



香港中文大學理學院

FACULTY OF SCIENCE

THE CHINESE UNIVERSITY OF HONG KONG

SCIENCE FACULTY RESEARCH DAY 2021



22 MAY 2021
09:15 - 13:30



Science

Empowers Your Dreams

PROGRAMME

ADVANCING SCIENCE THROUGH INTERDISCIPLINARY AND MULTIDISCIPLINARY RESEARCH AND COLLABORATION

09:15 – 09:30 **Welcoming Remarks**
Professor SONG Chunshan
Dean of Science

09:30 – 10:30 **Keynote Speech:**
**The Importance of Collaboration and Openness
in Basic Science and Research Publication**
Professor Randy SCHEKMAN
*University Professor, Department of Molecular and Cell Biology,
Howard Hughes Medical Institute, University of California, Berkeley*

10:30 – 10:55 **Computational Geometry and Its Application to Medical Image Analysis**
Professor LUI Lok Ming Ronald
Professor, Department of Mathematics

10:55 – 11:20 **“Synthetic Organelles”,
Bridging Chemical Biology, Synthetic Biology, and Biomedicine**
Professor XIA Jiang
Associate Professor, Department of Chemistry

11:20 – 11:45 **A Quest for the Physics of Living Matter**
Professor WU Yilin
Associate Professor, Department of Physics

11:45 – 12:00 **Break**

SHARING ON COLLABORATIVE RESEARCH FUND (CRF)

Professor CHAN Man Nin
Associate Professor, Earth System Science Programme

12:00 – 12:15

Professor HO Kin Fai
Associate Professor, Jockey Club School of Public Health and Primary Care, Faculty of Medicine

12:15 – 12:30

Professor WEI Yingying
Associate Professor, Department of Statistics

12:30 – 12:45

Professor YANG Sen
Assistant Professor, Department of Physics

12:45 – 13:00

Professor HUI Ho Lam Jerome
Associate Professor, School of Life Sciences

Professor YIP Yuk Lap Kevin
Associate Professor, Department of Computer Science and Engineering, Faculty of Engineering

13:00 – 13:15

Professor JIANG Liwen
Professor, School of Life Sciences

13:15 – 13:20

Q&A

Closing Remarks

13:20 – 13:30

Professor SONG Chunshan
Dean of Science

Message from the Dean of Science

Welcome to the Faculty of Science Research Day 2021 at The Chinese University of Hong Kong. Every year, the Faculty organises a Research Day where researchers gather together to share ideas and experiences in advancing research and collaboration in the Faculty and CUHK. Last year we had the first virtual Research Day 2020 amidst COVID-19 pandemic shortly after I joined the Faculty as the new Dean; it gave me the first exposure of research activities of our colleagues. This year the Faculty launches the premier event of physical-virtual hybrid Research Day with the theme of “Advancing Science through Interdisciplinary and Multidisciplinary Research and Collaboration”. Another highlight of this year’s Research Day is the “Sharing on Collaborative Research Fund (CRF)”.



Through interdisciplinary and multidisciplinary collaborative research, our researchers strive to advance fundamental understanding and also address the global grand challenges. In CUHK 2021-2025 strategic plan, a clear and pronounced emphasis on interdisciplinary research is identified which crosses the boundaries of individual academic units. Our Faculty has also provided inputs to the university strategic plan in seven interdisciplinary and multidisciplinary areas. These areas will also be highlighted in the Faculty Strategic Plan. Our Faculty recently selected five collaborative proposals for funding with the project impact funds, and the investigators come from two or three different disciplinary units. The Faculty will continue to support interdisciplinary and multidisciplinary research collaboration.

For the Faculty Research Day this year, we are honoured and very pleased to have a most distinguished scientist and a Nobel Laureate, Prof. Randy Schekman from the University of California at Berkeley as the Keynote Speaker. Prof. Randy Schekman will share his insight on collaboration and openness in basic science and research publication. I will ask my colleague Prof. Liwen Jiang to introduce Prof. Schekman in a few moments. We are also pleased to have 3 presentations by leading researchers from different units, including Prof. Ronald Lok Ming Lui in mathematics, Prof. Jiang Xia in chemistry, Prof. Yilin Wu in physics. They will share their interdisciplinary research for linking their various backgrounds with biological problems.

Over the past ten years, the Faculty has successfully developed 24 Collaborative Research Fund (CRF) projects and 3 Area of Excellence (AoE) projects funded by the Research Grants Council (RGC). We hope that the Research Day will promote the discussion among faculty members for collaborative research and facilitate their application of the future RGC CRF. In this connection, the Research Day this year also features the sharing by 7 colleagues from the Faculties of Science, Engineering and Medicine, including Prof. Man Nin Chan in earth system science, Prof. Kin Fai Ho in public health and primary care, Prof. Yingying Wei in statistics, Prof. Sen Yang in physics, Prof. Jerome Ho Lam Hui in life science and Prof. Kevin Yuk Lap Yip in computer science and engineering, as well as Prof. Liwen Jiang in life science to share their experiences in CRF grant application and also how they learnt from previous submissions.

We hope the Research Day 2021 will serve as a platform for researchers to exchange ideas from recent research advances and to encourage collaborative research across different disciplines.

Yours sincerely,

Chunshan Song
Dean of Science and
Wei Lun Professor of Chemistry

KEYNOTE SPEECH

The Importance of Collaboration and Openness in Basic Science and Research Publication

Professor Randy SCHEKMAN

University Professor, Department of Molecular and Cell Biology,
Howard Hughes Medical Institute,
University of California, Berkeley



For the most difficult challenges in scientific research, a more open and collaborative approach may make a difference in solving tough problems. Although collaborations are often encouraged by University leaders and funding agencies, the research rewards - jobs, promotion, authorship on publications and professional recognition - tend to favour the individual investigator. In my own career, key collaborations allowed my research group to achieve insights that would not have been possible on our own. Building on that theme, I will discuss where collaboration and openness has and will pay dividends.

How we publish our work represents one of the most difficult challenges to effective collaboration. Many young scholars feel that a first-author publication in a prestigious journal is the key to a job, promotion and success. Collaborations, though valued, sometimes prove to be impediments when the time comes to asking authorship. Part of a solution to this

problem is to de-emphasise the value of publication in journals that use exclusivity in branding themselves. One false metric that has exaggerated the perceived influence of many journal is the use of "impact factor" in self-promotion. I will discuss the publication model of a journal I started, *eLife*, and our effort to diminish the influence of impact factor and to promote open access publication.

Research collaborations also require support from funding agencies. Here again, the assignment of credit may interfere with appropriate recognition of the individual in a team effort. Because individual credit is built into the culture of academic science, meaningful long-term collaborations are quite rare. For personal and professional reasons, I have become involved in the formation of an international consortium of laboratories focused on basic issues in the molecular and cellular mechanism of Parkinson's Disease (<https://parkinsonsroadmap.org/>). I will review the challenge and our approach to this deadly disease.

KEYNOTE SPEAKER'S INTRODUCTION:

Prof. Randy Schekman is an investigator of the Howard Hughes Medical Institute and a Professor of Cell and Developmental Biology in the Department of Molecular and Cell Biology at the University of California at Berkeley. He was elected to the National Academy of Sciences (NAS) in 1992 and a Foreign Member of the Royal Society in 2013.

Prof. Schekman had been appointed as the Chairman of the Selection Committee for Hong Kong's Shaw Prize in Life Science and Medicine from 2016 to 2020. The Chinese University of Hong Kong (CUHK) awarded Prof. Schekman the degree of Doctor of Science, *honoris causa* in 2016. He is also a collaborator with CUHK's Area of Excellence Centre for Organelle Biogenesis and Function.

During the 1970s, Prof. Schekman studied yeast cells with malfunctions in vesicle transportation system. He demonstrated that the malfunctions were due to genetic defects and explained how different genes regulate different aspects of the transports. Prof. Schekman shared the 2013 Nobel Prize for Physiology or Medicine with James Rothman and Thomas C. Südhof "for their discoveries of machinery regulating vesicle traffic, a major transport system in our cells".

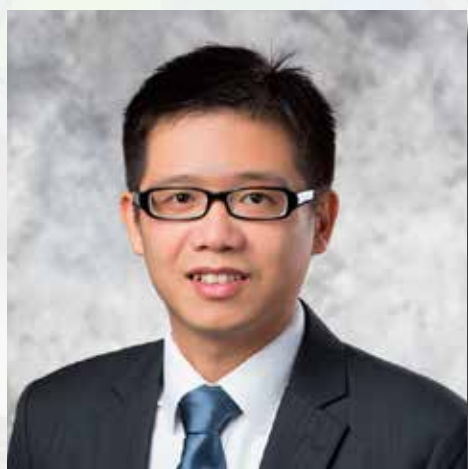
In 2002, Prof. Schekman was appointed Editor-in-Chief of the Annual Reviews of Cell and Developmental Biology. From 2006-2011 he served as Editor-in-Chief of the Proceedings of the NAS. From 2011-2019, he served as the founding Editor-in-Chief of an open access journal, *eLife*, sponsored by the HHMI, Wellcome Trust and the Max Planck Society. In 2019, he has been appointed as the Scientific Director for the Aligning Science Across Parkinson's (ASAP), an international program of collaborative research consisting of nearly 100 laboratories organised into 21 teams in 60 institutions around the world. To date, a total of USD \$161 million has been awarded to the teams to boost Parkinson's disease research.

Computational Geometry and Its Application to Medical Image Analysis

Professor LUI Lok Ming Ronald

Professor, Department of Mathematics
The Chinese University of Hong Kong

Geometry is an important topic in mathematics. It has recently attracted much attention and found successful applications in various fields. Applications have been found in medical image analysis, image processing and computer graphics. In particular, in the medical field, neuroscientists often need to locate structural differences between healthy and unhealthy brain structures and hence to detect systematic patterns of alterations in brain diseases. Geometry is able to accurately locate shape abnormality and systematically analyse the complicated anatomical structure for disease analysis. Using it, tools for disease diagnosis, such as Alzheimer's disease, can be developed. In this talk, I will give an overview on the recent advances of computational geometry and its medical applications.



Prof. Lui is a Professor in the Department of Mathematics at The Chinese University of Hong Kong (CUHK). He is also serving as the Executive Director of the Center for Mathematical Artificial Intelligence (CMAI), under the Department of Mathematics and Institute of Mathematical Sciences at CUHK.

Ronald got his PhD in Applied Mathematics from University of California at Los Angeles in 2008, under the supervision of Prof. Tony F. Chan. Before joining CUHK, he worked as a Postdoctoral Scholar for 2 years in the Department of Mathematics at Harvard University, hosted by Prof. Shing-Tung Yau. Prof. Lui's main research focus has been on computational quasi-conformal geometry and its applications to medical imaging, computer vision and computer graphics. The main goal is to develop mathematical theories, models and algorithms to effectively study geometric structures, using quasi-conformal Teichmüller theory as a tool.

Over the years, he has been developing computational algorithms for quasiconformal geometry, understanding their theoretical aspects and applying them to real-world applications. Ronald was awarded the Morningside Mathematics (Silver) Medal during the International Congress of Chinese Mathematicians in 2016. In 2018, he was awarded the HKMS Young Scholars Award by the Hong Kong Mathematical Society.

“Synthetic Organelles”, Bridging Chemical Biology, Synthetic Biology, and Biomedicine

Professor XIA Jiang

Associate Professor, Department of Chemistry
The Chinese University of Hong Kong

Organelles are structurally and functionally independent subcellular units of nanometer to micrometer scale within a cell. Larger than individual proteins but smaller than cells, organelles house diverse functions, are highly engineerable, and then can serve as a platform for transmitting signals and information to different cells and tissues for disease treatment. Remodeling of natural organelles, and *de novo* synthesis of organelle-like structures, yield unnatural subcellular structures that we call “synthetic organelles”.

One example of synthetic organelles mimics metabolons, multienzyme complexes that dominate key steps in metabolic pathways. We have shown assembling sequential enzymes in metabolic pathways produce multienzyme nanomachineries in different ways, including scaffold free, on protein scaffolds, on caveolae vesicles, and inside protein phase-separated coacervates. The multienzyme organelle-like structures in prokaryotic cells streamline the biosynthesis of terpene, and markedly increase the synthetic yield of important terpenoids such as carotenoids and amorpha-4,11-diene.

We also demonstrate the use of synthetic organelles for disease treatment, which we call “organelle therapy”. In one example, we engineered the surface protein of exosomes, and turned these extracellular organelles into drug delivery vehicles for small molecule drugs, miRNAs or CRISPR/Cas9 gene editing tools to targeted cells in the degenerated or damaged cartilage. In another example, we delivered exosomes from umbilical cord stem cells to mouse brain through intranasal administration, and alleviated the autism-like symptoms in a mouse model.

Besides synthetic organelles for biosynthesis and regeneration, we also develop new antibacterial agents against multidrug resistant microbes, including antibacterial peptides, nanoparticles, and enzymes. All these will not be possible without the support from our collaborators including pharmacists, surgeons, and private companies. These examples also showcase the central role of chemistry in multidisciplinary research towards grand impacts on human health.

A Quest for the Physics of Living Matter

Professor WU Yilin

Associate Professor, Department of Physics
The Chinese University of Hong Kong

Life is a unique far-from-equilibrium state of matter. It is one of the greatest mysteries of the observable universe. The origin, organization and evolution of living matter, when viewed together with the physical environment and in the context of the evolution of Planet Earth, are more than biological questions; answering these questions have become an essential and

well-grounded component of physical sciences. In this talk I will introduce our efforts to understand the physics of living matter, especially the motion and spatiotemporal self-organisation of living matter consisting of microbes, and will discuss the lessons learned from these efforts that could be useful for investigators working at the interface of disciplines.



Prof. Wu Yilin obtained his BSc in Physics from the University of Science and Technology of China in 2004 and PhD in Physics from University of Notre Dame in 2009. After postdoctoral research at Rowland Institute of Harvard University, he has been a faculty member in the Department of Physics at The Chinese University of Hong Kong (CUHK) as Assistant Professor (2012-2018) and Associate Professor (2018-present).

Prof. Wu's research interest is in biophysics and quantitative biology. His work has advanced the understanding on microbial motility, collective motion, and self-organisation of biological active matter. He received Young Researcher Award (2017) from CUHK and RGC Research Fellowship (2021-2025) from Research Grants Council of Hong Kong SAR.



Professor XIA Jiang

Associate Professor, Department of Chemistry
The Chinese University of Hong Kong

Trained as a bioorganic chemist, and currently an Associate Professor in the Department of Chemistry and in School of Life Sciences (by courtesy), Prof. Xia works at the interface between chemistry, biology, and biomedicine.

Current projects in his lab include (1) new protein reactions, and the functionalization of proteins and therapeutic antibodies, (2) synthetic metabolons and organelles based on protein assembly technologies for cascade biocatalysis, and (3) protein-based biomaterials for anti-bacterial infection and tissue regeneration.

He has a focused interest in subcellular structures, such as organelles and protein coacervates, and their biocatalytic and biomedical applications in anti-bacterial infection and tissue regeneration such as wound healing, diabetic foot ulcer, and cartilage repair. He has published about 90 research articles, established sustained collaboration with pharmacists, biologists and medical researchers, and been awarded more than 20 external grants, including collaborative grants, NSFC/RGC and ITC Guangdong-Hong Kong Technology Cooperation Funding Scheme as PI, and participated in AoE, CRF, RIF and ITC Midstream Research Programme for Universities as Co-PI. He also holds an adjunct position at Changzhou University and Shenzhen Institute of Advanced Technology. His research also produces patents that are in the process of seeking commercialisation.

SHARING ON COLLABORATIVE RESEARCH FUND



Professor CHAN Man Nin

Associate Professor
Earth System Science Programme
The Chinese University of Hong Kong

Prof. Chan is an Associate Professor and Director in the Earth System Science Programme, Faculty of Science at The Chinese University of Hong Kong (CUHK). His research area is ambient air pollution, focusing on the sources and formation mechanisms of particulate matter (PM). His research group applies novel analytical techniques coupled with high resolution mass spectrometers to investigate the composition and transformation of PM in the atmosphere, such that we can better understand their sources, environmental, and health impacts. Prof. Chan received his PhD in Environmental Science and Engineering at California Institute of Technology. Prior to joining CUHK, he was a postdoctoral fellow in the Chemical Science Divisions at Lawrence Berkeley National Laboratory.

Professor HO Kin Fai

Associate Professor
Jockey Club School of Public Health and Primary Care,
Faculty of Medicine
The Chinese University of Hong Kong



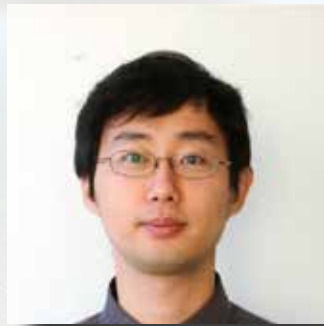
Prof. Ho is an environmental scientist, focusing on exposure assessment of air pollutants in Hong Kong and China. He has strong background in analytical chemistry with many years of solid experiences in toxic air pollutants (TAPs) and health related research. He is also competent in applying cutting-edge analytical chemistry techniques in indoor and outdoor air quality monitoring. He has published over 250 scientific articles in international peer-reviewed journals with overall 13,000 citations. His recent research focuses on toxic air pollutants and their impacts on human health such as particulate matter compositions, sources and health relations, exposure science and particle toxicology.



Professor WEI Yingying

Associate Professor
Department of Statistics
The Chinese University of Hong Kong

Prof. Wei is an Associate Professor in the Department of Statistics. She obtained her bachelor's degree in Mathematics from Tsinghua University in 2009 and her MSc Eng degree in Computer Science and PhD degree in Biostatistics from Johns Hopkins University in 2014. Her research focuses on developing statistical methods for analysing noisy, complex and heterogeneous big genomic data. Her six Bioconductor R packages have been well received by the community, with more than 68,000 downloads to date. Prof. Wei received the Faculty Exemplary Teaching Award from Faculty of Science, CUHK in 2017 and the W. J. Youden Award in Interlaboratory Testing from the American Statistical Association in 2019.



Professor YANG Sen

Assistant Professor
Department of Physics
The Chinese University of Hong Kong

Prof. Yang is an Assistant Professor in the Department of Physics, The Chinese University of Hong Kong (CUHK). He got his BSc from Tsinghua University and PhD in University of California, San Diego. He had worked in University of Stuttgart in Germany before joining CUHK in 2016. His research focuses on quantum optics and quantum information science in solid state systems, especially quantum computing and quantum sensing based on colour centres in diamond. In the recent years, the team has accomplished several breakthroughs. Together with colleagues in CUHK and from Japan, the collaboration team demonstrated the novel sensing for the pressure driven quantum phase transition (Science 366, 1355 [2019]). In 2020, his team invented a novel and universal direct laser writing material deposition method for nanofabrication (Nature Comm. 11, 5334 [2020]), patents have been applied by CUHK for this work.

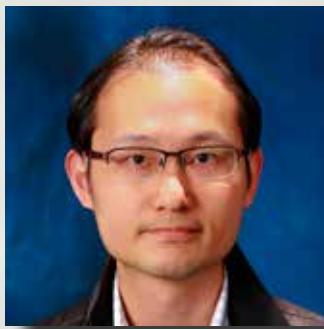
SHARING ON COLLABORATIVE RESEARCH FUND

Professor HUI Ho Lam Jerome

Associate Professor
School of Life Sciences
The Chinese University of Hong Kong



Prof. Hui is the Associate Professor of the School of Life Sciences, The State Key Laboratory of Agrobiotechnology (Partner Laboratory in The Chinese University of Hong Kong) and Simon F.S. Li Marine Science Laboratory of the School of Life Sciences. He is also the Director of Biology Programme, and members of Cell and Molecular Biology Programme, Environmental Science Programme, and Molecular Biotechnology Programme of the School of Life Sciences. He received his DPhil from University of Oxford, and postdoctoral training from University of Manchester and University of Oxford. In this Science Faculty Research Day dialogue with Prof. Kevin Yip, he will share his experiences in the collaborative research and grant applications.



Professor YIP Yuk Lap Kevin

Associate Professor
Department of Computer Science and Engineering,
Faculty of Engineering
The Chinese University of Hong Kong

Prof. Yip is an Associate Professor in the Department of Computer Science and Engineering at The Chinese University of Hong Kong (CUHK). He received his PhD degree in computer science and his postdoctoral training in molecular biophysics and biochemistry, both from Yale University. Prof. Yip's research interests include the use of computational methods to study basic biological systems and the corresponding biomedical applications. Due to the inter-disciplinary nature of his research, Prof. Yip has been involved in various collaborative projects within and beyond CUHK. Prof. Yip has applied/co-applied for the Collaborative Research Fund 32 times and the Theme-based Research Scheme 19 times. In this Science Faculty Research Day dialogue with Prof. Jerome Hui, Prof. Yip will share his experiences in the successful and failed collaborative grant applications and his views on fruitful and suboptimal research collaborations.



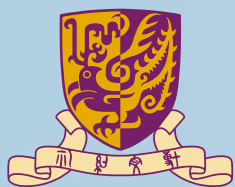
Professor JIANG Liwen

Professor
School of Life Sciences
The Chinese University of Hong Kong

Prof. Jiang is currently Choh-Ming Li Professor of Life Sciences and Director of AoE Centre for Organelle Biogenesis and Function, as well as Director of Centre for Cell and Developmental Biology at The Chinese University of Hong Kong (CUHK).

Prof. Jiang's research team has been working on the underlying mechanisms of protein transport, organelle biogenesis and function in plants for more than 20 years at CUHK, and has been internationally recognised as a leading group in the field.

Prof. Jiang received numerous awards for teaching and research achievements, including CUHK Science Faculty Exemplary Teaching Award 2008, CUHK Research Excellence Award for three times (2006-2007, 2009-2010, 2015-2016), Croucher Senior Research Fellowship twice (2009-10 & 2015-2016), Ministry of Education (MOE) Higher Education Outstanding Scientific Research Output Awards for three times (2009, 2013 and 2017), Outstanding Fellow of the Faculty of Science (2013) and Choh-Ming Li Professorship of Life Sciences (2014).



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