effects
- Experimental techniques include direct reactions, in-beam gamma spectroscopy and beta-decay spectroscopy

Visit the website of Dr Jane Dai: https://bit.ly/3mJihlb
Learn more about Dr Zhang's research: https://hkumath.hku.hk/~zhangpz
Learn more about the research of Dr Benjamin Kane: https://hkumath.hku.hk/~kane
Learn more about the research of Dr Benjamín Hua Chiang Lee: https://hkumath.hku.hk/~blee
Visit the website of Nuclear Physics Laboratory: https://www.physics.hku.hk/~nuclast
View the full versions of the self-introduction of our group members: https://bit.ly/3qEZ4oK
Visit the website of Complex Soft Materials Laboratory: http://wangku.weebly.com
Website of Dr Jane Dai: https://bit.ly/3mJihlb
Website of Dr Zhiwen Zhang: https://hkumath.hku.hk/~zhangpz
Website of Dr Benjamin Kane: https://hkumath.hku.hk/~kane
Website of Nuclear Physics Laboratory: https://www.physics.hku.hk/~nuclast
Visit the website of Complex Soft Materials Laboratory: http://wangku.weebly.com
Coastal Water Purifiers
7m² of a Hong Kong oyster reef filters almost one Olympic pool of water in a day

Key researchers: Dr Bayden D RUSSELL, Associate Professor of School of Biological Sciences and Associate Director of The Swire Institute of Marine Science

Historically, Hong Kong was home to thriving populations of shellfish reefs which dwindled over the decades owing to urbanisation, pollution and over-exploitation. These reefs act as both a food and income source as well as a supportive habitat for coastal marine life. In an effort to quantify the environmental benefits of restoring Hong Kong’s lost oyster reefs, The Swire Institute of Marine Science (SWIMS) and The Nature Conservancy (TNC) jointly made a breakthrough discovery that a single Hong Kong native oyster (Magallana hongkonensis) alone can purify up to 30 litres of water per hour in summer. It was also reinforced that oyster reef habitats nurture large portions of our intertidal biodiversity and restocking them can potentially increase the production of commercially valuable fish and crabs. The team hopes that with the added advantage of high natural recruitment rates in Hong Kong, this research paves a sustainable path to local oyster reef restoration where it will not have to rely on transplanting hatchery-reared oysters into the wild as in many parts of the world.

Earth Sciences
Breakthrough evidence for a reduced atmosphere on Ancient Mars

Key researchers: Dr Joe MICHALSKI, Associate Professor of Department of Earth Sciences and Deputy Director of the Laboratory for Space Research (LSR), and Mr Jia Huan LIU, PhD student.

At present, both Earth and Mars have oxidising atmospheres which cause iron-rich materials to react with oxygen and develop rust. However, this was not always the case in our planet’s evolution as Earth transitioned from being a reduced planet to an oxidised one, thanks to the genesis of life and photochemistry. Earth scientists at HKU succeeded in providing physical evidence that such an atmospheric transition occurred in early Mars as well, a hypothesis that had previously been exposed to reducing conditions, similar to observations on Earth’s oldest rocks. This finding could have strong overtones for researchers’ pursuit of life on ancient Mars.

Wealth Inequality
revealed to fuel global wildlife trade

Key researchers: Professor David DUDGEON (left), Emeritus Professor of School of Biological Sciences, HKU and Dr Jia Huan LIU, former Postdoctoral Fellow of School of Biological Sciences.

It is commonly assumed that the wide wealth gap exacerbates global trade as low-income economies are compelled to export wildlife products to meet the growing demands of wealthy countries’ consumers. The concerted efforts of a group combining ecologists from HKU’s School of Biological Sciences recently corroborated this premise. Analyzing over 20 years of legal wildlife trade data, the team underlined the significant inequalities in socioeconomic well-being between exporters and importers of wildlife goods. In prominent trade partnerships, importers’ per capita GDP was about 8-20 times higher than that of their export counterparts.

Greater wealth inequality in a post-pandemic world coupled with the positive correlation found between wealth inequality and the extent of the global wildlife market may have important implications on the international trade of wildlife products in the future. One take-home message of this research stresses the responsibility of affluent consumers to curb their demand for animal products, alongside encouraging governments to manage the trade with minimal endangerment of wildlife populations and the communities dependent on them as a source of protein or livelihood.

Research Stories

Often associated with food, oysters are less well-known for creating reef habitats that support coastal marine life.

Image Credit: ©Marine Thomas/Courtesy TNC

Low public awareness and wild harvesting of mussels and oysters remain the biggest challenges to their ecological restoration.

Image Credit: ©Kyle Obermann/Courtesy TNC

The blue-toned rocks in the upper-left of the image are depleted in iron because it was removed during weathering on ancient Mars. This is geological evidence that iron was lost from the rocks in reduced conditions.

Learn more: https://bit.ly/3b0ULcd

A 3-dimensional view of weathered bedrock shows the exposure of iron-rich red rocks beneath Fe-depleted blue-toned rocks in a crater wall.

Learn more: https://bit.ly/38R4gvx
**Research Stories**

**Key researchers:** Professor Billy CHOW(right), Professor of School of Biological Sciences and Dr Karthi DURAISAMY, Postdoctoral Fellow at Pramaciac, School of Biological Sciences.

**Learn more:** [https://bit.ly/3l381Uo](https://bit.ly/3l381Uo)

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**Obesity-Related Diseases**

**Key researchers:** Professor Xuechen LI, Professor of Department of Pharmacology and Pharmacy; Professor Yu WANG, Professor of Department of Pharmacology and Pharmacy, LKS Faculty of Medicine.

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**Chemistry**

**Promising novel synthetic biotherapeutics**

**Key researchers:** Professor Xuechen LI (as shown below), Professor of Department of Chemistry, Faculty of Science and Professor Yu WANG, Professor of Department of Pharmacology and Pharmacy, LKS Faculty of Medicine.

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**Biological Sciences**

**Promising novel synthetic biotherapeutics**

**Key researcher:** Dr Karthi DURAISAMY

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**Materials Science**

**Key researcher:** Dr Ziyang MENG (middle), Associate Professor of Department of Physics, Dr Zheng YAN (right) and Mr Chengkang ZHOU (left) are in his research team.

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**Physiology**

**First-year physics PhD students obtained the Higgs Mode via dimensional crossover reveals importance of dimensions in many-body systems**

**Key researcher:** Dr Zi Yang MENG (middle), Associate Professor of Department of Physics, Dr Zheng YAN (right) and Mr Chengkang ZHOU (left) are in his research team.

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BSc&LLB Bachelor of SCIENCE

Nurtures professionals with scientific and legal knowledge in a STEM-driven society

WHAT YOU WILL LEARN

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Disciplinary courses in Science, including capstone course

Compulsory courses, interdisciplinary core courses, capstone course, disciplinary electives

Law and science interdisciplinary electives

Core University English, Practical Chinese for Science students, Common Core

WHAT THE PROGRAMME COVERS

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- Scientific knowledge & research skills
  - Lectures, laboratory and workshops courses

INTERDISCIPLINARY

- Cross-disciplinary knowledge, analytical and evaluation skills
- Independent research experience with original thinking
  - Research courses
  - Field camps and Project-based courses
- Work experience
  - Internships • Placements

WHERE THIS PROGRAMME WILL LEAD YOU TO

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- Nurtures a scientifically literate population with legal knowledge to formulate solutions for challenges

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- Eligible to apply for the Postgraduate Certificate in Laws (PCLL) after completing the double degree programme
- In a position to apply for other postgraduate programmes in law or science

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- Entrepreneurs in biotechnology industry
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300

300 credits in 5 years

Endorsement from professionals:

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Programme details:

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World rankings of HKU Law:

2021

#21

2022

#42

In Life Sciences

#53

In Physical Sciences

World rankings of HKU Science:

2021

#21

2022

#42

In Life Sciences

#53

In Physical Sciences

#52

In Natural Sciences
The Laboratory for Synthetic Chemistry and Chemical Biology – making advanced cancer become a treatable chronic disease

A tripartite alliance involving The University of Hong Kong (HKU), Peking University and Imperial College, UK, has embarked on a research path to find cures for advanced and metastatic cancers. The Laboratory for Synthetic Chemistry and Chemical Biology is a 5-year programme led by Professor Chi Ming CHE, Head of Chemistry and the Zhou Guanghao Professor in Natural Sciences at HKU. The projects under the programme are to develop innovative, leading-edge interdisciplinary research that connects Chemistry, Molecular Biology and Clinical Oncology. It has been admitted to the Health@InnoHK programme with a projected funding of HK$502.3 million and a laboratory area in the Hong Kong Science Park.

At the Laboratory, four interdisciplinary programmes are conducted, namely Synthetic Chemistry, Chemical Biology of Natural Products and Chinese Medicine, Metal Anti-cancer Medicine, Diagnostics and Theranostics, and Multi-Omics and Innovative Analytical Technologies.

Finding the right drugs to improve the survival outcome of cancer patients

Supported by substantial funding, top scientists from the three universities are committed to discovering new relatively non-toxic drugs with high efficacy for treating cancer, with an initial focus on those plagued by liver cancer, nasopharyngeal carcinoma and lung cancer.

Currently, chemotherapy remains indispensable for patients at late stages of cancer disease. Besides the debilitating consequences brought by the treatment, it cannot fully eliminate the disease except prolonging the patient’s life for a limited time. As the leader who steers the direction of the projects, Professor Chi Ming Che sees the pivotal value of developing new targeted chemotherapy drugs that offer a kind of cure for those diseases in the long run. ‘We are working to find the right drugs from natural medicines and products as well as unnatural synthetic compounds to reduce the side effects of chemotherapy. But there comes the question, how can we develop drug candidates targeting the complete removal of the cancer cells/cancer stem cells, so as to prevent recurrence and to improve the survival outcome of cancer patients say by five to ten years?’

Genetic changes along with cancer progression, resistance to targeted drugs and immune escape of tumors are some of the challenges posed to cancer treatment. Yet, he remains optimistic, counting on the expertise and equipment facilities offered by a world-class laboratory. ‘We can use many different ways to study and test drugs to become a treatable chronic disease but at least we can kill the bad cells temporarily,’ he remarked.

The East-West Collaboration bringing hope to cancer patients and their families

Professor Che is confident of achieving a breakthrough in about five years’ time as he draws on the efforts of a strong team of interdisciplinary researchers at the Laboratory, set up by the alliance at Hong Kong Science Park. The local team comprises of young, established researchers from the chemistry, molecular biology and biomedical departments at HKU.

Opening up to collaborate with talented and resourceful teams across the world further fuels the innovative research through fostering talent exchanges. ‘Peking University’s medical faculty is home to a centre of precision medicine, and known for its multi-omics technology and advanced mass spectrometry, whereas Imperial College’s strength lies in chemical biology and medical diagnostics,’ said Professor Che.

Overall, he is grateful for having the chance to work on meaningful research offering hope to cancer patients and their families, hope not just for survival but at least a better quality of life by reducing side effects from chemotherapy. ‘It is best to have a drug that can at least prolong life, preventing relapse in five years. It might not be a total cure for cancer, but at least we can kill the bad cells temporarily,’ he remarked.

The Hong Kong Quantum AI Lab — Using AI to make a smart use of renewable energy

The Hong Kong Quantum AI Lab, also known as The Centre of Machine Learning for Energy Materials and Devices, is a multi-disciplinary programme that combines big data, machine learning, computational science and experiment calibration to discover new energy materials and devices, in particular, organic light-emitting diode and solid-state lithium battery.

Professor Guanghua CHEN from Department of Chemistry is the Director of the Lab, as well as the Lead Principal Investigator. The Lab has been admitted to AI@InnoHK over a five-year period and provided a laboratory area in Hong Kong Science Park. It aims at developing a computational platform integrating AI, computational science and experimental data to discover new materials. The Lab has joined forces with California Institute of Technology in using artificial intelligence to widen the use of renewable energy and create new-generation materials for organic light-emitting diodes (OLED).

Predicting the precise properties of next-generation materials

The immediate goal is to develop via the platform the next generation of materials for blue OLED, and solid-state lithium battery, ‘said Professor Chen. ‘The Centre is poised to accelerate the discovery and application of next-generation materials for OLED and solid-state lithium battery with data science, and establish Hong Kong as a global hub of materials science research, development and commercialisation,’ Professor Chen added.

It has been his longstanding goal to design molecule materials on computers. And working with data scientists helps fill the gap in the discovery of next-generation materials. ‘AI can help fill the gap. Deep learning requires a massive amount of data, and yet, experimental data is expensive to obtain. Is it possible that we use a limited amount of experimental data? The platform that the Lab is building is to resolve this problem,’ Professor Chen is optimistic that the Lab will be able to achieve a breakthrough in a few years’ time.

Carrying out more systematic research

The imminent task now is to set up the platform for screening ‘all sorts of materials’. Professor Chen hopes their effort will lead to the discovery of blue OLED materials with improved efficiency and life span. Another central mission of the Centre is to develop a solid-state lithium-ion battery that can offer safer, higher energy density power by Professor Chen — a missing link of the third energy revolution. ‘The liquid lithium-ion battery currently used is not safe for massive storage. We are using a new approach. I strongly believe that computational scientists working with data scientists and experimentalists can finally solve the problem.’

The reason for his high hopes is that he is one of the first scientists in the world to introduce AI into quantum chemistry. The Lab, he says, is in an advantaged, unique position with its computational platform and AI, and sufficient support not seen anywhere else. ‘I am very excited about this opportunity,’ he noted.

On the other hand, his Lab is ready to tap industrial expertise. It has forged alliances with major companies, including Guangdong Algaia Optoelectronic Materials and TCL Corporation to facilitate knowledge transfer, commercialisation of patents and provide early investments for its spin-offs, it has teamed up with the Hong Kong X-Tech Startup Platform.

Professor Chen acknowledges fresh insights have been brought by communicating with the industry and understanding the challenges they face. ‘For the past year, I have spent much effort to understand what they want. The problems we see may not be directly relevant to the industry. We academics have very nice tools, methodologies, and yet we have to modify our research according to the needs of the industry.’

The project aims to develop innovative, leading-edge interdisciplinary research that connects Chemistry, Molecular Biology and Clinical Oncology.
We have always been taught that habitat loss – a known threat to our planet and its biodiversity – occurs gradually over many years. PhD student Vriko Yu used to share that belief but was alarmed to witness first-hand a patch of coral off Hoi Ha Wan Marine Park disappear in just two months. Coral reefs are the ‘tropical forests of the sea’, known for their rich biodiversity which provides a highly complex habitat to support whole ecosystems of fish, plants and invertebrates.

‘Books have always said it takes decades for us to destroy the reefs,’ Vriko recalls, ‘but in reality, it can just be gone in the blink of an eye. That is when I started to think about what we can do to mitigate the impacts of climate change.’

Vriko’s love for diving started in her undergraduate studies, where she liked the excitement of finding and identifying the many sea creatures to a game of Pokemon Go. ‘What I like about diving is that I don’t know what I would get to see, like catching Pokemon! Typically when we dive, we go to hotspots which are where corals are.’ This made her realise that in order to continue conserving what we like to see underwater or foods we like to eat, first we need to rebuild the corals. ‘They are the foundation,’ she emphasises.

This drive to protect coral reefs led Vriko to start her own social enterprise, archiREEF – an environmental social enterprise offering a one-stop solution for impact changers at corporation or government levels, or even individuals that want to be involved in making a difference.

Growing into the international arena

To further promote coral reef conservation in the region, Vriko is currently serving as a non-official member on the Country and Marine Parks Board of The Government of HKSAR, as well as the Education Committee for WWF, where she shares her expertise on conservation with other stakeholders.

Yet, the protection of coastal reefs is a concern not only locally. Neighbouring regions also have sought Hong Kong’s coastal support in this aspect. Vriko, who additionally serves as the Assistant Director and Eco Diver Instructor for Reef Check Hong Kong (RCHK), provides the necessary training alongside other volunteer instructors to ensure that their international counterparts too, are better equipped with knowledge on reefs and how to monitor their status.

The research project is a big success. Vriko’s team revisited the site later and saw lots of marine life around the tiles – one of the cuttlefish moms even laid eggs under the tiles!

For those of you who wish to follow in Vriko’s footsteps with a postgraduate degree, Vriko is very satisfied with the support that HKU provides PhD students such as herself. ‘I have to thank my supervisor, Dr David Baker, for giving me the flexibility to decide what I wanted to do. It is not usual for students to have the autonomy to decide what they want to pursue, and have a supervisor fully supportive of them.’

With the additional help of travel grants, she was given opportunities to attend overseas conferences, gaining invaluable experiences outside of Hong Kong. One piece of advice she hopes all students can take is to be proactive. ‘In HKU, anything is accessible if you are willing to be proactive to ask. There are always channels to help!’ (Article by Kengie TANG)

Students’ Achievements

Miss Kannmani CHANDRA RAJAN, PhD candidate of The Swiss Institute of Marine Science (SWIMS) and School of Biological Sciences, won the ‘Constance Boone Award’ for best student presentation at American Malacological Society virtual annual meeting 2021. The presentation was mainly based on her research journal about oyster biomineralisation under ocean acidification. Students’ oral and poster contributions are evaluated based on the clarity of the presentation and the abstract, scientific merit, and the student’s ability to answer questions concerning the presentation.

Mr Mukesh KUMAR, the PhD student at School of Biological Sciences, won the Online People’s Choice Award in ‘HKU JMT Competition 2021’. The title of his presentation was ‘Why endure allergies when you can cure them?’ In his research, Mukesh has designed, and developed novel drug molecules and tested them on human cells and animal models of allergies. Among these molecules, he found one drug molecule has not only reduced the inflammation and the scratching behaviours of the mice but also significantly inhibited the root cause of allergy.

Mr Binlong YE, PhD student of Department of Earth Sciences, was awarded the Outstanding Paper Prize at a large planetary science conference organised by Chinese Geophysical Society. 500 papers were submitted this year, from which only 27 were selected to receive the award.

Mr Xuping YAO, PhD student from Department of Physics was awarded ‘The 2021 Ovshinsky Student Travel Award’ presented by the APS Division of Materials Physics at the 2021 APS March Meeting. The award is named after renowned American Scientist Stanford Ovshinsky, which is established to assist the career of student researchers, and has been endowed by the Ovshinsky family.

Mr Xuping YAO, PhD student from Department of Physics was awarded ‘The 2021 Ovshinsky Student Travel Award’ presented by the APS Division of Materials Physics at the 2021 APS March Meeting. The award is named after renowned American Scientist Stanford Ovshinsky, which is established to assist the career of student researchers, and has been endowed by the Ovshinsky family.
The expansion of The Swire Institute of Marine Science
Marking the beginning of a new era in marine research

A Plaque Unveiling and Opening Ceremony took place on July 28, 2021 at The Swire Institute of Marine Science (SWIMS) at Cape d’Aguilar Marine Reserve, celebrating its expansion and setting new milestones in marine biodiversity research.

Since its inception in 1990, SWIMS has long been a premier marine research centre driving our understanding of coastal marine ecosystems in Hong Kong and surrounding regions. Whilst earlier research relied on more field-based approaches, recent technologies have revolutionised marine biology. Three decades since its launch, it is an opportune time for SWIMS to modernise and expand its research capacity to provide HKU researchers with state-of-the-art facilities.

The officiating party gathered to unveil the plaque for SWIMS’ expansion.

From the left: Professor Gray A WILLIAMS, Director of HKU SWIMS; Mr Merlin SWIRE, Chairman of Swire Pacific Limited; Professor Xiang ZHANG, President and Vice-Chancellor of HKU; Professor Matthew R EVANS, then Dean of HKU Science.

Modernised facilities and equipment

Forming an L-shape with the existing main building, the expansion and renovation comprise a clean laboratory, biodiversity centre and both indoor and outdoor seawater aquaria, providing state-of-the-art facilities for its growing body of new staff and research students. “Through the addition of new facilities, SWIMS will be able to host more researchers from around the world and maintain its leading role in marine science research, while also catering to the growing interest in local marine ecology and biodiversity being developed by citizens in Hong Kong,” said Professor Gray A WILLIAMS, Director of SWIMS.

Riding on its re-opening, SWIMS also launches the ‘Restoring Hong Kong’s Whale’ Campaign to preserve the fin whale skeleton, the symbol of marine conservation that has been sitting on the shelf at SWIMS for three decades. Badly damaged by typhoon Mangkhut, the campaign will revitalise the icon and help support educational activities at SWIMS.

Clean Laboratory – What used to be staff offices and storage space has been converted into a brand new, state-of-the-art clean facilities for molecular and physiology research. It provides a clean and dry environment for extracting DNA and performing molecular analysis using advanced equipment and physiological experiments.

Biodiversity Centre – As part of the new structure, the centre will be a multipurpose space for public outreach and community engagement, a classroom for visiting school groups, and a compact system that houses the SWIMS museum specimen collection. This collection is the most comprehensive for marine species in Hong Kong, and will continue to be used for research and educational purposes.

Aquarium – Expanded from the existing structure, containing approximately 50-60 individual tanks in different dimensions to accommodate species of different sizes. The aquarium is designed specifically to provide a controlled environment where lighting, temperature and CO2 levels are adjustable for manipulating the environment according to the needs of different experiments.

The museum is managed by a team of experts from the School of Biological Sciences, including Dr Benoit GUÉNARD, Aline MACHADO DE OLIVEIRA and YU Ho Him, Anders. The HKBM team is currently running a fund-raising campaign: Bare Bone Restoration, to restore damaged specimens and to expand the collection for education, conservation study and research, as well as to increase visitors’ capacity by growing the team and organising more visits.

The first biodiversity museum in Hong Kong

The Hong Kong Biodiversity Museum (HKBM), the first museum in Hong Kong that is dedicated to biodiversity, is now open to the public for visits. It strives to be a natural history museum promoting environmental education and appreciation of biodiversity, fostering its preservation as a part of mankind’s natural heritage and by supporting scientific research on biodiversity, as well as increasing the biodiversity literacy of the public.

With over 10,000 specimens, HKBM hosts the largest and most comprehensive biodiversity collection within Hong Kong. Several of the species present, collected from the 1920s to 1970s, are unfortunately now considered as threatened and thus represent an important heritage to pass on to future generations. In addition to preserving these valuable specimens so that they can be studied and presented to the public, the work of the HKBM team includes the expansion of this biobank to better reflect our current knowledge about local and regional biodiversity.

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Strive for biodiversity: The first biodiversity museum in Hong Kong
Faculty of Science continued to excel in the latest Research Assessment Exercise (RAE) 2020 published in May. Among the five Units of Assessment (UoA) to which HKU Science submitted, under the Panels of Physical Sciences and Biology, we outperform other local universities and achieve the highest percentage of 4* ratings in three UoAs including Chemistry, Earth Sciences and other Physical Sciences, Mathematics and Statistics, affirming our world-leading position in the aforementioned fields (37% of all research submitted by the Faculty was judged to be world-leading (4*) by the RAE panel). More details: https://bit.ly/3PRKxwR

It is with deep sadness that we mourn for the passing away of Dr Stephen, Choi-Lai CHAN, our alumnus and former colleague of the Faculty of Science, on October 10, 2021, at the age of 81 in the company of his family. Dr Chan had been working in the Department of Mathematics for 34 years until he retired in 2002. He was also a founder and chair committee on HKU General Education (GE) in 1995. Under his supervision, over 200 courses and workshops in diverse areas were mounted between 1995 and 2000, with special emphasis on education of the whole person rather than mere transmission of knowledge and techniques. Obituary of Dr Stephen CHAN: https://bit.ly/3DRpdyY

The HKU Virtual Information Day 2021 was successfully held on October 30. For more information about our new initiatives in our Science curricula, as well as other information about our science programmes, please visit our One-stop platform for Science Undergraduate Admissions anytime and plan your university studies ahead of time. More details: https://bit.ly/3A65GN

For details of THE World University Rankings by Subject 2022, please visit: Detail of our accreditation: https://bit.ly/3aKFjCV

More details: https://bit.ly/3n6ySzN
Acknowledgements

We would like to express gratitude to our donors for their recent support, which is paramount for us to grow and scale new heights (in alphabetical order).

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Ms Winnie Oi Yee CHAN
Mr Wing Wah CHAN
Professor Chi Ming CHE
Ms Sabrina PANG
Professor David Lee PHILLIPS

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The Croucher Foundation Ltd.
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Ocean Park Conservation Foundation, HK
SGS Hong Kong Ltd.
Southern Marine Science and Engineering Guangdong Laboratory (Zhuhai)
Yunnan University

New Staff

Dr Haibo JIANG
Associate Professor of Department of Chemistry Research Interests: bioimaging, cell biology and metabolism, bioengineering

I am very excited to join the Faculty. My research largely focuses on the development and use of advanced bioimaging methods to understand mechanisms of how molecules are transported and processed. My long-term goal is to create better diagnoses and therapeutics for human diseases based on our fundamental discoveries.

Dr Yuan CAO
Assistant Professor of Department of Statistics & Actuarial Science, and Department of Mathematics Research Interests: machine learning, learning theory, high-dimensional data analysis, optimisation

I am very excited to join the Faculty of Science. My research focuses on understanding and advancing machine learning methods. Recently, I have been particularly interested in explaining how neural networks can be trained to fit the data, extract features, and make good predictions. Besides research, I like sports and music. I am looking forward to working together with the talented faculty members and students at HKU.

Dr Seungkyu LEE
Assistant Professor of Department of Chemistry Research Interests: reticular chemistry, porous crystalline materials, energy storage

I am very excited to join the team and start my new career in a beautiful city, Hong Kong! My research mainly focuses on inventing porous crystalline materials, including metal-organic frameworks and covalent organic frameworks, and studying their physical properties related to energy storage applications. My long-term goal is to establish a new class of materials with numerous structural and functional variations, inspiring many students and scientists worldwide. I’m looking forward to active collaborations with my new colleagues and students.

Dr Yating WANG
Assistant Professor of Department of Mathematics Research Interests: scientific computing and machine learning

It’s my great pleasure to join the HKU science family and be a member of the department! My research mainly lies in multiscale methods and machine learning for the simulation of complex physical processes. I am dedicated to developing efficient numerical solvers and trustworthy physics-informed learning frameworks for scientific applications. Besides, I enjoy hiking and cooking in my leisure time. I am really excited to be part of this beautiful city and can’t wait to explore this gourmet paradise.

Symbiotic relationships in which two organisms share nutrients are prevalent across the tree of life. Former PhD student Dr Inga Elizabeth CONTI-JERPE of the School of Biological Sciences from the class of 2019 proposed to apply a new technique she developed during her PhD that uses stable isotope analysis to quantify nutrient sharing in symbioses. She will use this method to measure nutrient exchange in a diversity of marine invertebrates, plants, and lichens to determine if certain traits are adaptations for more or less sharing. She was awarded a prestigious Plant Genome Postdoctoral Research Fellowship from the National Science Foundation of US. The proposed research will investigate the traits and underpinning genetics that modulate nutrient exchange between symbiotic partners at the University of California, Berkeley.

“I’m excited to use both stable isotope analysis and advanced genetic techniques to understand symbioses,” says Dr Conti-Jerpe. “Combining these technologies has huge potential, and I’m thrilled by the opportunity to add molecular tools to my toolkit.”


Alumna granted Research Fellowship from National Science Foundation, US

Supporting the investigation of the nutrients exchange between symbiotic partners

Alumni Corner

We would like to express gratitude to our donors for their recent support, which is paramount for us to grow and scale new heights (in alphabetical order).

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