State Key Laboratory of Marine Pollution
SKLMP

10th Anniversary

匯賢聚智　同心十載

Great Minds Unite, Save Ocean with Innovation

Vision & Mission
願景與使命

Vision 願景

To be a key international research centre in advancing marine environmental research that contributes to the protection and management of the marine environment and generates positive societal impact.

致力成為推動海洋環境研究的重要國際科研中心，為保護和管理海洋環境及發展社會福祉作出貢獻。

Mission 使命

- To protect marine environments of Hong Kong, South China, and Asia-Pacific region through high quality multidisciplinary research and innovations relevant to pollution monitoring and control, environmental risk assessment, ecosystem responses to stressors, and ecological restoration.
- 通過高質素的跨學科創新研究，特別是在污染監察和控制、環境風險評估、生態系統對壓力源的響應及生態修復等範疇，來守護香港、華南地區以及亞太地區的海洋環境。
- To build capacity by nurturing and training environmental scientists, managers, and entrepreneurs in the region.
- 培養和訓練環境科學家、管理人員及企業家，以建立地區內的核心能力。
- To support the Hong Kong SAR Government and the Chinese Central Government in the management of environmental quality and protection of marine ecosystems.
- 支持香港特區政府與中央政府監管環境質量及保護海洋生態的工作。

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Photo credit: Dr. Siu Gin Cheung

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Professor Way Kuo
President
City University of Hong Kong

郭位 教授
香港城市大學校長

The State Key Laboratory of Marine Pollution (SKLMP) of City University of Hong Kong (CityU) was formally established in 2010. This year, SKLMP enters its tenth anniversary which is an important milestone and worthy of commemoration.

香港城市大學（城大）的「海洋污染國家重點實驗室」正式成立於2010年，今年邁入第一個十周年，是一個重要的里程碑，很值得紀念。

It has been 12 years since I took up the mantle as President of CityU in May 2008, and I have observed the growth of the Laboratory every step of the way. In 2018, I remember how thrilled I was to witness the Laboratory receive its "Outstanding" rating from the Ministry of Science and Technology (MOST) and HKSAR Innovation and Technology Commission (ITC), and with this accolade, CityU's research in the field of marine pollution was also internationally recognised as excellent. The academic strength of its scientific research team, and laboratory equipment and other facilities are among the best in the field, which further reflects CityU's fulfilment of its mission of education, research and knowledge transfer, a significant contribution to society.

我自2008年5月任城大校長迄今已12年，見證着這所重點實驗室一步步成長。2018年，重點實驗室榮獲國家科技部及香港創新科技署頒發「優秀」級別，更令我感到興奮。此一評定，彰顯了城大在海洋污染領域的研究已達國際先進水平，其科研團隊的學術實力和實驗室的儀器設施等硬件，在同行間亦名列前茅，進一步體現城大踐行了建校辦學的宗旨，即致力於教學、研究與知識轉移，以期有貢獻於社會。

In terms of research achievement and knowledge transfer, the scientific research of "Transgenic Medaka Technology", as an example, has been successfully transferred into commercial applications, resulting in the founding of "Vitargent (International) Biotechnology Limited". This remarkable and innovative technology was awarded the Grand Prix at the 43rd Geneva International Exhibition of Inventions, which further confirmed the deserved international recognition of the Laboratory's research endeavours.

在研究成果及知識轉移方面，實例之一便是將「轉基因鯖鰭魚技術」的科研成果轉移到商業應用而大獲成功，由此創辦了「水中銀國際生物科技有限公司」。該項技術參加2015年日內瓦國際發明展，獲頒「最高榮譽大獎」，更足證這所實驗室的研究成果贏得國際社會讚許。

The global economy and people's lives have been severely affected by the coronavirus pandemic since the year of early 2020. I believe that this pandemic is an alarm bell, reminding us of the importance of the concept of "One Health". One Health concept is one of the five key interdisciplinary research areas of CityU as underpinned in our "Strategic Plan 2020-2025: World-class Research and Education". The integrated approach embedded in the One Health concept emphasises multiple disciplines working together to promote the health of humans, animals, and the environment.

自去年初新冠肺炎流行以來，全球經濟及世人的生活均遭受影響。我相信，疫症是一個警號，提醒我們不能忽視「健康一體化」的重要性。健康一體化是一個整合概念，也是城大的五大跨學科研究領域之一，明載於《2020–2025年策略性發展計劃：世界級研究與教學》。它強調多學科的合作研究，以期保護並增進人類、動物、環境的整體健康。

For instance, microplastic pollution of our oceans is an ever-growing concern. Ingestion of these microplastics by marine organisms is not only causing adverse effects on their health but also ours as they enter our food chain. Sunscreens contain emerging chemical pollutants such as oxybenzone (BP-3), resulting in coral bleaching as they are released into the sea, while the residual substances of antidepressants may induce swimming sluggish in fish and even causing infertility. These examples show that both human and animal health are inextricably connected with the health of the environment.

例如，海洋中的微塑膠污染日趨嚴重，海洋生物可能因吞食塑膠微粒而健康受損，且微粒甚至有進入食物鏈之風險，最終危害人類健康。再例如，不少防曬劑含有新興化學物污染物質如氧苯甲酮（BP-3）成份，進入海水後可致使珊瑚白化，而抗抑鬱藥的殘餘物質則可能使魚類游動呆滯，甚至不能繁殖。這些例子從反面證明人類、動物、環境各方面的健康是環環緊扣、密不可分的。

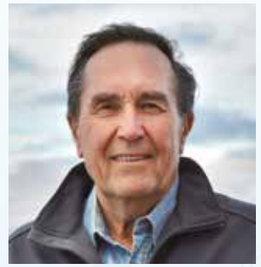
10 Preface
前言

The Laboratory has nurtured a large team of professionals, emphasised by CityU's "Education and Student Development", one of the five strategic themes of the University's long-term development. I believe that University's education and research are complementary to each other - teach without research, the knowledge will be outdated, yet research without teaching students and the knowledge will be lost forever. In order to impart our academic knowledge to our children, we must nurture and transform them into global citizens who are capable of efficient problem solving, effective communication and strong leadership.

這所實驗室多年來培訓人才不遺餘力，使得人才輩出。這正契合城大注重「教學與學生發展」的方針，亦是城大長遠發展計劃中的五大發展主題之一。我相信大學的教學與研究是相輔相成的：教研人員若不做研究，所教的內容便陳舊過時；若僅做研究而不教學生，則研究便失去承傳下一代之意義。我們的學術知識要得以承傳，就必須培育新一代專才，將學生培養成有能力解決問題、溝通交流，並能帶領全社會進步的全球公民。

SKLMP will soon be entering a second and even better decade. On this occasion, we look forward to the future and wish the Laboratory many more great achievements, to keep our oceans blue, healthy and in harmony with mankind.

「海洋污染國家重點實驗室」即將邁入更美好的第二個十年，值此承前啓後之際，我們遠瞻未來，祝願實驗室取得更大成就，令蔚藍的海洋長保健康，以豐盛寶藏與人類共存！



Dr. Donald M. Anderson
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I have been very fortunate to be part of SKLMP from its inception, including serving as Chairman of the International Advisory Committee in recent years. In the early 2000s, I was an international member of the MERIT programme (the Centre for Marine Environmental Research and Innovative Technology), one of eight Areas of Excellence supported by the University Grants Committee. Professor Rudolf Wu led a team of multiple distinguished investigators in the creation of a program to develop innovative chemical, biological, and engineering technologies for monitoring, assessing, and controlling the effects of human activities on the marine environment.

在海洋污染國家重點實驗室（SKLMP）成立之初，我很榮幸成為其中一員，包括近年出任國際顧問委員會主席。本世紀初，我是海洋環境研究及創新科技中心（MERIT）計劃的國際成員，該計劃獲大學教育資助委員會遴選為八個卓越學科領域之一。在胡紹燊教授的帶領下，多名傑出研究人員組成了研究小組並推出一個研究計劃，開發一系列創新化學、生物及工程科技，用作監察、評估及控制因人為活動對海洋環境所造成的影響。

The extraordinary success and productivity of MERIT led to the creation of SKLMP, which retained the majority of the participants and objectives while expanding into new areas of research with new partnerships. In a major departure from typical multi-investigator research programs in Hong Kong, this time the funding approach involved the formation of a State Key Laboratory (SKL) based in Hong Kong, but following the framework of the SKLs in Mainland China.

MERIT非常成功，成果豐碩，由此促成了SKLMP的創辦，大部分參與人員及研究目標得以保留，同時向新研究領域拓展。當時香港的典型研究計劃是有多位研究學者同時參加，而這次在香港成立國家重點實驗室的資助方式跟過往大相徑庭，要依照內地國家重點實驗室的架構。

At the time, there were only a handful of other SKLs in Hong Kong, as this was a new concept to foster high-level research jointly between Mainland China and the Hong Kong Special Administrative Region.

Those were challenging times, as initial funding was quite low (HK$2M per year), with many deserving projects to support and critical infrastructure to purchase. Through the hard work of SKLMP leadership, and in particular former Director Professor Paul Lam and Associate Director Dr. Leo Chan, that funding has increased to $10M per year at the present time, bringing SKLMP to the funding level of many SKLs in Mainland China, a significant accomplishment indeed. Since its inception in 2010, SKLMP as supported more than HK$27M in research, providing funding to more than 60 Principal Investigators at 10 institutions (including three collaborative institutions outside Hong Kong).

In this book, the history and noteworthy achievements of SKLMP are presented. From my perspective, SKLMP is highly productive, respected, and now moving forward with new leadership and vision under Director Professor Kenneth Leung. I am pleased to have been a part of that growth and success and look forward to continued interactions with a team of highly skilled scientists working in one of the most vibran and environmentally challenging areas of the world.

其時，香港的國家重點實驗室寥寥無幾，而這個全新的理念，可促進內地與香港特別行政區攜手進行高層次的研究。

那段時期可謂困難重重，因首筆撥款甚少（每年200萬港元），而值得支持的研究計劃頗多，需要購置重要的基礎設備亦不少。透過SKLMP管理層的努力，特別是實驗室前主任林群聲教授和副主任陳荔博士，現時的資助已增至每年1,000萬港元，使SKLMP達到內地許多國家重點實驗室的撥款水準，這確實是一項重大成就。自2010年成立以來，SKLMP為各項研究提供了逾2700萬港元的支持，為10間研究機構（包括3間香港以外的合作機構）的60多名主要研究人員提供了資助。

本書回顧了SKLMP的歷史及其令人矚目的成就。依我看來，SKLMP富卓越成效和備受尊崇。如今在實驗室主任梁美儀教授的新領導和新願景下繼續砥礪前行。我很高興能夠參與實驗室的發展，並與團隊分享實驗室的成果。我熱切盼望能繼續與來自這個全球最具活力及環境挑戰之地的傑出科學家團隊有更多的互動。

Preface 前言

It is hard to believe that 10 years have passed since the creation of the State Key Laboratory of Marine Pollution (SKLMP) was established in Hong Kong. I have had the honor to have participated in many aspects of it's development over these years. The SKLMP has fostered a cavalcade of positive experiences and friendships, for which I will be forever thankful. I remember early days of meetings among key individuals at the 6 primary universities to discuss if it was possible to establish a state key laboratory. Once it was decided to go for it, the theme of marine pollution was chosen as a socially relevant area to which each university could contribute. Once the kernel of an idea started to form, there were a number of trips to the mainland to discuss the potential with various agencies and administrators, followed by trips to various universities on the mainland to develop partnerships. In the end it was decided that the best match was with the State Key Laboratory of Marine Environmental Science (MEL) at Xiamen University. Early in this relationship I was made a guest professor in the College of Oceanography and Environmental Science and MEL. Over the years I have made many trips to Xiamen to collaborate on research projects and had the privilege to teach in the joint summer short course in Marine Pollution, which alternated between Xiamen and Hong Kong.

海洋污染國家重點實驗室(SKLMP)在香港成立至今，轉眼已是十年，真令人難以置信。十年來，我很榮幸從多個層面參與了實驗室的發展。在SKLMP，有過美好的經歷，結識了不少朋友，對此我將終生感激。記得在當年，六所大學的關鍵人物開會討論是否可創建一個國家重點實驗室。一旦下定決心去做，就選定了海洋污染這個主題，因為它是一個與社會息息相關的領域，每所大學都可為之作出貢獻。構思的核心一旦開始形成，我們就開始多次前往內地，與多個機構和管理層探討合作，然後再去多所內地大學建立夥伴關係。最終，我們確認廈門大學近海海洋環境科學國家重點實驗室是最佳的伙伴。在兩校合作的早期，我獲委任為海洋與環境學院及近海海洋環境科學實驗室的客座教授。這些年來，我多次前往廈門開展合作研究計劃，並有幸在廈門及香港輪流舉辦的海洋污染暑期聯合課程中任教。

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This was a very rewarding experience for all of the students and over the years grew in numbers of students and countries from which they hailed. I have also been fortunate to attend many of the annual conferences put on by the SKLMP. I have been impressed by the scholarship as well as breadth and depth of the studies undertaken by the various faculties and students supported by the SKLMP. The mentoring of students by faculty as well as the comradery developed among students and postdocs has been wonderful. I truly believe that the SKLMP facilitated better communication between and among groups in Hong Kong that hasled to collaborations that have resulted in synergies and discoveries and advancement of science that otherwise might not have happened. I know I am better for having been a part of the SKLMP.

Finally, as Hong Kong has continued the process of being reintegrated into the Greater Bay Area of China, the SKLMP has strengthened those ties through many collaborations and exchanges of students between institutions in Hong Kong and those in mainland China. For me personally, that has resulted in opportunities to meet new colleagues at various universities and recruit students and postdocs to my laboratory here in Canada. SKLMP has enriched the lives of the participants as well as fostered excellent science and furthered exchanges of culture and understanding as well as technical information. It has been a most rewarding journey that I am sure will continue for many years to come. Congratulations, SKLMP, you have progressed a long way; Best wishes for the decades to come.

對修讀課程的學生來說，這是獲益良多的經歷。過去幾年來，學生人數及參與國家在不斷增加。我很榮幸多次參加SKLMP舉辦的年度會議。SKLMP支持的眾多成員及研究生進行高水平和富深度的科研，令我印象深刻。教員對學生的諄諄善誘，學生及博士後的同窗情誼，令人感動。我認為SKLMP促進了香港各個相關科研團隊的交流，促成了合作，推動了科技的協同效應、發現與發展，若無SKLMP，未必能有今天的成就。我很清楚，正是身為SKLMP的成員，讓我能更進一步。

隨着香港繼續融入中國的大灣區，SKLMP通過本港與內地院校之間的緊密合作和學生交流，加强了聯繫。對我個人來說，透過這些協作交流，讓我有機會在不同大學結識新同事，亦使我覺得合適的研究生及博士後到我位於加拿大的實驗室。SKLMP豐富了參與者的生活，培育了卓越的科研，增強了文化交流、相互理解與科技資訊的互通。這是一段碩果累累的歷程，我相信，SKLMP在未來許多年裏將依然大有作為。祝賀實驗室已順利走過長路，祝實驗室在今後再展宏圖。

Preface 前言

Ocean is closely related to human's living environment, while human's economic activities have been interfering functions of the ocean, especially in the coastal waters. Since reform and opening up began, China's economy has developed significantly. However, it also exerts great pressure on the coastal waters, resulting in serious deterioration of coastal ecological environment.

The mission of the State Key Laboratory of Marine Pollution (SKLMP) is to protect the marine environment of Hong Kong and South China by identifying major threats, and developing tools and technologies to address and solve these problems. Over the past decade, the SKLMP covered quite extensive research areas and accomplished some remarkable achievements in the international arena.

As the Guangdong-Hong Kong-Macao Greater Bay Area and its coast are facing a deteriorating condition in terms of ecological environment, it is of particular importance to coordinating the utilization of marine resources and the protection of marine ecological environment. As the Chairman of the first two terms in the SKLMP Academic Committee, and I witnessed its steady development and naturally come to expect more of its further advancement.

海洋與人類生存環境息息相關，人類的經濟活動也一直在干擾着海洋尤其是近海的各項功能。改革開放以來中國經濟發展迅速，同時也爲我國的近海帶來了很大的壓力，導致近海生態環境嚴重惡化。

海洋污染國家重點實驗室的使命是：為保護香港和華南地區的海洋安全，識別海洋環境面對的主要威脅，並發展解決這些問題的相關技術和設備。實驗室過去十年的研究範圍頗為廣泛，並取得了不少在國際上具代表性的突出成果。

由於粵港澳大灣區及近海生態環境日益惡化，協調好海洋資源的利用與海洋生態環境保護之間的關係顯得尤為重要。作為實驗室學術委員會首兩屆的主席，我見證了海洋污染國家重點實驗室的穩定發展，對實驗室也有着更高的期望。

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State Key Laboratory of Satellite Ocean Environment Dynamics, Second Institute of Oceanography, Minstry of Natural Resources

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衛星海洋環境動力學
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The SKLMP should proactively conduct more field studies in the ocean, and organically integrate the field and laboratory works. Also, we should extensively conduct comparative research studies at global scale to gain a deep understanding of the problems that the ocean is actually facing.

實驗室要更積極走進海洋之中，有機地結合海洋實地考察和實驗室研究工作，並廣泛開展全球性的比較研究，以深入認識海洋正面臨的實際問題。

The SKLMP can focus on several specific research areas, build multi-teams of innovation, and encourage cross-sectoral team cooperation in major projects so as to foster the team spirit and the sense of identity. The research theme should also aims at finding solutions to related societal issues and the research perspective should be more widened and internationalized.

實驗室可聚焦幾個特定範疇的研究領域，建立多個創新團隊，鼓勵跨團隊協作研究重大項目以提高成員的合作精神與身份認同感，而研究主題應該是解決與社會相關的問題，研究的角度和層面應更加廣泛與國際化。

President Jinping Xi once said, “We must protect the marine ecological environment, pursue coordinated development of land and sea, and achieve harmony between mankind and the ocean. On the basis of maintaining the natural rehabilitation capacity of the ocean, we should scientifically and rationally utilize the marine resource, so that the marine ecological environment in China can make distinct improvements.” Regarding this, I hope the SKLMP can build on the present foundation and significantly advance and make more contributions to sustainability and protection of the marine environment.

我期望實驗室能在現有的基礎上，百尺竿頭，更進一步，為習近平主席所強調的「要保護海洋生態環境，堅持走陸海統籌、人海和諧的道路，在維護海洋自然再生產能力的基礎上，科學合理開發利用海洋資源，讓我國海洋生態環境有一個明顯的改善」貢獻出一份力量。

圖片來源： 曾康泰先生
Photo credit: Mr. Hong Tai Tsang

Director's Message
主任獻辭

The 10th anniversary is the moment for thanksgiving
十周年是一個感恩時刻

Professor Kenneth Leung
Director of SKLMP
City University of Hong Kong

梁美儀 教授
海洋污染國家重點實驗室主任
香港城市大學

The year 2020 marks the tenth anniversary of the State Key Laboratory of Marine Pollution (SKLMP). As one of the founding members of SKLMP, I am very pleased to witness the steady and healthy development of our laboratory over the past 10 years. I am profoundly honoured to be appointed as the Director of SKLMP to lead the laboratory into a new chapter.

2020年，海洋污染國家重點實驗室(SKLMP)邁進十周年。作為SKLMP其中一位創始成員，我很高興能夠見證着實驗室在過去十年來的穩健發展，更感到非常榮幸獲委任為實驗室主任，帶領實驗室邁進新里程。

While preparing this preface, the keyword that came up in my mind was 'thanksgiving'. First and foremost, I would like to extend my heartfelt gratitude to the co-founder Professor Rudolf Wu, for creating the Area of Excellence Centre of Marine Environmental Research and Innovation Technology (MERIT) which is a precursor for establishing the SKLMP. My sincerest gratefulness goes to the former Director of SKLMP, Professor Paul Lam for his dedicated leadership to build the team and ensuring the sustainability of SKLMP over the past decade. All of our past and current academic advisors from Mainland China and overseas, especially our best friends from Xiamen University are sincerely thanked for their encouraging advices, support and collaboration. We are also very grateful to the Ministry of Science and Technology, Innovation and Technology Commission, and City University of Hong Kong for their guidance and support throughout the years.

當我準備撰寫序言時，「感恩」兩個字在我腦中一直縈繞不去。首先，我想向聯合創辦人胡紹燊教授致以衷心的感謝，他創立了卓越學科領域的「海洋環境研究及創新科技中心」(MERIT)，即實驗室的前身；我非常感謝實驗室前主任林群聲教授，他建立了一支精英團隊及促使實驗室在過去十年間得以持續發展；我感謝來自中國內地及海外的學術顧問，特別是在廈門大學的摯友，一直給予我們寶貴的建議、支持與合作；我也要感謝國家科學技術部、香港創新科技署及香港城市大學多年來的指導與支持。

SKLMP was officially founded in 2010, but our footprint can be traced back to 2004, when MERIT was established to unite top notch academics with different expertise from six universities across Hong Kong. I am one of the poster children of MERIT-SKLMP because I literally grow up and develop my academic career in this family.

SKLMP於2010年正式成立，但我們的足跡其實可追溯自2004年。當年MERIT成立，匯集了香港六間大學不同專業知識的頂尖學者。而我正是MERIT-SKLMP的其中一名「代表出品」—— 這個「家庭」讓我如幼苗茁壯成長，並建立了自己的學術生涯。

The uniqueness of MERIT-SKLMP is its inter-university, multidisciplinary, inclusive and collaborative research environment that gathers together many great minds to become greater together. When I was an Assistant Professor, I had ample chances to interact and work with many renowned scholars like the late Professor John Gray (a marine ecologist), Professor John Giesy (an environmental scientist), Professor Joseph Hun Wei Lee (an engineer) and Professor Wai Keung Li (a statistician). I was able to learn from them on how to think, develop research questions, conduct high quality collaborative research, analyse the results, write manuscript and communicate effectively. Through observing the leaderships of Professors Rudolf Wu and Paul Lam, and Dr. Paul Shin. I also learnt how to develop successful group-research proposals, successfully run collaborative projects and organize fruitful international conferences. I am indebted to all of my mentors and collaborators in this caring family.

MERIT-SKLMP的獨特之處在於它是跨大學、跨學科、具包容性及富合作性的研究環境，匯聚了許多優秀學者，促進彼此的專業交流，激發出類拔萃的想法，遇強越強。當我還是助理教授時，我有很多機會與知名學者互動和合作，例如已故的 John Gray 教授（海洋生態學家）、John Giesy 教授（環境科學家）、李行偉教授（工程師）及李偉強教授（統計學家）。我從他們身上學會如何思考、設計研究問題、進行高質素的合作研究、分析結果、撰寫學術文章及實踐有效溝通。透過觀察胡紹燊教授、林群聲教授及單錦城博士的領導方法，我從中學會如何帶領團隊撰寫成功的研究計劃書，成功地開展及完成合作項目，以及組織具成效的國際會議。蒙各恩師的提攜及合作夥伴的關懷，確實不勝厚幸。

As a good way of thanksgiving, I have taken up the torch from Professor Paul Lam with boundless support and encouragement from the President of City University of Hong Kong, Professor Way Kuo. I will make every effort to bring SKLMP to new heights. We will continue our fine heritage to provide a conducive environment for nurturing our next generations of scientists for Hong Kong and the Greater Bay Area of China, whilst advancing science and technology for the betterment of the marine environment and mankind.

飲水思源，在香港城市大學校長郭位教授的大力支持和鼓勵下，我從林群聲教授手中接過棒來，務必竭盡所能帶領SKLMP再闖高峰，讓我們優良的傳統延續下去，為培育香港及大灣區下一代科學家提供一個有利的環境，同時發展科學技術以改善海洋環境與人類福祉。

Looking forward, my vision is to create and maintain our competitive advantage, particularly in today's highly competitive research environment. Members of SKLMP shall work closer together to identify and tackle the biggest and most eminent grand challenges in marine environmental research. At the same time, we shall accelerate our speed in translational research to promote innovations and technological advances in pollution monitoring and control, as well as contribution to the formulation of effective environmental management strategy and policy for supporting the nation, and the Government of the Hong Kong Special Administrative Region.

SKLMP has come a long way in 10 years. We are very proud of what we have achieved and confident in moving ahead with even higher aspirations. On this very special occasion, I would like to thank all current and former members of the SKLMP, our partners, the government and all those who have supported our work. All the achievements without them could not have been possible. Special mentions must be given to President Way Kuo, Mr. Kam Sing Wong, Dr. Siu Fai Leung, Ms. Rebecca Ting Ting Pun, Mr. Hoi Shan Hsu, Professor Jilan Su, Professor Dake Chen, Professor Fengchang Wu, Professor Minhan Dai, Professor Huasheng Hong, Professor John Giesy, and Dr. Don Anderson for kindly sharing their words of wisdom and congratulatory remarks in this anniversary book. I would also like to express my deep gratitude to our members of SKLMP who have contributed their stories in this book. The great effort of the production team especially the leadership of our Communication Officer, Ms. Agnes Liu for accomplishing this book in such a short time is most appreciated. Founding on the wonderful past and members' concerted efforts, we will jointly create a splendid future for SKLMP.

展望將來，我的願景是在當今競爭激烈的研究環境中，創造並保持我們的競爭優勢。SKLMP的成員應緊密合作，共同探索和應對海洋環境研究中最前沿和最重大的挑戰，同時，我們會大力支持國家和香港特別行政區政府加速科技成果轉化，促進污染監測和控制領域的創新科技研發，以及為協助制定有效的環境管理策略和政策作出貢獻。

SKLMP在這十年來走過了一段漫長的路，我們為取得的成就感到自豪，並對實踐更遠大的抱負充滿信心。在這個非常特別的時刻，我要感謝SKLMP所有現任及前任成員、合作夥伴、政府部門及所有支持我們工作的人。沒有他們的支持，便沒有今天的成就。於此，我要特別感謝郭位校長、黃錦星先生、梁肇輝博士、潘婷婷女士、徐海山先生、蘇紀蘭院士、陳大可院士、吳豐昌院士、戴民漢院士、洪華生教授、 John Giesy 教授及 Don Anderson 博士在本紀念特刊中惠贈充滿睿智的賀辭。我還要感謝SKLMP成員在書中分享了自己的故事，還有感謝出版團隊的努力，特別是傳訊主任廖婉薇女士帶領製作團隊在短時間內完成這本紀念特刊。建基於美好的過去和成員的共同努力，我們將一起為SKLMP創造光輝的未來。

圖片來源： 曾康泰先生
Photo credit: Mr. Hong Tai Tsang

Congratulatory Message
賀辭

香港城市大學海洋污染國家重點實驗室十周年誌慶

覃研科技
保護海洋

環境局局長　黃錦星

香港城市大學海洋污染國家重點實驗室十周年誌慶

實驗室憲集本地優秀科研人員，致力進行海洋污染和生態等多方面研究，並積極推動海洋生態及生物多樣性保育工作，貢獻良多。

謹祝百尺竿頭、繽創佳績！

漁農自然護理署署長　梁肇輝博士

香港城市大学海洋污染国家重点实验室十周年志庆

贵实验室成立十余年来，英才荟萃，成绩斐然，谱写了我国海洋环境与生态安全研究领域的崭新篇章。感佩之余，愿与贵室同仁携手奋进，为促进粤港澳大湾区发展、实现海洋强国梦而共创辉煌！

南方海洋科学与工程广东省实验室（珠海）主任

中国科学院院士　陈大可　教授

香港城市大學海洋污染國家重點實驗室十周年誌慶

人海和諧　澤被後代

創新科技署署長　潘婷婷女士

香港城市大學海洋污染國家重點實驗室十周年誌慶

浩瀚水世界　孕育千萬種
海洋實驗室　十年深耕作
匯聚群英志　愛護與探索
研究碩果豐　創科譜新章

京港學術交流中心總裁　徐海山

香港城市大学海洋污染国家重点实验室十周年志庆

贵实验室自成立以来，恪守理论联系实际，崇尚笃实严谨，在海洋污染监测、风险评估及污染控制等方面取得系列重大创新成果，为我国海洋生态环境保护与修复，及海洋学科发展做出重要贡献。期望贵实验室在新时代继续加强合作，永怀爱国之情，永念强国之梦，勇挑时代重担，争做科技创新先锋，支撑国家海洋环境保护战略。

中国环境科学研究院环境基准与风险评估国家重点实验室主任
中国工程院院士　吴丰昌　教授

10 Organisation Structure
組織架構

學術委員會 Academic Committee

國際顧問委員會 International Advisory Committee

王文雄 教授
Prof. Wenxiong Wang
H2O*主任
Director of H2O*

梁美儀 教授
Prof. Kenneth Leung
實驗室主任
Director

實驗室管理委員會 Laboratory Management Committee

實驗室諮詢委員會 Lab Consultative Committee

陳 荔 博士
Dr. Leo Chan
實驗室副主任
Associate Director

3大策略性研究小組 Three Strategic Research Teams

主題一 * Theme 1*	主題二 * Theme 2*	主題三 * Theme 3*
 張彤 教授 **Prof. Tong Zhang** 組長 **Leader**	 王文雄 教授 **Prof. Wenxiong Wang** 組長 **Leader**	 邱建文 教授 **Prof. Jianwen Qiu** 組長 **Leader**
 郭駿傑 博士 **Dr. Chun Kit Kwok** 副組長 **Deputy Leader**	 林忠華 博士 **Dr. James Lam** 副組長 **Deputy Leader**	 陳荔 博士 **Dr. Leo Chan** 副組長 **Deputy Leader**

實驗室行政 Lab Administration

吳敏慧 **May Ng** 行政主任 **Executive Officer**

關麗嫦 **Candy Kwan** 文 員 **Clerk**

廖婉薇 **Agnes Liu** 傳訊主任 **Communication Officer**

周曉恩 **Grace Chau** 項目主任 **Project Officer**

張皓婷 **Sora Cheung** 項目助理 **Project Assistant**

實驗室管理 Lab Management

吳佳俊 **Dr. Jiajun Wu** 科學主任 **Scientific Officer**

晏 萌 **Dr. Meng Yan** 科學主任 **Scientific Officer**

實驗室成員 SKLMP Members

研究人員及 Research Staff and

研究生 Postgraduate Students

*主題一：污染監控的創新科技
主題二：生態安全與環境風險評估
主題三：生態系統響應與生態修復

*Theme 1: Innovative Technology for Pollution Monitoring and Control
Theme 2: Eco-safety and Environmental Risk Assessment
Theme 3: Ecosystem Responses and Ecological Restoration

*H2O：海洋與人類健康研究中心
Research Centre for the Oceans and Human Health

10 Our Story
我們的故事

How It All Began
從心啓航

2020 marked the 10th anniversary of the State Key Laboratory of Marine Pollution (SKLMP).

This unique State Key Laboratory comprises top-notch scientists across an unprecedented range of disciplines coming from seven Hong Kong universities. Its operation model sets a new example for the scientific research community in Hong Kong and mainland China. However, this model was less than favourable during the application process until it was rated as “Outstanding” by the Ministry of Science and Technology (MOST), and subsequently upgraded as an independent SKLMP in late 2018. “The State Key Laboratory proposal was the most difficult one that I had ever written in the past 30 years of my profession.” admitted Professor Rudolf Wu, co-founder of SKLMP. Despite the process being full of twists and turns, he was committed to the mission of uniting Hong Kong’s talents in marine environmental research. Being a steersman, he braved the wind and waves, never forgot his original intention and sailed towards the vision of sustainable development.

To uncover the legends of SKLMP, co-founding Professors Rudolf Wu and Paul Lam, and Professors H.S. Hong and M.H. Dai, both significant contributors to the successful establishment of SKLMP, shared their valuable experiences and challenges encountered during the process of application. They also give their good wishes to Professor Kenneth Leung, the new Director of SKLMP who received the torch from Professor Lam in August 2020. Since then, Professor Leung takes the lead to embark on a new journey. Under his leadership, talents will be united to protect the blue ocean with science and innovative technologies.

海洋污染國家重點室自2010年成立至今，已經走過十個年頭。

這間與別不同的國家重點實驗室，是由香港七間大學的優秀海洋科學家組成，其破天荒的「跨大學、跨學科」運作模式，為本港以至內地的科研界樹立了新模式。其實，這個模式在當初申請時並不被人看好，至2018年終獲國家科技部的「優秀」評級肯定並升格為獨立「國家重點實驗室」，過程可謂波折重重，歷盡艱辛。即使「見慣風浪」的國家重點實驗室聯合創辦人胡紹燊教授亦坦承，申請過程是三十年來的職業生涯中最艱辛的。然而，堅毅的他為肩負起團結本港海洋科研人才的使命，乘風破浪，迎難而上，為本港海洋研究發展「掌舵」，千帆過盡，不忘初心，駛向可持續發展的願景。

為揭開SKLMP成立的心路歷程，聯合創辦人胡紹燊教授與林群聲教授，以及促成SKLMP誕生的洪華生教授與戴民漢教授，將在本特刊中分享他們在申請與建設過程中的寶貴經驗及所面對的各種挑戰；並向剛於2020年8月接替林群聲教授出任SKLMP新主任的梁美儀教授致以衷心的祝福。

長風破浪會有時，直掛雲帆濟滄海。海洋污染國家重點實驗室主任梁美儀教授秉承初心使命，在他的帶領下，匯賢共進護碧海，致知創新治污染。

10

Pass the Sun's spirit onto the next generation

有容乃大 桑火相傳

The blueprint of the SKLMP stemmed from the "Center for Marine and Environmental Research and Innovative Technology" (MERIT), funded by the Areas of Excellence (AoE) Scheme in 2004. Professor Rudolf Shiu Sun Wu, the former Chair Professor and the founding Head of the Department of Biology and Chemistry at CityU, was disappointed with the poor level of research collaboration between local universities whilst they eagerly formed partnership with renowned universities overseas. To address this issue, he came up with a mega multidisciplinary project proposal, with the mission of uniting eminent academics with different expertise from six universities across Hong Kong to start the journey.

海洋污染國家重點實驗室是建基於2004年卓越學科研究領域計劃（AoE）的「海洋環境研究及創新科技中心」（MERIT）。當時任職香港城市大學生物及化學系講座教授暨創系主任胡紹燊教授，有感於本港的大學彼此鮮有合作；卻以跟外國名牌大學合作為榮，認為很不合情理。所以，他便構思利用一個嶄新的大型科研項目，以凝聚香港不同大學和學科的學者來發揮大家專長，自己更毋懼挑戰當了「舵手」。

Professor Rudolf Shiu Sun Wu
Co-Founder of SKLMP

胡紹燊 教授
海洋污染國家重點實驗室
聯合創辦人

"Hong Kong is such a small place, and it lacked critical mass of professionals in any single field in a university, unlike in foreign famous universities and research institutes." said Professor Wu, who believed that it would be difficult to attain ground-breaking achievements, if researchers are not united and strive towards a common goal with global impact.

「香港是個很小的地方，無論任何領域，在同一院校都難以籌組較大型的專家團隊，跟外國著名大學及科研機構無可比擬。」胡教授深信，如果香港的研究員不團結一致，做一些具全球影響力的科研，則難成大業。

In 2004, he formed a team of 29 biologists, chemists, physicists, statistician and engineers from six local universities and a joined force with 10 top notch overseas environmental scientists. Together they successfully won an AoE grant from the University Grants Committee (UGC) to establish MERIT. Throughout the years, the team clinched a number of international awards, and made Hong Kong highly visible in the international arena of marine sciences.

2004年，胡教授凝聚了來自六間大學、包括生物、化學、物理、統計、工程等領域29個學者，以及10名外國頂尖環境科學家，向教資會成功申請AoE研究資助，成立了MERIT。多年來，團隊不同的創新科研成果奪得多項國際大獎，更使香港在國際海洋環境研究領域上聲名鵲起。

"Hong Kong has no shortage of elites. Our success was not built on individual smartness, but synergy." His team comprised of reputable professors and talented young scientists with great potential. But what made the team so attractive to join? "Good academics are not attracted by money; but by novel ideas that inspire and enable them to work on ground-breaking projects, which can only be done through collaboration."

「我們成功，不是因為我們特別『叻』，香港很多『叻』人，但我們勝在有凝聚力！」胡教授的團隊成員都是在海洋研究方面的權威教授，或極具潛質的年輕科學家。這團隊有何吸引力呢？「他們不是為錢，而是認同你的想法，希望做一些他們獨自不能做到的跨學科、有突破性的研究。」

MERIT's team model had achieved unprecedented success and it was not only highly commended by UGC's review panel, but also belauded by UGC as "true collaboration". However, Professor Wu was frustrated because AoE stipulated that only two grants can be awarded with a maximum ten-year span to any project, regardless of how innovative and earth-shattering the project is. "It was a great pity to see a decade of hard work built by a world leading team vanish."

MERIT的團隊模式獲得空前成功，贏得教資會評審委員會高度評價，教資會更讚揚MERIT是「真正合作」的科研團隊。可惜AoE規定，即使驚天動地的項目和成果，最多也只能獲得兩期、最多十年的資助。胡教授慨嘆：「辛苦地磨劍十年，建立了具國際領導地位的項目，卻不能持續發展。」

MERIT team attended Symposium on the State of the Pearl River Delta in Sept 2007.
MERIT團隊於2007年9月出席珠江三角州生態環境研討會。

One door closes, another opens
團隊模式不被看好

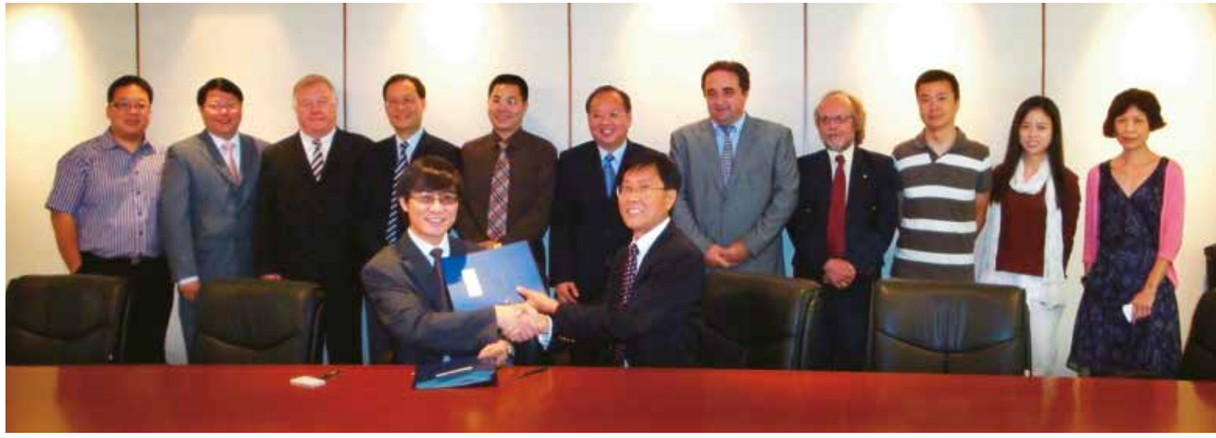
In 2006, the Ministry of Science and Technology (MOST) invited universities in Hong Kong to submit proposals for establishment of Partner State Key Laboratories. Professor Wu realised that State Key Laboratory would enable the sustainability for MERIT, so he submitted an application. However, this idea wasn't well-received by the authority initially. "Joint collaboration between six universities is very challenging, especially in its management, and there has been no successful precedent case in the Mainland thus far."

適逢2006年國家科學技術部計劃在香港成立國家重點實驗室夥伴實驗室，邀請香港的大學提交申請建議書。胡教授察覺設立國家重點實驗室才是長久之計，於是着手籌備申請，不過最初並未得到評審的認同：「要管理由六間院校合作的計劃滿有挑戰，此類項目在內地暫無成功先例。」

> "I spent much time and effort in preparation of the proposal, and it was the toughest mission in my 30 years of professional career."
>
> 我花了很多時間和精力去預備這份計劃書，是我三十年來職業生涯中最辛苦的一次！

The application process was presented with tremendous challenges. Professor Wu recalled, "I spent much time and effort in preparation of the proposal, and it was the toughest mission in my 30 years of professional career." In addition to the sheer scale of the project, the selection and assessment criteria between Hong Kong and the Mainland were also quite different. As such, an application must pass the expert panels of the Hong Kong Innovation and Technology Council (ITC) first, then followed by the scrutiny of the review panel of the MOST. Therefore, all application documents must be written in bilingual. "I have been revising and translating the documents for months, during that period I was not able to go to bed until one o'clock in the morning."

申請過程充滿挑戰，胡教授坦言：「我花了很多時間和精力去預備這份計劃書，是我三十年來職業生涯中最辛苦的一次！」除了因為計劃規模龐大，香港跟內地的評核準則亦截然不同。胡教授指出，申請要先後通過香港創新科技署專家小組和內地科技部專家小組兩次不同的審核，所有申請文件要有中、英文對照版本。「我花了好幾個月來完善文件的執整及繙譯工作，在這段期間，我差不多每天工作到凌晨一時才可以睡覺！」



Professor Wu signed a joint application document with Professor Dai.
胡紹燊教授與戴民漢教授簽署聯合申請文件。

Practice Putonghua
操練普通話

Before heading to Beijing to give his presentations in Putonghua to the MOST panel, Professor Wu was teased by one of his Mainland students that he could not even pronounce his own name correctly. Professor Wu laughed at himself, “I am thick-skinned, I am not afraid of being embarrassed” However, since he could not afford to miss any chance in the application, he later asked that student to be his Putonghua teacher and to correct his Putonghua “word for word”. He practised his Putonghua proficiency diligently for months. Eventually, his Putonghua at the official presentation impressed the Mainland audience and colleagues.

But something shocking happened. Just one month before the deadline, the team was informed that the mode of joint application between universities in Hong Kong was cancelled, and only application with a partner in the Mainland would be considered. Many local universities found it too late to do anything about it. When Professor Minhan Dai, Director of the State Key Laboratory of Marine Environmental Science (Xiamen University) heard about this difficult situation, he lent his helping hand and immediately flew to Hong Kong to sign a joint application document with CityU. Professor Wu is still thankful to Professor Dai for his timely aid after ten years: “The State Key Laboratory wouldn’t have been established without the kindness and great help of Xiamen University.” He also expressed his special gratitude to Dr. Leo Chan (Associate Director of SKLMP) who travelled to the mainland frequently to deal with a range of issues with relevant mainland officials. Professor Wu said, “The fact that he (Dr. Chan) helped me without expecting anything in return makes me even more grateful.”

申請過程中，胡教授必須數次到北京的國家科學技術部會談，用普通話做申請簡報及作答辯。其中有一件趣事，他練習用普通話做申請簡報及答辯時，曾無奈被他的內地博士研究生調侃，揶揄他連自己的名字也讀不準。他自嘲：「我面皮厚，其實不怕瘀（不怕出醜）」，但因這次申請不容有失，所以他請了這位博士學生當他的普通話老師，「逐隻字、逐粒音」糾正他，操練歷時數月，結果在正式面試時，連內地同事也對他的普通話刮目相看。

還有一次驚險的經歷，團隊在截止前一個月才獲悉申請模式有變。原計劃單獨以AoE的團隊聯合申請模式突然被取消，一個月內，香港申請單位必須改為伙拍一間內地單位申請，這令很多提交了申請的本港大學都被殺個措手不及。當時，合作多年的廈門大學近海海洋環境科學國家重點實驗室主任戴民漢教授獲悉此事後，二話不說便特地飛到香港，跟城大簽署聯合申請文件。事隔十年，胡教授至今仍難以忘懷：「我真的很感激戴民漢教授這樣義不容辭的幫助，國家重點實驗室能夠成立，廈門大學實在功不可沒。」胡教授還特別感激陳荔博士(海洋污染國家重點實驗室副主任)為申請實驗室頻頻到內地奔走。胡教授衷心感激：「他（陳荔博士）幫我們申請實驗室，從不計較什麼，只因認同我們的想法，所以我更欣賞他。」

Professor Wu believes that the quality of team members is most critical.
胡教授認為團隊質素最為重要。

> The most important thing is our strong unity in pursuing something that have an impact on China and globally.
>
> 最重要大家團結起來，同心合力做些大型的、對中國和世界有正面影響的研究。

Professor Wu believes that the quality of team members is most critical, and one should take an inclusive attitude to attract and accommodate all talent. He thinks SKLMP should first identify research areas that are not only significant problems in the coming ten years, but also can capitalize the distinct competitive advantages which Hong Kong has. This way, we can have a niche area to our advantage and make the best use of our expertise in Hong Kong.

As soon as the State Key Laboratory was officially approved by the MOST in 2009, Professor Wu left CityU and joined the University of Hong Kong, and Professor Paul Lam was then appointed as Director of the Laboratory. Professor Wu was strongly persuaded by his MPhil. supervisor, Professor Brian Morton, to take up the new position of the Director and Chair Professor of the School of Biological Sciences at HKU. “I had never thought about leaving CityU, but after much deliberation I accepted the offer. I wanted to make a contribution to my alma mater and do something different.”

Professor Wu still gets excited when he read the letter from the MOST confirming the establishment of SKLMP.
胡紹燊教授重看科技部發給SKLMP申請成功的確認信時，仍難掩興奮之情。

胡教授重視團隊質素，選賢任能，有容乃大。他寄語：SKLMP首要判斷未來十年世界重要的科研課題和香港擁有獨特的競爭優勢，然後廣納人才，凝聚團隊成員合作，創新突破。這樣才可以建立具有優勢的研究領域，同時也令香港人才的優勢得到最佳發揮。

然而，正當國家重點實驗室伙伴實驗室在2009年獲國家科技部批准申請之時，胡教授事業再創高峰，轉職香港大學，實驗室主任一職由林群聲教授接棒出任。「我從沒想過到港大，但因為師傅Brian Morton (香港大學榮譽退休教授)希望我重返母校領導生物科學學院。」經深思熟慮後，他最終接納師傅建議，赴任港大生物科學學院院長及講座教授，「我希望能回饋母校，也想做一些與別不同的事」。

He emphasised, “I was just the initial facilitator. We work as a team, so it doesn’t matter who becomes the Director of SKLMP. The most important thing is our strong unity in pursuing something that have an impact on China and globally.” Nevertheless, he expressed that he still has hearty attachment about the Laboratory, “I greatly treasure the memorable time and the path that I walked through with my teammates over the years.”

胡教授認為：「我們是一個團隊，我只是做牽頭策劃，誰做SKLMP主任也好，最重要是大家團結起來，同心合力做些大型的、對中國和世界有正面影響的研究。」他雖然離開了城市大學，但不諱言對實驗室仍有情意結，「我很珍惜大家多年來一起走過的每段路。」

Not to forget the original intention

寄語徒弟 勿忘初心

Thirteen years after Professor Wu had first applied for the State Key Laboratory in 2007, his former student Professor Kenneth Leung inherited his leadership position. Professor Wu is pleased and reminds him not to forget the original intention of the team. He advised that his first task is to unite all members, recruit new talents, reinforce their sense of belonging and strengthen the team to scale new heights.

胡教授於2007年申請成立國家重點實驗室，13年後，實驗室由其徒弟梁美儀教授接掌。胡教授為此感到欣慰，並叮囑徒弟：「要勿忘初心。」他建議梁教授首要任務是要團結成員和引進有能之士，加強他們的歸屬感，強化團隊的實力，攜手邁向更高境界。

Professor Wu reminds Professor Leung not to forget the original intention of the team.
胡紹燊教授叮囑梁教授勿忘初心。

Professor Wu greatly treasures the memorable time and the path that he walked through with his teammates over the years.
胡教授很珍惜大家多年來一起走過這條路。

“True leaders must have a macro vision,” said Professor Wu, “then convince team members what and how we should achieve to make us stand out from our counterparts in the future.” He added, “In the foreseeable future, both the size of funding and number of talent in mainland China will outshine those in Hong Kong. As such, we need to identify our own niche and avoid direct competition. Take for example, ecosystem function is an important research area in the coming decade that Hong Kong has experience, while relatively little has been done in mainland thus far. Besides, in ecotoxicology and risk management, therefore, we have considerable successful track records that we should continue to further excel.”

「作為領袖需要有宏觀的視野，」胡教授說：「把願景告訴團隊，並要激勵大家一起合作才能使團隊出類拔萃。」胡教授又指：「內地無論資金和人才的規模都比香港龐大得多。因此，我們應該避免和內地的大學直接競爭，而要專注香港具優勢的研究領域。例如生態系統功能的研究，將會是未來十年的重要課題之一，香港在這方面有些經驗，而內地則處啓航階段。又例如生態毒理學和風險管理方面，香港擁有不俗的科研成就，因此應該把握機會繼續做好。」

> “Ecosystem function is an important research area in the coming decade.
> 生態系統功能的研究，將會是未來十年的重要課題之一。”

Professor Paul Kwan Sing Lam
Co-Founder, Former Director of SKLMP

林群聲 教授
海洋污染國家重點實驗室
聯合創辦人暨前主任

10

Getting things done through people

群策群力 毋懼挑戰

In 2009, the Partner State Key Laboratory of Marine Pollution was approved by the Ministry of Science and Technology (MOST) to be established and was the only successful applicant in the field of environmental research among universities in Hong Kong. Being the lead institution, City University of Hong Kong, appointed Acting Vice President for Undergraduate Education Professor Paul Kwan Sing Lam as the Laboratory Director.

2009年海洋污染國家重點實驗室伙伴實驗室獲國家科技部批准成立，是當時本港大學在環境領域內唯一成功的申請者。城大作為依託申請單位，遂委任當時的署理副校長（本科生教育）林群聲教授為實驗室主任。

SKLMP is unique in how it curates its talented team of scientists and exceptional scholars, with the best in the marine field coming from various universities and departments. Inevitably this gives rise to certain challenges in management. Professor Lam explained, “Most State Key Laboratories take their members from a single university, management is therefore pretty standard. Further, our scientists and scholars may also have research funding from other sources, this could prove difficult to define when publishing a scientific article. Yet, despite these challenges, we are gifted with a broader selection of identities and multiple disciplines available to us.”

海洋污染國家重點實驗室最獨特之處，是由跨大學、跨學系的優秀科學家組成，在管理上無可避免會遇上很多挑戰。「其他的國家重點實驗室只由一間大學組成，在管理上或角色扮演非常清晰，但我們則不同，優點是凝聚了一班香港海洋界優秀的學者，但他們有多重身份，屬於不同院校的不同學科。他們的研究資金，部份可能來自我們，但同時又可能有其他資助來源，因此到發表科研成果時，他到底如何界定這是院校還是實驗室的文章呢？」雖然如此，我們很榮幸吸納了不同身份與跨學科的人才。

The professor continued, “Another challenge was that there was no government funding in the initial stage of the Laboratory’s establishment. Until 2011, SKLMP received HK$2 million in annual funding from the Innovation and Technology Commission (ITC). In 2013, the funding increased to HK$ 5 million (Editor: increased to HK$1,000 million in 2019), we started to call for proposals from members for research funding.” Professor Lam confessed that the financial amount to members was genuinely not significant. “We are not only scientific research partners, but also friends; when we are in need, they will help.”

對林教授來說，另一項挑戰則是，「實驗室成立初期沒有獲得政府資助，直至2011年起，我們每年獲得創新科技署提供200萬元的資助，而2013年資助增至500萬元時(編按：2019年增至1000萬元)，我們才開始鼓勵成員寫計劃書申請資助，但當時的資金亦不多。」林教授稱，實驗室在物資上對成員的幫助無足輕重，但「他們除了是科研合作夥伴，更是朋友；到了需要他們的時候，他們會幫手。」

It was the MOST’s performance review of the State Key Laboratory that touched him deeply. He emphasized,

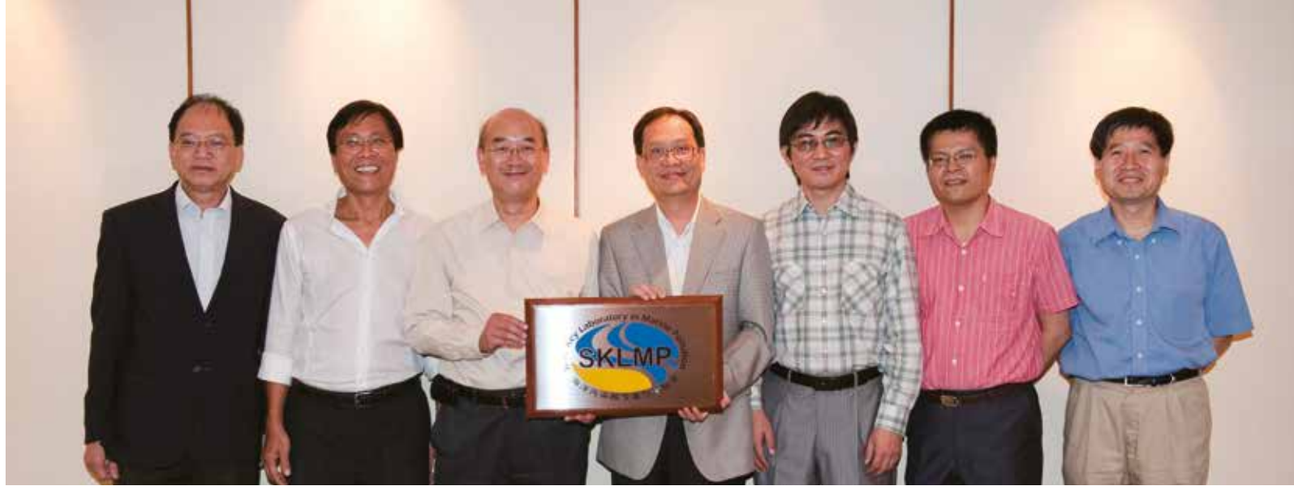
“The review is a big deal on the Mainland as the ranking of laboratories may affect the amount of research funding, and those who fail to meet the standards could even be delisted.”

令林教授感觸良多的，是國家科技部對國家重點實驗室五年一度的評核。林教授強調，「在內地(評核)是一件很大的事情，因為實驗室排名可能影響到研究資助金額，未達標的實驗室甚至會被除名。」

Professor Lam faced different challenges in management of SKLMP.
林群聲教授管理SKLMP時面對不同挑戰。

Professor Lam recalled when MOST came to the Laboratory twice for evaluation in 2017, all the key members from various universities came to meet with MOST and overseas experts. “Everyone was united during the review process and told how their research developed with the help of the Laboratory. As a result, foreign experts were deeply impressed by the uniqueness of the Laboratory. That made us got an “Outstanding” rating.”

2017年，國家科技部先後兩次來到實驗室進行評核，當時各間大學都派了代表來，面見科技部及海外專家。林教授憶述當年情景時，至今仍未能忘懷：「大家在評核的過程中都很團結，說出實驗室如何幫助他們發展。評審結束後，外國專家亦私下跟我說：你們這個實驗室很特別，是其中一間最好的，比很多實驗室也較好。因此我們拿了優秀評級。」



SKLMP was formed in 2010. Photo shows (from left) Professors Ming Hung Wong, Rudolf Shiu Sun Wu, Ying Shiu Norman Woo, Paul Kwan Sing Lam, Minhan Dai, Wenxiong Wang and Xiangdong Li.
海洋污染國家重點實驗室於2010年正式成立。圖為（左起）黃銘洪教授、胡紹燊教授、胡應劭教授、林群聲教授、戴民漢教授、王文雄教授及李向東教授合照。

He continued, “I think their support for the State Key Laboratory reflected their support for the discipline. We are in the field of marine environmental research, and everyone hopes this discipline continues to develop since the State Key Laboratory is an iconic academic institution. This is also why we were awarded such an accolade.

林教授認為，大家對國家重點實驗室的支持，也源於他們對學科的支持。「因為大家都做海洋環境研究，而國家重點實驗室是一個標誌性的學術機構，大家也希望這個學科繼續發展，是無私的支持。這也是我們獲頒『優秀』的原因。」

Professor Lam was humble in that he didn’t take credit for the success, despite his achievements in academic research greatly contributing to the assessment. He won the Second Class Natural Science Award presented by the Ministry of Education in 2011, 2012 and 2019, and also published more than 400 SCI papers. His research achievements have been significant, particularly in environmental chemistry and environmental risk assessment, and his work in emerging chemical pollutants have influenced policies and legislation in many parts of the world.

然而，林教授卻十分謙虛，並未提及其中一個取得「優秀評級」的重要因素，是他在科學研究上的卓越成就和學術地位。林教授在國際學術期刊發表超過400篇文章，先後於2011年、2012年及2019年三度獲國家教育部頒發自然科學獎(二等獎)。他在環境化學和環境風險評估領域的研究成果尤其突出，其關於新興有機污染物的研究成果，影響了世界上很多地方的相關政策與立法。

> “Everyone was united during the review process and told how their research developed with the help of the Laboratory.
> 大家在評核過程中都很團結，說出實驗室如何幫助他們發展 。”

CityU President Way Kuo (left) and SKLMP Founding Director Professor Lam (centre) attended the signing ceremony of an innovation and technology co-operation arrangement between the MOST and the HKSAR and plaque presentation ceremony. Photo shows the Minister of Science and Technology Mr. Zhigang Wang (right) in the ceremony.
城大校長郭位教授（左）與實驗室創辦人林群聲教授（中）出席國家科技部與特區政府創科合作協議簽署暨授牌儀式。右為國家科學技術部部長王志剛。

SKLMP held the fourth Academic Committee Meeting.
海洋污染國家重點實驗室舉行第一屆學術委員會第四次會議。

Professor Lam (left) won the Second Class Natural Science Award presented by the Ministry of Education.
林群聲教授（左）獲國家教育部頒發自然科學獎(二等獎)。

Professor Lam (left) was more than happy to hand over the Laboratory to Professor Leung (centre).
林群聲教授（左）對於梁美儀教授（中）接任為實驗室主任，感到十分欣喜。

Professor Lam said we need to identify what the major scientific issues and needs are.
林群聲教授認為，我們首先要確定什麼是重大科學問題和需求。

As the number of marine-related laboratories in Hong Kong and the Mainland continues to grow, Professor Lam believes that he is witnessing rapid advancement in the development of marine research in China through funding, talent, and connections. Hong Kong can no longer stay in the role of an intermediary. “We have to figure out how we can contribute in the big plan.”

目前，香港與內地與海洋相關的實驗室越來越多，林教授認為，目前中國的海洋研究發展進步迅速，有資金、人才、人脈，香港不能再停留做中間人的角色，「我們要思考在重大科研計劃中，我們能夠貢獻什麼？」

He believes that if the SKLMP can play a significant role in a large project and fit into the overall research blueprint of Mainland China, our achievements will not go unnoticed. Professor Lam continues, “But this is not easy. First of all, we need to identify what the major scientific issues and needs are. That’s the burning question. Second, there must be an impact that can benefit the country at the same time. But in which part of the overall national research blueprint do we have the niche to do well? This is our next challenge.”

他認為，假如海洋污染國家重點實驗室能在重大科研項目中扮演到一個很顯要的角色，又能配合到國家整體的研究藍圖，就能體現到我們的成就。但這樣殊不簡單，「首先我們要確定什麼是重大科學問題和需求？要對世界科學及社會有正面影響、同時可惠及國家的可持續發展；而在國家整體的研究藍圖中，有哪一部份可以由我們負責？而我們具備哪些獨特優勢確保我們能做得好？這是我們下一步的挑戰。」林教授說。

Professor Lam said he was more than happy to hand over the Laboratory to Professor Kenneth Leung since they had known each other for more than 30 years. “Kenny is very smart with a lot of ideas. I hope he will work his magic.” He also pointed out that the Laboratory needs new ideas, new practices and new styles. “As Kenny is willing to undertake this task, I think it is also the right time for the Laboratory to start afresh.”

對於梁美儀教授於去年八月落實上任為實驗室主任，林教授表示十分欣喜，因二人已相交相知超過三十年。「梁教授很聰明、有很多想法和創意，我希望他能發揮所長。」他又明言，實驗室需要新的想法和做法，新人事新作風，「今次梁教授願意承擔這個任務，我認為是實驗室新的機遇，可以再次出發。」

Professor Lam added, he wants to take this opportunity to thank everyone who has helped the laboratory set up and grow with the laboratory.

最後，林教授希望籍此機會，感謝所有曾經幫助實驗室成立及陪伴實驗室一起成長的人。

Professor Lam thanks everyone who has helped the laboratory set up and grow with the laboratory.
林群聲教授感謝所有曾經幫助實驗室成立及陪伴實驗室一起成長的人。

10

The heroine behind the scenes

仁者無私 功成不居

“Women hold up half the sky.” – Chinese proverb.

In the marine science world, there is a woman not only pioneered the field of Marine Biogeochemistry in China, but has also had an impact on the establishment and development of the SKLMP. This heroine behind the scenes, however, refused taking credit for the success, as if she were the “Invisible Woman” who came to give a helping hand at the critical moment.

Professor Huasheng Hong is renowned in China’s marine academia. She is the founding Dean of the College of Ocean and Earth Science, and also the founder of the State Key Laboratory of Marine Environmental Science (MEL) , pioneering a new discipline of Marine Biogeochemistry in China, and is listed as one of the China’s Top Ten People in marine science.

「女人能撐半邊天」。

在海洋科學界也有一名女性，不但開拓了中國海洋生物地球化學領域，更對海洋污染國家重點實驗室(SKLMP)的成立與發展有深遠的影響。可這位幕後功臣，功成而不居，宛如現代的隱形女俠，在關鍵一刻現身替人紓困解難。

「洪華生」這個名字在中國海洋學術界幾乎無人不曉，她是原廈門大學海洋與環境學院創院院長，又是廈門大學近海海洋環境科學國家重點實驗室（MEL）創辦人，開拓了中國海洋生物化學新學科領域，更曾獲封為「中國十大海洋人物」。

Professor Huasheng Hong
Founder of the State Key Laboratory of Marine Environmental Science (MEL), Xiamen University
洪華生 教授
廈門大學近海海洋環境科學
國家重點實驗室創始人

In 2007, CityU was the only university in Hong Kong that obtained the qualification of “Partner Laboratory” (later renamed as the State Key Laboratory) in the discipline of environmental sciences with support from MEL, and Professor Hong was the lynchpin in the process. During the two-year application process, she not only assisted Professor Wu in revising the proposal, but also imparted her valuable information and invited Mr. Shen Jianlei, Director of the Basic Department in the Ministry of Science and Technology (currently the Inspector of Department of Major Science and Technology Project of MOST) to Xiamen University where he met Professor Wu and offered a mock oral defense. This served as a vital opportunity for Professor Wu’s team to rehearse the presentation and receive feedback on the application.

2007年，SKLMP因獲得廈門大學近海海洋環境科學國家重點實驗室的支持，令城市大學成為香港當時唯一在環境科學領域取得「伙伴實驗室」資格(後正名為國家重點實驗室)的大學。洪華生教授就是擔當「穿針引線」的角色，在兩年多的申請過程中，她不但協助胡紹燊教授修改計劃書，還對申請的竅門傾囊相授，甚至親自邀請當時負責國家重點實驗室、科技部基礎司處長沈建磊先生(現任科技部重大專項司二級巡視員)，與胡教授團隊在廈門大學進行一場匯報預演，以汲取答辯的經驗及寶貴意見。

MERIT-SKLMP team and the Xiamen University MEL team have established a deep friendship for 20 years.
從MERIT到SKLMP， 香港團隊與廈門大學MEL團隊建立了長達20年的深厚友誼。

Professor Hong's selfless dedication is highly regarded by Dr Leo Chan, Associate Director of SKLMP. "When Professor Hong heard that we were applying for the establishment of SKLMP, she provided us with her proposal and related documents for the application of MEL for our reference. Because of her assistance and guidance, the formation of SKLMP in Hong Kong was approved by the MOST in 2009 and was awarded as outstanding State Key Laboratory in 2018 in the first assessment."

洪教授廣闊的胸襟與無私的奉獻，深受海洋污染國家重點實驗室副主任陳荔博士敬重：「當洪老師得知我們要申請建立國家重點實驗室後，便主動把她申報近海海洋環境科學國家重點實驗室的申請書及有關文件提供給我們參考；在她的幫助及指導下，SKLMP在2009年獲科技部批准籌建，並在2018年首次評估中取得優秀國家重點實驗室的榮譽。」

Nevertheless, Professor Hong was reluctant to receive any praise for its success. Instead, she downplayed her efforts and gave all credit to the team. "The Centre for Marine Environmental Research and Innovative Technology (MERIT) team indeed had a strong foundation which was the key to its success." Professor Hong continued, "This was the reason why the submission of the application went smoothly."

然而，這位德高望重的幕後功臣卻功成不居，對自己的付出輕描淡寫，把一切功勞歸於團隊。洪教授靦腆地說：「其實當時海洋環境研究及創新科技中心（MERIT）團隊已有很強的實力基礎，這才是致勝關鍵，因此在遞交申請文件時比較順利。」

She also emphasised, "Not only did we help SKLMP, but we also helped each other. I would like to express my sincere gratitude to Dr Leo Chan who helped us establish the Center of Major Equipment and Technology (COMET). The system has effectively facilitated the efficient use of instruments, making MEL ranked first in the evaluation of the open and shared scientific and technological resources information in the State Key Laboratory for two consecutive years."

她又強調：「我們是互相幫助，不只是我們幫助SKLMP申請，SKLMP也幫助我們，我特別感謝陳荔博士，他幫助我們建立了實驗室儀器設施共享管理系統，大大提高了儀器的使用效率，使MEL連續兩年在國家重點實驗室科技資源信息開放共享評估中位列第一。」

Professor Hong's determination and fearless character may be shaped by her experience. Now 77 years young and with a prestige academic status long recognised, she told that at the age of 36 she was sent to the United States to study. With her great perseverance and innate ability to learn, Professor Hong impressed both her supervisors and peers in the U.S. as she quickly overcame language barriers and earned her PhD degree at the top of her class.

Professor Hong was sent to the U.S. to study at the age of 36.
洪教授36歲時赴美留學。

洪教授的不言敗、不言懼的性格，或許跟她的經歷有關。現年77歲的她擁有崇高的學術地位，其實36歲才首次赴美深造，是中國第一位公派留學後回國服務的海洋學女博士。她憑着堅毅意志和驚人的學習能力，在當地極速克服語言障礙，更以班上第一名的優異成績提早完成博士學位，令美國的導師、同儕都刮目相看。

Professor Hong had a 20-year collaboration with Professor Rudolf Wu as early as 1992. While she was a visiting professor at the Research Center of the Hong Kong University of Science and Technology (HKUST), She met Professor Wu at a research conference and was impressed by the team model of CityU's Research Centre for Coastal Pollution and Conservation (i.e., an organization that led to establishment of MERIT); "Their members have done a fantastic job... a collaboration between six universities provides a solid foundation." In 1999, she signed an agreement with CityU to develop a long-term cooperative relationship, including coordinating scientific research and organising seminars. More than dozens of teachers, students and staff from Xiamen University had been sent to CityU on exchange programs to study.

洪教授娓娓道來，早於1992年與胡紹燊教授結緣，開啓雙方長達20年的友誼合作。當年她於香港科技大學研究中心任職客座教授，在一個研究會議上認識了胡教授，被當時城大「海岸污染與保育研究中心」（即MERIT的前身）的團隊模式所吸引：「研究團隊的成員做得很好...鼓勵六間大學的海洋科學界精英合作，是很重要的基礎。」她一直渴望加強雙方合作，終於1999年與城大正式簽訂協議書，展開長遠的合作關係，包括科研合作、舉辦研討會，洪教授更曾派出數十名廈門大學的師生職員，輪流到城大交流和學習。

Professor Hong's selfless dedication is highly regarded by Dr. Leo Chan.
洪華生教授無私的奉獻深受陳荔博士敬重。

Professor Hong had a 20-year collaboration with Professor Rudolf Wu as early as 1992.
洪華生教授與胡紹燊教授早於1992年結緣。

Professor Hong and MEL team attended a joint MMS Workshop on Marine Environment Research at HKU in 2008.
洪教授與廈門大學MEL的研究團隊於2008年到香港大學參加海洋環境研究研討會。

SKLMP and MEL established Partner State Key Laboratories.
海洋污染國家重點實驗室與近海海洋環境科學國家重點實驗室成立「伙伴實驗室」。

In 2007, when the MERIT team went to Xiamen University to visit the MEL, Professor Hong believed that the team was qualified to apply for the establishment of State Key Laboratory and fully supported their call for MEL as a partner laboratory. Professor Minhan Dai, Director of MEL, immediately flew to Hong Kong to sign a joint application document with CityU.

2007年，MERIT團隊前往廈門大學參觀近海海洋環境科學國家重點實驗室時，洪教授已確定香港團隊具備申請成為國家重點實驗室的條件，因此當她得悉胡教授需要MEL作為伙伴實驗室時，便大力支持；時任MEL主任的戴民漢教授，更立刻飛抵香港跟城大簽署聯合申請文件。

Professor Hong said frankly: “We have common goals and a mission. We both help and complement each other.”

洪教授坦言：「大家都有共同目標和理想，我們既是互相幫忙，也是互補不足。」

Competition is hotting up as more and more marine-related laboratories appear on the Mainland and Hong Kong. How does SKLMP preserve its academic research status in the marine field? Professor Hong believes that the Greater Bay Area has developed rapidly and Guangdong Province is very keen on the development of its own laboratories. SKLMP needs to fully utilise its advantages in Hong Kong, identify its own niche and integrate into the development of the Greater Bay Area. Professor Hong emphasized that SKLMP brings together talents across a range of disciplines and maintains a strong open connection with the world. This is key to its success.

內地及香港與海洋相關的實驗室越來越多，競爭越趨劇烈，SKLMP如何保持在海洋環境界的學術研究地位？洪教授認為，粵港澳大灣區的發展相當迅速，廣東省在實驗室方面的佈局力度很大，SKLMP需要充分發揮在香港的優勢，思考自身的特色與優勢，如何融入粵港澳大灣區的整個科學研究的佈局與發展中，做出更好的貢獻。洪教授強調，SKLMP匯聚了不同學科的人才，並與國際保持良好合作關係，應好好發揮人才與國際化優勢，這是成功的關鍵。

SKLMP and Mel Partner State Key Laboratories held an annual meeting.
海洋污染國家重點實驗室與MEL的伙伴實驗室舉行年度會議。

The United Nations Decade of Ocean Science for Sustainable Development (2021-2030) has already begun, and it also happens to be the next decade of development for SKLMP. Professor Hong said that the plan expected to achieve outcomes including “a clean ocean” where sources of pollution are identified and removed, and “a healthy and resilient ocean” where marine ecosystems are mapped and protected, which are also SKLMP’s strengths. We should pay more attention to international trends.

適逢今年踏入聯合國海洋科學促進可持續發展國際十年(2021-2030)計劃，也正好是SKLMP今後發展的十年。洪教授建議，計劃中提到期望達致的幾項重要成果，包括「清潔海洋」，即識別及消除污染源頭，以及「健康並具復原力的海洋」即生態系統如何得到保護、恢復和管理，也是SKLMP的強項，我們應多加關注國際大動向並融入國際大計劃中。

As Professor Kenneth Leung became the Director of SKLMP, Professor Hong expressed her joy. “Professor Leung and I have been friends for the past 20 years,” and praised him on his upbeat personality and open-mindedness. “I am sure he will unite many talented individuals and lead the team in producing sterling results. Professor Hong’s message: “ I believe SKLMP will grow stronger and better in the future.”

對於梁美儀教授接掌實驗室主任，洪教授深表欣喜：「我跟梁美儀教授是認識了20年的好朋友，有很長久的友誼。」她讚揚梁教授性格開朗，願意接受新事物，相信他定能團結人才、帶領團隊創造佳績。洪教授寄語：「SKLMP磨『劍』輝煌，今後輝煌再創，更上一層樓。」

> “SKLMP needs to fully utilise its advantages in Hong Kong, identify its own niche and integrate into the development of the Greater Bay Area.”
>
> SKLMP需要充分發揮在香港的優勢，思考自身的特色與優勢，如何融入大灣區的整個科學研究的佈局與發展中，做出更好的貢獻。”

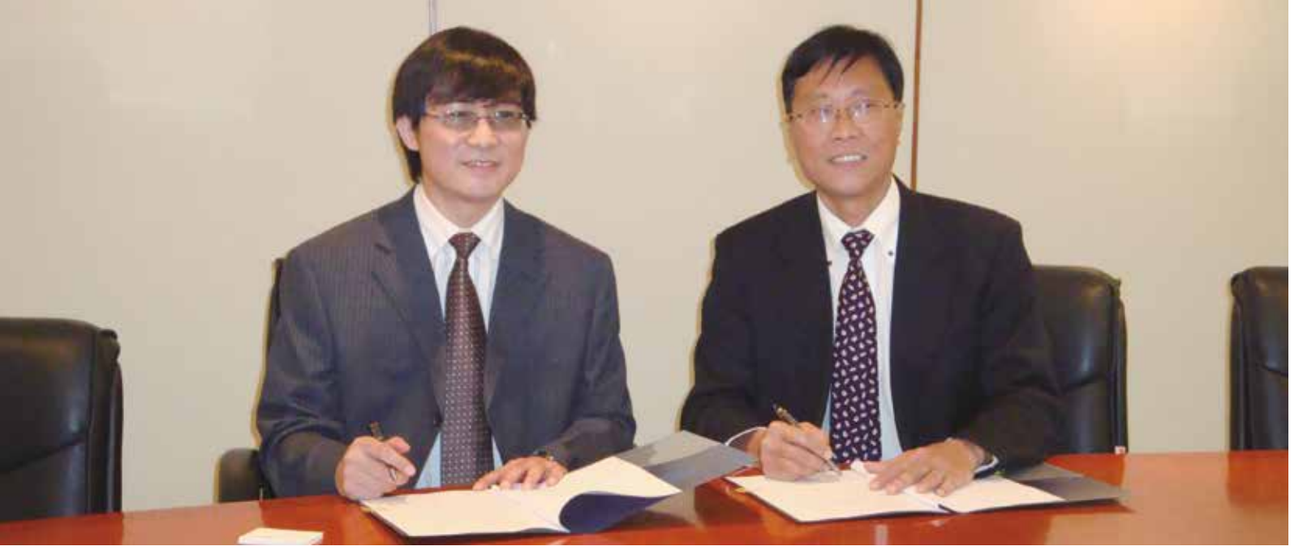
友誼歲月 攜手啓航

It was at a critical moment that, as if by some divine intervention, the application of State Key Laboratory of Marine Pollution (SKLMP) was granted. This “divine” who has mastered the fate of SKLMP is not some sci-fi character, but Director of the State Key Laboratory of Marine Environmental Science (MEL) of Xiamen University and Academician of the Chinese Academy of Sciences, Professor Minhan Dai. His popularity among students at Xiamen University gave rise to his nickname “Male Divine Professor”. Thanks to his unwavering support, the SKLMP eventually came to life.

海洋污染國家重點實驗室（SKLMP）在關鍵一刻申請成功，如有神助。這位掌握了SKLMP成立命運的「男神」，不是科幻角色，而是深受廈門大學學生愛戴、獲封為「男神教授」的廈門大學近海海洋環境科學國家重點實驗室（MEL）主任、中國科學院院士戴民漢教授。全賴他的大力支持，促成SKLMP 的誕生。

Professor Minhan Dai
Director of the State Key Laboratory
of Marine Environmental Science (MEL)
Xiamen University
Academician of the Chinese Academy of Science

戴民漢 教授
主任
廈門大學近海海洋環境科學國家重點實驗室
中國科學院院士



After receiving Professor Wu's invitation, Professor Dai immediately applied for VISA to go to Hong Kong and sign an agreement at CityU.
在收到胡教授的邀請後，戴民漢教授立刻向學校申請並馬上辦理赴港簽注，趕及到城大簽署協議。

Professor Dai is a renowned marine scientist in China. He still remembered how he assisted SKLMP in applying to MOST. "Before the application, I connected with Dr. Qinliang Tan, former Deputy Director of the Science and Technology Department of Xiamen University and now Vice President of North China Electric Power University, and Mr. Xianen Zhang, former Director General of the Basic Research Department at MOST. Then, I accompanied Professor Rudolf Wu (later the co-founder of SKLMP) and Professor Joseph Lee, former Vice-President of HKU, now President of Macau University of Science and Technology to Beijing for a presentation. In the beginning, MOST believed that it was not easy for joint collaboration among six universities in Hong Kong, so their recommendation was for SKLMP to apply from one university individually. This was not Professor Wu's preferred option and instead he insisted on the joint application with MERIT members."

戴教授是中國著名海洋科學家，當年他協助SKLMP向國家科技部申請的情景，至今仍歷歷在目：「在申請前，我和時任廈門大學科技處副處長、現華北電力大學副校長檀勤良博士，與當時科技部基礎司張先恩司長取得了聯繫，然後陪同胡教授及時任香港大學副校長、現澳門科技大學校長李行偉教授專程到北京彙報。初時，科技部認爲跨單位聯合組建國家重點實驗室存在一定的弱點，要聯合香港6所大學成立國家重點實驗室並不容易，並建議依托一所大學單獨申報，但胡教授堅持聯合MERIT成員一起申報。」

> "After receiving Professor Wu's invitation, we immediately applied for VISA to go to Hong Kong and sign an agreement at CityU, fortunately we were able to make it.
> 在收到胡教授的邀請後，我們立即向學校申請並馬上辦理赴港簽注，幸好最後趕及到城大簽署協議。"

> "We are honored to partner with SKLMP.
> 能夠以伙伴身份與SKLMP簽約，我們也感到十分榮幸。"

Professor Dai agreed that Hong Kong's marine scientific researchers were scattered across various universities at the time, thus a joint collaboration across universities could share equipment and fully unitise the strength of inter-disciplines of each university, which would be a model worth trying. "We originally planned a half-hour meeting with MOST's officials, but the officials were impressed by Professor Wu's presentation and his passion, and discussed with us for 1.5 hours. As a result, the joint application model was a shoo-in." Professor Dai continued: "When the establishment of SKLMP was later approved by MOST, MEL was notified as a partner laboratory to start the formation of Partner SKLMP."

戴教授也表示認同，當時香港從事海洋科學研究的人員分散於各間大學，聯合各間大學一起申請可以共享儀器設備、發揮各校的聯合學科優勢，是一個值得嘗試的模式。「本來我們計劃在科技部彙報交流半個小時，但由於胡教授的彙報非常精彩和誠懇，雙方談了一個半小時，這給科技部留下了很深刻的印象，聯合申請的形式也基本得到科技部的認可。」戴教授憶起當時的情景不禁莞爾，續說：「後來SKLMP獲批成立時，科技部也通過傳真知會MEL，請MEL作爲伙伴實驗室，協同SKLMP啓動建設。」

In another interview, Professor Wu expressed his special gratitude to Professor Dai for his timely support. Professor Dai explained, "It was the first attempt applying for the establishment of the State Key Laboratory in Hong Kong. We didn't know that a partnership agreement between two laboratories must be accomplished prior to the application. After receiving Professor Wu's invitation, we immediately applied for VISA to go to Hong Kong and sign an agreement at CityU, fortunately we were able to make it." Professor Dai added, "We are honored to partner with SKLMP."

胡紹燊教授在接受訪問時，多次表示感激戴教授的支持。戴教授指出，「由於當時在香港申請建立國家重點實驗室是一個嶄新的嘗試，在截止申請前很短的時間內，才獲悉申請條件之一是需要有一份兩間實驗室的正式合作協議。在收到胡教授的邀請後，我們立刻向學校申請並馬上辦理赴港簽注，幸好最後趕及到城大簽署協議。」然而，戴教授認為：「能夠以伙伴身份與SKLMP簽約，我們也感到十分榮幸。」

Professor Dai has established a deep friendship with SKLMP members.
戴民漢教授與SKLMP成員建立了深厚的友誼。

Cause and effect go hand in hand. Xiamen University has a long-standing relationship with SKLMP, and Professor Dai has already established a deep friendship with the AoE-MERIT team, the predecessor of SKLMP. He recalled the first contact with Hong Kong in 2004 when he participated in the Pearl River Estuary Pollution Project (PREPP) seminar. In 2006, Xiamen University developed a close scientific research exchange and talent training cooperation with scholars, including Professors Paul Lam, W.X. Wang, H.B. Liu, J.P. Gan, and Dr. Leo Chan, as the overseas team members of the “Marine Biogeochemical Innovation Base”. In 2007, led by Professor Rudolf Wu, the MERIT team visited MEL and they reached a consensus that the Hong Kong team should apply for the State Key Laboratory from MOST, and it was also recommended to cooperate in the exchange of scientific researchers, postgraduate training and administrative and technical professional trainings. In 2008, Professor Dai and a group of MEL researchers and technicians came to Hong Kong on an exchange program. The postgraduate summer school program under the theme of “Marine Ecotoxicology” also resumed in the same year. MEL and SKLMP currently run this program, and Beijing University and Taiwan Ocean University have been invited to join.

世間上沒有無因之果，也沒有無果之因。廈門大學與SKLMP淵源久遠，戴教授因緣際會，早已與SKLMP前身的AoE-MERIT團隊建立了深厚的友誼。他憶述與香港的接觸始於2004年參加珠江口污染研究計劃研討會；2006年，廈門大學與「海洋生物地球化學創新引智基地」的海外團隊成員，包括林群聲教授、王文雄教授、劉紅斌教授、甘劍平教授、陳荔博士等學者，開展了緊密的科研交流與人才培養合作。2007年，胡紹燊教授率領MERIT團隊到訪MEL，雙方取得共識，認為香港團隊應申請科技部的國家重點實驗室，並建議兩校團隊在科研人員交流、研究生培養、行政技術人員培訓等方面展開合作。2008年，戴教授與MEL一衆科研及技術人員來港交流，同年，戴教授重新啓動以「海洋生態毒理」爲主題的研究生暑期學校。雙方聯合輪流舉辦至今，並邀請了北京大學和台灣海洋大學共同參與。

SKLMP Partner SKL held the first academic committee meeting on January 8, 2011.
SKLMP國家重點實驗室伙伴實驗室於2011年1月8日舉行第一屆學術委員會會議。

Ten years on, given the strategic background of the country’s vigorous development of the oceans, the development of marine science and technology forces in the Greater China region is fast-growing. Professor Dai, however, believes that SKLMP has its own niche - “Its positioning is clearly defined to protect the marine environment of Hong Kong and the surrounding areas by studying and solving major issues threatening them.” He continued, “Hong Kong has its particular strengths as a special hub in terms of professionals, international exchanges, and the integration of science and technology.”

Professor Dai said: “I am absolutely delighted to witness the elites of seven universities in Hong Kong brought together by SKLMP since its establishment ten years ago. SKLMP has played a unique role. It has attained leading positions and achievements in global marine environment research, contributing to the development of marine science and technology in Hong Kong and worldwide. I look forward to SKLMP capitalizing on the innovative research advantages and creating another decade of excellence. I also hope that MEL and SKLMP will continue to integrate deeply, making contributions together to the development of the blueprint for the ocean.”

千帆過盡，十年後的今天，在國家大力發展海洋這一戰略背景下，大中華地區的海洋科技力量可謂日新月異，但是，戴教授認為SKLMP具備獨特的優勢：「SKLMP定位清晰，通過研究及解決威脅海洋環境的主要問題，保護香港和周邊地區的海洋環境安全。香港擁有特殊的門戶樞紐地位，在專業人才、國際交流、科學與技術相結合方面都有自己的特殊優勢。」

戴教授高興地說：「我非常欣喜地看到SKLMP成立十年來，彙集香港本地七所大學的精英力量，發揮了不可替代的作用，在全球海洋環境研究取得領先地位和成果，爲區域和國際海洋環境科學貢獻了力量，對推動香港地區的海洋科技發展也作出顯著貢獻。我期待SKLMP繼續發揮創新研究優勢，再創下一個十年的輝煌成就。我也希望MEL與SKLMP繼續深度融合，在海洋發展的藍圖裏協同貢獻力量。」

> “SKLMP’s positioning is clearly defined to protect the marine environment of Hong Kong and the surrounding areas by studying and solving major issues threatening them.
>
> SKLMP定位清晰，通過研究及解決威脅海洋環境的主要問題，保護香港和周邊地區的海洋環境安全。”

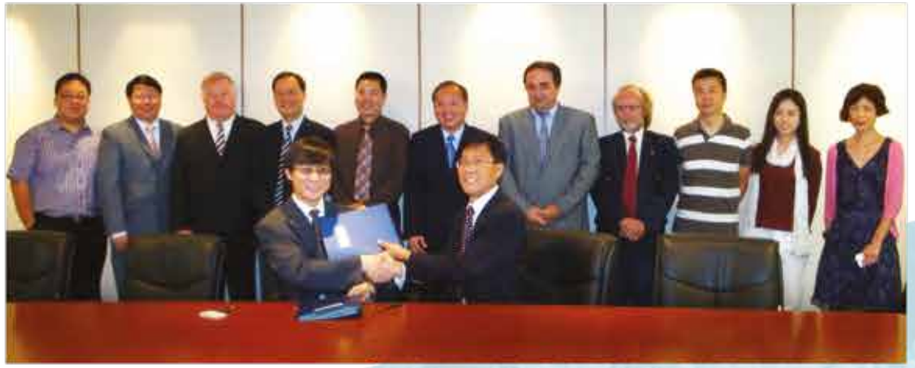
Milestones
歷史里程

SKLMP
KEY MILESTONES

2004

A team of researchers, led by CityU's Prof. Rudolf Wu, Chair Professor in the Department of Biology and Chemistry, was awarded HK$45 million under the UGC's Areas of Excellence Scheme, for the establishment of "The Centre for Marine Environmental Research and Innovative Technology", laid a solid foundation for the establishment of SKLMP.

教資會「卓越學科領域計劃」撥款4,500萬港元，資助城大生物及化學系胡紹燊講座教授提出的建議，設立「海洋環境研究及創新科技中心」(MERIT)，為日後成立「國家重點實驗室」奠下基石。



Prof. Rudolf Wu submitted a proposal to the Chinese Ministry of Science and Technology to form the partner State Key Laboratory in Marine Pollution (SKLMP).

胡紹燊教授向中國科學技術部申請成立海洋污染國家重點實驗室伙伴實驗室。

2005

"The Centre for Marine Environmental Research and Innovative Technology" was officially opened.

「海洋環境研究及創新科技中心」正式開幕。

2007

2009

中华人民共和国科学技术部
THE MINISTRY OF SCIENCE AND TECHNOLOGY
THE PEOPLE'S REPUBLIC OF CHINA

CityU obtained an approval from the Ministry of Science and Technology of China to set up Partner SKLMP.

城大獲國家科學技術部批准成立「海洋污染國家重點實驗室伙伴實驗室」。

2010

Partner State Key Laboratory in Marine Pollution (City University of Hong Kong) was established. Prof. Paul Lam took up the Directorship of P-SKLMP.

海洋污染國家重點實驗室伙伴實驗室(香港城市大學)正式成立，林群聲教授出任實驗室主任。

SKLMP co-organised the "International Conferences on Marine Pollution and Ecotoxicology" (ICMPE) in 2010, 2013, 2016, and 2019. ICMPE has been a signature event in the international arena of marine pollution research with over 25 years of history.

海洋污染國家重點實驗室於2010、2013、2016和2019年合辦了「海洋污染與生態毒理學國際會議」(ICMPE)。會議系列至今已有超過25年歷史，是國際海洋污染研究領域的標誌性盛事。

2011

The Innovation and Technology Commission (ITC) provided an annual funding of HK$2 million for SKLMP.

創新科技署向SKLMP提供每年200萬港元的恆常資助。

The Research Centre for the Oceans and Human Health (H2O), a satellite division of SKLMP in mainland China, was established in Shenzhen with the approval of the Shenzhen Municipal Government.

SKLMP的衛星機構「海洋與人類健康研究中心」，獲深圳市政府批准在深圳成立。

2012

SKLMP members Prof. Xiaoyan Li won the 2012 First Class award in the Natural Science category at the Higher Education Outstanding Scientific Research Output Awards (Science and Technology) form the Ministry of Education of China, while Prof. Paul Lam and Dr. James Lam won the Second Class award.

SKLMP成員李曉岩教授於國家教育部設立的「高等學校科學研究優秀成果獎(科學技術)」評選中，獲頒「自然科學獎」的一等獎，林群聲教授及林忠華博士獲頒二等獎。

Photo credit: Beijing-Hong Kong Academic Exchange Centre
圖片來源：京港學術交流中心

The Research Centre for the Oceans and Human Health (H2O) was officially opened.

「海洋與人類健康研究中心」正式啓用。

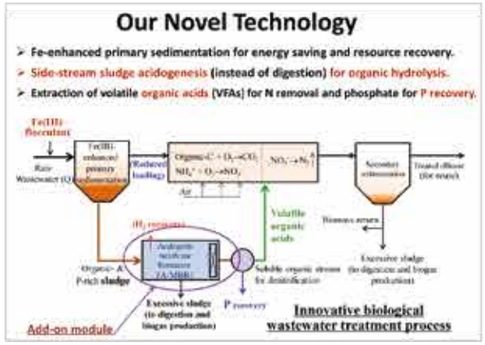
2013

The Innovation and Technology Commission (ITF) increased the amount of funding support to SKLMP from HK$2 million to HK$5 million each year.

創新科技署將SKLMP的年度資助經費，由200萬增至500萬港元。

SKLMP (CityU and Xiamen University) co-established the "Centre of Major Equipment and Technology (COMET)" to strengthen management and facilitate the sharing of major instruments among members. The success of COMET contributed to MEL being ranked first in the Assessment on Open Information and Sharing of Scientific and Technical Resource for National Key Laboratories undertaken by the Institute of Scientific and Technical Information of China.

SKLMP與伙伴實驗室「近海海洋環境科學國家重點實驗室（廈門大學）」(MEL) 共同建立「海洋與環境大型儀器與技術服務中心」，強化實驗室的大型儀器管理與共用，促使MEL連續兩年在中國科學技術信息研究所進行的國家重點實驗室科技資源信息開放共享評估中位列第一。



SKLMP member Prof. Xiaoyan Li and his research team received a large-scale grant from RGC Theme-based Research Scheme for the study of " Enhanced Separation and Sludge Refinery for Wastewater Treatment - Solving the Nexus of Pollution Control and Resource Recovery in Mega Cities".

SKLMP成員李曉岩教授帶領團隊，以《高效濃縮分離和污泥精煉協同新技術實現城市水污染控制和資源回收》，獲香港研究資助局「主題研究計劃」資助。

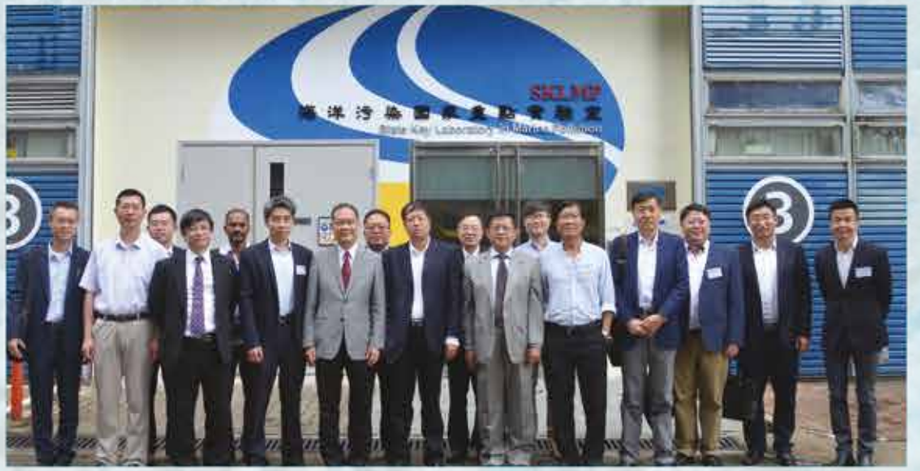
SKLMP member Prof. Jianping Gan and his research team received a large-scale grant from RGC Theme-based Research Scheme for the study of "Ocean Circulation, Ecosystem and Hypoxia around Hong Kong waters (OCEAN-HK)"

SKLMP成員甘劍平教授帶領團隊，以《香港及鄰近海域富營養化，缺氧及生態後果的診斷和預測：物理-生物地球化學-污染耦合研究》，獲香港研究資助局「主題研究計劃」資助。

2013 2015 2016 2017 2018

SKLMP co-organised the International Conference on Underwater Science, Technology and Education (ICUSTE), which aimed to promote academic exchange and collaboration in marine environmental science.

SKLMP 聯同國家自然科學基金委員會地球科學部、香港城市大學動物醫學院主辦「水下科學、技術與教育國際會議」，促進海洋環境科學與技術的學術交流與合作。



SKLMP was rated "Outstanding" in the re-assessment of the existing Partner State Key Laboratories organised by the Innovation and Technology Commission.

海洋污染國家重點實驗室伙伴實驗室，在創新科技署統籌的伙伴實驗室評核中，獲評為「優秀」級別。

The Ministry of Science and Technology approved the renaming of "State Key Laboratories of Marine Pollution (City University of Hong Kong)".

國家科學技術部正式批准命名為「海洋污染國家重點實驗室（香港城市大學）」。

2018

The Education University of Hong Kong joined SKLMP as a Member Institution and injected HK$15 million to set up a research hub.

香港教育大學加入成為成員大學，並斥資1500百萬元設立共享實驗室。

SKLMP was relocated to the fifth floor of the Yeung Kin Man Academic Building at CityU.

SKLMP 搬遷至城大楊建文學術樓五樓。

SKLMP members Prof. Paul Lam and Dr. James Lam won the 2019 Second Class award in the Natural Science category at the Higher Education Outstanding Scientific Research Output Awards (Science and Technology) form the Ministry of Education of China.

SKLMP成員林群聲教授與林忠華博士於國家教育部設立的「高等學校科學研究優秀成果獎（科學技術）」評選中，分別獲頒「自然科學獎」的二等獎。

SKLMP annual funding was increased from HK$5 million to $10 million provided by the Innovation and Technology Commission of the HKSAR.

創新科技署將SKLMP的年度資助經費由500萬增至1000萬港元。

2019

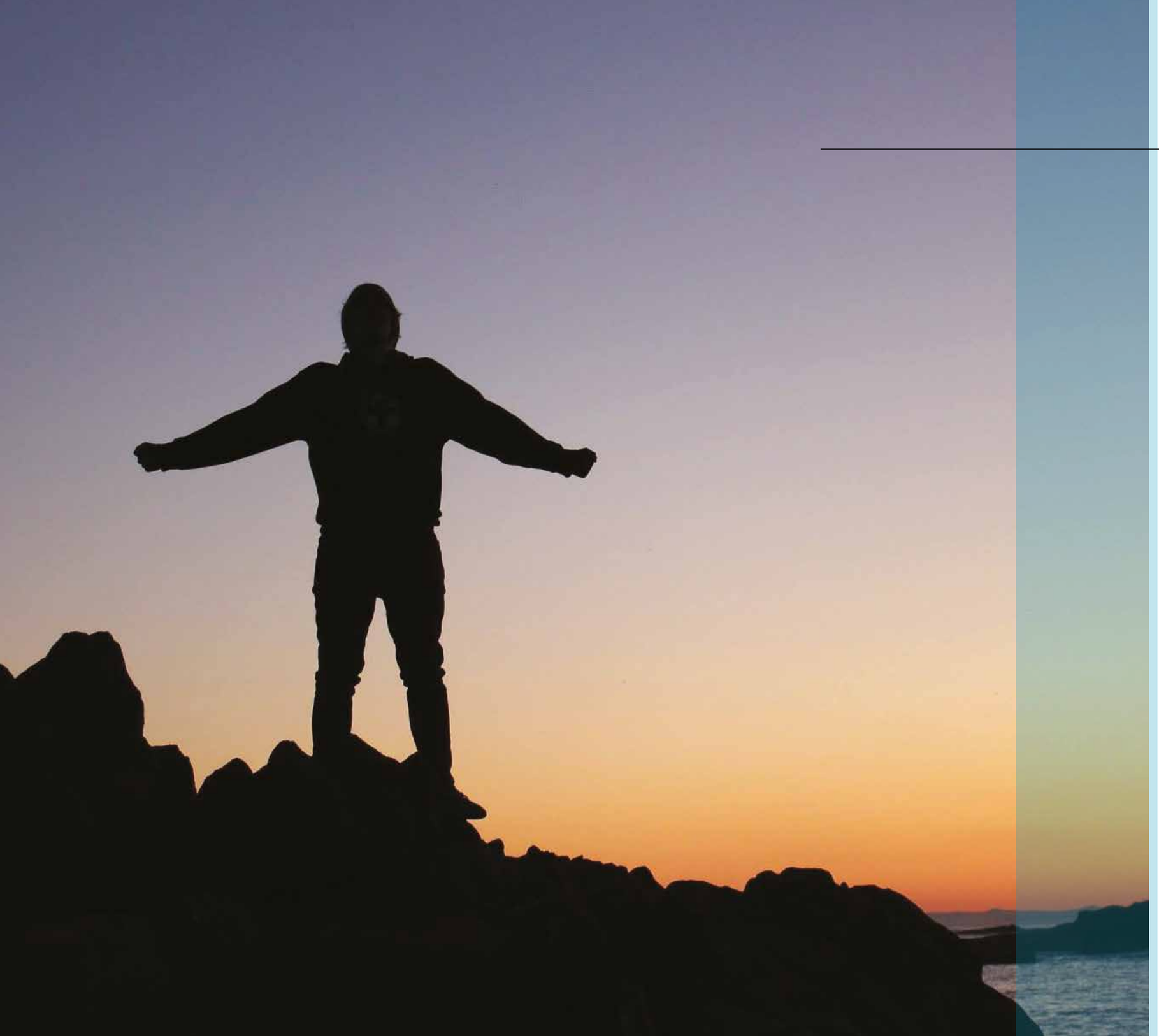
SKLMP member Prof. Tong Zhang and his research team received a grant from RGC Theme-based Research Scheme for the study of "Assess Antibiotic Resistome Flows from Pollution Hotspots to Environments and Explore the Control Strategies".

SKLMP 成員張彤教授帶領團隊，以《抗生素耐藥基因的環境污染傳播機制與控制阻斷策略研究》獲研究資助局的「主題研究計劃」資助。

2020

SKLMP celebrated its 10th anniversary.

海洋污染國家重點實驗室成立10周年。



10 Numbers in 10 Years

數字十年

數字十年

Numbers in 10 Years

After 10 years of effort,
finally we have...

十年來的努力，
我們取得成果...

542 Million HKD
Grants Received
*including research grants and consultancy services
獲得資助金額
*包括研究資助及顧問服務費

27 Million HKD
Funding Provided by SKLMP
實驗室資助金額

20
Top 1% Scientists
*Prof. Keith Ho & Prof. Tong Zhang have been recognised as the "Highly Cited Researchers"
*Data Source: Essential Science Indicators (ESI), Clarivate Analytics
首1%科學家
*何詠基教授及張彤教授獲譽為「高被引學者」
*數據來源：科睿唯安基本科學指標

295
Talents Nurtured
*including Mphil and PhD
人才培育
*包括哲學碩士及博士生

62
SKLMP Members
實驗室成員

60 Awards 獎項

7 Patents 專利

12
Highly Cited Papers
*Data Source: Web of Science (As of March 2021)
高引用率論文
*數據來源：Web of Science（截至2021年3月）

321
Projects
*including research and consultant projects
項目
*包括研究及顧問項目

700
SCI Papers Published
學術文章刊登

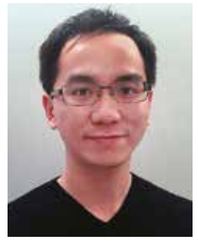
Research Scopes
研究範疇

Research Scopes in SKLMP
實驗室研究範疇

Based on our competitive advantage and core capability, SKLMP identifies the following three key research themes. SKLMP also endeavours to conduct translational research and deliver recommendations of environmental management strategies and policies for supporting the government with reference to our research outcomes.

鑑於SKLMP的核心科研力量及競爭優勢，我們確立以下三大主要研究主題；並積極把研究成果轉化，為政府提供環境管理的策略，支持其實施政策。

Prof. Tong Zhang (HKU)
Team Leader
張 彤 教授 (香港大學)
組長



Dr. Chun Kit Kwok (CityU)
Deputy Team Leader
郭駿傑 博士(香港城市大學)
副組長

Innovative Technology for Pollution Monitoring and Control
污染監控的創新科技

This research team primarily aims to develop a variety of novel technologies for monitoring and controlling marine pollution. These include, but limited to, new methods and tools for monitoring of priority chemical contaminants, algal toxins, waterborne pathogens and microplastics; innovative numerical models for forecasting the fate of pollutants and pathogens and estimating their carrying capacity in water bodies; real-time monitoring of water and sediment quality with novel sensors and IoT; advanced and cost-effective treatment technologies for removal of pollutants from wastewater, and novel *in situ* methods for combating harmful algal blooms.

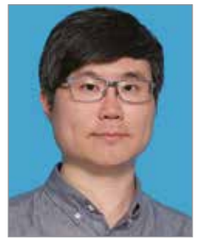
該研究團隊主要目的為研發一系列嶄新的科技，用以監察及控制海洋污染。這些科技包括（但不限於）監測受關注的化學污染物、藻類毒素、水生病原體和微塑膠等的新方法及工具；創新的數值模型，預測污染物和病原體在水環境中的暴露情況，並估計其在水體中的承載能力；運用新型感應器及物聯網實時監察水和沉積物的質量；以先進及具成本效益的處理技術移除污水中的污染物；以及建立創新方法去除海水中有害藻華（紅潮）。

Eco-safety and Environmental Risk Assessment
生態安全與環境風險評估

This research team primarily aims to investigate the environmental fate, exposure, bioaccumulation, biological effect and environmental risk of chemical contaminants, algal toxins and waterborne pathogens in the marine environment, and their implication to seafood safety. The results will provide scientific basis for environmental risk assessment and for the derivation of environmental quality benchmarks for risk management of these stressors to ensure ecosystem safety and human health. In particular, SKLMP is keen to make contributions to the establishment of national marine water quality criteria for protecting coastal marine environments in China.

該研究團隊主要目的為研究海洋環境中的化學污染物、藻類毒素、水生病原體在水環境中的暴露的情況、生物累積、生物效應與環境風險，以及對海產食物的安全性影響。研究結果將為環境風險評估提供科學基礎，以推導及制定環境質量基準和管理這些壓力源的風險，以確保生態系統安全及人類健康。SKLMP尤其希望為建立國家海洋水質基準作出貢獻，以保護中國沿海海洋環境。

Prof. Wenxiong Wang (CityU)
Team Leader
王文雄 教授 (香港城市大學)
組長



Dr. James Lam (EdUHK)
Deputy Team Leader
林忠華 博士 (香港教育大學)
副組長

Ecosystem Responses and Ecological Restoration
生態系統響應與生態修復

This research team primarily aims to reveal the response of the marine ecosystem to anthropogenic stressors such as water pollution, eutrophication, hypoxia, habitat destruction, overharvesting, warming, and acidification etc.; understand the process and mechanisms of ecosystem recovery after cessation of the environmental insult; explore novel technologies for monitoring marine biodiversity and ecosystem health (e.g. remote sensing, artificial intelligence, environmental DNA), and develop effective policy and novel technologies for restoration of degraded marine ecosystems (e.g. eco-engineering technologies).

該研究團隊主要目的為揭示海洋生態系統對人為壓力的響應，例如水污染、水體富營養化、缺氧、自然生境破壞、過度捕撈、暖化與酸化等；了解在停止環境侵害後，生態系統修復的過程和機制；探索監測海洋生物多樣性及生態系統健康的新技術（例如遙遠感應、人工智能、環境基因技術），以及制訂有效政策和創新技術（例如生態工程技術），藉此修復已受損的海洋生態系統。

Prof. Jianwen Qiu (HKBU)
Team Leader
邱建文 教授 (香港浸會大學)
組長

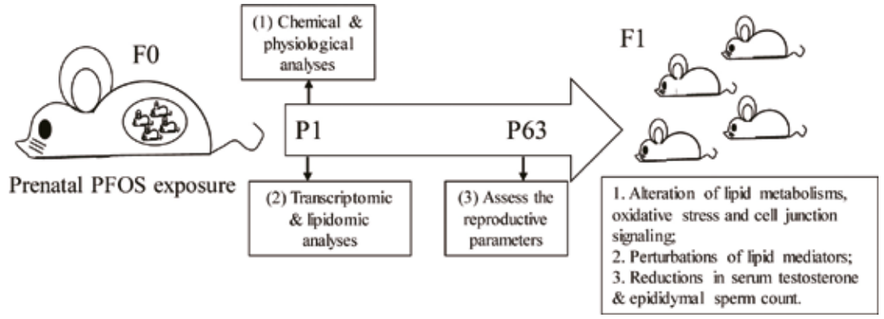
Dr. Leo Chan (CityU)
Deputy Team Leader
陳 荔 博士 (香港城市大學)
副組長

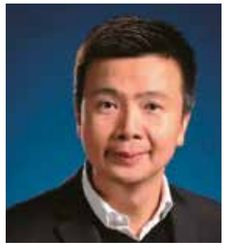
Research Highlights
研究焦點

Research Highlights
研究焦點

Basic Research 基礎研究

Endocrine-disrupting chemicals impose health concern in the public
內分泌干擾物給公眾帶來健康問題





Professor Chris K.C. Wong
黃港佳 教授

Humans are exposed to complex mixtures of environmental contaminants in their lives, including endocrine-disrupting chemicals (EDCs), with the risk of developing traits of metabolic syndrome.

人類生活暴露在複雜的混合環境污染物中，包括內分泌干擾物(EDCs)，具有代謝綜合征發展特質的風險。

Bisphenol A (BPA) is listed as an environmental obesogen, acting on estrogen receptors [ERs: ER-α, ER-β, and G-protein coupled estrogen receptor] to perturb body metabolism. On the other hand, a group of persistent EDCs, perfluoroalkyl acids (PFAAs), have been prioritized in the European research project OBELIX in 2009 as one of the risk factors in the alternation of development programing for metabolic diseases in life. Yet, the risks that these chemicals pose in human metabolic health have not been fully assessed and recognized.

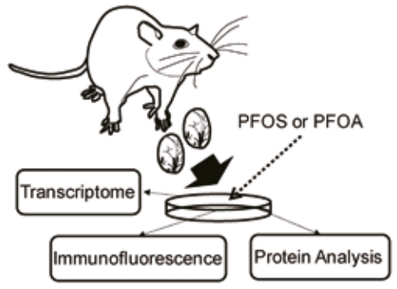
雙酚A(BPA)是一種環境激素，作用於雌激素受體[ERs：ER-α，ER-β和G-蛋白偶聯雌激素受體]，干擾機體代謝。另一方面，2009年歐洲研究項目OBELIX將一組持久性EDCs，即全氟烷基酸(PFAAs)列為優先受管制化學品，將其列為改變人代謝性疾病發展過程的風險因素之一。然而，這些化學物質對人體代謝健康構成的風險仍未被進一步評估和認識。

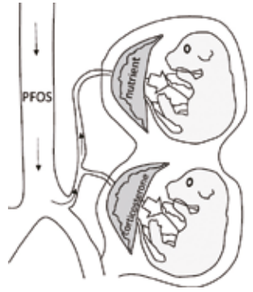
To evaluate the co-exposure risk to BPs and PFAAs via fish consumption, a time-trend analysis of the current concentrations of PFAAs and BPA was conducted. In addition, the concentrations of BPA analogs in the fish samples were determined. The data revealed that BPs and PFAAs coexist in the aquaculture environment, particularly for snubnose pompano and rice-field eels. Generally, a co-exposure risk to BPs and PFAAs can be identified via fish consumption in Hong Kong.

為了評估通過食用魚類引起的BPs和PFAAs共同暴露風險，我們對當前PFAAs和BPAs的濃度進行了時間趨勢分析。此外，還測定了魚類樣品中雙酚A類似物的濃度。數據顯示，BPs和PFAAs在水產養殖環境中共存，尤其是對金鯧魚和稻田鰻。通常在香港可通過食用魚類的情況來確定BPs和PFAAs的共同暴露風險。

This is the first report to indicate the presence of BPA analogs in market fishes. Possible additive metabolic-disrupting effect of BPA and its analogs as well PFAAs should be taken into consideration for human health risk assessment.

這是第一份研究報告表明市售魚類中存在雙酚A類似物。BPA及其類似物和PFAAs可能產生的累加的代謝干擾作用應被納入人類健康風險評估的考慮範圍。





Research Output

HT Wan, KP Lai, Chris KC Wong (2020). **Comparative analysis of PFOS and PFOA toxicity on sertoli cells.** *Environ Sci Technol 54*:3465-3475.

HT Wan, AYM Wong, S Feng, CKC Wong (2020) **Effects of in utero exposure to perfluorooctane sulfonate (PFOS) on placental functions.** *Environ Sci Technol 54 (24)*: 16050-16061

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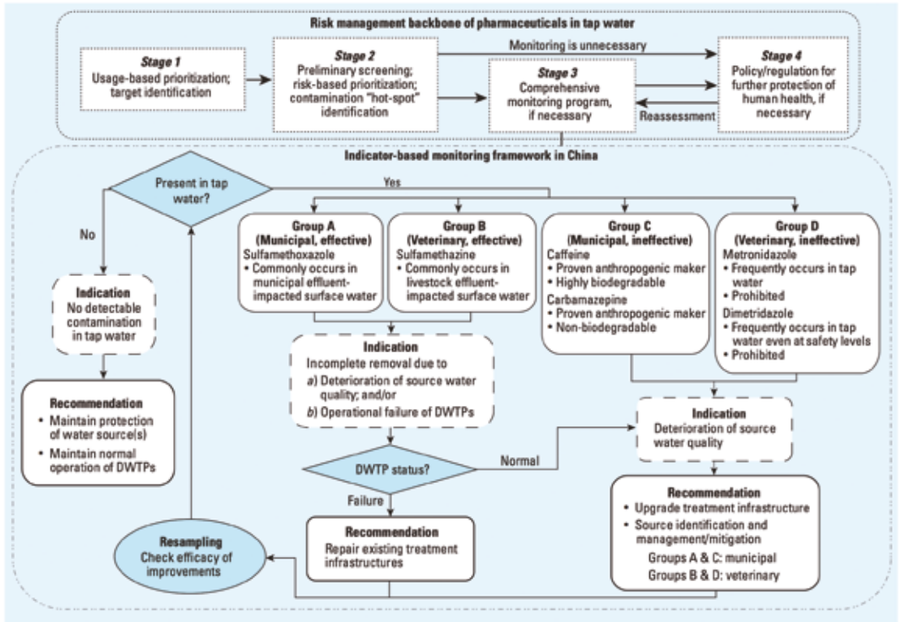
KP Lai, JC Lee, HT Wan, JW Li, YM Wong, TF Chan, C Oger, JM Galano, T Durand, KS Leung, CC Leung, R Li, Chris KC Wong (2017). **Effects of in utero PFOS exposure on transcriptome, lipidome, and function of mouse testis.** *Environ Sci Technol 51*:8782-8794.

YM Wong, R Li, CKF Lee, HT Wan, Chris KC Wong (2017). **The measurement of bisphenol A and its analogues, perfluorinated compounds in twenty species of freshwater and marine fishes, a time-trend comparison and human health based assessment.** *Marine Pollut Bull 124*:743-752.

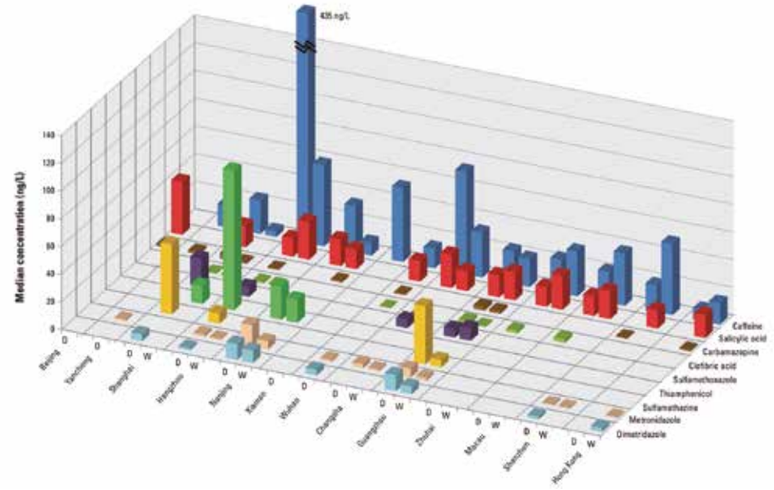
Pharmaceuticals in tap water: human health risk assessment and proposed monitoring framework in China
自來水中的藥物：中國人類健康風險評估和建議監測體系



Professor Paul K.S. Lam
林群聲 教授

Pharmaceuticals are known to contaminate tap water worldwide. In China, human and veterinary pharmaceuticals have frequently been detected in wastewater and surface waters at concentrations of generally < 1μg/L; levels of certain compounds, such as erythromycin-H_2O, salicylic acid, and cefalexin, have been reported to be at the high end of the values reported globally.

藥物污染自來水已為全世界熟知。在中國，廢水和地表水中檢測到人用和獸用的藥物，其濃度一般小於1μg/L；據報導，某些化合物，如水合紅黴素、水楊酸和頭孢氨苄的含量水準是全球報告的最高值。



However, the human health risks of pharmaceuticals in drinking water have rarely been evaluated. This information is needed for evaluating risk management and regulation with regard to pharmaceutical contamination in China. In this study, 113 samples from 13 cities in China were analyzed, and the detected concentrations were compared with existing or newly derived safety levels for assessing risk quotients at different life stages of humans.

然而，飲用水中藥物對人類健康的風險評價很少。這些資訊對評估中國藥品污染的風險管理和監管是必須的。本研究對中國13個城市的113個樣本進行分析，並將檢測到的濃度與現有或新制定的安全標準進行比較，以評估人類不同生命階段的風險商數。

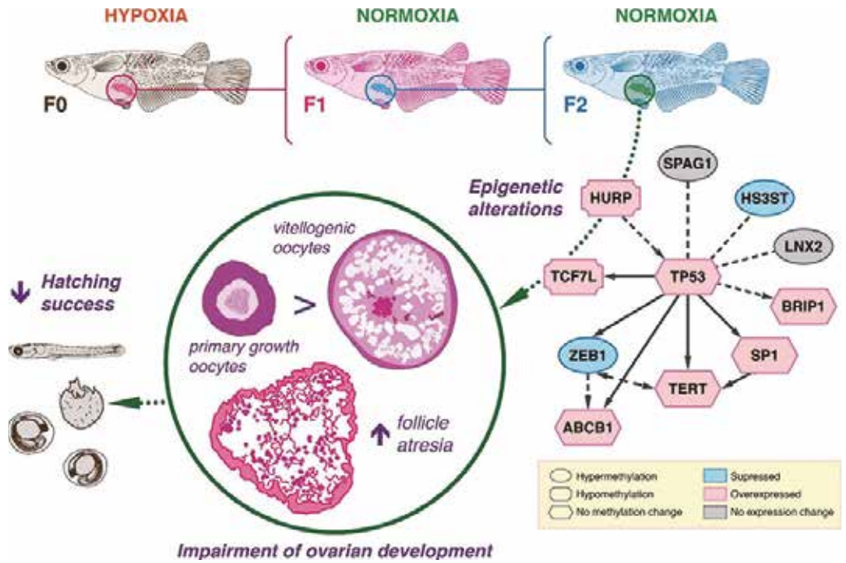
Chinese tap water is an additional route of human exposure to pharmaceuticals, particularly for dimetridazole, although the risk to human health is low based on the current toxicity data. Pharmaceutical detection and application of the proposed monitoring framework can be used for water source protection and risk management in China and elsewhere around the world.

中國的自來水是人類接觸藥物，特別是二甲硝咪唑的另一個途徑，儘管根據目前的毒理學資料，它對人類健康的風險很低。藥物檢測和實施監測體系可以作為中國和世界其他國家的水源保護措施和風險管理的手段。

Research Output

Leung, H.W., Jin, L., Wei, S., Tsui, M.M.P., Zhou, B.S., Jiao, L.P., Cheung, P.C., Chun, Y.K., Murphy, M.B. and Lam, P.K.S. (2013). **Pharmaceuticals in tap water: human health risk assessment and proposed monitoring framework in China.** *Environmental Health Perspectives 121(7),* 839-846.

Unravelling the effects, epigenetic changes and underlying mechanisms of hypoxia on fish reproduction and development
揭示缺氧對魚類繁殖和發育的影響、表觀遺傳變化和潛在機制



Professor Rudolf S.S. Wu
胡紹燊 教授

Globally, aquatic hypoxia (dissolved oxygen concentration less than 2.8 mg/L) is amongst the most pressing and widespread problems in marine and freshwater ecosystems. More than 400 hypoxic zone (commonly known as “dead zones”), with a total area of > 245,000 km^2, have been found worldwide. Hypoxia has caused mass mortality of marine animals, extinction of species, reduction of biodiversity, leading to major changes in structure and function of marine ecosystems and enormous economic loss.

在全球範圍內，水體缺氧(溶解氧濃度低於2.8 mg/L)是海洋和淡水生態系統中最緊迫和最普遍的問題之一。全世界已發現400多個缺氧區(俗稱“死區”)，總面積超過245000平方公里。缺氧導致海洋動物大量死亡，物種滅絕，生物多樣性減少，導致海洋生態系統結構和功能發生重大變化，並造成巨大的經濟損失。

For the first time in science, we demonstrated that hypoxia:

(a) is an endocrine disruptor, and interferes with hormones produced along the hypothalamic-pituitary-gonad axis (HPG axis) of fish, leading to reproductive dysfunction (e.g. impaired gonad development, spermatogenesis, sperm motility, fertilization success, hatching rate, and survival rate of juveniles). We further demonstrated that hypoxia can affect the role of miRNAs regulating the production of steroid hormones, and provided new insights into the molecular mechanism of endocrine disruption

(b) is a teratogen, and can lead to increased malformations, and delayed development through disrupting cell apoptosis and migration of primordial germ cells.

(c) affects sex differentiation and development of fish, leading to a male dominated second generation through down-regulating key genes controlling sex hormone synthesis and an increase in testosterone/estradiol ratio, thereby reducing reproductive success and posing a significant threat to the sustainability of natural fish populations.

(d) causes epigenetic changes, thereby leading to transgenerational reproductive impairments (impaired sperm quality, sperm motility and fertilization success rate) of the following two generations (despite these new generations have never been exposed to hypoxia before). We further show that hypoxia alters methylation of relevant genes in F0 sperm nd passed on to F2, and therefore changes the expression of related genes and proteins, thereby causing trans-generational reproductive impairments.

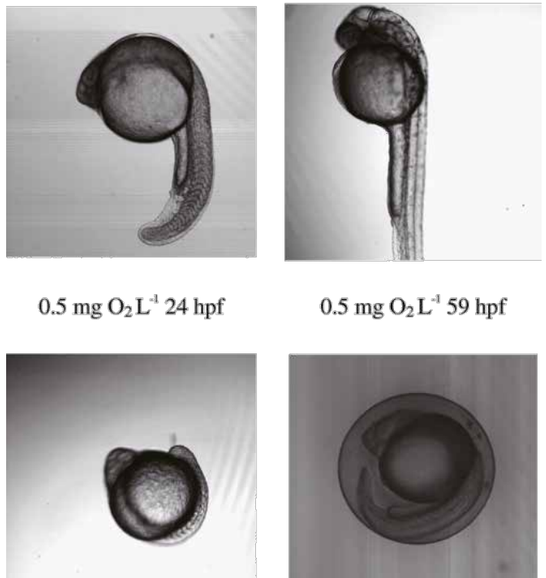
我們第一次從科學上證明了缺氧:

(a) 缺氧是一種內分泌干擾的因素，會干擾魚的下丘腦-垂體-性腺軸(HPG軸)產生的激素，從而導致生殖功能障礙(例如，性腺發育受損，精子產生，精子運動，受精成功，孵化率和幼魚存活率)。我們進一步證明了缺氧可以影響miRNA調節類固醇激素產生的作用，並為內分泌破壞的分子機制提供了新的見解。

(b) 缺氧是一種致畸劑，通過破壞細胞凋亡和原始生殖細胞遷移而增加畸形、延緩發育。

(c) 缺氧能影響魚類的性別分化和發育，通過下調控制性激素合成的關鍵基因並增加睾丸激素/雌二醇的比例，提高雄性第二代繁殖幾率，從而降低繁殖成功率。對自然魚類種群的可持續性構成重大威脅。

(d) 缺氧引起表觀遺傳改變，從而導致跨代的生殖器生殖功能受損，包括精子品質、精子活力和受精成功率，儘管這些後代以前從未接觸過缺氧。我們進一步研究發現缺氧改變了F0代精子中相關基因的甲基化並傳遞給第F2代，因此改變了相關基因和蛋白質的表達，從而導致跨代生殖損傷。



Our research unravels, for the first time, that hypoxia can pose a serious and long lasting threat to the reproduction and sustainability of natural fish populations, and also provides the underlying mechanisms.

我們的研究首次揭示了缺氧對自然魚類種群的繁殖和可持續性構成嚴重而持久的威脅，並提出了潛在的機制。

The above-mentioned scientific breakthroughs have attracted worldwide attention, and have been selected as cover stories by many top international scientific journal news outlets (e.g. Science News, News@nature.com, Scientific American, Science Direct, American Chemical Society, The World Science, Natural history magazine, Environmental News of Environmental Science & Technology, and QS WOWNEWS), as well as major global news media (e.g. ABC, CNN, Fox, Reuters, USA today, CBS news, EurekAlert, California Academy of Science, Los Angeles Times, La Monde, China Daily).

上述科學突破引起了全世界的關注，並被許多國際頂級的科學期刊（例如：Science News, News@nature.com, Scientific American, Science Direct, American Chemical Society, The World Science, Natural history magazine, Environmental News of Environmental Science & Technology, QS WOWNEWS）選為封面故事，並在全球主要新聞媒體發布（例如, ABC, CNN, Fox, Reuters, USA today, CBS news, EurekAlert, California Academy of Science, Los Angeles Times, La Monde, China Daily）。

Our research work has been selected and featured in two occasions by “Environmental Policy Science” of the European Union, to inform environmental policy of the EU.

我們的研究工作曾兩次被歐盟“環境政策科學”評選為專題，為歐盟的環境政策提供參考。

Since the sex hormone regulation and epigenetic regulation are highly conserved in vertebrates, our results suggest that hypoxia may also cause similar reproductive impairments, epigenetic changes and trans-generational effects on higher vertebrates (including humans).

由於性激素調節和表觀遺傳調節在脊椎動物中高度表達，我們的研究結果表明缺氧還可能對高等脊椎動物包括人類造成類似的生殖損傷，表觀遺傳變化和跨代影響。

Research Output

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Lai, K.P., Li, J.W., Tse, A.C.K., Cheung, A., Wang, S., Chan, T.F., Kong, R.Y.C. and Wu, R.S.S. (2016). **Transcriptomic responses of marine medaka’s ovary to hypoxia.** *Aquatic Toxicology 177,* 476-483.

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Shang, E.H.H. and Wu, R.S.S. (2004). **Aquatic hypoxia is a teratogen and affects fish embryonic development.** *Environmental Science & Technology 38(18),* 4763-4767.

Shang, E.H.H., Yu, R.M.K. and Wu, R.S.S. (2006). **Hypoxia Affects Sex Differentiation and Development, Leading to a Male-Dominated Population in Zebrafish (*Danio rerio*).** *Environmental Science & Technology 40(9),* 3118-3122.

Tse, A.C.K., Li, J.W., Wang, S.Y., Chan, T.F., Lai, K.P. and Wu, R.S.S. (2016). **Hypoxia alters testicular functions of marine medaka through microRNAs regulation.** *Aquatic Toxicology 180,* 266-273.

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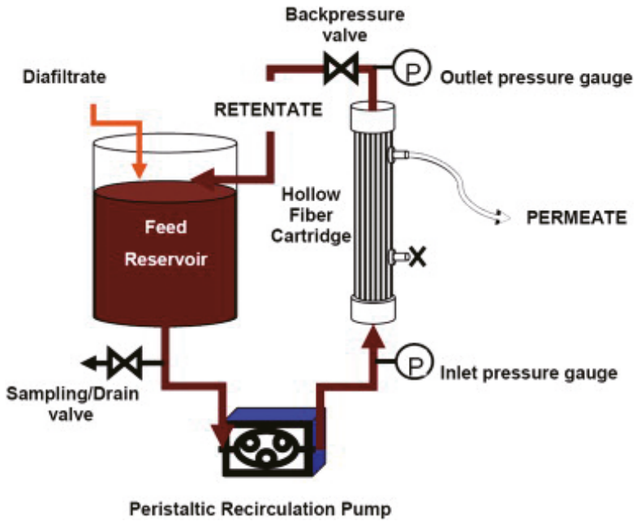
Wu, R.S.S., Zhou, B.S., Randall, D.J., Woo, N.Y.S. and Lam, P.K.S. (2003). **Aquatic hypoxia is an endocrine disruptor and impairs fish reproduction.** *Environmental Science & Technology 37(6),* 1137-1141.

DNA technologies for monitoring waterborne pathogens: A revolution in water pollution monitoring
檢測水傳播病原體的DNA技術：水污染監測的變革



Dr. Richard Y.H. Kong
江潤章 博士

Due to increasing population growth and anthropogenic pollution in the coastal zone, contamination of water and seafood with pathogens is probably responsible for the greatest number of human morbidities and mortalities worldwide. Hence, regular monitoring of waterborne pathogens is required to safeguard public health. Traditional methods rely on culturing of nonpathogenic indicator organisms for detection by inference, which are slow, not cost-effective, unable to distinguish harmful from benign strains, and fail to detect viable but nonculturable pathogens.

由於沿海地區人口增長和人為污染，水和海產品的病原體污染可能是全球引致大量人類疾病和死亡的最大原因。因此，需要定期監測水傳播的病原體，以保障公眾健康。傳統的檢測方法只能通過培養非致病性指示菌進行推斷，速度慢，成本低，不能區分有害菌株和良性菌株，不能檢測出無法培養的活體病原體。

To solve this problem, we have developed two new and powerful DNA-based technologies for water pollution monitoring quantitative triplex PCR assay and a pathogen DNA microarray that allow simultaneous quantification of several pathogens in a single water sample. This new method is much more rapid, reliable and cost effective than the traditional culture method in use.

為了解決這一問題，我們開發了兩種新的、具效能的DNA技術來監察水污染，技術包含三重定量PCR檢測和病原體DNA微陣列，可以同時定量單一水樣中的多種病原體。這種新方法比傳統的培養方法更加快速、可靠和經濟。

This innovative technique could provide a powerful supplement to conventional methods for more accurate risk assessment and monitoring of pathogenic microorganisms in the marine environment. The ability to rapidly monitor for various types of microbial pathogens would be extremely useful not only for routine assessment of water quality to protect public health, but also allow effective assessments of water treatment processes. Furthermore, such tests may be developed to include a wider range of pathogens and extended to examination of shellfish samples.

這一創新技術可為海洋環境致病病原體風險評估和監測的傳統方法提供有力補充。迅速監測各種類型的微生物病原體的能力對水質例行評估、保護公眾健康及水處理過程的有效評估將非常有用。此外，這種檢測方式可拓展應用於更多的病原體和貝類樣品檢查中。

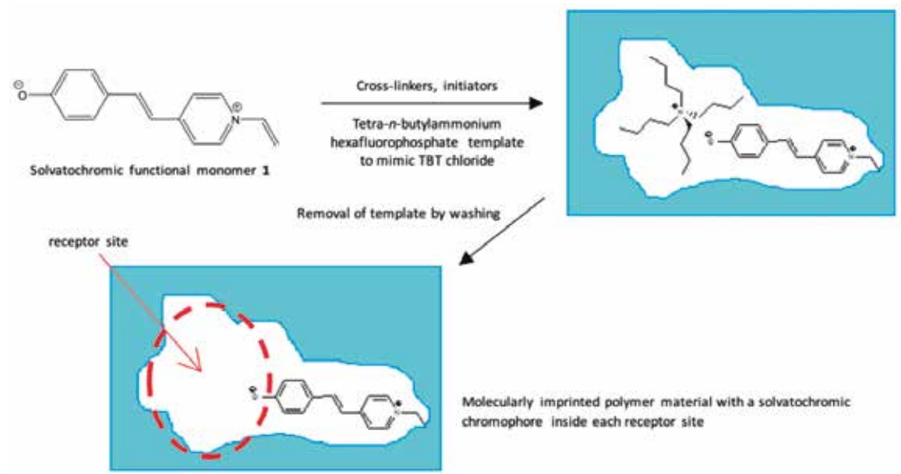
Research Output

Kong, R.Y.C., Lee, S.K.Y., Law, T.W.F., Law, S.H.W. and Wu, R.S.S. (2002). **Rapid detection of six types of bacterial pathogens in marine waters by multiplex PCR.** *Water Research 36(11),* 2802-2812.

Kong, R.Y.C., Mak, M.M.H. and Wu, R.S.S. (2009). **DNA technologies for monitoring waterborne pathogens: A revolution in water pollution monitoring.** *Ocean & Coastal Management 52(7),* 355-358.

Yang, N., Chu, D.L.H., Wong, M., Qi, H.Z., Wu, R.S.S. and Kong, R.Y.C. (2011). **Major human Hepatitis A virus genotype in Hong Kong marine waters and detection by real-time PCR.** *Marine Pollution Bulletin 62(12),* 2654-2658.

Smart stimulti-responsive materials for rapid detection of pollutants
用於污染物快速檢測的智慧型快速反應材料



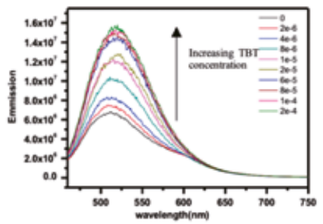
Professor Michael H.W. Lam
林漢華 教授

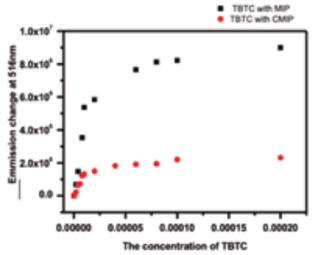
Our research group at the SKLMP focuses on the development of chemosensing materials via molecular imprinting and has already acquired a lot of experiences in the fabrication of molecularly imprinted polymers (MIPs) and other related materials.

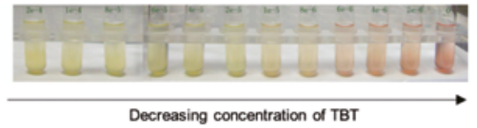
To tackle the challenge of the chemosensing of non-polar, hydrophobic organic contaminants that do not generally interact with commonly used signal transducers, we developed a novel molecular imprinting technology that makes use of solvatochromic molecular reporters to sense the minute changes in the polarity of the micro-environment within the molecularly imprinted receptor sites upon the molecular recognition and binding of such organic contaminants.

我們研究小組屬於海洋污染國家重點實驗室，致力於通過分子印跡技術開發化學傳感材料，並且已經獲得了製造(MIPs)和其他相關材料的大量經驗。

為解決一般不與通用信號感測器相互作用的疏水性有機污染物的化學傳感的問題，我們開發了一種新型分子印跡技術，利用溶劑致變色分子報告分子來感應識別和結合非極性污染物後分子印跡受體位置微環境極性的微小變化。







Luminescent (upper left) and colorimetric (right) responses of the MIP chemosensing material towards various concentrations of TBT in ethanol. Luminescent responses (monitored at 516 nm) of the chemosensing and control materials at different concentrations of TBT chloride (TBTC) are shown in the lower left.

To demonstrate the unique capability of our chemosensing technology, a special MIP material that can produce colorimetric and fluorometric responses upon the binding of tributyltin chloride is fabricated. This is the first time that tributyltin species can be detected by a chemosensor.

We will continue our work to develop more intrigue molecular sensing strategies that do not require specific molecular interactions with non-polar and hydrophobic analytes for molecularly imprinted chemosensing materials.

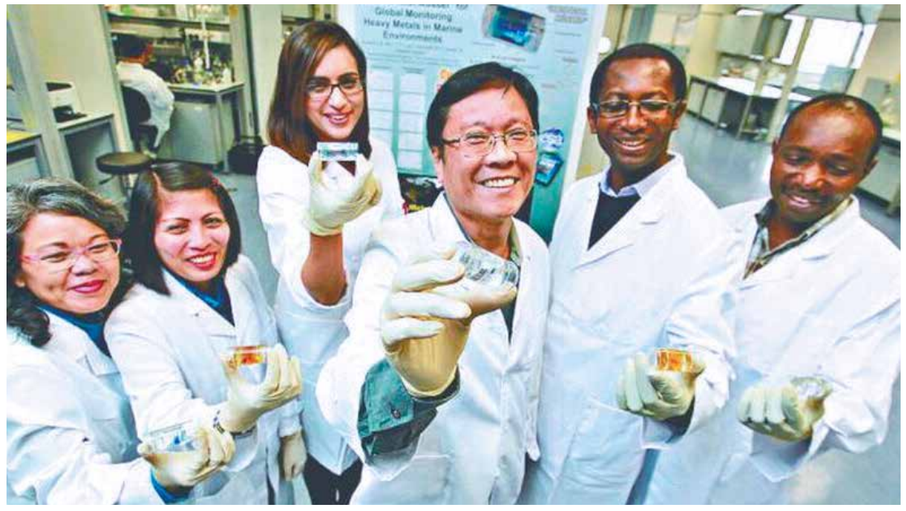
These new chemosensing mechanisms as well as the chemosensing materials developed will be very useful for the rapid, *in-situ* screening of selected environmental contaminants that are currently unable to be conveniently detected in complex sample matrices without the use of sophisticated analytical instrument after tedious *ex-situ* separation, pre-concentration and clean-up procedures.

為了證明我們的化學傳感技術的獨特能力，我們製造了一種特殊的MIP材料，該材料在結合氯化三丁基錫時可以產生比色和螢光響應。這是化學感測器首次檢測到三丁基錫類物質。

我們將繼續我們的工作，為分子印跡化學傳感材料開發出更多有趣的、不依賴於與非極性疏水分析物特異性作用/反應的分子傳感策略。

這些新的化學傳感機制以及開發的化學傳感材料對於現場快速篩選一些目前只能在實驗室環境中經歷分離、濃縮、純化的漫長過程才能從複雜樣品基質中檢測到的目標環境污染物非常有用。

Artificial Mussel: solving a 30-year-old global problem in heavy metal monitoring
人工貽貝：解決一個困擾全球30年的重金屬監測問題



Professor Rudolf S.S. Wu
胡紹燊 教授

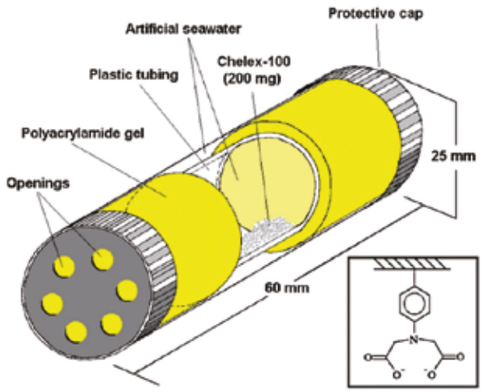
For more than 30 years, live mussels have been employed worldwide to monitor metal contaminants in marine waters. However, differences in biological and environmental conditions significantly affect metal levels in mussels, and more importantly, natural distribution often prevent comparison between species over large areas. To overcome this longstanding problem, Professor Rudolf Wu and Professor T.C. Lau have successfully developed a novel chemical device, called the 'Artificial Mussel' (AM).

30多年來，活貽貝在世界各地一直被用於監測海水中的金屬污染物。然而，生物和環境條件的差異會顯著影響貽貝的金屬含量，更重要的是，物種的自然分佈使物種之間的大範圍比較難以進行。為了克服這個存在已久的問題，胡紹燊教授和劉大鑄教授成功開發了一種新的化學裝置，稱為"人工貽貝"(AM)。

The AM offers reliable and time-integrated estimates of metal levels and overcome all the problems associated with the use of live mussels. This scientific advancement, for the first time, allows global comparison of metal concentrations in the marine environment.

AM能夠可靠且定時地評估金屬含量數據，並克服了所有使用活貽貝導致的相關問題。這一科學進步促進實現海洋環境金屬濃度在全球範圍內的比較。

Artificial Mussel (AM) is a novel chemical device invented for monitoring metals in marine environments. This device consists of a polymer ligand suspended in artificial seawater within a Perspex tubing, and enclosed with semi-permeable gel at both ends. Results of both laboratory and field experiments showed that uptake of metals (including As, Cd, Co, Cr, Fe, Hg, Mn, Ni, Pb, Se, and U Zn) by the AM is directly proportional to the exposure metal concentrations. The AM is able to accumulate the bioavailable fractions of metals, and the uptake of certain metals is much better than live mussels. Uptake and release of the metals of AM are similar to those of mussels, but less affected by salinity, temperature and other environmental factors.



人工貽貝(AM)是一種用於海洋環境金屬監測的新型化學裝置。該裝置由懸浮在人工海水中的聚合物配體、有機玻璃管容器和封閉有機玻璃管兩端的選擇透過半滲透性凝膠組成。室內和野外試驗結果表明，AM對重金屬(As, Cd, Co, Cr, Fe, Hg, Mn, Ni, Pb, Se, U和Zn)的吸收量與其暴露的金屬濃度成正比。AM能夠積累生物可利用的金屬形式，對某些金屬的吸收要比活貽貝好得多。AM對金屬的吸收和釋放與貽貝相似，但受鹽度、溫度和其他環境因素的影響較小。

Field studies demonstrated that the AM can not only provide a time-integrated estimate of metals concentrations, but also allows comparisons of metal levels in different environments and geographical areas beyond the natural distribution limits of biomonitors. The AM has also been successfully used in monitoring metals in freshwater and estuarine environments, and in estimating metal removal efficiency in wastewater treatment processes.

野外研究表明，AM不僅可以進行金屬濃度的定時評估，而且可以比較不同環境和地理區域的金屬水平，進而避免指示生物的自然分佈限制。該系統已成功地應用於淡水和河口環境的金屬監測，以及廢水處理過程中金屬去除效率的評估。

Impact:

- This break-through has attracted worldwide attention and was featured by the American Ecological Society.

- Professor Wu was commissioned by the International Atomic Energy Agency and the United Nations to conduct training workshops in Austria, Japan, Bangladesh and Hong Kong, to train over 40 scientists from different parts of the world in the use of AMs.

- Professor Wu launched a global 'Artificial Mussel Watch' programme with collaborators in 25 countries or regions spanning from North and South America, Europe, Asia to Australia. (Scotland, Iceland, Portugal, South Africa, Bangladesh, the Philippines, Russia, Thailand, Norway, Mexico, USA, Spain, Turkey, Australia, Brazil, Korea, Greece, India, Canada, Ghana, Namibia, Nigeria, Morocco, Sri Lanka and Mainland China).

- More recently, scientists in the USA is further exploring the feasibility of using the Artificial Mussels to monitor radionuclides in the marine environment.

影響：

- 這個重大突破已經引起世界範圍的關注，美國生態學會會刊亦報道了我們的創新發明。

- 胡教授曾獲國際原子能機構及聯合國委任，在奧地利、日本、孟加拉及香港舉辦工作坊，訓練來自世界各地超過40名科學家使用AM裝置。

- 胡教授與南、北美洲、歐洲、亞洲、澳洲等25個國家或地區（蘇格蘭、冰島、葡萄牙、南非、孟加拉、菲律賓、俄羅斯、泰國、挪威、墨西哥、美國、西班牙、土耳其、澳大利亞、巴西、韓國、希臘、印度、加拿大、迦納、納米比亞、尼日利亞、摩洛哥、斯里蘭卡和中國內地） 的合作夥伴開展了全球「人工貽貝監測」項目。

- 最近，美國科學家正在進一步探索利用人工貽貝監測海洋環境中的放射性核元素的可行性。

Research Output

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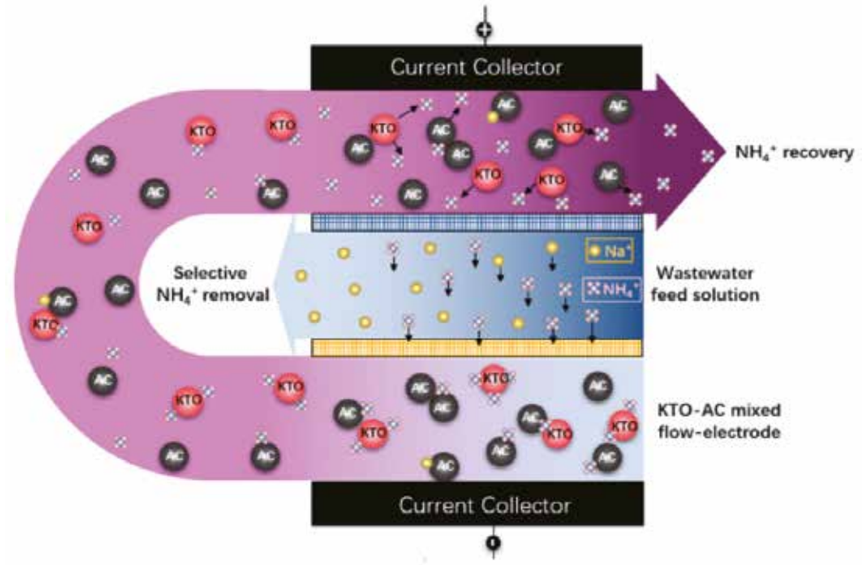
Gença, T.O., Po, B.H.K., F. Yılmaza, T.C. Lau, R.S.S. Wu, J.M.Y. Chiu, (2018). **Differences in metal profiles revealed by native mussels and artificial mussels in Sarıçay Stream, Turkey: Implications on pollution monitoring.** *Marine and Freshwater Research 69:* 1372-1378

Ruiz-Fernández, A.C., R. S.S. Wu, T.C. Lau, L. H. Pérez-Bernal, J. A. Sánchez-Cabeza, J. M.Y. Chiu, (2018). **A comparative study on metal contamination in Estero de Urias lagoon, Gulf of California, using oysters, mussels and Artificial Mussels: Implications on pollution monitoring and public health risk.** *Environmental Pollution 243:* 197-205.

Selective ammonium removal from synthetic wastewater by flow-electrode capacitive deionization using a novel $K_2Ti_2O_5$-activated carbon mixture electrode

基於新型鈦酸鉀-活性炭混合流動電極的電容去離子工藝選擇性去除合成廢水中的銨根離子



Professor X.Y. Li
李曉岩 教授

Ammonium (NH_4^+) in wastewater is both a major pollutant and a valuable resource. Flow-electrode capacitive deionization (FCDI) is a promising technology for chemical-free and environmentally friendly NH_4^+ removal and recovery from wastewater.

銨根離子(NH_4^+)是污水中主要的污染物之一，同時也是有價值的資源物質。流動電極電容去離子技術(FCDI)是一個無化學添加的環境友好型氨氮回收技術。

However, the coexisting sodium (Na^+) in wastewater, with a similar hydrated radius to NH_4^+, competes for the adsorption sites, resulting in low NH_4^+ removal efficiency. Here, potassium dititanate ($K_2Ti_2O_5$ or KTO) particles prepared by the electrospray method followed by calcination were mixed with activated carbon (AC) powder to form a novel KTO-AC flow-electrode for selective NH_4^+ removal over Na^+.

然而由於廢水中鈉離子的水合半徑和銨根離子相似，會與銨根離子競爭流動電極上的吸附位點，從而降低銨根離子去除效率。本研究通過靜電噴霧和高溫煅燒工藝製備出鈦酸鉀顆粒($K_2Ti_4O_5$KTO)，將其與活性炭粉末混合製成新型鈦酸鉀-活性炭流動電極，用於從含高鈉廢水中選擇性回收銨根離子。

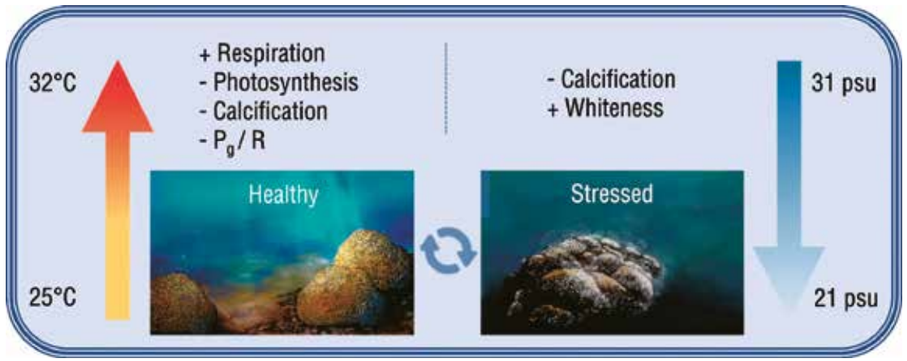
The mixed KTO-AC electrode exhibits a much higher specific gravimetric capacitance in NH_4Cl solution than in NaCl solution. Compared with the pure AC electrode in the FCDI tests on NH_4^+ removal from synthetic wastewater, 25 wt % KTO addition in the electrode mixture increases the adsorption selectivity from 2.3 to 31 toward NH_4^+ over Na^+, improves the $NH4^+$ removal from 28.5% to 64.8% and increases the NH_4^+ desorption efficiency from 35.6% to over 80%, achieving selective NH_4^+ recovery and effective electrode regeneration. Based on DFT calculations, NH_4^+ adsorption on the $K_2Ti_2O_5$ (0 0 1) surface is more thermodynamically favorable than that of Na^+, which contributes to the high NH_4^+ adsorption selectivity observed.

與採用純活性炭的FCDI工藝相比，在流動電極中摻入25wt%的KTO顆粒，含鈉廢水中銨根離子的選擇吸附性從2.3提高至31，銨根離子去除率從28.5%提高至64.8%，銨根離子解吸效率從35.6%增至80%，實現了對銨根離子的高效回收與電極再生。根據密度泛函理論計算結果，鈦酸鉀晶面(0 0 1)對銨根離子的吸附作用在熱力學上比鈉離子更穩定，因此對銨根離子具有選擇吸附性。

Research Output

Lin, L., Hu, J.H., Liu, J.H., He, X., Li, B. and Li, X.Y. (2020). **Selective ammonium removal from synthetic wastewater by flow-electrode capacitive deionization using a novel $K_2Ti_2O_5$-activated carbon mixture electrode.** *Environmental Science & Technology 54(19),* 12723-12731.

Underwater visual monitoring of health of coral ecosystem
水下視覺監測珊瑚生態系統的健康



Dr. Leo L. Chan
陳 荔 博士

Coral reef ecosystems are hotspots of biodiversity and productivity in the ocean. However, coral reefs are declining worldwide due to global changes in the marine environment. The increasing frequency of massive bleaching events in the tropics is highlighting the need to better understand the stages of coral physiological responses to extreme conditions. Understanding coral health from polyp-endosymbiont symbiosis to the community level provides the foundation for studying and developing potential mitigation and management strategies and achieving early detection of the onset of stress responses is crucial for implementing these strategies soon enough to help minimize impacts.

珊瑚礁生態系統是海洋生物多樣性和生產力的熱點。但是，由於全球海洋環境的變化，全世界的珊瑚礁正在減少。熱帶地區大規模白化事件日益增加，凸顯了需要更好地了解珊瑚在極端環境下生理反應階段的必要性。從珊瑚蟲共生體到群落水平了解珊瑚的健康狀況，可為研究和制定緩解和管理策略提供基礎，並盡早識別受壓反應的發生，這對可儘快實施這些策略以減少影響至關重要。

Accurate and precise assessment of coral metabolic processes is key to improving our knowledge of the reef building species, and how their ecosystems are influenced to varying degrees by the combination of local and global anthropogenic disturbance. The Community in-situ Metabolism (CISME) respirometry system enables comparatively rapid, non-destructive measurement of coral physiological indicators, with a level of precision and accuracy that enables the detection of small differences in coral metabolism among corals and over their natural diel cycle. The system is better suited for high spatial and temporal resolution sampling than other methods.

The novel underwater visual monitoring method can be an important tool for studying the effects of local stressors. Its practicality and low cost of use also would help support the continuous collection of observations needed to detect effects associated with interannual and decadal scale ocean-atmosphere climate variability, as well as the process of climate-driven changes in marine systems. Further development and application of this instrument and similar methodologies will improve our ability to generate rich and timely information about the energetic status of corals, which is urgently needed for coral reef management and conservation efforts.

準確和精確地評估珊瑚的代謝過程是提高我們對造礁物種認識，以及牠們的生態系統如何在不同程度上受到當地和全球人為干擾影響的關鍵。群落原位代謝(CISME)呼吸測量系統能夠相對快速、無損地測量珊瑚的生理指標，其精確度和準確度能夠檢測珊瑚之間及其自然晝夜迴圈中珊瑚代謝的微小差異。該系統比其他方法更適合於高時空分辨率採樣。

新的水下視覺監測方法可以成為研究原位壓力效應的重要工具。它的實用性和較低的使用成本也將有助於持續收集觀測資料，以探測年際和年代際尺度下海洋-大氣氣候變化以及海洋系統氣候驅動變化的演變有關的影響。進一步開發和應用該設備或類似方法將提高我們建立豐富且及時的有關珊瑚生理狀態信息的能力，這是珊瑚礁管理和保育工作迫切需要的。

The proteomic research of reef building corals

An increasing number of studies have demonstrated that proteomics holds a great potential for dissecting the biology of coral reefs. Coral proteomics is an essential complement to coral transcriptomics in interrogating coral biology, because of the poor correlation between coral (in both host and endosymbionts compartments) mRNA levels and the concentration of the respective proteins. However, unraveling the proteome of stony corals is still facing significant challenges. For instance, it is important to optimize physical and chemical methods that can efficiently extract proteins from the stony samples before downstream analysis using mass spectrometry (MS). Current work is focusing on improving the streamlined workflow for large-scale analysis of coral proteome using a label-free quantitative MS.

造礁珊瑚的蛋白質組學研究

越來越多的研究表明，蛋白質組學在詳細分析珊瑚礁生物學方面具有巨大潛力。珊瑚蛋白質組學是研究珊瑚生物學中對珊瑚轉錄組學的重要補充，因為珊瑚(在寄主和內共生體隔室中)mRNA水平與相應蛋白質濃度之間的相關性很差。然而，揭開石珊瑚的蛋白質組仍然面對着巨大的挑戰。例如：在使用質譜進行下游分析之前，優化能夠有效地從石質樣品中提取蛋白質的理化方法非常重要。當前的工作集中在簡化工作流程以使用無標記的定量質譜對珊瑚蛋白質組進行大規模分析。

The reef fish survey

Coral reef fish is one of the important components in coral community and the diversity and abundance of reef fish are some of the important indicators of the well-being of coral communities. In the early studies of reef fish in Hong Kong, quantitative data were limited because such investigations covered narrow geographical or temporal range and used different methodologies. There would be a difficulty to make comparison or collection of data in terms of reef fish community dynamic without a standardized methodology. Therefore, a comprehensive and systematic study using a standardized methodology is essential to fill the knowledge gap of the reef fish diversity, abundance and size distribution, and establish a long-term monitoring programme of reef fish assemblages in Hong Kong waters, including marine parks and marine reserve which are designated as protected areas to protect coastal ecosystems and fisheries resources.

礁魚調查

珊瑚礁魚類是珊瑚群落的重要組成部分之一，珊瑚礁魚類的多樣性和豐富度是珊瑚群落健康的重要指標。在香港對珊瑚礁魚的早期研究中缺乏定量數據，因為早期調查使用了不同的方法，且只涵蓋了狹窄的地理或時間範圍。如果沒有標準化的方法，就很難對珊瑚礁魚群落的動態數據進行比較或收集。因此，使用標準化方法進行全面系統的研究，對於填補香港水域中珊瑚礁魚類多樣性、豐富度和大小分佈的知識缺口，以及建立香港水域包括被指定為保護沿海生態系統和漁業的海岸公園和海岸保護區在內的珊瑚礁魚群的長期監測計劃至關重要。

The survey funded by AFCD has provided a reef fish community baseline for a long-term monitoring programme to assess the long-term environmental impact such as climate change, and also provided a baseline for any further planning of a new fishery related policy or setting up a new marine protection area. In future, the established geodatabase will allow investigators or governmental officers to access the species distribution information for environmental planning and conservation endeavors.

該調查獲漁護署支持，作為珊瑚礁魚群落基線，可用於長期監測計劃以評估氣候變化等長期環境影響，並為將來訂定新漁業政策或設立新的海洋保護區的任何進一步規劃提供基線。

Research Output

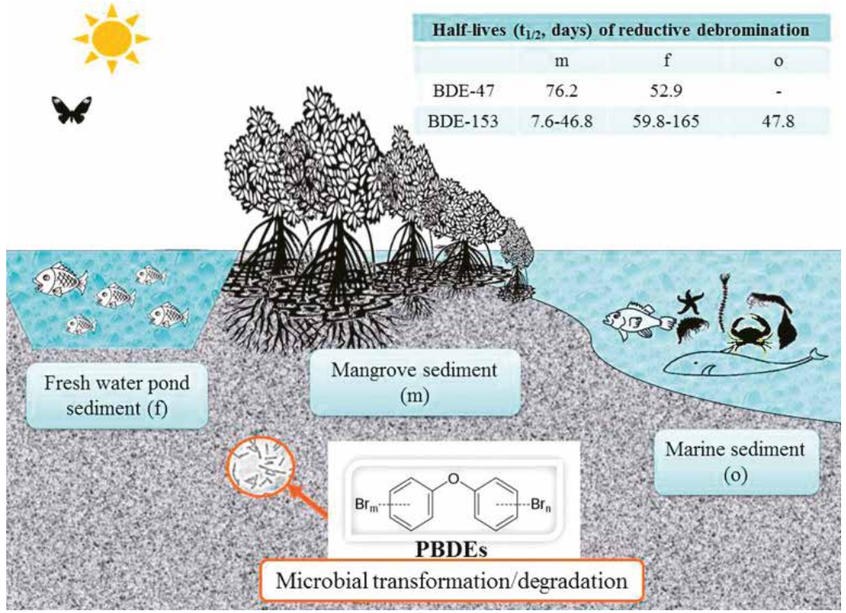
Dellisanti, W., Tsang, R.H.L., Ang, P., Wu, J.J., Wells, M.L. and Chan, L.L. (2020). **A diver-portable respirometry system for in-situ short-term measurements of coral metabolic health and rates of calcification.** *Frontiers in Marine Science 7*.

Dellisanti, W., Tsang, R.H.L., Ang, P., Wu, J.J., Wells, M.L. and Chan, L.L. (2020). **Metabolic performance and thermal and salinity tolerance of the coral *Platygyra carnosa* in Hong Kong waters.** *Marine Pollution Bulletin 153.*

Dellisanti, W., Chung, J.T.H., Chow, C.F.Y., Wu, J.J., Well, M.L. & Chan, L.L. (2021). **Experimental techniques to assess coral physiology in-situ: current approaches and novel insights.** *Frontiers in Physiology (Aquatic Physiology), doi: 10.3389/fphys.2021.656562;*

Ma, H.Y., Liao, H., Dellisanti, W., Sun, Y., Chan, L.L., Zhang, L. (2021) **Characterizing the host coral proteome of *Platygyra carnosa* using suspension trapping (S-Trap)**. *Journal of Proteome Research, 20(3), 1783 -1791.*

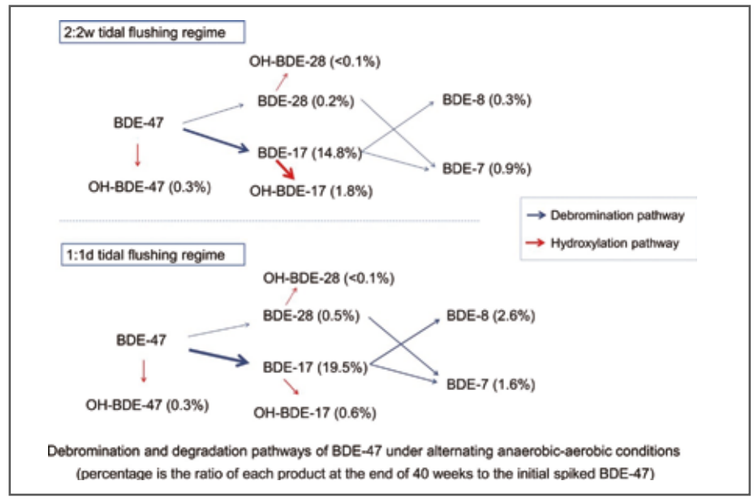
Responses of mangrove wetland ecosystems to toxic pollutants and remediation mechanism
紅樹林濕地生態系統對有毒污染物的響應及修復機制



Professor Nora F.Y. Tam
譚鳳儀 教授

Mangrove wetland ecosystems are common along the coastlines of the sheltered shores in tropical and subtropical regions, including HKSAR and South China. Mangroves are often under pollution stress and are sinks or receivers for various man-made pollutants, particularly in metropolises areas, such as Hong Kong and Shenzhen, with rapid urbanization, economic and infrastructural developments. Severe pollution problem in mangrove ecosystems has attracted more and more attention at both national and international levels.

紅樹林濕地生態系統是熱帶和亞熱帶地區（包括香港和中國華南地區在內）的內灣沿岸常見的生態系統。紅樹林，特別是如香港和深圳等城市化、經濟及基礎設施發展迅速的大都市地區的紅樹林，經常受到污染脅迫，是許多人造污染物的接收地和匯集地。紅樹林生態系統的嚴重污染問題正在越來越受到國家和國際社會的關注。



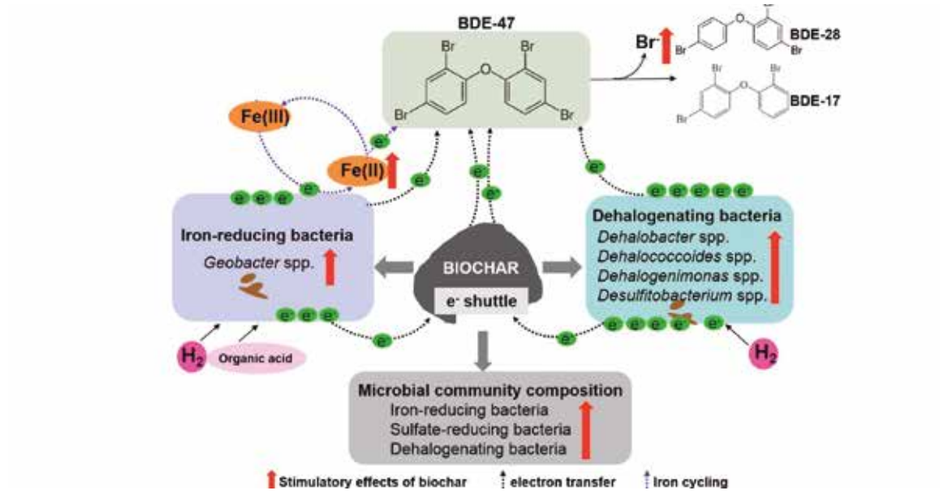
Debromination and degradation pathways of BDE-47 under alternating anaerobic-aerobic conditions (percentage is the ratio of each product at the end of 40 weeks to the initial spiked BDE-47)

The unique features of mangrove ecosystems, including high primary productivity, abundant detritus, rich organic carbon and anoxic/reduced conditions make them a preferential site for the uptake and preservation of persistent toxic organic pollutants. The responses of mangrove ecosystems to pollutants and how to remove them are very hot research topics in recent decades.

紅樹林生態系統的獨特特性，包括旺盛的初級生產力，豐富的碎屑和有機碳，缺氧或耗氧環境，使得它們容易吸收和留存有毒持續性有機污染物。紅樹林對污染物的響應以及去除機製成為了近年來研究的熱門話題之一。

The research adopted large-scale and long-term sampling methods to assess the pollution of nutrients, heavy metals and toxic persistent organic pollutants (POPs) in mangrove wetlands, particularly the Pearl River Estuary in China, focusing on the degrees, sources, transfer and fate of multiple pollutants. The research then evaluated the effects of pollutants on mangrove wetlands and their response mechanisms. The mangrove root was an important component, as it released oxygen to rhizophere, formed iron plaque on root surface and exudated low molecular weight organic acids, which could immobilize and degrade toxic pollutants.

本研究使用大規模和長期的採樣方法去評估紅樹林濕地，特別是中國珠江口的營養鹽、重金屬和有毒持久性有機污染物的污染情況，專注於評估多種污染物的污染程度、源頭、遷移和歸趨。由此評估污染物對紅樹林濕地的影響及紅樹林濕地的響應機制。紅樹根是紅樹林的重要組成部分，根系將氧氣釋放至根系周圍，其表面有鐵膜，能夠滲出小分子的有機酸，可以使固定並降解污染物。



Some mangrove plants had higher ability to tolerate and degrade toxic pollutants than the others, which were further developed as candidates for phyto- and bio-remediation purposes. The toxic POPs remediation efficiency could be significantly enhanced by combining the removal with the treatment of aquaculture effluent and the planting of suitable mangrove species.

一些紅樹植物對污染物的忍耐和降解能力很強，可以發展作為植物或生物修復的潛在手段。種植適當的紅樹植物可處理水產養殖廢水和去除污染物，並可顯著提高對有毒持久性有機污染物的修復效率。

The research also discovered mangrove sediment and root supported a high diversity of microbial community, the significance of bacteria in transforming and degrading toxic organic pollutants in mangrove ecosystems, and successfully isolated a list of microbial strains with high tolerance and good efficiency to remedy and decontaminate toxic pollutants from mangrove sediments subject to different degrees of pollution. The decontamination, degradation and transformation mechanisms of the pollutant-resistant microorganisms, particularly, the metabolic pathways and co-metabolism mechanisms of multiple toxic pollutants were elucidated. The key factors in the removal and degradation process, as well as the optimal degradation conditions, which are essential for the *in-situ* bioremediation of organic pollutants optimized, were identified.

本研究亦發現紅樹林沉積物和根系可以支援多樣性豐富的微生物群落，細菌在紅樹林生態系統中轉化和降解有毒持續性有機污染物過程中具有重要作用，並成功地分離出了一系列對受不同污染程度的紅樹林中的有毒污染物具有高耐受性和良好修復淨化效果的微生物菌株。抗污微生物對污染物的去除、降解和轉化機制，特別是其對多種有毒污染物的代謝通道和共代謝機制在本研究中得以闡明。有機污染物去除及降解過程中的關鍵因子及降解作用的最佳環境條件對優化後的有機污染物原位生態修復有重要意義，這些因素和條件在本研究中也得以鑒明。

Over the past decades, the research made significant contribution and produced ground-breaking results in pollution studies and ecology of mangrove wetland ecosystems. We discovered the resistance mechanism of mangrove plants to toxic POPs, and pollutant-tolerant plants and microorganisms in mangrove wetlands for the degradation and bioremediation of POPs: their decontamination functions, metabolism and co-metabolism mechanisms. We demonstrated mangrove wetland is our “green kidney”, a natural biological treatment system for the removal of nutrients and pollutants, its capacity and mechanism related to resistance and remediation. We employed constructed mangrove wetlands planted with a mixture of tolerant and capable species as effective waste water treatment systems for the purification and remediation of toxic contaminants in our environments. The work not only revealed an important ecological function of mangrove wetlands, it also provided essential scientific information for better conservation and management of mangrove ecosystems. The research employed multidisciplinary approaches in environmental sciences, chemistry, microbiology, etc., and developed novel techniques to tackle the pollution problem and enhance our scientific understandings of how mangrove ecosystem responds to pollution.

在過去幾十年間，本研究在紅樹林濕地污染研究、生態方面做出巨大貢獻，並取得了突破性的成果。我們發現了紅樹林植物對有毒持續性有機污染物的防禦機制，以及紅樹林濕地中耐污植物和微生物對持久性有機污染物的降解和生物修復作用：它們的去污功能，代謝和共代謝機制。我們闡明了紅樹林濕地是我們的「綠色腎臟」，一個去除營養鹽和污染物的天然的生物處理系統，同時亦說明瞭其耐受和修復污染的能力和機制。本成果不僅揭示出紅樹林濕地的重要生態功能，而且為更好地保護和管理紅樹林生態系統提供了重要的科學資訊。本研究結合了環境科學、化學、微生物學等多學科的研究方法，開發了解決污染問題的新技術，增強了我們對紅樹林生態系統如何應對污染的科學認識。

The series of research work has produced substantial impacts to the fields of Environmental Sciences, Marine Sciences, Microbiology and Analytical Chemistry, and is highly commented by peers at home and abroad. The research ideas and results have been widely appreciated and adopted by the peers.

此系列研究工作在環境科學、海洋科學、微生物學和分析化學等領域產生重大影響，受到國內外同行的高度評價。研究思路和成果已得到同行廣泛認可和採納。

Research Output

Pan Y, Chen J, Zhou H C, Cheung S G and Tam N F Y (2019). **Degradation of BDE-47 in mangrove sediments under alternating anaerobic-aerobic conditions.** *Journal of Hazardous Materials, 378:* 120709.

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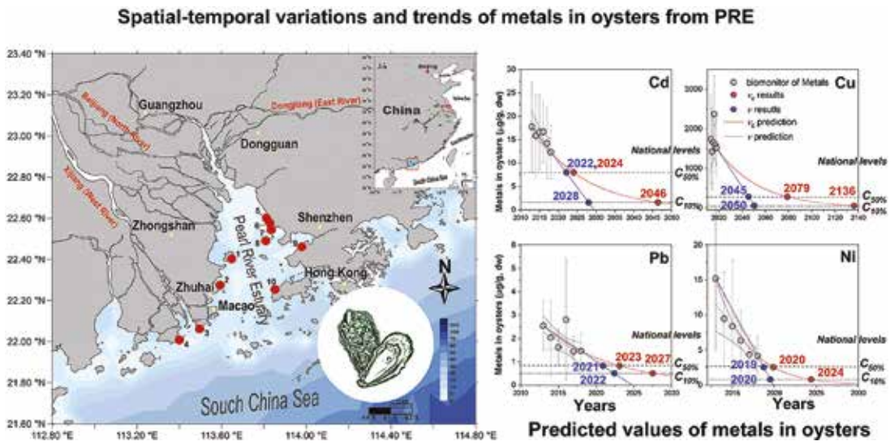
Zhong Y, Luan T G, Lin L, Liu H and Tam N F Y (2011). **Production of metabolites in the biodegradation of phenanthrene, fluoranthene and pyrene by the mixed culture of *Mycobacterium* sp. and *Sphingomonas* sp.** *Bioresource Technology, 102:* 2965-2972.

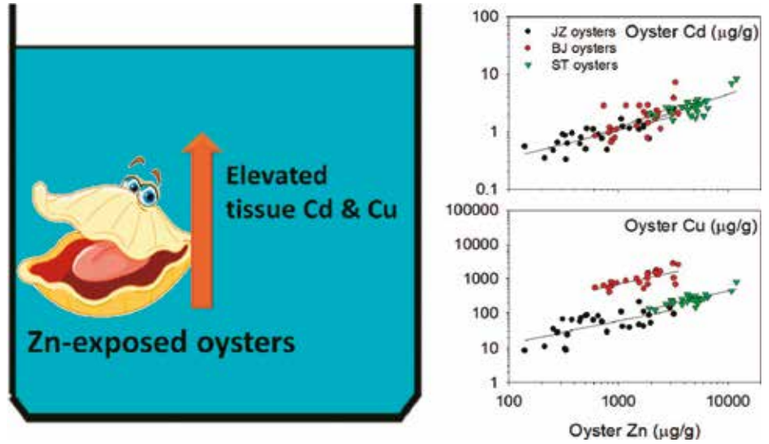
Trace metal contamination in estuarine and coastal environments in China
中國河口和沿海環境中的痕量金屬污染



Professor W.X. Wang
王文雄 教授

Metal pollution is one of the major environmental problems in Chinese coastal waters, including the Pearl River Delta. Such pollution has resulted in substantial concerns for environmental health and seafood safety. There are increasing calls to study the metal pollution as well as its impacts on the marine ecosystems, which are important for the management of water quality and seafood safety in China. Researches conducted in the laboratory of Professor Wenxiong Wang have addressed these pressing issues and provided new understanding of the ecotoxicology and biogeochemistry of metal pollutants in the marine environments, particularly in the Pearl River Estuary.

金屬污染是包括珠江三角洲在內的中國沿海水域的主要環境問題之一。這種污染對環境健康和海產品安全的影響已引起人們的密切關注。研究金屬污染對海洋生態系統的影響，對我國的水質管理和海產品安全管理具有重要意義。王文雄教授的實驗團隊所進行的研究解決了這些緊迫的問題，並對海洋環境尤其是珠江口中金屬污染物的生態毒理學和生物地球化學提出了新的認識。

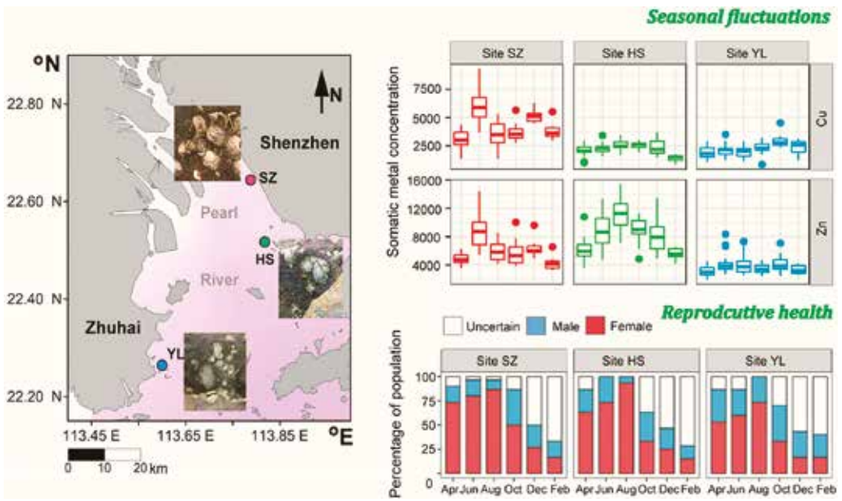


Professor Wang has extensively quantified the transfer of heavy metals along different food chains in marine environments, and demonstrated that the main route for metal uptake in marine organisms is via the food chain transfer (i.e., dietary exposure).

王教授對海洋環境中不同食物鏈上重金屬的轉移進行了廣泛的量化，並證明了海洋生物攝取重金屬的主要途徑是通過食物鏈轉移(即飲食中的暴露)。

Traditional toxicological studies typically expose the organisms to environmental pollutants in the aqueous environment, and Professor Wang's study provided important basis to conduct toxicity assessment under more environmentally realistic conditions due to trophic transfer of metals (Wang 2011). He conducted comprehensive mapping of metal contamination in sediments and marine organisms in Chinese coastal environments (Pan and Wang 2012, Lu et al. 2020). Such long series of monitoring in the Pearl River Estuary showed that although some of the metals showed their declining trends in their contamination levels over the past few years, other metals emerged as new concerns due to their new exploitation in the region.

傳統的毒理學研究通常將生物體暴露于水環境中的環境污染物中，王教授的研究為基於金屬的營養轉移，在更為現實的環境條件下進行毒性評估提供了重要依據(Wang 2011)。他對中國沿海環境中沉積物和海洋生物中的金屬污染進行了全面測繪(Pan and Wang 2012，Lu et al.2020)。在珠江口進行的長期監測資料顯示，儘管過去幾年中某些金屬的污染水平呈下降趨勢，但由於該地區新的開發，其他金屬成為新的污染關注點。



The monitoring of metal pollution in the Pearl River Delta also answered the long-standing question as why South China estuary oysters carry unacceptably high levels of cadmium (Cd), despite the fact that the coastal waters generally contain low levels of this pollutant. The abnormally high Cd levels in the oysters were mainly due to the low salinity in the estuarine waters which promoted the Cd bioavailability, as well as the possible contamination by other metals such as Zn (Liu and Wang 2012, Yin et al. 2017). Further toxicity assessment in the Pearl River Estuary showed that metals had measurable impacts on the reproductive performance of oysters (Weng and Wang 2019).

珠江三角洲的金屬污染監測也回答了一個長期存在的問題，即儘管沿海水域通常鎘的水平較低，但為什麼華南河口牡蠣中的鎘含量卻高得令人無法接受。牡蠣中鎘含量異常高的主要原因是河口水鹽度低，從而促進了鎘的生物利用度以及鋅等其他金屬的污染可能性（Liu and Wang 2012，Yin et al.2017）。珠江口進一步的毒性評估表明，金屬對牡蠣的繁殖性能有顯著的影響（Weng and Wang 2019）。

Professor Wang's extensive researches involve three frameworks: environmental transport, bioavailability and bio-accumulation, and toxicity at different biological levels. A better understanding of the metal impacts on marine environments could inform environmental risk assessments for environmental management and policies. These include the revision of government regulations on metal contamination in foods and water quality standards in protecting human health and the marine environment, as well as seafood safety.

王教授的研究涉及三個框架：環境遷移、生物利用度和生物累積性，以及不同生物學水平的毒性研究。更好地瞭解金屬對海洋環境的影響可以為環境管理和政策的環境風險評估提供依據。這些措施包括修訂關於食品中金屬污染的政府條例和水質標準，以保護人類健康和海洋環境，以及海產品安全。

Research Output

Liu F, Wang WX. (2013). **Facilitated bioaccumulation of cadmium and copper in the oyster *Crassostrea hongkongensis* solely exposed to zinc.** *Environmental Science and Technology 46:* 1670-1677.

Lu GY, Pan K, Zhu A, Dong Y, Wang WX. (2020). **Spatial-temporal variations and trends predication of trace metals in oysters from the Pearl River Estuary of China during 2011-2018.** *Environmental Pollution 264:* 114812.

Pan K, Wang WX. (2012). **Trace metal contamination in coastal and estuarine environments in China.** *Science of Total Environment 421/422:* 3–16.

Wang WX. (2011). **Incorporating exposure into aquatic toxicological studies: An imperative.** *Aquatic Toxicology 105S:* 9-15.

Weng NY, Wang WX. (2019). **Seasonal fluctuations of metal bioaccumulation and reproductive health of local oyster populations in a large contaminated estuary.** *Environmental Pollution 250:* 175-185.

Yin Q, Wang WX. (2017). **Relating metals with major cations in oyster *Crassostrea hongkongensis*: A novel approach to calibrate metals against salinity.** *Science of Total Environment 577:* 299-307.

Science Feature
科研專題故事

10 Shoring Up The Coastlines

Eco-tiles enhance marine biodiversity on artificial seawalls

拯救海岸線 - 生態海堤提高生物多樣化

Professor Kenneth Mei Yee Leung
Director of State Key Laboratory of Marine Pollution (CityU)
梁美儀 教授
海洋污染國家重點實驗室主任

Eco-engineered tiles before deployment (left) and after 12 months (right). More species like sea snails are found on the tiles after 1 year.

人工生態組件的原貌（左）和置於海堤12個月後（右）的情況，可見有不少生物例如石鱉、海螺及帽貝依附在上面生長。

Professor Kenneth Mei Yee Leung (second from right) and his team, Chi Chiu Lo (from the left), Thea E. Bradford and Dr. Juan C. Astudillo.

梁教授（右二）與他的團隊，（左起）羅智超、Thea Bradford及周嘉樂博士（右）。

About 16% of Hong Kong's coastline is artificial seawalls, which are unfavorable for marine life and weaken the coastal ecosystem. Professor Kenneth Mei Yee Leung, Hong Kong marine ecologist and Director of the State Key Laboratory of Marine Pollution (SKLMP), came up with a clever plan to upcycle the ashes and sediment waste discarded by the Tuen Mun T-Park incinerator to eco-tiles to create a mimic of natural habitat for the existing "concrete seawall". This strategy not only solves the problem of municipal solid waste in Hong Kong, but also enhance biodiversity. The seawall becomes an ecological corridor, enabling marine plants and animals to be able to grow healthily, providing food for marine life, and can also become a nursery to increase fishery resources.

香港有16%的海岸線屬於人工化海堤，不利海洋生物棲息，削弱了海岸生態系統。香港海洋生態學家、香港城市大學海洋污染國家重點實驗室主任梁美儀教授，想出一條妙計，把屯門T-Park焚化爐棄置的灰燼及沉積物廢料物盡其用，升級再造成為環保生態磚，為現有的「石屎海堤」創造比較自然的生境，既解決本港都市固體廢物問題，又能改善生態，增加生物多樣性；海堤變為一條生態走廊，使海洋動植物能健康生長，為海洋生物提供糧食，也可成為育苗場增加漁業資源，一舉三得。

However, he emphasized that having an ecological seawall does not mean that the sea can be filled at will. On the contrary, as 63% of the coastline of the Greater Bay Area have built artificial seawalls which pose varying degrees of impact on the ecological environment, he believes that the technology of eco-tiles can be applied to the Greater Bay Area as a mitigation plan for ecological restoration.

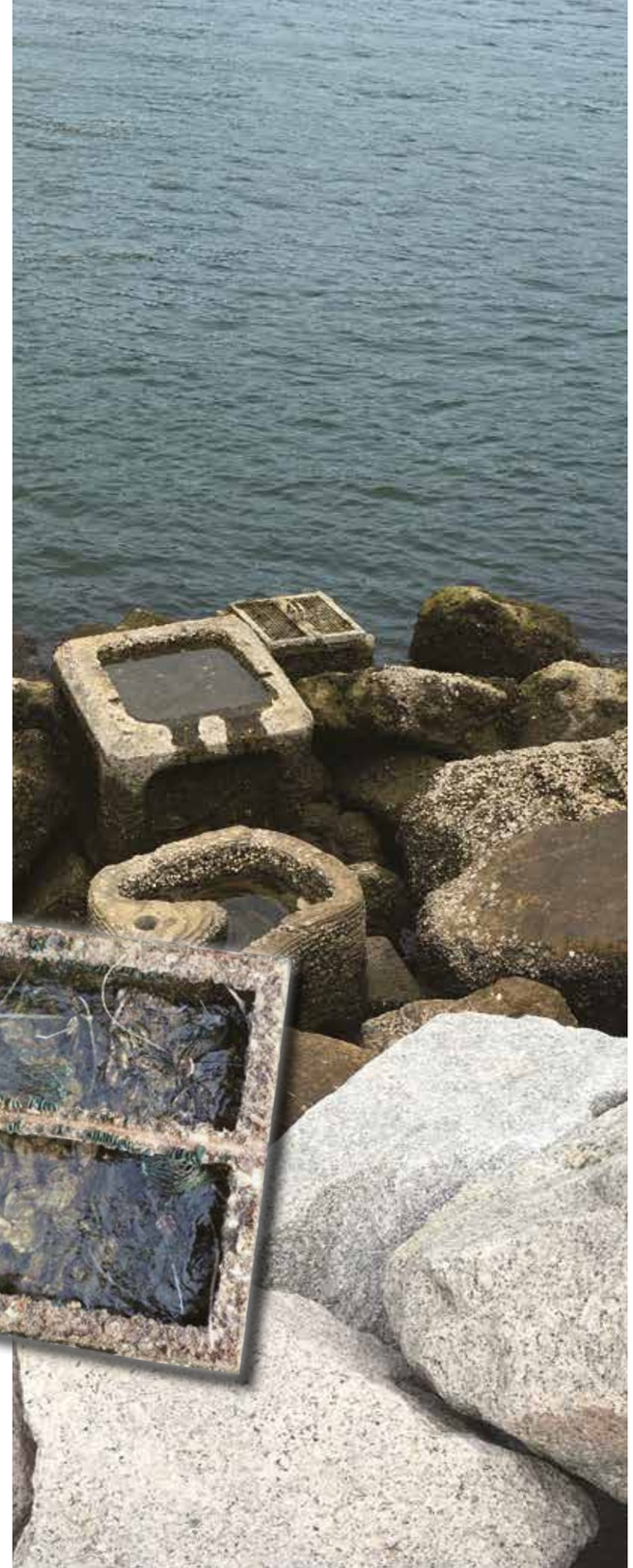
“This is not my specialty, but it seems that fate has chosen me.” Professor Leung specializes in environmental toxicology research for 25 years. At the same time, he has profound experiences in marine environmental research, including pollution, ecology, biodiversity, and water quality management, etc. He recalled that the government conducted a feasibility study on ecological seawalls as early as 2016 and consulted him for advice. At that time, he participated in the “World Harbour Project” to test experimental tiles and deployed them in Hong Kong. He later developed locally designed and made eco-engineered tiles and other fixtures which can be locally fit in Hong Kong’s environment.

Coastal development and reclamation have caused a global increase in artificial concrete seawalls that protect the shoreline from wave action, erosion and flooding. However, the smooth concrete surfaces of artificial seawalls are not inhabitable for marine organisms and can reach extremely high temperatures when exposed at low tide. This makes them unsuitable for many intertidal marine species, including the filter-feeding oysters that improve water quality. The resulting lack of biodiversity weakens the coastal ecosystem.

但梁教授強調，有生態海堤不代表可以隨意填海。相反，鑑於大灣區海岸線高達63%都建了人工海堤，對生態環境有不同程度的影響。他相信，生態海堤的技術能應用於大灣區，作為生態修復的緩解方案。

「我本身不是做這領域，但好像是命運選了我。」梁教授從事環境毒理學研究25年，同時對海洋環境研究，包括污染、生態、生物多樣性、水質管理等，都有豐富的經驗。梁教授憶述，政府早於2016年進行有關生態海堤的可行性研究，並向他諮詢意見；適逢當時參與了「世界海港項目」測試人工生態磚塊組件，他便開始在香港測試其可行性，成功後更自行研發出本地適用的生態磚和其他組件。

沿海發展和填海工程令全球的人工海堤急增，以保護海岸線免受海浪衝擊、侵蝕及水浸，但其表面平滑，不利海洋生物寄居；日間退潮時也因曝露於空氣中及日照而變得極高溫，令許多潮間帶的海洋生物（包括屬濾食性動物、有助改善水質的蠔）均難以棲息，削弱了海岸生態系統。



As oysters and mussels placed in the oyster baskets feed on micro-algae and organic matters in seawater, they help purify the water body.
蠔籠內放置的蠔和青口會攝食水中的微生藻和有機物，可淨化水體。

Professor Leung led a research team to test the effectiveness of eco-engineered tiles in Hong Kong. The team attached the tiles with crevices of different depth to the vertical seawalls in Sham Shui Kok on Lantau Island and Lok On Pai in Tuen Mun in the western waters of Hong Kong for 12-month testing. The experiment brought very positive results as the abundances of marine organisms on the seeded tiles with crevices increased by fourfold compared to flat tiles. Their findings were published recently in the international journal Marine Pollution Bulletin, titled “Provision of refugia and seeding with native bivalves can enhance biodiversity on vertical seawalls”. This paper has been selected and featured by “Environmental Policy Science” of the European Commission, to inform their environmental policy.

Combining the principles of ecology and engineering, the experimental tiles were constructed with crevices and grooved surfaces, provided a diversified habitat and shelter for small marine organisms.

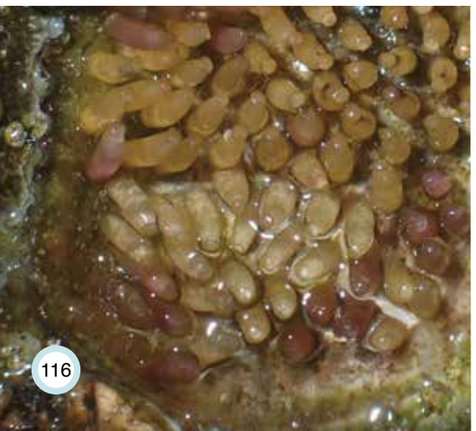
Research results also revealed that, compared with flat tiles, the tiles with crevices had increased by up to 51% in the number of species, and had four times the number of animals. In particular, those with crevices of 2.5 cm or 5 cm deep had up to twice the number of species present in the shaded crevices than the exposed ledges. Species such as snails and limpets preferred the cooler and shaded crevices of the tiles. It was observed that by increasing the surface complexity with crevices, the eco-tiles provided shelter and reduced the surface temperature which allowed a greater variety of species such as snails and limpets to live and grow.The research team also attached live rock oysters to half of the tiles for 12 months, to test if the oysters could further enhance marine biodiversity. The result showed that tiles with oysters attracted the growth of new oysters during the experiment and provided food for predators, thus promoting a healthy ecosystem.

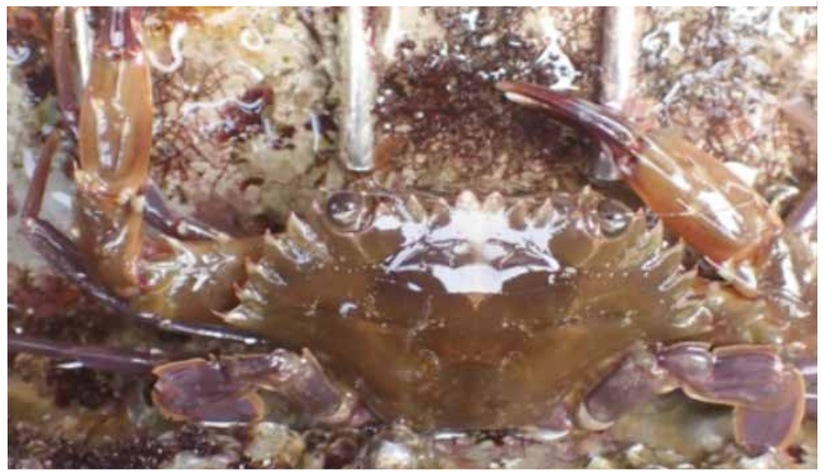
梁美儀教授帶領研究團隊測試「人工生態磚塊組件」，並安裝在大嶼山深水角和屯門樂安排的垂直海堤進行12個月的測試，結果發現海洋生物量急增高達4倍。該項技術可應用於香港現有的所有海堤，能改善香港人造海岸的海洋生態系統。研究成果亦以〈Provision of refugia and seeding with native bivalves can enhance biodiversity on vertical seawalls〉為題，在國際期刊《海洋污染簡報》上發表。這研究文章亦被歐盟《環境政策科學》評選為專題，為歐盟的環境政策提供參考。

人工生態磚結合了「生態」與「工程」的原理，磚塊表面粗糙、具坑紋的設計，為較小的生物提供了遮蔭和縫隙的多元化生境及庇護所，從而吸引更多較大的生物如魚和蟹等，建立豐富的生態系統。

研究結果顯示，相對沒有罅隙的磚塊，有罅隙的人工生態磚塊增加最多51%的物種，生物數量更最高激增逾四倍；而罅隙深2.5或5厘米磚塊內的物種數量，比坑紋與坑紋間突出位置的高近兩倍，例如海螺和帽貝等動物，會棲息於較陰涼的坑紋內。研究結果證明組件的坑紋增加了表面的複雜程度，為動物提供遮蔭和庇護，同時降低棲息處的溫度。團隊又在一半組件上種上活石蠔作測試，發現石蠔在12個月後存活狀況良好，甚至在坑紋內孕育出新的石蠔，部分更成為捕獵者的食物，促進了生態系統健康地運作。







"The results from our experiment clearly showed that we can effectively enhance marine biodiversity on seawalls by increasing habitat complexity through eco-engineering. This technology can be applied to all existing seawalls in Hong Kong to promote biodiversity," said Professor Leung.

梁教授說：「這個在香港進行的實驗，結果令人鼓舞，清楚顯示了利用生態工程增加生境的複雜度，能夠提升海堤的海洋生物多樣性。這種生態工程技術可以應用於香港所有人工海堤，以提升生物多樣性。」

Supported by HKSAR Civil Engineering and Development Department, an on-going trial of various eco-engineered fixtures (i.e., tiles, panels, tidal pools, armouring units and oyster baskets) being carried out in vertical and sloping seawalls in Ma Liu Shui, Sai Kung, and Tuen Mun. The experiment will soon be extended to Tsuen Wan in the mainland. Professor Leung believe that there is great potential in applying the eco-engineering technology to help mitigate the negative effects of artificial seawalls not just in Hong Kong, but also internationally.

團隊現時繼續進行研究，在香港土木工程拓展署的支持下，現於馬料水、西貢和屯門垂直的海牆和斜式的防波堤，試驗多款人工生態組件，如磚塊、板塊、潮汐池、蠔殼籃等，未來則會擴展至荃灣。梁美儀教授相信，透過生態工程技術的應用，可以在香港、以至全球其他地方減緩人工海堤帶來的負面影響。

Professor Leung explained, the Hong Kong study is part of the international collaboration World Harbour Project initiated by the Sydney Institute of Marine Science to address these issues which deployed the same experimental tiles in 14 coastal cities worldwide including Hong Kong, Sydney, and San Francisco for 12 months. The results showed that the increased complexity consistently enhanced the biodiversity of marine invertebrates on the experimental tiles across all locations, despite some variation. It was also found that the effects of complexity on total species richness and mobile mollusc abundance were the greatest at lower latitudes while the cover of sessile invertebrates responded more strongly to complexity at higher latitudes.

梁教授闡述，是次測試屬於「世界海港項目」(World Harbour Project) 的一部份。該項目由悉尼海洋科學研究所發起，在包括香港、悉尼、三藩市等全球14個地方進行一年實驗。「世界海港項目」團隊發現「人工生態磚塊組件」在所有測驗地點均能提升海洋生物多樣性，但有地區性差異。在低緯度或熱帶的地區，生境的複雜程度對總物種數量和可移動的軟體動物數量的影響最大；而在高緯度或亞熱帶地區，生境複雜程度對固着無脊椎動物，例如石蠔、藤壺和貽貝的覆蓋率影響更大。

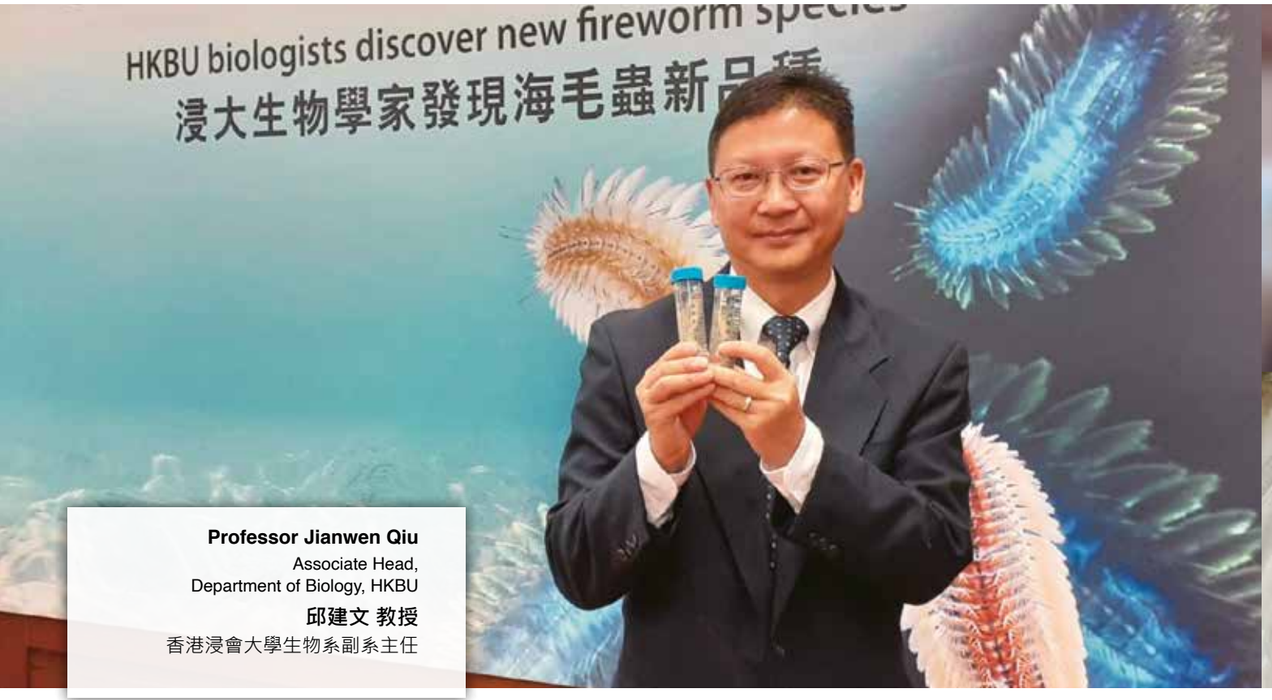
The research findings were published in Global Ecology and Biogeography under the title "A global analysis of complexity-biodiversity relationships on marine artificial structures".

該項研究發表的論文題為〈A global analysis of complexity-biodiversity relationships on marine artificial structures〉，已經刊登於科學期刊《全球生態和生物地理》(Global Ecology and Biogeography)。

New Fireworm Named

The 4th biologist in the world in 100 years

全球百年來第四人　發現海毛蟲新品種



Professor Jianwen Qiu
Associate Head,
Department of Biology, HKBU
邱建文 教授
香港浸會大學生物系副系主任

Nothing is more scary than encountering creatures with venomous bristles for the first time, but such encounters are apparently fascinating to taxonomists who conduct rigorous research to name and classify these organisms. Professor Jianwen Qiu, Associate Head of the Department of Biology at HKBU, has already discovered 17 new species over the last decade. He is concerned about the society and passionate about solving biology related problems. In 2018, when he noticed that fireworms had been spotted at numerous beaches in Hong Kong, he led a research team to identify the species and successfully named a new fireworm. When he learnt that the damage of local coral by bleaching and predation, he was determined to study the harm of predators to corals, and by sheer chance discovered three species of sea rabbit (nudibranchs). He is a down-to-earth biologist who combines biological expertise with social responsibility to resolve practical issues.

Fireworms invaded beachers in Hong Kong in 2018. There were some reports of swimmers being stung.
2018年，海毛蟲在本港泳灘爆發，有泳客被刺傷。

Professor Qiu pointed out that fireworms may not be beautiful to people, but they may serve as bioindicators of ecological restoration.
邱教授指海毛蟲雖並不美觀，卻是生態恢復的重要標誌。

New Fireworm "*Chloeia bimaculata*"
新品種「雙斑海毛蟲」

恐怕沒有什麼比首次遇見有毒的生物更可怕了，但對生物學家來說可能是一件有趣的事，並且是一連串嚴謹而精密研究的開始。浸大生物系副系主任邱建文教授，在過去十年間已經發現了17個新物種。他關心社會，熱心解決生物相關的問題：2018年，他從報章上得悉本港泳灘爆發海毛蟲，便帶領研究團隊在鑑別物種之餘，成功發現並命名一種嶄新的海毛蟲物種；當他讀到關於本港珊瑚白化及被海膽侵食的消息時，便決心研究捕食者對本港珊瑚的危害，又因此而成功地發現三個「海兔」的新物種。邱教授擅於運用生物學知識解決社會問題，可謂「貼地」的生物學家。

In June 2018, fireworms were found in numerous locations across Hong Kong including Tsuen Wan and Tuen Mun, triggering public panic given that their bristles are toxic. Despite the wide news coverage of the outbreak, no one knew the species identity of the fireworms. Professor Qiu and his research team set out to collect specimens from local beaches and shallow-water. Fireworms are common in tropical and subtropical shallow-water ecosystems. They belong to the family Amphinomidae, a group of marine polychaetes. Each body segment of a fireworm has a pair of fleshy outgrowths that bear many chaetae (bristles), which are brittle and hollow. Once broken, they release neurotoxins that can produce a painful burning sensation on the skin around the area of contact, giving the species its common name - fireworm.

2018年6月，本港屯門與荃灣的泳灘突然出現大批海毛蟲，螫傷了泳客並引起公眾恐慌，但沒有人知道這些海毛蟲屬於哪個物種。邱教授遂帶領研究小組從沙灘及淺海收集樣本，鑑別海毛蟲的品種。海毛蟲是環節動物，常見於熱帶和亞熱帶的淺水生態系統，屬「多毛綱」內的「仙蟲科」。每個體節都長有一對疣足（小腳），上面滿佈脆弱而空心的有毒剛毛。當人接觸到這種毒素，皮膚會紅腫及產生猶如火灼般的疼痛。

Identification of the fireworms species is essential in studying the composition of their toxins, laying the groundwork for the development of a cure against its toxic effects. It was quick for the team to identify the fireworms to the genus *Chloeia*. However, it was never an easy task to identify the specimens since there were 27 species of *Chloeia* around the world. The team had to compare the specimens they collected with other species of the same genus. “Unfortunately,” Professor Qiu explained, “Most literature on the described species of *Chloeia* is very old. The majority of papers were published in the late 19th to early 20th century. Some of the descriptions are too sketchy for identification, which made the task even more difficult.”

鑑別爆發的海毛蟲物種是有助研究其毒素的成份，是找出相應的治療方法的第一步。可是，海毛蟲屬下全球原有27個物種，鑑別並不容易。團隊首先確定標本的屬，然後便與整個屬的所有物種進行對照。可惜「海毛蟲屬下物種的文獻大多非常古老，大部分發表於19世紀末至20世紀初，描述十分簡略，增加了辨識的難度。」

To ensure the accuracy of the research, the team borrowed holotypes, i.e., the original specimens upon which the description of a new species are based, from museums overseas. Eventually, the team found that the specimens they collected belong to two fireworm species, of which one from Sharp Island, Sai Kung is a new species that had not previously been reported. Due to the signature two black spots, arranged one behind the other on each segment of its body, Professor Qiu gave the name “*Chloeia bimaculata*” to this particular species. This is the first fireworm species named in Hong Kong and only the fourth named species to be added to the fireworm genus *Chloeia* in the last century.

邱教授稱，為確保研究準確，團隊從外國的博物館商借模式標本（即描述新物種時依據的原始標本）以作對照，結果發現收集到的標本包含兩個物種，其中一種於西貢橋咀洲的珊瑚群落沙底收集到的，是從未被確認過的新物種。由於牠身體每節都有兩個深色斑點，以一前一後的方式排列，邱教授因此為牠取名為「雙斑海毛蟲」。這是首個於香港命名的海毛蟲物種，同時亦是全球近百年來僅第四次發現海毛蟲新物種。

As for the fireworm specimens collected from the two beaches in Tsuen Wan and the shallow waters of Tolo Harbour during the 2018 outbreak, the team checked a large volume of past literature, compared the pictures and specimens of 27 fireworm one by one, and performed DNA sequence comparisons. Eventually the team confirmed the specimens as “*Chloeia parva*”, first named in 1868. Unlike *Chloeia bimaculata*, this species has a dark Y-shaped mark on each segment. After dissection, the team described the morphology of the species in detail, further enriching the characteristics of the species.

至於在爆發期間，團隊從荃灣兩個泳灘及吐露港的淺海水域收集到的海毛蟲樣本，翻查大量文獻，逐一比對27種海毛蟲圖片及樣本，並進行DNA序列比對，邱教授團隊發現樣本為1868年命名的「梯斑海毛蟲」。與雙斑海毛蟲不同，該物種每個體節背部的中央均有一個深色的Y形斑紋標記。團隊更在解剖後，詳盡描述是次發現的物種特徵，豐富了該物種的形態特徵記錄。

Professor Qiu's research team accidentally found tiny nudibranchs were eating the corals.

邱教授研究團隊偶然發現了體積細小的海兔侵食珊瑚。

Professor Qiu selected nine coral species and tested their survival ability to resist various stresses in the laboratory.

邱教授挑選了九種珊瑚品種，在實驗室測試牠們抵抗逆境的能力。

Professor Qiu explained that as there is no direct food value for fireworms, it may be less attractive to people conduct research when compared to economically important species. However, the destruction of their habitats may result in a drastic change in the whole ecosystem as they are part of the marine food chain. In addition, due to their rapid responses to habitat improvement, fireworms may serve as bioindicators of ecological recovery. Professor Qiu said, "fireworms may not be beautiful to people, so I hope our work will bring more attention to the values of these less visible animals."

邱教授解釋，由於海毛蟲沒有直接的食用價值，因此從事海毛蟲研究的學者不多，但作為食物鏈的重要一環，其棲息生境一旦受到破壞，可能導致整個生態系統發生劇變；而在研究生態恢復的成效時，海毛蟲是繁殖較快的底棲生物，是生態恢復的其中一個重要標誌。邱教授嘆道：「海毛蟲這類生物並不美觀，較少人留意，所以我很想幫牠們找出價值。」

In recent years, Professor Qiu and his team have been engaged in research on the impact of climate change on corals in the South China Sea. They selected nine coral species in Hong Kong and tested their survival ability and physiological changes (ability to resist adversity) under different temperatures and salinity pressures in the laboratory, hoping to predict the winners and losers of South China Sea corals under global changes, and to help the government improve the effectiveness of coral conservation. While cultivating corals, they accidentally discovered a new coral species (currently being described) and three new species of nudibranchs (commonly called "sea rabbits"), two of which their descriptions have been published in academic journals.

邱教授團隊近年一直從事氣候變化對南中國海珊瑚影響的研究。他們挑選了九種香港常見的珊瑚品種，在實驗室測試它們面對不同溫度和鹽度壓力下的存活能力以及生理變化（抵抗逆境能力），期望可預測南中國海珊瑚在全球變化下的贏家和輸家，從而幫助政府提高珊瑚保育的成效。在養殖珊瑚時，他們偶然地發現了一個新的珊瑚物種（目前正在描述）以及3個新的海兔物種，其中兩種的描繪已發表在學術期刊。

Some nudibranchs are colorful predators of corals, though tiny when compared with other coral predators such as parrot fish. Thus, their damage to corals is largely ignored. Professor Qiu recalled, "Until one day, our students shockingly noticed that the corals kept in the lab had lost substantial amount of tissues. Upon closer inspection, they found tiny nudibranchs were eating the corals and even laid eggs on their surface." In order to effectively control their impact on corals, his team will continue to study these nudibranchs to determine how many species are present in Hong Kong, what species of corals they prefer to eat, how much they eat per day, and who their enemies are.

海兔色彩鮮艷，但和常見的珊瑚捕食性動物如鸚鵡魚相比，其體積較小，因此較少人留意它們對珊瑚的傷害。邱教授說：「學生們在養珊瑚做實驗時，有一天發現珊瑚死了，細察之下，才留意到有很多很細小的海兔吃了珊瑚，並且已經在珊瑚上產卵。」他會繼續研究本港的海兔數量、每隻海兔的珊瑚食量、會否只吃某一種的珊瑚以及有什麼天敵等，以期有效地控制它們對珊瑚的危害。

Hong Kong waters are small yet home to around 6000 marine plant and animal species, accounting for a quarter of the total number in China. The city's rich biodiversity is due to its special geographic location as well as high habitat diversity. Of course, it is also important to have a group of marine biologists like Professor Qiu who work diligently to discover them.

香港海域面積雖然很小，卻孕育近6,000個已知的海洋動植物物種，約為全中國已知海洋物種的四分之一。香港擁有豐富的生物多樣性，與其獨特的地理位置以及豐富的生境異質性有關，但亦有賴一班像邱教授的海洋生物學家去發現牠們。

The above discoveries were published in the international academic journal Zoological Studies.

上述三項發現已分別在國際學術期刊《動物學研究》（Zoological Studies）上發表。

Two Species of Fireworms (Annelida: Amphinomidae: *Chloeia*) from Hong Kong: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6917566

A New Species of Predatory Nudibranch (Gastropoda: Trinchesiidae) of the Scleractinian Coral *Goniopora*: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7689335

A New Species of Predatory Nudibranch (Gastropoda: Trinchesiidae) of the Coral *Pavona decussata*: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7689335

10 Correcting The Bias

In estimating carbon density in tidal wetlands - 23% greater than previously estimated

修正全球估算方法　紅樹林儲碳量被低估23%

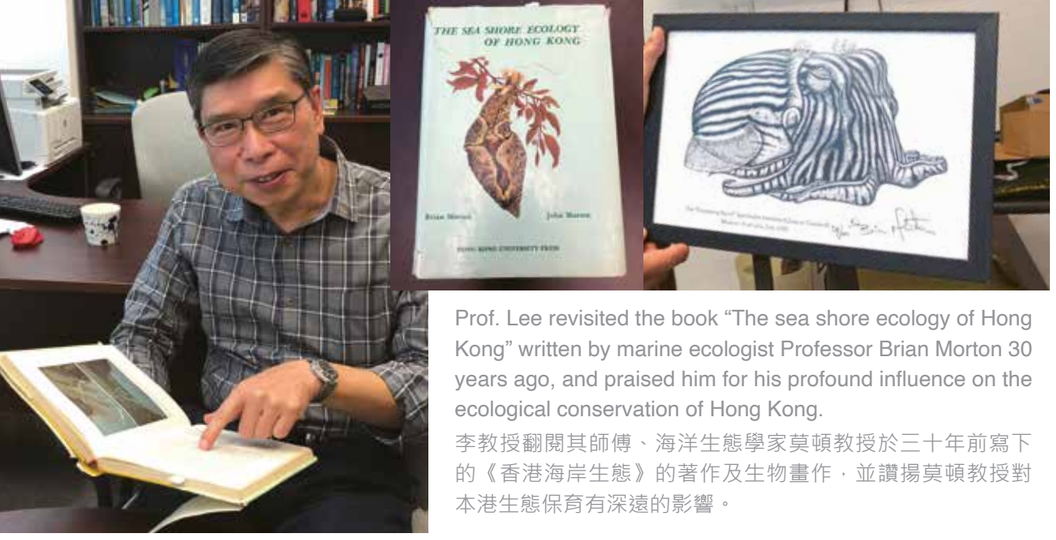
Professor Shing Yip Lee
Director
Simon F S Li Marine Science Laboratory (CUHK)

李成業 教授
香港中文大學李福善海洋科學研究中心主任

Mangroves are an incredibly effective tool against climate change by storing carbon. However, in the past 30 years, the mangrove habitat has been generally regarded as an exporter of materials, including carbon, to the coastal ocean, among other services such as providing stopover sites or nursery areas for migratory birds, fish and mammals. Their carbon storage role, however, has not been seriously considered. Professor S.Y. Joe Lee, Director of Simon F.S. Li Marine Science Laboratory of CUHK and a mangrove specialist who has been researching on coastal wetlands for more than three decades. His recent work with his postdoctoral fellow Dr. X. Ouyang found that the conversion factor conventionally used for assessing mangroves carbon stock was wrong and confirmed that mangroves and other marine wetlands stored 23% more carbon from the atmosphere than previously estimated, which exemplifies the astonishing impact of “Blue Carbon” in mitigating climate change.

全球氣溫上升，溫室效應加劇，「碳排放」成為環境科學家的重大研究主題。過去30年，紅樹林生境僅被視為一個「淨輸出」的生態系統，為雀鳥或魚類提供覓食與棲身之所；鮮有人討論紅樹林的儲碳價值。香港著名紅樹林專家、香港中文大學李福善海洋科學研究中心主任李成業教授與其博士後研究員歐陽曉光，憑着科學家求真的研究精神，揭露出傳統使用的紅樹林儲碳量的轉換系數有誤，以致全球紅樹林生態系統估算的碳儲量比實際低約23%，意味着紅樹林蘊藏着驚人的儲碳價值，有助紓緩全球暖化問題。

Professor Lee measuring sediment CO_2 flux in a mangrove plantation in Malaysia.
李教授在馬來西亞的紅樹林收集沉積物中二氧化碳數據。



Prof. Lee revisited the book “The sea shore ecology of Hong Kong” written by marine ecologist Professor Brian Morton 30 years ago, and praised him for his profound influence on the ecological conservation of Hong Kong.

李教授翻閱其師傅、海洋生態學家莫頓教授於三十年前寫下的《香港海岸生態》的著作及生物畫作，並讚揚莫頓教授對本港生態保育有深遠的影響。

Professor Lee pointed out that from 1970 to around 2005, the mainstream research direction of material dynamics in mangrove systems was influenced by saltmarsh research. During that period, saltmarsh was regarded as a net “exporter”, providing carbon or other nutrients to nearshore fish and shrimps to support the food chain. The carbon storage function of mangroves was not given any attention until 2011, when an important scientific paper confirmed that the mangrove habitat has the highest carbon storage capacity among global forest ecosystems. The stock of “Blue Carbon” in mangroves is 3-5 times higher than “Green Carbon” in terrestrial forests.

Professor Lee believed that the concept of the function of the mangrove ecosystem has changed from “exporter” to “importer” due to the general conclusions drawn through the use of limited data. The estimation in previous studies relied on conversion factors from other habitats that estimated sediment organic carbon from organic matter, which is measured by the “loss-on-ignition” method (mass loss after heating the sample at high temperature for several hours). When heated, organic matter is released as gases from the sediment sample. The weight difference before and after (the “loss-on-ignition” value) provides a proxy for the organic carbon present, without reference to potential variability associated with specific sediment types. “They [Researchers] were taking shortcuts.” Professor Lee said disappointedly.

李教授指出，早年紅樹林的研究遠落後於鹽沼（saltmarsh）研究，而當時鹽沼被視為向近岸的魚、蝦提供碳或其他養份來支持食物鏈，是「淨輸出」的生態功能，研究員便把對鹽沼的理解搬到紅樹林上應用。這是1970至約2005年間成為主流說法。直至2005年起，才漸漸有人研究紅樹林的儲炭功能，2011年美國更有一份重要文章發表，肯定了紅樹林是儲炭能力最高的生境，其儲碳能力「藍碳」相對於陸地森林「綠碳」大三至五倍。

李教授認為，紅樹林的生態系統功能由「淨輸出」變為「輸入」，兩種論述南轅北轍，是由於用了有限的數據作出概括性的結論，以致有這樣極端的轉變。碳儲量的估計也不例外。他闡釋，普遍為人採用的loss-on-ignition估算碳儲量——把有機物如沉積物放進高溫爐內燒，有機物在高溫下變成二氧化碳排走，再比較燒前和燒後的重量，作為估計它的碳含量，這方法並不準確，因所採用的樣本跟濕地中多元化沉積物不同。李教授嘆道：「大家在走捷徑，沒有等待適用於紅樹林、潮間帶濕地系統的轉換系數來做研究。」

Professor Lee and his research team have combined data from past studies in different countries and new field measurements of sediments in tidal wetlands. Through comparison and analysis as well as inclusion of previously neglected components (e.g. dead wood), the team revealed that carbon stocks in mangrove forests reach 3.7-6.3 Pg (one Pg = 10^{15} g or one billion metric tonnes), which suggests a previous underestimate of 23%.

李教授與研究團隊全面審視在不同國家中，真正適用於紅樹林、沼澤研究的環境內所產生的數據，再重新訂立更適合的轉換系數。通過比較分析及納入從前被忽略的成份（例如腐木），估算出全球紅樹林生態系統的碳儲量高達 3.7 至 6.3 Pg（Pg 相等於 10^{15} 克或 10 億噸），這一數字暗示過去被低估了23%。

Prof. Lee observed some crab species in the mangrove forests of Hong Kong and Australia that harvest freshly fallen leaves.

李教授在香港及澳洲的紅樹林都察覺到，有些蟹的品種會收割紅樹林的葉。

The capacity for cabon storage in the mangrove ecosystem is high. When mangrove leaves fall, they are usually covered by sediment. Mangrove sediment have low oxygen concentration, slowing the breakdown of organic matter and thus, boosting carbon storage.

紅樹林的儲碳能力很高，因紅樹林經常浸在水中，泥土的沉積物氧氣濃度低，令有機物分解速度變慢，因此碳便會儲存起來。就如一片樹葉掉下，自然地被沉漬物封住，然後因為缺氧而令分解變慢，就會儲存在沉漬物。

However, some organisms in the mangroves can accelerate carbon emissions. For example, there is a high density of crab burrows in tropical mangroves. These burrows will become conduits, allowing oxygen to enter the deep soil and carbon dioxide to be discharged through the pipes. Interestingly, Professor Lee observed some crab species in the mangrove forests of Hong Kong and Australia that harvest freshly fallen leaves. “They usually hide in the burrows, and as soon as they sense a leaf has fallen they quickly retrieve it before returning underground. When the leaves are consumed and assimilated by the crabs, they contribute to CO_2 emissions.” Therefore, processes mediated by the animals are very important to the carbon cycle and are the object of Professor Lee’s research.

然而，紅樹林中有些生物可加速碳排放，例如紅樹林有很多蟹洞，那些洞穴便會變成管道，讓氧氣進入深層泥土，二氧化碳經管道排出來。有趣的是，李教授在香港及澳洲的紅樹林都察覺到，有些蟹的品種竟然會收割紅樹林的葉。「牠們平日躲在洞穴中，但只要當紅樹的樹葉掉下來，牠們就會感應到而鑽出來，再用迅雷不及掩耳的速度把葉拿入洞穴中吃掉。當蟹把葉吃掉，就會變成二氧化碳排放出來。」香港紅樹林的蟹有數十品種，數量亦不少，因此生物功能對碳循環十分重要，是李教授研究的對象。

Professor Lee said that if we have a better understanding of mangrove habitats, the drivers of carbon cycling, storages, and emissions, such knowledge will have great future application values. If the government wishes to reduce carbon emissions using the carbon sequestration capacity of wetlands, the goal of long-term carbon storage can be achieved by creating artificial wetland habitats that are designed and operated to maximize this function. He advised the government that priority should be given to nature-based solutions to reduce carbon emissions.

Mangroves are remarkably tough. With their roots submerged in water, mangrove trees thrive in hot, muddy, salty conditions, but they still support diverse fauna (including snakes, insects, rats, and ants – they are still part of the biodiversity). Professor Lee admitted that mangrove forests may at first sight not as inviting as blue-water coral reefs, and perhaps less attractive to young people involved in research, particularly if that involves working for a long time in soaring temperatures. Professor Lee likened mangroves to “Pi Dan” (century eggs) – “they may not win an award for instant visual appeal and the first bite for “novices” could be challenging, but if you get used to eating them you may eventually find them delicious.” Professor Lee laughed. “Similarly, if you are willing to spend time studying mangroves, you will find them to be very special.” He added, “Trees that grow in the sea? They adapt to challenging conditions and have developed amazing physiological structures, shapes and ways of reproduction. Mangroves are survivors.”

The research titled “Improved estimates on global carbon stock and carbon pools in tidal wetlands” was published in the scientific journal Nature Communications in January last year.

李教授說，假如我們如對紅樹林的生境、對碳循環的成因、儲存及排所等問題有更多理解，這些知識會有很大的應用價值。假如將來政府願意用濕地的方法，協助解決碳排放問題，例如出資建立人工紅樹林濕地，就可以透過創造生境達到長遠的儲碳目的，因為紅樹林是可塑造的系統。政府應該優先採用自然的解決方法（nature-based solution），去解決碳排放問題。

紅樹林生長在一些鬆軟潮濕且滿佈泥濘的「濕地」上，生物眾多（包括蛇蟲鼠蟻橫行），看來惡劣的環境令遊人卻步。李教授笑稱，跟在藍天碧海環境中做珊瑚研究相比，紅樹林對年輕人來說吸引力可能較低，特別是在夏天時，研究員需要汗流浹背地在林中長時間做研究，非常辛苦。李教授卻以「皮蛋」比喻紅樹林：第一眼雖未必美觀，但假如你願意花時間去研究它，就會發現紅樹林是很特別：「哪有樹能在海中生活？而且它們為了適應這嚴竣的環境，演化出不同的生理結構、形態、繁殖，有很多奇妙的生存方法。紅樹林是逆境求生的例子。」就如皮蛋一樣，李教授笑着說：「吃得皮蛋多，或許終會發現它的美味！」

研究題為〈Improved estimates on global carbon stock and carbon pools in tidal wetlands〉，去年一月已於學術期刊《自然通訊》上發表。

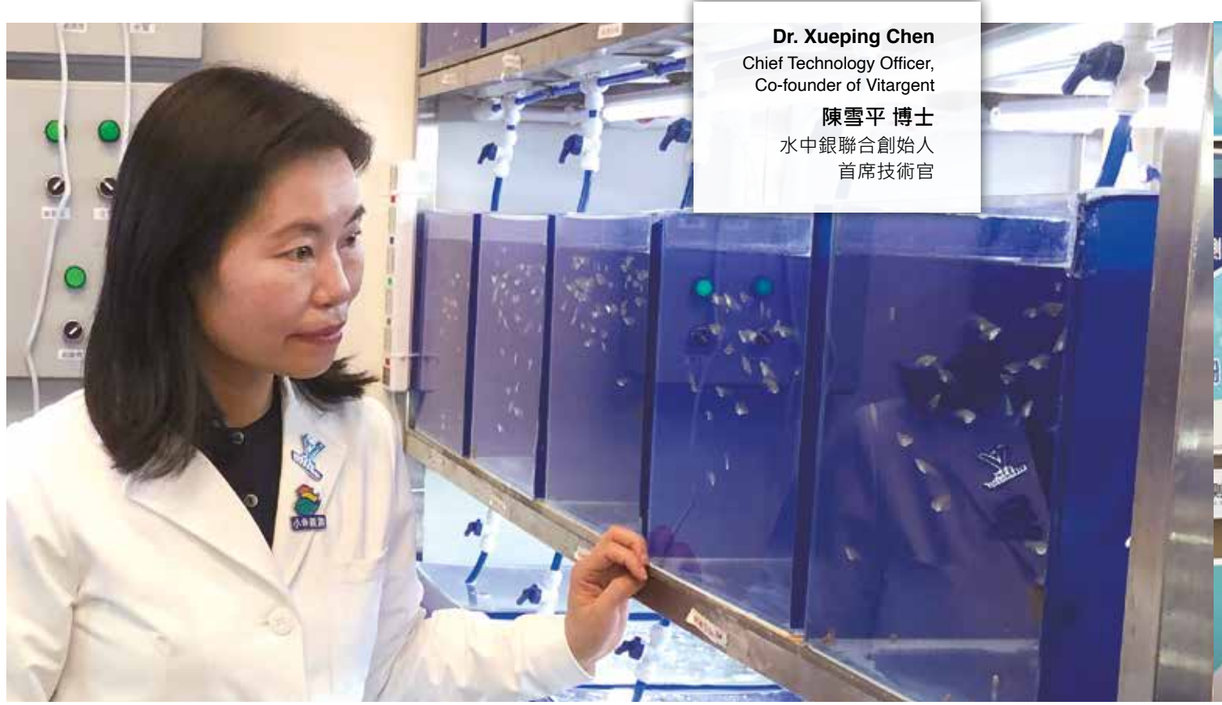
10 Scientist Turned Entrepreneur

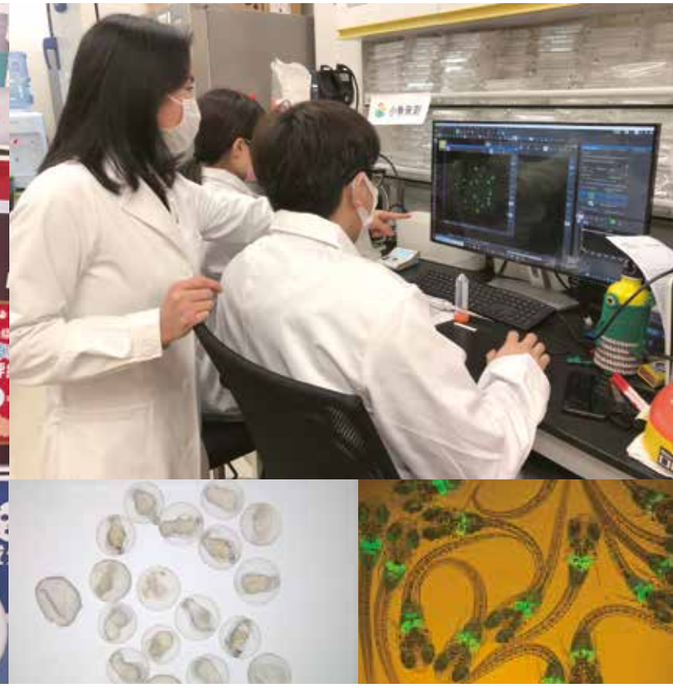
Transgenic medaka technology was invented to safeguard product safety

科學家變創業家 - 研發轉基因鯖鰭魚檢測產品安全

Dr. Xueping Chen
Chief Technology Officer,
Co-founder of Vitargent

陳雪平 博士
水中銀聯合創始人
首席技術官





Dr. Xueping Chen successfully transferred “Transgenic medaka fish technology” into commercial products.

陳雪平博士成功把「轉基因鯖鰭魚」及「斑馬魚」胚胎毒理檢測技術轉移為商業應用。

Hong Kong universities have long been renowned for their achievements in exceptional basic research. Nevertheless, technology transfer is their weakest link. Dr. Xueping Chen, an outstanding scientist nurtured by SKLMP, successfully transferred her co-invention “Transgenic medaka fish technology” into commercial products and eventually co-founded Vitargent Biotechnology. Backed by prominent investors including PwC, Nan Fung Group, and WI Harper Group and supported by Mr. Wan Gang, Vice Chairman of the CPPCC National Committee to help settle in Beijing, Vitargent has been providing its services to over 100 global enterprises worldwide.

本港大學基礎科研成就卓越，但難以將科研成果轉化為商品。然而，海洋污染國家重點實驗室悉心培育的優秀科學家陳雪平博士，成功把「轉基因鯖鰭魚」及「斑馬魚」胚胎毒理檢測技術轉移為商業應用，並與拍檔創立了水中銀生物科技公司，至今已為全球逾百間大型企業提供服務，吸納了包括普華永道、南豐集團、美商中經合集團等著名投資者，甚至獲得全國政協副主席萬鋼的青睞，協助落戶北京。

The idea of “Transgenic medaka fish” originally came from Professor Shuk Han Cheng, Dr. Chen’s PhD supervisor who co-developed the world’s first innovative technology. “Medaka was chosen to be genetically modified species to monitor marine pollution since it is easy to culture, adaptable to both seawater and freshwater, and they are very sensitive to toxic substances.” Dr. Chen, who serves as the Chief Technology Officer at Vitargent said proudly, “SKLMP was the first one to develop the medaka biological monitoring model. Professor Cheng was my supervisor. I am very grateful to her for her guidance and support.”

「轉基因鯖鰭魚」的意念源自陳博士的老師鄭淑嫻教授，師徒二人共同研發出來的全球首創技術。現任水中銀首席技術官陳博士解釋，鯖鰭魚繁殖快，容易飼養，能適應鹹水及淡水環境，對有毒物質亦非常敏感，因此被我們挑選做轉基因魚以監測海洋污染。「可以說，是SKLMP首先把鯖鰭魚研發成生物監測模型。鄭教授是我的博士指導老師，我很感激鄭教授的指導與支持。」陳博士說。

Vitargent’s first-in-the-world transgenic medaka and zebrafish fish embryo toxicity (FET) test technologies have the capacity to screen over 1,000 toxicants at one time. “Transgenic medaka fish” can be used for product safety testing of raw materials and end products of daily consumer goods (including food, medicines, plastic products, cosmetic and skin care products), as well as monitoring water quality. Transgenic medaka bioassay (estrogen equivalent testing) is Vitargent’s exclusive technology, which sees fish embryos become fluorescent in the presence of estrogens, and the intensity of the fluorescence can quantify the toxicants. The entire test only requires 24 hours.

水中銀憑藉其全球獨家首創的「轉基因鯖鰭魚」及「斑馬魚」胚胎毒理測試技術，已被驗證能夠同時測試超過1,000種有害物質。「轉基因鯖鰭魚」可以用來檢測日常消費品及其原材料（包括食品、藥物、塑膠製品與化妝護膚品），以及監測各種水質環境。水中銀獨家擁有應用「轉基因鯖鰭魚」卵黃幼魚檢測雌激素（雌激素當量檢測）技術，當這些卵黃幼魚接觸雌激素時，會發出不同強度的綠色螢光，檢測人員從而可量化雌激素含量，而整個檢測時間只需24小時。

Another biological toxicology testing technology which makes use of zebrafish embryos to detect overall toxicity, identify toxicity target organ, and reveal the toxicology mechanism of a product, can be applied in various fields including food and beverage, pharmaceuticals, cosmetics and sewage monitoring. Zebrafish models can mimic human metabolic activities, resulting in the embryos developing defects in the presence of toxicants within 48 hours, making it possible to predict a product’s toxicity in fish and its potential effects on human beings.

另一項技術則透過「斑馬魚」胚胎作毒理測試，可以應用於食品、藥物開發、化妝品、污水監測等領域，能有效檢測產品的整體毒性、識別致毒目標器官與顯示致毒機制。「斑馬魚」可以模擬人類藥物新陳代謝的活動，在有害有毒物質中，胚胎在48小時內發育出現異常，不僅可以預測樣品對於魚類的毒性，也可以預測樣品對於人類的影響。

Dr. Chen (left) is very grateful to her PhD supervisor, Prof. Cheng (right) for her guidance and support.

陳博士（左）感激博士指導老師鄭淑嫻教授（右）的支持。

Vitargent’s test service covers industries including food, beverages, cosmetics and water.
水中銀的檢測服務包括食品、飲品、花妝品和水。

Since its establishment in 2010, Vitargent has won a plethora of awards, including Grand Prix at the 43rd Geneva International Exhibition of Inventions and WIPO medal for inventors at the International Invention Fair in the Middle East. It is the first ISO 17025 accredited laboratory in Asia that provides fish-embryo-based toxicity testing. In 2018, Vitargent was invited by Guangdong Provincial Government to become one of the initiators of the “Guangdong Quality Improvement Alliance” and is the only non-mainland company. Vitargent is based in Hong Kong with licensed laboratories and affiliates in Belgium, Taiwan, Guangzhou, Shenzhen, Shanghai and Beijing.

水中銀自2010年成立以來屢獲殊榮，包括「第43屆日內瓦國際發明展的最高榮譽大獎」和「中東全球發明大會金獎」等，也是亞洲第一家榮獲 ISO 17025 認證以魚胚胎進行毒理測試的公司。2018年，水中銀獲廣東省政府邀請成為「廣東質量提升聯盟」發起單位之一，是唯一一家非內地機構。水中銀以香港為基地，在比利時、台灣、廣州、深圳、上海、北京均設有實驗室或子公司或辦事處。

Although the business has matured and its test service covers industries including food, beverages, cosmetics and water, Dr. Chen confessed that not everything was easy. “We spent 8 years studying the testing method of daily products and established a set of principles and guidelines.” She continued, “Health products use animal testing, but consumer products do not. We do biological testing to fill the gap in the market to provide biological data for consumer products.” Dr. Chen admitted that she encountered many challenges in running the business and involved herself in varying fields of knowledge. These qualities of a businessperson are all from the training of SKLMP.

雖然業務目前已上軌道，但陳博士坦言一切得來不易。水中銀的檢測服務包括食品、飲品、花妝品和水，「我們花了8年鑽研生活用品的檢測方法，建立了一套通行的原則和指引。」她續說：「保健產品會使用動物測試，但消費品沒有，我們做生物測試是填補了消費品缺乏生物學數據這一市場缺口。」陳博士笑言，她首次從商即遇上很多挑戰，也需要涉獵不同領域的知識。這些從商的特質，都是從SKLMP訓練出來。

Vitargent has won Grand Prix at the 43rd Geneva International Exhibition of Inventions in 2015.

水中銀於2015年奪得第43屆日內瓦國際發明展的最高榮譽大獎。

Dr. Chen was impressed by the close connection between professors and students.
陳博士難忘實驗室的濃厚人情味。

Dr. Chen graduated from Xiamen University with an Mphil in Zoology in 2005. She went to CityU to pursue a PhD in Environmental and Toxicology, where she officially began her academic research career at AoE-MERIT, the predecessor of SKLMP. “I was particularly impressed by the strong academic atmosphere of SKLMP. Professors are willing to share their expertise and students are closely connected. We are like a family, and we have a lot of interaction.” She also praised the International Conference on Marine Pollution and Ecotoxicology (ICMPE) organized by SKLMP, where students have the opportunity to discuss and work with world-renowned professors, so as to establish their global mindset and research skills.

陳博士2005年於廈門大學動物學哲學碩士畢業後，便到香港城市大學攻讀環境和毒理學博士學位，正式在 SKLMP 前身的 AoE-MERIT 展開學術研究生涯。「我特別難忘 SKLMP 濃厚的學術氣氛，教授們很願意分享專業知識。學生之間雖然各有不同的專業範疇和研究領域，但彼此關係密切融洽。我們猶如一個大家庭，大家有很多互動。」她又大讚實驗室舉辦的「海洋污染與生態毒理學國際會議」，使學生有機會與世界知名教授交流和合作，從而建立國際觀與研究技能。

Dr. Chen added that the expertise she learnt from SKLMP ten years ago is useful even today. “I always treasure my opportunities and training including the research I did in Japan, participating in international academic conferences and exhibitions, and writing academic papers and patents. I acquired a diverse skillset which broadened my vision.”

陳博士稱，十年前從 SKLMP 鍛鍊到一身「武功」受用至今。「我很珍惜學習機會，包括到日本做研究、出去參加大型的國際學術會議及展覽、撰寫學術文章及專利等，令我變得多元化，也發現世界原來很大。」

Woman Scientist turned Entrepreneur. She said frankly, “It may be difficult, but every problem has a solution. I am grateful for the support from SKLMP along the way. I wish the Laboratory further success and will continue to cultivate more outstanding young scientists.”

從科學家搖身一變成為創業家，她坦言：「困難一定有，但方法總比困難多。我很感恩一路走來，得到海洋污染國家重點實驗室的支持，在此祝願實驗室培育更多年輕傑出的科學家。」

Highlights of Past Activities

歷年重點活動

Oyster SOS:
Restoring oyster reef ecosystems
香港富蠔計劃: 修復蠔礁生態

In a cross-sectoral collaboration with oyster and fish farmers, academics, schools, NGOs, and religious groups, members of the State Key Laboratory of Marine Pollution (SKLMP), are translating ecological research into a community-based project called 'Oysters Save Our Seas' (Oyster SOS) in 2020. It aims to improve water quality and enhance marine biodiversity through restoring oyster reefs.

為改善水質和提高海洋生物多樣性，香港城市大學海洋污染國家重點實驗室(SKLMP)的成員在2020年聯同蠔民漁民、科研人員、學校教師、非政府環保機構、以及宗教團體，開展了一項由生態研究轉化而成的社區為本蠔礁修復項目——香港富蠔計劃。

Why Oysters? 為什麼是蠔?

Oysters provide crucial ecosystem services. They form reef habitats for marine life and protect shorelines against storms. As filter feeders, an adult oyster could filter as much as 180 liters of seawater a day by eating microscopic algae and suspended organic matter in the water column. As the Director of SKLMP, Professor Kenneth Leung has noted, "If we put enough oysters, they can effectively improve water quality via biofiltration and reduce chances of harmful algal bloom."

Yet, 85% of oyster reefs are gone globally due to over-dredging and habitat loss. Hence, the goal of Oyster SOS is to restore oyster reefs through ecological restoration, scientific research, STEM & environmental education, and public engagement.

蠔在生態系統服務上擔當關鍵角色。牠們既能形成蠔礁生境，亦可保護海岸線免受風暴侵蝕。作為濾食性動物，一隻成年蠔每天能過濾多達180公升的海水，以攝食水中的微海藻和懸浮有機物。實驗室主任梁美儀教授指出：「假如我們野放足夠數量的蠔，牠們就可透過生物過濾，有效地改善水質和減少紅潮爆發的機會。」

然而，由於過度採集和棲息地喪失，全球已有85%的蠔礁消失了。因此，計劃的目標是透過生態修復、科學研究、數理工科和環境教育及公眾參與來修復香港的蠔礁。

Oyster SOS Activities 香港富蠔計劃活動

Activities 校本活動

Working with teachers, Oyster SOS will design project-based studies and field activities for local primary and secondary students where they can help restore oyster reefs and conduct biodiversity surveys. Such direct learning experience fosters students' connection and appreciation to the natural environment.

計劃將和教師合作，為本地中小學設計專題研習及實地考察活動。學生能親自參與蠔礁修復及生物多樣性調查，透過切身體驗，學會欣賞及保護自然環境。

Public Engagement 公眾參與

Oyster SOS organises education events to raise public awareness on oyster reef restoration. We have held workshops at the Hong Kong Eco-Film Festival and at partners' venues. Oyster shells are also recycled from local restaurants to be used as substrates for oyster larvae to grow after being treated and weathered.

計劃會舉辦教育活動來提高公眾對蠔礁修復的關注。我們曾在香港環保電影節（HKEFF）中舉辦工作坊，亦將在社區夥伴的場地舉行講座和小型展覽等。我們也會從餐廳回收蠔殼，經處理後用作蠔苗生長的基質。

Stakeholder Engagement
持分者參與

Working with the oyster farming community, our activities will introduce the history and current status of local oyster cultivation which is one of Hong Kong's intangible cultural heritages. The project will also work with religious groups to guide the deployment of native oyster species as the main organisms for mercy releases.

計劃會與蠔民團體緊密合作，在活動中介紹已列入為非物質文化遺產的本地養蠔業歷史及現況。計劃亦會與宗教團體研究在舉行放生活動時，根據指引，把原生的蠔視為放生的主要物種。

Overseas Exchange
海外交流學習

Oyster SOS also joined a field study delegation on oyster reef restoration and oyster farming organised by The Nature Conversancy to visit oyster reef restoration sites in New York and the Chesapeake Bay, United States. Through understanding the challenges and success of their projects and exchanging know-hows with local leaders, we learnt from their experience to better plan for our restoration project.

計劃派出代表參加了為期七天的「大自然保護協會：美國紐約及切薩皮克灣貝類養殖及蠔礁修復考察團」。透過與當地人員交流，了解美國蠔礁修復的成功和挑戰，汲取經驗以在本港制定更完善的生態復修計劃。

10 Coral Academy
珊瑚學院

Coral Academy is an outreach programme we launched in 2018. With the support from the Agriculture, Fisheries and Conservation Department (AFCD), we have organized programmes of different scales for the general public and secondary school students, including the "Learn about Hong Kong Coral Communities and Conservation Workshop", "Secondary School Coral Nursery Education Programme.", and "Learn about Hong Kong Coral Communities and Conservation Workshop".

These programmes aim to enhance secondary school students' awareness and knowledge of the marine environmental issues, problems and solutions; to establish a connection between participants and local corals through first-hand experience of nurturing coral fragments to be used in coral restoration works; and motivate students to take action to implement environmental solutions. We have also partnered with local organisations, such as the WWF Hong Kong, Hong Kong Ocean Park and the Jane Goodall Institute Hong Kong to develop marine environmental education programmes for primary and secondary schools, and the general public. Such partnerships provide valuable learning opportunities for CUHK students to engage as tutors in the programmes, enhance their science communication skills that will be useful in their wider lives.

「珊瑚學院」是2018年正式創辦的外展計劃。在香港漁農自然護理署（漁護署）的支持下，珊瑚學院舉辦了連串大小規模的體驗活動，對公眾，尤其是中學生進行環保教育，撒下保育的種子。當中包括「中學工作坊——認識香港珊瑚群落及保育」，「東平洲珊瑚生態探索之旅」及「育養珊瑚校園計劃」。

這些活動，旨在提高學生及公眾對香港海洋生物多樣性和珊瑚保育的認識和關注；透過親身體驗培育用於珊瑚復育計劃的珊瑚，建立參與者與本地珊瑚之間的聯繫；以及促進個人行為和生活方式的改變，以行動實踐保育。珊瑚學院亦與本地機構合作保育，包括世界自然基金會(香港分會)，香港海洋公園，及珍古德協會(香港)協辦海洋環境教育活動予本地公眾及中學生。這些活動亦為中文大學的學生提供了寶貴的學習機會，使他們成為課程的導師，學以致用。

Dr. Apple Chui
Member of SKLMP
Research Assistant Professor
CUHK
Founder of Coral Academy
崔佩怡 博士
SKLMP 成員
研究助理教授
中文大學生命科學學院
珊瑚學院創辦人

What We Do 珊瑚學院的活動

“Learn about Hong Kong Coral Communities and Conservation Workshop”
「中學工作坊—認識香港珊瑚群落及保育」

The workshop includes a coral introductory seminar, a presentation of AFCD “HK Marine Biodiversity” documentary, a showcase of coral skeletons, a visit to the coral culturing facilities at the Simon F.S. Li Marine Science Laboratory CUHK, and a first-hand experience in adoption of a coral. These activities will help connect the students to corals and trigger their commitment in coral conservation.

透過珊瑚講座、漁護署《香港海洋生物多樣性》紀錄片放映、珊瑚骨展示、中文大學李福善海洋科學研究中心的導賞，讓參加者認識珊瑚及本地的海洋生物多樣性，參加者參觀珊瑚培育及研究基地後，能助養珊瑚，建立與本地珊瑚之間的聯繫，更添一份保育珊瑚的使命！

“Learn about Coral Communities and Conservation in Tung Ping Chau Marine Park Workshop”
「東平洲珊瑚生態探索之旅」戶外體驗

Participants can have a quick glimpse of Hong Kong’s marine ecology as well as the magnificent coral world through different interactive activities, including an introductory seminar on corals, coral identification workshops, and a guided eco-shore exploration in the marine park, observing various traces of intertidal wildlife and corals. Afterwards, participants will visit the coral culturing facilities at the Simon F.S. Li Marine Science Laboratory CUHK, and end the day with a first-hand experience in adoption of a coral.

參加者不但透過珊瑚工作坊以互動方式認識本地海洋生態，更能夠在導師帶領下探索東平洲海岸公園的海岸，透過遊戲尋找海岸上的珊瑚骨及潮間帶各種小生物的痕跡。東平洲之旅緊接著中文大學李福善海洋科學研究中心的導賞及助養珊瑚，啟發新一代成為保衛海洋的一份子。

“Secondary School Coral Nursery Education Programme”
「育養珊瑚校園計劃」

Turning local secondary schools into coral culturing stations before outplanting. This one-year programme is designed to provide students with solid knowledge and experiences in coral conservation works through school-based culturing of alive local coral fragments, which will then be outplanted for actual local coral restoration work in Hong Kong. By taking the vital role of maintaining coral tanks and monitoring coral growth and health, teams of teachers and students can learn about coral biology and ecology while establishing a sense of mission to restore coral communities and to protect the ocean. Throughout the year, there are also various conservation engagement activities, including guided eco-tours, aquarium tour, coastal clean-ups, and sharing sessions.

將全港中學化為珊瑚培育基地，而本地中學生及老師則組成團隊擔當起照料及紀錄珊瑚健康成長的重大任務，從體驗中學習到香港海洋生態及科學知識，同時建立保護海洋的使命感。在全年計劃中，參加團隊亦有分享保育經驗的環節，與校內外群體宣揚珊瑚保育重要性，一同見證香港的珊瑚保育工作：「育養珊瑚校園計劃」參加學校由起初的5間增至本年度15間中學，育養珊瑚的種類更多元化，全年的活動亦日趨豐富，包括海岸公園戶外生態導賞、水族館導賞、海岸清潔、校內外分享環節等，讓師生有更深入及全面的海洋保育學習體驗。

Our Impact 珊瑚學院的成果

Over 5,000 students and teachers from 30 schools have participated in our programmes over the past three years. Not only did participants gained knowledge and interest towards marine lives, but also affirmative inspirations and behavioural changes in marine conservation. It is believed that the interactive activities and unique first-hand experiences offered by the Coral Academy have planted seedlings of conservation in the hearts of the new generation, allowing conservation effort done by scientists to reach broader and farther.

在過往三年間，已有超過5,000名來自30間中學的教師與學生參與珊瑚學院舉辦的講座及活動，他們不但產生了對香港海洋生態的興趣，當中亦從參加者中聽到不少深刻而正面的感受，更立志為保育作出行為改變，相信珊瑚學院互動性強的親身體驗活動能夠在新一代心中埋下保護生態的種子，讓科學家的珊瑚保育工作走得更闊更遙遠。

Spin Kid Project
「哪吒」計劃

Not only working actively at the frontier of scientific research in the marine environment, the SKLMP, CityU, also actively participates in community services and public education. Through promoting diving training and related activities, SKLMP wishes to promote and raise public awareness on the conservation of marine biodiversity and the sustainable use of valuable marine resources.

香港城市大學海洋污染國家重點實驗室（SKLMP）不僅拓展海洋環境科學研究的前沿工作，亦積極參與社區服務和公眾教育，希望通過推廣潛水培訓和相關活動，促進和提高公眾對保護海洋生物多樣性和可持續利用寶貴海洋資源的認識。

In Chinese mythology, the Spin Kid is a well known character. When he was young, he was just like a spoiled teenager. However, after he found some cool and powerful weapons, he decided to change. He started to help the underprivileged groups, fight against evil and uphold justice. Finally, he became a hero in the eyes of Chinese people. Through the Spin Kid Project, scuba diving could be one of the platforms for the teenagers to find their strengths and inner-self to face the continuous challenges ahead. Furthermore, these ocean lovers would create an excellent army for marine environmental research and marine conservation.

「哪吒」是中國家傳戶曉的神話人物，他就如一名受寵壞的年輕人一樣。在找到風火輪、乾坤圈和混天綾後，洗心革面，為人間正義打拼，與邪惡力量抗衡，抑強扶弱，守護眾生，直到業盡情空。「哪吒」計劃是希望透過潛水運動，為這些青少年哪吒提供一個揮灑青春精力的舞台，幫助他們不停尋找挑戰，釋放潛藏力量，從而為海洋研究培育優秀生力軍。

The Spin Kid Project was established on 21st September 2012 when it was kick-started by the SKLMP Dive Team. There are 200 participants, with 60 and 30 trained as certified Open Water Divers and Advanced Open Water Divers, respectively under this scheme.

「哪吒」計劃於2012年9月21日啟動，我室潛水隊亦正式成立。通過「哪吒」計劃，成功培養開放水域潛水員60名，開放水域進階潛水員30名，參與活動人數累積超過200人次。

"Reef Check" in Sharp Island
香港珊瑚普查

Reef Check has been organized by the HKSAR Government for more than 20 years, and SKLMP fully supports this important endeavor. The data collected from different reef check teams are important for developing policies to conserve the corals and their habitat.

香港特區政府舉辦「香港珊瑚普查」已二十多年，SKLMP大力支持此項工作。SKLMP潛水隊獲派到位於橋咀洲南部進行珊瑚普查，為香港政府採集數據，有助制定保育珊瑚政策。

Exchange Programme with Peking University
北大學生交流活動

The Spin Kid Project provided opportunities for Environmental Science undergraduates and teachers of Peking University to experience snorkeling and scuba diving in Sai Kung, Hong Kong, giving them a chance to reflect on how to protect our marine resources in China.

「哪吒」計劃承接了香港城市大學與北京大學環境科學系學生的交流活動，北大老師和學生透過在香港西貢海域浮潛及體驗潛水去探索海洋，讓他們從活動中去思考如何進一步保護我們蔚藍的海底世界。

Coral Reef Research in Kiribati
基里巴斯研究之旅

In October 2012, Associate Director of SKLMP, Dr. Leo Lai Chan, led three team members to conduct 14-day research at Kiribati and collect fish samples required for ciguatera research, one of the research thrusts of SKLMP. Kiribati is an island nation in Central Pacific east of the Indonesian archipelago. Compared with other areas of the Pacific, Kiribati has a much higher risk of ciguatera. The research team was tasked with the mission to identify how the toxicity is related to marine species and sampling location.

海洋污染國家重點實驗室副主任陳荔博士於2012年10月帶領三位隊員遠赴沉沒的國度「基里巴斯」，展開為期十四天的研究，以收集雪卡毒素研究所需要的魚樣本，這也是SKLMP的研究重點之一。基里巴斯是印度尼西亞群島東部中太平洋的一個島國。與太平洋其他地區相比，基里巴斯人患雪卡毒素的風險要高得多。研究團隊的任務是確定毒性與物種和位置的關係。

Extreme Environments Program: The Coral Triangle
「極地環境」計劃：珊瑚大三角探索

Dr. Chan led the CityU School of Creative Media undergraduate students to learn to dive and participate in CityU's ground-breaking Extreme Environments Programme: The Coral Triangle between 25th February and 8th March 2017. His role was overseeing the work and ensuring the safety of eight CityU students over a 10-day period on Sipadan Island off the eastern coast of Sabah, Malaysia. He trained the students to be proficient scientific divers, i.e., not simply recreational divers who are capable of conducting experiments underwater. Coral Triangle Expeditions 2017 was not only a highly educational experience for the media students; it was also a platform for promoting "ocean" citizenship.

陳博士帶領八名完成潛水訓練的城大創意媒體學院學生，參加了突破性的「極地環境」計劃：珊瑚大三角探索之旅。他們於2017年2月25月至3月8日前往馬來西亞沙巴州東岸的西巴丹島進行為期十天的考察，陳博士負責指導學生的工作及確保他們的安全。陳博士培訓參與活動的學生成為熟練的科學潛水員，勝任水下實驗的工作。「珊瑚大三角探索之」不僅讓習藝的學生深受教益，亦是推廣「海洋公民權」的平台。

Photo Credit： Deep Focus@ The School of Creative Media, CityU
圖片來源：入目三分 @ 創意媒體學院，香港城市大學

Students went through diving training two months before the trip, under Dr. Chan's supervision. Eight students attended the classes and obtained the diving certification. The expedition travelled first to Tawau in Sabah, Malaysia and then to their base in Mabul Island. During the trip, students visited multiples sites in the region including Sipidan, one of the highest-rated underwater sites in the world for divers. Students observed SKLMP scientific research and explored caves, coral reefs and wrecks. They encountered a broad diversity of marine life including sharks, turtles, moray eels and a plethora of fish species.

在陳博士的指導下，學生在出發前兩個月便開始接受潛水訓練。八名學生修讀了相關課程，考獲潛水證書。探索之旅的第一站是馬來西亞沙巴島的斗湖，然後抵達他們的基地馬布爾島。學生到訪該區不同的潛水地點，包括擁有世界罕見水底美景的西巴丹島。

學生除了從旁觀察海洋污染國家重點實驗室進行科學研究，也參與探索海洞、珊瑚礁和沉船遺骸，接觸的各色海洋生物包括鯊魚、海龜、海鰻和其它各式各樣的魚類。

Photo Credit： Deep Focus@ The School of Creative Media, CityU
圖片來源：入目三分 @ 創意媒體學院，香港城市大學

“Diving gives my research a new dimension. Of course, I can conduct chemical analysis on a dead coral fish sample without ever visiting its habitat, but then I will miss the opportunity to witness how coral bleaching reduces food sources of coral reef fishes, and see many of them nibble the dead coral and associated algae.”

Dr. Maggie Mak
Former Scientific Officer of SKLMP
Shared her experience after the Kiribati trip

「潛水為我的研究提供了新的角度。當然，即使我沒有到過棲息地，也可以對已死了的珊瑚魚樣本進行化驗。但我便會錯過機會見證珊瑚白化如何減少珊瑚魚的食物來源，看見牠們只靠吃已故珊瑚及其上的植物維生。」

麥艷玲博士
SKLMP前科學主任
分享了在基里巴斯的經驗

“After seeing various kinds of corals and fishes through diving underwater, I awakeningly realized the beauty of the ocean and the importance of marine conservation.”

A member of the exchange team
School of Environmental Engineering
Peking University

「在海底看見了各色珊瑚礁和魚，讓我覺醒地發現海洋的美麗與保護海洋的重要性。」

社會實踐團隊一名成員
環境科學與工程學院
北京大學

After learning to scuba dive, I was able to experience the amazing life forms of the underwater world. The ocean is a paradise with its beautiful ecosystem and spectacular organisms. Fascinated by the ocean, I came to realise how rapidly we were losing this paradise due to climate change and human activity. What was once a vast ecosystem now leaves behind a tampered memory. My artwork acts like a visual timer indicating a sense of urgency as the number decreases. It reminds us of the limited time we have to witness and save this utopia to which life on earth heavily depends upon.

Yogesh Rai
School of Creative Media
CityU

在我接受深海潛水訓練後，我得以體驗到在水底世界中奇妙的生態。海洋儼如天堂一樣，存活着美麗生態系統與壯麗的生物。我沉醉於海洋之中，開始意識到隨着氣候轉變和人類活動，我們正快要失落這片樂園。曾幾何時這個豐富而廣闊的生態系統，如今剩下的是已被篡改的憶記。我的藝術作品仿如一個視覺計時器，隨着數字遞減來揭示出急切性。它提醒我們，在有限的時間裏，我們必須親身見證及拯救這個烏托邦——這個地球萬物賴以維生的烏托邦。

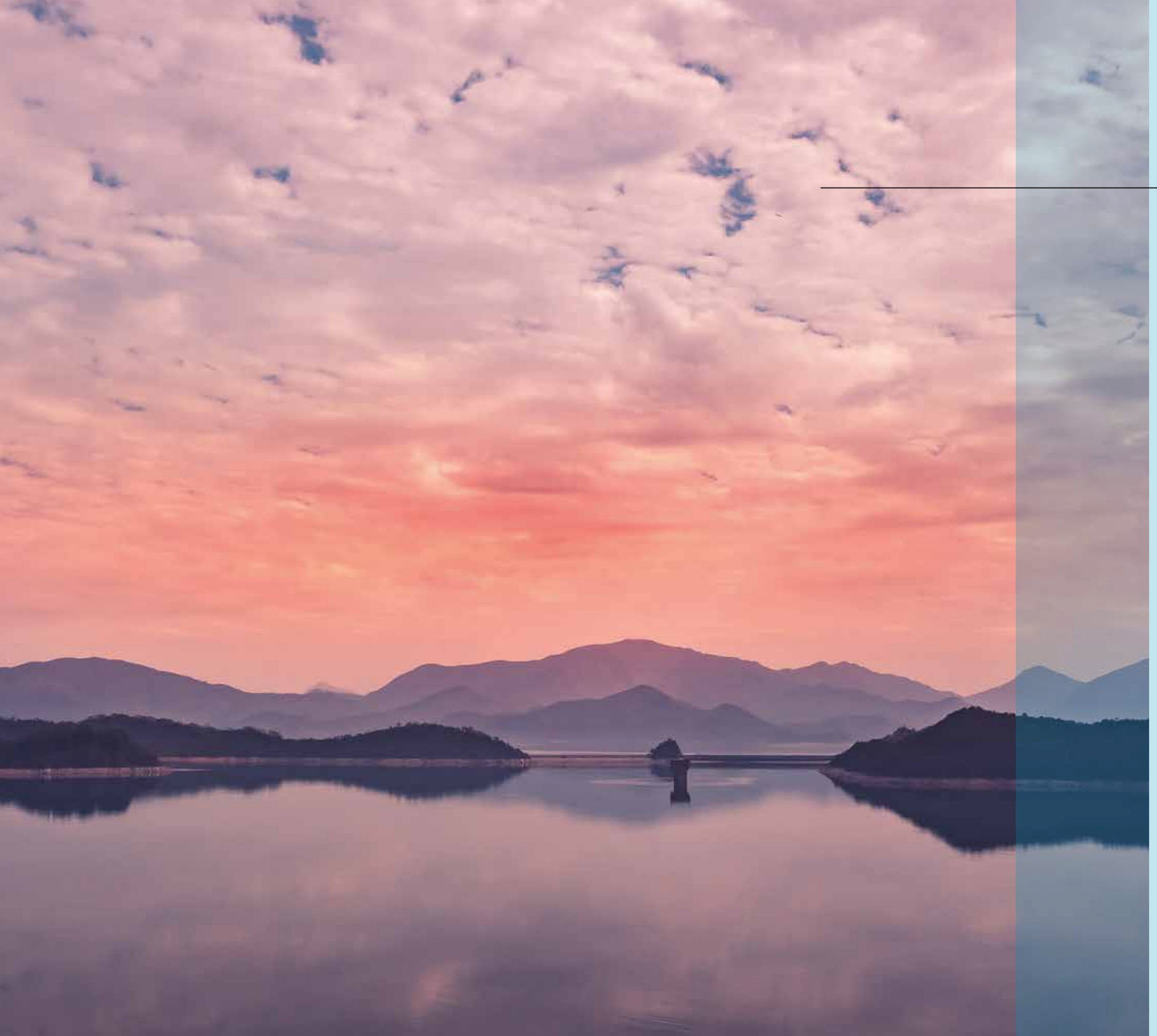
Yogesh Rai
創意媒體學院
香港城市大學

“Scuba diving is a challenging task for me as I don’t know how to swim. Although I only dove for a short time in the morning and the deepest point was approximately 5 m, the greatness of the ocean with lots of fishes and corals surprised me. The feeling of touching those little organisms was so different from watching them on TV. Plus I feel that to work on something uncertain, the first step is that I should be brave, and ultimately overcome the fear in that heart. When I first jumped into sea, the fear made me feel so tense that I could not follow the instruction of my instructor. After I tried to adjust myself and adapt to the environment. I started to relax and changed my attention to the beautiful view under the sea. This experience is not only applicable to scuba diving, but also suitable for all the challenges ahead.”

A member of the exchange team
School of Environmental Engineering
Peking University

「由於之前不會游泳，因此潛水對於我而言算是一次很大的挑戰吧。雖然只有短短一個上午的時間體驗潛水，而且最深只下潛到了5米的深度，但海洋中豐富的魚類和珊瑚還是讓我歎為觀止，親手觸摸了很多之前只是在電視上看到過的生物，感覺是非常不同的。而且，我覺得接觸未知事物首先要做的事就是消除自己內心的恐懼。在剛剛下水時，心理的潛在束縛使我無法按照教練的要求做動作，整個人都很僵硬。但當我主動調整自己，去適應周圍的時候，我的身體變得輕鬆了，也可以將注意力轉移到周圍的風景上了。這種體驗不僅適用於潛水，也同樣適用於其他一切未知的事物。」

社會實踐團隊一名成員
環境科學與工程學院
北京大學

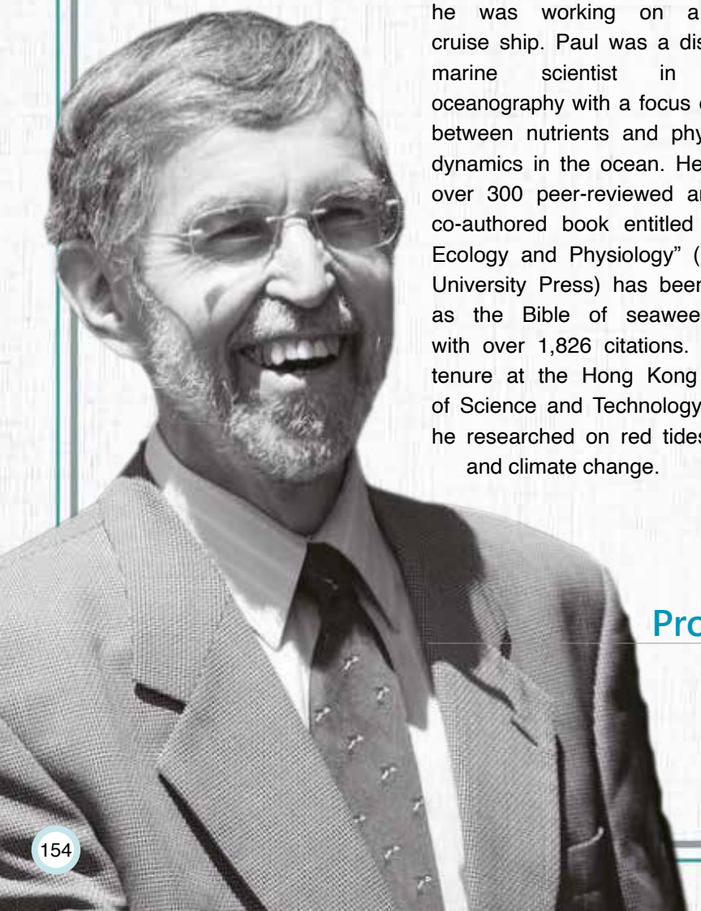


In Memoriam
永遠懷念

In memory of
Professor Paul Harrison & Dr. Doris Au
永遠懷念賀瑞燊教授、歐慧婷博士

During the past 10 years, our State Key Laboratory of Marine Pollution tragically lost two core members, our beloved friends, Professor Paul James Harrison and Dr. Wai Ting Doris Au.

過去十年，海洋污染國家重點實驗室不幸失去了兩位重要成員與摯友——賀瑞燊教授與歐慧婷博士。



On 17th December 2016, Professor Paul James Harrison suddenly passed away due to complications of the influenza A virus while he was working on a scientific cruise ship. Paul was a distinguished marine scientist in biological oceanography with a focus on ecology between nutrients and phytoplankton dynamics in the ocean. He published over 300 peer-reviewed articles. His co-authored book entitled “Seaweed Ecology and Physiology” (Cambridge University Press) has been regarded as the Bible of seaweed ecology with over 1,826 citations. During his tenure at the Hong Kong University of Science and Technology (HKUST), he researched on red tides, hypoxia, and climate change.

2016年12月17日，賀瑞燊教授在科研船上工作時，因感染甲型流感病毒而引致的併發症突然辭世。他是生物海洋學領域的傑出海洋科學家，主要研究海洋中營養物質和浮游植物動態之間的生態學關係。他發表了逾300篇經同行評審的論文，與人合著的《海藻生態學與生理學》（劍橋大學出版社）公認為海藻生態學的經典，獲引用逾1,826次。在香港科技大學任職期間，他的研究領域是紅潮、缺氧與氣候變化。

Although he won numerous awards such as Fellow of the Royal Society of Canada, he was a humble person and a supportive mentor to many research students and young scientists. He was a founding member of both AoE-MERIT and SKLMP, and later on became an overseas academic advisor of SKLMP after his retirement from HKUST. Professor Paul Harrison will be greatly missed by many of us. We won’t forget his smiles, his passion in scientific research and his caring of young researchers.

賀瑞燊教授曾榮獲加拿大皇家科學院院士等多項榮譽，平日卻謙恭有禮，對後輩循循善誘，是多位研究生及年青科學家的優秀導師。他是香港卓越領域-海洋環境研究（AoE-MERIT）與SKLMP的創始成員，從科大退休後獲任SKLMP海外學術顧問。他的笑容，他對科學研究的熱忱，他對年青研究人員的關愛，我們將銘記在心。

Prof. Paul James Harrison
賀瑞燊 教授

On 7th February 2020, Dr. Doris Wai Ting Au sadly passed away after a long battle against bowel cancer. She was a founding member of both MERIT and SKLMP. Doris devoted 27 years of her life in studying marine pollution, ecotoxicology and hypoxia, and published over 128 refereed papers and 8 book chapters in these areas. She was well-known about her works on application of histopathological diagnosis to study toxic effects of pollutants in marine organisms, especially in marine medaka fish. For instance, her single-author review article appearing in Marine Pollution Bulletin entitled "The application of histo-cytopathological biomarkers in marine pollution monitoring: a review" has been well cited with over 540 citations.

2020年2月7日，歐慧婷博士在與腸癌作長期鬥爭後不幸去世。歐博士是MERIT和SKLMP的創始成員，投入了27年時間研究海洋污染、生態毒理學和低氧環境對海洋生物的反應，在上述學術領域發表逾128篇論文，並撰寫了8篇著作章節。在運用組織病理學診斷以研究污染物對海洋生物（尤其是海洋鯖鰭魚）的毒性作用領域，她的研究名揚學界。例如，她作為單一作者在《海洋污染簡報》中發表過的一篇綜述文章，題目名為〈The application of histo-cytopathological biomarkers in marine pollution monitoring: a review〉，並獲得引用超過540次。

Doris also invented some innovative technologies in studying toxicology of chemical contaminants including the high-throughput histoarray and medaka embryo chip. Doris was a very kind and lovable person, and a great mentor to many research students and postdocs. At SKLMP, Doris was instrumental to create and organise a number of our annual summer training courses for young scientists in collaboration with colleagues of Xiamen University, while she co-organised or co-chaired a number of international conferences. She always served as a wonderful host for our visiting scholars such as organizing unforgettable wine-tasting dinner parties. Doris also served on a number of advisory committees for the HKSAR Government such as the Advisory Council on Food and Environmental Hygiene and the Appeal Board of the Environment Bureau. The scientific contributions and friendliness of Dr. Doris Au will be fondly remembered by all of us.

歐博士亦發明了研究化學污染物毒理學的創新技術，包括高通量組織芯片和鯖鰭魚胚胎陣列。歐博士待人和善，是多位研究生及博士後的良師。在SKLMP期間，歐博士與廈門大學的同事合作，為實驗室的青年科學家創建及主辦了多次年度暑期培訓課程，並且協辦或共同主持了多個國際會議。她常常對來訪學者給予細心及殷勤的照顧，讓他們賓至如歸，比如籌辦了數次令人難忘的品酒晚宴。歐博士亦出任多個香港特區政府諮詢委員會，包括食物及環境衛生諮詢委員會與環境保護署上訴委員會。歐博士的科學貢獻與溫文爾雅，我們將永遠難忘。

Dr. Doris Au
歐慧婷博士

10 Acknowledgement

鳴 謝

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Happy 10th
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