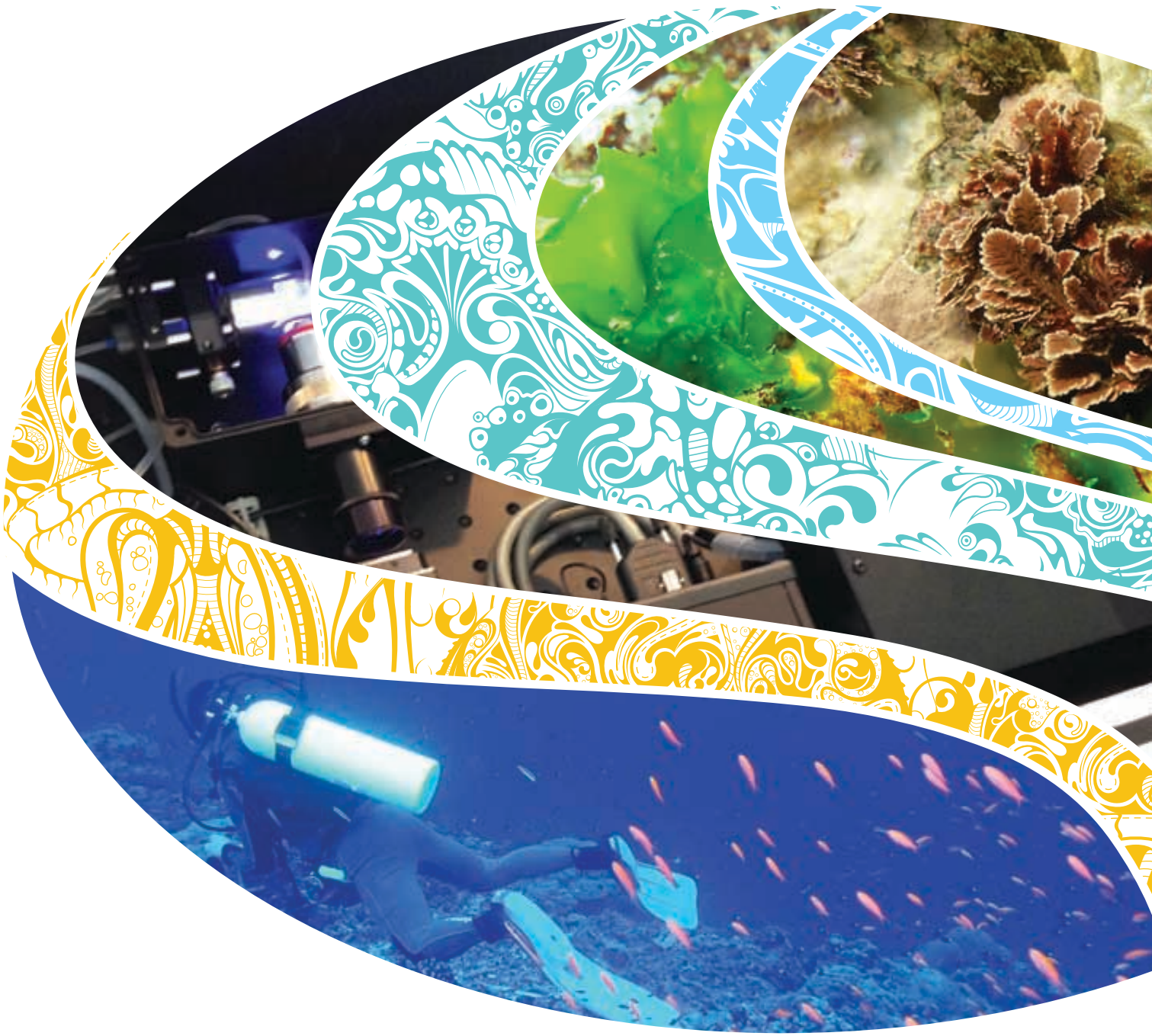
2014

Annual Report 年度報告



海洋污染國家重點實驗室
State Key Laboratory in Marine Pollution

State Key Laboratory in Marine Pollution

SKLMP

海洋污染國家重點實驗室

海洋污染國家重點實驗室
State Key Laboratory in Marine Pollution

Envisions a solid base where coordinated and long-term research can be conducted to tackle marine pollution problems.

希望通過堅實的長期協作研究平台以解決海洋污染問題。

The mission of the SKLMP is to protect the marine environment of Hong Kong and South China by identifying major threats such as algal toxins and contaminants of emerging environmental concern, and developing tools and technologies to address and solve these problems.

海洋污染國家重點實驗室的使命為通過明確威脅海洋環境的主要問題，如藻毒素和新興環境污染物等，並發展相關設備和技術致力於這些問題的解決，以保護香港和華南地區的海洋環境安全。

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A Message from the Director
主任致辭

The end of 2014 marked four memorable years since the establishment of the State Key Laboratory in Marine Pollution (SKLMP). This year, we are moving full steam ahead to prepare for a big challenge in 2016: the first 5-year assessment of Partner State Key Laboratories in Hong Kong (PSKLs) set out by the Ministry of Science and Technology of China (MOST). In this challenging year, we will continue to uphold professional research standards, further contribute to society, and be grateful for all the support that we have received along the way.

Hong Kong has lacked a long history in the area of marine pollution research due to the absence of substantial projects and funding support in this field. In 2004, Prof Rudolf SS Wu of City University of Hong Kong (currently Chair Professor and Director of the School of Biological Sciences, The University of Hong Kong) brought together outstanding researchers from six local universities (City University of Hong Kong, The Chinese University of Hong Kong, Hong Kong Baptist University, The Hong Kong Polytechnic University, The University of Hong Kong, and The Hong Kong University of Science and Technology) to found the Centre for Marine Environmental Research and Innovative Technology (MERIT), which was selected by the University Grants Committee (UGC) as one of the twelve Areas of Excellence (AoE) in Hong Kong. Since its inception, the MERIT team established itself as a leading international research group in the area of marine pollution, consistently earning excellent ratings in the UGC annual assessments. In 2009, with the approval from the MOST, MERIT officially became SKLMP. Composed of 37 experts from the six member universities, SKLMP has the advantage of the dynamic interactions of team members and access to multi-disciplinary research facilities and programs, all of which have enabled SKLMP to thrive among state key labs in mainland China and among international research laboratories. At the same time, building up and maintaining a sense of belonging and identity within the team can pose a challenge. In response, we always remind ourselves of an ancient Chinese story: "There was a king who wished for swift horses. To show his sincerity and determination, he spent a great amount of money even on a horse carcass. Finally, people were touched and brought their best horses to the king." The moral of the story reminds us that it is important to bring people together to pursue a common goal of research excellence and to provide a world-leading research team in which scientists can thrive

The outstanding achievements of SKLMP would be impossible without the teamwork of our members. In order to facilitate collaboration and build a sense of belonging, we have devoted our energies to strengthen our capabilities. In the past four years, we have invested HK$30M in shared facilities, daily operations and maintenance. Moreover, another HK$4.5M of the HK$5M grant from the Innovation and Technology Commission (ITC) was used as the SKLMP Seed Collaborative Research Fund (SCRF) for member universities. We believe our diligence will lead to a promising 2015.

The marine environment is fundamentally interconnected with the water cycle, marine and terrestrial food webs and climate regulation; at the same time, humans benefit from marine resources such as food and energy. In light of the importance of the marine environment, marine pollution together with other threats including climate change and energy depletion are still the major challenges in the 21st century. The balance between environmental protection and development must be of priority for the foreseeable future, particularly in rapidly-developing countries. In view of Shenzhen's growing demand for marine ecosystem conservation and sustainable use of marine resources, the Shenzhen Key Laboratory for the Sustainable Use of Marine Biodiversity (SUMB) was established under the approval of the Science and Technology Innovation Commission of Shenzhen Municipality. The goal of SUMB is to

enhance sustainable development and application of related technology in marine resource utilization, to promote the development of the maritime economy as well as marine conservation.

In 2012, the worldwide production of fisheries products exceeded those from wild fisheries, and reached US$100 billion, of which 60% was contributed by mainland China. In the past two decades, aquaculture has been one of the fastest growing sectors in the global food industry, and will remain as an indispensable food source in the coming century. Locating in a subtropical region and bounded with extensive coastlines, Hong Kong was once rich in fisheries resources. Substantial overexploitation caused fish stocks to decline over the past few decades. Mariculture became an alternative industry to cope with the local seafood demand. However, unsustainable mariculture practices, including over-farming and abuse of veterinary drugs, pose risks to both food safety and the quality of the marine environment. Additional factors such as harmful algal blooms and waterborne pathogens in local waters further affected the aquaculture sector, making culture efficiency largely unguaranteed and discouraging operators from participation. Currently, the local demand for fisheries products is still largely supported by imports.

In view of the current local situation with respect to mariculture, SKLMP has set up a project called Sustainable Ecological Aquaculture (Project SEA). Collaborating with top research teams from the mainland, Taiwan and Hong Kong, Project SEA built up an experimental mariculture demonstration platform at O Pui Tong, Kat O in the northeastern waters of Hong Kong. This project aims to advance local mariculture development in terms of enhanced efficiency and ecological sustainability and to support in situ scientific research including environmental monitoring, bioremediation, and disease diagnosis and control. Through cooperation among different stakeholders including government, academia, research centres and the aquaculture sectors, we anticipate that sustainable and ecologically responsible aquaculture methods can be developed as a model for aquaculture worldwide. We hope that this model can ultimately facilitate future aquaculture development, maintain a high quality marine environment and thus healthy marine ecosystems, secure the safety of fisheries products, and enable sustainable use of marine resources in Hong Kong and mainland China.

SKLMP also endeavored to facilitate collaboration between Hong Kong and institutions on the mainland through the establishment of the Shenzhen Marine Research and Technology Consortium (SMART). Based on SMART, the Shenzhen Ocean Emerging High-tech Industry Promotion Association was also set up to further enhance cooperation between the research and industrial sectors and to promote the maritime economic development of Shenzhen through our previously formulated "Shenzhen Marine Industrial Development Plan (2013-2020)" for the Shenzhen Municipal Government.

Lastly, I would like to assure our leaders, colleagues and friends that SKLMP will continue to sustain fundamental research, to promote innovative scientific exploration, as well as to nurture future generations of students and researchers. Under the rapid growth of maritime development in China, SKLMP is determined to strengthen its leading role in marine pollution research, and to contribute to sustainable utilization of marine resources.

I wish you and your family a Happy New Year and a very successful and prosperous 2015.

Yours sincerely,

Paul Kwan Sing Lam
Director of the State Key Laboratory in Marine Pollution
31st December 2014

當日曆翻過2014年12月31日，海洋污染國家重點實驗室 (SKLMP) 已走過了啟動建設以來的第四個年頭。踏進2015年，SKLMP將積極準備迎接2016年香港夥伴國家重點實驗室的首次評估，此項評估讓我們感到了前所未有的壓力。在匆匆疾行的數年間，每當回顧每一件大事，體味個中滋味時，我們總會感受著強烈的社會責任感，但我們始終謹記的仍然是感恩之心。

由於長期以來缺乏重大研究項目的支持，香港海洋污染研究的發展歷史並不悠久，直至2004年在香港城市大學胡紹燊教授(現為香港大學生物科學學院院長)的領導下，彙集了香港本地六所大學 (香港城市大學、香港大學、香港科技大學、香港浸會大學、香港中文大學和香港理工大學)的優秀科研人員，共同建立「海洋環境研究及創新科技中心」(以下簡稱MERIT)，並於2004年被香港特別行政區政府轄下的大學教育資助委員會 (教資會) 甄選為香港「卓越學科領域」之後，逐漸發展成為具有國際競爭力和處於國際科研前沿的香港海洋污染研究團隊。自創辦以來，MERIT的工作一直獲得嘉許，每年均獲教資會國際評審小組全部成員給予優異的評價；在此基礎上，MERIT在2009年獲國家科技部批准，正式建設成為海洋污染國家重點實驗室 (SKLMP)。SKLMP的組成結構特別，由六所夥伴院校聯合組成，優勢在於37 位成員的多學科融合以及六所大學的設施共用，整體研究實力及規模與國際同行及內地學界不相伯仲，但挑戰在於如何形成成員的歸屬感及認同感。我想借此機會，用以下的一個故事去表述我們的誠意及決心：

「一國君欲用千金求千里馬，可三年過去了也沒得到。這時，一位臣子自告奮勇去完成這個任務，但這人用五百両黃金只買了千里馬的骨頭回來。國君很不高興。這位臣子卻說，這樣是為讓天下人都知道，大王是真心地想高價錢買馬，而不是騙人。果然，不到一年，就有人送來了三匹千里馬。」

其實求千里馬和求人才是同樣道理，以感情凝聚人，以平台吸引人，以事業激勵人，將吸引更多更好的人才；就如同天體引力大時出現大潮，引力小則出現小潮的「海潮效應」。

SKLMP的成功實賴成員間的通力合作，回顧過去的四年，在運行管理上，SKLMP努力建設「基本體系」，竭力為成員搭建舞台，至今共投入港幣三仟萬用於共用儀器的購置、日常維護及運行，另將創新科技署伍百萬港幣資助中之四佰伍十萬撥作成員院校開放協作研究基金，希望能進一步加強成員的協同合作、歸屬感及認同感，亦冀望此等舉措能在2015年為SKLMP帶來豐碩的科研成果。

海洋污染、氣候變暖、能源匱乏，是二十一世紀面臨的最大難題，海洋的環境與地球的水循環，生物鏈，以及氣候的調節息息相關，同時海洋的豐富資源也提供了人類食物及能源的來源。故此，如何在持續地利用海洋資源的同時，減少人為的污染源，使得環境保育與經濟發展並行，則是現代人的重要議題。因應深圳市在海洋生態保護及生態安全、海洋資源的持續開發與利用等方面的社會需求，經深圳市科技創新委的批准，依託SKLMP的科研中堅力

量，成立了「深圳市海洋生物多樣性可持續利用重點實驗室」，該實驗室的成立希望增強深圳對海洋資源的開發能力和應用技術，加速海洋經濟的發展及海洋生態環境的保護。

此外，全球水產品生產量在2012年已達到了1000億美元，超過由野外捕撈的數量，中國內地的產量也已佔了在全球產量的60%，在過去的二十年間，水產養殖已經是糧食生產業增長最快速的行業，並將會在下一世紀繼續成為世界上不可或缺的糧食供應來源。香港位於亞熱帶地區，海岸線長，過去有著豐富的亞熱帶經濟魚產品足供本地使用。在取用不平衡的狀態下，使得魚資源日漸枯竭，因此開始了漁排海上養殖的模式；然而，水產養殖業並沒有認真地對環境負起責任，在過度養殖的狀況下，導致生態環境愈趨惡劣，並由於濫用獸藥及化學藥物，引起一連串食品安全問題，使得養殖成效變差，加上有害藻華及水生病原菌的威脅，最終令許多人放棄了養殖產業，至此水產品大多依賴進口。

有見於此，SKLMP希望以「可持續生態的水產養殖項目 (Project SEA) 」作為平台，聯合兩岸三地高水準科研團隊，積極配合香港漁業發展需要及政府相關產業政策，以香港海魚養殖區為試驗基地，致力推動高科技海魚養殖業的發展，並為近海污染的監測、評估、預防、控制、治理和環境污染生物修復等方面提供科學依據和技術支撐，希望在官、學、研、產的鼎力合作下，使可持續生態的水產養殖成為香港的重點發展模式，以保證水產養殖業和海洋產業的健康發展，保障生態系統健康和食品安全，實現海洋生物資源的可持續利用及我國海洋水域的可持續使用。

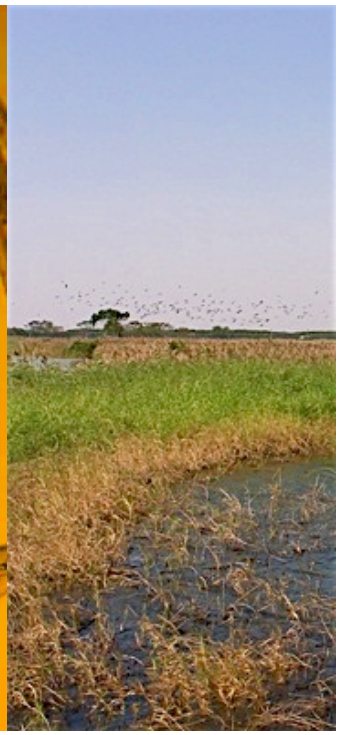
在促進與內地院校及科研單位合作方面，基於深圳海洋研究與技術聯盟（Shenzhen Marine Research and Technology Consortium，英文簡稱SMART）的基礎上，在中國科學院深圳先進技術研究院作為理事長單位牽頭下，香港城市大學深圳研究院、清華大學深圳研究院、深圳虛擬大學園及中集集團作為副理事長單位，共同成立了「深圳市海洋新興高科技產業促進會」。促進會希望能依據SMART製定的「深圳市海洋產業發展規劃（2013-2020年）」，充分發揮產學研合作優勢，為推動深圳市海洋經濟的發展做出更大貢獻。

最後，我與實驗室同仁向支持及關心我們的領導、同事及海內外朋友保證，我們將一如既往勤業篤志、腳踏實地、眼望未來，努力去造就一個氛圍、培育一個系統、扶植一代新人，也希望在我國海洋事業快速發展的背景下，SKLMP能在海洋污染研究科學領域加強國內外的引領作用，提高國際影響力，使SKLMP可以持續健康發展，在此對各位致以最美好的新年祝福。

林群聲

海洋污染國家重點實驗室(SKLMP)主任
二零一四年十二月三十一日

Research Scopes in SKLMP
實驗室研究範疇

研究範疇1 Research Scope 1	研究範疇2 Research Scope 2	研究範疇3 Research Scope 3	研究範疇4 Research Scope 4
			
Pollution Monitoring Technology 污染檢測技術	Marine Ecosystem 海洋生態系統	Risk Assessment 風險評估	Pollution Control and Bioremediation 污染控制與生物修復

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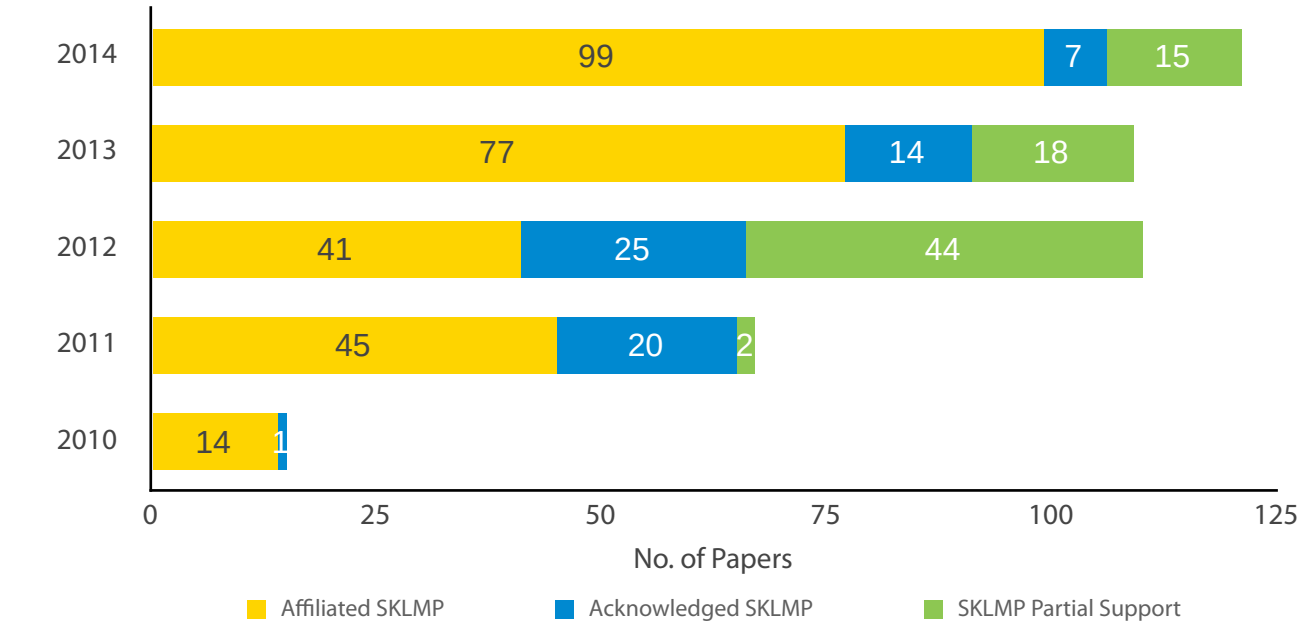
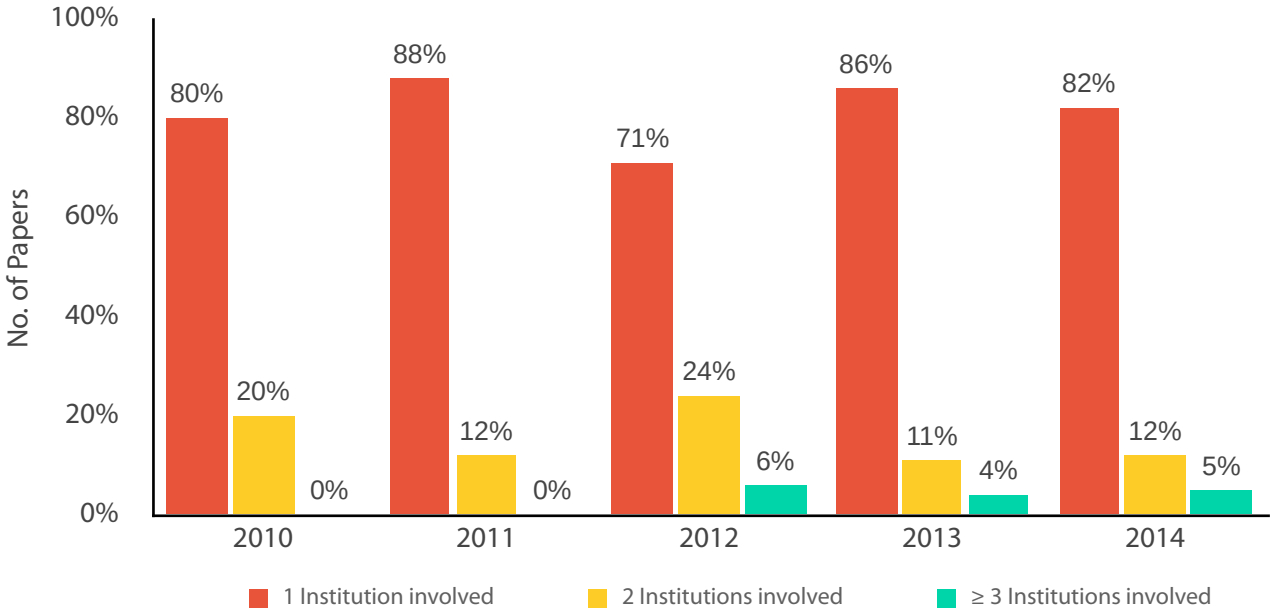
Research Output 研究成果*

Number of SCI publications of SKLMP (2010-2014)
2010-2014年SKLMP的SCI論文數目

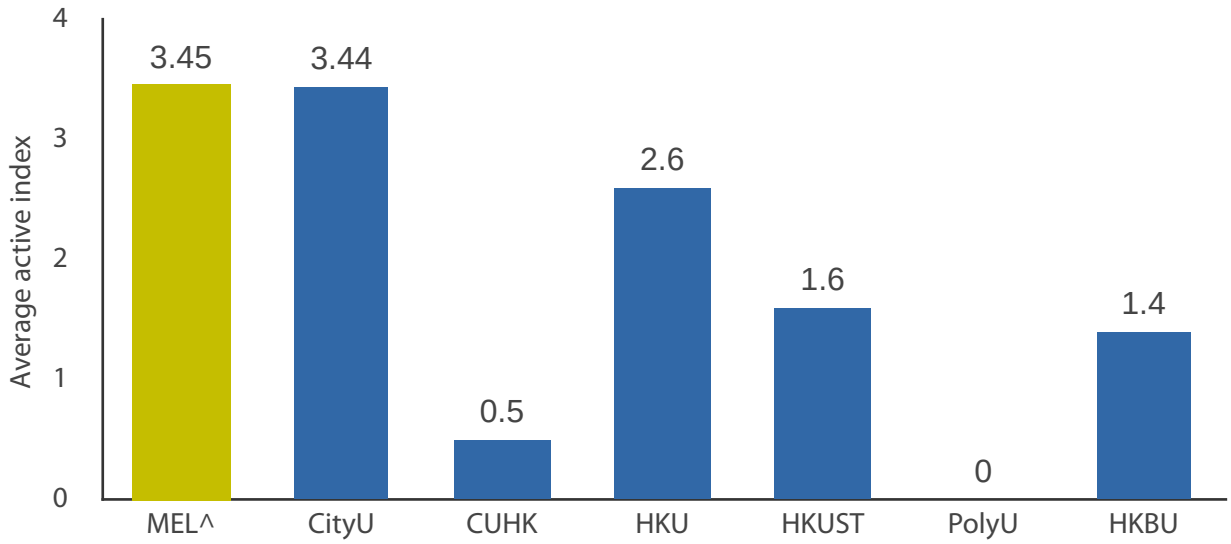


Degree of collaboration among member institutions based on SCI publications in 2010-2014
2010-2014年成員院校合作發表SCI文章的情況

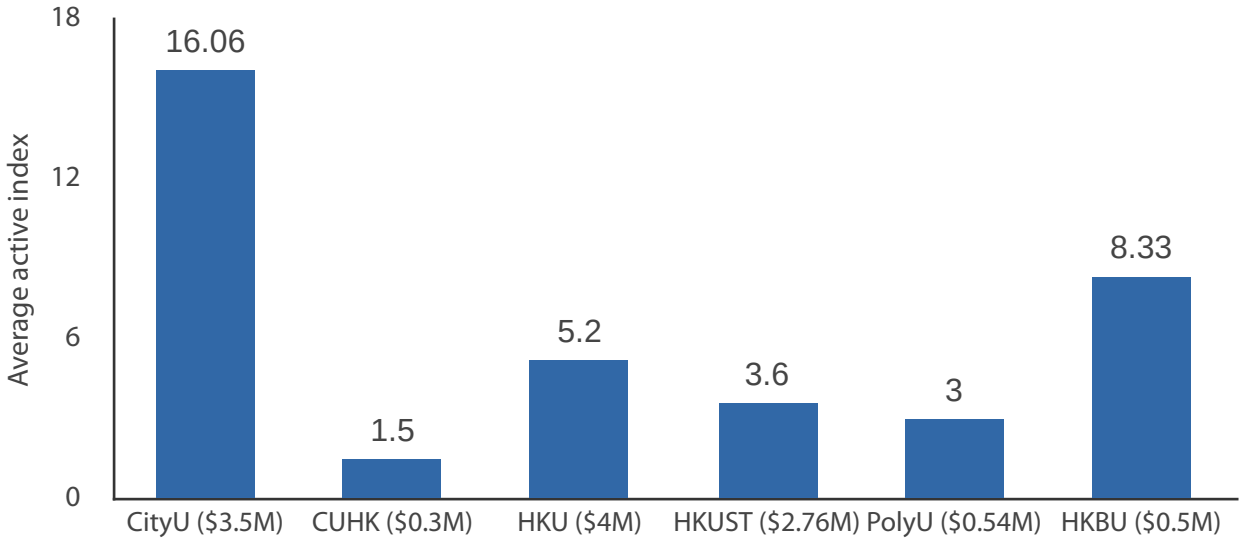


*Research Outputs information provided by members.
Number of members in 2010-12: CityU (13), CUHK (4), HKU (5), HKUST (6), PolyU (1), HKBU (2)
Number of members in 2013: CityU (18), CUHK (2), HKU (5), HKUST (5), PolyU (1), HKBU (7)
Number of members in 2014: CityU (18), CUHK (2), HKU (5), HKUST (5), PolyU (1), HKBU (5)

Average active index# of 6 institutions (2014)
成員院校的活躍指數(2014)



Cumulative average active index # of 6 institutions (2010-2014)
成員院校的活躍指數(2010-2014)



#Average active index = SCI publications/members per institution
平均活躍指數 = SCI 文章數目/院校成員人數

^MEL: State Key Laboratory of Marine Environmental Science, Xiamen University
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Total amount of funding supported by the Innovation and Technology Commission (ITC) allocated to each university are shown in parentheses

Part 1. Papers with the SKLMP included as the first author's affiliation
以SKLMP為第一單位的期刊論文

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Part 2. Papers with the SKLMP as one of the affiliations
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Green or sustainable or suitable chemistry and engineering?
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Dr. Lam, J.C.W.

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The ISME conference
Aug 2014, Seoul, Korea

Prof. Leung, K.M.Y.

Environmental challenges and research opportunities for Hong Kong's Harbour
The inaugural workshop of the World Harbour Project
12-13 Nov 2014, Sydney, Australia

De novo* transcriptomic profile in the gonadal tissues of the intertidal whelk *Reishia clavigera
SETAC Europe 24th Annual Meeting
11-15 May 2014, Basel, Switzerland

A comprehensive review of marine biodiversity in Hong Kong
The 3rd World Conference on Marine Biodiversity
12-16 Oct 2014, Qingdao, China

***De novo* transcriptomic analysis of the mussel *Perna viridis* with an emphasis on tissue-specific patterns for ecotoxicological and environmental studies**
SETAC Asia/Pacific 2014 Conference
14-17 Sept 2014, Adelaide, Australia

Temperature-dependent chemical toxicity models and their implications on derivation of water quality criteria and ecological risk assessment
SETAC Asia/Pacific 2014 Conference
14-17 Sept 2014, Adelaide, Australia

Basic statistics for environmental research; The challenges in search of the "Holy Grail" for protecting aquatic ecosystems from chemical pollutants; Retrospective environmental risk assessment and Effective risk communication
The First Sino-Finnish Summer School in Environmental Science
4-15 Aug 2014, Finland

Developing a platform of environmental omics for the green-lipped mussel *Perna viridis*
SETAC Europe 24th Annual Meeting
11-15 May 2014, Basel, Switzerland

Comparison of temperate and tropical aquatic species' acute sensitivity to nickel
The Nickel Tropical Risk Assessment Workshop organized by Nickel Producers Environmental Research Association
29-30 Apr 2014, Singapore

Field-based species sensitivity distribution and community sensitivity distribution as alternative ways for field validation of the PNECs derived from laboratory based approaches
The ECETOC Workshop on Estimating Toxicity Thresholds for Aquatic Ecological Communities from Sensitivity Distributions
11-13 Feb 2014, Amsterdam, Netherlands

Prof. Li, K.W.

Matern covariance function for spatio-temporal environmental datasets
The 24th Annual TIES (The International Environmetrics Society) Conference
15-18 Dec 2014, Guangzhou, China

Prof. Li, X.Y.

Particle dynamics in water and engineering systems: Characterization and modeling
4th International Conference on Civil Engineering and Building Materials (CEBM2014)
23-24 Nov 2014, Hong Kong, China

Dr. Ma, E.C.H.

Pacific ciguatoxin-1 modulates motor function and EEG activity in mice
Society for Neuroscience 2014
15-19 Nov 2014, Washington DC, USA

Pacific ciguatoxin-1 reduces regenerative capacity of peripheral neuron in vitro
Society for Neuroscience 2014
15-19 Nov 2014, Washington DC, USA

Dr. Murphy, M. B.

Pharmaceutical residues and occurrence of antibiotic-resistant bacteria in Hong Kong surface waters and sediments.
SETAC Europe 24th Annual Meeting
11-15 May 2014, Basel, Switzerland

Dr. Shin, P.K.S.

Conservation in action: the high school juvenile horseshoe crab program in Hong Kong
A Horseshoe Crab Celebration
24-26 Apr 2014, New York, USA

Prof. Yu, P.K.N.

Modulation of NF-kB in rescued irradiated cells
9th International Symposium on the Natural Radiation Environment (NREIX)
23-26 Sept 2014, Hirosaki, Japan

Proton dose response of zebrafish embryos
2nd Global Chinese Congress on Radiation Research (GCCRR2014)
11-15 May 2014, Suzhou, China

Dr. Wai, T.C.

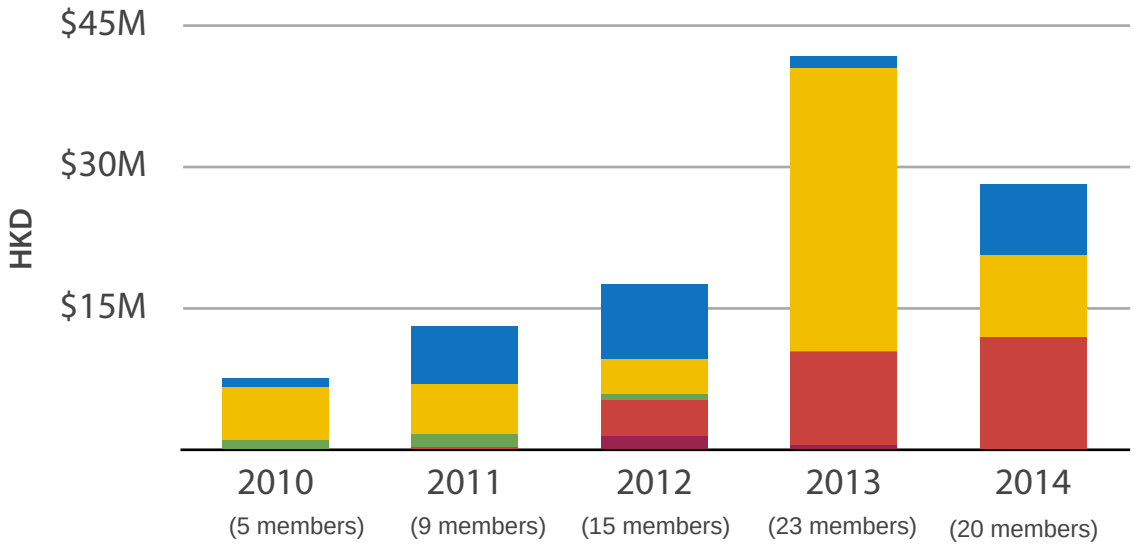
Grazers influence the trophic dynamics of tropical rocky reefs: carbon use and ecological thresholds in alternate community states
The 10th International Temperate Reefs Symposium (ITRS)
12–17 Jan 2014, Perth, Australia

Grazers influence the trophic dynamics of tropical rocky reefs: carbon use and ecological thresholds in alternate community states
1st Xiamen Symposium on Marine Environmental Sciences. State Key Laboratory of Marine Environmental Science
9–11 Jan 2014, Xiamen, China

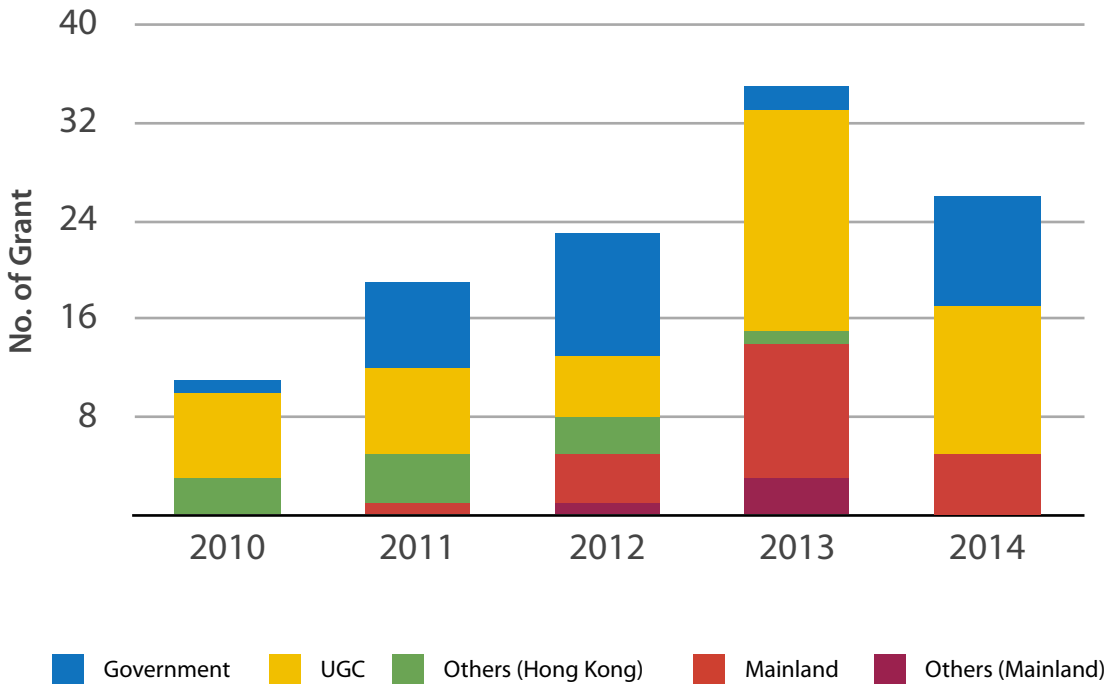
Research Grants 研究資助*

Competitive External Research Grants
外部的研究資助

Amount of Competitive External Research Grants (2010-2014)#
2010-2014外部的研究資助總額#



Number of Competitive External Research Grants (2010-2014)
2010-2014外部的研究資助項目統計



* Research Outputs information provided by members.
Number of members in 2010-12: CityU (13), CUHK (4), HKU (5), HKUST (6), PolyU (1), HKBU (2)
Number of members in 2013: CityU (18), CUHK (2), HKU (5), HKUST (5), PolyU (1), HKBU (7)
Number of members in 2014: CityU (18), CUHK (2), HKU (5), HKUST (5), PolyU (1), HKBU (5)

#1RMB=1.24HKD (2015)

Grants from Hong Kong 香港科研資助

Government 政府部門

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
		2015			
1	*Lycium Barbarum* Polysaccharides Accelerate Axonal Regeneration: Possible Implications for Nerve Repair 枸杞多醣加速軸突再生：神經修復的啟示	Health and Medical Research Fund 醫療衛生研究基金	On-going	**Ma, E.C.H.**	997,908
2	International Conference on Biodiversity, Ecology and Conservation of Marine Ecosystems 2015 (BECoME 2015) 海洋生態與生物多樣性保育國際研討會2015 (BECoME 2015)	Environment and Conservation Fund 環境及自然保育基金	On-going	**Leung, K.M.Y.**	331,660
3	Valorization of the Exoskeletons of Crustaceans in Seafood Waste into Chemicals and Fuels 甲殼類海產品外骨骼廢棄物衍生的化學物和燃料的利用	Environment and Conservation Fund 環境及自然保育基金	On-going	**Horváth, I.T.**	1,373,720
	Subtotal				$2,703,288
		2014			
4	Molecular Mechanism of Ciguatera Fish Poisoning Associated Neurological Effects and Identification of Potential Treatment 魚中毒雪卡毒素後相關神經學效應的分子機理以及潛在治療方法的探究	Health and Medical Research Fund 醫療衛生研究基金	On-going	**Ma, E.C.H.** Chan, L.L. Lam, P.K.S.	979,400
5	Therapeutic Potential of Heat Shock Protein 27 on Guillain–Barré Syndrome 熱休克蛋白27對吉巴氏綜合症的治療潛力	Health and Medical Research Fund 醫療衛生研究基金	On-going	**Ma, E.C.H.**	915,200
6	Assessment of Conventional, New Persistent Organic Pollutants (POPs) and Trace Elements in Hong Kong Cetaceans 香港鯨豚動物中傳統與新興持久性有機污染物和微量元素的評估	Environment and Conservation Fund 環境及自然保育基金	On-going	**Lam, J.C.W.** Lam, P.K.S.	986,000
7	Provision of Services to Study the Aquatic Ecosystem and Water Quality Management of Deep Bay 后海灣水域生態系統與水質管理研究	Environmental Protection Department 環境保護署	On-going	**Lam, P.K.S.** Chan, L.L. Wai, T.C. Lam, J.C.W.	648,440
8	Ecology and Biodiversity of Benthic Dinoflagellates in Hong Kong 底栖渦鞭毛藻的生態及生物多樣性	Environment and Conservation Fund 環境及自然保育基金	On-going	**Wai, T.C.** Lam, P.K.S. Chan, L.L. Ang, P.O. Lu, C.K.	500,000
9	Extended Fish Resources Study for the Proposed Marine Park in the Brothers Islands (under Agreement No. CE10/2013(EP) Detailed Study of the Marine Park in the Brothers Islands – Design and Construction) 擬建大小磨刀海岸公園漁業資源附加研究 大小磨刀海岸公園的詳細研究 (合約編號：CE10/2013(EP)) 附加部分	Highways Department 路政署 (via Ove Arup & Partners Hong Kong Ltd.)	On-going	**Wai, T.C.** Lam, P.K.S.	440,000

* 項目名稱以英文譯本為準　　#Person with underline is SKLMP member

Government 政府部門

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
10	Field Study on Constructed Wetland in Removing Pollutants from Combined Village Sewage 研究利用人工濕地處理鄉村污水	Drainage Services Department 路政署	On-going	**Wong, M.H.** Man, Y. B. Chow, K. L. Li, W. C. Leung, A.O.W.	1,190,000
11	Ecological and Health Risk Assessments of Major Persistent Toxic Substances (PTS) in Deep Bay Area, in Relation to their Removal Efficiency in Yuen Long and Shek Wu Hui Sewage Treatment Works 元朗及石湖墟污水處理廠對主要持久性有毒物質的清除效率及在後海灣海域的生態和健康風險評估	Drainage Services Department 路政署	On-going	**Wong, M.H.** Man, Y.B.	1,420,000
12	Exploring Microbial Diversity and Antibiotic Resistant Genes of Hong Kong Marine Sediment using Advanced Molecular Techniques 使用先進的分子技術研究香港海洋沉積物中微生物多樣性和抗生素耐藥基因	Environment and Conservation Fund 環境及自然保育基金	On-going	**Zhang, T.** Leung, K.M.Y. Li, X.D.	494,760
	Subtotal				$7,573,800
		2013			
13	Development of Osmium-based Compounds as Anti-cancer Drugs (2013-2015) 開發含鋨配合物的抗癌藥物	Innovation and Technology Fund 創新及科技基金	On-going	**Lau, T.C.** Lam, M.H.W.	971,000
14	Fish Resources Study for the Proposed Marine Park in the Brother Islands - Additional Ichthyoplankton Survey (Contract No. HHZMB 2/2012 (EP)) 大小磨刀島嶼（規劃中的）海岸公園的魚類資源研究 – 魚類浮游生物調查	Highways Department 路政署	Completed	**Lam, P.K.S.** Wai, T.C.	238,000
	Subtotal				$1,209,000
		2012			
15	Survey of Juvenile Fish Resources at the Three Marine Parks at Northeast Hong Kong 香港東北地區三個海岸公園的幼魚資源調查	Agriculture Fisheries and Conservation Department 漁農自然護理署	Completed	**Leung, K.M.Y.** Leung, P.T.Y. Yau, C. Lai, V.C.S.	798,000
16	Dosing of Ferric Iron for the Control of Odour Problems in Typhoon Shelters 投加三價鐵控制避風塘臭味問題	Environment and Conservation Fund 環境及自然保育基金	On-going	**Li, X.Y.** Shang, T. Shih, K.	1,058,500
17	Field Sampling, Species Identification and Data Analysis of Benthic Infaunal Communities of Hong Kong Marine Waters 香港水域底棲水生動物群落的採樣、種類鑒定和數據分析	Environmental Protection Department 環境保護署	Completed	**Qiu, J.W.** Leung, K.M.Y. Li, X.Z.	800,000
18	Analysis of the Relationship between Marine Water Quality Parameters and Climatic and Other Environmental Factors 海洋水質參數與氣候及其他環境因子的關係研究	Environmental Protection Department 環境保護署	Completed	**Li, W.K.** Leung, K.M.Y.	515,000

Government 政府部門

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
19	Fish Resources Study for the Proposed Marine Park in the Brothers Islands 大小磨刀島嶼（規劃中的）海岸公園的魚類資源研究	Highways Department 路政署	Completed	**Lam, P.K.S.** Wai, T.C.	1,180,000
20	Application of Cold Plasma Techniques for Disinfection of Bacteria of Air Ventilation Systems in Hospitals and Healthcare Facilities 冷等離子體技術在醫院及其他醫療保健場所通風系統殺菌中的應用	Research Fund for the Control of Infectious Diseases 控制傳染病研究基金	Completed	Kong, R.Y.C.	1,000,000
21	Erosion and Growth of Massive Corals in Hong Kong 香港大型珊瑚的侵蝕與生長	Environment and Conservation Fund 環境及自然保育基金	On-going	**Qiu, J.W.**	981,000
22	Decontamination Effect of Biochemical Processes in Sewage Plants of Hong Kong 香港污水處理廠有毒化學物質的清除效率研究	Drainage Services Department 渠務署	Completed	**Lam, P.K.S.** **Lam, J.C.W.**	400,000
23	A Review of Marine Biodiversity and Ecological Surveys in Hong Kong 香港海洋生物多樣性和生態調查	Environment and Conservation Fund 環境及自然保育基金	Completed	**Williams, G.A.** Leung, K.M.Y.	456,380
24	Provision of Services for the Technical Review and Statistical Analysis of the Datasets of Waterbird Monitoring Programme for the Deep Bay Area and Baseline Ecological Monitoring Programme for the Mai Po Inner Deep Bay Ramsar Site 后海灣水鳥監控程序數據集和米埔內后海灣拉姆薩爾國際重要濕地生態基線監控程序數據集的技術評審和統計分析服務供給	Agriculture Fisheries and Conservation Department 漁農自然護理署	Completed	**Lam, P.K.S.**	793,500
	Subtotal				$7,982,380
	2011				
25	Effect of Vaccine Combined with Traditional Chinese Medicine on Prevention of Disease in Grey Mullet 結合傳統中藥的疫苗對鯔魚疾病防治的研究	Agriculture Fisheries and Conservation Department 漁農自然護理署	Completed	**Wong, M.H.**	410,000
26	Removal Efficiencies of Toxic Chemicals in Sewage Treatment Works in Hong Kong 香港污水處理廠有毒化學物質的清除效率研究	Drainage Services Department 渠務署	Completed	**Wong, M.H.**	900,000
27	Integrated Fish Pond Farming Using Food Processing Waste: for Quality Fish Production and Habitat Conservation 利用食品加工廢棄物用於池塘漁業養殖：用於高質量魚產品的養殖以及生境保護	Environment and Conservation Fund 環境及自然保育基金	On-going	**Wong, M.H.**	1,900,900
28	International Conference on Deriving Environmental Quality Standards for the Protection of Aquatic Ecosystems (EQSPAE-2011) 水生生態保護的環境品質標準國際會議	Environment and Conservation Fund 環境及自然保育基金	Completed	**Leung, K.M.Y.**	495,800
29	Review and Development of Marine Water Quality Objectives-feasibility Study 海水水質目標的回顧與發展- 可行性分析	Environmental Protection Department 環境保護署	Completed	Kong, R.Y.C.	860,000

* 項目名稱以英文譯本為準　　#Person with underline is SKLMP member

Government 政府部門

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
30	High-Efficiency-multifunction-green-vertical Municipal Wastewater Treatment System: Development and Demonstration 高效多功能綠色直立城市廢水處理系統的發展與示範	Innovation and Technology Fund 創新及科技基金	To Be Confirmed	**Tam, N.F.Y.**	1,080,000
31	Qualification of Antibiotic Residues and Microbial Antibiotic-resistant Genes in Fish Ponds and Marine Culture Zones of Hong Kong 抗生素殘留以及香港魚塘和海洋養殖區微生物抗生素耐藥基因的定量分析	Environment and Conservation Fund 環境及自然保育基金	Completed	Leung, K.M.Y.	499,880
	Subtotal				$6,146,580
		2010			
32	Development of Highly Efficient Semiconductor Nanoparticles as Photocatalysts for the Degradation of Organic Pollutants in Water under Visible Light 可作光催化劑對水中有機污染物進行可見光降解的高效半導體納米粒子的開發	Innovation and Technology Fund 創新及科技基金	Completed	**Lau, T.C.**	998,430
	Subtotal				$998,430

University Grants Committee 大學教育資助委員會

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
		2015			
1	Conventional and Emerging Halogenated Flame Retardants in Marine and Estuarine Food Webs in Subtropical Hong Kong Waters: Accumulation Profiles, Trophic Transfer, and Source Identification (亞熱帶香港水域海洋與河口食物網中傳統與新興鹵化阻燃劑研究：富集特徵、營養轉移及源辨識)	General Research Fund 優配研究金	On-going	**Lam, P.K.S.** Lam, J.C.W.	717,749
2	e-Enhanced Primary Sedimentation and Sludge Acidogenesis for Resources (P and PHA) Recovery during Wastewater Treatment 採用鐵混凝沉澱及污泥酸化實現廢水處理中的資源（磷和生物塑料）回收	Collaborative Research Fund 協作研究金	On-going	**Li, X.Y.** Leung, K.M.Y. Lee, P.H.H. Li, X.D. Shih, K.M. Zhang, T. Zhang, X.R. Hu, H.Y. Zhang, J.J.	8,893,340
3	Physico-chemical Characterization and Inhalation Toxicity of Urban Ambient Airborne Particulate Matters (PMs) in Subtropical Regions 亞熱帶地區城市環境中大氣顆粒物的物理-化學表徵及吸入毒性的研究	General Research Fund 優配研究金	On-going	**Li, X.D.**	900,000
4	Brain Astrocytes Drive Mood and Cognitive Dysfunction in Chronic Visceral Pain 腦膠質細胞在慢性內臟痛伴隨的情緒及認知功能障礙的作用	General Research Fund 優配研究金	On-going	**Li, Y.**	929,664
5	An Innovative Membrane Bioreactor (MBR) Process with Iron Dosing for Phosphorus Removal and Recovery during Biological Wastewater Treatment 鐵強化除磷與生物磷回收的新型膜生物反應器工藝開發	Collaborative Research Fund 協作研究金	On-going	**Li, X.Y.**	500,000
6	Managing Pharmaceutical Waste from Households in Hong Kong 香港家居醫藥廢物管理	General Research Fund 優配研究金	On-going	**Chung, S.S.** Wong, C.K.C.	497,992
	Subtotal				$12,438,745
		2014			
7	Estrogenic Chemicals Impair Immune Function and Reproduction in Fish: Unraveling Gender Specific Effects and Underlying Mechanisms 外源性雌激素對魚類免疫以及生殖系統的影響：揭示其機理以及性別特異性反應	General Research Fund 優配研究金	On-going	**Au, D.W.T.**	818,400
8	Population Trends, Food Sources, Habitat Use, and Race Element Exposure of Marine Mammals in Pearl River Delta: Using Teeth as Biological Time Capsules for Tracing Environmental Changes (2014-2016) 珠江三角洲海洋哺乳動物種群趨勢、食物源、棲息地利用與微量元素暴露量：利用牙齒作為生物時間囊以追蹤與檢測環境變化	General Research Fund 優配研究金	On-going	**Lam, P.K.S.** Lam, J.C.W. Wai, T.C. Chang, C.W. Huang, S.L. Wang, C.H. Yao, C.J.	435,614

* 項目名稱以英文譯本為準　　#Person with underline is SKLMP member

University Grants Committee 大學教育資助委員會

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
9	Trophic and Growth Analysis of Marine Subtidal Gastropod Assemblages in Contrasting Subtropical Environments 不同亞熱帶環境下海洋潮下帶腹足類群落營養及生長分析	General Research Fund 優配研究金	On-going	**Shin, P.K.S.** Cheung, S.G.	850,444
10	Uncovering the Cellular and Molecular Mechanisms of Delayed Heart Regeneration in the Zebrafish Mutant Breakdance 揭開在斑馬魚突變體霹靂舞的延遲心臟再生的細胞和分子機制	General Research Fund 優配研究金	On-going	**Cheng, S.H.**	836,100
11	Response of Air-sea CO_2 Fluxes in the Northern South China Sea to Carbon Export Associated with the Pearl River Plume 南海北部海-氣二氧化碳通量對珠江沖淡水輸出的碳和營養鹽 的響應	NSFC/RGC 國家自然科學基金/研究資助局	On-going	**Gan, J.P.**	1,125,000
12	Phylogenetic Diversity and Contribution of Anaerobic Ammonium Oxidation (Anammox) Bacteria to Nitrogen Removal in Mangrove Wetland Ecosystem 紅樹林濕地生態系統中厭氧氨氧化細菌的系統發育多樣性和豐度	General Research Fund 優配研究金	On-going	**Gu, J.D.**	656,521
13	Nutritional Niche of E. Coli in Marine Sediment 大腸桿菌於海洋沉積物中的營養生態位	General Research Fund 優配研究金	On-going	**Lau, S.C.K.** Lam, H.	606,223
14	Quantification of Organic Ultraviolet Filters in Hong Kong Surface Waters and Assessment of their Toxicities to Local Coral Species 有機紫外防曬劑在香港表層水體中的定量及其對本地珊瑚物種的毒性評估	General Research Fund 優配研究金	On-going	**Murphy, M.B.** Fan, T.Y.	369,579
15	Numerical Modeling Study of Slope Currents and Cross-Slope Transports in the Northern South China Sea 南海北部陸坡流和誇陸坡輸運的數值模擬研究	General Research Fund 優配研究金	On-going	Gan, J.P.	692,894
16	Metal Catalyzed Oxidation of Organic Substrates by Nitrogen Oxyanions and Oxides (2014-2016) 金屬催化含氮酸根離子以及氧化物氧化有機物	General Research Fund 優配研究金	On-going	**Lau, T.C.**	974,193
17	Evaluation and Comparison of Ultraviolet Radiation Exposure in High-rise City Environments 高樓城市環境中紫外線輻射水準的評估和比較	General Research Fund 優配研究金	On-going	**Yu, P.K.N.**	491,960
18	Geographic and Temporal Variations in the Phylogenetic Diversity of the Marine Cyanobacteria *Synechococcus* in Estuarine and Coastal Waters of Hong Kong 海洋藍青細菌聚球藻系統多樣性在香港河口和近岸海域的時空變化	General Research Fund	On-going	**Liu, H.B.**	822,731
	Subtotal				$8,679,659

University Grants Committee 大學教育資助委員會

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
		2013			
19	Personal Genomics and the Lay Construction of Scientific Knowledge in Online Forums 個人基因與網上討論區上外行建構的科學知識	General Research Fund 優配研究金	On-going	Kong, R.Y.C.	483,855
20	Evaluation of Glucuronide and Sulfate Metabolic Conjugates of Bisphenol-A (BPA) and Tetrabromobisphenol-A (TBBPA) in Municipal Wastewaters as Population Exposure Markers for the Endocrine Disrupting Chemicals 以葡糖苷酸和雙酚-A與四溴雙酚-A的硫酸代謝配合物作為城市污水中內分泌干擾物人群暴露標記的評價	General Research Fund 優配研究金	On-going	**Lam, M.H.W.**	559,800
21	Pharmaceuticals in Municipal Sewage Treatment Works of China: Behaviour and Risk Assessment 城市污水處理廠污水中殘留藥物的性狀及其風險評估	NSFC-RGC 國家自然科學基金/研究資助局	On-going	**Lam, P.K.S.** **Yu, H.Q.** Lam, J.C.W.	1,122,301
22	Green- and Blue-Colored Oysters in the Pearl River Estuary: Metal Biodynamics, Acclimation, and Remediation 珠江口藍色和綠色牡蠣的金屬生物動力學、適應和治理	General Research Fund 優配研究金	On-going	**Wang, W.X.**	1,299,049
23	Green Slope Engineering: Bioengineered, Live Cover Systems for Man-made Fill slopes and Landfill Capillary Barriers in Hong Kong 香港綠色斜坡工程：人造斜坡生態複蓋系統及垃圾堆填區毛細複蓋層	Collaborative Research Fund 協作研究金	On-going	**Ng, C.W.W.** Tham, L.G. Wong, M.H. Zhang, L.M. Zhang, Q. Pryor, M. Chu, L.M. Wang, Y.H. Hau, B.C.H. Yan, W.	8,000,000
24	Molecular Determinants of Critical Period in Peripheral Nerve Regeneration 周圍神經再生關鍵時期的分子決定因素	Early Career Scheme 傑出青年學者計劃	On-going	**Ma, E.C.H.**	1,030,520
25	Ecology and Biodiversity of Benthic Marine Ecosystems Before and After the Trawling Ban in Hong Kong Coastal Waters 香港海岸水底在拖網作業前後的生態和生物多樣性	Collaborative Research Fund 協作研究金	On-going	**Leung, K.M.Y.** Cheung, W. Chu, K.H. Li, X.D. Sadovy, Y.J. Lam, P.K.S. Dudgeon, D. Williams, G.A. Li, W.K. Qiu, J.W.	7,300,000
26	Phylogenetics of Chinese Sargassum (Brown Algae, Fucales, Phaeophyceae) 中國馬尾藻的譜系及類群進化關係	General Research Fund 優配研究金	On-going	**Ang, P.O.**	900,000

* 項目名稱以英文譯本為準　　#Person with underline is SKLMP member

University Grants Committee 大學教育資助委員會

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
27	Adaptive Strategies of Corals to Elevated Sea Surface Temperature along a Temperature Gradient in Northern South China Sea 南中國海北部造礁珊瑚對海水溫度變化的適應策略	General Research Fund 優配研究金	On-going	**Ang, P.O.**	779,429
28	Therapeutic Potential of Heat Shock Protein 27 on Chemotherapy-induced Peripheral Neuropathy 熱休克蛋白27對化療引起的周圍神經病變的治療潛力	General Research Fund 優配研究金	On-going	**Ma, E.C.H.**	692,826
29	The Diversity and Population Dynamics of *Escherichia Coli* in Response to the Dissolved Nutrients and Microbial Communities of Marine Sediment 海洋沉積物中微生物多樣性及其大腸桿菌多樣性和群體動態對溶解營養鹽的響應	General Research Fund Early Career Scheme 優配研究金傑出青年學者計劃	On-going	**Lau, S.C.K.**	1,700,000
30	Oxidation Chemistry of Manganese Nitrido Complexes 氮化錳復合物的化學氧化研究	General Research Fund 優配研究金	On-going	**Lau, T.C.**	813,750
31	Composite MoS2/Me/TiO2 Catalyst Film as a Visible Light-driven Photoelectrode for (MEC) Concurrent Hydrogen Generation and Wastewater Organic Degradation MoS2/Me/TiO2多層複合物光電極的制備及其在可見光作用下光解水制氫並同時降解有機污染物	General Research Fund 優配研究金	On-going	**Li, X.Y.**	500,000
32	Mechanistic Study on the Organotin-mediated Imposex in the Rock Shell *Thais clavigera* using RNA-sequencing Analysis (2012-2013) 採用RNA測序分析技術研究有機錫誘發的荔枝螺性畸形機理(2012-2013)	General Research Fund 優配研究金	Completed	**Leung, K.M.Y.** Qiu, J.W.	850,000
33	Sources and Biodynamics of Mercury in Marine Fish in Hong Kong Coastal Waters 香港沿海水域海洋魚體內汞的來源和生物動力學研究	General Research Fund 優配研究金	On-going	**Wang, W.X.**	1,200,000
34	Multiple Stressor Effect of Uranium and Gamma Ray on Zebrafish 鈾和伽馬射線對斑馬魚的多重脅迫效應	PROCORE-France/Hong Kong Joint Research Scheme 法國與香港合作研究計劃	Completed	**Yu, P.K.N.** Cheng, S.H. Guillermin, C.A. Laplace, J.G. Pereira, S.	90,000
35	The Impact of Perinatal Exposure to Perfluoroalkyl Acids, and its Linkage to Predisposition of Metabolic Disorders in Adult Offspring 圍產期暴露于全氟羥基酸對成年子女代謝紊亂的影響及相關性	General Research Fund 優配研究金	Completed	**Wong, C.K.C.**	1,098,250
36	A Study of Responses of the Invasive Apple Snail *Pomacea Canaliculata* to Environmental Stressors Using Shotgun Proteomics 應用鳥槍法蛋白組學研究入侵生物 – 福壽螺對環境脅迫因數的響應	General Research Fund 優配研究金	On-going	Wong, C.K.C.	750,000

University Grants Committee 大學教育資助委員會

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
37	Response of the Phytoplankton, Mcirozooplankton and the Prokaryotic Communities to Atmospheric Dust Deposition: an -Omics Approach 採用組學方法研究大氣灰塵沈積物對浮游植物、微型浮游動物和原核生物群落的影響	General Research Fund 優配研究金	On-going	**Liu, H.B.**	950,000
	Subtotal				$30,119,780
		2012			
38	Air-surface Exchange of Persistent Organic Pollutants (POPs) and Heavy Metals (MNs) in Peri-urban Agricultural Ecosystems of the Pearl River Delta, South China 典型持久性有機污染物和重金屬在珠江三角洲城郊農田生態系統的大氣沉降與擴散交換	NSFC/RGC 國家自然科學基金/研究資助局	Completed	**Li, X.D.**	863,800
39	PBDE: Bioaccumulation, Maternal Transfer and Effects on Darwinian Fitness Traits in Multiple Generations of Marine Gastropod PBDE 在海洋腹足類動物多代中的積累、母體轉移及其對達爾文適合度特性的影響	General Research Fund 優配研究金	On-going	Wu, R.S.S.	764,711
40	Integration of Biomimetic Microparticle-based Multiplexed Assays and Microfluidic Systems for High Throughput Quantitative Detection and Discrimination of Endocrine Disrupting Chemicals 聯合基於多復路分析的仿生微粒技術與微流體系統用於高通量辨別與檢測內分泌干擾物的研究	General Research Fund 優配研究金	On-going	**Yang, M.M.S.**	775,000
41	Assessment of Benthic Community Health in Subtropical Waters Using Biological Indices and Life-trait Analysis 應用生物指數和生命特徵分析法評估亞熱帶海域底棲生物群落健康狀況	General Research Fund 優配研究金	Completed	**Shin, P.K.S.** Cheung, S.G.	699,264
42	Interactions among Biodegradable Chelants, Soil Microbes, and Plant Roots in the Phytomanagement Process of Metal-contaminated Soils 金屬污染土壤植物修復中可生物降解螯和劑，土壤微生物，和植物根系的主要相互作用	RGC/GRF 研究資助局/ 優配研究金	On-going	**Li, X.D.**	600,000
	Subtotal				$3,702,775
		2011			
43	Comparison of the Acute Sensitivity to Chemicals of Tropical and Temperate Aquatic Animal Species: Meta Analysis and Mechanistic Studies 整合分析與機制研究：熱帶與溫帶不同物種水生動物對化學品的急性敏感度比較	General Research Fund 優配研究金	Completed	**Leung, K.M.Y.** Lam, M.H.W.	710,000
44	Biokinetics, Bioavailability, and Chronic Toxicity of Metal Nanoparticles in Aquatic Organism 水生生物中金屬納米粒子的生物動力學、生物利用度以及慢性毒性的研究	General Research Fund 優配研究金	Completed	**Wang, W.X.**	1,050,000

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University Grants Committee 大學教育資助委員會

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
45	Uncovering the Molecular Links between Hypoxia and Endocrine Disruption: a Functional Study of Zebrafish Leptin 低氧與內分泌物分解之間的分子聯繫：斑馬魚瘦素的功能研究	General Research Fund 優配研究金	Completed	**Kong, R.Y.C.**	1,000,000
46	The Functional Roles of Zebrafish irx1a Gene in Heart Development and Regeneration 斑馬魚irx1a基因在心臟發育和再生中的作用研究	General Research Fund 優配研究金	Completed	**Cheng, S.H.**	820,000
47	Risk Assessment and Remediation of Cadmium Contamination in Registered Vegetable Farms in the Pearl River Delta Region 珠江三角洲區域蔬菜農場的鎘污染風險評估及其修復	General Research Fund 優配研究金	Completed	Wong, M.H.	787,755
48	Measurement and Assessment of Novel Halogenated Flame Retardants in Waterbirds and Marine Cetaceans in Hong Kong 香港水域水鳥和鯨類動物中新興阻燃劑的測量和評估	General Research Fund 優配研究金	Completed	**Lam, P.K.S.**	462,000
49	UGC AoE Sustained Funding Sub-project 大學教育資助委員會 – 卓越學科領域計劃維持的子研究項目	University Grants Committee 大學教育資助委員會	To Be Confirmed	Tam, N.F.Y.	410,000
	Subtotal				$5,239,755
		2010			
50	Marine Environmental Research and Innovative Technology, MERIT 海洋環境研究與創新型技術，MERIT	Areas of Excellence Scheme 卓越學科領域計劃	Completed	**Au, D.W.T.**	700,000
51	Automated Micro/Nano-scale Execution of Tasks with Multiple Biological Cells Using a Table-Top Robotic Bio-manipulation System 使用台式機械人生物操縱系統對多種生物細胞自動執行微/納米級任務	Competitive Earmarked Research Grant 角逐研究用途補助金	Completed	**Cheng, S.H.**	1,484,960
52	C-H Bond Activation by Nitrido Imido and Amido Complexes of Ruthenium bearing Salen Ligands 具有Salen 配基的釕的Nitrido, Imido, Amido 絡合物對碳氫鍵的活化作用	Competitive Earmarked Research Grant 角逐研究用途補助金	Completed	**Lau, T.C.**	1,115,000
53	From Genes to Behavior: the Roles of Iroquois Genes in the Development and Function of Zebrafish Embryonic Retinal Neurons 從基因至行為: Iroquois 基因在斑馬魚胚胎視網膜神經發育與功能中的作用	Competitive Earmarked Research Grant 角逐研究用途補助金	Completed	**Cheng, S.H.**	1,034,994
54	Nanotherapeutics in Angiogenesis: Synthesis and in Vivo Assessment of Drug Efficacy and Biocompatibility in the Zebrafish Embryos 血管新生的納米療法: 合成及在斑馬魚胚胎體內評估藥物療效及生物相容性	Competitive Earmarked Research Grant 角逐研究用途補助金	Completed	**Cheng, S.H.**	740,565
55	UGC AoE Sustained Funding Sub-project 大學教育資助委員會-卓越學科領域計劃維持的子研究項目	University Grants Committee 大學教育資助委員會	Completed	**Cheng, S.H.**	285,000

University Grants Committee 大學教育資助委員會

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
56	Chinese Medicine Research and Further Development 中藥研究與發展	University Grants Committee 大學教育資助委員會	Completed	Cheng, S.H.	166,500
	Subtotal				$5,527,019

* 項目名稱以英文譯本為準 #Person with underline is SKLMP member

Others 其他

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
		2013			
1	Assessment of Human Exposure to Per- and Polyfluorinated Compounds (PFCs) in Hong Kong via Food Consumption 香港市民通過食物攝入全氟化合物的風險評估	CityU Strategic Research Grant	Completed	**Lam, P.K.S.** Lam, J.W.C.	70,000
	Subtotal				$70,000
		2012			
2	Identification of Mammalian Species Used in Food by Flow-Through DNA Hybridization System 採用導流DNA雜交技術識別食物中哺乳動物的種類	CityU Applied Research Grant	Completed	**Cheng, S.H.**	170,235
3	Photosynthetic and Proteomic Responses of the Marine Diatom *Thalassiosira Pseudonana* to Triphenyltin Exposure 假微型海鏈藻對三苯基錫的光合以及蛋白組學的響應研究	HKU (Small Project Grant)	Completed	**Leung, K.M.Y.** Lo, C. Leung, P.T.Y.	80,000
4	Conservation of Horseshoe Crabs in Ha Pak Nai, Hong Kong: Bridging Science and Community Participation 結合科研與社區參與的香港下白泥馬蹄蟹的保育計劃	Ocean Park Conservation Foundation Hong Kong 香港海洋公園保育基金	On-going	**Shin, P.K.S.** Cheung, S.G. Kong, R.Y.C.	420,876
	Subtotal				$671,111
		2011			
5	Futian-CityU Mangrove Research and Development Centre 香港城市大學福田城大紅樹林研發中心	CityU Applied R&D Grant	To Be Confirmed	**Tam, N.F.Y.**	850,000
6	The Developmental Toxicity of UV Sunscreens 紫外光遮光劑的發育毒性研究	CityU Strategic Research Grant	Completed	**Cheng, S.H.**	180,000
7	An Ecological Study of Horseshoe Crab Spawning and Nursery Beach for Conservation Purposes: Ha Pak Nai, Hong Kong 香港下白泥馬蹄蟹的產卵及其哺育海灘的生態學保護研究	Ocean Park Conservation Foundation Hong Kong 香港海洋公園保育基金	Completed	**Shin, P.K.S.**	250,000
8	Impact of Sea-level Rise on Protection and Management of Coastal Mangrove Wetland 海平面上升對沿海紅樹林濕地保護與管理的影響研究	Ocean Park Conservation Foundation Hong Kong 香港海洋公園保育基金	To Be Confirmed	**Tam, N.F.Y.**	200,115
	Subtotal				$1,480,115

Others 其他

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (HKD)
		2010			
9	Time-series and Spatial Statistical Studies on Marine Water Quality Monitoring Data in Hong Kong: Implications of the Effectiveness of Environmental Policy and Management, and Definition of Water Pollution Control Zones 對香港海洋水質監測數據的時間和空間統計研究: 對環境政策及管理有效性的影響，以及水污染管制區的定義	HKU Seeding Funding for Small Project	Completed	**Leung, K.M.Y.** Li, W.K.	72,000
10	Smart Ambience of Affective Learning (SAMAL): An innovative Exploration of Smart Ambience for Integrating Affect and Cognition in Learning Life Science and Information Management 智慧情境的情感學習：智慧情境對整合在學習生命科學與信息管理中產生的情感與認知的創新探索	Teaching Development Grant, CityU	Completed	Cheng, S.H.	800,000
11	Understanding the Estrogen Dynamics and Longevity Gender Gap in Medaka 青鳉魚雌性激素動力學以及雌雄壽命差異的研究	CityU Strategic Research Grant	Completed	**Au, D.W.T.**	180,000
	Subtotal				$1,052,000

* 項目名稱以英文譯本為準 #Person with underline is SKLMP member

Grants from Mainland China 內地科研資助

Government 政府部門

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (CNY)
		2015			
1	Mangrove Plant Polyphenols in Intertidal Zone: Their Transformation and Effects on Carbon and Nitrogen Mineralization 潮間帶紅樹林植物多酚對碳、氮礦化的影響作用	NSFC Young Scientists Fund 國家自然科學基金青年基金	To Be Confirmed	**Chao, Z.H.** Tam, N.F.Y.	260,000
	Subtotal				CN¥260,000
		2014			
2	Assessment of Antibiotics in Sewage and Characterization of Antibiotic-degrading Bacteria 城市污水中抗生素的檢測及其降解菌研究	Shenzhen Strategic Emerging Industry Development Special Fund 深圳市戰略性新興產業發展專項資金	On-going	**Lam, J.C.W.** Lin, B.K.	200,000
3	Deep Ocean Biogeochemical Processes and its Coupled Physical Dynamics Control the Sea-air CO_2 Fluxes in the Basin Area of the South China Sea 南海深部生物地球化學-物理耦合過程對海---氣介面CO_2通量的調控	National Science Foundation of China Key Project 國家自然科學基金重點項目	On-going	Gan, J.P.	1,750,000
4	Combined Organic Pollutants in Soils 土壤中的復合有機污染物	National Basic Research Program of China 國家重點基礎研究發展計劃項目(973計劃)	On-going	Li, X.D.	4,500,000
5	Acute and Chronic Neurotoxic Actions on Brain Neuron and Astrocyte Correlated with Cognitive Deficits in Rats 急性及慢性蓄積性雪卡中毒對大鼠腦神經元、膠質細胞和腦認知功能損害的研究	Shenzhen Strategic Emerging Industry Development Special Fund 深圳市戰略性新興產業發展專項資金	On-going	**Li, Y.** Chan, L.L.	150,000
6	Shenzhen Key Laboratory for Sustainable Use of Marine Biodiversity 深圳市海洋生物多樣性可持續利用重點實驗室	Special Fund for Shenzhen Future Industrial Development 深圳市未來產業發展專項資金	On-going	**Chan, L.L.**	3,000,000
	Subtotal				CN¥9,600,000
		2013			
7	Development, Optimization and Validation of Key Techniques for Mass culture of Toxic *Gambierdiscus* Spp. For Isolation and Purification of Ciguatoxins 用於高產雪卡毒素的有毒綱比甲藻批量養殖術研究	Shenzhen Strategic Emerging Industry Development Special Fund 深圳市戰略性新興產業發展專項資金	On-going	**Chan, L.L.**	400,000

Government 政府部門

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (CNY)
8	Meridional Circulation in the South China Sea 中國南海的經向環流	National Science Foundation of China Key Project 國家自然科學基金重點項目	On-going	Gan, J.P.	1,000,000
9	Research on Long-term Efficiency of Constructed Mangrove Wetland for Wastewater Treatment and the Related Mechanisms 紅樹林人工濕地淨化系統的長期有效性及機制研究	Shenzhen Strategic Emerging Industry Development Special Fund 深圳市戰略性新興產業發展專項資金	To Be Confirmed	**Tam, N.F.Y.** Li, F.L.	461,452
10	Metal Pollution Monitoring in PRE 珠江口的金屬污染監測	State Oceanic Bureau 國家海洋局	Completed	**Wang, W.X.**	320,000
11	Marine Environmental Science Conference and SMART Inauguration 海洋環境科學學術交流會暨深圳海洋研究與技術聯盟成立儀式	Shenzhen International Technology Cooperation and Communication Project 深圳市國際科技合作交流活動類項目	On-going	**Lam, P.K.S.**	100,000
12	Assessment and Characterization of Novel and Unknown Per- and Polyfluorinated Compounds in Pearl River and Yangtze River Delta 珠江三角洲和長江三角洲新型與未知全氟化合物污染狀況及其生態風險	National Natural Science Foundation of China 國家自然科學基金	On-going	**Lam, P.K.S.** Lam, J.C.W.	740,000
13	Assessment of Conventional & Emerging Halogenated Flame Retardants in Two Estuaries of China: Pearl River Delta and Yangtze River Delta 中國珠江與長江河口地區傳統及新興鹵系阻燃劑環境分布特徵與生態風險評估	National Natural Science Foundation of China 國家自然科學基金	On-going	**Lam, J.C.W.**	280,000
14	High Efficiency Photocatalytic and Electrocatalytic Water Splitting and Carbon Dioxide Reduction 分解水和還原二氧化碳的高效光/電催化體系研發及機理研究	Shenzhen Strategic Emerging Industry Development Special Fund 深圳市戰略性新興產業發展專項資金	On-going	**Lau, T.C.**	600,000
15	Biokinetics and Toxicology of Heavy Metals in Southern China Estuaries 華南河口重金屬的生物動力學與毒理學	National Natural Science Foundation of China 國家自然科學基金	On-going	**Wang, W.X.**	3,000,000
16	Development, Optimization and Validation of Methods for Isolation, Purification and Trace Analysis of Ciguatoxins 雪卡毒素高純度提取與痕量分析技術研究	Shenzhen Strategic Emerging Industry Development Special Fund 深圳市戰略性新興產業發展專項資金	On-going	**Lam, P.K.S.** Chan, L.L.	300,000
17	Study of the Key Factors that Influence the Flux of Ciguatera Toxins through Marine Food Webs 西加毒素在海洋食物鏈傳遞之關鍵因子研究	National Natural Science Foundation of China 國家自然科學基金	On-going	**Chan, L.L.**	760,000
	Subtotal				CN¥7,961,452

* 項目名稱以英文譯本為準　　#Person with underline is SKLMP member

Government 政府部門

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (CNY)
		2012			
18	Development of Nanotechnology-based Detection Platform for Early Diagnosis of Lung Cancer 用於肺癌早期診斷的納米技術檢測平台的建立	National Program on Key Basic Research Project of China (973 Program) 國家重點基礎研究發展計劃項目(973計劃)	On-going	Yang, M.M.S.	830,000
19	Integrated Technology Development for Algal Bloom Online Monitoring and Development and Validations in Lake Tai 水華在線檢測設備的集成與應用示範	National Science and Technology Major Project "十二五"國家重大科技專項	On-going	**Lam, P.K.S.**	800,000
20	Research Centre for Ocean and Human Health 海洋與人類健康研究中心	Supporting Fund from Shenzhen Virtual University Park 深圳虛擬大學園專項扶持經費	Completed	**Lam, P.K.S.**	500,000
21	Health Risk Assessment of Toxic Trace Elements and Polycyclic Aromatic Hydrocarbons (PAHs) Via Indoor Dust from Coal-burning Households in Rural China 中國農村燃煤家庭室內大氣顆粒物中有毒元素與多環芳烴的健康影響	NSFC/RGC Joint Research Scheme 國家自然科學基金/研究資助局聯合研究計劃	On-going	**Wong, M.H.** **Liu, W.X.** Wu, S.C. Wu, F.Y. Liu, W.K. Leung, C.K.M. Fu, X.F. Yu, Y.X. Liu, Y. Meng, B.J.	897,000
	Subtotal				CN¥3,027,000
		2011			
22	Eco-remediation Technology and Demonstration of the Coastal Wetland in Shenzhen Bay 深圳灣濱海濕地修復技術推廣應用示範工程	Shenzhen Municipality 深圳市政府	To Be Confirmed	**Tam, N.F.Y.**	200,000
	Subtotal				CN¥200,000

Others 其他

	Project Title * 項目名稱	Grant Type 資助類型	Status 狀態	Investigators# 項目負責人 (PI/Co-I)	Amount 金額 (CNY)
		2013			
1	Training Program for Analysis of Emerging Pollutants in Source Water 水環境樣品中抗生素檢測技術人員培訓	Shenzhen Academy of Environmental Science	Completed	**Lam, J.C.W.**	60,000
2	Method Development and Determination of Antibiotic Compounds in Shenzhen Source Water 深圳水環境樣品中抗生素檢測方法開發與含量檢測	Shenzhen Academy of Environmental Science	Completed	**Lam, J.C.W.**	190,000
3	Marine Environmental Monitoring Programme for the Remediation and Development Project at the Estuary Area in the Eastern District of Shantou 汕頭市東部城市經濟帶河口治理及綜合開發項目施工期海洋環境跟蹤監察	Cooperation Program with Shantou University	Completed	**Lam, P.K.S.** Lam, J.C.W.	120,000
	Subtotal				CN¥370,000
		2012			
4	Demonstration of Circular Economy: Study on the Eco-remediation of Shenzhen Overseas Chinese Town 循環經濟示範僑城濕地生態系統修復研究	Shenzhen Overseas Chinese Town Holding Company 深圳華僑城歡樂海岸項目	To Be Confirmed	**Tam, N.F.Y.**	1,200,000
	Subtotal				CN¥1,200,000

* 項目名稱以英文譯本為準 #Person with underline is SKLMP member

Funding support from CityU
城大內部撥款資助項目

CityU Internal Research Fund (IRF)
城大內部研究經費

IRF is a seed grant allocated to SKLMP CityU members of SKLMP for attracting large outside grants and bringing members together within CityU

	Project Title * 項目名稱	Investigator# 項目負責人	Amount 金額 (HKD)
	Feb 2015 - Jan 2017		
1	Pilot baseline study of marine biodiversity and aquaculture environment at O Pui Tong mariculture zone and its surrounding area 澳背塘及其周邊地區之海洋生物多樣性及水產養殖環境的基線調查	Chan, L. L.	150,000
2	Trophic interactions of the rocky shore community under ocean acidification 岩岸群落在海洋酸化下的營養互動	Cheung, S.G.	150,000
3	Design and development of microbead-based biosensors for multiplexed detection of waterborne pathogens in mariculture zone 設計開發新型微球生物傳感器及微流體陣列檢測平臺用於海水養殖區中病原體的多重檢測	Yang, M.M.S.	150,000
4	Functional monitoring the toxicity of water borne chemical pollutants on neuronal activities using whole-brain-wide imaging 基於全腦成像技術的水性化學污染物對神經活動的毒性檢測	Cheng, S.H.	150,000
5	Bone miRNAs deregulation and skeletal impairment in offspring induced by parental exposure to benzo[a]pyrene 青鱂魚苯並(a)芘暴露導致後代骨細胞小RNA表達異常以及骨質損害/損傷的研究	Au, D.W.T.	150,000
6	Effect of alternating aerobic-anaerobic conditions on microbial transformation of polybrominated diphenylethers (PBDEs) in mangrove sediments 紅樹林沉積物好氧-厭氧交替環境下多溴聯苯醚（PBDEs）的微生物轉化作用及機理研究	Tam, N.F.Y.	150,000
	Nov 2012 - Oct 2014		
7	Expression of Plasma Immune Proteins is Gender-dependent and Related to Fish Susceptibility to Pathogen 血漿中免疫蛋白性別特異性的表達及其與魚類對病原物易感性的關係	Au, D.W.T.	200,000
8	Studies on Multiple Stressor Effect of Ionizing Radiation and Heavy Metals on Marine Fish Using Marine Medaka (*Oryzias melastigma*): Towards a Realistic Risk Assessment 利用海洋青鱂（*Oryzias melastigma*）研究電離輻射和重金屬在海洋魚類中的多重應激源效應：邁向實際的風險評估	Yu, P.K.N.	600,000 (From SKLMP: $400,000) (From CSE:$200,000)
9	Phytoremediation of Polybrominated Diphenyl Ethers (PBDEs) by Mangrove Wetlands 利用紅樹林濕地植物修復多溴聯苯醚的研究	Tam, N.F.Y.	200,000
10	Responses of Marine Organisms to Ocean Acidification: Does Ecosystem Matter? 不同生態系統中的海洋生物對海洋酸化的反應的比較	Cheng, S.G.	200,000

CityU Internal Research Fund (IRF)
城大內部研究經費

IRF is a seed grant allocated to SKLMP CityU members of SKLMP for attracting large outside grants and bringing members together within CityU

	Project Title * 項目名稱	Investigator# 項目負責人	Amount 金額 (HKD)
11	Risk Assessment of Pharmaceutical Residues and Occurrence of Antibiotic-resistant Bacterial Genes and Strains in Hong Kong Surface Waters and Sediments 在香港的地表水和沉積物中之藥物殘留風險評估及抗生素耐藥性細菌的基因和菌株的發生	Murphy, M.B.	200,000
12	Development of Radiation Biodosimeter Using Transgenic Bacterial Sensor Strains Immobilized in Microfluidic Network 將轉基因細菌感應株固定於微流控芯片發展而成的電離輻射生物劑量計	Cheng, S.H.	500,000 (From SKLMP: $200,000) (From CSE:$300,000)
	Jan 2011 - Dec 2012		
13	Development of Novel Technology for Early Diagnosis and Monitoring of Immunotoxic Pollutants in Marine Environment 建立新技術和方法用於早期監控和診斷海洋環境中的免疫毒性污染物	Au, D.W.T.	100,000
14	Quantification of Poly- and Perfluorinated Compounds (PFCs) and Species Identification of Shark Fins Purchased from Hong Kong Seafood Shops 在香港海味乾貨店購買的魚翅的聚和全氟化合物(全氟碳化物)之定量和鯊魚種屬鑑定	Murphy, M.B.	200,000
	Jan 2010 - Dec 2011		
15	Development of Highly Efficient ZnO Tetrapods Nanoparticles for Photodegradation of Organic Pollutants in Water under Visible Light	Lau, T.C.	150,000
16	International Collaborative Research on Endocrine Disrupting Compounds (EDC) and Emerging Persistent Organic Pollutants (POPs) in South China Sea	Cheng, S.H.	200,000
17	Long-term Measurements of Ultraviolet Radiation in Marine Environments in Hong Kong	Yu, P.K.N.	150,000
18	Sorption and Degradation of Polybrominated Diphenyl Ethers (PBDEs) by Green Microalgae with and without the Effect of Metals	Tam, N.F.Y.	200,000
19	Unraveling Tissue-specific Mechanisms for *in vivo* Regulation of Estrogen Target Genes in Medaka	Au, D.W.T.	200,000

* 項目名稱以英文譯本為準 #Person with underline is SKLMP member

CityU Internal Research Fellowship Programme (RFP)
城大內部博士後基金

The fund aims to support and nurture young scientists to ensure sustainable research activity

	Project Title * 項目名稱	Investigator # 項目負責人	Amount 金額 (HKD)
	Jan 2013 - Dec 2014		
1	A Holistic Approach to Unravel Xenoestrogen Induced Immunosuppressive Effects and Reproductive Impairment in Fish: Implications for Risk Assessment and Monitoring of Immunosuppressants in Waters 體研究方法揭示外源性雌激素引起的免疫抑制及對生殖系統的影響：對風險評估和監控水體中免疫抑制物的提示	Au, D.W.T.	400,000
2	Comparative Investigation on Resistance and Defense Mechanism of Coral Reef Fishes to Ciguatoxins (CTXs) 珊瑚礁魚類對雪卡毒素的抗性和防禦機制比較研究	Chan, L.L.	400,000
3	Significance of Roots and Microorganisms in Phytoremediation of Polybrominated Diphenyl Ethers (PBDEs) by Mangrove Plants 紅樹植物根系及其根際微生物對多溴聯苯醚的植物修復功能及機制	Tam, N.F.Y.	400,000
4	Identification of Biomarkers for Low Dose Radiation: Linking Radiation Induced Effects from Molecular to Physiological Levels 低劑量輻射生物標記的鑒定：放射性誘導的分子和生理層面影響之間的聯繫	Cheng, S.H.	400,000

Funding support from the Innovation and Technology Commission
創新科技署國家重點實驗室專項基金資助的項目

SKLMP Seed Collaborative Research Fund (SCRF)
SKLMP種子協作研究基金

The fund aims to promote excellent, collaborative and interdisciplinary research programs among members from the six collaborating universities

	Project Title * 項目名稱	Investigators # 項目負責人	Amount 金額 (HKD)
	Apr 2014 - Mar 2017		
1	Investigation of coupled circulation and ecosystem process in Mirs Bay-Tolo Habor (Hong Kong) during summer time 香港大鵬灣-吐露港夏天海流-生態耦合系統過程的研究	Gan, J.P. (HKUST) Lam, P.K.S. (CityU) Chan, L.L. (CityU) Liu, H.B. (HKUST) Chan, R.K.Y. (HKBU) Ang, P.O. (CUHK)	1,500,000
2	Identification and assessment of emerging persistent organic pollutants (POPs) in Hong Kong coral communities 香港的珊瑚群落中新興持久性有機污染物（POPs）的評估	Lam, J.C.W. (CityU) Ang, P.O. (CUHK)	900,000
3	Functional responses of marine ecosystem to hypoxia 海洋生態系統對缺氧的功能性響應	Wu, R.S.S. (HKU) Tam, N.F.Y. (CityU) Shin, P.K.S. (CityU) Cheung, S.G. (CityU) Au, D.W.T. (CityU) Ang, P.O. (CUHK) Chiu, J.M.Y. (HKBU) Liang, Y. (HKBU)	2,000,000
4	Transgenerational effects of hypoxia in fish and underlying mechanisms 缺氧對魚類的跨代影響及其內在機制	Kong, R.Y.C. (CityU) Wong, C.K.C. (HKBU) Chiu, J.M.Y. (HKBU) Au, D.W.T. (CityU) Wu, R.S.S. (HKU)	2,200,000
5	Development of electrochemical sensing platform based on AuNPs modified TiO2 nanotubes for emerging chemicals of concern and pharmaceutical residues detection 開發基於金納米粒子修飾的二氧化鈦納米管的電化學傳感平台用於環境污染物的檢測	Yang, M.M.S. (CityU) Wu, R.S.S. (HKU) Lam, P.K.S. (CityU) Lam, M.H.W. (CityU) Chan, L.L. (CityU)	900,000
	Nov 2011 - Oct 2014		
6	Assessing the Impacts of Organic and Metal Pollution on Symbiotic Microbial Communities in Marine Corals and Sponges by Metagenomics and Transcriptomics Approaches 利用宏基因組和宏轉錄組技術評估有機物污染和重金屬污染對海綿和珊瑚的共生微生物群落的影響	Qian, P.Y. (HKUST) Wang, W.X. (HKUST) WU, R.S.S. (HKU) Qiu, J.W. (HKBU) Lee, O.O. (HKUST) Chiu, J.M.Y. (HKU)	900,000
7	Establishing the Green Lipped Mussel *Perna viridis* as a Universal Marine Model Organism and Pollution Biomonitor for Ecotoxicology and Environmental Genomics 翡翠貽貝（*Perna viridis*）作為海洋生態毒理學和環境基因組學的通用模式生物以及相關污染物生物指示種的研究	Leung, K.M.Y. (HKU) Lam, P.K.S. (CityU) Wong, C.K.C. (HKBU) Chan, L.L. (CityU)	900,000

* 項目名稱以英文譯本為準　　#Person with underline is SKLMP member

SKLMP Seed Collaborative Research Fund (SCRF)
SKLMP種子協作研究基金

The fund aims to promote excellent, collaborative and interdisciplinary research programs among members from the six collaborating universities

	Project Title * 項目名稱	Investigators # 項目負責人	Amount 金額 (HKD)
8	Health Risk Assessments of Residents in the Pearl River Delta exposed to Brominated Flame Retardants (BFRs) 在珠江三角洲暴露於防火劑的健康風險評估	Wong, M.H. (HKBU) Wang, H.S. (HKBU) Man, B.Y.B. (HKBU) Wu, S.C. (CityU) Lam, P.K.S. (CityU) Wong, C.K.C.(HKBU) Jones, P.D. (University of Saskatchewan, Canada) Giesy, J.P. (University of Saskatchewan, Canada)	300,000
9	Interactive Effects of Climate Change and Hypoxia on Fish Sex Determination: Estrogen synthesis and Masculinisation 2011 氣候變化及缺氧對魚類性別決定（雌激素合成及雄性化）的相互影響	Kong, R.Y.C.(CityU) Wu, R.S.S. (HKU) Yu, R.M.K. (University of Newcastle, Australia)	900,000
10	Sources and Bioaccumulation of Mercury and Cadmium in the Pearl River Estuary (PRE) and Hong Kong Coastal Waters 珠江河口和香港沿海水域汞、鎘的來源和生物富集	Li, X.D. (PolyU) Wang, W.X. (HKUST)	900,000

Open Science Research Fund (OSRF)
開放科學研究基金

The fund aims to build research capacity, and to encourage, facilitate and support excellent, collaborative and interdisciplinary research programs among members and non-members in the field of marine environmental science

	Project Title * 項目名稱	Investigators# 項目負責人	Amount 金額 (HKD)
	Mar 2014 - Feb 2016		
1	Health risk assessments of residents in the Pearl River Delta exposed to brominated flame retardants (BFRs) 珠江三角洲暴露于防火劑的健康風險評估	**Wong, M.H. (HKIEd) Man, Y.B. (HKIEd) Wang, H.S. (SYSU) Wu, S.C. (ZAFU) Lam, P.K.S. (CityU) Lam, J.C.W. (CityU) Wong, C.K.C. (HKBU) Jones, P.D. (University of Saskatchewan) Giesy, J.P. (University of Saskatchewan)**	100,000

Director Discretionary Fund (DDF)
主任資助基金

The fund is allocated by the SKLMP Director to support exploratory projects for encouraging innovation and new initiatives

	Project Title 項目名稱	Investigator 項目負責人	Amount 金額 (HKD)
	Jan 2015- Dec 2015		
1	Design and evaluation of a FWM-LED light engine with visible spectrums modulated for photobioreactor (PBRs) 設計及評估具有可調控可見光波長的 LED 光學引擎的光生物反應器	**Shen, S.C. (NCKU) Chen, Y.M. (NCKU)**	80,000
	Oct 2013 - Oct 2014		
2	Project PSI-FI an acronym for particle species identification by flow imaging using light sheet microscopy and flow cytometry. 使用光片顯微鏡與流式細胞儀的流式成像對PSI-FI粒子進行物種鑑定	**Chan, R.K.Y. (HKBU) Chan, L.L. (CityU) Wu, V.J.J. (CityU) Wu, J.L. (HKBU)**	100,000

* 項目名稱以英文譯本為準 #Person with underline is SKLMP member

Summary of the Internal Research Fund (IRF) Projects
IRF項目概要

Apr 2013 – Mar 2015 (Completed)

EXPRESSION OF PLASMA IMMUNE PROTEINS IS GENDER-DEPENDENT AND RELATED TO FISH SUSCEPTIBILITY TO PATHOGEN
血漿中免疫蛋白性別特異性的表達及其與魚類對病原物易感性的關係

Doris W. T. AU, Y. W. LAM, Joseph L. HUMBLE

IRF

Funding Amount : HK$200,000

In teleost fish, the innate immune system serves as the first line of host defense to pathogens before the adaptive immune system is ready and potent enough to take over. The plasma immune proteins are known to be important functional components of the innate and adaptive immune system. Fish complement system is a highly important part of their innate immune system. Gender- and age- dependent expressions of plasma immune proteins, in particular the complement system proteins, are important consideration for assessing host's resistance to microbial infection. Using the marine medaka as a fish model, the present study aims to investigate the plasma proteome and identify meaningful immune proteins that can be link to fish susceptibility to pathogens. The relationship between fish age and gender with immune function was first investigated, by subjecting marine medaka at different age groups (21 days, 4, 6 and 10 months old) to pathogenic bacteria (*E. tarda*) challenge, and fish mortality was monitored. At all of the adult age groups, a gender dependent difference in vulnerability was evident. In addition, fish of different age groups differed in their resistance to bacterial challenge. Aiming to identify and characterize plasma immune proteins in the marine medaka, here we developed and applied a method to characterize the plasma proteome using one-dimensional polyacrylamide gel electrophoresis and high performance liquid chromatography tandem mass spectrometry. The mass spectrometry data will be used to provide a catalogue of plasma proteins, which will serve as useful reference for future functional studies.

血漿中蛋白是天然和獲得性免疫系統中具有重要功能的組成部分。魚類有原始的獲得性免疫系統，而補體系統是整個免疫系統中的重要的組成部分。補體系統蛋白能抵禦細菌侵染，它的表達存在性別和年紀的特異性，能作為的重要的生物標記。但是，如今還沒有關於魚類血漿蛋白質組的相關報導。為了研究魚類年齡以及性別和免疫功能的關係，我們利用海洋青鱗作為模式生物，選取了3周，4個月，6個月和10個月的魚用細菌侵染進行了宿主抵禦實驗，並觀察死亡率。在成魚階段的實驗中，雌魚都比雄魚易感性更高。而且，6個月和10個月成魚比4個月的成魚對細菌抵抗力更高。我們利用了用一維聚丙烯醯胺凝膠電泳和高效液相色譜 – 串聯質譜法識別和描述了海洋青鱗血漿中的免疫蛋白。質譜資料能作為將來功能性研究重要的參考。

Research Output

Papers with the SKLMP included as the first affiliation 以*SKLMP*為第一單位的期刊論文

1 Yu, W.K., Fong, C.C., Chen, Y., van de MERWE, J.P., Chan, A.K.Y., Wei, F., Bo, J., Ye, R.R., Au, D.W.T., Wu, R.S.S, Yang, M.M.S. (2013) **Gender-specific transcriptional profiling of marine medaka (*Oryzias melastigma*) liver upon BDE-47 exposure.** *Comparative Biochemistry and Physiology Part D: Genomics and Proteomics*, 8:255-262.

2 Shanthanagouda, A.H., Guo, B.S., Ye, R.R., Chao, L., Chiang, M.W.L., Singaram, G., Cheung, N.K.M., Zhang, G., Au, D.W.T. (2014) **Japanese medaka: a non-mammalian vertebrate model for studying sex and age-related bone metabolism in vivo.** *PloS one, 9(2):e88165.*

3 Fong, C.C., Shi, Y.F., Yu, W.K., Wei, F., van de Merwe, J.P., Chan, A.K.Y., Ye, R., Au, D.W.T., Wu, R.S.S., Yang, M.S. (2014) **iTRAQ-based proteomic profiling of the marine medaka (*Oryzias melastigma*) gonad exposed to BDE-47.** *Marine Pollution Bulletin, 85:471-478.*

*Papers with the SKLMP as one of the affiliations*以*SKLMP*為作者單位之一的期刊

4 Chen, L., Ye, R., Xu, Y., Gao, Z., Au, D.W.T., Qian, P.Y. (2014) **Comparative safety of the antifouling compound butenolide and 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one (DCOIT) to the marine medaka (*Oryzias melastigma*).** *Aquatic toxicology, 149:116-25.*

IRF

Jan 2013 – Dec 2014 (Completed)

DEVELOPMENT OF RADIATION BIODOSIMETER USING TRANSGENIC BACTERIAL SENSOR STRAINS IMMOBILIZED IN MICROFLUIDIC NETWORK
將轉基因細菌感應株固定於微流控芯片發展而成的電離輻射生物劑量計

S. H. CHENG, Peter K. N. YU

Funding Amount : HK$500,000

Using of nuclear energy poses an ever-increasing need for research on the radioecology and safety. Ionizing radiation will ionize the water molecules inside the cells and generates reactive oxygen species (ROS) and double-strand DNA breaks (DSBs), which may lead to mutation accumulation and cancer. Specifically, the alpha radiation has much stronger ionizing power and larger relative biologic effectiveness, at about 20 times when compared to beta particles and gamma ray photons. They are highly radiotoxic when ingested or come into direct contacts, like drinking contaminated water.

It was realized that traditional physical monitoring devices would not be able to assess the actual bio-effects caused by the ionizing radiation, especially alpha radiation, due to short range of alpha radiation and the complex biological processes involved. Previous studies showed that radioactive contamination of water sources might lead to radionuclide accumulation in the biota and enter our food chain. With the increasing public concern on health issues, development of a bio-monitoring system, especially for alpha radiation contamination is highly beneficial. Transgenic technology has been widely used for monitoring environmental pollution recently. A biomonitoring system combining transgenic technology and microfluidic technology can overcome the limitations of most of the physical radiation dosimeters as it can provide information of biological responses, such as oxidative stress and predict the potential hazard to radiation, especially alpha radiation. In this project, transgenic engineering was applied to generate transgenic bacteria for radiation monitoring. We would like to develop an on-chip radiation biodosimeter using transgenic bacteria *Deinococcus radiodurans*, which is extremely radioresistant. *D. radiodurans* have a quick transcriptional response to radiation, showing that it is sensitive enough to be used as an ideal radiation bio-indicatior. The small size of *D. radiodurans* allows the detection of alpha radiation. Different transgenic bacteria strains expressing various fluorescent proteins under the control of the different transcriptional promoters will be generated. The transgenic bacteria strains will be irradiated by alpha radioisotope, and the strains with the highest sensitivity and specificity will be selected and immobilized in the microfluidic chip and will further develop as a prototype. This prototype will be tested and validated with water sample containing alpha-radionuclides in the Institut de Radioprotection et de Sûreté Nucléaire (ISRN) in France.

對於核能利用的放射性生態學研究和安全性研究需求日益增加。電離輻射會將細胞中的水分子電離，生成活性氧和DNA雙鏈斷裂，從而導致突變累積和癌症。α輻射擁有更強的電離能力和相對生物效應，大概為β粒子和伽馬光子的20倍。攝入和直接接觸，如飲用輻射污染水，都會產生強放射毒性。

傳統的物理監測裝置無法評估電離輻射引起的生物效應，特別是α輻射的電離效應，這是由於α輻射的射程短，並且其導致的生物效應包括了大量複雜的生物過程。已有研究發現，放射性污染水源會導致生物放射性核素累積而進入食物鏈。隨著公眾對健康問題關注度的提升，發展放射性污染的生物監測系統，特別是α輻射的生物監測系統是十分有益的。
近年來，轉基因技術被廣泛應用於環境污染監測領域。將轉基因技術與微流控技術結合而發展出的生物監測系統可以克服大部分物理輻射劑量計的缺陷，因為這一監測系統可以提供生物回應方面的資訊，如氧化應激和預測輻射污染，特別是α輻射的潛在危害。在本專案中，我們利用轉基因工程發展出轉基因細菌進行輻射監測，希望利用轉基因耐輻射球菌研製出輻射劑量計晶片。耐輻射球菌對輻射有快速的轉錄回應，這種高靈敏度使其成為理想的輻射生物指示物。耐輻射球菌體積小，因而可以檢測α輻射。我們將利用不同的轉錄啟動子控制不同的螢光蛋白表達，從而發展出不同的轉基因菌株。用α放射性同位素輻照轉基因細菌，將具有最高靈敏性和特異性的菌株固定於微流控晶片，並進一步發展成監測系統原型。我們將在法國輻射防護與核安全研究院，利用α放射性核素污染的水樣檢測和驗證該監測系統。

Research Output

Papers with the SKLMP included as the first affiliation 以SKLMP為第一單位的期刊論文

1 Choi, V.W.Y., Ng, C.Y.P., Kobayashi, A., Suya, N., Ishikawa, T., Cheng, S.H., Yu, K.N. (2013)
Bystander Effect between zebrafish embryos in vivo induced by high-dose X-rays.
Environmental Science and Technology, 47:6368-6376.

2 Choi, V.W., Konishi, T., Oikawa, M., Cheng, S.H., Yu, K.N. (2013)
The threshold number of protons to induce adaptive response in zebrafish embryos.
Journal of Radiological Protection, 33:91-100.

3 Ng, C.Y., Choi, V.W., Lam, A.C., Cheng, S.H., Yu, K.N. (2013)
The multiple stressor effect in zebrafish embryos from simultaneous exposure to ionizing radiation and cadmium.
Journal of Radiological Protection, 33, 113-121.

4 Choi, V.W.Y., Ng, C.Y.P., Kong, M.K.Y., Cheng, S.H., Yu, K.N. (2013)
Adaptaive response to ionizing radiation induced by cadmium in zebrafish embryos.
Journal of Radiological Protection, 33:101-112.

5 Chen, X.P., Xu, S.S., Tan, T.F., Lee, S.T., Cheng, S.H., Lee, F.W.F., Xu, S.J.L., Ho, K.C. (2014)
Toxicity and estrogenic endocrine disrupting activity of phthalates and their mixtures.
International Journal of Environmental Research and Public Health, 11:3156-3168.

6 Tian, L., Cheng, J.P., Chen, X.P., Cheng, S.H., Mak, Y.L., Lam, P.K.S., Chan, L.L., Wang, M.F. (2014)
Early developmental toxicity of saxitoxin on medaka (*Oryzias melastigma*) embryos.
Toxicon, 77:16-25.

IRF

Nov 2012 – Oct 2014 (Completed)

RESPONSES OF MARINE ORGANISMS TO OCEAN ACIDIFICATION: DOES ECOSYSTEM MATTER?
不同生態系統中的海洋生物對海洋酸化的反應的比較

S. G. CHEUNG, Paul K. S. SHIN

Funding Amount : HK$200,000

A large proportion of the carbon dioxide (CO_2) released into Earth's atmosphere by human activities is absorbed by the oceans. When dissolved in water, CO_2 forms carbonic acid, increasing the concentration of H^+ (hydrogen ion) and lowering the pH in ocean waters. Under the Intergovernmental Panel on Climate Change (IPCC) future CO_2 emission scenarios, a drop in ocean pH of up to 0.5 units by 2100 has been predicted with "with a high level of confidence". There is a growing concern of the effect of ocean acidification on marine organisms with relevant publications increasing gradually in recent years. Recent data suggest that ocean acidification impacts the performance of marine organisms via changes in calcification rates (a drop in pH will cause a corresponding decrease in carbonate saturation level, adversely affecting organisms with calcified shells) and other physiological responses. Acidification, however, does not occur in isolation but in concert with other stresses, such as warming and reduced salinity. Few studies, however, have examined the interactive effect of acidification and other direct or indirect results of global change, which may aggravate the effect of ocean acidification on marine organisms. Intertidal species are subjected to greater fluctuations in temperature, salinity, pH, etc. Therefore, they are expected to develop greater tolerances to environmental changes, for example, ocean acidification. As far as we know, no study has been carried out to test this hypothesis. Most of the previous studies on ocean acidification only focused on a single species or compared closely related species in the same habitat. If the hypothesis is correct, this helps us predict relative tolerances of closely-related species based on the environment they inhabit. Besides, it implies that intertidal communities may be more resistant to ocean acidification than subtidal communities. We propose to test the above hypothesis by comparing two species of nassariid gastropods in the same genus. One of them is intertidal species whereas the other is subtidal. The combined effects of ocean acidification and low salinity on the physiological responses, as well as growth and development of critical life stages of key species will be investigated. The substantial improvements made by the proposed research efforts to the existing predictive framework will be central to the management and conservation of living marine ecosystems in the face of climate change.

海洋吸收了大部分人類活動所產生並釋放到空氣中的二氧化碳。二氧化碳溶解于水中會產生碳酸，導致氫離子的濃度增加，從而降低海水的pH。根據跨政府氣候變化委員會（IPCC）對於未來二氧化碳排放情況的預測，到2100年，海水的pH"極有可能出現"下降0.5個單位的情況。海洋酸化對於海洋生物的影響吸引了越來越多的注意力，相關的文獻數量在近年來也在逐步地持續增長。目前的資料顯示，海洋酸化影響海洋生物的鈣化率（pH的下降會導致碳酸鹽的飽和度降低，從而對鈣化的有殼動物產生不利影響）和其他一系列生理過程。更重要的是，酸化並不是單獨發生的，而是與其他問題協同發生，比如海洋變暖和鹽度降低。少量文獻研究了海洋酸化和其他直接的或者間接的氣候變化的後果的協同作用，這些變化可能加劇海洋酸化對海洋生物的影響。潮間帶的生物面對更大範圍的溫度，鹽度和pH等條件的變化。因此，研究者預計他們面對環境變化，比如海洋酸化時會有更好的耐受性。據我們目前所知，還沒有任何研究檢驗過這個假設。之前的大多數文章都只關注一個物種，或者比較生活在同一環境的相近物種。如果我們的預測是正確的，那麼這個研究會幫助我們更好地預見基於相似生活環境的相近物種可能具有的相關耐受性。另外，研究表明潮間帶物種群落可能比潮下帶群落的抗壓能力更強。我們希望通過比較同一個屬中的兩種織紋螺來驗證上述的假設，其中一種生活在潮下帶而另外一種生活在潮間帶。本研究將會闡述海洋酸化和低鹽度的協同作用，以及關鍵物種生活史的重要階段的生長和發育過程。計畫的研究成果為現行的預測框架提供充分的改進，這對於現有的海洋生態環境面臨氣候變化時的管理和保護是至關重要的。

Research Output
Papers with the SKLMP included as the first affiliation 以SKLMP為第一單位的期刊論文

1 Zhang, H.Y., Shin, P.K.S., Cheung, S.G. (2015)
Acclimation of the physiological responses and scope for growth to the combined effects of ocean acidification and temperature in a subtidal scavenger *Nassarius conoidalis* (Gastropoda: Nassariidae).
Marine Environmental Research (Accepted)

Nov 2012 – Oct 2014 (Completed)

RISK ASSESSMENT OF PHARMACEUTICAL RESIDUES AND OCCURRENCE OF ANTIBIOTIC-RESISTANT BACTERIAL GENES AND STRAINS IN HONG KONG SURFACE WATERS AND SEDIMENTS

在香港的地表水和沉積物中之藥物殘留風險評估及抗生素耐藥性細菌的基因和菌株的發生

Margaret B. MURPHY, Maureen V. BOOST

Funding Amount : HK$200,000

The occurrence of pharmaceuticals in the natural environment due to extensive human use and release has been documented worldwide in recent years. The widespread occurrence of these biologically active compounds in both abiotic and biotic samples has raised concern about their potential toxic effects with regard to both ecological and human health. In particular, the ubiquitous environmental occurrence of human and veterinary antibiotics, coupled with clinical data showing a global rise in drug-resistant bacterial strains, has prompted research into the presence of antibiotic-resistance genes (ARGs) and resistant bacteria in natural systems. Our previous work has shown that antibiotic loadings from sewage treatment plants into the Hong Kong environment are among the highest in the world for some antibiotics; likewise, clinical studies have shown that the rate of antibiotic resistance among some bacterial strains is very high in Hong Kong. This study will therefore investigate the presence of antibiotic resistance in the Hong Kong environment in order to determine the potential impacts of pharmaceutical release. Year-long sampling of surface seawater and marine sediment will be carried out to examine seasonal variation in environmental pharmaceutical concentrations. Seawater samples will be extracted and analyzed based on our previously published method with modifications, while a new method will be developed for pharmaceutical quantification in marine sediments. Seawater and sediment samples will also be analyzed for the presence of ARGs and for resistant bacterial strains using genotypic and phenotypic methods based on sample filtration, bacterial culture on MacConkey agar and sensitivity tests for Gram-native, Gram-positive and anaerobic strains, as well as polymerase chain reaction for the amplification of ARGs. Concentrations in seawater and marine sediments will be compared with the occurrence data for the ARGs and resistant bacterial strains to determine correlations between antibiotic levels and the presence of resistance in the environment. The results of these analyses will be used to carry out a risk assessment of pharmaceuticals in the Hong Kong environment using a probabilistic approach and the use of species sensitivity distributions. This approach can then be applied to future research in China and in the Asia-Pacific region.

近年，由於人類的廣泛使用及排放，世界各地也有在自然環境中檢測到藥物發生的記錄。由於這些藥物對於生態和人類健康有潛在毒性作用，這些生物活性化合物在生物和非生物樣本中的普遍發生引起了人類對它們的關注。特別地，這些普遍在環境發生的人用和獸用抗生素，加上臨床數據顯示抗藥性的細菌菌株在全球性上升，已促使研究抗生素抗藥性基因和抗藥性細菌在自然系統中的存在。我們過往的研究發現，某些抗生素從香港的污水處理廠排放到環境的濃度都位居世界首位。同樣地，臨床研究顯示，在香港發現的某些菌株的抗藥比率是非常高的。因此，本研究將調查抗生素耐藥性在香港的環境的存在，從而判斷藥物釋放的潛在影響。為查看季節性對環境中藥物濃度的變化，本研究將進行長達一年的表層海水和海洋沉積物的採樣。海水樣品的提取及分析方法將基於我們先前公佈的方法進行修改，而一個新開發的方法將用於海洋沉積物中的藥物量化。基於樣本過濾用於基因型和表型的方法，海水和沉積物樣品也將進行抗生素抗藥性基因和抗藥性細菌菌株存在的分析，在麥康凱瓊脂細菌培養和革蘭原生的靈敏度測試，革蘭氏陽性菌和厭氧菌株，以及使用聚合酶鍊式反應來放大抗生素抗藥性基因。在海水和海洋沉積物中的濃度將與抗生素抗藥性基因和抗藥性細菌菌株的發生數據進行比較，以判斷在環境中抗生素的水準和抗藥性的相關性。這些分析的結果將被用來進行香港環境藥物的風險評估，包括使用概率的方法以及物種敏感度分佈。然而，這種方法亦可以應用在未來中國和亞太地區的研究。

Jan 2013 – Dec 2014 (Completed)

PHYTOREMEDIATION OF POLYBROMINATED BIPHENYL ETHERS (PBDES) BY MANGROVE WETLANDS
利用紅樹林濕地植物修復多溴聯苯醚的研究

Nora F. Y. TAM, H. T. ZHOU

Funding Amount : HK$200,000

Polybrominated biphenylethers (PBDEs), the widely used flame-retardant additives, are ubiquitous, persistent and toxic contaminants. Due to their hydrophobicity, PBDEs released to environments are accumulated in sediments, particularly in estuaries, the special coastal zones strongly influenced by anthropogenic activities. Extremely high concentrations of PBDEs have been recorded in estuarine sediments in South China. Although penta- and octa-BDEs have been banned since 2000s due to their toxicities, deca-BDEs are still produced and applied around the world. The persistence, toxicity and carcinogenic properties of PBDEs have led to increasing attention on their remediation. Over the last few decades, phytoremediation has been suggested as an innovative, non-intrusive and inexpensive technology that utilizes plant systems to remove toxic contaminants from the environment. Previous work on phytoremediation has focused on the cleanup of metal contaminated upland soil using terrestrial plants, concentrating on phytoextraction (uptake and accumulation of pollutants within plant tissues). Little is known about the phytoremediation of toxic organic pollutants by wetland plants in coastal environments. Our recent research demonstrates that mangrove plants had some tolerance to polycyclic aromatic hydrocarbons (PAHs) and the wetland system was capable of removing and degrading PAHs in contaminated sediments. However, the performance of mangrove wetlands in the cleanup of PBDE-contaminated sediments and their tolerance to PBDE stresses has never been reported. Without a clear understanding of how mangrove plants tolerate PBDE toxicity, their ability to remove and degrade PBDEs, it is difficult to promote and apply phytoremediation, an emerging technology. The proposed study therefore aims to explore the feasibility of using mangrove wetland systems to cleanup sediments contaminated with PBDEs and understand the fate of PBDEs in contaminated sediments. The study also compares the performance of different mangrove plant species, aiming to identify the most tolerant and effective species for phytoremediation purposes. The results from the proposed work will not only fill the knowledge gap on the fate of PBDEs in estuarine sediments, it will also provide very useful scientific information for developing phytoremediation strategies to clean-up contaminated sediments.

多溴聯苯醚（Polybrominated Biphenyl Ethers, PBDEs）是一類被廣泛應用於阻燃材料的添加劑，具有分佈廣，穩定性高和毒性強的特點。由於其具有疏水性質，導致PBDEs在釋放到環境後大量積聚在沉積物中，特別是在受人類活動影響較大的河口海岸帶地區。中國南方地區已經成為PBDEs的高度污染區域。儘管高毒性的五溴和八溴聯苯醚已於2000年被明令禁止使用，但十溴聯苯醚在全世界範圍內仍在不斷地生產和應用。可持續性、高毒性和致癌性的PBDEs已經引起人們不斷關注，並開始對其治理工作進行相關研究。在過去的數十年中，植物修復被認為是一個具有創新性、非入侵性和廉價的技術，利用植物系統將有毒污染物從環境中去除。已有的研究工作主要集中在利用陸生植物將重金屬從污染環境中提取，包括利用植物組織吸附和積聚污染物。然而，利用濕地植物修復沿海環境中有機污染物的研究則鮮有報導。我們近年來的研究顯示紅樹植物對多環芳烴（Polycyclic Aromatic Hydrocarbons, PAHs）具有一定的耐受性，同時紅樹林濕地系統具有一定能力清除和降解沉積物中的PAHs。但是，紅樹林濕地對PBDEs污染的沉積物的淨化能力，及紅樹植物對PBDEs脅迫下的耐受性都是還未涉及的研究領域。為了促進並把紅樹植物修復技術發展為新興的清除PBDEs污染的技術，紅樹植物對PBDEs毒性的耐受性，及其對PBDEs的去除和降解能力等方面的研究需要深入開展。本研究目的是探討利用紅樹林濕地系統清除沉積物中PBDEs的可行性，並進一步瞭解PBDEs在沉積物中的轉化途徑。同時，比較不同紅樹植物在污染條件下的特異性，進一步篩選和確定高耐受性和高有效性的植物種類，並應用於植物修復工程。本研究專案的預期結果，不僅可以填補PBDEs在河口沉積物轉化途徑的研究空白，而且為進一步完善植物修復技術在去除沉積物中污染物的應用提供科學理論依據。

Research Output

Papers with the SKLMP included as the first affiliation 以SKLMP為第一單位的期刊論文

1 Yan, Z.Z., Tam, N.F.Y. (2013)
Effects of lead stress on anti-oxidative enzymes and stress-related hormones in seedlings of *Excoecaria agallocha Linn*.
Plant and Soil, 367:327-338.

2 Wang, P., Wong, M.H., Tam, N.F.Y. (2013)
Antioxidant responses of two microalgae, *Selenastrum capricornutum* and *Chlorella* sp., to estradiol and ethinylestradiol.
Journal of Applied Phycology, 25:891-903.

3 Zhu, H.W., Wang, Y., Wang, X.W., Luan, T.G., Tam, N.F.Y. (2014)
Distribution and accumulation of polybrominated diphenyl ethers (PBDEs) In Hong Kong mangrove sediments.
Science of Total Environment, 468-469:130-139.

4 Wang, Y., Zhu, H.W., Tam, N.F.Y. (2014)
Polyphenols, tannins and antioxidant activities of eight true mangrove plant species in South China.
Plant and Soil, 374: 549-563.

5 Wang, Y., Zhu, H.W., Tam, N.F.Y. (2014)
Effect of a polybrominated diphenyl ether congener (BDE-47) on growth and antioxidative enzymes of two mangrove plant species, *Kandelia obovata* and *Avicennia marina*, in South China.
Marine Pollution Bulletin, 85:376-384.

IRF

IRF

Nov 2012 – Oct 2014 (Ongoing)

STUDIES ON MULTIPLE STRESSOR EFFECT OF IONIZING RADIATION AND HEAVY METALS ON MARINE FISH USING MARINE MEDAKA (*Oryzias melastigma*): TOWARDS A REALISTIC RISK ASSESSMENT
利用海洋青鱂（*Oryzias melastigma*）研究電離輻射和重金屬在海洋魚類中的多重應激源效應：邁向實際的風險評估

Peter K. N. YU

Funding Amount : HK$600,000

Under realistic situations, living organisms are exposed to a mixture of environmental stressors, and the resultant effects due to such exposures are referred to as "multiple stressor effects". The resultant effects are not necessarily simple sums of the effects caused by individual stressors, i.e., showing additive characteristics. Instead, they can also show synergistic or antagonistic characteristics. However, due to a lack of information on multiple stressor effects, most biological risks on organisms (including marine organisms) can only be speculated by assuming additive characteristics among different environmental stressors.

Hong Kong will be in a region with the highest density of nuclear reactors in China in about 10 years, as 15 to 20 new nuclear reactors in Guangdong province alone will become operational. The routine or accidental fallout from these nuclear reactors will expose living organisms to ionizing radiations. Nuclear accidents at Chernobyl in Ukraine, Three Mile Island in USA, and most recently at Fukushima in Japan remind us that safety issue of nuclear power, including the associated contingency planning and risk assessment, is still a major concern. Nevertheless, the multiple stressor effects of heavy metals and ionizing radiation have not been extensively studied.
The present proposal aims to investigate the multiple stressor effect of ionizing radiation and heavy metals on marine fish using marine medaka (*Oryzias melastigma*) as a model. Apoptotic signals induced in the marine medaka will be used as the biological end point, which will be revealed through Acridine Orange staining or TUNEL assays. Realistic doses of ionizing radiation and heavy metals will first be separately applied to the fish model to obtain dose-response relationships for each individual stressor. The multiple stressor effect can then be identified by exposing the fish model to combinations of stressors, and by comparing the dose-response relationships for combined exposures to those for individual stressors. The results will significantly contribute to the goal of realistic risk assessment for combined exposure of marine fish to ionizing radiation and heavy metals.

在現實環境裡，生物體會受到多種應激源的影響，產生的效果被稱為"多重應激源效應"。多重應激源效應未必是個別應激源影響的簡單總和，這些個別應激源的影響也可以顯示協同或拮抗特性。然而，由於缺乏多重應激源效應的資料，大多數生物體（包括海洋生物）的風險評估只能在多重應激源效應就是個別應激源影響的總和的簡單假設下提出。

在大約十年後，香港將處於全中國核反應堆密度最高的區域內，單是廣東省便將有15至20座新的核反應堆投入使用。這些核反應堆的正常或意外排放都會引致生物體受到額外的電離輻射劑量。烏克蘭切爾諾貝利，美國三哩島，和最近日本福島的核事故都時刻在提醒我們核電的安全依然是值得我們關注的問題，包括相關的應急計劃和風險評估。然而，重金屬和電離輻射的多重應激源效應還沒有被廣泛研究。
本課題旨在探討利用海洋青鱂（*Oryzias melastigma*），通過吖啶橙染色或TUNEL測定揭示的 細胞凋亡信號以研究電離輻射和重金屬在海魚中的多重應激源效應。透過實際的電離輻射和重金屬劑量，個別應激源的劑量反應關係會先被確立，再通過對比不同應激源組合的劑量反應關係，以揭示電離輻射和重金屬的多重應激源效應。得出的結果將有助於評估海魚同時暴露於電離輻射和重金屬時的實際風險。

Research Output

Papers with the SKLMP included as the first affiliation 以SKLMP為第一單位的期刊論文

1 Choi, V.W.Y., Cheung, A.L.Y., Cheng, S.H., Yu, K.N. (2012)
Hormetic effect induced by alpha-particle-induced stress communicated *in vivo* between zebrafish embryos.
Environmental Science and Technology, 46:11678-11683.

2 Choi, V.W.Y., Ng, C.Y.P., Kobayashi, A., Konishi, T., Suya, N., Ishikawa, T., Cheng, S.H., Yu, K.N. (2013)
Bystander effect between zebrafish embryos *in vivo* induced by high-dose X-rays.
Environmental Science and Technology, 47:6368-6376.

3 Choi, V.W.Y., Ng, C.Y.P., Kong, M.K.Y., Cheng, S.H., Yu, K.N. (2013)
Adaptive response to ionizing radiation induced by cadmium in zebrafish embryos.
Journal of Radiological Protection, 33:101-112.

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Multiple stressor effect in zebrafish embryos from simultaneous exposures to ionizing radiation and cadmium.
Journal of Radiological Protection, 33:113-121.

5 Choi, V.W.Y., Konishi, T., Oikawa, M., Cheng, S.H., Yu, K.N. (2013)
Threshold number of protons for inducing adaptive response in zebrafish embryos.
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6 Choi, V.W.Y., Ng, C.Y.P., Kobayashi, A., Konishi, T., Oikawa, M., Cheng, S.H., Yu, P.K.N. (2014)
Response of 5 hpf zebrafish embryos to low-dose microbeam protons.
Journal of Radiation Research, 55:i113-i113.

7 Choi, V.W.Y., Ng, C.Y.P., Kobayashi, A., Konishi,T., Oikawa, M., Cheng, S.H., Yu, P.K.N. (2014)
Roles of nitric oxide in adaptive response induced in zebrafish embryos in vivo by microbeam protons.
Journal of Radiation Research, 55:i114-i114.

8 Choi, V.W.Y., Ng, C.Y.P., Kobayashi, A., Konishi, T., Oikawa, M., Cheng, S.H., Yu, P.K.N. (2014)
Exogenous carbon monoxide suppresses adaptive response induced in zebrafish embryos in vivo by microbeam protons.
Journal of Radiation Research, 55:i115-i115.

9 Kong, E.Y., Choi, V.W.Y., Cheng, S.H., Yu,K.N. (2014)
Some properties of the signals involved in unirradiated zebrafish embryos rescuing -particle irradiated zebra fish embryos.
International Journal of Radiation Biology, 90:1133-1142.

IRF

Feb 2015 – Jan 2017 (Ongoing)

BONE miRNAs DEREGULATION AND SKELETAL IMPAIRMENT IN OFFSPRING INDUCED BY PARENTAL EXPOSURE TO BENZO[a]PYRENE
青鱂魚苯並(a)芘暴露導致後代骨細胞小RNA表達異常以及骨質損害/損傷的研究

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High incidences of skeletal defects have been reported in feral fish from waters polluted by polycyclic aromatic hydrocarbons (PAHs) and crude oils. Recent studies using medaka have shown that sublethal exposure to waterborne benzo[a]pyrene (BaP, a ubiquitous PAH in the environment) not only increased the incidence of bone deformities in the exposed parents, but also significantly induced tail deformities in their early larva that had not been prior exposed to BaP. Increasing evidence from mammalian studies indicate that many adverse cross-generational effects caused by chemicals involve the activation or silencing of genes via microRNAs. It has been shown that BaP intake and tobacco smoking (a major source of BaP/PAH intake) can deregulate the miRNAs associated with osteogenesis in the lungs or in embryos from exposed fathers. Many osteogenesis-related miRNAs were on the list of the dysregulated pulmonary miRNAs in lung cancer patients with a history of smoking.

From an ecotoxicological perspective, abnormal skeletal phenotypes (including spinal curvature, tail defects and reduced body length) will directly affect swimming as well as impair mating behavior and food captivity of the fish, which are likely to amplify into adverse outcomes associated with reduced growth and reproductive fitness. Impairments of these Darwinian's fitness traits in fish will likely impede the sustainability of the fish population, particularly when such adverse outcomes, induced by BaP, persist across generations. The ecological consequence of BaP contamination in the environment is likely to be worse than we expect. There is an urgent need to re-assess the risk of BaP/PAHs in the environment.

To be meaningful and useful for risk assessment, it is essential to understand the molecular action and the toxicity pathways of BaP in regards to cross-generational skeletal deformities, which however remains virtually unknown. Using the medaka as a model fish, the present study is set to identify the key miRNAs regulating bone homeostasis in medaka. Their involvement in BaP induced cross-generational bone deformities will be further tested. BaP is ubiquitously found in water and air. The results of this study will also be relevant and essential for human health risk assessment.

多環芳烴（polycyclic aromatic hydrocarbons,PAHs）和原油會造成魚類骨骼缺陷（選用：畸形）高發。最近的研究表明青鱂魚通過水體暴露於非致死濃度苯並芘（一種常見的環境多環芳烴）不但直接導致受暴露青鱂骨骼變形，還會導致未受暴露後代早期幼魚的尾部骨骼變形。越來越多用哺乳動物模型的研究證據指出許多化學物質對生物的跨代有害作用與小RNA（miRNA）的激活或抑制有關。研究顯示苯並芘的攝入和吸煙（多環芳烴主要攝入來源）會影響在肺部或父親受過暴露胚胎的與骨質生成有關的小RNA表達。在有吸煙史的肺癌病人中，許多與骨質生成有關的RNA也存在表達異常。

從環境毒理學的角度看，骨骼的異常表型，包括脊柱彎曲，尾部異常和身體長度縮短等會直接影響魚類游泳，交配行為和覓食能力。這種影響很有可能導致嚴重的後果，如生長減慢和繁殖能力下降。這些對魚類進化適應性的損害，特別是如苯並芘的跨代作用，將很可能會影響魚類整體種群的持續性。苯並芘污染造成的生態學後果很可能比我們預計的要更為嚴重。因此我們需要對苯並芘和其他多環芳烴重新進行風險評估。

為了更好地進行風險評估，我們需要對苯並芘導致的跨代骨骼缺陷現象的分子水評機理和毒理通路有更多的認識，但如今這方面的研究還非常缺乏。本研究用青鱂魚作為模式生物確定調節骨骼生長穩態的小RNA，並研究這些小RNA是否參與苯並芘導致的跨代骨骼異常。苯並芘在水體和空氣中普遍存在，因此這項研究的結果也對苯並芘對人體健康影響的風險評估有重要參考意義。

Feb 2015 – Jan 2017 (Ongoing)

PILOT BASELINE STUDY OF MARINE BIODIVERSITY AND AQUACULTURE ENVIRONMENT AT O PUI TONG MARICULTURE ZONE AND ITS SURROUNDING AREA

澳背塘及其周邊地區之海洋生物多樣性及水產養殖環境的基線調查

Leo L. CHAN, J. W. QIU, James C. W. LAM, T. C. WAI, Maggie Y. L. MAK, J. J. WU, Priscilla T. Y. LEUNG, Z. Y. ZHAO, P. P. SHEN

Funding Amount : HK$150,000

The recent establishment of SKLMP fish raft in O Pui Tong at Kat O is an experimental based mariculture platform to support in situ scientific research and facilitate development of culture fisheries with enhanced efficiency and ecological sustainability in Hong Kong. In line with this, the potentials of the development and implementation of the Integrated Multi-Trophic Aquaculture (IMTA) are of particular interest; and an experimental IMTA design will be setup at O Pui Tong SKLMP fish raft to investigate the mechanisms with regard to sustainability, system dynamics and bioremediation. Therefore, baseline information on the marine biodiversity and aquaculture environment prior to the commencement of IMTA experiment is essential for future assessment and monitoring plan of its functions. In this study, a pilot baseline survey will be performed in O Pui Tong and its surrounding area including Kat O Wan as an impacted control and Camp Cove as a control of non-mariculture zone, for both dry and wet seasons of 2015. The baseline data collected under this Before-After Control-Impact (BACI) design will advance our understanding on the application potentials of IMTA by the fish raft, and can also provide valuable information to the future mariculture development projects.

海洋污染國家重點實驗（SKLMP）在吉澳澳背塘所建立的漁排，是一個實驗性的海魚養殖示範平台。它有助於開展實地科學研就並促進香港養魚業發展高效生態養殖。同時，我們對開展與實施多營養級綜合水產養殖（IMTA）尤感興趣。有見及此，我們將於澳背塘的SKLMP漁排上設立一個試驗性的IMTA，用以研究與可持續性、系統動力學和生態復修相關的機理。 因此，在開展IMTA實驗以前有關海洋生物多樣性和水產養殖環境的資料對其功效的評估和監測計劃都是必不可少的。在本研究中，我們會在2015年旱季及雨季於澳背塘及其周邊地區開展基線調查，地點包括作為受影響區之對照地點的吉澳灣，和作為非養殖區之對照地點的白沙頭灣。基於這個項目實施前後的影響對照設計所得的基線調查資料有助我們了解IMTA在應用上的潛在價值。與此同時，它更為未來海漁養殖提供寶貴的資料。

Feb 2015 – Jan 2017 (Ongoing)

FUNCTIONAL MONITORING THE TOXICITY OF WATER BORNE CHEMICAL POLLUTANTS ON NEURONAL ACTIVITIES USING WHOLE-BRAIN-WIDE IMAGING

基於全腦成像技術的水性化學污染物對神經活動的毒性檢測

S.H. CHENG, P. SHI, Michael H. W. LAM

Funding Amount : HK$150,000

In the proposed project we intend to utilize our platform to study four major categories of toxic chemicals commonly found in the aquatic environment, (polybrominated diphenyl ethers, endocrine disrupting chemicals, organic solvents and metals) which might have an effect on the neural development of brain and the brain-wide neuronal dynamics linking the processing of senses and the motor movements. Until date there has been no systematic study that provides direct insight into the instantaneous effects of these pollutants on the brain activity patterns of developing vertebrate. The reconstruction of neural activity across complete neural circuits, or brain activity mapping, has great potential in both fundamental and translational neuroscience research. Larval zebrafish, a vertebrate model, has recently been validated to be amenable to whole brain activity mapping. We recently demonstrated a microfluidic array system ("Fish-Trap") that enables high-throughput mapping of brain-wide activity in awake larval zebrafish. Unlike the commonly practiced larva-processing methods using a rigid gel or a capillary tube, which are laborious and time-consuming, the hydrodynamic design of our microfluidic chip allows automatic, gel-free, and anesthetic-free processing of tens of larvae for microscopic imaging with single-cell resolution. Notably, this system provides the capability to directly couple chemical stimuli with real-time recording of neural activity in a large number of animals, and the local and global effects of pharmacoactive drugs or neurotoxic chemicals on the nervous system can be directly visualized and evaluated by analyzing the toxic molecule induced functional perturbation within or across different brain regions. Using this technology, we recently tested a set of neurotoxin peptides and obtained new insights into how to exploit neurotoxin derivatives as therapeutic agents. This novel and versatile "Fish-Trap" technology coupled with similar experimental strategy can be readily utilized to study the effect of toxic waterborne chemical pollutants on functional brain circuits. In the proposed project we intend to utilize our platform to study an array of toxic chemicals that have been identified to be found commonly in the aquatic environment. Until date there has been no systematic study that provides direct insight into the instantaneous effects of these pollutants on the brain activity patterns of developing vertebrate.

在此擬議項目中，我們計劃利用我們自主研發的檢測平台來研究四大類常見於水生環境中的有毒化學物質（多溴聯苯醚，內分泌干擾物，有機溶劑和金屬）對大腦神經發育和連接感覺和運動神經的全腦神經活動的影響。目前，沒有一項系統的研究能夠即時地、直接地觀察這些污染物對發育中脊椎動物的大腦活動規律的影響。完整神經回路中的神經活動重現，或大腦活動映射，在基礎和轉化神經科學研究上都具有巨大的研究潛力。斑馬魚幼體，一種脊椎動物的實驗模型，最近已被證實能夠用於全腦活動映射研究。而我們最近研發的微流體陣列系統，能夠實現對未麻醉斑馬魚幼體的全腦活動的大規模高通量映射。與傳統費力耗時的採用剛性凝膠或毛細管的斑馬魚處理方法相比，我們的系統採用流體力學設計，無需凝膠和麻醉劑，可以一次性全自動處理幾十條斑馬魚，並同時對大腦進行單細胞分辨率的顯微成像。當然，此系統更具備在化學刺激的直接耦合下進行大規模全腦活動實時記錄的能力。藥理活性藥物或具有神經毒性的化學物質對大腦局部或全部的影響都可被直接觀察到，更可通過對大腦某個部位或不同部位間神經聯繫的分析對有毒分子所造成的腦部擾動進行深層次評估。使用該技術，我們實驗組最近已經完成對一組神經毒素肽的測試，並在如何利用神經毒素衍生物作為治療劑的問題上獲得了新的見解。利用這種全新的，多功能的技術，加上成熟的實驗方法，能夠使得研究有毒水性化學污染物對大腦功能回路的影響變得簡單可行。在此擬議項目中，我們希望利用我們研發的檢測平台去研究在水生環境中的一系列有毒化學物質。迄今為止，還未有一項系統的研究能夠提供這些污染物對發育中脊椎動物的大腦活動規律的即時影響。

Feb 2015 – Jan 2017 (Ongoing)

TROPHIC INTERACTIONS OF THE ROCKY SHORE COMMUNITY UNDER OCEAN ACIDIFICATION
岩岸群落在海洋酸化下的營養互動

S. G. CHEUNG, Paul K. S. SHIN

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In addition to global warming, an increase in anthropogenic CO_2 production reduces pH of the ocean, termed "ocean acidification" (OA), as the ocean is the sink of CO_2. According to the Intergovernmental Panel on Climate Change (IPCC), it is predicted that by the year 2100, the pH of the surface ocean will decrease by 0.3–0.5 units.

A decrease in pH has a great impact on marine organisms particularly the shelled animals as dissolution of shell may be faster than shell formation under low pH. OA also disturbs physiology of marine organisms and results in reduction in survival and growth. Although studies on the effect of OA on individual species and life stages increase dramatically in the past few years, the results provide little clues to predict long-term consequences of OA at population and community levels. This is because population abundance and community structure are determined not only by individual species tolerance to OA, but also through biological interactions such as predation and inter-specific competition. For example, when the prey is more sensitive to OA than the predator, the predator will enjoy a weakened prey. In contrast, if the predator is more affected by OA, the prey will enjoy a lower predation risk. The situation is even more complicated when more than one prey species is preferred by a predator as the two prey species may have different tolerance to OA. Very few studies, however, have addressed these problems and most of them were on fish ecology.

The rocky shore community is one of the most biologically diverse and productive communities throughout the world with dominant rocky shore occupiers including barnacles and mussels. Most of the animals on the rocky shore possess an external hard shell as an adaptation against wave action and water lost. Therefore, they are highly susceptible to OA. The proposed study will investigate the effect of OA on predator-prey interactions between a predatory muricid gastropod and its preferred prey which are barnacles and mussels. The results will help us predict possible consequences of OA on the population structures of the prey species and the structure and functioning of the rocky shore community.

由於海洋是二氧化碳的一個沉積處，人為產生的二氧化碳除了使全球變暖之外，還造成了海水酸度的下降，這種情況我們稱之為"海洋酸化"。根據政府間氣候變化協會的預計，到2100年，海洋表面的酸度值會降低0.3至0.5個單位。

酸鹼度的降低會對海洋生物，尤其是有殼類動物造成深遠的影響。其原因是在低酸度條件下，殼的溶解可能比形成要快。同時，海洋酸化也會打亂海洋生物的生理活動，從而導致存活率下降或生長延滯。儘管在過去幾年間，關於海洋酸化對於單一種類和生長階段的研究迅速增多，但我們依然很難從這些結果中推測海洋酸化對於種群數量和群落層次的長期影響。這是因為種群的豐度和群落結構不僅僅取決於單一物種對於海洋酸化的抗性，同時也取決於生物環境之間的相互作用，比如捕食關係，種間競爭等等。具體來說，當被捕食者比捕食者對海洋酸化更敏感時，捕食者更容易捕食到弱者。相反，如果捕食者更加敏感，那麼被捕食者被捕的風險就降低了。當一個捕食種有多個被捕食物件，而不同的被捕食種又對海洋酸化有不同的抗性時，情況就變得格外複雜。目前少有研究涉及這個問題，並且這些研究大部分局限在魚類生態學。

從世界範圍來看，岩石海岸群落是一個生物多樣性非常豐富又充滿生機的生態群落。在這個群落中，優勢生物有藤壺和貽貝。大多數岩石海岸生物擁有堅硬的外殼用來抵擋潮水的作用和水分流失。因此，他們在海洋酸化進程中非常易受影響。當前的研究將探討海洋酸化對於骨螺（muricid gastropod）及其攝食的藤壺或貽貝之間的捕食關係的影響。這些結論會幫助我們推測海洋酸化對於捕食種類種群和岩石海岸群落的結構和作用所產生的可能影響。

Feb 2015 – Jan 2017 (Ongoing)

EFFECT OF ALTERNATING AEROBIC-ANAEROBIC CONDITIONS ON MICROBIAL TRANSFORMATION OF POLYBROMINATED DIPHENYLETHERS (PBDEs) IN MANGROVE SEDIMENTS

紅樹林沉積物好氧-厭氧交替環境下多溴聯苯醚（PBDEs）的微生物轉化作用及機理研究

Nora F. Y. TAM, T. G. LUAN

Funding Amount : HK$150,000

Polybrominated biphenylethers (PBDEs), the widely used flame-retardant additives, are ubiquitous, persistent and toxic contaminants. They have a structure in which 1-10 bromines are substituted on two benzene rings connected by an ether bond. The three major commercial PBDEs mixtures are penta-, octa- and deca-BDEs, having 5, 8 and 10 bromines, respectively. Due to their hydrophobicity, PBDEs released to environments accumulate in sediments, particularly in estuaries, the special coastal zones strongly influenced by human impacts. Extremely high concentrations of PBDEs have been recorded in estuarine sediments in South China. Although penta- and octa-BDEs have been banned since 2000s due to their toxicities, deca-BDEs are still produced and applied around the world. Some researchers suggested that under anaerobic conditions, deca- and octa-BDEs in bioreactors and sludge treatment processes could be reduced to lower brominated PBDEs, such as hexa- and penta-BDEs, which are more stable and toxic. Previous studies on polychlorinated biphenyls (PCBs), having similar chemical structures as PBDEs, reported that PCBs were dechlorinated in sediments under anaerobic conditions and the lower chlorinated PCBs were completely metabolized with ring cleavage under aerobic conditions. Whether the highly brominated PBDEs could be debrominated by microorganisms in anaerobic estuarine sediments is still debatable, and knowledge on the aerobic degradation is even scarcer. The effects of alternating aerobic and anaerobic conditions on the microbial transformation of PBDEs in sediments have never been reported. Mangrove wetlands representing an important intertidal ecosystem in tropical and subtropical regions occupy 75% of the coastal areas worldwide with a global area of around 160,000 km2. Mangroves are significant ecological interfaces between land and sea, and are subject to frequent tidal flushing with alternating aerobic and anaerobic environments. The proposed study therefore aims to investigate the debromination and metabolism of PBDEs by indigenous microorganisms in mangrove sediments subject to different aerobic and anaerobic conditions. The metabolic products will be identified and the relationships between PBDE biotransformation and microbial abundance in sediments will also be evaluated. The results from the proposed work will not only fill the knowledge gap on the fate of PBDEs and the roles of microorganisms in estuarine sediments, it will also provide very useful scientific information for developing bioremediation strategies to clean-up contaminated sediments.

多溴聯苯醚（PBDEs）是一類具有普遍持久性和高毒性的阻燃劑有機污染物，由一個醚鍵連接兩個取代有1-10個溴原子的苯環構成，常見有商用五溴、八溴和十溴產品。疏水性的PBDEs進入環境後，易被沉積物吸附，尤其在人類活動劇烈的河口區域。我國華南河口已有超高PBDEs濃度的報導。雖然高毒性的五溴和八溴產品已禁止生產，但十溴仍在生產和使用。厭氧條件下，高溴PBDEs在生物和污泥處理中生成更穩定和更毒的低溴。高氯多氯聯苯醚（PCBs）在厭氧沉積物中發生脫氯作用，而在好氧條件的低氯PCBs發生完全的開環代謝。然而，具有相似結構的PBDEs鮮有相關厭氧和好氧降解的報導，厭氧-好氧交替在沉積物微生物降解PBDEs的作用是個空白研究領域。紅樹林是熱帶亞熱帶潮間帶的重要生態系統，占全世界75%海岸。本項目旨在研究不同厭氧和好氧條件及其交替環境下，紅樹林沉積物降解PBDEs功能及其與土著微生物的關係。本研究將揭示PBDEs在河口沉積物轉化途徑及微生物降解作用，為建立PBDEs污染的生物修復技術提供科學理論。

Feb 2015 – Jan 2017 (Ongoing)

DESIGN AND DEVELOPMENT OF MICROBEAD-BASED BIOSENSORS FOR MULTIPLEXED DETECTION OF WATERBORNE PATHOGENS IN MARICULTURE ZONE

設計開發新型微球生物傳感器及微流體陣列檢測平臺用於海水養殖區中病原體的多重檢測

Michael M. S. YANG, Richard Y. C. KONG, Leo L. CHAN, Priscilla T. Y. LEUNG, J. J. WU, Maggie Y. L. MAK, L. F. HUANG, X. YAO, W. Q. YUE

Funding Amount : HK$150,000

Waterborne pathogens (bacteria, viruses and protozoa) that pose a significant threat to mariculture and human health may cause big economic losses due to water pollution. Because much emphasis is put on the prevention of aquatic animal diseases, there is an urgent need to develop rapid and accurate methods to identify/detect the level of specific waterborne pathogens in order to ensure the microbial safety of mariculture produce. Biosensors using a variety of biorecognition methodologies have the ability to facilitate detection of a variety of microbial pathogens of interests with high sensitivity. However, the presence of low concentrations of waterborne pathogens and the complex environmental matrices where they occur pose major obstacles for pathogen detection technologies. The SKLMP fi sh raft in O Pui Tong at Kat O is operated under the requirements of accredited fi sh farm scheme of the Agriculture, Fisheries and Conservation Department and is also an experimental based mariculture platform to support in situ scientific research for the improvement of culture fi sheries in Hong Kong. Therefore, the development of novel biosensors for early and accurate detection of pathogens in environmental matrices on a routine basis will be highly beneficial in helping to prevent the transmission of waterborne diseases to consumers, thereby protecting public health and lowering the fi nancial burden on the health care system. In this project, we propose to develop a microbead-based biosensor for multiplexed detection of waterborne pathogens, using enzyme-labeled Au nanoparticles and fl uorescence quantum dots for signal amplification and microfluidics-based microbead arrays for parallel processing of multiple samples. The platform may potentially be used for developing multiplexed assays for detection and differentiation of other pathogens.

水生病原體（細菌，病毒和原生動物等）威脅着海水養殖和人類健康，并導致經濟損失。目前許多防治重點放在預防水產動物疾病，但是也迫切需要積極發展快速，準確的方法來檢測特定水生病原體，以確保海產養殖的微生物安全性。生物傳感器技術是利用各種生物識別方法對各類微生物病原體進行高靈敏度和特異性檢測。然而，水生病原體一般濃度很低，複雜環境都會干擾檢測技術。

海岸污染重點實驗室在澳背塘吉澳的魚筏根據漁農自然護理署的優質養魚場計劃要求進行操作，也是旨在改善香港的養殖漁業的海水養殖實驗平台。因此，設計開發新型生物傳感器用於海水養殖區中病原體早期和準確檢測將極大的有利于預防水源性疾病傳播給消費者，從而保護公眾健康，降低衛生保健系統的經濟負擔。本項目旨在設計開發一種微球生物傳感器，應用酶標記的金納米顆粒和熒光量子點技術進行檢測信號的放大，解決水生病原體低濃度檢測的靈敏度問題，並且應用微流體陣列技術進行多通道平行檢測。

Summary of the Research Fellowship Programme (RFP) Projects
RFP項目概要

Apr 2013 – Mar 2015 (Completed)

A HOLISTIC APPROACH TO UNRAVEL XENOESTROGEN INDUCED IMMUNOSUPPRESSIVE EFFECTS AND REPRODUCTIVE IMPAIRMENT IN FISH: IMPLICATIONS FOR RISK ASSESSMENT AND MONITORING OF IMMUNOSUPPRESSANTS IN WATERS
體研究方法揭示外源性雌激素引起的免疫抑制及對生殖系統的影響：對風險評估和監控水體中免疫抑制物的提示

Doris W. T. AU, Terrance C. K. LAU, Joseph L. HUMBLE

Funding Amount : HK$400,000

Earlier studies on chronic toxicity of xenoestrogens or estrogen active chemicals (EACs) in fish were largely focused on adverse outcomes related to reproductive impairment. An increasing number of field and laboratory studies have shown that many EACs in environment could depress the expressions of major immune proteins and increase fish susceptibility to pathogens. The findings support the immunosuppressive role of EACs in fish. Surprisingly, no studies have ever been conducted to evaluate the manifestation of EACs induced adverse effects on fish immune function and reproduction concomitantly in the same fish population. Moreover, the mechanisms by which EE2 (a model EAC) impairs immune function in male and female fish are virtually unknown. Such information is crucial for a holistic assessment of the risk of EACs in waters.

The marine medaka (*Oryzias melastigma*) has recently been established as a model fish for immunotoxicoloogy. Here, we exposed adult marine medaka to a range of environmentally relevant concentrations of EE2 and assessed the effects upon the immune and reproductive systems, using a suite of molecular, physiological and whole organism endpoints. The results of range finding experiment and definitive experiments indicate the NOEC and LOEC at which EE2 impairs the immune and reproductive systems. Gender dependent responses regarding reproductive dysfunction and immune impairment were also compared, which revealed the existence of sex specific effects of EE2 on immune competence of marine medaka. Liver samples of female medaka were employed for next generation sequencing (NGS) analysis to identify differentially expressed genes involved in key immune and reproduction pathways that were deregulated by EE2. Interesting, several key complement system genes involved in the innate immune function were identified as down-regulated and these are considered potential novel biomarkers for immune suppression in the marine medaka. The hepatic transcriptomic data also revealed the major biological processes that were affected by EE2 exposure in female medaka, including the biochemical pathways related to amino acid and sugar metabolism as well as xenobiotic bio-transformation.

早期關於外源雌激素或雌激素活性化學物（estrogen active chemicals，EACs）對魚類慢性影響的研究主要著重於其對生殖系統的不良後果。越來越多的實驗室和野外實驗證明許多雌激素活性化合物可以抑制主要免疫蛋白的表達和影響魚類對病原物的抵抗力。這些發現證實了雌激素活性化合物對魚類免疫系統的影響。然而，在同一條件下雌激素化合物對同一群體魚類免疫和生殖功能影響的研究卻一直缺失。而且，雌激素活性化合物對雌魚和雄魚免疫功能的影響的具體機理也未知。這些資訊都對雌激素活性化合物的整體風險評價非常重要。

近年來海洋青鱂 (*Oryzias melastigma*) 被建立為模式魚類用於免疫毒理的研究中。在此，我們用一系列環境相關濃度的人造雌激素EE2暴露海洋青鱂，然後用不同分子、生理和整魚水準的參數評價對免疫和生殖功能的影響。系列濃度實驗和限定濃度實驗結果可以提供EE2影響免疫和生殖功能的無可觀察到反應的最高量（NOEL）和可觀察到反應的最低量（LOEL）。我們比較了不同性別魚類的生殖和免疫功能，發現了EE2對海洋青鱂有性別特異性影響。我們用第二代測序技術對EE2暴露和對照組雌魚肝臟的轉錄組進行測序，識別出被EE2抑制的參

與免疫和生殖功能的差異表達基因。結果表明天然免疫中的重要的補體基因表達被下調，這些補體基因可以被用作海洋青鱂受到免疫抑制的重要新的生物指標。肝臟轉錄組資料也表明許多主要的生化過程受到了影響，包括了氨基酸、糖類代謝以及外源物生物轉化通路。

Research Output

Papers with the SKLMP included as the first affiliation 以SKLMP為第一單位的期刊論文

1 Yu, W.K., Fong, C.C., Chen, Y., van de MERWE, J.P., Chan, A.K.Y., Wei, F., Bo, J., Ye, R.R., Au, D.W.T., Wu, R.S.S, Yang, M.M.S. (2013)
Gender-specific transcriptional profiling of marine medaka (*Oryzias melastigma*) liver upon BDE-47 exposure. *Comparative Biochemistry and Physiology Part D: Genomics and Proteomics*, 8:255-262.

2 Cheung, N.K.M., Cheung, A.C.K., Ye, R.R., Ge, W., Giesy, J.P., Au, D.W.T. (2013)
Expression profile of oestrogen receptors and oestrogen-related receptors is organ-specific and sex-dependent: the Japanese medaka *Oryzias latipes* model. *Journal of Fish Biology, 83:295-310.*

3 Shanthanagouda, A.H., Guo, B.S., Ye, R.R., Chao, L., Chiang, M.W.L., Singaram, G., Cheung, N.K.M., Zhang, G., Au, D.W.T. (2014)
Japanese medaka: a non-mammalian vertebrate model for studying sex and age-related bone metabolism in vivo. *PloS one, 9(2):e88165.*

*Papers with the SKLMP as one of the affiliations*以*SKLMP*為作者單位之一的期刊

4 Chen, L., Ye, R., Xu, Y., Gao, Z., Au, D.W.T., Qian, P.Y. (2014)
Comparative safety of the antifouling compound butenolide and 4,5-dichloro-2-n-octyl-4-isothiazolin-3-one (DCOIT) to the marine medaka (*Oryzias melastigma*). *Aquatic toxicology, 149:116-25.*

Jan 2012 – Dec 2014 (Completed)

COMPARATIVE INVESTIGATION ON RESISTANCE AND DEFENSE MECHANISM OF CORAL REEF FISHES TO CIGUATOXINS
珊瑚礁魚類對雪卡毒素的抗性和防禦機制比較研究

Leo L. CHAN, Y. L. MAK, M. YAN

Funding Amount : HK$400,000

Ciguatoxins (CTXs) are a group of natural marine biotoxins that are commonly found in marketed coral reef fi shes. They are of great concerns as consumption of CTX-contaminated coral reef fi shes can induce ciguatera fish poisoning (CFP) in human. Because of global warming and an increase in nutrient input in the marine environment, there is a growing likelihood of CTX-causative dinoflagellates, and hence CTXs spreading into new regions of the globe. More importantly, CTXs may negatively affect wildlife since a laboratory study has demonstrated that CTX-exposed fi sh embryos exhibited cardiovascular, muscular and skeletal abnormalities. A reduction of larval survivability in fi shes was also observed when greater CTX levels were exposed to fi sh embryos. Additionally, mortality of piscivorous marine mammals such as Hawaiian monk seals was reported in a CFP-prone area in Hawaii. CTXs may therefore represent an unrecognized threat to marine life and eventually pose an ecological risk to coral reef system in the CFP-prone regions. Based on the P-CTX-1 exposure study, we have defined orange-spotted grouper (*Epinephelus coioides*) and marine medaka (*Oryzias melastigma*) as the CTX-resistant and CTX-sensitive fishes, respectively. Study on the pharmacokinetics (i.e. accumulation, subsequent change in tissue distribution and elimination of CTXs) of CTXs in orange-spotted grouper and marine medaka will be conducted in order to provide insight on species-specific variations in physiological mechanisms that render CTX-resistant coral reef fi shes ability to mediate harms after CTX exposure. The study of genomic and the complementary DNA sequence of the excitable tissue such as nerve, skeletal muscle, brain and heart of CTX-resistant and sensitive coral reef fi sh species will also be carried out to understand the molecular basis of the defense mechanism of fi shes against CTXs. All the results will provide systematic scientific information for clarifying the role of CTXs to act as natural selection agents which can result in long-term changes of coral reef community and ecosystems.

雪卡毒素(CTXs)是一類常見於市售珊瑚礁魚中的天然海洋生物毒素。因食用受污染的珊瑚礁魚而引起的人類雪卡毒中毒(CFP)事件與CTXs有密切相關。由於全球氣候變暖和投放海洋環境中的營養物質增加，產毒甲藻以至CTXs有日益增長和擴散至全球新地區的可能性。更重要的是，自實驗室研究論證了CTXs暴露於魚胚胎中表現出心血管、肌肉和骨骼異常現象，CTXs極有可能對野生生物產生不利影響。同時還觀察到當使用更高濃度的CTXs暴露于魚胚胎時，幼魚的存活率降低。此外，肉食性海洋哺乳類動物(如夏威夷僧海豹)的死亡在夏威夷的一個CFP多發地區已有報導。因此，在CFP多發地區，CTXs對於海洋生物是可代表一種未確認的威脅，並最終引起珊瑚礁體系的生態風險。在本研究中，我們已在實驗室研究基礎上證明了點帶石斑魚 (*Epinephelus coioides*) 及海水青鱗魚 (*Oryzias melastigma*) 分別為對CTXs有抗性和敏感的魚類。我們將探討CTXs在點帶石斑魚及海水青鱗魚的藥代動力學 (即CTXs的積累，在組織中的分佈和消除的隨後變化) ，以便瞭解有抵抗力的魚類在調節CTXs危害的生理機制是否存在物種特異性變異。另外，我們將開展基因組和互補DNA序列研究以闡明對CTX有抗性和敏感的珊瑚礁魚類的興奮組織 (如神經，骨骼肌，大腦和心臟) 對CTXs的防禦機制。所有的結果將提供有系統的科學資訊來明確CTXs在珊瑚礁群落和生態系統長期變化及自然選擇中所扮演的角色。

Research Output

Papers with the SKLMP included as the first affiliation 以SKLMP為第一單位的期刊論文

1 Mak, Y.L., Wai, T.C., Murphy, M.B., Chan, W.H., Wu, J.J., Lam, J.C.W., Chan, L.L., Lam, P.K.S. (2013)
Pacific ciguatoxins (P-CTXs) in food web components of coral reef systems in the Republic of Kiribati.
Environmental Science and Technology, 47: 14070-14079.

Papers with the SKLMP as one of the affiliations以SKLMP為作者單位之一的期刊

2 Tian, L., Cheng, J.P., Chen, X.P., Cheng, S.H., Mak, Y.L., Lam, P.K.S., Chan, L.L., Wang, M.F. (2014)
Early developmental toxicity of saxitoxin on medaka (*Oryzias melastigma*) embryos.
Toxicon 77:16-25.

Jan 2013 – Dec 2014 (Completed)

IDENTIFICATION OF BIOMARKER FOR LOW DOSE RADIATION: LINKING RADIATION INDUCED EFFECTS FROM MOLECULAR TO PHYSIOLOGICAL LEVELS

低劑量輻射生物標記的鑒定：放射性誘導的分子和生理層面影響之間的聯繫

S. H. CHENG, J. P. CHENG

Funding Amount : HK$400,000

The Tsunami-driven accidental meltdown of the Fukushima Dai-ichi nuclear power plant (NPP) has illustrated the wide-ranging effects on the marine ecosystems associated with airborne fallout over the ocean and oceanic discharge of radionuclides found in contaminated water. Hong Kong receives part of its electricity supply from the Daya Bay nuclear plant, one of the first commercial NPP operated by the China Guangdong Nuclear Power Group. It is known that this Nuclear Power Group is planning to build over 20 more NPP in Guangdong, posing an ever increasing need for research on the radioecology in marine pollution. Among the radionuclides, the Americium-241 and Plutonium-240 are alpha emitters commonly found in nuclear reactors and in nuclear explosions. Their much longer decay half lives (at 432 years and 6,563 years respectively), compared to the gamma emitter Cesium-137 (at 30 years) means that these alpha emitters persist much longer in the environment. The alpha particles have much larger relative biologic effectives, at about 20 times when compared to beta particles and gamma ray photons. Alpha particles are highly radiotoxic when ingested or come into direct contacts, generating reactive oxygen species and double strand DNA breaks. However it is very difficult to monitor by the equipment due to its short range. Therefore, special efforts will be required to monitor their existence and to determine both biological and ecological consequences under realistic exposure. With this seed funding, we will gather the biological data to measure a biological relevant endpoint under conditions of alpha particle exposures and co-stressors. This exploratory project will enable us to design a transgenic zebrafish to be used to perform biomonitoring of alpha particles in seawater and its potential effects with mixtures of stressors such as metals and endocrine disruptors.

海嘯造成的日本福島第一核電站核心熔融事故向人們展示了通過大氣散播的放射性塵埃和放射性污水的排放入海對海洋生態系統大範圍的影響。香港的部分電力供應來自中廣核集團運營的第一個商業化核電站，廣東大亞灣核電站。該集團計畫在廣東建立超過20個核電站，對於海洋污染的放射生態學研究迫在眉睫。在所有的放射性物質中，鎢-241和鈽-240是核裂變反應堆和核爆炸中常見的α放射源。它們具有很長的半衰期（分別為432年和6563年），相比銫-137（半衰期30年）這類γ放射源，α放射源會在環境中停留較長時間。此外，α粒子具有較高的相對生物效應，大約是β粒子和γ射線的20倍。當攝入和直接接觸時，α粒子具有很強的放射毒性包括產生活性氧類物質和造成雙鏈DNA斷裂。由於穿透能力弱，這類放射污染目前仍然很難用儀器檢測。因此需要將更多努力集中於研究如何檢測該物質的存在和測量其真實環境條件暴露後產生的生物學及生態學後果。利用這個子專案，我們會收集生物學資料用於測量α粒子和其他環境因數暴露過後的相關生物學終點。這個探索性的項目將會有助於我們設計轉基因斑馬魚作為生物檢測器，用於檢測海水中的α放射污染以及與其他環境壓力共同作用時的潛在影響，例如重金屬和內分泌干擾物污染。

Research Output

Papers with the SKLMP as one of the affiliations以SKLMP為作者單位之一的期刊

1 Choi, V.W.Y., Ng, C.Y.P., Kobayashi, A., Suya, N., Ishikawa, T., Cheng, S.H., Yu, K.N. (2013)
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2 Choi, V.W, Konishi, T., Oikawa, M., Cheng, S.H., Yu, K.N. (2013)
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Journal of Radiological Protection, 33:91-100.

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The multiple stressor effect in zebrafish embryos from simultaneous exposure to ionizing radiation and cadmium.
Journal of Radiological Protection, 33:113-121.

4 Choi, V.W.Y., Ng, C.Y.P., Kong, M.K.Y., Cheng, S.H., Yu, K.N. (2013)
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5 Chen, X.P., Xu, S.S., Tan, T.F., Lee, S.T., Cheng, S.H., Lee, F.W.F., Xu, S.J.L., Ho, K.C.(2014)
Toxicity and estrogenic endocrine disrupting activity of phthalates and their mixtures.
International Journal of Environmental Research and Public Health, 11:3156-3168.

6 Tian, L., Cheng, J.P., Chen, X.P., Cheng, S.H., Mak, Y.L., Lam, P.K.S., Chan, L.L., Wang, M.F. (2014)
Early developmental toxicity of saxitoxin on medaka (*Oryzias melastigma*) embryos.
Toxicon, 77:16-25.

May 2013 – Apr 2015 (Completed)

SIGNIFICANCE OF ROOTS AND MICROORGANISMS IN PHYTOREMEDIATION OF POLYBROMINATED BIPHENYL ETHERS (PBDEs) BY MANGROVE PLANTS (AREA D: POLLUTION CONTROL AND BIOREMEDIATION)

紅樹植物根系及其根際微生物對多溴聯苯醚的植物修復功能及機制

Nora F. Y. TAM, H. C. ZHOU

Funding Amount : HK$400,000

REP

Toxic, recalcitrant and newly emerged organic pollutants such as polybrominated biphenyl ethers (PBDEs) are common contaminants in coastal sediments, and their carcinogenic properties have led to increasing attention on their remediation. Over the last few decades, phytoremediation has been suggested as an innovative, non-intrusive and inexpensive technology that utilizes plant systems and associated microorganisms to remove toxic contaminants from the environment. Previous work on phytoremediation, however, focused mainly on the uptake and accumulation of pollutants (mostly heavy metals) within tissues of terrestrial plants. Little is known about the phytoremediation of toxic organic pollutants by wetland plants in coastal environments. Unlike metal removal, the most significant phytoremediation process for organic pollutants such as PBDEs is rhizosphere degradation, the breakdown of pollutants by microorganisms in the root zone environment (the rhizosphere). Because coastal wetland plants are subject to tidal fl ushing with alternating aerobic and anaerobic environments which support both aerobic and reductive transformation/degradation of PBDEs. Wetland plants are also known to transfer oxygen from the above-ground tissue to the roots for internal respiration. Excess oxygen is released to the surroundings (rhizosphere) to provide aerobic pockets for microorganisms to degrade pollutants and the formation of iron plaque, which could immobilize pollutants on root surface and uptake. However, the roles of roots and the rhizosphere effects of wetland plants, such as mangroves, have never been explored. The proposed study therefore aims to investigate the significance of roots, including the effects of roots in releasing oxygen to create an aerobic environment in the rhizosphere, the formation of iron plaque on root surface, the roles of root exudates on the degradation, mobility, bioavailability of PBDEs, the selection of PBDE-degraders and the changes of the microbial community structure in rhizosphere and bulk sediments during phytoremediation by mangrove plants. The detailed functions of roots in different mangrove plant species on the remediation of coastal sediments contaminated with PBDEs will be compared. The results from the proposed work will provide a thorough scientific understanding on the significance and mechanisms of mangrove roots, the rhizopshere and the associated microorganisms in the cleanup of coastal sediments contaminated with PBDEs.

多溴聯苯醚（Polybrominated Biphenyl Ethers, PBDEs）是海岸河口沉積物普遍存在的一類新型的具有持久性、高毒性和致癌性的有機污染物。因此，其相應的環境修復手段日益被人們所關注。在過去數十幾年中，植物修復技術，即利用植物-微生物系統去除環境中有毒污染物的技術，已被認為是一種具有創新性、非入侵性和低廉的生物修復技術。然而，先前植物修復的相關研究工作主要集中在陸生植物對污染物，特別是重金屬的吸收和富集。鮮有關於利用水生濕地植物對有機污染物的植物修復相關報導。與重金屬去除機制不同，有機污染物的植物修復機制主要是植物根際降解，特別是在根際微生物群落的參與下對有機污染物，如PBDEs的降解。河口海岸濕地植物生長於週期性的潮水漲落生境，形成了有氧和厭氧的交替環境，從而為PBDEs的有氧和厭氧還原性降解過程提供了必要的環境條件。濕地植物通過組織呼吸過程把氧氣從地上部分組織傳輸到根系。過量釋放到根際的氧氣促進了微生物有氧降解污染物和根系鐵膜的形成，根系鐵膜能起到固定並吸收污染物的作用。然而，相關的濕地紅樹植物的根系和根際效應尚未進行研究探討。本研究旨在探討利用紅樹植物修復降解PBDEs過程中植物根系的作用，包括以下幾部分：1.根系在釋放氧氣並形成根際有氧降解環境的作用；2.根系表面鐵膜的形成機理過程；3.根系分泌物對PBDEs的降解、轉移和生物利用過程的作用；4.沉積物和根系微生物群落結構的變化，及篩選降解PBDEs的目標微生物；5.分析比較不同的紅樹植物在修復降解河口海岸沉積物PBDEs過程的根系功能的特異性。本研究的預期結果將為揭示紅樹植物根系及其根際微生物在降解河口海岸沉積物PBDEs的作用和機理提供詳細深入的科學理論依據。

Research Output

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1 Jiang, X.T., Peng, X., Deng, G.H., Sheng, H.F., Wang, Y., Zhou, H.W., Tam, N.F.Y. (2013)
Illumina sequencing of 16S rRNA tag revealed spatial variations of bacterial communities in a mangrove wetland.
Microbial Ecology, 66:96-104.

2 Zhu, H.W., Wang, Y., Wang, X.W., Luan, T.G., Tam, N.F.Y. (2014)
Distribution and accumulation of polybrominated diphenyl ethers (PBDEs) In Hong Kong mangrove sediments.
Science of Total Environment, 468-469:130-139.

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Polyphenols, tannins and antioxidant activities of eight true mangrove plant species in South China.
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4 Wang, X., Tam, N.F.Y., Fu, S., Ametkhan, A., Ouyang,Y., Ye, Z.H. (2014)
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Annuals of Botany, 114:271-278.

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Plant and Soil, 374(1-2):815-828.

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Chemosphere, 99:152-159.

8 Wang, Y.F., Wu, Y., Pi, N., Tam, N.F.Y. (2014)
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Environmental Pollution, 187:136-144.

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Journal of Hazardous Materials, 265:61-68.

10 Zhu, H. W., Wang, Y., Wang, X.W., Luan, T.G., Tam, N.F.Y. (2014)
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Environmental Science and Technology, 48(9):4724-4731.

Papers with the SKLMP grant or support acknowledged 致謝*SKLMP*支持的期刊：

11 Leung,J.Y.S., Tam,N.F.Y. (2013)
Influence of plantation of an exotic mangrove species, *Sonneratia caseolaris* (L.) Engl., on macrobenthic infaunal community in Futian Mangrove National Nature Reserve, China.
Journal of Experimental Marine Biology and Ecology, 448:1-9.

Summary of the Seed Collaborative Research Fund (SCRF) Projects
SCRF項目概要

Nov 2011 – Oct 2014 (Completed)

INTERACTIVE EFFECTS OF CLIMATE CHANGE AND HYPOXIA ON FISH SEX DETERMINATION: ESTROGEN SYNTHESIS AND MASCULINISATION
氣候變化及缺氧對魚類性別決定（雌激素合成及雄性化）的相互影響

Richard Y.C. KONG, **Rudolf S.S. WU,** Richard M.K. YU

Funding Amount : HK$900,000

Episodes of aquatic hypoxia (< 2 mg O_2 L^{-1}), along with elevated water temperatures are likely to be exacerbated as climate change progresses. Recent studies by our group have demonstrated for the first time that hypoxia disrupts fish sex differentiation, leading to a male-biased sex ratio in the zebrafish and Japanese medaka. Coincidentally, in many fish species exposure to elevated water temperature also leads to male-biased sex ratios. Under climate change, increased frequency of hypoxic episodes and warmer waters are likely to intensify such sex change events. Such shifts in the operational sex ratio are likely to have dire consequences for reproduction and recruitment of fish assemblages inhabiting small lentic waterbodies, potentially leading to losses in biodiversity and fisheries productivity. Despite this emerging threat, the question of how hypoxia and elevated temperature interactively alter fish sex differentiation and hence sex ratios remains unexplored.

One of the mechanisms known to disrupt sex differentiation is interference with sex hormone synthesis. Recent findings in our lab suggest that the inhibition of estrogen synthesis might be a crucial cause of hypoxia-induced masculinisation (the development of male sexual characteristics in a genotypic female). Curiously, inhibition of estrogen synthesis has also been widely observed in masculinised fish as a result of heat treatment, indicating both hypoxia and elevated temperature may share common mechanisms of action on sex differentiation.

Ovarian aromatase (*cyp19a*) is the steroidogenic enzyme that converts androgens to estrogens. Decreases in *cyp19a* gene expression can be a major cause of reduced estrogen synthesis under hypoxic and heat conditions, however, the mechanism underlying this gene suppression remains elusive. The transcription factor hypoxia inducible factor-1 (HIF-1) is the master regulator of a broad range of genes responsible for oxygen homeostasis. Intriguingly, HIF-1-mediated gene expression is upregulated not only by hypoxia but also high temperature, implying its critical role in adaptive responses to both stresses (including repression of energy-consuming reproductive processes). As suggested by a recent study using mammalian cancer cells, a possible mechanism of how HIF-1 suppresses *cyp19a* gene expression could be via depletion of the estrogen receptor (ER), a key transcriptional activator of *cyp19a*, although this possibility has not been tested *in vivo* or in fish thus far. Through understanding the responses and effects of hypoxia-and heat-induced HIF-1 on *cyp19a* gene expression and estrogen synthesis, this study will establish a novel molecular link between climate change and altered sex ratio in fish populations.

水體缺氧（溶解氧濃度低於每升2毫克）及水温上升的情況很可能因氣候變化行進而加劇。本小組最近的研究已經首次證明，在斑馬魚和日本青鱂魚中，缺氧狀況會破壞魚類的性別分化,導致雄性偏向性比。巧合地，許多魚類品種在暴露於高溫水後，也會出現雄性偏向的性別比率。在氣候變化之下，水域缺氧 狀況次數的增多和水溫提升可能加劇性別改變事件。這種性別比例變化很可能對魚類繁殖和聚居於小型靜水生態系統中的魚類群落造成可怕的後果，可能損 害生物多樣性和漁業生產力。儘管這些問題日趨嚴重，但缺氧和高溫如何交互改變魚類性別分化及性別比例這個問題仍未可知。

干擾性激素合成是一個眾所周知會破壞性別分化的機制。本實驗室最近的研究結果表明，抑制雌激素合成可能是導致缺氧引起的雄性化（基因型雌性發育出 男性性徵）的一個重要原因。同時，雄性化魚類受熱後出現雌

激素合成抑制的情況也普遍存在，說明了缺氧和高溫可能在影響性別分化上共用相同的作用機制。
卵巢芳香化酶（*cyp19a*）是轉化雄激素為雌激素的類固醇合成酶。*cyp19a*基因表達水平下降可能是導致在缺氧和受熱情況下雌激素合成降低的一個重要原因。可是，有關該基因受抑制的機制仍不清楚。轉錄因子低氧誘導因子-1（HIF-1）是大量維持氧穩定基因的的主調節器。有趣的是，HIF-1α介導的基因表達水平上升不僅受缺氧狀況，同時亦因高溫影響，這意味著它對適應這兩種環境壓力有關鍵作用（包括抑制耗能的生殖過程）。最近一項使用哺乳動物癌細胞的研究中提出，HIF-1 抑制 *cyp19a* 基因表達的可能機制是由於雌激素受體（ER）*cyp19a* 的一個關鍵轉錄激活因子）的消耗。可是，這個可能性從未在活體或魚類上作測試。通過了解 *cyp19a* 基因表達和雌激素合成如何受缺氧和受熱誘導的 HIF-1 影響，本研究將對氣候變化和魚類種群間性別比改變建立一個新的分子橋樑。

SCRF

Research Output

*Papers with the SKLMP as one of the affiliations*以*SKLMP*為作者單位之一的期刊

1 Nusrin, S., Tong, K.H., Chaturvedi, G., Wu, R.S.S., Giesy, J.P., Kong, R.Y.C. (2014)
Regulation of CYP11B1 and CYP11B2 steroidogenic genes by hypoxia-inducible miR-10b in H295R cells.
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Evidence for microRNA-mediated regulation of steroidogene-sis by hypoxia. *Environmental Science & Technology, 49(2):1138-1147.*

Nov 2011 – Oct 2014 (Completed)

ESTABLISHING THE GREEN LIPPED MUSSEL *PERNA VIRIDIS* AS A UNIVERSAL MARINE MODEL ORGANISM AND POLLUTION BIOMONITOR FOR ECOTOXICOLOGY AND ENVIRONMENTAL GENOMICS

翡翠貽貝（*PERNA VIRIDIS*）作為海洋生態毒理學和環境基因組學的通用模式生物以及相關污染物生物指示種的研究

Kenneth M.Y. LEUNG, Paul K.S. LAM, Leo L. CHAN, Chris K.C. WONG, J.W. QIU

Funding Amount : HK$900,000

SCRE

The green-lipped mussel *Perna viridis* is widely used as a sentinel species in marine pollution monitoring and ecotoxicological studies in Asia-Pacific region. This species is considered as a tropical/subtropical equivalent biomonitor of the temperate Mytilus species. In order to elucidate pollutant effects on this common biomonitor species and provide early warning signals of pollutant-mediated stresses, it is prerequisite and essential to understand the toxic mechanisms at molecular level and identify a suite of reliable exposure- and effect-related biomarkers for diagnostic purpose. Global analyses of the expression levels of genes and their products (i.e., RNA and proteins) are increasingly employed in marine model organisms (e.g., copepods, medaka fi sh, and mussels Mytilus species) to achieve such goals. Despite the important role of *P. viridis* in environmental and toxicological studies, its genomic resources are currently extremely limited when compared with their temperate counterparts, Mytilus species. Such an obstacle has significantly hindered the further development of *P. viridis* as a universal model species for ecotoxicological, genomic and proteomic studies. Therefore, this study aims to fi rst establish a comprehensive and representative putative transcriptome database for *P. viridis* using the next generation sequencing technology. With the help of bioinformatics, the outcomes of this study will significantly improve our genomic knowledge of *P. viridis*. The analysis will cover three main organs, i.e., hepatopancreas, adductor muscle and gill, which are commonly used in biomonitoring. The established tissue-specific transcript databases will provide a novel and important "back-bone" resource for genome-wide association studies of *P. viridis* which will enable us to uncover the toxic mechanisms, establish concentration-dependent biomarker responses, and develop advanced pollution monitoring tools. Secondly this study aims to address the molecular toxic mechanisms of selected trace metals (e.g. cadmium and copper), persistent organic pollutants (e.g. triphenyltin and PBDE) and nano-particles (e.g. nano metal oxides and carbon nanotubes) in *P. viridis* upon waterborne and/or dietary exposure. The results of this study will also help us to underpin the toxic response pathways for various groups of pollutants, from which we will identify a suite of reliable biomarkers for further development of gene-based biosensors and ELISA-based protein-arrays. These advanced diagnostic tools can be used to provide rapid effect-based biomonitoring of marine pollution and screening for new chemicals in the near future. Given the popularity and increasing importance of *P. viridis*, this work will make significant visible impact and contribution to the advancement of marine pollution research in the region.

翡翠貽貝（*Perna viridis*）是一種在亞太地區被廣泛應用於檢測海洋環境污染的指示生物。牠的地位與溫帶的貽貝(Mytilus物種)看齊，是熱帶及亞熱帶地區內等效的生物檢測物種。為了更好的闡述污染物對該指示種的毒性響應機制以便找出早期預警信號，我們有必要對其在污染物暴露時所產生的分子毒理機制及相關物標記進行研究。近年來，基因序列及其表達產物（如核糖核酸和蛋白質）已被廣泛應用於海洋生物指示種（如橈足類，青鱗和貽貝）的相關毒理研究。雖然翡翠貽貝在環境科學和環境毒理學領域中處於非常重要的地位，但是牠與溫帶的貽貝 (Mytilus物種) 相比，牠的基因信息資源卻相當匱乏，這也大大阻礙了其作為生態毒理學、基因組學和蛋白質組學模式生物的建立。因此，本研究首先利用"下一代"基因測序技術（next generation sequencing）建立一個翡翠貽貝的轉錄組數據庫。通過借助於生物信息學手段，測序所得結果將會顯著地增加我們對翡翠貽貝的基因組序列的了解。本研究中採用三種常被用來作為生物監測的器官（即肝胰臟、內收肌和腮）進行轉基因組序列分析。這些器官特異的轉錄組數據將會為我們進一步研究翡翠貽貝基因相關的毒性響應機制提供重要的資源基礎；例如，毒理機制的分析，濃度相關的生物標記的建立以及更高級別的污染檢測工具的開發等。

其次，本研究項目亦致力於翡翠貽貝對相關污染物如重金屬（如鎘和銅），持續性有機污染物（如三苯基錫和多溴二苯醚）以及納米顆粒物（如納米金屬氧化物和碳納米管）通過水性暴露或食物暴露時的分子毒理學機制進行研究和分析。研究結果會幫助我們了解分析不同污染物所產生的特異性的毒性反應途徑，進而識別出更加可靠的生物標記，以便進一步建立以基因為基礎的生物監測指標和以酶聯免疫吸附試驗為基礎的蛋白質陣列。這些診斷工具亦可應用於快速而有效的海洋污染物的生物監測以及新化學物質的篩選。鑑於翡翠貽貝在海洋領域的重要生物位置，本研究結果不單將會對海洋污染物研究和發展提供重要的參考價值，並且促進亞太地區的海洋環境檢測方面的技術和相關的科研。

Research Output

Papers with the SKLMP as one of the affiliations以SKLMP為作者單位之一的期刊

1 Bao, V.W.W., Leung, K.M.Y., Lui, G.C.S., Lam, M.H.W. (2012)
Acute and chronic toxicities of Irgaol alone and in combination with copper to the marine copepod *Tigriopus japonicus*.
Chemosphere, 90(3):1140-1148.

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Marine Pollution Bulletin, 85:254-260.

7 Bao, V.W.W., Leung, K.M.Y., Lui, G.C.S., Lam, M.H.W. (2012)
Acute and chronic toxicities of Irgaol alone and in combination with copper to the marine copepod *Tigriopus japonicus*.
Chemosphere, 90(3):1140-1148.

Jan 2012 – Dec 2014 (Completed)

SOURCES AND BIOACCUMULATION OF MERCURY AND CADMIUM IN THE PEARL RIVER ESTUARY (PRE) AND HONG KONG COASTAL WATERS
珠江河口和香港沿海水域汞、鎘的來源和生物富集

X. D. LI, W. X. WANG

Funding Amount : HK$900,000

Toxic metals are among the major contaminants in marine ecosystems. Metal contamination has become a major environmental problem in many parts of the world. In the Pearl River Estuary (PRE) and Hong Kong coastal water, two metals are of major concern in the marine environments, namely mercury and cadmium. It is well known that mercury (especially its organic form: methylmercury) is biomagnified at the top of marine food chains (such as in marine fi sh). Recent evidence has also shown that cadmium can be biomagnified in marine benthic food chains (e.g., intertidal rocky shores). The biomagnification of these two metals in predatory marine fish and gastropods can present significant health risks to human through seafood consumption in Hong Kong and the South China co astal regions. Although metal pollution has been recognized in Hong Kong for several decades, the understanding of the biological and environmental behaviors of mercury and cadmium still remains very poor. The mechanisms on how different marine organisms handle metals and how such handling affects metal toxicity are extremely challenging research topics. Such complexity is further augmented by the very complicated but unique hydrographic conditions in the subtropical Pearl River Estuary and Hong Kong coastal waters. This proposed research project will aim to study (1) the sources and geochemical behavior of mercury and cadmium in the PRE and Hong Kong waters; (2) the biological fates and food web dynamics of mercury and cadmium in the subtropical region; and (3) the bioaccumulation of mercury and cadmium in the top predators of these food chains under different hydrographical conditions/exposure histories, and the assessment of seafood safety issues in the study area. The proposed research will increase our understanding of mercury and cadmium pollution in coastal environments, and will provide scientific advice to regulatory agencies and industries for better management of toxic metals in the marine environment.

有害重金屬是海洋生態系統中的主要污染物。 金屬污染已成為很多地方主要的環境問題，在珠江河口和香港沿海水域，汞和鎘這兩種金屬值得廣泛關注。 眾所周知，海洋食物鏈頂端（如海洋魚類）會對汞（特別是它的有機形態：甲基汞）產生生物放大作用。 最近有證據顯示，鎘在海洋底棲食物鏈也有生物放大作用（如潮間岸）。 這兩種金屬在魚類和腹足動物的生物放大作用，會通過水產品的食用而對人類產生重大健康風險。儘管幾十年來，香港金屬污染的情況已被普遍認識，但對汞、鎘的生物化學過程和環境行為的認識仍然非常有限。 關於海洋生物如何處理不同的金屬污染物以及金屬毒性機制的研究具有非常重要的意義。 由於珠江河口和香港沿海複雜而獨特的亞熱帶水文條件，使得研究變得更具有挑戰性。本研究課題主要集中在：(1)汞和鎘在珠江河口和香港水域的來源和環境地球化學行為；(2)汞和鎘在亞熱帶河口地區的生物傳遞及環境效應; 和(3)汞和鎘在不同水文條件/暴露途徑下在食物鏈的生物累積效應，以及水產品食物安全問題的評估。本研究課題將提高對沿海環境汞、鎘污染問題的認識，並將向監管機構和有關行業提供科學的建議，以更好促進的海洋環境保護和管理。

Research Output

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1 Liu, F.J., Wang, W.X. (2013)
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Environmental Science & Technology, 46:1670-1677.

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3 Chen, B.W., Liang, X.M., Xu, W.H., Huang, X.P., Li, X.D. (2012)
The changes in trace metal contamination over the last decade in surface sediments of the Pearl River Estuary, south China.
Science of the Total Environment, 439:141-149.

4 Yin, R.S., Feng, X.B., Chen, B.W., Zhang, J.J., Wang, X.W., Li, X.D. (2015)
Identifying the sources and processes of mercury in subtropical estuarine and ocean sediments using Hg isotopic composition.
Environmental Science & Technology.

Nov 2011 – Oct 2014 (Completed)

ASSESSING THE IMPACTS OF ORGANIC AND METAL POLLUTION ON SYMBIOTIC MICROBIAL COMMUNITIES IN MARINE CORALS AND SPONGES BY METAGENOMICS AND TRANSCRIPTOMICS APPROACHES
利用宏基因組和宏轉錄組技術評估有機物污染和重金屬污染對海綿和珊瑚的共生微生物群落的影響

P. Y. QIAN, W.X. Wang, Rudolf S.S.WU, J.W. Qiu, O.O. Lee, Jill M.Y. Chiu

Funding Amount : HK$900,000

Polybrominated diphenyl ethers (PBDEs) have been widely used as flame retardants since the 1970s and become ubiquitous in the environment nowadays. In the present study, we examined whether PBDEs could alter the bacterial communities inhabiting the marine sponge and alter their response to environmental stress. Our results showed that the bacterial community structure shifted from a *Proteobacteria*-dominated to a *Firmicutes*-dominated community in response to PBDE-47 at a time- and concentration–dependent manner. Exposure to a higher level of PBDE-47 caused a decrease in the autotrophic *Chromatiaceae* (potentially symbiotic) but an enrichment for the Clostridium and other heterotrophic bacteria. A metagenomic comparison indicated that functional genes of two bacterial DNA repair systems (UvrABC and RecBCD) were significantly enriched by PBDE-47, which may be responsible for the repair of DNA adducts and strand breaks caused by PBDE-47. Genes responsible for bacterial spore formation and flagellar motility were also enriched, likely serving as a defense mechanism against the cytotoxicity of PBDE-47. Functional comparisons showed that functional genes involved in multidrug efflux pump, chemotaxis signal transduction, carbohydrate hydrolysis and ABC transporter for nutrient uptake were also significantly enriched by the treatment. Our results suggest that PBDE-47 confers a selection pressure on bacterial communities with multiple strategies to defend against the perturbation of PBDE-47.

Copper has been one of the major heavy metal pollutants in the marine environment. Effect of copper on symbiotic microbial community in sponge, and the subsequent defense mechanism of microbial community are largely unknown. Our treatment experiment and analysis on the copper treated sponges and the controls showed that copper treatment has shift the bacterial community which is dominated by a sulfur oxidizing bacterium (SOB) to a heterotrophic community dominated by *Fulvitalea*, *Clostridium*, *Roseobacter* and genera from *Flavobacteria*. The functional analysis indicated that the copper treatment has significantly enriched the microbial functions of membrane transport, motility and chemotaxis, and virulence. Overall, the copper treatment transferred the symbiotic microbial community to a copper-enduring community with virulence.

Marine sponges are the most primitive metazoan and form close association with sponge-specific symbiotic microbial communities. Sulfur cycling driven by sulfur reducing bacteria (SRB) and sulfur oxidizing bacteria (SOB) plays essential role in many sponges. However, the detailed bacterial characteristics and physiology of SRB or SOB are largely unknown. Here we present the first nearly complete genome of symbiotic SOB of sponge by the method of metagenomic binning. Usage of ancient polyphosphate glucokinase, and lack of transposase suggest that the symbiotic relationship had been established between the SOB and sponge for a long time. The symbiotic life mode of the SOB was supported by the richness of ankyrin repeats in proteins which help the bacterium escape from digestion of host. The complete set of the genes involved in sulfur oxidizing is supposed to protect the host from intoxication. Remarkable lack of virulence compared to the free living counterparts probably also contributed to the symbiosis between the bacterium and the host. Interestingly, however, the bacterium is greedy. It developed versatility in uptake and metabolism of carbohydrates (saccharides utilization, aromatic compound degradation, amino acid uptake and so on) for heterotrophic life, compared to the reference SOB. The capability of both autotrophic and heterotrophic metabolism has contributed to robust competitiveness of the bacterium which has become the most dominant species in the microbial community of the sponge.

19世紀70年代以來，多溴聯苯醚（PBDEs）被廣泛的用作阻燃劑並且在環境中積累。在此項研究中，我們研究PBDEs對海綿中細菌群落的影響和它們（細菌群落）對環境脅迫的反應。結果表明PBDE-47能將變形菌門為主的細菌群落轉變成硬壁菌門為主的細菌群落，並且它的影響與處理時間和濃度相關。高濃度的PBDE-47處理能降低自養的著色菌科細菌（潛在共生細菌）的含量，而增加梭菌屬和其它異養的細菌的含量。宏基因組比較分析顯示PBDE-47處理能顯著富集DNA修復系統（UvrABC and RecBCD）相關的功能基因，而這些基因可能與PBDE-47造成的DNA損傷的修復相關。芽孢形成和鞭毛運動相關的基因也增加了，可能與防禦PBDE-47的細胞毒性相關。另外，藥物清除, 化學信號傳遞, 碳水化合物水解和養分跨膜運輸相關的基因也被顯著富集了，這些功能可能與細菌群落抵禦PBDE-47毒性的多重策略有關。

金屬銅已經成為海洋環境裡重金屬污染的主要成分，但是銅對海綿裡微生物群落的影響，以及它們的防禦性機制仍然未研究清楚。我們的銅處理實驗及分析表明，銅可以將自養的硫氧化細菌（也即前面所提到的著色菌科細菌）為主的細菌群落轉變為異養的*Fulvitalea*, *Clostridium*, *Roseobacter* 和*Flavobacteria* 為主的細菌群落。功能分析顯示，細胞膜運輸，細胞運動和化感，還有毒力相關的功能基因被顯著富集了。整體上看，海綿共生的微生物群落被轉變成耐銅的具有致病性的微生物群落。

海綿是最原始的後生動物，並且與海綿特異性的共生微生物群落密切相關。硫還原和硫氧化細菌參與的硫循環在海綿體內發揮重要作用。然而，這些細菌的具體生理特徵尚未研究清楚。我們首次分析一個幾乎完整的海綿體內共生的硫氧化細菌基因組（利用以上兩個宏基因組資料）。這個硫氧化細菌具有相似的共同祖先。它在糖酵解代謝中使用 polyphosphate glucokinase，而這個酶以古老的磷酸來源 polyphosphate 為唯一底物。轉座基因在它的基因組中幾乎缺失。以上結果表明這個細菌在很久以前同海綿形成共生關係，並可能與古老的海綿共同進化。這個細菌特異性出現在海綿體內，並且具備硫氧化的能力（可以保護宿主海綿免受硫化物毒性），而且它的基因組中具有豐富的共生相關蛋白（(ankyrin repeats protein, 使細菌免受宿主海綿消化），這些證據表明這個細菌是海綿中的共生菌。另外，與親緣關係最近的自由生活的細菌相比，它的基因組中毒力基因大幅度被刪減，可能與共生關係形成有關。更有趣的是，這個細菌除了在海綿體內合適的環境中自養生存以外，與近緣細菌相比，它還具備異養生活的能力：具有吸收並利用環境中各類碳水化合物（糖類，氨基酸，肽類，芳香族化合物）的功能基因。這種自養和異養兼備的生活方式使得這個細菌具有較強的競爭力，從而成為海綿微生物群落中的主要的細菌。

Research Output

*Papers with the SKLMP as one of the affiliations*以*SKLMP*為作者單位之一的期刊

1 Tian, R.M., Qian, P.Y. et al. (2015)
Effect of polybrominated diphenyl ether (PBDE) treatment on the composition and function of the bacterial community in the sponge *Haliclona cymaeformis*.
Frontiers in Microbiology (Accepted)

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2 Tian, R.M., Qian, P.Y. et al. (2014)
Effect of copper treatment on the composition and function of the bacterial community in the sponge *Haliclona cymaeformis*.
mBio, 5(6):e01980-14.

3 Tian, R.M., Qian, P.Y. et al. (2014)
Genomic analysis reveals versatile heterotrophic capacity of a potentially symbiotic sulfur-oxidizing bacterium in sponge.
Environmental microbiology, 16(11):3548-3561.

Apr 2014 – Mar 2017 (Ongoing)

IDENTIFICATION AND ASSESSMENT OF EMERGING PERSISTENT ORGANIC POLLUTANTS (POPs) IN HONG KONG CORAL COMMUNITIES
香港的珊瑚群落中新興持久性有機污染物（POPs）的評估

P.O. ANG, James C.W. LAM

Funding Amount : HK$900,000

Over the past decades, coral communities have become some the most threatened ecosystems in the world. Degradation of coral communities can be associated with a wide range of environmental stressors such as global climate change, pollution, increased sedimentation, overfishing, eutrophication and coral disease. Studies have indicated the adverse effects of environmental contaminants to the coral species. These contaminants may significantly cause the decline of coral communities worldwide. While the presence of major contaminants like heavy metals in corals has been well studied, the presence of persistent organic pollutants (POPs) and their possible effects on corals are less understood. Hong Kong is located at the mouth of the Pearl River Delta (PRD) which has experienced a rapid rate of development over the past decades. Fast economic development, along with the large number of manufacturing industries in the area, makes the PRD a potentially significant source of various new and emerging toxic chemicals such as halogenated fl ame retardants (HFRs) and perfluoralkyl substances (PFASs). Recently, several groups of POPs including polybrominated diphenyl ethers (PBDEs) and perfluorooctanesulfonate (PFOS) have been identified in various environmental matrices and even detected in the local wildlife. Most importantly, increasing trends of these persistent pollutants were found in the blubber of local cetaceans and coastal waters. In addition to PBDEs and PFOS, some of their replacements have also been detected in the local environmental samples such as sediment and seawater. However, there is no such information on the current status of these toxic and recalcitrant contaminants in the local coral communities. In view of the importance of Hong Kong as a possible refuge for corals and coral communities under the projected increase in sea surface water temperature as a consequence of global warming, it is important to elucidate the distribution pattern of these emerging POPs and the newly identified HFRs and PFASs in the local coastal environment, especially among the corals across a possible pollution gradient from west to east of Hong Kong. The present study therefore examines the occurrence and spatial variations of these traditional and new HFRs and PFASs in the local coral communities as well as the different life history stages of selected coral species along this gradient. To the best of our knowledge, there are no studies, to date, that consider the exposure sources of emerging HFRs and PFASs associated with coral communities.

過去幾十年，珊瑚群落因不同的環境壓力（如全球氣候變化、污染排放、沉積增加、過度捕撈、水體富營養化、珊瑚疾病）不斷退化，成為世界上最瀕危的生態系統之一。研究表明環境污染物對珊瑚物種產生不利影響，會造成世界範圍內珊瑚群落的衰退。目前，珊瑚體內重金屬的污染研究已較為成熟，但持久性有機污染物（POPs）研究相對較少，且其對珊瑚的可能影響認識尚淺。香港位於高速發展的珠江三角洲河口地區。經濟的快速發展與大批製造業的創立使珠江三角洲成為各新興有毒化學物質，如鹵系阻燃劑（HFRs）和全氟化合物（PFASs）的重要潛在污染源。近期研究已證實該地區環境介質和野生動物體內存在包括多溴聯苯醚（PBDEs）和全氟辛烷磺酸（PFOS）在內的幾組持久性有機污染物，其濃度在當地鯨豚類鯨脂和沿岸水體中有上升的趨勢。除此之外，PBDEs和PFOS替代物在環境樣品（如沉積物和海水）中亦有檢出。然而，該類有毒/持久性污染物在珊瑚群落中的現狀卻無相關資訊。香港作為全球變暖導致表層水溫上升背景下珊瑚及其群落的可能避難所，在珊瑚保護中扮演著重要作用，闡明當地沿海環境，特別是橫跨香港東西污染梯度的珊瑚群落中，這些新興持久性有機污染物及新發現的HFRs和PFASs的分佈特徵具有重大意義。況且，迄今為止人們尚未考慮過HFRs和PFASs暴露源與珊瑚群落衰退的關係。因此，本研究探討這些傳統與新興HFRs和PFASs在當地珊瑚群落中的存在、空間變化及其在特定珊瑚物種不同生命階段中的演變和影響。

Apr 2014 – Mar 2017 (Ongoing)

TRANSGENERATIONAL EFFECTS OF HYPOXIA IN FISH AND UNDERLYING MECHANISMS

缺氧對魚類的跨代影響及其內在機制

Richard Y.C. KONG, Chris K.C. WONG, Jill M.Y. CHIU, Doris W.T. AU, Rudolf S.S. WU

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Globally, hypoxia is one of the most widespread and pressing problem in aquatic environments. More than 400 "Dead Zones" have been identified by the United Nations around the world, including two out of the three major estuaries in China (the Pearl River and Yangtze River estuaries). Extensive studies have shown that hypoxia causes major changes in community structure as well as declines in species diversity and fi shery production over large areas. These changes have led to severe economic and habitat losses, both in Hong Kong and worldwide. Our earlier studies revealed, for the fi rst time, that hypoxia is an endocrine disruptor as well as a teratogen, causing reproductive dysfunction, deformities and a male-biased Fl generation in fi sh. In mammals, recent studies have revealed that some endocrine-disrupting chemicals (EDCs) can cause adverse effects in offspring (including decreased reproductive capacity, defornities and infertility) through epigenetic alterations (including DNA methylation, histone modification and microRNA regulation) without any change in the DNA sequence, despite the offspring never being exposed to EDCs. A recent mammalian study further provided evidence that the exposure of parents to hypoxia can result in sexual retardation, mortality, abnormal development and behavioural changes in the second generation. Whether hypoxia alters epigenetic regulation and causes adverse transgenerational effects in fi sh remains unknown. Also, whether or not the altered epigenome may be restored to the original state, and how long this takes remain unknown. This novel proposal aims to provide answers to these two important questions. Clearly, the risk posed by hypoxia on the sustainability of natural populations might have been grossly underestimated should transgenerational effects occur and persist.

在全球範圍內，缺氧是水環境中最普遍和迫切的問題之一。全球已有400多個水體被聯合國確定為"死區"，其中包括中國三大河口中的兩個（珠江和長江河口）。大量的研究表明，缺氧導致大面積的種群結構嚴重變化，物種多樣性和漁業產量下降。這些變化在香港及世界各地都造成了嚴重的經濟和棲息地的損失。我們先前的研究首次揭示了缺氧是內分泌幹擾物及致畸物，它會引起生殖功能障礙，畸形和F1代魚的雄性偏向性。在哺乳動物中，最近的研究表明，即便其後代從未暴露於內分泌幹擾物，某些內分泌幹擾物仍會通過改變表觀遺傳性狀（包括DNA甲基化，組蛋白修飾和微小RNA調節）對其後代產生不利的影響（包括降低生殖能力， 畸形和不育）而不需要改變任何的DNA序列。最近的一項哺乳動物研究進一步證實，父母暴露於缺氧環境可導致子代性發育遲緩，發育和行為異常，甚至死亡。缺氧是否改變了表觀遺傳調控，從而導致對魚類的不利影響發生跨代效應仍是未知。此外，已改變的表觀遺傳特性是否可以恢復到原來的狀態，需要多久才能恢復這也仍是未知的。該創新性研究計劃以解決這兩個重要問題為目標。顯然，缺氧造成的跨代效應的發生和持續給自然種群的可持續性發展帶來的風險可能被嚴重低估。

Apr 2014 – Mar 2017 (Ongoing)

INVESTIGATION OF COUPLIED CIRCULATION AND ECOSYSTEM PROCESS IN MIRS BAY-TOLO HARBOUR (HONG KONG) DURING SUMMER TIME
香港大鵬灣-吐露港夏天海流-生態耦合系統過程的研究

J.P. GAN, Paul K.S. LAM, Leo L. CHAN, H.B. LIU, Robert K.Y. CHAN, P.O. ANG

Funding Amount : HK$1,500,000

In 1998, Hong Kong suffered a devastating red tide attack that resulted in the worst loss of fi sh culture zone and damage of marine environment. The red tide was neither originated from the nutrient rich but likely light-limited Pearl River waters in the western part of Hong Kong waters, nor from offshore surface waters. The origin of the red tide was from Mirs Bay, which is located in the eastern part of Hong Kong Island and occupies about 50% of total sea area of Hong Kong. More than 10 years after the episode, the source of available nutrient that formed the red tide remains unclear. Lack of understanding about the role of the eastern part of Hong Kong waters has hindered us from obtaining holistic understanding on marine environment of the entire Hong Kong as well as solving the 1998 puzzle. With a deep central channel, unique shelf and coastline topography in the adjacent coastal waters, Mirs Bay is closely linked with the intrusions of nutrient rich deep waters from adjacent shelf, as a result of amplified cross-isobath shoreward transport at the lee of Hong Kong Island during southwesterly monsoon and from the Tolo Harbor to the north. Based on evidences derived from HKW and from the other parts of the world's oceans, it is hypothesized that: (H1) circulation and biogeochemical substance transports are largely controlled by the shelf-bay circulation associated with wind and tidally forced hydrodynamic response to the unique topography in Mirs Bay and (H2) the nutrient enrichments from adjacent shelf and from the inland harbor lead to an enhanced biological production in the bay. Study of this coupled harbor-bay-shelf circulation is crucial to scientifically understand the interactive dynamics in a harbor-bay-shelf system, and to complete the picture for the oceanic circulation and associated biogeochemical condition in Hong Kong waters. We propose to conduct fi eld measurements, laboratory analysis and coupled physical-ecosystem numerical modeling to investigate hypotheses H1 and H2. Ultimate goal of the project is to identify the process and mechanism that the eastern part of Hong Kong waters play on the water ecosystem in the entire Hong Kong waters.

在 1998 年，香港遭受了一次毀滅性的赤潮爆發，導致了有史以來最嚴重的水產養殖業和海洋生態環境災害。該赤潮既不是由香港西側高濁度富營養鹽的珠江沖淡水引致，也不是來源于外海表層水，該赤潮起源于香港東部占香港水域總面積約 50%的大鵬灣。直到十幾年后的今天，我們對支持該赤潮發生所需營養鹽的來源仍未了解。對香港東部水體的認識不足嚴重阻礙了我們對香港海洋環境的系統全盤理解乃至解開上述 1998 年赤潮發生之謎。大鵬灣具有非常深的中央水道和獨特的鄰近陸架及海岸線地形，當西南季風盛行時，香港島北面以及吐露港北向的跨等深線向陸架流得到增強，因此，高營養鹽深層水的入侵將對大鵬灣的水環境具有非常的重要影響。根據從香港水域以及全世界其他部分的近岸水域得到的證據，我們提出以下兩點假設：（假設 1）大鵬灣內的環流和生物地球化學物質輸運主要受控于陸架-海灣環流和灣內獨特地形下風及潮汐驅動的水動力學響應；（假設 2）來自鄰近陸架和內陸港口的營養鹽富集是導致大鵬灣內生物生產力提升的主要原因。對上述港口-海灣-陸架體系環流的耦合研究對科學理解該體系內的交互動力學機制乃至全面認識香港水域的海洋環流和生物地球化學狀況至關重要。為驗證及研究上述科學假設，我們建議開展相關的現場觀測、實驗室分析和耦合物理-生態系統數值模型研究。該項目的終極目標是準確掌握香港東部水體在香港整體海域生態系統中扮演的角色及相應的過程和機制。

Apr 2014 – Mar 2017 (Ongoing)

DEVELOPMENT OF ELECTROCHEMICAL SENSING PLATFORM BASED ON AUNPS MODIFIED TiO_2 NANOTUBES FOR DETECTION OF EMERGING CHEMICALS OF CONCERN AND PHARMACEUTICAL RESIDUES
開發基於金納米粒子修飾的二氧化鈦納米管的電化學傳感平台用於環境污染物的檢測

Michael M.S. YANG, R.S.S. WU, Paul K.S. LAM, Michael H.W. LAM, Leo L. CHAN

Funding Amount : HK$900,000

SCRF

The current methods for the determination of environment pollution involve time-consuming detection processes and complex pre-treatment steps, which are not suitable for in-situ monitoring of samples and rapid processing of multiple samples.

Electrochemical sensors are expected to play an increasing role in environmental monitoring. Significant technological advances facilitate the environmental applications of electrochemical devices. They are inherently sensitive and selective towards electroactive species, fast and accurate, compact, portable and inexpensive. However, many current used electrodes are prone to surface fouling and passivation by radical intermediates or polymerization products generated by the electrochemical reactions between the analytes and electrode surface, which can lead to significant signal attenuation as well as reduced sensitivity and selectivity over time.

Recently, a refreshable electrode composed of AuNPs modified carbon-doped TiO_2 nanotube arrays (C-doped TiO2-NTAs) was proposed and fabricated in our lab by quick annealing of the as-anodized TiO_2-NTAs in argon and electrodeposition. The electrode not only has excellent electrochemical activity, but also can be easily photocatalytically refreshed to maintain the high selectivity and sensitivity because they combine the merits of high electrocatalytic properties of AuNPs and photochemical properties of C-doped TiO_2-NTAs.

By taking these advantages, we plan to develop high-sensitivity and recyclable electrochemical sensing platforms for environment pollutants monitoring, e.g. emerging chemicals of concern (ECCs) (Alkylphenol, phenol, bis-phenol A, Benzo(a)pyrene, etc.), pharmaceutical residues (PRs) (sulfonamides, erythromycin, azithromycin, etc.) and microcystin. The outstanding and promising electrochemical analysis may have immense potential in high-sensitivity and high-selectivity sensor devices for environmental pollutants monitoring.

目前，檢測環境污染物的方法很多，但是大多方法都需要對樣品進行預處理，導致過程複雜，消耗大量的時間，因此不適合快速檢測和在線監測。

電化學檢測法，由於具有方法簡單、靈敏度和選擇性高、響應速度塊、成本低，設備簡便利於攜帶等優點已在環境監測等領域發揮重要作用。電極是電化學方法的核心，然而，現有的電極都面臨著一個重要污染問題，在電化學檢測過程中，由於被分析物會沉積到電極的表面，更有部分被分析物會電聚合到電極表面形成緻密的絕緣膜，導致電極的重現性、靈敏度和選擇性降低，大大縮短電極的壽命，浪費資源，增加成本。因此，開發可更新的電極/電化學傳感器具有深遠的研究意義和現實應用價值。

最近，本實驗室通過簡單的方法開發了一種具有光輔助自清潔的二氧化鈦納米管陣列(C-doped TiO_2-NTAs) 電極，通過電化學的方法將納米金顆粒可控修飾到二氧化鈦納米管陣列表面形成複合電極。該複合電極/電化學傳感器綜合了納米金顆粒優異電催化性能和二氧化鈦光清潔性能的優點，因此可以實現電極既具有良好電化學性能的同時，又可以保持電極不受污染，或在不損壞電極的情況下對電極進行光照清潔恢復到電極的初始狀態。

綜合該複合電極的優異性，本實驗室擬開發具有高靈敏度和可重複使用的電化學傳感器平台實現對環境污染物的在線監測。

Apr 2014 – Mar 2017 (Ongoing)

FUNCTIONAL RESPONSES OF MARINE ECOSYSTEM TO HYPOXIA
香港大鵬灣-吐露港夏天海流-生態耦合系統過程的研究

Rudolf S.S. WU, Nora N.F. TAM, Paul K.S. SHIN, S.G. CHEUNG, Doris W.T. AU, P.O. ANG, Jill M.Y. CHIU, Y. LIANG

Funding Amount : HK$2,000,000

The primary objective of environmental management is to maintain the sustainability of ecosystem services. Traditional approach widely adopted is to maintain biodiversity, based on the assumption that different species in the ecosystem perform different roles and functions, and decrease in biodiversity would impair ecosystem function and hence ecosystem services. Emerging evidence shows that this assumption may not necessarily be true, since the function of the species eliminated may be covered by other species performing the same function. Indeed, it has been shown that ecosystem function does not necessarily have a strong and direct dependence on species diversity. Thus, from an environmental management perspective, protecting ecosystem function would be much more important than protecting ecosystem structure, since the former is directly related, while the latter is only indirectly related, to ecosystem services. Nevertheless, the effects of pollution on ecological function of marine ecosystem remain virtually unknown.

Hypoxia poses a significant threat to marine ecosystem over very large areas worldwide. The problem of hypoxia is particularly pronounced in China, and two out of the three major estuaries have been designated as "Dead Zones" by the United Nations. In this proposal, both laboratory and field experiments are proposed to test the hypothesis that hypoxia will alter important ecological functions of microbial community (i.e. nutrient recycling, decomposition and aerobic/anaerobic activities) and benthic community (trophodynamics, functional groups, metabolism, secondary productivity, carbon sequestration and energy status), thereby affecting ecosystem services. This pioneer study will enable us to understand the functional roles of microbial and benthic species in marine ecosystem, and how these important functions may be affected by hypoxia. This completely novel research will also provide extremely useful information for marine environmental management, and enable us to build our core capability in this new area and capitalize the enormous funding opportunities presented to us in the coming years.

環境管理主要目標是維持生態系統服務的可持續性。廣泛採用的傳統方法是保持生物多樣性。假 設不同物種在生態系統中執行不同的角色和功能,生物多樣性的降低會影響到生態系統功能,進 而影響其服務。新證據表明,這種假設不一定正確,因為物種功能的喪失可以被其他物種所執行 的相同功能所替代。因此,從環境管理角度來看,生態系統功能保護遠比結構保護重要,因為前 者與生態系統服務直接相關,後者僅間接相關。然而,污染對海洋生態系統生態功能的影響依然 鮮為人知。目前全球大範圍內存在缺氧問題,對海洋生態系統造成了極大威脅,中國尤為嚴重, 三大河口區中的兩個已被聯合國劃定為"死亡區"。本研究將提出室內和野外實驗方法,檢驗這 樣的假設:缺氧將改變微生物群落重要生態功能(如養分循環、分解和有氧/厭氧活動)和底棲生 物群落重要生態功能(如營養動力學、官能團、代謝、次級生產力、固氮和能量狀態),進而影 響生態系統服務,其研究結果可以幫助我們理解微生物和底棲生物物種在海洋生態系統中的重要 功能作用及其如何受缺氧影響。此外,該項全新的研究還可為海洋環境管理提供極具價值的資訊, 使我們能夠在該領域建立核心競爭力,在未來幾年裡擁有大量的融資機會。

Summary of the Director Discretionary Fund (DDF) Projects
DDF項目概要

Oct 2013 – Oct 2014 (Completed)

PROJECT PSI-FI PARTICLE SPECIES IDENTIFICATION BY FLOW IMAGING USING LIGHT SHEET MICROSCOPE AND FLOW CYTOMETRY
使用光片顯微鏡 與流式細胞儀的流式成像對PSI-FI粒子進行物種鑑定

Robert K.Y. CHAN, Leo L. CHAN, Vicky J.J. WU, J.L. WU

Funding Amount: HK$100,000

DDF

The project involved the development of a new type of field instrument of imaging flow cytometer that can produce very sharply focused fluorescence images of all the phytoplankton particles flowing through a flow tube. The project is a successful one in that the flow rate achieved far exceeded our original goal reaching 30 ml/min. With an imaging speed of 100 frames per second, we can now obtain up to 300,000 particles per minute. This surpassed 2 orders of magnitude better than current technologies. The system is ideally suited to real-time measurement and enumeration of phytoplankton in the water. Using software, biomass communities can be determined and species identifications are possible. An area of interest is to use the instrument to look for HAB species to both study the biology of these particles as well as an early warning system for HABs.

本項目主要是開發一種新型可現場作業流式成像細胞儀，其功能是當浮游植物粒子通過流通池時，可以快速地生成對焦的熒光圖像。新研發設備的流量遠遠地超出我們預期的目標，可以達到30ml/min。其每秒100幀的成像速度使得我們每分鐘可以獲得高達30萬個浮游植物粒子的圖像，這要比現有的成像技術高出2個數量級。該系統非常適合於實時監測和統計水中的浮游植物。配合軟件分析便可確定水中的生物群落並進行物種鑑定。該設備可應用於識別引起赤潮的藻種，研究這些物種的生物學特性，並建立赤潮預警系統。

Jan 2015 – Dec 2015 (Ongoing)

DESIGN AND EVALUATION OF A FWM-LED LIGHT ENGINE WITH VISIBLE SPECTRUMS MODULATED FOR PHOTOBIOREACTORS (PBRs)
設計及評估具有可調控可見光波長的 LED 光學引擎的光生物反應器

S.C. SHEN, Y.M. CHEN

Funding Amount: HK$80,000

The thesis present a novel full wavelength modulation LED (FWM-LED) light engine to improve traditional photobioreactors(PBRs) of single wavelength. The FWM-LED light engine consists of RGBW LED light sources, coupling lens, and optical fi bers. The coupling lens is designed using symmetrical luminous intensity distribution curves, LIDC Mapping, which computing light distribution curve and light energy mapping. This LIDC mapping method can simplify our design into correspondent with the LIDC angles of light sources and target. It is for fiber coupling lens, which is increasing the efficiency of coupling between entrance of fi ber and RGBW light sources. In general, temperature could affect alga's growth either, so providing air condition system to helping heat-dissipating is needed. Therefore, this study design and fabricate the FWM-LED light engine in outdoors then light would pass throughout the coupling lens. The bendable fi ber could guide the light into the PBRs providing luminance. Experimentally observed the biomass of case using FWM-LED light engine are 166% higher than the case only providing white light. Therefore, the FWM-LED light engine can provide spectrums near to the ideal for microalgae to enhance the biomass increasing remarkably in a unit period cultivation.

本研究設計一種新型波長可調變的LED光學引擎，用來改善傳統光生物反應器 (photobioreactors, PBRs) 所使用的單一波長光源。此波長可調之光學引擎包含了R、G、B三原色及白光的LED光源、耦合透鏡和光纖。其中，耦合透鏡的設計是使用配光曲線映射法 (LIDC Mapping)。配光曲線映射法可以利用光源與目標面的配光曲線之間角度映射來簡化傳統設計透鏡所需的計算式。所設計出的耦合透鏡，可以用來增加光源和光纖入口之間的耦合效率。一般而言，由於微藻對於溫度變化很敏感，而光源產生出的熱能會影響微藻的生長，所以需要另外提供空調維持環境溫度。因此，本研究設計並製作出可擺放在室外的光波長可調變之光學引擎，利用耦合透鏡使光線聚集進入光導中，並藉由光導傳遞到光生物反應器(PBRs)來培養微藻。由實驗證實，在單位時間內，使用波長可調變LED光學引擎養殖，其微藻生物質量是使用LED白光組的1.66倍。因此，波長可調變LED光學引擎能提供任意微藻的理想光譜，使微藻在單位時間內的生物質量將能大幅增加。

Summary of the Open Science Research Fund (OSRF) Project
OSRF項目概要

Mar 2014 – Feb 2016 (Ongoing)

HEALTH RISK ASSESSMENTS OF RESIDENTS IN THE PEARL RIVER DELTA EXPOSED TO BROMINATED FLAME RETARDANTS (BFRs)
在珠江三角洲暴露於防火劑的健康風險評估

M. H. WONG, Y. B. MAN, Chris K. C. WONG, H. S. WANG, S. C. WU, James C. W. LAM, Paul K. S. LAM, Paul D. JONES, John P. GIESY

Funding Amount : HK$100,000

OSRF

The concentrations of polybrominated diphenyl ethers (PBDEs) and novel brominated flame retardants (nBFRs) such as methoxylated (MeO-) and hydroxylated (OH-) PBDEs in the environment and humans have been increasing in recent years all over the world. This is particularly the case in the Pearl River Delta (PRD), which is a global power house producing a large amount of electronic products. As important environmental endocrine disruptor chemicals, these organobrominated compounds have the potential to cause serious thyroid hormone disruption, neurotoxicity and adverse developmental effects in humans. However, our knowledge about the intakes, body accumulation and potential transgenerational exposures to these BFRs, especially nBFRs, is very limited. We hypothesize that (1) PBDEs and nBFRs could accumulate in human bodies via inhalation and food ingestion, especially fi sh consumption, and (2) The accumulated PBDEs and nBFRs in the maternal body can be biotransferred to the next generation via transplacental transport and breast feeding. The major objectives of the present proposal are to develop validated methods for the analysis of nBFRs, investigate their occurrences in foodstuffs, and human tissues and to evaluate the associated health risks. This proposed project comprises 5 parts: (1) Determination of average daily intakes of BFRs for residents in the PRD, via consumption offi sh and other food products available in the region; (2) Measuring the transfer of BFRs through the intestinal barrier using the Caco-2 cell line model, the transport of BFRs across human cultured alveolar A549 cell monolayers (3) Assessing human health risks of oganobromine compounds in human blood and breast milk samples, and the correlation of BFRs concentrations between daily intakes and human body burdens; (4) Determining transgenerational exposure of BFRs to newborns in the region via placental transfer and breast feeding; and (5) Reviewing the current issues and providing guidance concerning food consumption for local residents, especially for sensitive populations such as pregnant woman, women of childbearing age, and infants, with regards to BFRs.

近幾年全球環境及人體中的多溴聯苯醚（polybrominated diphenyl ethers，PBDEs）和新型溴系阻燃劑（novel brominated fl ame retardants，nBFRs）的濃度均有所上升，後者如甲基化（MeO-）和羥基化（OH-)的多溴聯苯醚。特別是在電子產品的世界級產區—珠江三角洲地區。這些有機溴化物是環境中主要的內分泌干擾物，能導致嚴重的甲狀腺激素分泌紊亂，神經性中毒，且不利於人體發育。然而，我們目前對這些BFRs在人體的攝入量，體內富集以及跨代傳遞等情況卻不甚瞭解，特別是nBFRs，目前瞭解非常有限。我們的研究作如下假設：（1）PBDEs和nBFRs可通過吸入和食物攝取在人體中積累，特別是通過魚類食品攝入；（2）孕婦體內積累的PBDEs和nBFRs可通過胎盤和哺乳傳遞。主要目的是為nBFRs分析，其在食品、人體組織中的存留情況研究，以及其相關的健康風險評估提供確切的資料。該提議研究包含5部分：（1）測定珠江三角洲地區居民通過魚類食品及當地的其它食品的日均BFRs攝入量；（2）通過Caco-2細胞株模型測定BFRs穿透腸黏膜屏障的傳遞情況；BFRs穿透肺泡A549細胞層的傳遞情況（3）通過人體血液及哺乳乳液樣品中的有機溴化物分析，評估其健康風險，以及BFRs濃度與日常攝入量、人體負荷的相關性；（4）測定當地新生兒通過胎盤及哺乳傳遞BFRs的情況；（5）回顧與BFRs相關的現有刊物，為當地居民，特別是孕婦、哺乳期婦女及嬰兒等敏感人群提供食品消費指導。

Research Output

Papers with the SKLMP as one of the affiliations以SKLMP為作者單位之一的期刊

1 Man, Y.B., Chow, K.L., Man, M., Lam, J.C.W., Lau, F.T.K., Fung, W.C., Wong, M.H. (2015)
Profiles and removal efficiency of polybrominaed diphenyl ethers by two different types of sewage treatment work in Hong Kong. *Science of the Total Environment, 505:261-268.*

2 Chen, Z.J., Liu, H.Y., Cheng, Z., Man, Y.B., Zhang, K.S., Wei, W., Du, J., Wong, M.H., Wang,H.S. (2015)
Polybrominated diphenyl ethers (PBDEs) in human samples of mother–newborn pairs in South China and their placental transfer characteristic. *Environment international, 73:77-84.*

Academic Meetings/Conferences 學術會議/講座

The Fourth Academic Committee Meeting of the State Key Laboratory in Marine Pollution

海洋污染國家重點實驗室第一屆學術委員會第四次會議成功召開

On 13th to 14th January 2014, the Fourth Academic Committee Meeting of the State Key Laboratory in Marine Pollution (SKLMP) was held at City University of Hong Kong. Ten Academic Committee members including Prof. Jilan Su, Dr. Don M. Anderson and Prof. Minhan Dai attended the meeting, together with 20 special guests from the US, Canada, Taiwan and mainland China, and about 100 delegates from SKLMP member laboratories and universities.

This meeting was divided into two sessions. The first part involved SKLMP research project reports and the second part included a presentation delivered by the SKLMP Director, together with the Academic Committee Meeting which evaluated the working progress of the SKLMP in 2013 and formulated the SKLMP development plan for 2014.

2014 年 1 月 13 至 14 日，海洋污染國家重點實驗室第一屆學術委員會第四次會議在香港城市大學成功召開。蘇紀蘭院士、Don M. Anderson 博士、戴民漢教授等 10 名學術委員、來自美國、加拿大、臺灣及中國大陸等 20 餘名海內外特邀嘉賓、各校主管領導及實驗室成員共約 100 人出席會議。

此次會議分兩大議程，第一部分為 SKLMP 研究項目報告，第二部分是實驗室主任匯報工作以及 SKLMP 第一屆學術委員會第四次會議，審議實驗 室 2013 年工作進展並規劃 2014 年年度工作重點。

Prof. Kwan Sing Lam, Director of the SKLMP, delivered a speech to welcome guests and expressed his sincere gratitude to them for their support of the establishment and development of the SKLMP. In the first session, SKLMP members (Prof. Shuk Han Cheng, Prof. Kwan Ngok Yu, Prof. Mei Yee Leung, Prof. Yuanpei Qian, Prof Ming Hung Wong, Prof. Xiangdong Li, Dr. Wai Ting Au, Dr. Lai Chan, Dr. Siu Gin Cheung and Dr. Margaret B. Murphy) presented their latest research developments to guests, followed by in-depth discussion in the meeting..

In the second session, Prof. Kwan Sing Lam delivered the SKLMP Director's report to the Academic Committee, covering the topics of research progress, laboratory platform formulation, funding utilization, cultivation of research talent, international communication and cooperation and public education.

The Academic Committee discussed and evaluated the development of the SKLMP in 2013, affirming the lab's achievement and suggesting that as a laboratory jointly established by six universities, the SKLMP should set clear development goals and deepen communication among the member universities on resource sharing and collaboration.

實驗室主任林群聲教授在會上致歡迎辭，對與會的專家學者表示了熱烈的歡迎,並對各位專家對重點實驗室的建設和發展給予的支持和幫助表示誠摯的感謝。與會期間鄭淑嫻教授、余君岳教授、梁美儀教授、錢培元教授、黃銘洪教授、李向東教授、歐慧婷博士、陳荔博士、張肇堅博士及 Margaret B. Murphy 博士等實驗室成員分別將各自研究領域的最新研究進展和成果向蒞會嘉賓作出報告，同時展開了熱烈的交流探討。

其後根據會議議程，林群聲教授向學術委員會就 SKLMP 2013 年的各項研究進展和成果、實驗室的平臺建設與經費、研究隊伍建設及人才培養、國際合作與交流與公眾教育等作主任工作報告。

最後學術委員會就實驗室 2013 年的工作進行了討論與審議，充分肯定了實驗室過去一年取得的成績，同時建議 SKLMP 作為一個六所高校的聯合實驗室，應進一步探討下一階段發展目標，在資源共用與交叉合作等方面要進一步加強，並就建設內容、定位、特色以及隊伍建設等方面提出了寶貴的意見和建議。

The Fourth Xiangjiang Marine Forum-Workshop on Marine Algae (2014)
2014香江海洋論壇第四講-海洋藻類研討會

On 20th March 2014, hosted by the State Key Laboratory in Marine Pollution (SKLMP), City University of Hong Kong, and co-hosted by the Hong Kong Agriculture, Fisheries and Conservation Department (AFCD), the Fourth Xiangjiang Marine Forum-Workshop on Marine Algae was opened with remarks by the SKLMP Director, Professor Paul Lam. This workshop was the fourth in the series of seminars of the Xiangjiang Marine Forum held successfully since 2012. Referring to the wide range of studies covered in the seminar, Professor Paul Lam emphasized that "Everyone attending the seminar is equally important, and so is every speech". In this way, this seminar aimed at integrating studies from various fields to inspire new ideas.

The main theme of this seminar was divided into three categories: environmental and contamination assessment of marine algae; applications of marine algae; and the development and challenges of scientific diving. Environmental assessment of marine algae is crucial to the coastal ecology and marine fisheries of China, and there was in-depth discussion of this topic during the workshop. The application of marine algae is an emerging hot topic in the scientific community, since they can be used in nutraceuticals, bio-diesel, marine Vibrio infection reduction, diabetes treatment and anti-aging cosmetics.

2014年3月20號，由香港城市大學海洋污染國家重點實驗室（SKLMP）主辦，香港漁農護理署（AFCD）協辦的"海洋藻類研討會"在 SKLMP 主任林群聲教授的致詞中揭開序幕，這同時也是香江海洋論壇自2012年以來成功舉辦的第四次系列研討會。由於本次研討會所探討的範疇相當廣泛，因此林教授強調"每一位研究不同範疇的在場嘉賓對於本會議都是非常重要的。"希望藉由不同研究領域的科學成就一起啟發不同的新思維。

本次會議探討的主題主要可分為三大類-海洋藻類環境與污染評估、海洋藻類應用以及科學潛水發展與挑戰。海洋藻類環境評估對於中國沿海的生態與海洋漁業至關 重要，會議中多位元學者針對此主題進行了深入的探討，如亞潮流為海洋污染一個重要的運輸媒介，因此若我們可以掌握溫度鹽度對於潮流的影響，未來也許可以藉以舒緩海洋污染的現況；而赤潮與綠潮現象的研究，也可以針對其特性進行瞭解，以降低其對海洋生態所造成的危害。藻類應用也是現今科學界新興的討論議題，可應用于保健食品、生物柴油，降低海洋弧菌感染,對抗老化與治療糖尿病等方面，最後陳荔博士與我們分享了科學潛水的歷史與知 識,除了讓我們瞭解了科學潛水與休閒潛水的區 別外,也讓我們對海底世界的科學研究有了更多 的信心與期待。

A field trip was arranged on the second day to allow the attending scientists to have practical experience in field sampling as well as obtaining first-hand knowledge about marine algae in the Hong Kong coastal region. Attending scientists from the Asia-Pacific region, staff from the SKLMP and AFCD, as well as students were able to get involved in the process of sampling through diving to better understand field sampling and the hardships that might be involved. The algal experts in attendance used the algal samples collected on-site for demonstrating the methods of collecting, isolating and identifying micro- and macro-algae. This field trip not only offered opportunities for on-site study and a better understanding of marine algae, but also provided a good platform for sharing ideas.

In light of the diversity of participants' knowledge and experience in various fields, this seminar stimulated new ideas and sparked excitement which we believe will strongly promote comprehensive scientific development and cooperation, and the on-site sampling experience will stimulate the interest of participants in marine research and conservation.

此次香江論壇為了讓更多海洋科學家可以實際體驗野外採樣與提升海洋藻類知識，還安排了野外實操。來自亞太地區的多位學者以及 AFCD，SKLMP 的同事與學生，親身體驗潛水採樣過程，瞭解了野外實地採樣的狀況與艱辛。在場的藻類專家亦利用採樣品作為活教材進行藻類分離鑒定技術的講解與習性分析，此行不僅兼 具實地考察與理論分析幫助參與者提升對藻類認識外，更為參與者與藻類專家提供了一個良好交流平臺。

我們有理由堅信此次會議中各位學者藉由不同領域主題的相互碰撞，激發出的璀璨無比的科學火花將強有力地推動各項研究的全面發展與合作，同時野外採樣的體驗也將激發參與者對海洋研究與保育的興趣。

The First Brainstorming on Marine Visualization
海洋可視化集思會在深圳召開

On 20th June 2014, hosted by the State Key Laboratory in Marine Pollution (SKLMP), City University of Hong Kong and the Research Center for the Oceans and Human Health, City University of Hong Kong Shenzhen Research Institute, the first brainstorming session on Marine Visualization was held at City University of Hong Kong Shenzhen Research Institute Building. Delegates from government, universities and enterprises attended the brainstorming session, including Dr. Lai Chan, Vice Director of H2O, City University of Hong Kong Shenzhen Research Institute; Mr. Zhiwen Zheng, Director of Shenzhen Marine Environment and Resource Monitoring Center; Mr. Raymond Man, veteran underwater photographer; Prof. Zhonghua Cai, Vice Director of Division of Ocean Science and Technology; Mr. Qingbei Jiang, Vice President of Literary Federation of Shenzhen Longgang District; Mr. Tony Chen, Science Research Manager of City University of Hong Kong Shenzhen Research Institute; and Ms. Fiona Jiang, Chief Operating Officer of the Business College, City University of Hong Kong.

Dr. Lai Chan first delivered a speech entitled "Scientific diving, public safety diving and marine protection". With photographs and video, Dr. Chan introduced the application of diving in scientific research, the newly-established Sea Dweller Union (SDU) and the Asia Pacific Academy of Underwater Sciences (APAUS), currently in preparation. He considered that besides recreation, scientific research, reef checking and garbage collection, divers with professional qualification could fulfill the missions of marine rescue, victim retrieval and criminal evidence collection. Therefore Dr. Chan expected that government, universities and enterprise could jointly promote the development of scientific diving.

2014年6月20日，由香港城市大學海洋污染國家重點實驗室 (SKLMP) 與香港城市大學深圳研究院海洋與人類健康研究中心 (H2O) 主辦的海洋可視化集思會在香港城市大學產學研大樓召開，會議旨在推動影像技術在我國海域生物多樣性及水下科學研究中的應用。與會的嘉賓包括，H2O 副主任陳荔博士，深圳市海洋環境與資源監測中心鄭志文主任，資深水下攝影專家萬志權先生，清華大學蔡中華教授，深圳龍崗區文聯副主席蔣慶北先生，香港城市大學深圳研究院科研經理陳俊鐸先生及香港城市大學商學院營運總監蔣嬋女士等各界代表。

會議首先由陳荔博士作了題為"科學潛水，公共安全潛水與海洋保護"的發言。陳博士通過圖片和視頻介紹了潛水在科學中的應用、新成立的潛者聯盟組織以及擬籌建的亞太水下科學研究院。陳博士認為潛水除了休閒、科學研究、珊瑚普查，垃圾清理之外，通過培訓擁有專業資格的潛水夫還能夠履行救急扶危、拯救遇溺者及尋回遇難者、為執法人員搜證及將罪犯繩之于法等使命，呼籲與會的政府、院校、企業組織共同推動科學潛水的發展。

State Key Laboratory in Marine Pollution

Dr. Meng Yan from the SKLMP then introduced the research directions of the SKLMP and the marine visualization project, including promotional videos of SKLMP development, diversity and community structure of coral reeffi shes in Shenzhen and public education about scientific diving, with the goal of further popularizing marine sciences education to the public. Mr. Raymond Man explained the significance and feasibility of the marine visualization project from the perspective of photography and shared his photography experience in Hong Kong as well as the video produced by his team.

隨後 SKLMP 代表晏萌博士介紹了實驗室的工作內容與正在進行中的海洋可視化項目,包括實驗室宣傳紀錄片,深圳珊瑚魚種群特徵研究宣傳紀錄片、科學潛水理念與教育推廣宣傳紀錄片等多個可視化項目,期望通過宣傳紀錄片的方式，進一步在社會各界普及海洋文化與教育。而來自香港的資深水下攝影專家萬志權先生則從攝影的專業角度闡述了海洋可視化專案的必要性和可行性,並分享了自己在香港的攝影工作經歷,拍攝思路以及團隊所拍 攝的視訊短片。

The rest of the meeting was a discussion hosted by Prof. Zhonghua Cai to share guests' views on marine visualization. Director Zhiwen Zheng from the Shenzhen Marine Environment and Resource Monitoring Center mentioned that the Shenzhen government attached great importance to marine ecology protection and considered that the aim of the marine visualization project was for the public in Shenzhen to explore the beauty of the oceans. Mr. Qingbei Jiang explained that marine ecology could be expressed by means of painting and expected that marine scientists could provide authentic marine material as painting resources. Ms. Fiona Jiang looked forward to the cooperation between the marine visualization project and the Business College of City University of Hong Kong, utilizing the public and private funds of the Business College to develop this project. Other attending guests presented the views of their industries. All of the guests were positive regarding the development of the potential of the marine visualization project and reached an intention to cooperate to jointly promote it.

會議餘下時間是由蔡中華教授所主持的與會嘉賓對於海洋可視化專案的探討與分享。深圳市海洋環境與資源監測中心鄭志文主任從政府的角度闡述了深圳政府對於海洋保護與海洋生態展示的重視，並認為海洋可視化項目主要是要挖掘深圳本地海洋的美麗，使其能夠為公眾所欣賞。文聯蔣慶北先生從藝術的視角出發，認為海洋生態可以通過繪畫藝術的形式表現出來展示給大眾，並期望與會的海洋生態研究專家可以提供真實的海洋素材供創作所用。蔣嬋女士則希望能夠將香港城市大學商學院的課程與海洋可視化專案結合起來，為商學院的公私募基金和海洋可視化專案之間搭建橋樑，達成共贏局面。與會的其他嘉賓也從自身所在的業界角度發表了對於海洋可視化專案的建議與意見，一致看好海洋可視化專案的未來發展潛能，並希望在座的政府、科研院所和企業界的專家代表能夠達成合作意向，一起推動海洋可視化專案的進展。

After the brainstorming session at the City University of Hong Kong Shenzhen Research Institute, guests then went to the Guan Shanyue Art Museum to visit a painting exhibition called "Love of Earth" held by Mr. Qingbei Jiang and had a group photo with the paintings.

會議在熱烈討論的氣氛中結束，嘉賓隨後一同前往關山月美術館參觀蔣先生所舉辦的"大地情懷"作品展，畫作給人強烈濃厚的衝擊感，與會嘉賓紛紛表示讚賞，並與蔣先生及其畫作合影留念。

The 11th International Symposium on Persistent Toxic Substances (ISPTS)
第十一屆持久性有毒污染物國際研討會

On 27th to 30th, October, 2014, the 11th International Symposium on Persistent Toxic Substances (ISPTS) was held at City University of Hong Kong. It was co-organized by the State Key Laboratory in Marine Pollution (SKLMP), Department of Biology and Chemistry, City University of Hong Kong, the State Key Laboratory of Environmental Chemistry and Ecotoxicology (SKLECE), Research Center for Eco-Environmental Sciences (RCEES), Chinese Academy of Sciences and the State Key Laboratory of Environmental and Biological Analysis (SKLEBA). About 200 scientists and experts attended this symposium.

The ISPTS2014 consisted of a two-day symposium and a one-day field trip. The symposium covered interdisciplinary topics of significance, ranging from analytical chemistry and the characterization of PTS to environmental and eco-toxicology. The main themes included: 1. Sources and fate of PTS; 2 Toxicology of PTS; 3 Emerging PTS of concern; 4.Risk assessment of PTS; 5.Mitigation and remediation of PTS; 6.Analytical and Bioanalytical methods. During the symposium, scientists from the US, Canada, Japan, Australia, Taiwan, Hong Kong and mainland China exchanged their most recent findings on PTS with oral and poster presentations, including Chief Editor of Environmental Science & Technology, Prof. Jerald L. Schnoor, and Chief Editor of Environmental Health Perspectives, Prof. Hugh A. Tilson.

Awards for "Young Scientist", "Best Oral Presentation" and "Best Poster Presentation" were announced at the closing ceremony of this symposium. Dr. James. C.W. LAM, from SKLMP won the "Young Scientist" award while Dr. Mirabelle M.P. TSUI and Miss Qian WU won the "Best Poster Presentation." After the two-day symposium, some of the participants joined the field trip to Hong Kong Geopark on October 30th.

2014年10月27日至30日，由香港城市大學海洋污染國家重點實驗室和香港城市大學生物及化學系主辦，中國科學院生態環境研究中心環境化學與生態毒理學國家重點實驗室及浸會大學環境與生物分析國家重點實驗室協辦的第十一屆國際持久性有毒污染物國際研討會在香港城市大學成功舉行。

本次大會由香港城市大學林群聲教授和中國科學院生態環境研究中心江桂斌院士擔任共同主席。會議得到了國內外同行的積極回應和踴躍參加，來自海內外相關研究領域的專家學者近200人出席了此次會議。會議期間，來自美國，加拿大，日本，韓國，澳洲，臺灣，香港，中國內地等著名科研院所和機構的嘉賓學者通過口頭報告和海報展示等方式，分享了他們在這六大 PTS 主題領域內的研究成果。美國工程院院士、著名雜誌 ES&T 主編 Jerald L. Schnoor 教授、著名雜誌 EHP 主編 Hugh A. Tilson 等作了精彩的大會主旨報告。

會議共設立了4個分會場，此次研討會閉幕式還評選出了"青年科學家獎"，"最佳口頭報告獎"及"最佳海報獎"三個獎項，香港城市大學海洋污染國家重點實驗室林忠華博士榮獲"青年科學家"，徐美寶博士和吳茜小姐獲得"最佳海報獎"。研討會結束後，與會人員還前往香港西貢地質公園進行為期一天的實地考察。

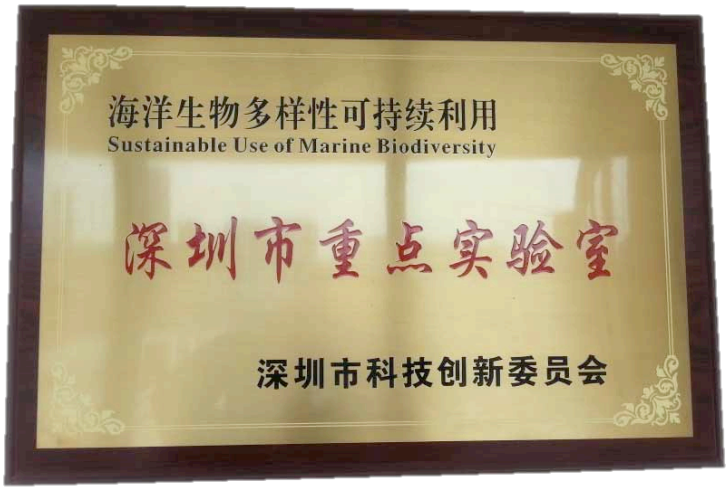
The International Symposium on Persistent Toxic Substances (ISPTS) has been held annually since 2004, and it aims to provide a valuable opportunity for environmental scientists and experts from all over the world to interact and exchange research ideas and contribute to global understanding of PTS.

從2004年起，ISPTS 已經成功舉辦過十屆，旨在為全球研究持久性有毒污染物的科學家提供一個交流平臺，分享他們關於PTS的最新研究方法，研究成果和創新學術理論框架，共同促進全球 PTS 研究的發展。

Review of Major Event
實驗室大事回顧

Shenzhen Key Laboratory for Sustainable Use of Marine biodiversity (SUMB)
深圳市海洋生物多樣性可持續利用重點實驗室

Marine biodiversity is of great significance and plays a pivotal role in providing a unique set of goods and services to society. To improve the marine ecological environment and develop the sustainable marine economy of Shenzhen, Shenzhen Key Laboratory for Sustainable Use of Marine Biodiversity (SUMB) was established with the approval of the Shenzhen Science and Technology Innovation Commission and with support from the research experts in the SKLMP. The aims of the SUMB are to promote academic exchange and collaboration in marine environmental science, to enhance the awareness of marine environment protection, to facilitate the sustainable use of marine resources and the healthy development of the marine industry, and to focus on a study of the comprehensive environmental problems and their countermeasures. SUMB will attempt to become a highly influential laboratory in Shenzhen as well as in the Pearl River Delta and an integrated platform for research, development, training and education, technology transfer and professional services. SUMB will be in a significant position for developing innovative talents with ability in marine environment research. SUMB is established on a multi-disciplinary basis in order to study key scientific questions, and the main research directions include: (1) Coastal marine biodiversity and ecological integrity; (2) Research and development of marine bioactive compounds and their applications; (3) Ecological restoration and conservation of the marine environment; and (4) Sustainable development of marine ecological aquaculture.



為了改善海洋生態環境，使深圳市的海洋經濟可持續發展能力得以提升，在深圳市"建設海洋強市"戰略的指導下，經深圳市科技創新委的批准，依託香港城市大學海洋污染國家重點實驗室的科研中堅力量，成立了深圳市海洋生物多樣性可持續利用重點實驗室。其創建宗旨在於推進海洋環境科學的學術交流及研究合作，增強海洋環境保護意識，促進海洋資源的可持續利用與海洋產業健康發展，挖掘重點海域的環境綜合問題及其對策研究。努力使本實驗室成為在深圳乃至珠三角具有重要影響力的，集研究、發展、培訓與教育、技術轉化和提供專業服務的綜合平臺，為海洋環境科學研究 的創新性人才培養提供必要條件。本實驗室以多學科交叉為基礎著眼于海洋環境研究中的重大科學問題。主要的研究方向包括: 1）近海海洋生物多樣性與生態安全; 2）海洋生物活性成分研發與應用; 3）受損海洋環境的生態修復與保護; 4）海洋生態養殖體系構建與持續利用。

Academic Exchange and Collaborations
學術交流與合作

16 Nov 2014

The 16th China High-Tech Fair in Shenzhen 第十六屆深圳高交會

On 16th November, 2014，the 16th China High-Tech Fair began in Shenzhen Convention & Exhibition Center. With the theme of innovation-driven growth and environmentally-friendly development, this High-Tech Fair contained six sessions such as High-Tech Trade, High-Tech Product Exhibition and China High-Tech Forum. The City University of Hong Kong Shenzhen Research Institute selected 11 key projects to display in its booth. The State Key Laboratory in Marine Pollution (SKLMP) exhibited a phytoplankton flow cytometer and benthic dinoflagellate bioreactor as examples of ongoing cutting-edge research on toxic algae monitoring and benthic dinoflagellate culture. The scientific diving training system was also in the spotlight at the fair. The scientific diving training system aims to maximize the protection of scientific divers and the underwater environment at the same time. SKLMP will continue to improve this training system through various kinds of diving activities, deepening and broadening underwater scientific research. SKLMP will also make full use of the market demand information received from participants of the High-Tech Fair, speeding up the promotion and application of scientific research achievement.

2014年11月16日，第十六屆中國國家高新技術成果交易會（以下簡稱"高交會"）在深圳會展中心拉開帷幕，本屆高交會以"堅持創新驅動，加快綠色發展"為主題，設有高新技術成果交易、高新技術專業產品展、中國高新技術論壇等六大板塊。此次高交會上，我校經過精心挑選有11個項目做重點展示，其中海洋污染國家重點實驗室共展出了"用於浮游植物分析鐳射片光螢光成像流式細胞儀"、"底棲甲藻生物反應器"、"科學安全潛水培訓體系"等三個項目，從有害藻華的有效監測預防到具備科研和經濟價值藻種的培育繁殖技術，它們不但代表我室科研項目最新進展，同時也是我室自主創新實力的充分展現，而科學安全潛水培訓體系則致力於最大程度保障水下作業人員以及水下自然環境的安全，仍在不斷地實踐和完善中，將強有力地推進水下科研、作業的廣度和深度。我們也將積極跟蹤、落實高交會期間獲得的市場需求資訊，加快科技成果的推介和轉化。

25 Aug 2014

A Visit of the State Key Joint Laboratory of Environment Simulation and Pollution Control to the SKLMP, CityU
北京環境模擬與污染控制國家重點聯合實驗室參訪

On 25th to 26th August 2014, Ms. Xia Huang, Director of the State Key Joint Laboratory of Environment Simulation and Pollution Control (ESPC), together with four ESPC secretaries—Ms. Ruirui Li, Mr. Zhiqiang Wang from Tsinghua University, Ms Xiuhua Ji from Peking University and Ms. Yun Qi from Beijing Normal University—visited the State Key Laboratory in Marine Pollution, City University of Hong Kong (SKLMP). The delegation was warmly received by Prof. Paul Kwan Sing Lam, Director of the SKLMP and Dr. Leo Lai Chan, Vice Director of SKLMP. During this visit, both sides discussed future collaboration, lab operations, and daily laboratory management and administration work, with the expectation that future exchange of ideas and methods and promotion of scientific research will occur.

2014年8月25日-26日，北京環境模擬與污染控制國家重點聯合實驗室（ESPC）的黃霞主任以及李瑞瑞老師、王志強老師（清華大學）、季秀華老師（北京大學）和亓贇老師（北京師範大學）一行五人在林群聲教授等人陪同下參訪香港城市大學海洋污染國家重點實驗室 (SKLMP) 以及 SKLMP 成員在香港其他高校的實驗室，參訪各方就實驗室的聯合機制，日常技術管理和行政工作進行了詳細探討，希望能夠借鑒彼此好的管理制度和方法，更好地促進科研事業的發展，同時達成了未來合作的共識。

16 Jun 2014

Visit of Ming Fai International Holdings Ltd
深圳明輝實業國際有限公司參訪調研

On 16th June 2014, in order to further promote exchange and cooperation between university research institutes and private enterprise, Prof. Jo-shu Zhang from the Department of Chemical Engineering, National Cheng Kung University, Prof. Zhonghua Cai of Tsinghua University and Dr. Lai Chan, Vice Director of the State Key Laboratory in Marine Pollution (SKLMP), City University of Hong Kong, undertook a visit to Ming Fai International Holdings Ltd. The delegation was received warmly by Ms. Elaine Chan, the R&D Director of Ming Fai, and her colleagues. In the meeting the delegation discussed the research and development of a coral-friendly UV blocker from the aspect of algal extraction, and laid down plans for future close cooperation in marine technology research, including jointly promoting the development of marine scientific research. After the meeting, the delegation visited the Ming Fai showroom with a detailed introduction from Ms. Chan and her colleague.

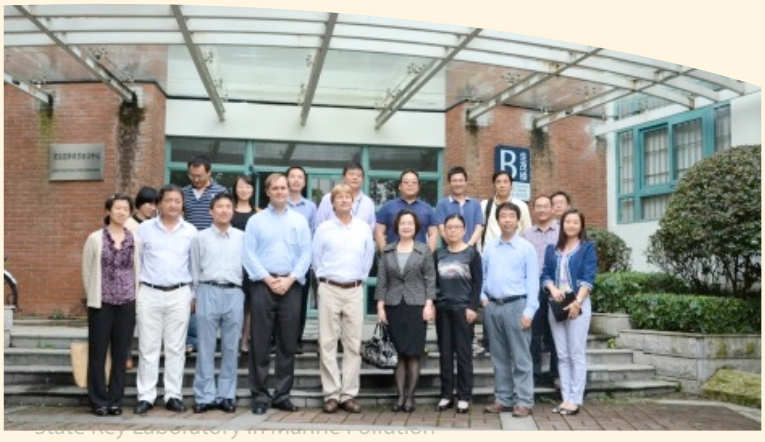
2014年6月16日，陳荔博士與臺灣成功大學化工系張嘉修教授及清華大學深圳研究生院海洋學部蔡中華教授一行到深圳明輝實業國際有限公司進行參訪調研，明輝集團研發總監陳亦寧女士及其同事進行了熱情接待。研討會上各方就海藻提取對珊瑚無害的防曬霜的研究與製作方法進行交流探討，並希望借助各自優勢在今後的海洋技術研究及產業化過程中能夠緊密合作，共同推動海洋科學研究的發展。研討會結束後，明輝集團陳亦寧總監陪同與會嘉賓一同參觀了明輝集團的產品陳列室。

5 May 2014

Visit of the Monterey Bay Aquarium Research Institute (MBARI) to Shenzhen and Hong Kong 美國蒙特利灣海洋研究所來訪

On 5th to 11th May 2014, Dr. Lai Chan, Vice Director of the State Key Laboratory in Marine Pollution (SKLMP), City University of Hong Kong welcomed Dr. Chris Scholin, President and CEO of Monterey Bay Aquarium Research Institute (MBARI) and Dr. James G. Bellingham, MBARI Chief Technologist, as well as Dr. Yanwu Zhang, undertook a visit to universities and research institutes in Nanjing, Shenzhen and Hong Kong. During these visits, experts and scientists held in-depth discussions on marine scientific research, establishing a solid foundation for future research cooperation, talent cultivation and industrial application. The MBARI delegation was invited to Shenzhen University Town Library and delivered a lecture entitled "The development and Application of Autonomous Ocean Observation Systems". The lecture theatre was full and there were positive interactions between the speakers and audience during the Q&A session, creating a good academic atmosphere.

2014年5月5-11日，由我室陳荔副主任積極牽頭，在南京大學，中科院深圳先進技術研究院和清華大學深圳研究生院的聯合支持下，邀請到美國蒙特利灣海洋研究所（Monterey Bay Aquarium Research Institute，MBARI）所長 Chris Scholin 博士、首席技術專家 James G.Bellingham 博士及張燕武博士一行三人在南京，深圳，香港三地高校進行學術交流。訪問期間，專家們就彼此在海洋研究領域取得的進展和成果進行了廣泛的交流和探討，為今後從科研、應用產業、學生培養等方面合作提供了良好的基礎。MRARI 的三位專家還應邀參加了深圳西麗大學城新論名家講座，並作了題為"海洋自助觀測系統的開發與應用"的報告，現場提問環節中聽眾與演講嘉賓積極互動，營造了良好的學術氛圍。

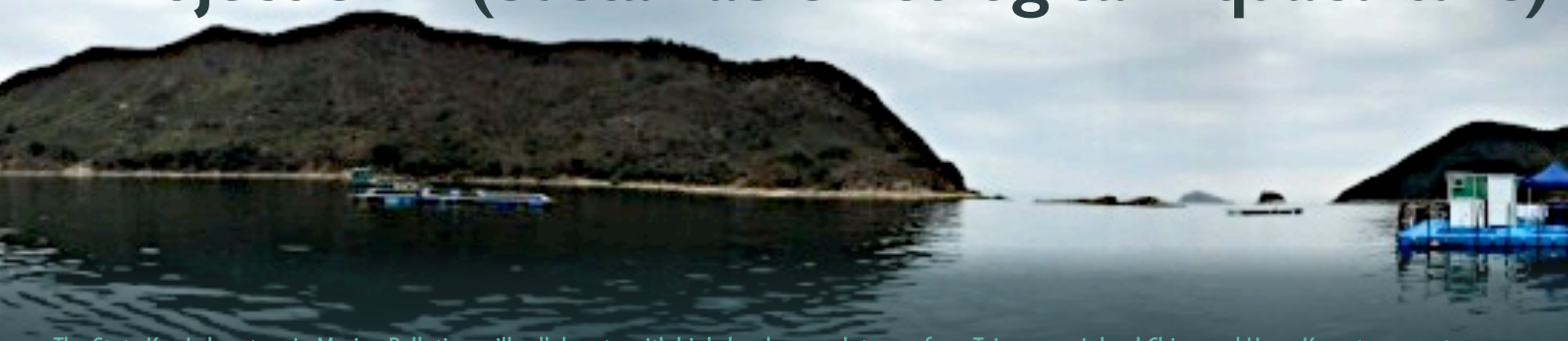


The International Conference on underwater science, technology and education (ICUTE)
水下科學、技術與教育國際研討會

Scuba diving is playing an important role in the study of marine biology, ecology and environmental science in recent years and is treated as a type of research method similar to molecular biotechnology. In addition to the study on the cutting-edge researches in marine pollution, SKLMP would like to carry out underwater sampling and ecosystem investigation by scuba diving, pushing forward the development of underwater scientific research and scientific diving professional education. Scientific Safety Diving in Asian-Pacific Region is initiated by the marine scientific research team in SKLMP, referring to a diving mode that will maximize protection of scientific divers and underwater environment. The development of scientific safety diving is at the initial stage in China. To advance the progress of the marine science and culture and develop international cooperation in marine scientific research, the International Conference on underwater science, technology and education (ICUTE) will be held in City University of Hong Kong on 17th-23th July, 2015. City University of Hong Kong will jointly organize the conference with Division of Earth Sciences of National Natural Science Foundation of China. This conference is also supported by Beijing-Hong Kong Academic Exchange Centre and The Hong Kong, Macau and Taiwan Affairs Office of The National Natural Science Foundation of China, and Education, Science and Technology Department, Liaison Office of the Central People's Government in Hong Kong Special Administrative Region. With conference talks and scientific diving training， this conference aims to explore the setup of the first scientific training system in China, to facilitate the international collaboration of underwater research and to raise the public awareness for marine conservation.

近年水肺潛水在海洋生物、生態及環境科學研究中日益重要，並被視作為等同分子生物技術的研究手段。海洋污染國家重點實驗室除了開展與海洋污染有關的前沿研究外，希望利用水肺潛水進行海底取樣和對海洋生態系統進行調查，促進水下科學研究與科學潛水專業教育的發展。SKLMP的海洋科研團隊首先提出亞太地區了科學安全潛水的概念，其是指在開展水下科研活動時，嚴格保障潛水者自身安全，並且不污染不破壞水底環境的一種潛水方式。科學安全潛水的推廣與實踐在中國地區尚處於起步階段，為推動中國海洋科學及文化的進步，開拓國際化的海洋科學研究道路，SKLMP 將於2015年07月17日至2015年07月23日在香港城市大學舉行水下科學、技術與教育國際研討會 (ICUTE)。本次會議由香港城市大學與國家自然科學基金委員會地球科學部主辦，並榮獲京港學術交流中心、國家自然科學基金委員會港澳台事務辦公室及中央人民政府駐香港特別行政區聯絡辦公室 教育科技部的支持。會議旨在通過會議報告及科學潛水培訓等方式，探索出中國第一個科學潛水培訓體系，促進國際水下科學研究合作，提高公眾海洋保護意識。

Project SEA (Sustainable Ecological Aquaculture)



The State Key Laboratory in Marine Pollution will collaborate with high-level research teams from Taiwan, mainland China and Hong Kong to promote and develop high-tech aquaculture in Hong Kong. A business license has been approved by the AFCD, and a new fish culture zone in O Pui Tong has been selected to be the first near-shore marine aquaculture station for the project. With the purpose of developing high quality, efficient and environmentally friendly modern aquaculture, we plan to carry out the following work:

海洋污染國家重點實驗室將聯合兩岸三地高水準科研團隊，推動高科技海魚養殖業的發展。本項目已經獲得香港漁農自然護理署頒發的商業養殖牌照，位於澳背塘海域的新的養殖區將作為本項目首個臨海海水養殖站。為了發展高質量、有效的且環境友好型的現代化養殖，我們將開展如下的工作：

1. Aquaculture Environment monitoring: Development of novel optical online monitoring and alert system for separation and enumeration algal bloom species

Maintaining a good mariculture environment is a key to ensure sustainable use of fish culture zones and successful rearing of healthy and high quality fish. The Hong Kong aquaculture industry is facing two major challenges: HABs and marine pathogens, each of which can cause fish disease and mortalities. Currently, the Government conducts regular sampling to assess the composition and density of phytoplankton in Hong Kong marine waters, but this type of monitoring is not carried out for pathogens. Moreover, the snapshot monitoring scheme provides only cross-sectional data and requires manual species identification, which can result in unreported cases or a delay in reporting. Therefore, the health authorities and aquaculture operator may not be able to make proactive management to mitigate economic impacts caused by outbreaks of HABs and marine pathogens.

Our recently established fish raft at O Pui Tong is an experimental mariculture platform to support in situ scientific research and to facilitate development of sustainable ecological aquaculture in Hong Kong. To deal with the environmental, social and economic problems caused by HABs and marine pathogens, this team of researchers has initiated regular samplings to characterize spatio-temporal variations of environmental factors, HAB species and marine pathogens in the marine waters. However, it is time consuming and labor-intensive. Here we propose a major step forward through the acquisition and deployment of two submersible, autonomous instruments, the Imaging flow Cytobot (IFCB) and Environmental Sample Processor (ESP) to provide high-resolution, continuous data on the abundance of a wide range of phytoplankton and marine pathogens in the mariculture zone.

Here we propose to jointly deploy these instruments in Hong Kong marine waters using our fish raft as a platform to collect real-time data on the composition and density of phytoplankton and marine pathogens that will reveal patterns during the cycles of HAB and marine pathogen outbreaks and provide early warning to the nearby aquaculture operators and Hong Kong government. Furthermore, data from the joint ESP-IFCB deployment will be compared to another newly invented instrument for phytoplankton monitoring by this team. The outcome will advance our understanding on the control of HABs and fish disease, enable the invention of advance field equipment for HABs and marine pathogen detections, and facilitate sustainable development of fisheries industries in Hong Kong.

1. 養殖環境監測

研發新型的可視化在線監測以及警報系統，用以分離和計量赤潮原因種。良好的海上養殖環境的維持是保障養殖區漁業資源可持續利用以及健康且高品質魚類成功繁育的關鍵。 香港的養殖業正在面臨兩大挑戰：赤潮以及海洋病原體最能夠引起魚類疾病和死亡。目前，政府定期進行採樣，以評估香港的海水組成和浮游植物密度，但這種類型的監控無法針對病原體。此外，快照監控計劃只可提供橫截面資料，仍需要手動進行物種鑒定，這可能會導致無法報告或報告的延遲。因此，衛生部門和水產養殖經營者可能無法進行主動管理，故無法減輕赤潮和海洋病原體暴發所引起的經濟影響。

我們最近在澳背塘建設完成的漁排，作為一個試驗型的養殖平臺，用來支持本地科學研究，並促進可持續生態水產養殖業在香港的發展。為了處理因赤潮和海洋病原體所引起的環境、社會和經濟問題，本研究團隊已開始定期採樣以了解環境因素的時空變化特徵以及赤潮物種和海洋病原體在海水中的存在和分佈。然而，這種做法耗時且耗力，由此，我們計劃通過購買和安置兩個潛水式的自動監測儀儀器，即可成像的流式細胞儀（Imaging flow Cytobot，IFCB）以及環境樣品分析儀（Environmental Sample Processor，ESP）。我們將在收集更大範圍的高分辨且連續的浮游植物及海洋病原體的數據研究中，做出了重要的貢獻。

在此我們計劃使用裝配有上述儀器的漁排為平臺，收集浮游植物和海洋病原體的實時監測數據，這些數據將有助揭示紅潮和海洋病原體爆發的週期，並以此建立預警系統通知周圍養殖戶以及政府。更進一步，ESP-IFCB 結合裝置所取得的數據將與來自本團隊其他新研發的浮游植物監測裝置的數據相比較。其結果將有效提高我們對紅潮以及魚病防控的認識，進而促進香港海魚養殖產業的可持續發展。

SEA計劃（可持續生態水產養殖）

2. Investigation and analysis of epidemiological findings with regards to data collection on the presence of marine pathogens and disease diagnosis in fish cultured in fish culture zones

The collection of baseline data regarding the presence of certain pathogenic marine organisms deserves epidemiological analysis to determine the significance of the organisms found. This must be coupled with the gross pathology and histopathology findings from diseased animals. Only by determining the significance of these pathogens will it be possible to move onto the next step in reducing fish diseases in mariculture zones by the use of, for example, risk analysis to determine the likely port of entry of pathogens and to examine the standard operating procedures of the fish farmers to assess the risk factors for disease and establish some biosecurity criteria. The collection of data will facilitate the development of disease surveillance criteria and allow an improvement in fisheries production.

Investigation and correlation of waterborne pathogens to pathological findings in *Epinephelus coioides* and *Epinephelus lanceolatus*

The principal aim will correlate waterborne pathogens identified with the ESP to the gross pathology and histopathology of diseased or dead groupers. This will allow for initial baseline data being documented for lesions and pathogen relationships in Hong Kong. The routine necropsy procedures, histopathology, special and immunological staining of organs and tissues will be carried out. This information is needed to determine if the waterborne pathogens found cause overt disease or chronic disease that may either hinder their development, render the fish unfit for consumption, or cause a direct public health impact. Therefore determining and quantifying the importance of the waterborne pathogens found.

3. Prevention and control of fish diseases

We plan to import a fish virus vaccine against nervous necrosis virus and iridescent virus for injection or oral use, and rapid virus detection kits from Taiwan for fish disease control; to develop disease-resistance and a growth-stimulating fish feed with the cooperation of researchers from Taiwan.

4. Fry production

We intend to introduce economic PI-SPR (Pre-immunized Specific Pathogen Resistant) early hatched fry in order to provide high-quality fry or juveniles of high economic-valued groupers to local fish-farmers. A combination of Recirculation Aquaculture System (RAS) and the traditional method of growing fish in outdoors cage will be used to minimize the morality of fishes.

This RAS will be used to rear fish fry at high densities, in indoor tanks with a "controlled" environment. Recirculating systems filter and clean the water for recycling back through fish culture tanks. New water quality technology, testing and monitoring instrumentation, and computer enhanced system design programs, much of it developed for the waste water treatment industry, can been incorporated and these have revolutionized our ability to grow fish in tank culture and fish pens.

5. Equipment development

We will set up a multifunctional laboratory on fish rafts to explore the ways to mitigate harmful algal blooms and reduce aquaculture pollution; and develop and install environmentally friendly equipment supported by green energy (such as wind and solar power) and invent new types of fish raft for high technology aquaculture development.

6. Service and product promotion

We will invite and employ fishermen affected by the ban on trawling to join the project, thus making a contribution to the nurturing of a new generation of fishermen. The laboratory on the fish rafts will be open to nearby fishermen for emergency testing and analysis, and we will provide technical guidance and new products, such as fish, vaccines, food, farming equipment, etc. to local fish farmers. We will also further develop a new Standard Operating Procedure (SOP) to enhance the standard and quality of locally cultured fish into international standard.

2. 調查和分析與目前在魚類養殖區中養殖魚類病原體和疾病診斷數據相關的流行病學現象

收集某些致病海洋生物的基線數據后將進行流行病學分析，用來確定已被發現病原種的重要性。這個過程必須要將患病動物的肉眼病理和組織病理學的研究結果相結合。開展下一步防治措施的重要前提確定這些病原微生物的危害性，進而有助減少魚類病害在海域養殖區發生的概率，例如，開展以確定水體病原微生物可能來源為目標的風險分析以及審查養魚戶的操作標準，進而進行疾病的風險評估並建立相關生物安全標準。這些資料的收集將促進疾病監測標準的發展，從而有效提高本地漁業的產量。

開展對病原微生物的調查以及其對點帶石斑魚（*Epinephelus coioides*）和鞍帶石斑魚（*Epinephelus lanceolatus*）造成的病理學現象

主要目的是發現ESP所識別的水體病原微生物與生病或病死石斑魚的肉眼病理學金和組織病理學的關聯。這些養殖病害及其病原體的相關結果將被作為香港地區的基線數據被首次記載。將開展例行程式屍體檢驗，組織病理學，特殊器官和組織的免疫染色。這些研究數據將幫助我們確認所發現的病原微生物可否造成明顯的症狀或慢性疾病，致使魚類發育遲緩，不具備市場潛力，甚至直接造成公共食品安全的隱患。由此有必要確定和量化已發現的水生病原微生物的影響力。

3. 魚病防治

我們計劃引入來自臺灣的注射或口服的神經壞死病毒/虹彩病毒疫苗和病毒快速檢測試劑盒進行魚病防治；與來自台灣的研究人員合作開發抗病增產的魚飼料。

4. 魚苗生產

我們計劃引進經濟型PI-SPR（預先免疫）的孵化早期魚苗，以向本地魚養殖戶提供高品質且高經濟值石斑魚幼魚。將循環水養殖系統（RAS）與傳統方式的戶外網箱養殖相結合，以減少養殖魚類的死亡。這種循環水養殖系統將用於魚苗在室內可控環境中的高密度養殖。

循環水系統可以過濾和清潔養殖用水，實現其在魚類養殖池中的循環利用。來自污水處理工藝的新型水質優化技術，監測和監控設備，優化的計算機管理系統，將被整合及應用在魚池和魚塘養殖技術的革命中。

5. 設備研發

我們將在漁排建設一個多功能實驗室，探索減輕紅潮危害以及減少水產養殖污染的方法；開發和安置由綠色能源（比如風能和太陽能）支援的環保設備和創造新型漁排，由此推動高科技水產養殖的發展。

6. 服務與產品推廣

聘請受禁拖網影響的漁民參與該項目，提高年輕漁民子弟的科技化養殖意識。開放海上實驗室，用於突發事件應急檢測，為當地養殖戶提供新技術（如生態養殖技術）與新產品如魚，疫苗，食品，養殖設備等。我們還將進一步制訂新的標準操作程序（SOP），以提高養殖業的標準并將本地養殖魚類的品質提升到國際化水平。

THE 6TH ENVIRONMENT AND HEALTH SUMMER SCHOOL (EHSS) ON "OCEANS AND HUMAN HEALTH"

第六屆海洋環境與健康（EHSS）暑期學校成功舉辦

On 7th July 2014, co-organized by the State Key Laboratory in Marine Pollution, City University of Hong Kong (SKLMP), the State Key Laboratory of Marine Environment Science, Xiamen University (MEL), the State Key Joint Laboratory of Environment Simulation and Pollution Control, Peking University (ESPC) and The National Taiwan Ocean University, the 6th Environment and Health Summer School (EHSS) on "Oceans and Human Health" began with an opening ceremony held in the City University of Hong Kong. From 7th to 16th July, this summer school was held in Hong Kong, Shenzhen and Zhuhai.

More than 70 participants attended the summer school, including postgraduate and undergraduate students from the United States, Canada, Japan, Philippines, Chile, Taiwan, Hong Kong and Mainland China. The research theme this year was "Oceans and Human Health", covering the topics of 1) Marine Pollution and Environmental Toxicology; 2) Environmental Impact Assessment and Human Health Risk Assessment; 3) Interaction of Ocean, Earth and Atmospheric Interfaces; 4) Sustainable Ecological Management; and 5) Marine Environmental Economics, Policies and Ecological Civilization.

The Hong Kong session of this summer school was conducted in the SKLMP. Besides thefi eld trip to the Mai Po Inner Deep Bay Ramsar Site, the SKLMP also invited renowned professors around the world to deliver lectures on Oceans and Human Health, Environmental Impact Assessment and Environmental Toxicology, including Professor Kwan Sing Lam, Director of the SKLMP; Prof. Tracy Collier, Senior Advisor of the National Oceanic and Atmospheric Administration; and Prof. Markus Hecker, of the University of Saskatchewan. A poster presentation was arranged during the lectures, providing an academic exchange platform for both speakers and participants.

2014年7月7日，由香港城市大學海洋污染國家重點實驗室、廈門大學近海海洋環境科學國家重點實驗室、北京大學環境模擬與污染控制國家重點實驗室和國立臺灣海洋大學聯合舉辦的"第六屆環境與健康（EHSS）暑期學校"在香港城市大學開幕。暑期學校於7月7-16日先後在香港（7月7-12日）、深圳（7月13-14日）和珠海（7月15-16日）舉行。

本次暑期學校共有70余名中外學生參加，包括美國、加拿大、日本、菲律賓、智利、臺灣、香港及中國內地的研究生及本科生。研討主題是"海洋與人類健康"，重點針對海洋污染對人類健康影響、環境影響及人類健康風險評價、可持續生態管理。

在香港的行程部分主要由香港城市大學海洋污染國家重點實驗室策劃並執行，除了米埔內後海灣拉姆薩爾國際重要濕地考察之外，實驗室更邀請了海內外著名教授講授海洋與人類健康、環境影響評價以及環境毒理學的課程，如實驗室主任林群聲教授、美國國家海洋與大氣管理局高級顧問Tracy Collier教授、加拿大薩省大學Markus Hecker教授等。課程期間更舉辦了海報展示環節，為老師與學生提供了一個學術交流的平臺。在深圳和珠海的部分則把海洋生態文明與可持續發展部分作為重點。

State Key Laboratory in Marine Pollution

The Shenzhen and Zhuhai sessions mainly focused on Marine Environmental Civilization and Sustainable Development. The Shenzhen session was jointly conducted by the Peking University Shenzhen Graduate School and the Shenzhen Marine Research and Technology Consortium (SMART). Activities organized in Shenzhen included seminars on Shenzhen environmental change and protection, a university tour, a nature photography exhibition, group oral presentations and a mangrove natural reserve fi eld trip. In Zhuhai, Prof. Min Hu, Prof. Qi Wang and Prof Yi Huang from the Peking University Ecological Civilization Institute (Zhuhai) delivered lectures on the Interaction of Ocean, Earth and Atmospheric Interfaces, Marine Environmental Economics, Policies and Ecological Civilization and Global Environment Outlook of Marine and Coastal Environmental Assessment. Mr. Shanliang He, Director of the Zhuhai Environmental Protection Monitoring Station then introduced the current situation of environmental protection in Zhuhai. On the fi eld trip, participants visited coastal nature reserves such as Gaolan Harbor and Hengqin Island. Through the tour of the Zhuhai Environmental Protection Monitoring center, participants acquired knowledge of the monitoring measures to water, gas, noise and solid waste and learned about the advanced equipment involved.

深圳的行程主要由北京大學深圳研究生院策劃，深圳海洋研究與技術聯盟（SMART） 共同執行，活動形式包括深圳環境變遷與保護研討會、校園導覽、自然生境攝影比賽、學生演講比賽、紅樹林實地考察等。在珠海的行程由珠海北京大學生態文明研究院和珠海市監測站共同策劃並執行，學習形式多樣，有課程講座、實地考察、監測站參觀等。“北京大學生態文明珠海研究院”胡敏、王奇、黃藝三位教授分別向學生介紹海、陸、氣相介面交換及反應，海洋環境經濟、政策以及生態文明，全球海洋環境狀況及沿岸環境評價。珠海市環境監測站何山亮站長介紹珠海市環境生態保護情況。實地考察部分，學生參訪了高欄港、橫琴島等沿海保護區，並通過對珠海市監測站的參觀學習，瞭解其對水、氣、聲、固廢等檢測手段、先進的設備以及完善的管理體系，瞭解珠海市目前環境檢測手段和體系。

此次暑期學校通過專家講座、實地考察旅行、學生自我展示以及小組學術探討等方式，不同國家、地區的師生零距離交流，加深學生對於環境科學與污染研究的最新進展的認識。同時鼓勵學生在小組討論時就所學所見闡述自己觀點，啟發學生思考、提高其交流和邏輯思維能力。這次活動不僅讓參與的學生受益頗豐，同時也是舉辦單位之間展示學術成就，交流教學經驗的盛會。

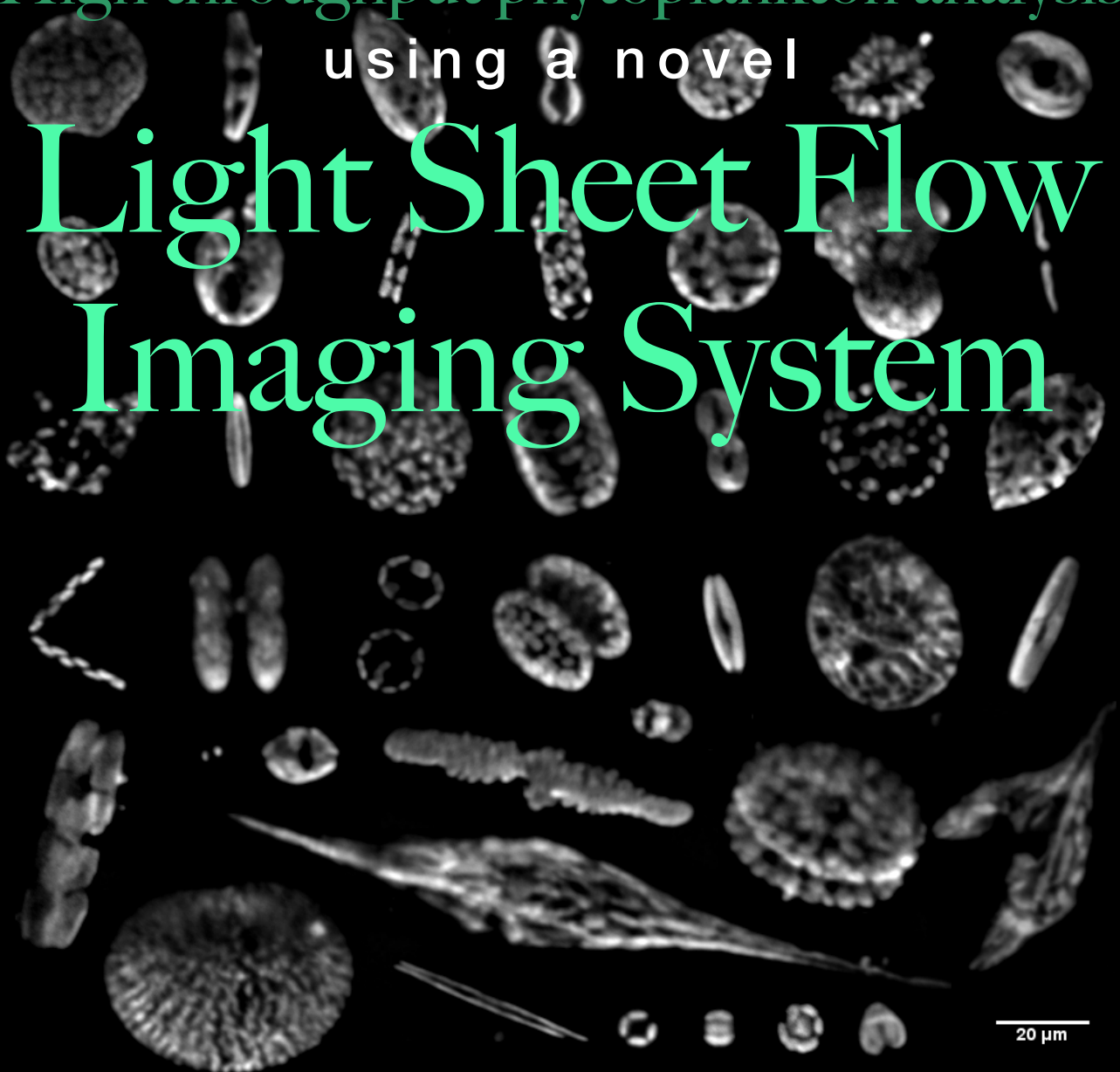
Held in Hong Kong, Shenzhen and Zhuhai, this summer school aimed to encourage participants to express their own views in group discussions, cultivating their logical thinking and communication ability.

During the Zhuhai session, a further discussion was held among State Key Laboratory in Marine Pollution, City University of Hong Kong (SKLMP), State Key Laboratory of Marine Environmental Science, Xiamen University, State Key Joint Laboratory of Environment Simulation and Pollution Control, Peking University and Zhuhai Environmental Protection Monitoring Station, pushing forward the cooperation in environmental ecology civilization construction in Zhuhai. The long term goal of this summer school is to unite those research institutions to advance complementary sharing and cooperation, promoting marine environmental research and technology development in Hong Kong, Macao and Zhuhai, and jointly establishing a South China marine research center.

珠海暑期學校期間，香港城市大學海洋污染國家重點實驗室、廈門大學近海海洋環境科學國家重點實驗室、北京大學環境模擬與污染控制國家重點實驗室與珠海市環境監測站進一步研討，拓展在珠海環境生態文明建設中的合作。期望今後集合各研究單位元的特長，推進實現資源分享與互補式合作，推動港珠澳地區的海洋環境研究與技術開發，共建南方海洋環境研究中心。

Members' Research Activities
成員動態

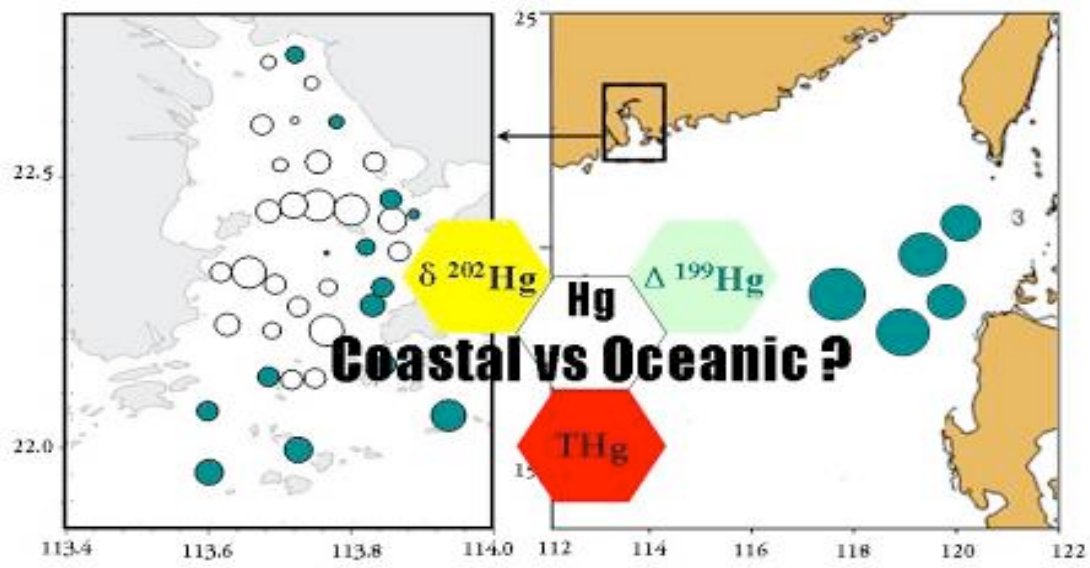
High throughput phytoplankton analysis using a novel Light Sheet Flow Imaging System



The project involved developing 2 sets of instruments for detecting phytoplankton particles for field applications. The instruments use a new technology that combined light sheet microscopy with flow cytometry. The result is that the systems performed to get clear fluorescence images of all phytoplankton particles flowing through a flow cell up to a flow speed of 30 ml/min. The instruments can count up to 300,000 particles per minute with the assistance of software programs. The systems has been tested and the performances exceeded all expectations. The system can produce typical image capture listed below and can capture up to 100 of these frames per second. As discernable from the images, very large dynamic range of these particles are possible ranging from 1 to 300 µm with a spatial resolution of around 0.3 µm.

Dr. Robert K.Y. Chan

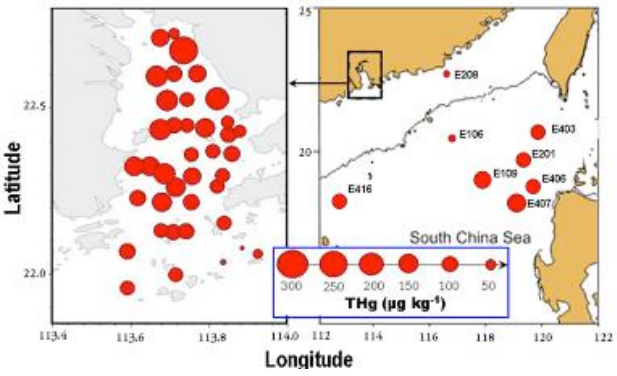
State Key Laboratory in Marine Pollution

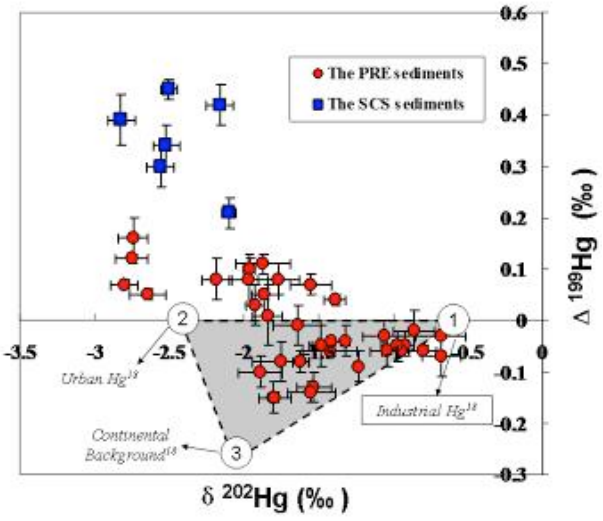


Identifying the sources and processes of mercury in subtropical estuarine and ocean sediments using Hg isotopic composition

Prof. Li, X.D.

The concentrations and isotopic compositions of mercury (Hg) in surface sediments of the Pearl River Estuary (PRE) and the South China Sea (SCS) were analyzed. The data revealed significant differences between the Hg in fine-grained sediments collected from the PRE (8 to 251 μg kg^{-1}) and those collected from the SCS (12 to 83 μg kg^{-1}). Large spatial variations in Hg isotopic compositions were observed in the SCS (δ202Hg: -2.82 to -2.10‰; Δ199Hg: +0.21 to +0.45‰) and PRE (δ202Hg: -2.80 to -0.68‰; Δ199Hg: -0.15 to +0.16‰). The large positive Δ199Hg in the SCS indicated that a fraction of Hg has undergone Hg2+ photo-reduction processes prior to incorporation into the sediments. The relatively negative Δ199Hg values in the PRE indicated that photo-reduction of Hg is not the primary route for the removal of Hg from the water column. The riverine input of fine particles played an important role in transporting Hg to the PRE sediments. In the deep ocean bed of the SCS, source-related signatures of Hg isotopes may have been altered by natural geochemical processes (e.g., Hg^{2+} photo-reduction and preferential adsorption processes). Using Hg isotope compositions, we estimate that river deliveries of Hg from industrial and urban sources, and natural soils could be the main inputs of Hg to the PRE. However, the use of Hg isotopes as tracers in source attribution could be limited due to the isotope fractionation by natural processes in the SCS.





Dr. Paul K.S. Shin

As Co-Chair of the IUCN (International Union for Conservation of Nature) Species Survival Commission Horseshoe Crab Specialist Group, I continued to research and promote the conservation of horseshoe crabs in Hong Kong as well as internationally. I have been invited to give presentations on horseshoe crab conservation at workshop/seminar/conference in Quangxi, Hong Kong and the USA. Horseshoe crab has also been one of the icons being promoted in the 2014 Conservation Day of the Ocean Park Conservation Foundation. I am also involved as an editor for the upcoming book "Changing Global Perspectives on Biology, Conservation, and Management of Horseshoe Crabs" to be published by Springer in 2015.

Horseshoe Specialist

IUCN SSC
Horseshoe Crab
Specialist Group

Dr. S.G. Cheung

Crab Group

In May 2012, a Horseshoe Crabs Specialist Group was established under The International Union for Conservation of Nature (IUCN), and I was one of the 8 members in the steering committee. The IUCN is the world's oldest and largest global environmental organization. Founded in 1948, it is the largest professional global conservation network with more than 1,200 member organizations including 200+ government and 900+ non-government organizations. Now I am a member of the working group on education under the Horseshoe Crabs Specialist Group.

Collaborations with China

The Beibu Bay Marine Resources and Environmental Ecology Workshop Cooperation Platform was established among mainland China, Taiwan and Hong Kong on 8th June 2014 in Guangxi and I am the coordinator of Hong Kong. The platform serves as a focal point for collaboration within Greater China on the research and sustainable use of marine resources in Beibu Bay, China.

The Horseshoe Crab Conservation Union was established among mainland China, Taiwan and Hong Kong on 8th June 2014 in Guangxi and I am a member of the organizing committee. The Union is to foster collaboration within Greater China on the research and conservation of horseshoe crabs.

Benthic and Epiphytic Toxic Algae (BETA):

底棲附生產毒藻類

Gambierdiscus, *Ostreopsis,* and *Prorocentrum* are three genera of benthic and epiphytic toxic algae (BETA) which are of increasing interest as most of them are potent toxin producers [ciguatoxins (CTXs), palytoxin (PlTx), okadaic acid (OA) and dinophysistoxins]. They are either confirmed (*Gambierdiscus*) or suspected (*Ostreopsis* and *Prorocentrum*) to play a role in ciguatera fi sh poisoning in humans, which is one of the most common forms of phycotoxin-borne seafood illness across the globe, affecting 50,000 – 500,000 people annually. Recent studies indicated the presence of *Gambierdiscus*, *Ostreopsis* and *Prorocentrum* in Thailand, Malaysia, Korea, Japan, Taiwan, and Hainan in China. A new *Gambierdiscus* species named *G. scabrosus* was described from Japan. One group of phycotoxins, CTXs, has also been detected in coral reef fi shes collected along the coast of south China and Taiwan. Recently, *Gambierdiscus* and *Ostreopsis*, together with numerous unidentified benthic dinoflagellates were isolated from rocky and coral habitats in Hong Kong waters. These snapshot studies indicated that BETA exist in the South China Sea, and some of them could well be new and toxic species.

Attention has been recently paid to the ecological impacts of BETA. A number of laboratory and fi eld studies have proven that CTXs, PlTX, OA and their derivatives may not only lead to human health problems, but also induce mortalities of crustaceans, sea urchins, fi shes and marine mammals. Predators of high trophic levels may generally be exposed to greater levels of phycotoxins via their diets and therefore are at higher risk associated with BETA. It is conceivable that predators in a BETA-affected coral ecosystem could be eliminated by phycotoxins, causing an elevated abundance of CTX-resistant grazers. The excessive grazing pressure could result in a top-down effect on primary production via over-grazing and cause a reduction in coral recruitment and larval growth rate, and even induce the external bioerosion of corals. Hence, BETA may not only lead to impacts at an individual or population level, but affect the coral ecosystem as a whole. The dislodgement and fragmentation of coral networks could also promote BETA proliferation, intensifying their adverse impacts on coral ecosystems. Over time, there could be a cascade effect on the structures, functions and food web dynamics of coral ecosystems.

綱比甲藻、渦鞭毛藻和原甲藻為三類底棲性和附生性的有毒藻類（BETA），由於大多會產生強毒素，如雪卡毒素（CTXs），岩沙海葵毒素（PlTx），綱田酸（OA）和鰭藻毒素（DTXs），因此其研究也越來越受到重視。綱比甲藻已被證實在雪卡魚中毒事件中是扮演不可或缺的角色，另外渦鞭毛藻和原甲藻也有可能與雪卡魚中毒有關。雪卡魚中毒是常見的食源性海產中毒，每年有50000 - 500000受到其影響。最近研究指出綱比甲藻、渦鞭毛藻和原甲藻在泰國，馬來西亞，韓國，日本，台灣，以及中國海南都有發現。並在日本發現了一種名為 *G. scabrosus* 的綱比甲藻新種。其中一種藻毒素 CTXs可在中國南部和台灣的海岸的珊瑚魚體內檢測到。近年來，在香港水域的岩石和珊瑚棲息地分離出綱比甲藻和渦鞭毛藻，以及其他許多尚未確定品種的底棲甲藻。研究顯示，BETA存在於南中國海，並且有一些可能為有毒的新種，因此BETA對於生態影響的近來也備受關注。許多實驗室和野外研究已經開展，並證明CTXs可能對運動,心跳,呼吸,食慾和生存率會產生不良的影響。高營養級捕食者通常透過攝食會接觸到更高水平的藻毒素，因此底棲附生有毒藻類可對其產生更高風險。而在富含底棲附生有毒藻類生長的珊瑚礁環境的獵食者很有可能會經由藻毒素的自然選擇而被淘汰，並導致對於CTX有抗性的初級消費者的數量顯著的上升。而在初級消費者過度攝食下，可能會由上至下影響食物鏈的初級生產力，並且也會導致珊瑚礁與幼魚的生長速率的降低,甚至導致珊瑚礁受到外來侵蝕。因此，底棲附生有毒藻類不僅在個體或群體水平產生影響，也會影響整個珊瑚生態系統。

Dr. Leo L. Chan
Prof. Paul K.S. Lam

State Key Laboratory in Marine Pollution

An emerging threat to coral ecosystems and human health

對華南珊瑚生態系統的新興威脅

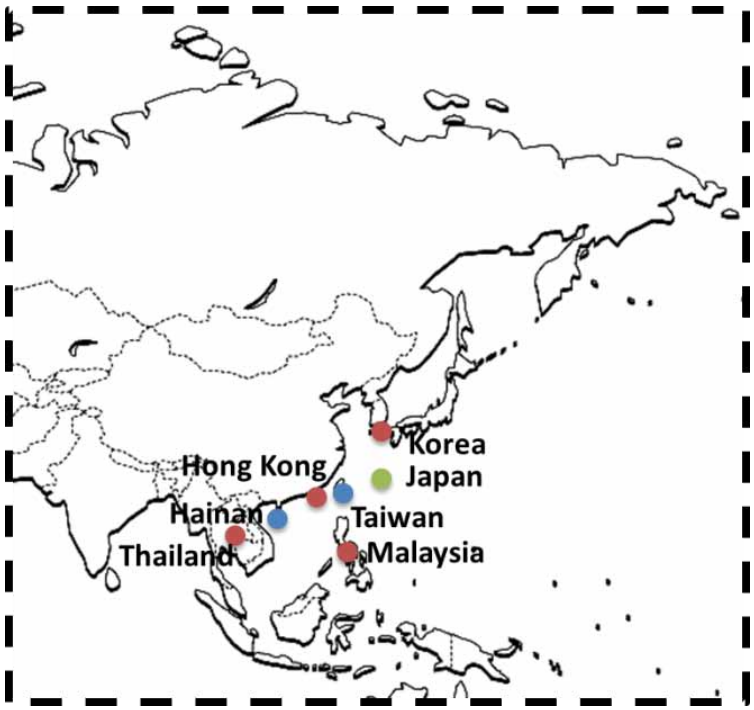


Figure 1 Distribution of BETA in Southeast Asia (red dot: Discovery of known BETA species; green dot: Discovery of new BETA species; Blue dot: Identification of ciguatoxic coral reef fishes)

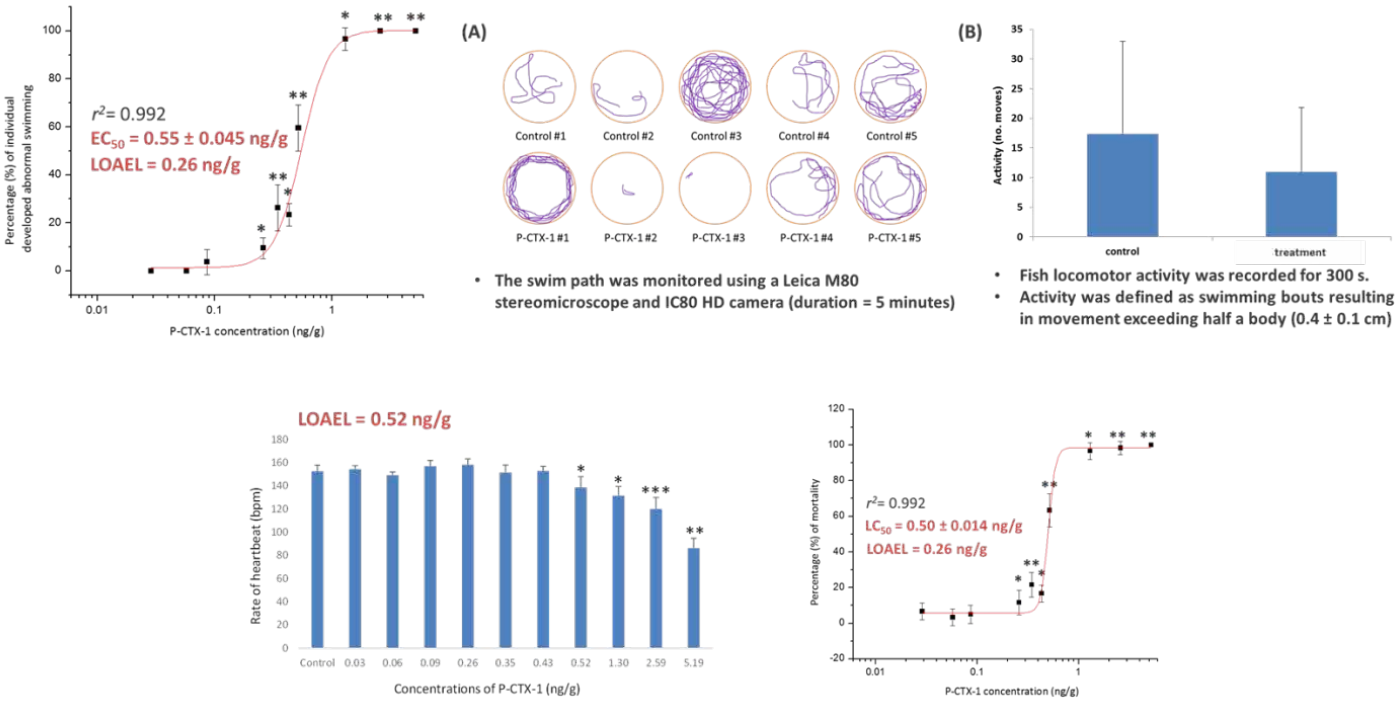


Figure 2 Adverse effects of P-CTX-1 on (a) locomotion, (b) heartbeat rate and (c) survival of larval marine medaka (*: $p < 0.05$; **: $p < 0.01$; ***: $p < 0.001$)

Using the CTX standards developed in the SKLMP, Professor Ying Li, Department of Biomedical Sciences (BMS), and his neurobiology group at CityU have successfully shown that P-CTX-1, one of the main ciguatoxins prevalent in the Pacific Oceans, is capable of invoking brain cortex neuronal excitotoxicity *in vivo*, supporting the notion that neuron and astroglia signals may play a role in acute ciguatera fish poisoning. In addition, Prof. Li has also shown that the chronic sub-clinical exposure of P-CTX-1 induces maladaptive decision making and impairment of spatial memory of rats in the Morris water maze (Figure 4). Dr. Eddie Ma, another neuroscientist at BMS, has shown that the motor coordination, motor function and the electrical activity of the motor cortex in the mouse brain are significantly reduced, before returning to normal baseline levels two weeks after repeated exposures to P-CTX-1 (two sub-lethal doses in three days). Further studies show that these P-CTX-1 pre-exposed mice sustain permanent motor deficits, loss of axons, and failure to restore synapse formation in distal muscle after peripheral nerve injury. Mice release a distinct set of neurotransmitters in the motor cortex shortly after 1 hour exposure to P-CTX-1. We have also shown that a substantial amount of P-CTX-1 remains in the brain and peripheral nerve two months after the first exposure. These data indicate that accumulated P-CTX-1 poses long-term irreversible adverse effects on the nervous system.

Because ciguatoxins are lipid-soluble toxins, they can accumulate and become stored in various important organs (e.g. the brain) in the bodies of seafood consumers. These new findings indicate that there can be long-term disturbances of the central nervous system once mammals are exposed to CTXs.

使用SKLMP純化CTX標準品，生物醫學系（BMS）的李嬰教授和他在城市大學的神經生物研究團隊發現在太平洋地區盛行的一種主要雪卡毒素，P-CTX-1，能夠在體內調節大腦皮質神經元興奮性毒性，並且指出神經元與星形膠質細胞信號可能在急性雪卡魚毒中毒中扮演重要的角色。此外，李教授還發現長期亞臨床的P-CTX-1暴露會引起大鼠在水迷宮實驗室中的無法做出判斷並產生空間記憶障礙.（圖4）。另一位BMS的神經學家馬智謙博士表明，在三天內兩次給予小鼠亞致死劑量的暴露，會造成小鼠的運動協調，運動功能和大腦皮層的電活性顯著降低，但結束暴露兩周後可恢復到正常水平。進一步的研究證實經暴露P-CTX-1的小鼠會產生永久運動缺陷，軸突缺乏和喪失外周神經損傷後末端肌肉的突觸形成能力。而在暴露P-CTX-1一個小時後，小鼠的運動皮層會釋放出一組不同的的神經遞質。我們還發現P-CTX-1暴露兩個月後，在腦和外週神經上還有相當一部分P-CTX-1殘留。這些數據證明積累的P-CTX-1會對神經系統造成長期不可逆的影響。食用珊瑚礁魚類已被證明對人類有益，這主要是因為其富含的n-3多不飽和脂肪酸有益於神經發育與腦功能，也能降低老年癡呆症的風險，但食用含雪卡毒素的珊瑚礁魚類可能會造成中樞神經系統的長期損害並導致無法預期的人類健康風險。

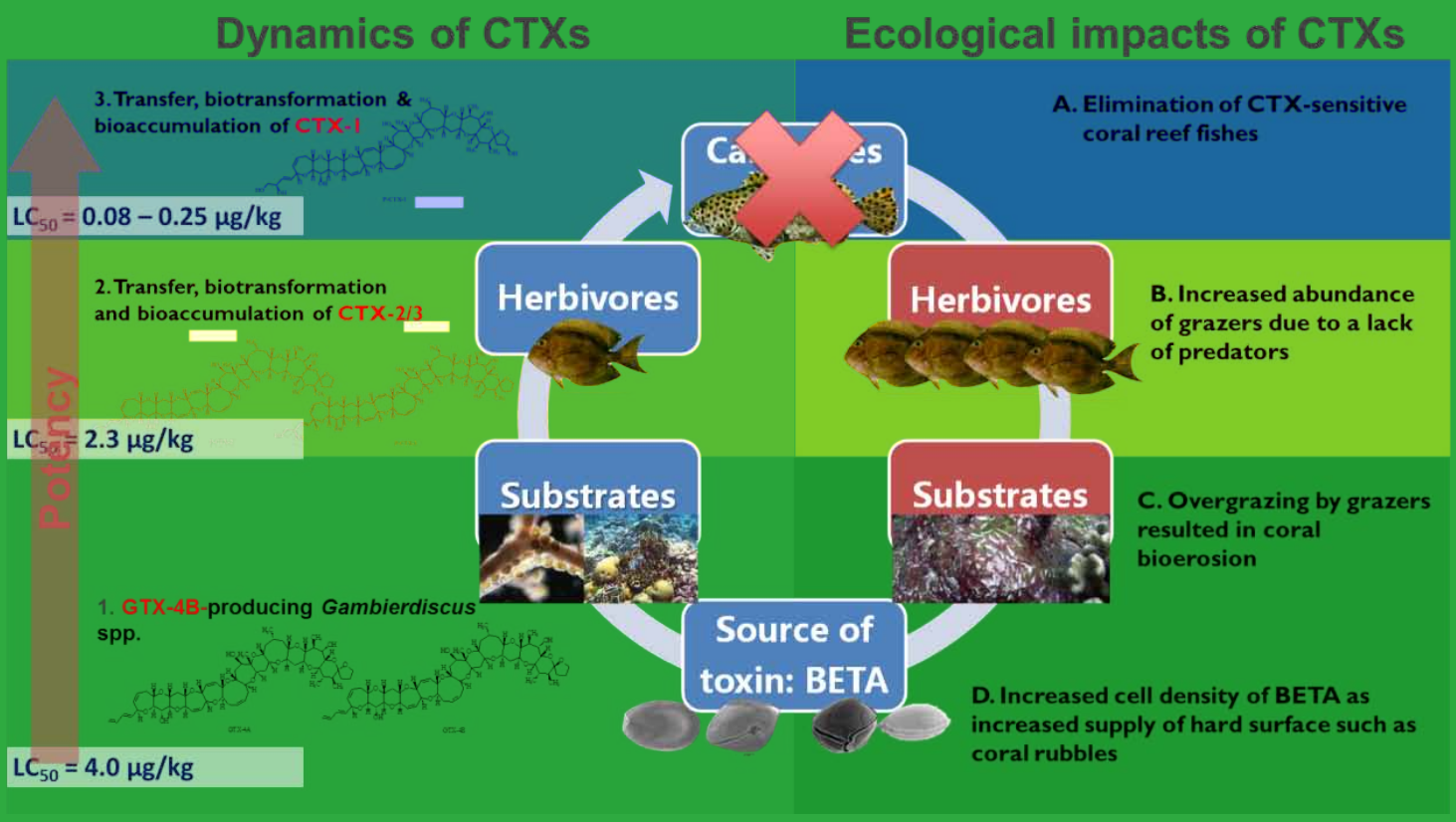


Figure 3 Schematic diagram showing the dynamics of CTXs and ecological impacts of CTXs

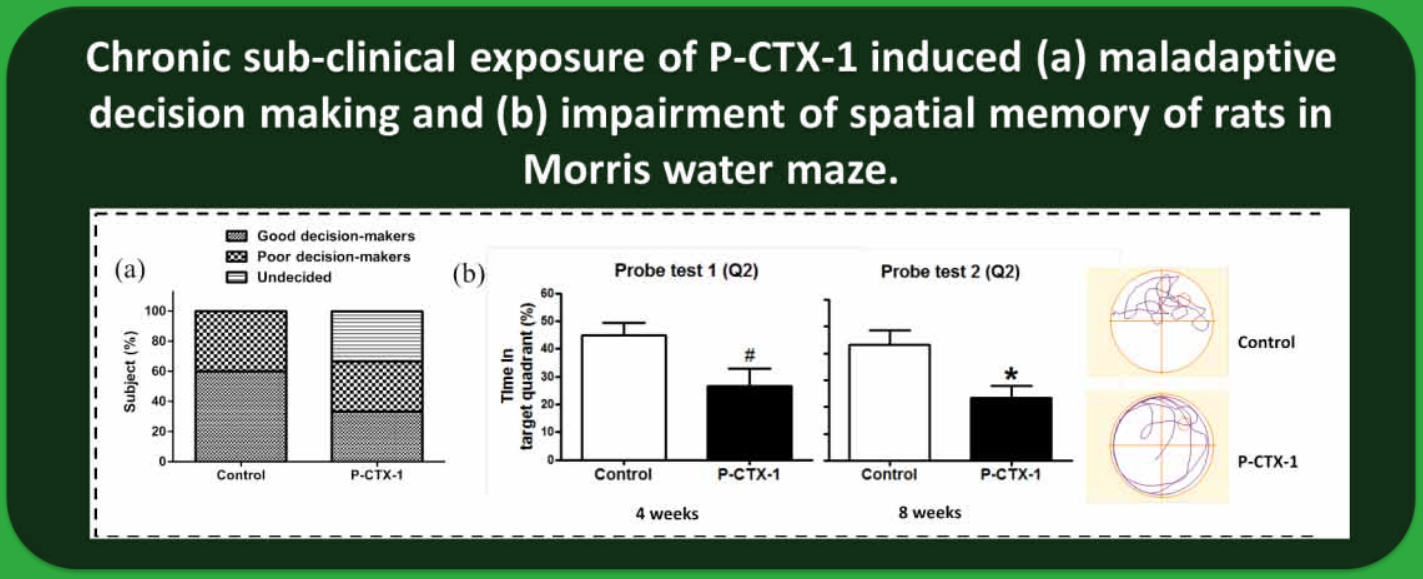


Figure 4 Adverse effects of chronic P-CTX-1 exposure on (a) decision making and (b) spatial memory of rats (*: $p < 0.05$)

Diving for Sciences and Public Safety

The romance of idyllic coral islands as portrayed by adventure novels is now tarnished by massive coral bleaching, exacerbated by pollution, global warming, and military activities. Dead bleached coral provides surfaces on which toxic dinoflagellates and other plankton can settle, and coral fish are contaminated by feeding on the dead coral smothered with the toxic dinoflagellates, which produce ciguatoxins. Over 400 fish species, including groupers, snappers, mackerel and moray eels, are thought to be prone to these ciguatoxins, meaning that contaminated coral fish can easily find their way into the human food chain.

Over 500,000 people are affected by ciguatera fish poisoning (CFP) each year, and such a trend is set to continue to rise since coral fish are regarded as a delicacy. Although ciguatera is endemic to tropical regions, the trading of coral fish has brought ciguatera to other parts of the world. The above figure may not reflect the true extent of ciguatera poisoning since minor cases are probably not reported or are misdiagnosed.

過去像是冒險小說般浪漫的珊瑚礁島嶼如今卻由於大規模的珊瑚白化,污染,全球暖化和人類活動造成破壞。死珊瑚白化提供了有毒甲藻和其他浮游生物能附著生長，而珊瑚魚則會藉由攝食的方式被附著於表面的有毒甲藻所生產的雪卡毒素而污染。超過400種魚類，包括石斑,鯛魚,鯖魚和海鰻，被認為是容易累積雪卡毒素的品種，這意味著帶有雪卡毒的珊瑚魚可以很容易地進入人類食物鏈中。

珊瑚魚被視為美味佳餚，每年約有50萬人會受雪卡毒魚類中毒（CFP）影響,近幾年雪卡毒素中毒的人口是越來越高的。雖然雪卡毒素主要是分布在特有的熱帶地區，但食用珊瑚魚貿易導致含毒珊瑚魚散布世界各地。此外上述的中毒案件並不全然，輕微的案件可能不被記錄或者錯誤診斷，並不能反映雪卡毒素中毒的真實程度。

Dr Leo Chan has been visiting the Republic of Kiribati and collecting the fish samples required for ciguatera research since 2005. Kiribati is an island nation in the Central Pacific east of the Indonesian archipelago. Compared with other areas of the Pacific, Kiribati has a much higher risk of ciguatera. The Shenzhen Toxic Algae Research (STAR) team was tasked with the mission of identifying how toxicity is related to species and location and also to identify the mechanism by which biotoxins present in marine environments are transformed into ciguatoxins as well as their transfer and bioaccumulation mechanisms. Since its inception, the STAR team has successfully attracted more than HK$10M of research funding from Hong Kong and Mainland China covering a number of different areas, with several new proposals in the pipeline.

從2005年起，陳荔教授前往參訪基里巴斯共和國，並且就收集各式的雪卡毒素珊瑚魚樣本。基里巴斯共和國為一島國，位於太平洋中部東部印度尼西亞群島。基里巴斯共和國與太平洋的其他地區相比，其擁有較高的雪卡毒素的存在風險。深圳有毒藻類研究（STAR）團隊的研究任務主要是鑑定雪卡毒素相關的物種和位置，同時找出海洋環境中雪卡毒素的轉化,生物轉移和生物累積等機制。本單位自成立以來，已經成功吸引許多來自香港和中國不同的領域約港幣一千萬的科研經費。

潛水科學與公共安全

Dr. Leo L. Chan

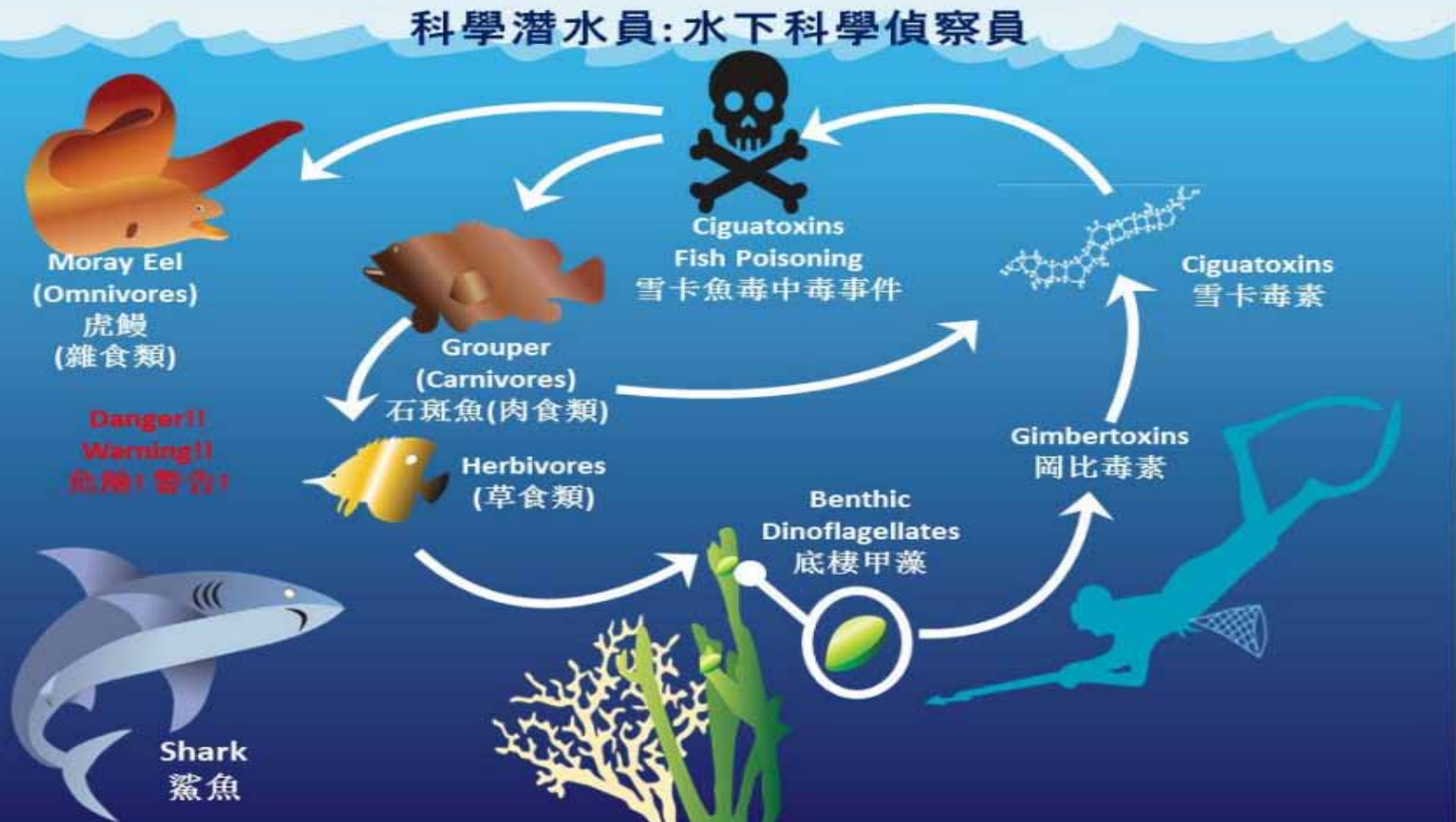
Scuba diving, an essential tool in coral research, allows students and scientists to understand the organisms or the system by seeing the "goings-on" in natural habitats. Dr. Chan said, "Diving gives my research a new dimension. Of course, I can conduct experiments on a dead coral fish without ever visiting its habitat, but then I shall have missed the opportunity to witness how coral bleaching reduced the food sources of the hungry fish, which had to nibble at dead coral." The underwater fish surveys conducted by the STAR team shed new light on popular assumptions about the impact of ciguatoxins on fish. While the current literature suggests that ciguatoxins will not cause harm to fishes, the team found that many species of carnivorous fish indigenous to non-contaminated areas were absent from contaminated areas. This phenomenon may show that fishes are as susceptible to ciguatoxins as are humans.

At present, there is no specialized scientific diving training in Hong Kong or Mainland China, and most scientific divers were trained via recreational diver training programs. Although scientific diving can be fun as well as a challenging and exciting adventure, if not conducted by properly trained and equipped individuals, it can be dangerous and even deadly.

In order to facilitate the development of safe and productive scientific divers through education, research, advocacy and the advancement of standards for scientific diving practice, certification, and operation, Dr. Chan has attended various professional diving training programs, e.g. recreational diver instructor, public safety diver instructor, underwater criminal investigator and closed circuit rebreathers. He has also visited various USA and Taiwan universities which are dedicated to the advancement and practice of scientific diving so as to gain experience and acquire the necessary knowledge and techniques of scientific diving.

水肺潛水為珊瑚礁研究中一個重要的工具，可以讓學生和科學家在自然棲息地實地看到並理解生物體與生態系統。陳荔博士認為：「潛水可以賦予研究一個全新的面貌。當然，我可以不需要了解珊瑚魚的自然棲息地也能對其標本進行實驗,然而就會錯過親眼目睹珊瑚白化如何減少了珊瑚魚食物來源的機會。」由深圳有毒藻類研究進行的水下魚類調查揭示了雪卡毒素對魚類的影響，並帶來了新的觀點。雖然目前的研究文獻認為雪卡毒素不會造成魚類的傷害，但本研究小組卻發現雪卡毒素高發地的肉食性魚類物種及數量有明顯下降的現象。此種現象可能顯示魚類可能和人類一樣對於雪卡毒素具有敏感性。

現時，香港或中國並沒有專門的科學潛水訓練，科學潛水員皆是通過休閒潛水訓練課程所培訓的。雖然科學潛水很有趣，但它同時也是一個具有挑戰性和令人興奮的冒險活動，如果不通過適當的訓練和裝配正確的裝備，科學潛水也可以是危險且致命的。為了發展安全且具有科學能力背景的潛水員,必須通過教育、研究、宣傳和科學實踐作為手段,並以認證和標準操作流程作為依據。陳荔博士過去也參訪了美國與台灣的大學並致力於增進與實踐科學潛水，不僅已積累豐富的經驗，同時也掌握必要的知識和科學潛水技術。



The risk of marine eutrophication and hypoxia around Hong Kong

Prof. J. Gan

Since the total volume of wastewater discharge from the Pearl River has increased from 2.5x10^8 tons in 1990 (Dai et al., 2006, Mar. Chem.) to 8.6x10^8 tons with DIN ~36x10^4 tons in 2013 (Bulletin of Marine Environmental Status of Guangdong Province in 2013, Administration of Ocean and Fisheries of Guangdong Province), we see that the risk of marine eutrophication and hypoxia is rapidly increasing around Hong Kong.

We have conducted a 24-day (July 6-July 29, 2014) field survey in the Pearl River Estuary adjacent to Hong Kong waters. The measurements included vertical profiling 131 stations along 10 transacts in the region and two time series measurements.

This was a multidisciplinary field study that measured physical variables of temperature, salinity, water depth, DO, turbidity and velocity and biogeochemical variables of pH, NO_3, NH_4, PO_4, Chl-a and others. Meteorological variables of wind, sea-level pressure, air temperature, humidity and others were also sampled during the cruise. The objective of the survey was to investigate the hydrodynamics (e.g. wind- driven current, tidal and buoyance forcing, frontal dynamics) and associated biogeochemical responses in nutrients, biological productivity, algal bloom and hypoxia in the region. The biophysical processes in the survey region largely determine the marine ecosystem in Hong Kong waters and serve as crucial upstream conditions for physical and biogeochemical processes in Mirs Bay and Tolo Harbour in the western part of Hong Kong waters during summer. Figure 2 shows the influence of the Pearl River plume as an upstream condition on the regional biophysics.

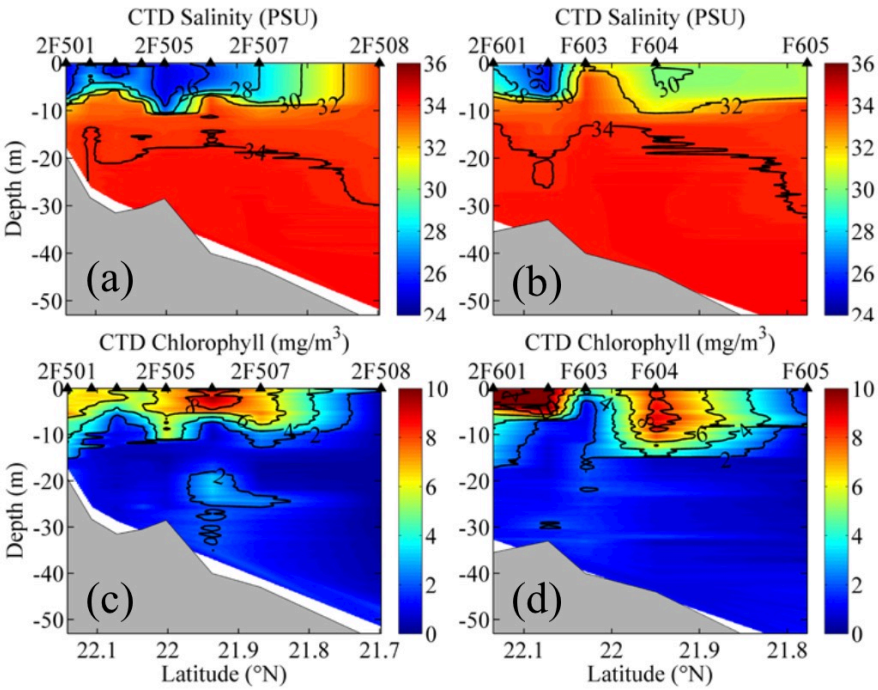
Indeed, we found that the bottom hypoxia (DO<2 mg/L) now covers an area ~ southwest of Hong Kong (blue area in Figure 3). The time series of NO_3 and bottom DO in the last two decades (Figure 4, data from Environmental Protection Department of Hong Kong) clearly indicates that the intensity of eutrophication and hypoxia is increasing and causing deterioration of water quality in the area. The frequency and intensity of summer hypoxia have been obviously increasing in SW waters and under the current trends, a full-scale hypoxia will outbreak in the entire SW waters and subsequently other parts of Hong Kong waters five years from now.

歷史資料顯示,通過珠江輸入的污水逐年增加,由1990 年的 2.5x10^8 噸 (Dai et al., 2006, Mar. Chem) 增加到 2013 年的 8.6x10^8 噸 (2013 年廣東省海洋環境狀況公報,廣東省海洋與漁業局)。香港周邊海洋環境富營養化和缺氧的風險與日俱增。

我們在 2014 年 7 月 6 日至 29 日開展了為期 24 天的珠江口和香港鄰近水域的現場航次調查。觀 測涵蓋 10 條斷面共計 131 個大面站位以及 2 個時間序列站位。

該航次是一個包括海洋物理、化學和生物研究的多學科現場調查,測量的參數包括溫度、鹽度、水深、溶解氧、濁度、流速、pH、硝氮、氨氮、磷酸鹽、葉綠素、氣溫、氣壓、濕度、風速等。 航次的目的是該海域的水動力情況(如風驅動流場、潮汐及浮力、鋒面動力學等)和相應的生物 地球化學響應(如營養鹽分佈、生物生產力、水華及缺氧等)。研究區域的物理和生化過程反映 是香港海域生態系統的主控因子,同時也是夏季調控位於香港水域西面的大鵬灣和吐露港中物理 和生地化過程的關鍵上游條件。圖 2 展示了珠江沖淡水對香港海域的影響。

在本航次調查中,我們確實發現有一個面積達



Dr. Jian-Wen Qiu

The InterRidge Student and Postdoctoral Fellowship Recipient-Sun Jin

大洋中脊獎學金得主-孫進

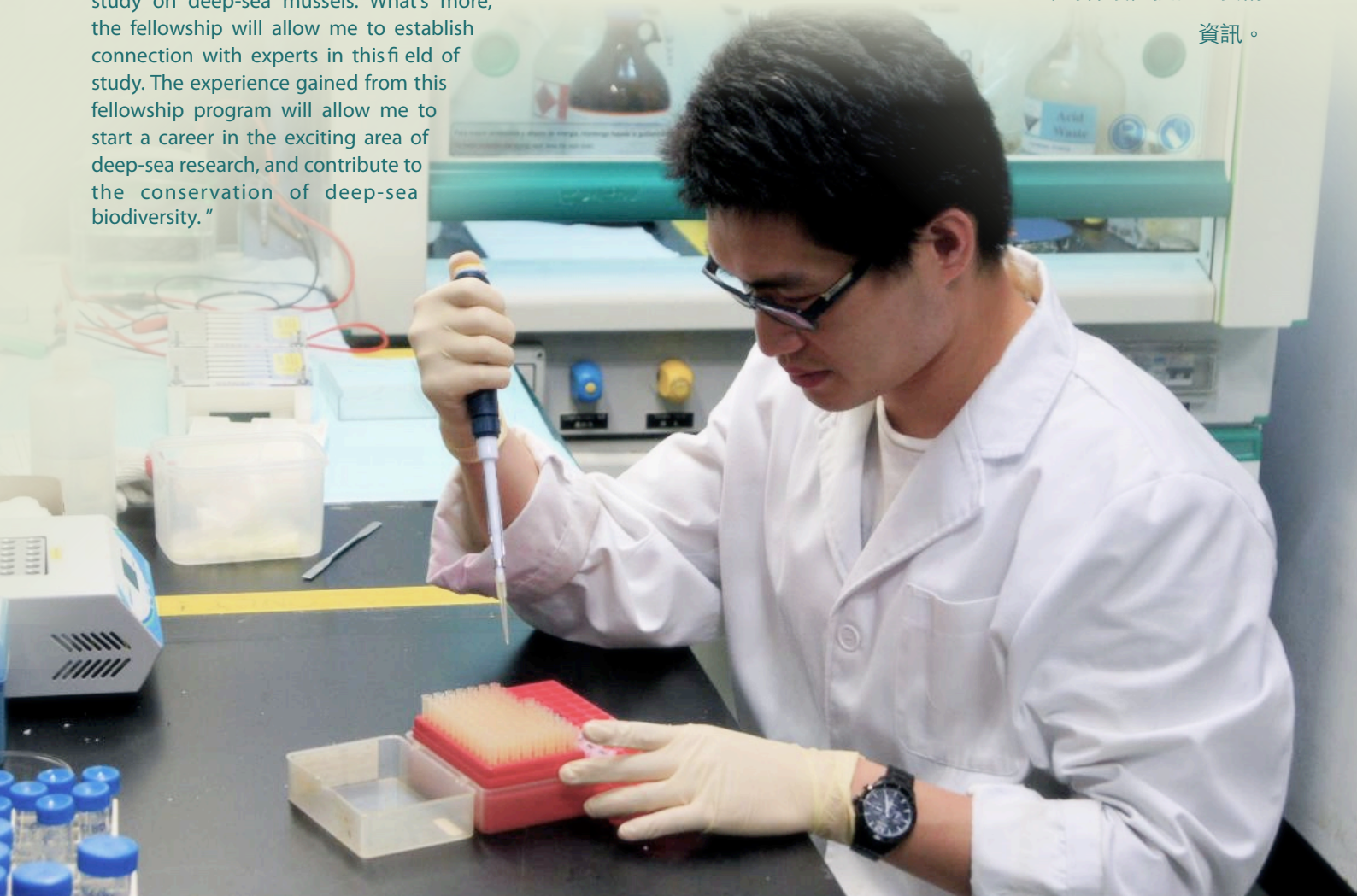
Dr Sun Jin, Research Associate of the Department of Biology of HKBU, was awarded The InterRidge Student and Postdoctoral Fellowship, becoming the first Hong Kong recipient of this international fellowship and one of only four recipients in the world this year.

Jin Sun got his PhD in 2013 at Department of Biology Hong Kong Baptist University, and is currently working as a research associate under the supervision of Dr Jian-Wen Qiu. During his PhD study, he mainly study on the adaptation and evolution of the notorious invasive apple snail using next-generation sequencing (NGS) and proteomics approaches. After graduation, he was fascinated by the deep-sea samples collected by manned submersible Jiaolong and decided to move into this new field. His current project is regarding the physiological adaptation and population connectivity of deep-sea mussels Bathymodiolus platifrons using functional genomics and proteomics approaches. His proposal is "Genetic connectivity of deep-sea mussels in Western Pacific examined by population genomic approach". "Studying genetic connectivity can reveal the genetic diversity of populations and provide information for the designation of marine protected areas." In the proposal, he said "This is a rare opportunity for me to study deep-sea mussels collected from different regions of the Western Pacific. Without this regional collaboration, it would be impossible to conduct a genetic connectivity study on deep-sea mussels. What's more, the fellowship will allow me to establish connection with experts in this field of study. The experience gained from this fellowship program will allow me to start a career in the exciting area of deep-sea research, and contribute to the conservation of deep-sea biodiversity."

香港浸會大學生物系副研究員孫進近日獲得「2014年大洋中脊研究生和博士後研究員獎學金計劃」獎學金，成為首位獲得此項國際獎學金的香港學者，而今年全球只有4名得獎者，其他3人分別來自英國和法國。

「大洋中脊」設立獎學金計劃旨在鼓勵有潛質的年輕海洋科學家從事深海科學的發展，孫進將利用獎學金到日本參與研究巡航，並與海洋研究開發機構（JAMSTEC）的日本科學家高井研博士和渡部裕美博士聯合進行深海研究。未來兩年，他期望研究西太平洋區域深海貽貝（又稱青口）的基因關連。

孫進向大會提交名為「利用群體基因組學的方法，分析西太平洋深海貽貝的基因關連性」的研究專案。他指基因關連研究可以顯示一種群體的基因多樣性，為建立深海保護區提供重要的資訊。



Social Education & Community Service
公眾教育與社會服務

2014 Xiamen University
2014廈門大學

On 2th November, 2014, the State Key Laboratory in Marine Pollution (SKLMP), City University of Hong Kong, attended the Xiamen University Ocean Sciences Openhouse 2014 jointly organized by the State Key Laboratory of Marine Environmental Science (Xiamen University), CoseeChina and Key Laboratory of Coastal and Wetland Ecosystems (Xiamen University), Ministry of Education. Exhibitors in this open house included teachers and students from laboratories in the College of Ocean and Earth Sciences and College of the Environment & Ecology, Xiamen University. More than 2500 Xiamen citizens and students from middle and primary schools attend the open house.

SKLMP exhibited two posters: *Ciguatera: Emerging Threats to Coral Ecosystems and Human Health and Research Raft as a Demonstration*: *Sustainable Ecological Aquaculture, SEA Project,* and also introduced scientific diving organized by Sea Dweller Union (SDU). This exhibition gained full support from renowned Hong Kong documentary producer and director Mr. Raymond Man, and his Hong Kong underwater documentary and photos were displayed. The SKLMP booth received attention from participants, not only introducing them to marine biodiversity but also promoting scientific diving and its significance to marine environmental protection and scientific research.

2014年11月2日，香港城市大學海洋污染國家重點實驗室參加了由廈門大學近海海洋環境科學國家重點實驗室、中國海洋科學卓越教育夥伴計畫（CoseeChina）和濱海濕地生態系統教育部重點實驗室共同主辦的2014廈門大學海洋科學開放日展覽活動。此次展覽的參與方包括廈門大學海洋與地球學院、環境與生態學院多個實驗室及海洋研究相關的學生社團，參與觀眾多為來自廈門各個中小學的學生及其家長，總人數接近2500人。

我室此次參展的內容包括"雪卡毒素：珊瑚礁生態系統與人類健康的新型威脅"和"可持續生態水產養殖"相關海報，以及潛者聯盟科學潛水科普知識，此次參展得到香港首屈一指的海洋攝製專家萬志權老師的大力支持，展出他攝製的香港海底生態紀錄片及相片，展示內容受到了參展觀眾的熱烈歡迎和關注。活動參與者驚訝於海底生物多樣性的同時，也開始了解什麼是科學潛水以及科學潛水對於海洋環境保護和科學研究的重要作用。

State Key Laboratory in Marine Pollution

Ocean Sciences Openhouse
海洋科學開放日參展

The other booths provided interactive experiments and games such as buoy observation, an ocean handicraft workshop and pH experiment, attracting students and their parents to participate. This open house was also open to tourists from all parts of the country and invited local media for publicity. According to the introduction of the open house staff, this activity was prepared for three months and promoted in middle and primary schools in Xiamen. The goal of this marine sciences open house was to popularize marine sciences to the public and enhance their awareness of marine environmental protection, pushing forward the development of marine scientific research and education.

其他參展攤位也向觀眾們提供了各種互動的遊戲，如浮標觀測，貝殼標本製作，pH值測試小實驗等，吸引了不少小學生及他們的家長，還有來自各地的遊客以及廈門當地媒體。據了解，本次海洋科學開放日籌備近三個月，分別到廈門各個中小學進行宣傳，"開放日"旨在向公眾普及海洋科學知識，促進對海洋的認知，提高全民的海洋環境保護意識，從而推動海洋科學研究和教育的發展。

International Diving Education and Application Symposium (IDEAS)
國際潛水教育與應用研討會

1. Background 背景

The ocean, occupying 71% of the earth, is the leading character of the blue planet, and is an ancient and sacred world, which bears the weight in the origin of life and evolution; it is a kingdom of vastness and the unknown, and fills the dreams and hopes of mankind; and the deep sea is the last frontier of the earth. A long, long time ago, mankind originated from the ocean; today, humans are unable to return to their "homeland" of birth on their own unless relying on "scuba" and "armored diving suits"; in the future, it is worthy of some deep thoughts as to whether we should be the guardian of the ocean or the explorer. In the realm of oceanography, scientists have held different views on ocean exploration, some insisting on using remote cameras, sensors or remote operated vehicles (ROV), others, such as we, have kept relying on diving, using human instinct to explore the ocean.

覆蓋地球71%面積的海洋是藍色星球的主角，它是遠古而神聖的世界，承載著生命的起源與進化；它是博大而未知的國度，承載著人類的夢想與希望；深海是地球上最後的待開闢疆域。遠古，人類來自海洋；今天，人類已經無法直接返回故鄉，為了圓回鄉之夢，我們需要「水肺」及「盔甲」；未來，我們要做海洋的守衛者，還是開拓者，值得深思。在海洋界，科學家對探索海洋的方法持有不同看法，有些人堅持遙距以攝錄鏡頭及感測器探海；而有些人如我輩堅持以身探海，用人類的本能去感受海洋。

State Key Laboratory in Marine Pollution

Since the 1930s, scuba diving has been widely used in Europe and the U.S. in education and research fields such as oceanography, geology, marine biology, marine ecology, archaeology, engineering, diving medicine, diving psychology; and such special skills have been defined as "scientific diving". Besides pure science, scientific diving has also become an important tool for applied science such as fishery management, environmental impact risk assessment, and energy explorations. Scientific diving in the U.S., Australia and Europe has developed locally based on a scientific diving safety management system which possesses a risk management function that protects the safety and health of individual divers, as well as the employing organization from excess liability exposure. The key thing is RECIPROCITY and there are strict administrative restrictions for diving with non-qualified colleagues.

自上世紀三十年代始，水肺潛水在歐美各地被廣泛應用於海洋學、地質學、生物學、生態學、考古學、工程學、水下醫學、水下心理學及水下生理學等重要學科教育及研究中，而該種特殊技能被定義為「科學潛水」。除了純科學之外、科學潛水也已經成為漁業管理、環境危害評估和能源開發等相關應用科學的重要工具，科學潛水在美國、澳洲和歐洲等地都發展著本地的管理體系。科學潛水在美國、澳洲和歐洲等地都發展了本地的科學潛水安全管理體系，其具有風險管理的功能可保障潛水者的安全與健康以及使雇主避免過多的責任風險。重要的是這是互惠的，對不符合資格的同事潛水必須有嚴格管理措施。

Presently, there is limited specialized training for scientific diving in Hong Kong or even Mainland China: most scuba scientists only train and equip as recreational divers. Scientific diving is an exciting, challenging and adventurous activity but can be dangerous and fatal if proper specialized training and suitable equipment is lacking. However, the danger level for scuba diving is ranked 43rd among all sporting events and, by the way, soccer/football is ranked 42nd and aviation No. 1.

目前，香港和中國內地均沒有專門的科學潛水訓練，大多數的科學潛水員只能通過休閒潛水的培訓獲得潛水技能。儘管科學潛水是一項富有趣味性、挑戰性、刺激性的冒險活動，但如果沒有受過專業的訓練或者合適的裝備，就可能會有危險甚至導致死亡。話雖如此，水肺潛水活動的危險等級在所有的運動項目中排行第43位，第42位是足球，第1位是航空。

Owing to the lack of scientific diving training and certification, diving safety guidelines and operational procedures, scientific divers from Europe and the U.S. are unable to conduct research collaboration in Hong Kong and Mainland China; and, by the same token, because of lack of certification reciprocity, our underwater scientists are not able to conduct research in Europe and the U.S. either, and this is a major obstacle for scientific exchanges, academic discipline development, technological advancement, personnel training and international collaboration.

在缺乏科學潛水訓練及認證、潛水安全規範和操作程序下，歐美水下科學家無法來我國開展水下科學合作研究；同樣地，在缺乏互認資格機制下，我國水下科學家亦無法在歐美各地開展水下科學研究，對學科發展，技術進步，人才培養，國際地區合作造成極大障礙。

In addition to the performance of cutting-edge research on marine pollution, the SKLMP realized that scuba diving is playing an increasingly crucial role in marine biology, ecology and environmental science research, and is now treated as a type of research method similar to molecular biotechnology. The SKLMP wishes to enhance professional diving standards, and to work out professional diving certification and operational specifications, by developing underwater science and research techniques, and initiating professional diving practices. Eventually, a safe and highly efficient diving education system will be established for China and other Asia-Pacific regions.

海洋污染國家重點實驗室（SKLMP）除了開展與海洋污染有關的前沿研究外，有見近年水肺潛水在海洋生物、生態及環境科學研究中日益重要，並被視作為等同分子生物技術的研究手段。SKLMP希望通過開發水下科研技術與開展專業潛水實踐以提升專業潛水標準並制定出專業潛水的認證和操作規範。最終將會在中國及亞太地區建立起一個安全高效的潛水教育體系。

2. Development of Scientific safe diving systems for China and other Asia-Pacific regions

中國及亞太地區科學安全潛水體系的發展

This scientific diving system in development is a multidisciplinary program: its goal is to equip students and scientists with the tools and technology for underwater scientific data collections. The program includes the fundamental theory of scuba diving, diving physics and physiology, incorporating the means of underwater scientific investigation with diving technology to enable students to possess the fundamental skills to become engaged in the research in marine biology, marine physics and underwater archaeology.

開發中的科學潛水課程是一門多學科交叉的課程，旨在讓學生與科學家掌握採集水下科學資料的工具及技術。課程包括基礎的水肺潛水理論、潛水物理及生理學，並將潛水技術結合水下科學考察的各種手段及方法，使學生具備從事海洋生物學、物理海洋學及水下考古學的基本技能。

Diving enables students and scientists to directly observe living marine organisms and their morphology, behavior and interactions and hence enables an understanding of the actual ecological processes in the environment, thereby contributing to the breakthroughs in marine environmental education and research. Scuba diving conducted by scientists is an invaluable research tool; a trained scientific eye underwater provides research value and flexibility that unmanned systems often do not. A combination of scuba diving and scientific expertise enables scientists to study the underwater environment and make a significant contribution to the advancement of underwater scientific research and education.

潛水使學生和科學家們能直接觀察海洋生物及生態系統在自然界中真實的狀態，譬如海洋生物的形態、行為及其相互作用，從而瞭解實際環境中的生態過程。我們深信科學家的一雙慧眼是無法被水下自主航行觀察及研究平台所取代。潛水與科學專業的結合使科學家可更深入研究水下環境，為水下科學研究和教育做出重大貢獻。

At the same time, diving education will enable students to transform fear to courage, faintheartedness into accomplishment, timidity into confidence, anticipation to passion; it also will teach students to open their hearts and minds to the hidden beauty of nature's creation and our obligation to protect the environment, teach them the value of character and integrity, and also help to foster self-esteem and transform others around themselves to a changed life for the better and forever.

同時潛水教育使學生從懼怕化為勇氣，退縮化為成就，膽怯化為信心，期待化為熱情；並可教導學生用心欣賞大自然的潛藏之美與人類保護自然環境的責任，幫助學生建立自信，傳授品格與誠信的價值，改變他人，讓人活出更美好的人生。

En route to exploring scientific safe diving systems that are suitable to the development of our country, the underwater sciences research team at the SKLMP has concentrated on acquiring advance experience in the field both locally and internationally, engaging in extensive dialogues and exchanges with world renowned underwater scientists, research institutions, educational institutions and recreational diving training organizations. In 2013 and 2014, our team members attended the annual symposia of the American Academy of Underwater Sciences (AAUS) and its workshops

在探索適用於我國發展的科學安全潛水體系的道路上，SKLMP 的海洋科學研究團隊致力於吸收國內外先進的經驗，與世界知名的水下科學家、科研機構、教育機構以及休閒潛水培訓機構等開展了廣泛的交流。2013年及2014年，團隊成員連續兩年參加美國水底科學協會年會及水下科學研究工作坊。

3. International Diving Education and Application Symposium (IDEAS 2014)
國際潛水教育與應用研討會（IDEAS 2014）

In May 2014, the SKLMP successfully organized the first International Diving Education and Application Symposium (IDEAS 2014) at the City University of Hong Kong, with participants including professors, researchers, government officials, undergraduates and graduate students from the University of Connecticut; City University of Hong Kong; Chinese University of Hong Kong; The University of Hong Kong; Hong Kong Baptist University; Hong Kong Institute of Education; Agriculture, Fisheries and Conservation Department of Hong Kong Government; National Taiwan Cheng Kung University; Xiamen University; Tsinghua University; Shantou University; Second Institute of Oceanography of State Oceanic Administration; and the Science, Technology and Innovation Commission of Shenzhen Municipality . The symposium covered topics ranging from scientific meetings, scientific diving courses and training, to a scientific safety divers workshop and open-water divers workshop. Participants reached consensus on future cooperation through academic exchanges, discussion and practices hoping to capitalize on scuba diving for underwater scientific research and scientific diving education.

We all believed that research and development of recreational and scientific diving in terms of theories, techniques and equipment requires support from government, enterprises, scientific research institutions and the public.

2014年5月，SKLMP在香港城市大學成功地舉辦了第一屆國際潛水教育與應用研討會（IDEAS 2014年）。參加者包括教授，研究人員，政府官員，及本科生和研究生。他們來自康乃狄克大學、香港城市大學、香港中文大學、香港大學、香港浸會大學、香港教育學院、香港漁農自然護理署、國立臺灣成功大學、廈門大學、清華大學、汕頭大學、國家海洋局第二海洋研究所、深圳市科技創新委員會。本次研討會的內容包括科學會議，科學潛水課程與培訓，科學安全潛水員工作坊及開放水域潛水員工作坊。參與者通過學術交流，討論與實踐對未來的合作達成共識，希望利用潛水開展水下科學研究和科學潛水教育。

我們都認為，無論休閒潛水還是科學潛水在理論，技術和設備方面的研究和發展均需要來自政府，企業，科研機構和公眾的支援。

4. International Diving Education and Application Symposium (IDEAS 2015)
國際潛水教育與應用研討會（IDEAS 2015）

Starting from 17th January and closing on 15th February, 2015, the IDEAS questionnaire received 72 valid responses. Respondents came from universities, research institutes and diving institutions in mainland China, Hong Kong, Taiwan and elsewhere in South East Asia. The majority were postgraduates and undergraduates with a science or engineering academic background and their ages ranged from 15 to 45.

In terms of the respondents' diving interest and knowledge, the majority of them are interested in marine scientific research development and marine conservation. More than 50% of the respondents knew something about recreational diving but hardly knew about scientific diving and could not tell the difference between them.

For diving course participation, more than 90% of the respondents would like to participate in diving activities such as underwater lectures and marine ecotourism, expecting to apply diving skills in their future marine scientific research. According to this questionnaire, 19 respondents will attend the workshop for scientific diving instructor; 29 respondents will attend the workshop and symposium on scientific diver training and underwater sciences and technology; and 56 respondents will attend the international scientific diving education and application summer school.

For diving cost, more than two thirds of the respondents are willing to attend a self-funded diving course but it is hoped that sponsorship will be given for excellent performance. About three quarters of the respondents considered that a reasonable price range for the diving course should be HK$3,500 to HK$4,500.

Most of the respondents were eager to receive IDEAS information such as participants' selection criteria, symposium announcement and schedule. Some respondents suggested that IDEAS should include courses about aquaculture and ecology and other activities to promoting scientific research.

自2015年1月17日至2015年2月15日，本次2015IDEAS調查問卷歷時一個月，共收回有效答復72份。在人員信息方面，參與問卷人員多來自中國內地，香港，台灣及東南亞國家等地的高校，科研院所及潛水機構，以高校碩士研究生及本科生為主，學術背景多為理科和工科，年齡介於15至45歲

在潛水知識與興趣方面，絕大部分答卷者都對海洋科學研究與保育有興趣。在潛水知識方面，過半答卷者較為了解休閒潛水，對於科學潛水的理解比較粗略，也不甚了解科學潛水與休閒潛水之間的區別。

在潛水參與度方面，超過90%的答卷者願意參與潛水相關活動，如水下海洋生物課程，水下生態旅遊，希望將學得的潛水技能應用於未來的海洋科學研究。根據問卷，在研討會三個環節中，願意參與科學潛水教練工作坊的人數為19，參與科學潛水訓練及水下科學與技術研討會的人數為29,參與科學潛水教育與應用暑期學校的人數為56.

在潛水課程費用方面，超過三分之二的答卷者願意參與自費潛水課程，但希望在表現優秀時獲得資助，75%的答卷者認為3500-4500港幣的費用較為合理。

大多數答卷者希望獲得更多 IDEAS 資訊，如參與的資格，會議通知與會議議程等。部分答卷者也希望可以附帶關於水產養殖，生態學等相關研究的課程，以潛水推動科學發展。

The Spin Kid Project
哪吒計劃

Not only working actively at the frontier of marine pollution research, social responsibility is also one of the key missions of the SKLMP.

In Chinese mythology, the Spin Kid is a well-known character. When he was young, he was just like many teenagers nowadays, spoilt and rebellious. However, after he found some cool and powerful weapons, he decided to change. He started to help the underprivileged groups, fight against evil and protect justice. Finally, he became a hero in the eyes of Chinese people.

From the view of public safety, marine conservation and environmental protection demands, the promotion of professional diving education can provide teenagers a platform to find their strengths and inner-self to face the continuous challenges ahead. Finally, these ocean lovers would create an excellent army for marine pollution research, marine conservation and public safety. It is expected that these youngsters will pass their passion and responsibilities to others, so as to keep pushing sport diving forward.

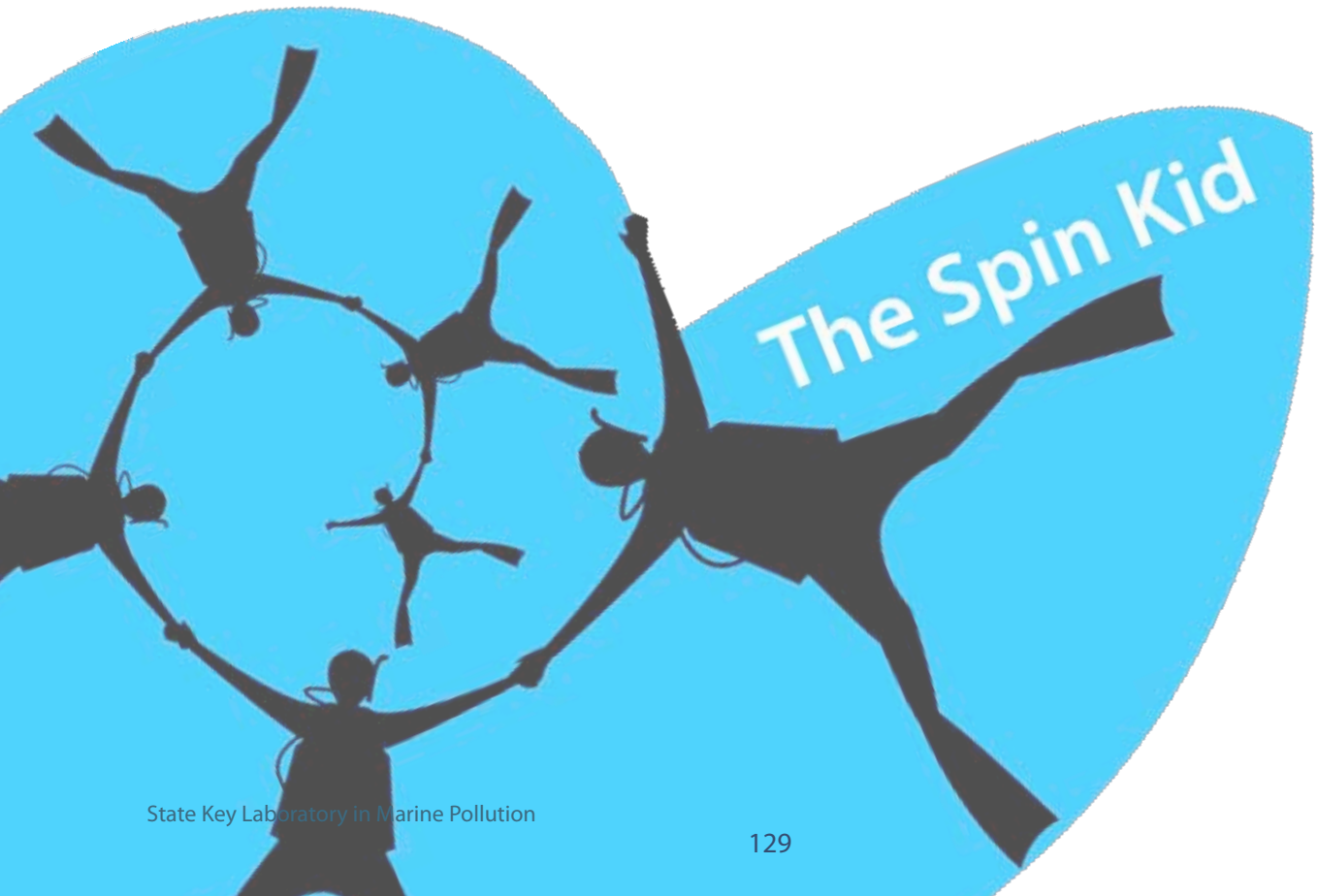
With the rise and development of public safety and scientific safety diving training, we believe diving activity, once viewed as a recreation, will gradually be expanded into the areas of marine environmental protection, a new type of vocational skill in a variety of industries and even more, provide opportunities to promote scientific, economic, social and civilizational development.

在開展前沿科研工作的同時，SKLMP也不忘肩負的社會責任。

「哪吒」是中國家喻傳戶曉的神話人物，他像很多時下年輕人一樣，被受寵壞及叛逆。在找到又酷又炫的風火輪、乾坤圈和混天綾後，他洗心革面，為人間正義打拼，與邪惡力量抗衡，抑強扶弱，維持公義，最終成為中國人眼中的英雄。

從公眾安全，海洋保育與環境保護的需求來看，通過專業潛水教育可以為青少年提供一個揮灑青春精力的舞臺，幫助他們不停找尋挑戰，釋放潛藏而驚人的力量，從而為海洋研究培育潛在的優秀生力軍。希望青少年的熱情與責任感能薪火相傳，從而不斷推動潛水運動前進。

隨著公共安全與科學安全潛水培訓的提升與發展，我們相信曾經被視為休閒娛樂的潛水活動，將逐步擴大到海洋環境保護領域以及成為多種行業的一個新型職業技能，促進科學，經濟，社會和文明的發展。



Program Introduction and Targets
項目內容及對象

Programs for CityU Students and Visiting Students from other Universities
城大學生及其他大學訪問學生

Basic and Scientific Diving Training: To train undergraduates who are interested in marine science with basic and scientific diving skills to promote the study of biodiversity and the importance of marine conservation, and to nurture them as scuba marine scientists.
基礎及科學潛水訓練：訓練對海洋科學有興趣的本科生，掌握潛水技能後，推動生物多樣性及海洋保育方面的研究，培養他們成為水肺潛水海洋科學家。

Underwater Lecture and Semester-By-Sea: To encourage and support students and scientists (with relevant diving training) to explore biodiversity around the world and employ diving as a tool to directly observe living marine organisms in terms of their morphology, behavior and interactions, and hence enable the understanding of the actual ecological processes in the environment, thus contributing to breakthroughs in marine environmental research.
水下講堂及海邊學期：鼓勵及支持學生和科學家們在世界各地自然界真實的狀態中，認識海洋生物多樣性及保育海洋的重要性，通過直接觀察海洋生物的形態、行為及其相互作用，從而瞭解實際環境中的生態過程，為科學研究及創新作出貢獻。

Project Deliverables
項目成果

To establish safe and high-efficient diving education systems for professional diving and to drive an innovative diving industrial chain:-
為專業潛水建立安全，高效的潛水教育系統和推動創新潛水產業鏈：

Simultaneous development of professional diving education systems by academics, governments and industries in order to train high-quality underwater professional divers.由學術界，政府和業界共同開發專業潛水教育系統，以培養高素質的專業水下潛水員。

It is the right time, for the accurate positioning and the huge market demand for diving in China (including the need for training, talent and equipment) to form the circle of supply chains that leads to the direct transformation of techniques to productivity and so create substantial business value with good market prospects.
現今正適逢良機，通過準確定位，挖掘中國巨大的潛水市場需求（包括對培訓，人才和設備的需求），形成循環供應鏈，使技術向生產力的直接轉化以創建大量具有良好的市場前景的商業價值。

Community Services & Public Education
社會服務及公民教育

To promote and raise public awareness of the conservation of biodiversity and marine environment and the sustainable use of valuable marine resources via diving.
通過潛水提升公眾對海洋環境與生物多樣性保育及可持續性利用珍貴海洋資源的意識

Marine Conservation Seminar and Forum: To educate the public concerning the importance of marine biodiversity and marine conservation;
海洋保育講座及論壇：教育大眾認識海洋生物多樣性及保育海洋的重要性;

Basic & Professional Diving Training: To equip secondary school students with living skills and contribute to the community via delivering a message on marine conservation;
基礎及專業潛水訓練：使中學生掌握謀生技能，通過海洋保育貢獻社會。

"Embrace Challenge Together" - by working hand-in-hand between able bodied and disabled persons to demonstrate and reach out to others to promote the benefits and enjoyment of being underwater.
"擁抱挑戰"：通過健康人士和傷健人士之間一起手把手一起合作向他人展示水下的優勢和樂趣。

The Ocean+ Project

To catch the strategic opportunity of marine economic development, and bring the unique advantages of the SKLMP into full play, the SKLMP aims to carry out professional diving education through the Ocean+ Project which will nurture amateur marine scientists from the public.

To better explore and protect the ocean, we need to learn more about it. The father of scuba diving, Jacques Cousteau, once said: "The Sea, once it casts its spell, holds one in its net of wonder forever". Diving is the key for entry to the blue planet, and mankind must respect and abide by the rules of Sea Dweller, for only then can mankind get along with the ocean, attain safety and pleasure, and finally integrate itself as part of the blue planet.

Marine scientists should first complete the process of seeing the ocean by eyes, exploring the ocean by sensors, going into the ocean by boat and diving in the ocean by themselves, and then helping the public to savor the fascination of the underwater through up-close experience. Diving is tending nowadays towards turning the whole diving industry and scuba enthusiasts into the best media for promoting marine science education and raising public awareness of marine conservation and environmental protection. We believe that recreational diving and scientific diving should stimulate one another for mutual development.

Besides, diving is a growing industry and of increasing importance not only in terms of the economic aspect but also for public safety. In a rainstorm which occurred in Shenzhen (30th August 2013) and a drowning incident which occurred in Beijing (21st January 2012), firemen were unable to save victims who were trapped in vehicles because of their lack of specialized underwater training. This revealed the weakness of our country in dealing with underwater accidents and underwater criminal investigations, and the need to develop and promote professional training such as public safety diver and underwater criminal investigators. Such training means a lot to law enforcement agencies and to the community, since public safety divers and underwater criminal investigators usually operate in dangerous environments to save lives, retrieve bodies, recover crime evidence, etc. Promoting such a career with respected duties can also raise the social responsibility and consciousness of citizenship among our next generation. The ultimate target is to spread the oceanic culture to every corner in our society and make every single citizen an "Oceanographer" who loves and respects our ocean.

海洋+計劃

為抓住當前海洋經濟發展的戰略機遇並將SKLMP的獨特優勢充分發揮，SKLMP計劃通過海洋+計劃開展專業潛水教育培育市民成為民間海洋科學家。

要更好的"經略海洋、保護海洋"，其基礎就是認識海洋。潛水之父雅克·庫斯托曾經說過："海洋一旦施展其魔法，你將墜入這奇妙世界不能自拔"。潛水是進入這個藍色星球的關鍵，而人類必須尊重和遵守海居者的規則，因為只有這樣人類才能相與海洋安全快樂的共存，並最終融入這個藍色星球。

研究海洋的科學家們應該完成"看海 – 探海 – 下海 – 潛海"的轉變，通過近距離的體驗，才能幫助市民了解水下世界的魅力。近年來潛水運動日趨普及，而潛水業界及潛水愛好者，是宣傳海洋科普教育，提高公眾海洋保育和環境保護意識的最佳媒介。我們相信，休閒潛水和科學潛水應相互促進，共同發展。

此外，潛水行業正在蓬勃發展，不僅對經濟，對於公共安全也越來越重要。2013年8月30日在深圳發生的一場暴雨和2012年1月21日在北京發生的一起溺水事件，由於缺乏專業水下技能的培訓，消防人員束手無策，駕車者被困水中，最終溺水罹難。從而可見我國在水下意外處理及罪案調查方面， 力量極之薄弱，亟需推廣及發展公共安全潛水員與水下罪案調查員的教育。公共安全潛水員與水下罪案調查員對執法機構和社會大眾來說意義非常重要，他們通常在危險的環境中執行任務，肩負著救急扶危、拯救遇溺者及尋回遇難者、為執法人員搜證及將罪犯繩之于法等神聖使命，期望通過推動這種具有使命感的職業，提升年青一代的社會責任感及公民意識感。最終的目標是將海洋文化傳播到社會各階層，讓每一個公民成為熱愛海洋、尊重海洋的"海洋家"。

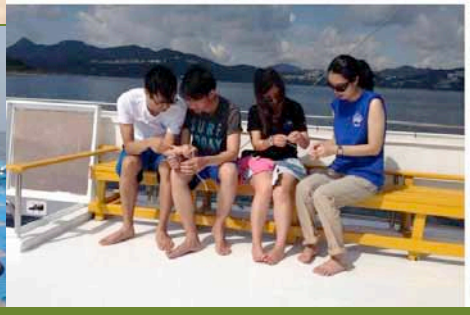
Rescue Training and First Aid Training
水面救援訓練急救訓練

The Ocean Oasis (O2)

海洋綠洲

The SKLMP will try to transform the fi shing activities on fi shing boats and luxurious activities on pleasure vessels and yachts into nationwide marine environmental monitoring and protection activities. This project will encourage and trainfi shermen, yachters, captains and crew to transform their vessels into an Ocean Oasis (O2) amateur marine scientific research vessel during their normal activities by helping marine scientists to measure water quality and collect water samples for scientific purposes. It is hoped that this project will elevate public awareness in protecting the ocean and sustainable marine resources and to cultivate the concept of environmental protection by these "Citizen Scientists". They can organize regular activities on their Ocean Oasis vessels such as sharing of scientific fi ndings, marine photography exhibitions, marine-themed books circulating gatherings and scientific forums. In this way, the Ocean Oasis vessel will become a communication platform to team up ocean lovers and marine experts from various fields, and to build a positive image of the amateur marine scientists, realizing our Nation's Ocean Dream together.

SKLMP將嘗試將漁船上的捕魚活動及遊樂船隻與遊艇上的娛樂活動改變成為全國性的海洋環境監測和保護活動。該項目將鼓勵和培養漁民，遊艇艇主，船長和船員在船隻進行例常工作時變為海洋綠洲民間海洋科考船，以幫助海洋科學家測量水質和收集水樣用於科學研究。希望這個項目能提升公眾保護海洋與可持續海洋資源的意識以及通過這些"民間科學家"培養環保理念。他們可以組織海洋綠洲船隻進行定期的活動，如分享科研成果，舉辦海洋攝影展，以海洋為主題的書籍流通會和科學論壇。通過這種方式，在海洋綠洲將成為一個匯集來自各個領域的海洋愛好者和海洋專家的交流平臺，並建立的民間海洋科學家的正面形象，共同實現中國的海洋夢。



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