



Science @ HKU 港理

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FACULTY OF SCIENCE NEWSLETTER


Blossom of Illustrious Developments in 50 Years

– Celebrating the Golden Jubilee of the Department of Statistics and Actuarial Science



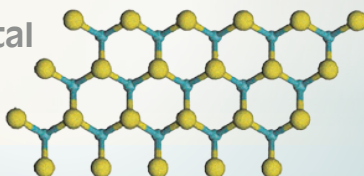
Our Pride & Joy

Highlights

-  Development of the World's First Light-seeking Synthetic Nanorobot

- Ocean Acidification Study Offers Warnings for the Future of Marine Habitats

- 2D Transition Metal Dichalcogenides (TMDs)



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FROM THE EDITOR

Dear readers,

50 years ago, a small teaching unit was founded in HKU. Over the years, it grows stronger and stronger, evolving to the best department of its kind in Hong Kong according to the latest QS World University Ranking by subject. Do you know which department it is? In this issue of *Science@HKU*, we celebrate the 50th anniversary of the Department of Statistics and Actuarial Science by reporting its history, current status and future plans.

Science@HKU is not a one-sided channel for the Faculty of Science to report interesting research achievements and teaching developments. We would also like to hear feedback, comments and news from readers like you, especially our alumni. If you have anything to share with us, please feel free to send in your story to the Faculty.

Yours sincerely,
Professor Hoi Fung CHAU
Chief Editor

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Message from the Associate Dean

A Beautiful Friendship Begins



About Professor Billy CHOW

Professor Billy K C Chow is Associate Dean (Development and External Relations: Local) and Professor, Chair of Endocrinology at the Faculty of Science, HKU. He is an award-winning scientist, internationally recognised for his research into molecular endocrinology and in particular for his pioneering research into the hormone secretin and its multiple actions within the human body. His laboratory is the first one to substantiate the neuroactive functions of secretin in the central nervous system and to demonstrate the pleiotropic activity of secretin in the pituitary, kidney, testis and liver. Professor Chow graduated with BSc and PhD degrees from the University of British Columbia before joining HKU in 1991. He is a Croucher Foundation Senior Research Fellow (2004), the first scientist from Hong Kong receiving the International Akira Arimura Young Investigator Award (2007) and the Grace Pickford Medal of Endocrinology (2005). He is also a recipient of the Outstanding Researcher Award (2005) and the HKU Research Output Prize (2010) from HKU.

It is my great pleasure to write to you. I am the new Associate Dean in development and external relations. I would like to take this opportunity to remark the upcoming 80th anniversary of the Faculty of Science in 2019. Usually in celebrating anniversaries, precious metals and gems are used to represent how significant the passing years are, but for the 80th anniversary, Oak is the chosen gift. Though the Oak tree takes years to reach full maturity, it produces one of the strongest types of wood available. In some cultures, the Oak symbolises great wisdom, knowledge and durability. Its towering noble strength shows its ability to endure and grow even in adverse conditions only because the roots dig deep into the ground and help the trunk establish a firm foundation. The alumni of the Faculty are the roots, allowing branches to reach out far for sustenance as the new leaves, our present students, to collect strength. We are all connected like every part of the tree is interrelated, and we all have our importance and roles to play.

We are living in changing times. We are given endless streams of information daily. Things that used to take many days to achieve can now be done in just minutes. We have more time to do more things and yet interpersonal relationships seem to be more challenging than ever before. Yes, we are connected at all the time through the Internet but conversations have been replaced with words on an app, and to show our emotions, a little picture is used.

We are missing real human connection: to our roots, to our shared beginnings.

Let's change this. Let's take this fantastic opportunity for us to group, connect, gather and celebrate our achievements, discuss our future plans. Not as an identity behind a touched up photo but person-to-person, one alumnus to another. This is a great chance for you and I to build a stronger alumni community in which all of us will play our roles to support the present and future growth of the Science Faculty that we are all proud of.

Professor Billy K C CHOW
Associate Dean
(Development and External Relations: Local)

Warm Reunion of the Science Family



The Faculty is taking an initiative to strengthen our connection with generations of alumni. We had a warm and intimate reunion with around 60 alumni at HKU on January 12, 2017, filling the evening with laughter and joy.

Apart from learning the updates of the Faculty's recent developments from our new Dean Professor Matthew R EVANS, our alumni were also fascinated by the cutting edge research of our first-class researchers and the ample learning opportunities of our students. Touring around the campus and laboratories, they also relived a small part of their university life and reminisced the good old days.

"This is the beginning of a beautiful friendship." – as quoted by Professor Billy CHOW, Associate Dean of Development and External Relations (Local) in the Reception. Let's CONNECT and stay tuned for more alumni activities!



Blossom of Illustrious Developments in 50 years

– Celebrating the Golden Jubilee of the Department of Statistics and Actuarial Science

Message from the Head of the Department of Statistics and Actuarial Science

In 1967, the Department of Statistics and Actuarial Science (then Department of Statistics) was established in The University of Hong Kong.

Growing from originally a special teaching unit to now one of the most established statistics and actuarial science departments in the world, the Department has unquestionably come a long way through the years with only one senior lecturer and one lecturer to begin with. Now the Department has expanded to almost 90 teaching members, supporting staff and research students altogether.

On the voyage of teaching and learning, the Department's determined mission to provide state-of-the-art education has led to the respective offering of the Bachelor of Science (Majors in Decision Analytics, Risk Management, and Statistics), Bachelor of Science in Actuarial Science, Master of Statistics, MPhil and PhD programmes, which have never stopped evolving for the betterment of our students.

As ranked No. 1* for the subject of Statistics and designated as one of the only two Centers of Actuarial Excellence in Hong Kong, we will continue to look beyond the challenges and competition ahead. We reaffirm our commitment to academic excellence with relentless dedication and unflinching efforts in research and scholarship.

The year 2017 is a special year, for it marks the Golden Jubilee of the Department. Over the past 5 decades, the Department has shown to the world its strengths and resolutions.

All the achievements and honours clearly should belong to all the talented and dedicated colleagues of the Department, academic and supporting. I am very grateful to have the chance of working with them in the last 34 years or so since I have joined the University. Yet the Department will not be able to achieve so much if there is no strong support from you all – our alumni and friends. Thanks also go particularly to our patrons, Professor Swee-hock SAW and Dr Patrick POON, more students of the Department could be awarded with scholarships which serve as great encouragement for the scholarship recipients.

More recently, the University is aspired to make overseas experience more available to students. In response, the Department signed an MOU with the National School for Statistics and Information Analysis in France for student exchange. The first exchange was successfully held last summer with 20 students. In the meantime, the University's objective is to have 50% of its student body to have such overseas experience by 2019. To realise this goal, your generous help would be much appreciated.

With your support, we believe that our international renown in the science disciplines can be heightened to a new level, bringing the Department to the next milestone. As the name of this special anniversary suggests, the Department will undoubtedly continue to shine like a golden sun and blossom with dynamic developments in the years to come.



Professor Wai-keung LI
Chair Professor and Head of Department of Statistics and Actuarial Science

* HKU Statistics ranks No. 1 in HK and No. 20 worldwide overall in the QS World University Rankings by Subject 2017.

A Night to Remember – the Golden Jubilee Banquet

To celebrate the Department's Golden Jubilee, a banquet was held on March 11, 2017. Over 400 alumni and friends joined the banquet and this was a perfect occasion for them to reunite and catch up after years. That evening was filled with great memories and happiness. The participants were deeply inspired by the alumni's sharing and the Department's dynamic developments in the past half century.

Glorious History

Early years

50 years ago, the Statistics discipline existed as a special teaching taskforce before it became an independent unit, then a proper department later, with the initial aim to serve other departments with its quantitative research expertise. Since then, the Department of Statistics and Actuarial Science (then Department of Statistics) continues to show its growing importance not only in HKU but also in the society.

In 1969, Professor Swee-hock SAW, the Chair Professor and founding Chair of the Department, developed the second and third year statistics courses, up to half of a degree curriculum, to be combined with another half in the disciplines such as Economics. He contributed much to the Department even he has left the University; for example, he donated for the Saw Gold Medal and Saw Swee Hock Statistics Scholarship, and supported for the establishment of the Saw Swee Hock

Visiting Professorship to promote Statistics education and research in Hong Kong.



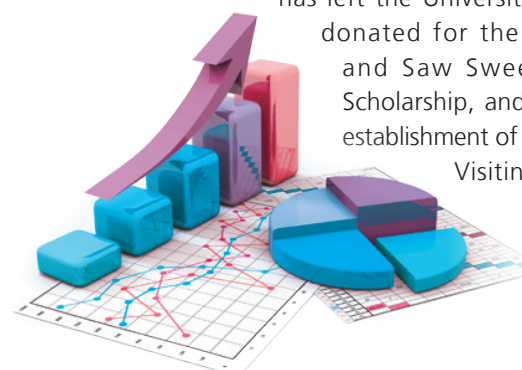
1980s – 1990s

In 1985, Professor John AITCHISON, the succeeding Head of the Department, put much effort into setting up a computer room furnished with personal computers, which not only helped solve the numerical problems in research at the Department, but also enabled demonstration of computer implementation which was previously impossible. Two years before his retirement, Professor AITCHISON launched a part-time MSocSc (Applied Statistics) programme.

In 1989, Professor Richard COWAN, who succeeded Professor AITCHISON as Chair Professor, led the Department into making substantial changes in the course structure by introducing clearly defined streams of courses and emphasising computer-aided elements in the curriculum. In particular, a Data Analysis Team was formed with new computer-aided courses in data analysis using SAS launched with hands-on teaching and learning.

In 1993, the one-semester course in basic actuarial science was developed into a full BSc (Actuarial Science) degree which was launched in 1994 with 20 student places. The programme has kept maintaining its high ranking and quality ever since.

In 1998, the Department renamed the Department of Statistics and Actuarial Science. Apart from the BSc (Actuarial Science), the Department had three study themes under BSocSc (Statistics): Mathematical Statistics, Applied Statistics and Risk Management themes, which have evolved gradually into the two Science Majors: the BSc (Statistics) and the BSc (Risk Management) after the Department's transfer to the Faculty of Science in 2004.



2000s – 2010s

Professor Kai Wang NG served as the Head from 1999 to 2006 and from 2010 to 2013 while Professor Wai Keung LI served as the Head for the rest of the period in between and up to the present. They led the Department in becoming a top research-led department at an international level. To date, it has very strong ties with the international academic community and has organised or co-organised a total of 40 international conferences and workshops. World class academics such as Professor Tze Leung LAI of Stanford University, recipient of the prestigious President's Award of the Committee of Presidents of Statistical Societies of North America, and Professor Hans U GERBER, who received the Life Time Contribution Award from the International Actuarial Association, are serving on the Department's Advisory Board. Professor Howell TONG, a former Chair Professor, has also been appointed Distinguished Visiting Professor again since 2004 to formalise his continued ties with the Department.

The Department has a very proud record of academic honours won by its teachers. Moreover, it was placed No. 1 in Asia and No. 10 worldwide for its Actuarial production by the NAAJ for the period from 1982 to 2011. In 2011, it was designated a Centre of Actuarial Excellence (CAE) by the US Society of Actuaries (SOA) for a period of five years with the status recently renewed for another half a decade. It is at this time of writing the only university in Asia receiving a CAE research grant, which amounted to over two million Hong Kong Dollars.

Since 2015, a new major Decision Analytics has been launched to meet the needs of the society for talents in the area of data science. In the following years, the Department ranks No. 1 both in Asia in terms of employer reputation and in Hong Kong overall according to the QS World University Ranking by Subject 2016 and 2017.

In addition to academic excellence, the Department believes strongly that it is important to serve the society by producing high quality graduates well trained in statistics, actuarial science, risk management, and decision analytics, and has therefore strived its best to equip its students with the state of the art in every course it runs. Generous donations from Dr Patrick POON

and Professor Swee-hock SAW, together with a matched amount from the University, were also of great assistance, particularly in actuarial research and encouragement to students in statistics-related majors.

The Department also believes strongly that its success is impossible without the hard work of its teaching and non-teaching staff, the strong support of its students, its alumni, its business and industrial patrons and the society of Hong Kong. We never cease committing ourselves to high quality academic research and teaching and will continue to maintain our research and teaching vitality, and inspire our students.



- Professor Swee-hock SAW was appointed as the Founding Chair
- Developed the Statistics curriculum

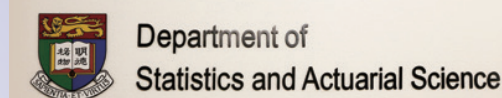
Established in Knowles Building as one of the departments under the Faculty of Social Sciences



Launched the Master of Statistics programme (then Master of Social Sciences in Applied Statistics programme)

Launched the Bachelor of Science in Actuarial Science programme

Moved offices from Run Run Shaw Building to Meng Wah Complex



- Renamed the Department of Statistics and Actuarial Science
- HKU designated the area of financial time series as an area of distinction within the University



- Transferred to the Faculty of Science
- Launched the Major of Risk Management
- Established the Patrick Poon Lecture Series in Actuarial Science



Established the Saw Swee Hock Public Lecture in Statistics



- Established the Patrick S C Poon Professorship in Statistics and Actuarial Science
- Designated as a Center of Actuarial Excellence by the US Society of Actuaries



Moved offices from Meng Wah Complex to Run Run Shaw Building

Milestones Timeline

2017

2015

Launched the Major in Decision Analytics

2014

2011

2009

2004

1998

1995

1994

1987

1985

1969

1967

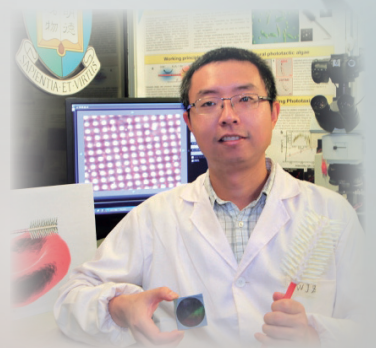
HKU Statistics ranked No. 1 in Hong Kong and No. 20 worldwide according to the QS World University Rankings by Subject 2017



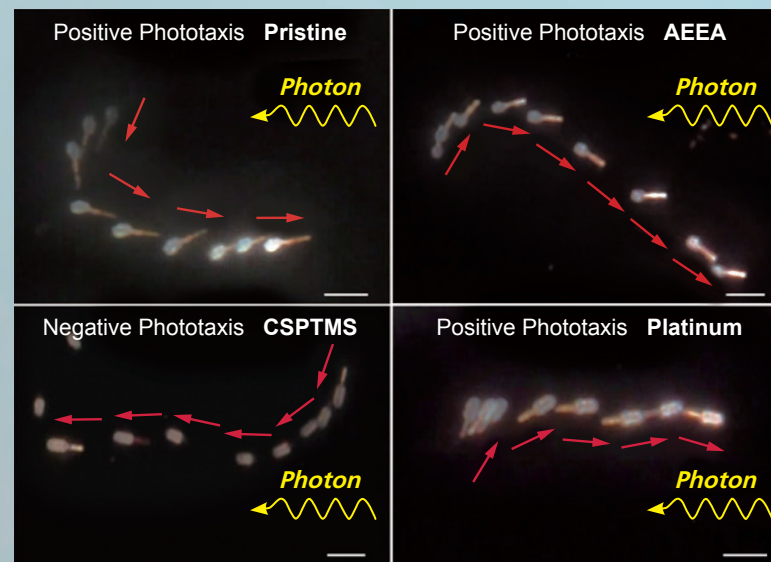


Development of the World's First Light-seeking Synthetic Nanorobot

by Dr Jinyao TANG, Department of Chemistry



Even since the concept of nanotechnology was conceived several decades ago, researchers have envisioned machinery and tried to develop tiny robots for the healthcare and manufactory purposes. As described in the 1966 science fiction movie *"Fastastic Voyage"*, miniaturised submarine was injected into human body to cure illness by delivering drugs to specific sites or performing surgery without single cut on patient's body; we could imagine that in the near future, thousands or millions of nanorobots would "swim" inside our body, search and destroy tumors from single cell level while our healthy cells would not be harmed as current chemotherapy or radiotherapy do. Also, we could imagine that nanorobots would be self-assembled into amazing shapeshifting android with multi-functions as the T-1000 shown in another famous movie named *"Terminator 2"*.

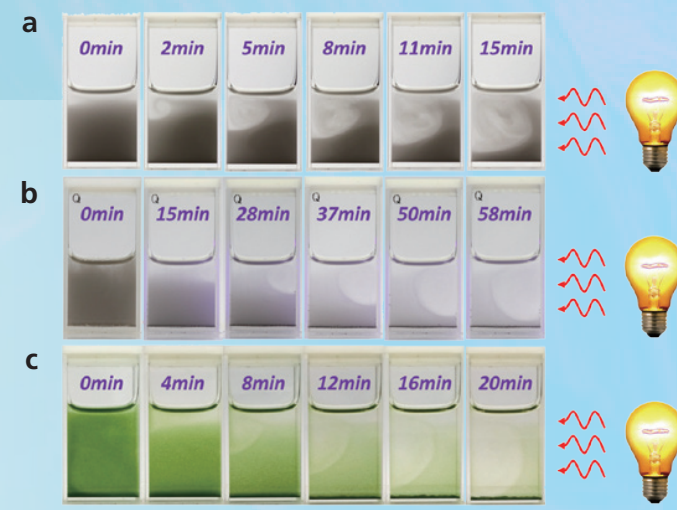


← The direction of Janus nanotrees' movement

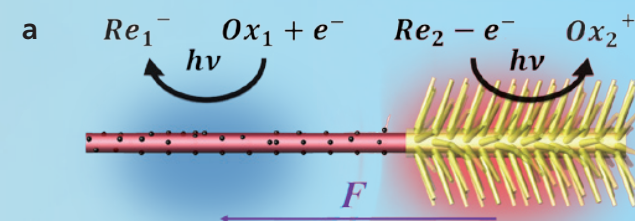
Programmable phototaxis of individual Janus nanotree by chemical treatment; superimposed images of sequential frames indicate that the pristine and AEEA-treated Janus nanotrees migrate in a tail-forward direction and exhibit positive phototaxis. The CSPTMS-treated Janus nanotree migrates in a head-forward direction and exhibits negative phototaxis. The platinum nanoparticle decorated Janus nanotree migrates in a head-forward direction and shows positive phototaxis.

Schooling of artificial microswimmers as compared with natural green algae

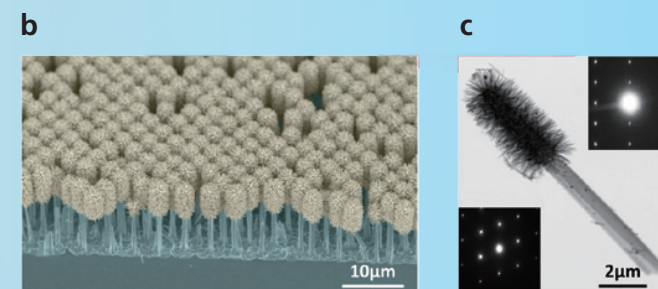
(a) Sequential images of the green algae, *E. gracilis* suspension in aqueous solution with illumination from the right side demonstrate positive phototaxis; (b), (c). Sequential images of the pristine and CSPTMS-treated Janus nanotree suspension in H_2O_2 solution with UV illumination from the right side demonstrate positive (b) and negative (c) phototaxis.



Schematic design and structure characterisation of a Janus artificial microswimmer



(a) Schematic of a Janus artificial microswimmer. An array of TiO_2 nanowires (yellow) is grown on a silicon nanowire (pink). Platinum (black) nanoparticles, which serve as the electrocatalyst, are attached to the surface of the silicon nanowire. Upon illumination, photo-excited minority carriers drive the PEC reaction on the nanotree's surface and generate charged PEC products. The electric field generated by unbalanced ions propels the charged Janus nanotree;



(b) False-colored scanning electron microscope image of a Janus nanotree forest prepared on a silicon substrate; (c) Transmission electron microscope image of an individual Janus nanotree. Selected area electron diffraction patterns of a TiO_2 nanowire (inset, upper right) and silicon nanowire (inset, lower left) indicate the single crystalline nature of both materials.

Nevertheless, many challenges would be encountered during the development of nanorobots, especially constructing a working nanorobot prototype. Its main challenges stem from two major difficulties: (1) the discovery of new way and energy source to propel the nanoscopic objects in solution; and (2) the exploration of method to program or remotely control the nanorobots so that they can perform their function or respond to designated external stimuli. Furthermore, making a nanometer-scale battery and equipping it in the nanorobot as a control is obviously a great challenge.

Fortunately, the Mother Nature often gives scientists a lot of hints to solve their problems. In nature, green algae absorb energy from sunlight and are able to "see" and migrate towards a better illuminated area. This ability is called phototaxis, which benefits green algae to regulate their light exposure for better photosynthesis. Inspired by the natural green algae, Dr Jinyao TANG's team from the Department of Chemistry, HKU has successfully developed the world's first light-seeking synthetic nanorobot which can collect energy from incident light and be programmed to swim towards or away from light source after over three years' efforts.

Dr TANG's team's nanorobots are composed of two common and non-toxic semiconductor materials: silicon and titania. They are incorporated into a "small tree" structure. Similar to green algae, this "small tree" can absorb energy from light, have photosynthesis and generate a propulsion force for moving. By carefully engineering the surface of those tiny trees, the nanorobots can swim towards or away from light source under control. This is the critical step for potential biomedical applications by nanotechnology.

Under the microscope, it is observed that the nanorobot's motion can be controlled easily and the nanorobots can have different maneuvers such as left or right turn. More impressively, millions of these nanorobots in solution act like a school of fish in the ocean. These findings are inspiring for the future development of nanorobots for biological applications as well as daily life applications.

For more information, please visit
https://www.youtube.com/watch?v=gG_qhujg6VE



Ocean Acidification Study Offers Warnings for the Future of Marine Habitats

Calcifying Coral Reefs and Mussel Beds Particularly Vulnerable



by Dr Bayden RUSSELL and Dr Thiyagarajan VENGATESEN,
The Swire Institute of Marine Science (SWIMS) & School of Biological Sciences

Acidification of the world's oceans, caused by global carbon dioxide emissions, could drive a cascading loss of biodiversity in some marine ecosystems, according to research published recently in *Nature Climate Change*.

The research, done as part of an international collaboration between researchers from The Swire Institute of Marine Science (SWIMS) of The University of Hong Kong (HKU), The University of British Columbia (UBC), and colleagues in the USA, UK, Europe, Australia and Japan, combined biodiversity and environmental impact data from dozens of existing studies to paint a more nuanced picture of the impact of ocean acidification and to advance our understanding of what marine ecosystems may look like in the future.

It has been known for some time that there will be marine animals that are big “losers” and some plants which will be “winners” with climate change and ocean acidification, both driven by increasing carbon concentrations in the atmosphere and world's oceans. While most research in the field focuses on the impact of climate change and ocean acidification on individual species, this new work focuses on the impact of ocean acidification on living habitats, such as coral reefs, mussel beds, kelp forests and seagrass meadows that form the homes of thousands of marine species. Overall, these studies point towards ocean acidification causing a decline in the biodiversity, and function, of oceans into the future.



Sea grass beds, like these off the coast of British Columbia, Canada, might buffer the impact of ocean acidification.



Sea grass beds and kelp forests, like these off the coast of Oregon, might buffer the impact of ocean acidification

Photos courtesy:
Professor Christopher HARLEY,
University of British Columbia



Coral reefs lose their structure in acidified conditions, like near the volcanic vents in Papua New Guinea (Photo courtesy: Dr Bayden RUSSELL, SWIMS, HKU).



Coral ecosystems, like these pictured off the coast of Mexico, will be hit hard as the oceans become more acidic (Photo courtesy: Professor Christopher HARLEY, University of British Columbia).

Large declines in coral reef biodiversity are expected

Dr Bayden RUSSELL, a researcher at SWIMS and co-author on the paper, said that based on their findings from locations where volcanoes acidify the seawater it is possible that the structure of coral reefs could be dissolved by future ocean acidification. Noting that it is this habitat structure which facilitates the large biodiversity we see on coral reefs globally, he further said that this loss of habitat will likely cause large declines in reef biodiversity.

The researchers were able to test their predictions against real-world data from two sites: a coral reef near Papua New Guinea and a group of seagrass beds in the Mediterranean, both where carbon dioxide from active volcanoes acidifies the ocean. In the case of the coral reef, the diversity and complexity of marine life in the area decreased as acidification increased.

Seagrass shows complex responses

Despite predictions that the seagrass beds would fare well under increased levels of carbon dioxide, however, no increases in biodiversity were observed. The study noted, for the first time, that seagrasses show complex responses under ocean acidification. While some may do better, many seagrass systems will decline, causing the number of fisheries species to decline relative to current levels. This highlights a need to focus not only on individual species, but on how the supportive habitat that sets nature's stage responds and interacts to climate change.

Healthy coral reefs, like this one in Papua New Guinea, are complex in structure and support high biodiversity (Photo courtesy: Dr Bayden RUSSELL, SWIMS, HKU).

Mussel production could show a decline

Natural reefs built by the mussels on the northwest coast of the USA are similarly predicted to decline in abundance, with the associated decline in biodiversity, under future acidification. In the Pacific Northwest, the number of medium to large-sized edible saltwater mussels is likely to decrease as the chemistry of our oceans changes, and this is a piece of bad news for the hundreds of species that use them for habitat.

While mussels do not create natural beds in Hong Kong like other parts of the world, Dr RUSSELL admitted that mussels and other bivalves in aquaculture, like oysters, are likely to be affected in a similar way and show a decline in production.



Mussels and oysters from Lau Fau Shan aquaculture area, Hong Kong (Photo courtesy: Dr Thiyagarajan VENGATESEN, SWIMS, HKU).

Oysters in Hong Kong and Mainland China are well known for the production of seafood, health supplements, and for providing multiple ecosystem services. Because of the similar nature of oysters and mussels, Dr Thiyagarajan VENGATESEN, a researcher at SWIMS, HKU and also a co-author on the paper, said that China is seriously concerned about this emerging threat. China is a center of oyster production, with >80% of world's oysters produced in China, and their coastal waters are vulnerable to ocean acidification. Worryingly, this ocean acidification impact is intensified as eutrophication, climate warming and anthropogenic pollution are occurring faster in this region than in other parts of the world.

What can we do?

The cause of ocean acidification is known – global carbon dioxide emissions. As carbon dioxide from the atmosphere dissolves into the world's oceans it creates carbonic acid. Therefore, while this current research points towards some dramatic negative effects because of ocean acidification, there is something we can do; reduce our reliance on carbon-based energy. Not only will reducing our use of fossil fuels improve the air that we breathe but it will also improve the health of the oceans we rely on.

Ocean
Acidification

About
SWIMS



The article “Ocean acidification can mediate biodiversity shifts by changing biogenic habitat” published in *Nature Climate Change* is available at
<http://dx.doi.org/10.1038/nclimate3161>

Learning from Peers through SENIOR TUTOR SCHEME

You learn best when you teach others. That's why the teaching team of SCNC1111 Scientific Method and Reasoning, which comprises **Dr Eddy LAM**, **Dr Rachel LUI**, **Dr William CHEUNG**, implemented the **Senior Tutor Scheme** to encourage and facilitate undergraduate students in sharing their study experience. This scheme is a teaching innovation, applicable to all disciplines. In the past semester, 9 active students were chosen as senior tutors. They were in Year 3 or 4 with rich academic and cultural exchange experiences. The fact that the tutors come from different disciplines in Science also broadens and adds new perspectives to mathematics and statistics teaching.

The tutors contributed in all stages – from designing, preparing and conducting the tutorials, to marking and commenting on assignments. They did not come unprepared: weekly meetings were held by the teaching team as a training to ensure tutors had sufficient knowledge of pedagogy and class management. The teaching team oversaw each tutorial and provided assistance when necessary. Trainings on Moodle, the usage of Google forms and centralised email systems also facilitated smoother implementation.

The scheme's implementation in the past semester was undoubtedly a win-win case for everyone.

For more information, please visit the coverage by TELL:

<http://tl.hku.hk/2017/01/senior-tutors-scheme-in-the-faculty-of-science/>



teach
JESU

Situated on the shores of Cape d'Aguilar peninsula, Hong Kong's only Marine Reserve, SWIMS provides an interdisciplinary environment to researchers for projects as well as collaborations with other marine facilities, with particular focus on the marine science in South-east Asia and the North-west Pacific. It is supported by both HKU and The Swire Group.

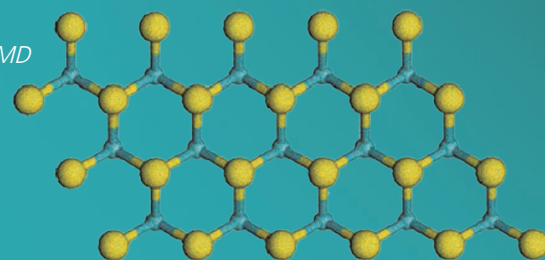


2D Transition Metal Dichalcogenides (TMDs)

by Professor Xiaodong CUI, Department of Physics





Diagram of TMD

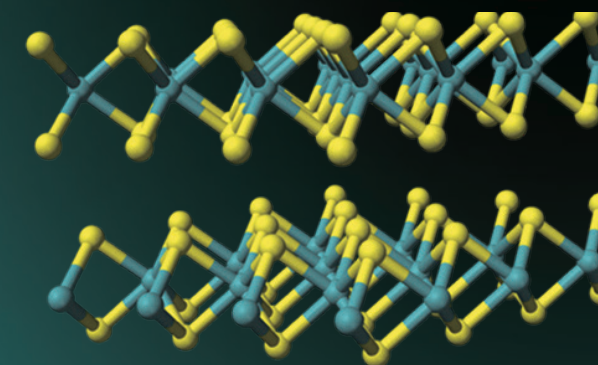


The ultimate goal of making atomic size electronic devices stimulates the research on 2-dimensional (2D) materials in which thickness of those materials is only atomically size and electrons are confined in 2D sheet instead of moving in 3-dimension (3D). In this early century, graphene, the first atomic 2D material and a single layer of carbon atoms, was discovered. This discovery kicked off the research on atomic 2D materials. Nowadays, graphene has been a star material with promising applications in many fields. However, as a candidate for building block in electronic devices, graphene suffers an intrinsic disadvantage: it is a semi-metal instead of a semiconductor which owns a band gap. Due to the lack of band gap, one cannot switch off the current flow in graphene with the established protocols. Fortunately, other real 2D materials, including 2D metal and 2D semiconductors, were found after the discovery of graphene. Among the big family of intrinsic 2D semiconductors, monolayer (single layer) transition metal dichalcogenides (TMDs) is regarded as one of the most promising materials for future electronics.

TMDs are a family of layered semiconductors of the type MX_2 in which M is a transition metal atom (Mo, W, etc.) and X is a chalcogen atom (S or Se). TMD crystals layers are packed with a weak Van-der-Waals attraction and could be exfoliated to single or multiple atomic layers to form perfect and environmentally robust 2D crystals. Atomically thin TMD crystals with a sizeable bandgap in the visible and near infrared range satisfy numerous requirements for ultimate electronics and optoelectronics. Furthermore, the characteristic inversion symmetry breaking presented in monolayer TMDs leads to non-zero but contrasting Berry curvatures and orbit magnetic moments (both describe quantum properties for electrons in the crystal) at particular points in the crystal momentum space. These features provide an opportunity to manipulate electrons' additional internal degrees of freedom, namely the valley degree of freedom, to a less familiar quantum number, making monolayer TMD a promising candidate for the conceptual valleytronics. While Conventional semiconductor electronics uses the flow of electric charge, Valleytronics involves utilising "valleys", a new degree of freedom of electrons (as information carriers) in a controlled way. Electron spin, another internal degree of freedom of electrons which is addressed in quantum mechanism, is strongly coupled with the valley degree of freedom in monolayer TMD. These extra degrees of freedom and the interplay of spin and valley provide a rich platform for future quantum electronics and quantum devices.

With these fascinating goals in minds, researchers have been growing great enthusiasm for 2D TMD study. Among the crowded teams worldwide, Professor Xiaodong CUI's team from the Department of Physics marks the HKU team in this fast growing and competitive map. Professor CUI's team collaborated with Professor Wang YAO's team from the same department and demonstrated that valley polarisation could be generated, which means that all electrons have the same valley degree of freedom or the same quantum number, with certain polarised light excitations. Namely, a certain light polarisation could generate a valley polarisation and so one could manipulate the valley degree of freedom with the control of light polarisation. The experiment was recognised as a milestone to valleytronics (Nature Nanotechnology 7, 488(2012)). Professor CUI's team further conducted a series of work to demonstrate the exotic physics properties induced by the interplay between spin and valley degrees of freedom. Although it is uncertain that 2D TMDs will lead in future electronics, it is obvious that they offer a rich platform to explore the physics in 2D world.

Diagram of MX_2  M = Mo, W  X = S, Se



For the list of references, please visit:
<http://www.scifac.hku.hk/2dtmds>



New Staff

Dr Joseph MICHALSKI

Associate Professor, Department of Earth Sciences

Research interests: astrobiology, planetary geology

“I am fascinated by the perspective that we gain by looking back at Earth from space. My work focuses on the use of remote sensing (or satellite imaging) to investigate the geology and mineralogy of planets. I study the geology of Earth, but most of my research focuses on the analysis of infrared remote sensing data from Mars, which we use to find locations where ancient life could have formed or existed, over 3 billion years ago.”



Dr Alexander S Y SHUM

Lecturer, Faculty of Science

Teaching areas: science and mathematics education, professional development education, applied mathematics (optimal control)

“I discovered my love for teaching while doing my PhD in mathematics at the University of Waterloo in Canada. I am always trying to find better ways to explain and help students to discover scientific concepts as I believe those concepts should be accessible to everyone. I hope to bring my passion for teaching science and mathematics to the common core at HKU. Looking forward to it!”



Dr Tanja SOBKO

Assistant Professor, School of Biological Sciences

Research interests: healthy lifestyle interventions, connectedness to nature, sports nutrition

“I have a multidisciplinary background in pharmacology, nutrition, physical activity and health. I was lucky to spend many years in the best labs of Karolinska Institutet, Sweden, understanding how our body works in health and in disease. Today, I can apply this knowledge and together with my team, help the Hong Kong families modify their lifestyles for better health. The project I lead is “Play&Grow” – by exposing our children to nature, it aims to promote daily habits and routines at an early stage of our lives.”



Dr Lu ZHANG

Assistant Lecturer, School of Biological Sciences

Teaching areas: food and nutritional science, such as food microbiology, grain science, food safety and quality management, public health nutrition

“Having grown up in a large agricultural province in China, I have always been fascinated by the journey of food from the field to our table. This interest led me to pursue a master degree at Kansas State University and a PhD at the University of California, Davis in food science. I hope to share with my students about my knowledge and experience in studying everything about food.”



When East Meets West

– Incoming Exchange Students Growing Intellectual Minds at HKU

Apart from organising outgoing student exchange programmes, the Faculty of Science welcomes incoming exchange students all over the world each semester. With a supportive learning environment and a fascinating local culture, our incoming exchange students enjoy their studies in Hong Kong very much. Let's hear what Francesca and Fredrik, our incoming exchange students, experienced in the Faculty as well as HKU.

Fredrik Parnefjord GUSTAFSSON

MSc graduate (Double Major in Physics and Civil Engineering) of Lund University, Sweden

Incoming exchange postgraduate student in the 2nd semester of 2015-16, and was offered an opportunity to do research with the HKU Nuclear Physics group at RIKEN in Japan from May to August, 2016



“I have long heard of the excellent academic environment and diverse culture in Hong Kong. This inspired me to go on exchange in this flourishing city, experiencing the student life there and expanding my research connections.

Not only did I receive a warm welcome from HKU Science, I was also offered to work together with the Nuclear Physics group in the Faculty. This allowed me to experience the stimulating and collaborative research atmosphere, confirming the high academic standard of HKU I was told before. I was fascinated by the great diversity and experience of staff and professors there – their willingness to help and work together with students is essential for an encouraging and fruitful research environment. I had a great opportunity offered by the Nuclear Physics group to conduct research at the world renowned research facility RIKEN near Tokyo with distinguished scientists across the world. From there, I have gained valuable international research connections which are far beyond my expectations.



Apart from the rewarding research experience, the surroundings of HKU also encourage me to explore the beautiful nature, city life and fascinating culture of Hong Kong.



Francesca Manuela FORTIQUE CARLEO

BSc student (Major in Human Nutrition and Dietetics) of the University of Navarra, Spain

Incoming exchange student in 2016-17

“As a Venezuelan, I am excited to experience an exchange year in HKU which is probably the best place for science that I could go to.

In HKU, I met people with different cultures and countries; I visited laboratories in which I have never had the experience before; I got feedback from professors that are currently conducting some major research in areas which I am deeply interested in. Furthermore, I was amazed by the in-campus bookshop and supermarket at which I could get all my supplies from, and attracted by the huge numbers of clubs and societies that I could not find in my home university. I grew and learned more in these months in Hong Kong than what I did in four years in Venezuela!



As an overall experience, I enjoy my exchange life at HKU – I made new friends from totally different places; I learned from professors who were always eager to answer all of my questions; I travelled and discovered new places, tried new things and also showed others about how my life in the western countries was. It has been a journey of learning and teaching, one that I would recommend with my eyes closed.



External Awards

Dr Ho Yu AU-YEUNG, Department of Chemistry, was awarded the **Graeme Hanson Early Career Researcher Award 2016**. This award is made to support and recognise rising scientists in their early careers. Dr AU-YEUNG's research mainly relates to molecular recognition and selective detection of biologically important species, including ions, small organic molecules and enzymes.



Professor Xiaodong CUI, Department of Physics, was awarded the **Croucher Senior Research Fellowship** for his distinguished research achievements in 2D semiconductors.



Dr Ji-Dong GU, School of Biological Sciences, was awarded the **2016 Guangzhou Science and Technology Award** with his research project "Response and feedback mechanisms of typical estuary ecosystems to environmental changes in the northern South China Sea".



Dr Wing Tat CHAN, Department of Chemistry, received the **Faculty Award for Service Contribution 2015-16** for his distinguished performance in serving the Faculty.



Professor Chi Ming CHE, Zhou Guangzhao Professorship in Natural Sciences, received the **Faculty Knowledge Exchange (KE) Award 2016** for his enormous contributions in fostering knowledge transfer in organic light-emitting diode (OLED) development and applications.



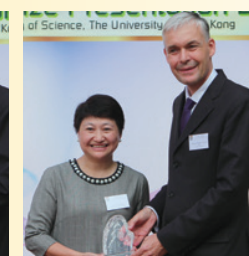
Dr William CHEUNG, Faculty of Science, received the **Faculty Award for Teaching Excellence 2015-16** for his high-quality dedication to teaching.



The **Faculty Excellent Teaching Assistant Award 2015-16** went to Dr Gavin W PORTER of the Faculty of Science for his substantial efforts in developing and teaching in the Common Core courses, and Miss Yu CHEN, PhD student under the supervision of Professor Pauline CHIU of the Department of Chemistry, for her enthusiasm in providing teaching support in classes.



Dr Wai Hung SIT and Ms Laura WONG from the School of Biological Sciences, and Ms Christina LING from the Department of Chemistry received the **Faculty Award of Outstanding Non-academic Staff 2015-16** for their outstanding performance among non-academic staff.



Acknowledgement

Acknowledgement

We would like to express our gratitude to our donors for their support in Year 2016.
(in alphabetical order)

Anonymous Donor
Ms Archana ANAND
Professor Chi Ming CHE
Dr Xueping CHEN
Mr Chiu Ying LAM
Professor Kin LAM
Ms Pui Chun LAU
Mr Alan LI
Mr Wing Lung NGAI
Mr Gangxiang PENG

Professor David L PHILLIPS
Dr Patrick S C POON
Mr Kwan Ying SHUM
Mr Chun Man SIU
Mr Xie YANG
Mr Chi Shing YIP
Mr Zhiming ZHOU

Thank you!

2016

October

20

With combined efforts of the Faculty of Science and the Department of Chemistry, the programme **"Workshop on Analytical Chemistry: Measuring Pollutants in Water"** was held on October 20, 2016 for secondary school students, enriching their understanding in the chemistry of water pollution and analytical chemistry methodologies for measuring toxic elements in water.

November
2

The Faculty of Science and Graduate House co-organised a public lecture named **"Gold Clusters, Colloids and Nanoparticles"** on November 2, 2016, at which **Professor David Michael P MINGOS**, FRS, Emeritus Professor of Inorganic Chemistry from University of Oxford expounded why scientists have been captivated by the physical and chemical properties of gold along the course of time. He also covered the applications of these gold species and their relevance to the development of nanotechnology.

November
23

A public lecture entitled **"Can we save coral reefs? If so, how?"** was co-organised by the Faculty of Science and The Swire Institute of Marine Science (SWIMS) on November 23, 2016, at which **Professor Jeremy JACKSON** from the Scripps Institution of Oceanography and Smithsonian Institution shared with us the global decline of reef corals in relation to climate change and localised effects, and possible ways of reef corals conservation.

December
7

The programme **"Big Data Workshop"** was organised by the Big Data Research Cluster (BDRC) of the Faculty of Science on December 7, 2016 for introducing the importance of Big Data and promoting interdisciplinary collaborations in different science fields. For more information of BDRC, please visit:

<http://www.saasweb.hku.hk/bigdata>

December
15/16

The Faculty of Science and the Centre for the Enhancement of Teaching and Learning (CETL), HKU, co-organised a 2-day programme **"Excellence in Teaching Workshop – How Harvard Teaches and Innovates"** on December 15 & 16, 2016, at which **Professor Robert LUE** and **Professor Xiao-Li MENG** from Harvard University shared with us the innovative teaching skills and new-age integration of online and residential education for the 21st century.

February
8

2017

Dr Michael PITTMAN from the Department of Earth Sciences, in collaboration with his esteemed colleagues, introduced a global adventure **"Dinosaur Ecosystems"** on how palaeontologists use animal, plant fossils and their living forms to reconstruct the dinosaur world at Massive Open Online Course (MOOC) learning platform of edX, a quality education provider offering high-quality courses from the world's best universities and institutions to learners everywhere. Registrants can enroll the course on their schedule and learn at their own pace. For more information, please visit:

<https://www.edx.org/course/dinosaur-ecosystems-hkux-dinox>

March
7

The programme **"Exploring the Rich Biodiversity of Hong Kong"** was co-organised by the Faculty of Science and the School of Biological Sciences on March 7, 2017 for secondary school students, enriching their understanding in global biodiversity, miniature ecology and different species of birds and butterflies around the campus.

March
20

A public lecture entitled **"Solar Energy – Energy for the Future"** was held on March 20, 2017. **Professor Aleksandra B DJURIŠIĆ** from the Department of Physics gave a brief overview of different solar energy technologies from silicon panels to organic materials. She also discussed the challenges of reducing cost and achieving wide scale applications of solar energy and demonstrated how to make a solar cell.

