10th

臺灣海洋生物技術學會 2012 Taiwan Marine Biotechnology Society

OMICS THE OMICS IN THE OCEAN

The Omics in the Ocean

The 10th International Symposium for Marine Biology and Biotechnology
The 7th Taiwan Society of Marine Biotechnology Academic Symposium

2024

9.26 Thu. — 28 Sat.

PROGRAM BOOK

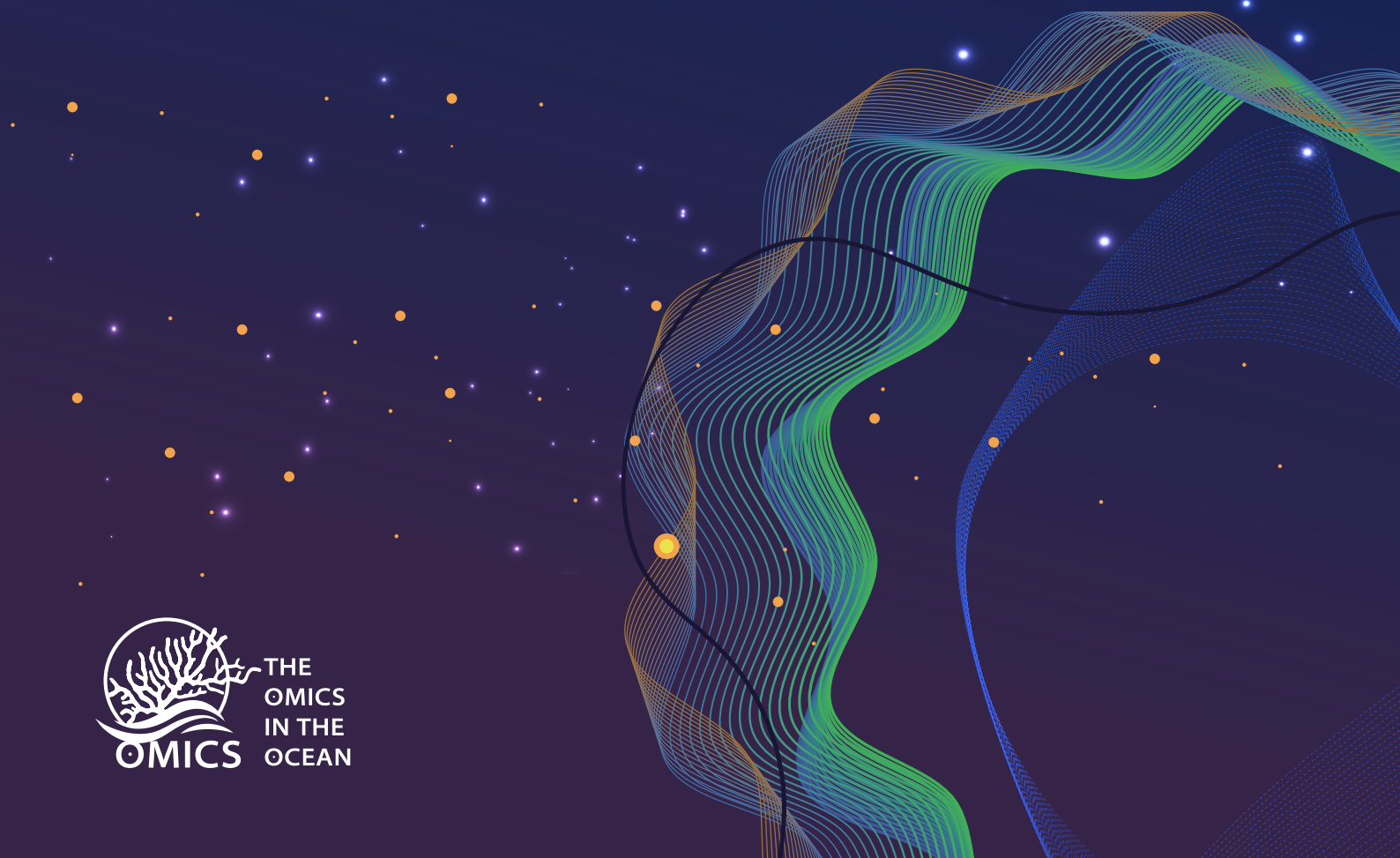
NATIONAL MUSEUM OF MARINE BIOLOGY & AQUARIUM

Content

The Omics in the Ocean

The 10th International Symposium for Marine Biology and Biotechnology
The 7th Taiwan Society of Marine Biotechnology Academic Symposium

ABOUT THE SYMPOSIUM



THE OMICS IN THE OCEAN

History & Theme

For promoting the research, conservation, education and extending cooperation on marine sciences and biotechnology, the National Museum of Marine Biology and Aquarium (NMMBA) and the College of Marine Sciences, National Dong Hwa University began to hold a national symposium on marine biotechnology in September of 2006 and 2007 respectively.

Starting in 2008, the annual national symposium was transformed into an international symposium entitled “The Omics in the Ocean — The International Symposium for Marine Biology and Biotechnology”. Omics represents a field of study in Greek. In mandarin pronunciation, Omics represents the profound secrets or the truth. With the increasing attraction and application of various omics approaches in biological research, we adapt this title to symbolize our effort and enthusiasm to explore the beauty and truth of the ocean. Since 2008, we have held night symposiums which have attracted about 150 participants annually, including distinguished scholars, experts and students from around the world. This symposium has been serving as a great platform for researchers and students to share the latest progress in various areas of marine biology and biotechnology.

This year, we specially invited the "Taiwan Marine Biotechnology Society" to co-organize this symposium with us, so the name of the symposium will be merged into "The Omics in the Ocean — The 10th International Symposium for Marine Biology and Biotechnology&The 7th Taiwan Society of Marine Biotechnology Academic Symposium". Our annual theme is “Innovative Applications and Sustainable Development in the Blue Ocean”. Our distinguished speakers invited from around the world will give talks on this topic from different perspectives. There will also be poster display on other areas of marine biology and biotechnology. We believe that all participants will benefit from and enjoy this year’s symposium.

Organizer

National Museum of Marine Biology and Aquarium, Taiwan

Adviser

Ministry of Education, Taiwan

Co-organizers

Taiwan Marine Biotechnology Society, Taiwan

National Sun Yat-sen University, Taiwan

Organizing Committees

Te-Hao Chen	Research Fellow/ Acting Curator, Department of Biology, National Museum of Marine Biology and Aquarium
Zhi-Hong Wen	Distinguished Professor, Department of Marine Biotechnology and Resources, National Sun Yat-sen Univerity
Li-Hsueh Wang	Associate Research Fellow/ Director, Department of Planning and Research, National Museum of Marine Biology and Aquarium
Yuan-Bin Cheng	Professor/ Director, Department of Marine Biotechnology and Resources, National Sun Yat-sen Univerity
Ping-Jyun Sung	Research Fellow, Department of Planning and Research, National Museum of Marine Biology and Aquarium
Liang-Chun (Mark) Wang	Associate Professor, Department of Marine Biotechnology and Resources, National Sun Yat-sen Univerity
Chang-Wen Huang	Associate Professor, Department of Aquaculture, National Taiwan Ocean University
Hsing-Hui Li	Assistant Research Fellow, Department of Planning and Research, National Museum of Marine Biology and Aquarium
Shih-Wei Lee	Assistant Research Fellow, Department of Planning and Research, National Museum of Marine Biology and Aquarium
Shao-Hung Peng	Assistant Research Fellow, Department of Biology, National Museum of Marine Biology and Aquarium
Yao-Ju Wu	Assistant Research Fellow, Department of Science Education, National Museum of Marine Biology and Aquarium

Grant

National Museum of Marine Biology and Aquarium (NMMBA)
No. 2, Houwan Road, Checheng, Pingtung 94450, Taiwan, R.O.C.
Tel:+886-8-8825001
http://www.nmmba.gov.tw/english/index.aspx

國立海洋生物博物館
NATIONAL MUSEUM OF MARINE BIOLOGY & AQUARIUM

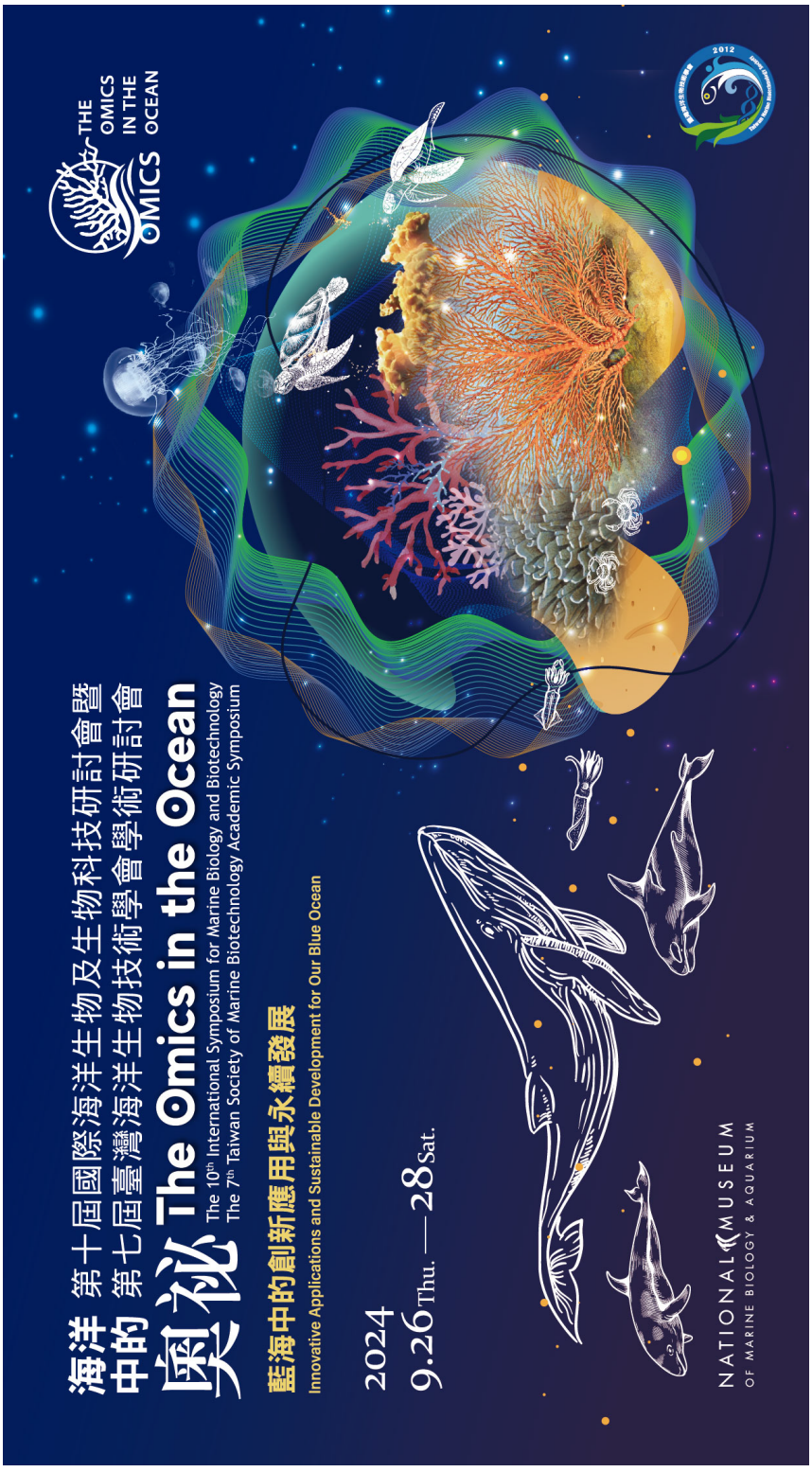
National Science and Technology Council
No. 106, Sec. 2, Heping E. Rd., Taipei 106214, Taiwan, R.O.C.
Tel: +886-2-27377992
https://www.nstc.gov.tw/

NSTC 國家科學及技術委員會
National Science and Technology Council

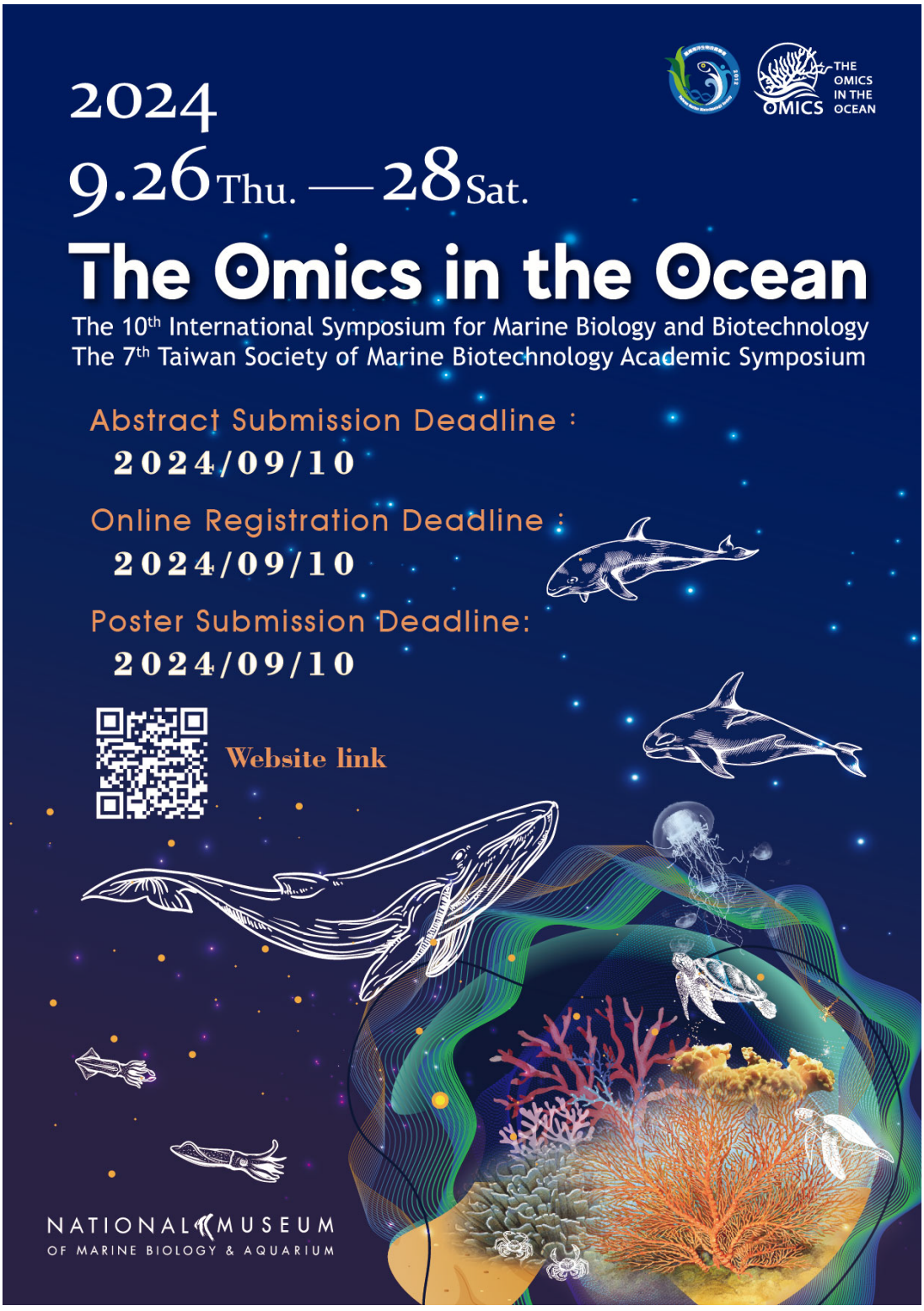
Taiwan Marine Biotechnology Society
National Taiwan Ocean University Center of Excellence for the Oceans
No.2, Beining Rd., Jhongjheng District, Keelung City 20224, Taiwan (R.O.C.)
Tel：02-2462-2192 #5283 or #5286 / Fax：02-2782-4595
E-mail：tmbs.wu@gmail.com
https://www.tmbs.com.tw/news.php

臺灣海洋生物技術學會 2012 Taiwan Marine Biotechnology Society

Key Vision of the Symposium



Poster of the Symposium



The Omics in the Ocean

The 10th International Symposium for Marine Biology and Biotechnology
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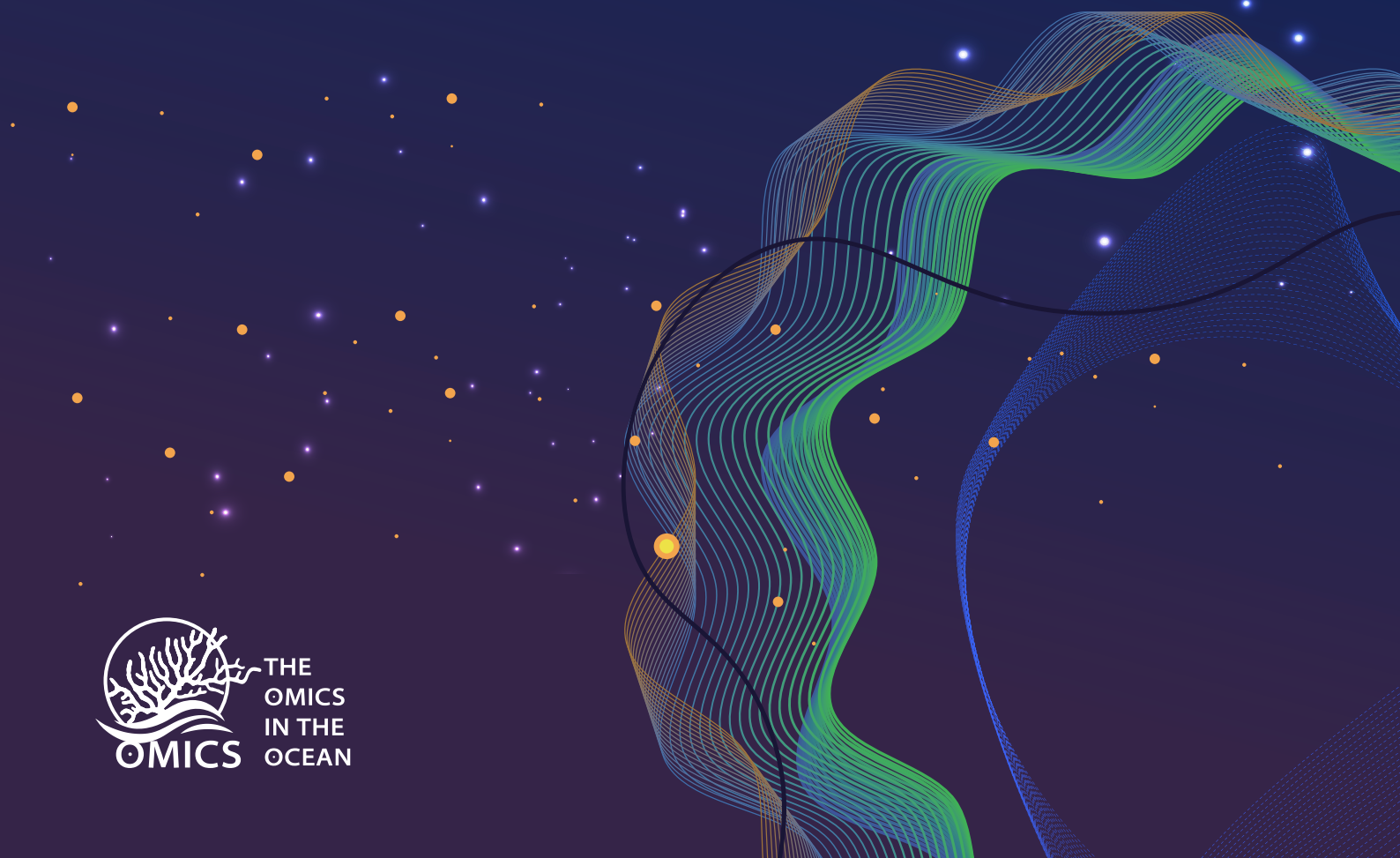
SYMPOSIUM PROGRAM



THE OMICS IN THE OCEAN

Thursday - Sep 26, 2024

13:30-17:00 Registration
13:30-17:00 Paste Poster

Friday - Sep 27, 2024

~08:30 Registration
08:30-08:40 Opening

Section 1. Coral Restoration and Biotechnology

	Topic	Speaker	Moderator
08:40-09:30	Thoughts From My Selective Memoirs	Dr. I-Chiu Liao	Dr. Hsin-Yiu Chou
09:30-10:10	Echinoderm genome evolution represented in echinobase, a whole phylum model organism database.	Dr. Peter D. Vize	Dr. Jen-Leih Wu
10:10-10:50	Coral survivorship, performance, and biodiversity enhancement using 3D printed ceramics in coral restoration	Dr. David Michael Baker	Dr.Wei-Jung Chen
10:50-11:10	Coffee break		
11:10-11:50	Development of Automatic Software for Dissecting Complex Social Behavior in Fish and Crayfish	Dr. Chung-Der Hsiao	Dr. Tzong-Yueh Chen
11:50-13:20	Lunch & Poster section & General assembly meeting		

Section 2. Marine Environmental Change and Biodiversity

	Topic	Speaker	Moderator
13:20-14:00	What is the appropriate time period for marine ecological surveys and monitoring?	Dr. Kwang-Tsao Shao	Dr. Te-Hao Chen
14:00-14:40	Enhancement of bleaching stress tolerance in coral endosymbiotic microalgae using genetics	Dr. Ching-Nen Nathan Chen	Dr. Zhi-Hong Wen
14:40-15:20	Geographical differences affect the seasonal succession of copepods in the southern waters of the East China Sea	Dr. Li-Chun Tseng	Dr. Hsin Lee
15:20-15:40	Coffee break		

Section 3. Blue Carbon Cycling and Reapplication

	Topic	Speaker	Moderator
15:40-16:20	Influence of Chitosan enriched Zinc Nanoparticles for the growth performance, feeding and metabolic process of aquatic animals-A Nanotechnology Approach	Dr. K. Murugan	Dr. Crystal McRae
16:20-17:00	Exploring the 'Dark Matter' of Microbiomes: Integrating Omics Strategies to Study Marine Symbiotic Microorganisms and Plastisphere	Dr. Ying-Ning Ho	Dr. Li-Li Chen
17:00-17:40	Museum social responsibility- How to response to challenges in changing environment	Dr. Tung-Wei Shih	Dr. Chia-Wei Lin
18:00-21:00	Banquet (Invited)		

Saturday - Sep 28, 2024

Section 4. Back to the Ocean: The Odyssey of Marine Reptiles and Cetaceans

	Topic	Speaker	Moderator
08:30-09:10	Examining Taiwan's Cetacean Conservation History Through the First Blue Whale Stranding in Nearly a Century	Dr. Hao-Ven Wang	Dr. Shi-Wei Lee
09:10-09:50	Biotechnology's Role in Advancing Cetacean Conservation in Taiwan	Dr. Wei-Cheng Yang	Dr. Chang-Jer Wu
09:50-10:10	Coffee break		

Section 5. From Beginning to Future

	Topic	Speaker	Moderator
10:10-10:50	Reconstructing paleo-reef fish community	Dr. Chien-Hsiang Lin	Dr. Shi-Wei Lee
10:50-11:30	A possible prehistoric stranding site for cetaceans in southernmost Taiwan	Dr. Tzu-Ruei Yang	Dr. John Han-You Lin
11:30-11:50	Poster award & Closing ceremony		
11:50~	Farewell		

The Omics in the Ocean

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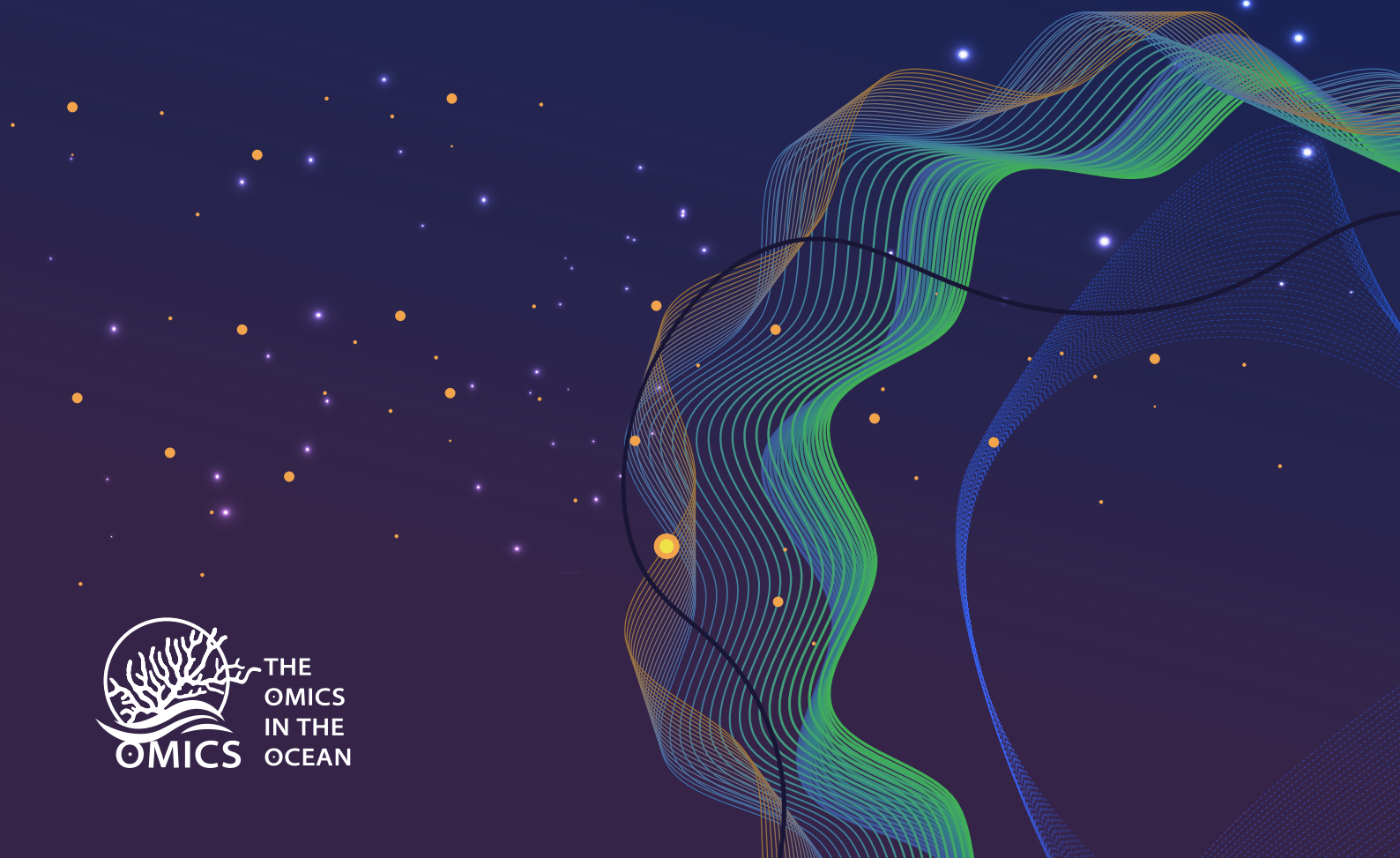
INVITED LECTURES



THE OMICS IN THE OCEAN

Dr. I-Chiu, Liao (廖一久)

Email: icliao@mail.ntou.edu.tw

Tel: 2462-2192 # 2934

Affiliation:

- Lifetime Distinguished Professor, National Taiwan Ocean University, Keelung, Taiwan
- Chair Professor, National Pingtung University of Science and Technology, Pingtung, Taiwan
- Chair Professor in the field of Aquatic Biology, National Chung Hsing University,
- Distinguished Chair Professor for Research, Institute of Fisheries Science of National Taiwan University, Taipei, Taiwan

EDUCATION & EXPERIENCES

Experiences

1968-1969 Res. Fel., Rockefeller Found
1968-1974 Assc. Prof., Dept. of Zoology & Inst. of Oceanology, NTU
1971-1987 Dir., Tungkang Marine Lab., TFRI
1987-2002 Dir. Gen. TFRI
1984-1990 Tech. Adv., Milkfish Project, US Agency for Intl. Dev.
1984-1992, 1998-2004 Councilor, Asian Fisheries Soc.
1985-1998 Chairman, Twn. Chapter
1998-2001 Pres., Asian Fisheries Soc.
2005-2008 Pres., Fisheries Society of Taiwan.

Education

B.S., Zoology. National Taiwan University
M. of Agr., University of Tokyo
Ph.D. of Agr., University of Tokyo

RESEARCH INTERESTS

1. Aquaculture,
2. Aquatic Ecology,
3. Stock Enhancement and Sea Ranching,
4. Aquaculture Management

GRANTS AND AWARDS

1987 Hon. Life Mem., World Aquacul. Soc.
1990 Fellow, the World Academy of Sciences, TWAS(Former: 3rd World Academy of Sciences)
1992 Academician, Academia Sinica, Taiwan
1995 Hon. Life Mem., Asian Fisheries Soc.
2009 Presidential Science Prize
2010 The Phi Tau Phi Scholastic Honor Prize
2012 Lifetime Achievement Award, Global Aquaculture Alliance
2012 Top Ten People of the Year of China Fisheries Industry, Fisheries Advance Magazine
2014 The Order of the Rising Sun, Gold Rays with Neck Ribbon, Japan
2017 Japanese Society for Aquaculture Science, Honorary Member
2017 Agricultural Association of Taiwan, Agricultural Academic Award
2018 Executive Yuan Council of Agricultural, Agricultural Professional Medal
2019 Nikkei Asia Prizes, Winner for Science and Technology
2021 The 9th Outstanding Contribution Award for the Oceans

Thoughts From My Selective Memoirs

I-Chiu Liao

National Taiwan Ocean University
*E-mail: icliao@mail.ntou.edu.tw

Abstract

Thank you for the inviting me on this rare opportunity to share some of the thoughts and experience in my life with the vibrant younger generation. “Nikkei Asia” (日本經濟新聞 Nikkei Shinbun), one of the prominent newspaper in Japan, publishes the deeds of various notable Japanese figures in daily newspapers and electronic columns in a monthly series. This column 私の履歴書 or “My Personal History” has been running for over 120 prominent individuals and has been well-received.

In 2019, I was awarded the Nikkei Asia Prizes, which led to further contact with the “Nikkei”. Consequently, I decided to write up “My Personal History” in a monthly series, which was eventually published from August 1st to August 31st, 2023.

In this series, I recount some memories from my close to 90 years of life and today I would select a few most engraved ones and share with my younger country fellows. I hope this presentation benefits you all and wish you live happily, love brilliantly, live with dignity, and live meaningfully.

Thank you very much

Dr. Peter D. Vize

Email: pvize@ucalgary.ca

Tel: +61 401-300-965

Affiliation:

1. Department of Biological Sciences, University of Calgary, Alberta, Canada
2. Department of Biochemistry & Molecular Biology, University of Calgary, Alberta, Canada

EDUCATION & EXPERIENCES

Experiences

2018-present Professor Emeritus, Dept. of Biological Sciences, University of Calgary
2018-11.2028 Faculty Professor, Dept. of Biological Sciences, University of Calgary
2018-present Professor of Marine Genomics (Adjunct), NMSC, Southern Cross University, Australia
2016 Visiting Academic, University of Queensland (January-August)
2014-2020 Full Member, Alberta Children's Hospital Research Institute
2005-2018 Professor of Marine Ecology, University of Calgary.
2005-2020 Professor of Computer Science (Adjunct), Faculty of Science, University of Calgary.
2001-2005 Associate Professor of Biological Sciences (with tenure) and AHFMR Senior Scholar, University of Calgary.
1999-2001 Associate Professor of Molecular Cell and Developmental Biology (with tenure), University of Texas at Austin.
1993-1999 Assistant Professor of Zoology (tenure track), University of Texas at Austin.
1990-1992 Postdoctoral Fellow, Department of Biochemistry & Molecular Biology, Harvard University with Professor Douglas Melton.
1988-1989 Postdoctoral Scientist, MRC, Mill Hill, London with Dr. Michael Sargent.

Academic education

1983 B.Sc. Hons.- Genetics & Biochemistry, Monash University, Melbourne Australia
1987 Ph. D.- Molecular Biology, University of Adelaide, Australia
1988-89 Postdoc- Developmental Biology, MRC, Mill Hill, London
1990-92 Postdoc- Developmental Biology, Harvard University

RESEARCH INTERESTS

1. Marine Ecology
2. Computer Science

GRANTS AND AWARDS

07.23-06.2028 NIH P41 Echinobase Joint-PI, P41HD095831 US$3.9 million
06.21-05.2026 NIH P41 Xenbase; a Xenopus model organism database US$8.7 million renewal, Joint Director. P41 HD064556
07.18-06.2023 NIH P41 Echinobase Joint-PI, P41HD095831 US$3 million
04.17-04.2023 NSERC Discovery Grant- PI RGPIN-2017-03882 CN$234,000 "Molecular clocks regulating coral spawning" (renewal)
11.15-10.2021 NIH P41 Xenbase; a Xenopus model organism database US$7 million renewal, Joint Director. P41 HD064556
06.15-09.2015 NIH P41 Xenbase; a Xenopus model organism database US$300,000 Administrative supplement. Joint Director.
10.12-10.2018 Wellcome Trust (UK) Database support for the EXRC UK£46,000 sub-contract 26657
05.12-04.2017 NSERC Discovery Grant- PI 288142-2012 CN$131,000 "Molecular clocks regulating coral spawning" (renewal)
06.11-05.2016 NIH R01 GM099149 (USA) US$2 million "Transcriptome profiling and targeted genic improve-

ment of X. tropicalis genome" co-PI with M. Khokha (Yale) and M. Gilchrist (MRC, UK)
04.10-03.2011 NSERC Discovery Grant - PI CN$29,000 "Molecular clocks regulating coral spawning"
05.10-05.2015 NIH P41 HD064556 (USA, Joint Director with A.Zorn) US$4.7 million "Xenbase: a Xenopus model organism database"
06.08-06.2011 BBSRC (UK), subcontract to EXRC CN$150,000
10.07-10.2008 Wellcome Trust (UK), subcontract to EXRC CN$80,000
04.05-03.2010 NIH R01 HD45776 (USA)- PI US$2 million "Xenbase: a Xenopus model organism database"
05.04-04.2007 Japanese Society for the Promotion of Science US$450,000 (with N.Ueno and K.Cho) "Xenopus functional genomics"
01.03-01.2006 Canadian Institutes of Health Research-PI MOP-67152 CN$302,100 "Embryonic kidney development"
10.02-10.2003 Canadian Institutes of Health Research-PI IHD - 61223 CN$128,000 "Role of p63 in regulating cell specification, division and apoptosis"
09.01-08.2003 ANPI Bioinformatics databases CN$400,000 09.01-06.2006 AHFMR Senior Scholarship 200000536 CN$470,000 "Developmental models of organogenesis and tumorigenesis"
09.01-08.2003 AHFMR Establishment Grant 200000537 CN$250,000
09.01-06.2006 AHFMR Research Prize 200100305 CN$100,000
09.01-08.2002 AHFMR Major Equipment Award 200000538 CN$175,000
02.00-02.2002 National Science Foundation IBN 9983061 PI US $312,000 "Molecular regulation of pronephric development" renewal
08.96-01.2000 National Science Foundation IBN 9630621 PI US $339,000 "Molecular regulation of pronephric development"
07.1996 National Kidney Foundation Young Investigator Award US $ 50,000
01.94-12.1995 Texas Advanced Research Program. (#187) PI US $160,000 "Role of the WT1 gene in kidney induction"
1989-1991 Jane Coffin Childs Memorial Fund for Medical Research Postdoctoral Fellow. page , Cur riculum Vitae; Peter D. Vize 2
1984-1987 Commonwealth Postgraduate Research Award
1983 First Class Honours in Genetics.

EDITORIAL BOARD/ACADEMIC REFEREE

1. Associate Editor:

Genesis, The Journal of Genetics and Development, 2015
Biology of the Cell, 2005-2007

2. Editorial Board:

Biology of the Cell (2005-2010)

3. Manuscript Reviewer:

Acta Anatomica
Biochemistry and Cell Biology
BMC Developmental Biology
Development
Development Genes and Evolution
eLife
Genesis
G3
JASN
J. Physiology
Marine Ecology Prog Ser.
Molecular Ecology
Nature Communications
Plankton and Benthos Research
Proc. Natl. Acad. Sci. USA
Trends in Cell Biology

Biological Bulletin
Bioinformatics
BMC Evolutionary Biology
Developmental Biology

Frontiers Marine Biol.
Genome Biology
Int. J. Dev. Bio.

JoVE
Molecular Ecology
Molec. Genetics & Genomics
Nephron
Phil. Trans. Royal Soc. B.
Science

Biology of the Cell
BMC Genomics
BMC Research Notes
Developmental Dynamics

Gene Expression Patterns
Gulf of Mexico Science
Journal of Cell Biology

Kidney International
Mechanisms of Development
Nature
Nucleic Acids Research
PLoS One
Scientific Reports

Echinoderm genome evolution represented in Echinobase, a whole phylum model organism database

Peter D. Vize

Department of Biological Sciences, University of Calgary, Calgary, Alberta, T2N1N4, Canada
E-mail: pvize@ucalgary.ca

Abstract

The ancient marine phylum, Echinodermata, has existed for half a billion years and encompasses extraordinarily diversity including the brittle stars, sea stars, sea urchins, sea cucumbers and crinoids. They play key ecological roles in ecosystems ranging from the intertidal zone to the depths of the abyssal plains. These animals are widely used in developmental biology to study gamete fertilization and early morphogenic processes such as gastrulation. They were also the phylum in which system biology was born and used to build the first gene regulatory networks. Echinobase is a model organism knowledgebase supporting echinoderm research by linking genomic data from this diverse set of organisms to other gene centric data types such as gene expression, gene function, gene interactions and publications. Inter-relating data over this evolutionary distance is challenging. Data in different fields is bridged using a set of ontologies- controlled vocabularies with relationships between terms. One of the central ontologies is the Echinoderm Anatomical Ontology or ECAO, which captures the anatomy of developing echinoderm embryos and embryonic stages for the entire phylum. We also bridge Echinoderm data to biomedical models through the use of DIOPT, an orthology prediction suite. In this instance the standard echinoderm model, the purple sea urchin, is vertically mapped to the human genome to identify potential orthologs. The same system also horizontally maps the purple urchin genome to other echinoderm genomes. The matrix of conserved relationships then permits genes in any of the represented species to be linked to the vast data on genetic diseases, protein-protein interactions and gene function available from human and other vertebrate datasets. While early phases have focused on conservation across the phylum, we have also been identifying paralogs within each species. As gene duplication plays a key role in diversification and evolution we hope to move from tools to study conserved features and processes to the evolution of this phylum.

Dr. David Michael, BAKER

Email: dmbaker@hku.hk
Tel: +852 3917 3606
Affiliation:
The Swire Institute of Marine Science, School of Biological Sciences, The University of Hong Kong

EDUCATION & EXPERIENCES

Experiences

2013 - present Associate Professor, The Swire Institute of Marine Science, School of Biological Sciences, The University of Hong Kong
2024 - present Director, Swire Institute of Marine Science
2020 - present Director, HKU Stable Isotope Ratio Mass Spectrometry Laboratory (SIRMS)
2023 - present Associate Director, Knowledge Exchange Office
2011 – 2012 MarineGEO Fellow (formerly Marine Science Network), Smithsonian Institution
2010 – 2012 Post-doctoral Associate & Visiting Investigator, Carnegie Institution of Washington, Geophysical Laboratory

Academic education

Ph.D. (2010) Ecology & Evolutionary Biology; Cornell University
M.S. (2004) Biology; American University
B.A. (2001) Biology; St. Mary's College of Maryland

RESEARCH INTERESTS

1. Coral Reef Ecology
2. Biogeochemistry
3. Stable Isotope Ecology
4. Symbiosis
5. Global Change
6. Marine Pollution

GRANTS

2023

1. Environment and Conservation Fund; *A mammoth task: creating a reliable and cheap test to distinguish mammoth and elephant ivories to prevent trafficking and laundering of elephant ivory*. (118/2022; 890 K HKD)
2. Marine Conservation Enhancement Fund; *From Conservation to Carbon Neutral: Quantifying Blue Carbon in Coastal Sediments and Their Contribution to Carbon Budgets.* (MCEF21112; 1.4 M HKD)
3. Research Grants Council Hong Kong, GRF; *Are amino acids the key to understanding the coral symbiosis?* (17114723; 1.24 M HKD)

2022

1. Agriculture, Fisheries and Conservation Department; *Provision of Service on Further Monitoring for Restored Corals on 3D-printed Reef Tiles in Hoi Ha Wan Marine Park.* (AFCD/SQ/256/18/C; 1.4 M HKD)

2020

1. Agriculture, Fisheries and Conservation Department; Provision of Service for Conducting Coral and Sea Urchin Baseline Surveys and Management Works in the Northeastern Hong Kong Waters. (AFCD/SQ/316/19/C; 689 K HKD)

2. Environment and Conservation Fund; *Assessing the impacts of human stressors on freshwater carbon cycling – Implications on CO2 emission and biodiversity conservation in Hong Kong.* (86/2019; 1.29 M HKD)
3. HKU Outstanding Young Researcher Award; *To recognize, reward and promote exceptional research accomplishments of academic and research staff.* (300 K HKD)
4. HKU Seed Fund for Basic Research; *Applying a Historical Approach to Understand the Future of Coral Reefs and using (aeDNA) to Enhance Understanding of Sediment Core Archives.* (201910159293; 69.3 K HKD)
5. Research Grants Council Collaborative Research Fund; *What lies beneath: Human and environmental health risk factors in our ocean - an experimental application of MarineGEO-Hong Kong.* (C7013-19G; 5.9 M HKD)
6. Research Grants Council Collaborative Research Fund; *Symbiosis in the sea: a comparative study of mutualism, symbiont competition, and parasitism on coral reefs.* (17108620; 1.19 M HKD)
7. Smithsonian Institution; *The Good, the Bad, the Bad, & the Ugly: carbon storage, eutrophication effects, and emergent health risks, global marine sediment microbiome.* (AR200040; 700 K HKD)

2019

1. Agriculture, Fisheries and Conservation Department; *Provision of Service to Design and Deploy 3D-printed Artificial Reefs for Coral Transplantation in Hoi Ha Wan Marine Park.* (AFCD/SQ/256/18/C; 1.4 M HKD)
2. HKU Seed Fund for Basic Research; *Hong Kong: The City that Coral Built.* (201811159203; 79.9 K HKD)
3. Research Grants Council Collaborative Research Fund; *SIRMS 2.0: Establishing Asia's premier stable isotope ratio mass spectrometry laboratory in Hong Kong.* (C7050-18E; 7.6 M HKD)

2018

1. Agriculture, Fisheries and Conservation Department; *Provision of Service of Monitoring of Restored Hard Corals at Hoi Ha Wan Marine Park.* (AFCD/SQ/177/17/C; 600 K HKD)
2. HKU Seed Fund for Basic Research; *Hong Kong: Hot and gorged – The future of corals in an urbanized environment.* (201711159240; 88.2 K HKD)
3. National Geographic Young Explorers Grant; *Lime kilns as an archive for changing biodiversity on coral reefs in SE Asia: from the Qing Dynasty to modern day Sri Lanka.* (AR170039 31.2 K HKD)

2017

1. Environment and Conservation Fund; *Assessing the Marine Biodiversity and Ecology of Tolo Harbour and Channel, with Particular Reference to Coastal Marine Environments of Ting Kok and Shuen Wan Hoi – Phase II.* (2016-79 ; $4.2M HKD)
2. Environment and Conservation Fund Hong Kong; *MarineGEO - Hong Kong: Towards an understanding of marine biodiversity and ecosystem function.* (67/2016; $3.2M HKD)
3. Ocean Park Conservation Foundation Hong Kong, *Forming a scientific foundation for coral reef restoration and resilience in Hong Kong.* (OT01.1718; $466K HKD)

2016

1. Agriculture, Fisheries and Conservation Department; Provision of Service of Hard Coral Restoration at Hoi Ha Wan Marine Park. (AFCD/SQ/3/16/C; 1.05 M HKD)
2. Research Grants Council Hong Kong, GRF; *Sedimentary records of historical coral diversity and distribution in the South China Sea.* (#17304116; $360K HKD)
3. University Grants Council, The University of Hong Kong Seed Funding for Basic Research; *3-D printed coral reefs: exploring the relationship between rugosity and biodiversity.* ($80K HKD)

2015

1. Research Grants Council Hong Kong, GRF; *Determining the sources of nitrogen to the coral skeletal organic matrix.* (#17303615; $0.7M HKD)
2. University Grants Council, The University of Hong Kong Seed Funding for Basic Research; *A Pilot Survey of Marine Biodiversity using Autonomous Reef Monitoring Structures (ARMS): A First Step for MarineGEO Hong Kong.* ($47K)

2014

1. Environment and Conservation Fund (Hong Kong), *Two centuries of nitrogen pollution in Hong Kong's coastal waters reconstructed from hard-coral and octocoral δ15N records.* (#2013-04; w. N. Duprey; $0.5M HKD)
2. Research Grants Council Hong Kong, GRF; *Clash of the Dinoflagellates! Nitrogen competition among coral-hosted symbionts.* (#17100014; $1.03M HKD)

Coral survivorship, performance, and biodiversity enhancement using 3D printed ceramics in coral restoration

David Michael Baker

The Swire Institute of Marine Science, School of Biological Sciences, The University of Hong Kong
*E-mail: dmbaker@hku.hk

Abstract

Coral reef restoration is accelerating around the world - and not a moment too soon. Mass coral bleaching, epizootic diseases, and ongoing habitat destruction from local and global factors are accelerating the losses of reefs around the world. The time for action is now. In this talk, I will present the work of our restoration company, Archireef, which was spun-off from university research. Archireef combines an ancient biocompatible material - ceramics - with advanced additive manufacturing through 3D printing. By leveraging financing from industry - we are able to achieve rapid results at scale, all over the world. Archireef's scope of services include advanced photogrammetry for monitoring coral health and reef development, eDNA metabarcoding for quantifying biodiversity enhancement, and assessment of ecosystem functions and services towards a site valuation. In doing so, we bridge the divide between conservation and finance towards a nature-positive future.

Dr. Chung-Der Hsiao (蕭崇德)

Email: cdhsiao@cycu.edu.tw

Tel: +886-3-2653545

Affiliation:

Department of Bioscience Technology, Chung Yuan Christian University, Taoyuan, Taiwan

Chung-Der Hsiao is Distinguished Professor of Chung Yuan Christian University for Department of Bioscience Technology. He completed the undergraduate and graduate education in National Taiwan University (majored in Fishery Science). For postdoctoral training, he joined Dr. Pung-Pung Hwang's group at ICOB, Academia Sinica, and worked on fish physiology and bioinformatics. By 2007, Chung-Der was recruited by Chung Yuan Christian University and established his own laboratory, where he used the cutting-edge methods to generate many zebrafish disease models like apoptosis, obesity, skin cancer and aging. From 2012, Chung-Der was invited by GeneTex International Corp, Zgenebio Biotech and Taikong Corp as research consultant to initiate several cooperation projects on developing zebrafish antibodies, TALEN/CRISPR genome editing tools, transgenic fish, next generation sequencing technologies as well as Zebrafish behavioral assessment tools. From 2019, Chung-Der was promoted as full professor of Chung Yuan Christian University; and from 2021, Chung-Der was promoted as director of Research Center for Aquatic Toxicology and Pharmacology. Recent studies in Chung-Der's lab focus on using deep learning technology to study animal neuro behavior and cardiac physiology. Chung-Der (H-index 36) is author of over 250 high impact journal articles, including ***Nature, Nature Physics, Biomedicine & Pharmacotherapy, Environmental pollution, Ecotoxicology and Environmental Safety*** etc. He is frequently invited to talk at international and local conferences across a diverse range of fields, and has also spoken to school, students and public audiences. His research has strong application potentials and several patents have been issued regarding to use zebrafish as a human disease models like aging, obesity and cancer. (https://www.researchgate.net/profile/Chung_Der_Hsiao)

EDUCATION & EXPERIENCES

Experiences

Postdoc (2003-2004) Institute of Molecular Biology, Academia Sinica, Taiwan
Distinguished Postdoc (2004-2006) Institute of Cellular and Organismic Biology, Academia Sinica, Taiwan
Visiting scientist (2006/3-2006/12) Institute of Molecular and Cellular Biology (IMCB), A-Star, Singapore
Visiting scientist (2009/7-2009/12) Genome Research Center, Academia Sinica, Taiwan
Assistant professor (2007/8-2013/7) Department of Bioscience Technology, Chung Yuan Christian University, Taiwan
Associate professor (2013/8-2019/7) Department of Bioscience Technology, Chung Yuan Christian University, Taiwan
Professor (2019/7-now) Department of Bioscience Technology, Chung Yuan Christian University, Taiwan
Department of Chemistry, Chung Yuan Christian University, Taiwan
Vice Director (2021/7-now), Center of Nanotechnology, Chung Yuan Christian University, Taiwan
Director (2021/7-now), Research Center for Aquatic Toxicology and Pharmacology, Chung Yuan Christian University, Taiwan
Professor (2024/7-now) Distinguished Professor, Chung Yuan Christian University, Taiwan

Academic education

Ph.D. (1998-2002) Institute of Fisheries Science, National Taiwan University, Taiwan
M.Sc. (1995-1998) Institute of Fisheries Science, National Taiwan University, Taiwan
B.Sc. (1991-1995) Department of Zoology, National Taiwan University, Taiwan

RESEARCH INTERESTS

1. Zebrafish genetic mutant screening and gene functional manipulation
2. High efficient plasmid construction by using Gateway recombination
3. High efficient transgenesis in Zebrafish by using Tol2 transposon
4. Conditionally gene expression by using Heat shock and Cre/LoxP system
5. Fluorescent double in situ hybridization and immunostaining
6. Confocal laser scan microscope and cell imaging
7. High resolution histology by using resin section
8. Image-based cytometry analysis of cell cycle deregulation
9. Transcriptomic analysis of gene expression by microarray and deep sequencing
10. TALEN/CRISPR-mediated gene knock out technology
11. Large-scale screening of suitable antibodies for serving Zebrafish community
12. Development of new small animal models suitable for performing drug screening
13. Animal behavioral assessment and new software development

GRANTS AND AWARDS

2001 Chien-Tien Hsu's Award Presentation, The Chinese Society of Cell and Molecular Biology
2001/2002 Outstanding Students Conference Travel Grant, Foundation for the Advancement of Outstanding Scholarship
2004 Distinguished Postdoctoral Fellowship, Academia Sinica
2004 Research Travel Grant, Max-Planck-Institute of Molecular Genetics, Germany
2004 Outstanding Post-Doctor Researchers Conference Travel Grant, Foundation for the Advancement of Outstanding Scholarship
2006 Visiting Scientist Research Grant, IMCB, A-Star, Singapore
2009 Visiting Scientist Research Grant, Genome Research Center, Academia Sinica
2020 Annual subsidies research rewards for colleges and universities
2021 Annual subsidies research rewards for colleges and universities
2022 Annual subsidies research rewards for colleges and universities
2023 Annual subsidies research rewards for colleges and universities

Development of Automatic Software for Dissecting Complex Social Behavior in Fish and Crayfish

Chung-Der Hsiao [1,2,3,4]

[1] Department of Bioscience Technology, Chung Yuan Christian University

[2] Department of Chemistry, Chung Yuan Christian University

[3] Department of Biomedical Engineering, Chung Yuan Christian University

[4] Research Center for Aquatic Toxicology and Pharmacology, Chung Yuan Christian University

*E-mail: cdhsiao@cycu.edu.tw

Abstract

Understanding complex social interactions in aquatic organisms is pivotal for effective conservation, aquaculture, and ecological research. Traditionally, ethological studies have relied on extensive manual observation and coding of animal behavior, a process that is time-consuming, subjective, and prone to human error. This research presents the development of innovative, automated software designed to dissect and quantify intricate social behaviors in fish and crayfish species. The software incorporates advanced computer vision and machine learning algorithms to accurately detect, track, and classify a wide range of social behaviors, including fighting, chasing and prey-predator interaction. By employing deep learning techniques, the system is capable of recognizing individual animals, even within densely populated environments, and extracting detailed information about their spatial relationships, body postures, and movement patterns. The developed software offers several key advantages over traditional methods. Firstly, it significantly reduces the time and effort required for behavioral analysis, allowing researchers to focus on higher-level interpretations and hypothesis testing. Secondly, it provides objective and quantitative data, minimizing the impact of human bias and increasing the reliability of research findings. Thirdly, the software enables the collection of large-scale datasets, facilitating the identification of subtle behavioral patterns and the discovery of novel social phenomena. Potential applications of the software span various fields of aquatic biology. In conservation, it can be used to assess the impact of environmental stressors on social behavior, inform habitat restoration efforts, and monitor the effectiveness of conservation interventions. In aquaculture, the software can optimize breeding strategies, improve animal welfare, and enhance production efficiency. Furthermore, it can contribute to fundamental research on social evolution, communication, and ecotoxicity to aquatic animals.

Keywords: Fish; Crayfish; Automated analysis; Computer vision; Machine learning; Ethology; Aquaculture; Toxicology

Related publication:

Luong et al. 2024. Fish 3D locomotion APP (F3LA): a user-friendly computer application package for automatic data calculation and endpoint extraction for novel tank behavior in fish. Journal of Fish Biology (In press)

Suryanto et al. 2023. Using crayfish behavior assay as a simple and sensitive model to evaluate potential adverse effects of water pollution: emphasis on antidepressants. Ecotoxicology and Environmental Safety 265, 115507.

Saputra et al. 2023. Using DeepLabCut for markerless cardiac physiology and toxicity estimation in water fleas (Daphnia magna). Aquatic Toxicology 263, 106676.

Dr. Kwang-Tsao Shao (邵廣昭)

Email: zoskt@gate.sinica.edu.tw

Tel: (O)02-2788-7330; 2789-9545; 2789-9556

Affiliation:

Emeritus Research Fellow, Biodiversity Research Center, Academia Sinica

Emeritus Chair Professor & Part-time Professor in NTOU

Emeritus Chair Professor in NSYSU

Consultant, Academia Sinica Center for Digital Cultures

Consultant, National Museum of Marine Science and Technology

So far I have published around three hundreds of journal papers, many technical reports and books. I am dedicated to public awareness for marine conservation and sustainable fisheries in Taiwan. I used to be the pivotal person of the Taiwan delegation to GBIF before I retired. In past 20 years, I have established six national biodiversity databases including TaiCOL, TaiBOL, TaiEOL, TaiBIF, TaiBON, TaiGISD and built a very popular Taiwan Fish Database in 1980's.

EDUCATION & EXPERIENCES

Experiences

1996-2002-Director of Institute of Zoology, Academia Sinica
2004-2008 & -2016 Acting Director and the Executive Officer, Biodiversity Research Center, Academia Sinica
1991 Director of Institute of Marine Biology, NTOU Presidents of Taiwan Ichthyological Society, Cetacean Society etc.
2010-2015 Member of National Sustainability Committee, Executive Yuan

Education

Ph.D. in Department of Ecology and Evolution, SUNY at Stony Brook, USA (1983)

RESEARCH INTERESTS

1. Fish taxonomy, ecology and evolution
2. Marine Ecology & Conservation
3. Biodiversity Informatic

AWARDS

1. Outstanding Research Award (National Science Council), 1994-1995
2. Ten Outstanding Youth of R.O.C. (29th), 1991
3. Cultural Medal of the M.O.E.1998；Ho-Chin-Duei Outstanding Academic Award 2006
4. Ten Outstanding Agricultural Experts of R.O.C. 2008
5. Forestry and Nature Conservation National Award 2011
6. Social education national Award in 2022
7. Marine Education Promotion National Award in 2024.

What is the appropriate time period for marine ecological surveys and monitoring?

Kwang-Tsao Shao

Biodiversity Research Center, Academia Sinica

*E-mail: zoskt@gate.sinica.edu.tw

Abstract

The reason why ecological distribution data should be collected over a long period of time is that long-term data is the only way to see whether the trend of ecosystem change is getting better or worse and the reasons for it, and to test whether the conservation policies or measures adopted by the government are effective or not. If the monitoring is done for the purpose of environmental impact assessment, the data before, during and after the development as well as the control group must be used for impact analysis (BACI) in order to understand whether the development will affect the surrounding environment. However, ecological surveys are costly in terms of manpower and material resources, especially in the case of marine ecological surveys. Therefore, the funding provided by the organizer is usually not long. Moreover, the governmental unit of the monitoring program has to go through open tendering, resulting in frequent turnover of the winning survey unit or the personnel responsible for the survey, which makes it impossible to maintain a consistent survey methodology and the quality of the surveys varies. In addition, the frequency of the survey, whether it should be conducted annually, quarterly or monthly, is also limited by the manpower, material resources and weather conditions of the survey, and the most cost-effective frequency or duration of the survey should be determined under the consideration of the permissible statistical sampling error.

How long does it take for an ecological survey to reflect changes in biodiversity? Three years, five years, ten years, thirty years, fifty years, what is considered medium term or long term? How many surveys should be conducted each year, etc. are often strategies that need to be thought out by the authorities in charge of nature conservation or environmental protection. Taiwan's EIA system is generally used for large-scale development projects, such as power plants, offshore wind farms, petrochemicals, sewage treatment plants, or science parks, which require year-round monitoring data from the pre-construction period to the end of operation, and even for several years after decommissioning. Therefore, it is usually possible to collect long-term data for 30-50 years. Other occasional pollution, natural disasters, or general research studies can only be conducted for 3-5 years. The lack of long-term monitoring data from fixed stations, even in protected areas designated by different ministries or decrees, often makes it impossible to answer the question of whether biodiversity has changed for the better or for the worse over the years since the establishment of the protected area.

In order to answer this question, we used the medium- and long-term data on fish assemblages in the intertidal and subtidal zones along the coast of Taiwan that we had on hand, including the surveys of deformed fishes, impingement, coral reef fishes, and drift-nets in the northern nuclear power plant in the period of 20-40 years, the fishes collected in the tidal pools of the southern and northern parts of Taiwan in the period of 20-50 years, and the surveys of the cold intrusion event in Penghu in the period of 7 years, to make an analysis and a comparison. It was found that the trend of long-term ecological assemblages or ecosystem changes varied with the nature of the survey items or indicators (number of species, number of individuals, feeding habits or trophic level, thermoregulation) or sampling methods, the range of activities of the main target fishes, or their habitats (transients, semi-residents, or residents).

Dr. Ching-Nen Nathan Chen(陳慶能)

Email: nathanc@mail.nsysu.edu.tw
Tel: +886-7-5252-000 # 5106
Affiliation:
Department of Oceanography, National Sun Yat-sen University, Kaohsiung,Taiwan

EDUCATION & EXPERIENCES

Experiences

Professor, 2016 – present, Dept of Oceanography, National Sun Yat-sen University, Taiwan
Associate Professor, 2013 – 2016, Dept of Oceanography, National Sun Yat-sen University, Taiwan
Assistant Professor, 2009 – 2013, Institute of Marine Biology, National Sun Yat-sen University, Taiwan Aug 2018–Apr 2020 Center for Ecology and Environment, Tunghai University, Taiwan. Assistant Researcher
Assistant Professor, 2005 -2008, Dept of Biology, University of Missouri-Rolla, USA.Aug 2017–Oct 2017 National Museum of Marine Biology and Aquarium, Taiwan. Ministry of Science and Technology, Research Assistant
Postdoctoral fellow and adjunct instructor, 2000 – 2005, Dept of Biology, Washington University in St. Louis, USA.

Education

Ph.D., 1999, National Taiwan University and Washington University in St. Louis, Missouri, USA (a sandwich program)

RESEARCH INTERESTS

1. Biochemistry, genetics, physiology and evolution of microalgae
2. Physiology and ecology of seagrass
3. Coral bleaching, the symbionts' aspect

INTERNATIONAL SERVICE

1. Taiwan office Head, the Society for Coastal Ecosystems Studies – Asia Pacific (SCESAP, Headquarter at Kyushu University, Japan)
2. Founding Director, the International Graduate Program of the College of Marine Sciences, National Sun Yat-sen University, Taiwan
3. Organized more than 10 international symposia/workshops

Enhancement of bleaching stress tolerance in coral endosymbiotic microalgae using genetics

Ching-Nen Nathan Chen*, Tze Ching Yong, Jih-Terng Wang

Department of Oceanography, National Sun Yat-sen University, Kaohsiung [804], Taiwan
*E-mail: nathanc@mail.nsysu.edu.tw

Abstract

Frequent and persistent high surface seawater temperature, often coupled with high light intensity, results in coral bleaching. Coral bleaching is caused by the exocytosis of endosymbiotic dinoflagellates due to overproduction of reactive oxygen species (ROS) in the symbionts. Strategies to reduce ROS production and enhance ROS scavenging efficiency in coral symbionts are crucial for preventing the collapse of coral reef ecosystems. However, cell physiology and genetics studies of coral symbionts have been hampered by the difficulty of cloning the symbionts. The present study presents a new method developed for cloning coral symbionts using a simple procedure. Experiments performed with two species of symbionts cloned from Turbinaria sp. revealed that high salinity activated endogenous tolerance against bleaching stress under high temperature (36 °C) and high light intensity (340 mol photon/m2/s). Pretreatment at 50 ppt salinity reduced the proportion of cells stained for ROS by 59% and 64% in the two species exposed to bleaching stress compared with those incubated at 30 ppt. These findings suggest that the genomes of coral symbionts have developed mechanisms for ameliorating damages caused by environmental stress through their evolution. The cloned symbionts were mutagenized using EMS and selected for tolerance against high temperature and high light stress. These mutants were characterized and fresh data in this regard will be presented in this symposium.

Dr. Li-Chun Tseng, Ph.D., D.Sc.(曾立鈞)

Email: lichuntseng@mail.ntou.edu.tw

Tel: (O) +886-2-24622192 Ext. 5304

Affiliation:

Assistant research fellow at the Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan.

Experienced in sedimentation pollution effects on soft coral in coastal areas. Expertise in field of zooplankton and copepod ecological studies. Interested in oceanography related subjects, such as, migration, distribution, toxic effects, global issues about oceanic acidification, warming, blooming, as well as artificial environmental impact on marine biology.

EDUCATION & EXPERIENCES

Experiences

Feb 2023– Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan. Assistant Research Fellow

Sep 2009–Jan 2023 Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan. Postdoctoral fellow

Jul 1990–Aug 2009 Department of Laboratory Medicine, Mackay Memorial Hospital, Danshuei District, New Taipei City, Taiwan. Medical laboratory scientist

Education

Sep 1998–Jan 2008 Ph. D., Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan.

Sep 1996–Jun 1998 Master D., Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan.

Sep 1995–Jun 1996 Department of Biology, Chinese Culture University, Taipei, Taiwan.

Sep 1983–Jun 2008 Department of Medical Laboratory Science and Biotechnology, Chung Hwa College of Medical Technology, Tainan County, Taiwan.

RESEARCH INTERESTS

1. Marine pollution and coral reefs
2. Marine Ecology: zooplankton and planktonic copepods
3. Ecological research on shallow hydrothermal vent areas
4. Marine biodiversity, and coral reef symbionts

EDITORIAL BOARD/ACADEMIC REFEREE

1. Frontiers in Marine Science (Associate Editor)
2. Discover Oceans (Editorial Board Members)
3. Journal reviews: (2020–2024):

   Scientific Reports, Continental Shelf Research, PLOS ONE, Frontiers in Ecology and Evolution, Frontiers in Marine Science, Regional Studies in Marine Science, Journal of Natural History, Journal of Oceanography, Journal of Experimental Marine Biology and Ecology, Journal of the Marine Biological Association of the United Kingdom, Journal of Marine Science and Technology, International Journal of Aquatic Science, International Journal of Advance Agricultural Research ... etc.

Geographical differences affect the seasonal succession of copepods in the southern waters of the East China Sea

Li-Chun Tseng[1], Chi Chou[2], Juan Carlos Molinero[3], Qing-Chao Chen[4],†, Jiang-Shiou Hwang[1,5,6]*

[1] Institute of Marine Biology, National Taiwan Ocean University, Keelung, 202301, Taiwan
[2] Department of Pathology, Mackay Memorial Hospital, Danshuei District, New Taipei City 251020 Taiwan
[3] MARBEC, IRD/CNRS/IFREMER/Université de Montpellier, Sète CEDEX 34203, France
[4] South China Sea Institute of Oceanology, Chinese Academy of Science, Guangzhou, China
[5] Center of Excellence for Ocean Engineering, National Taiwan Ocean University, Keelung 202301, Taiwan
[6] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung 202301, Taiwan
† Deceased 3 April 20151
*E-mail: lichuntseng@mail.ntou.edu.tw

Abstract

The southern East China Sea (ECS) demonstrates fluctuations in mesozooplankton and copepod composition, which are shaped by the interaction of China Coastal water and Kuroshio water. Nevertheless, despite some local studies in northern Taiwan that have contributed to our understanding of the seasonal succession, there has been a paucity of attention paid to the geographic succession, the remaining uncertainties regarding the spatial distribution patterns of mesozooplankton taxa and diverse copepods along the northern Taiwan coastline, and the potential for further research in this area. To address this research gap, the present study collected mesozooplankton and hydrographic parameters during the prevailing southwest monsoon (August 2009), the prevailing northeast monsoon (October and November 2009), and the end of the northeast monsoon (March 2010) in Northern Taiwan. The present results enhance our understanding of the geospatial variations in the distribution patterns of dominant copepods, including the abundant species Calanus sinicus, Euchaeta rimana, Paracalanus parvus, Ditrichocorycaeus affinis, Oithona fallax, and Temora turbinata. Additionally, they delineate the seasonal distribution range of these species with the interplay waters. The research yielded a total of 22 major mesozooplankton taxa. Furthermore, a total of 77 copepod species were identified, belonging to three orders, 22 families, and 39 genera. The mean abundance of all copepods was found to range from 220.2 ± 200.3 (inds m-3) in October and November 2009 to 1773.3 ± 1782.1 (inds m-3) in March 2009. The most abundant species were: The most prevalent species were Temora turbinata (31.74%), Ditrichocorycaeus affinis (27.42%), and Paracalanus parvus parvus (20.38%). The abundance of 17 copepod species exhibited a significant positive correlation with seawater temperature, whereas the abundance of 5 copepod species correlated significantly negatively with seawater temperature. The results of the present study revealed that the interplay of waters influences the geospatial distribution and assemblages of mesozooplankton and copepods in the littoral zone of northern Taiwan.

Keywords: Mesozooplankton; Copepod; Biodiversity; Seasonal succession; Biogeography; East China Sea

Professor Dr. K. MURUGAN

Email: kmvvk@buc.edu.in

Tel: +61 7 4753 4370

Affiliation:

CSIR-Emeritus Scientist, Department of Zoology, School of Life Sciences, Bharathiar University, Coimbatore, India

World Top Scientist 2% at Global Level (Mycology and Parasitology), Stanford University Ranking –Consecutive years for 2020, 2021& 2022, 2023 & 2024.

Top Scientist in India (19h position) in Biology and Biochemistry 2024 by Researchcom ranking (https://research.com/university/bharathiar-university)

Citations	21512
h-index	77
i10-index	383

RESEARCH INTERESTS

1. Predatory Copepods and Mosquito Vector Control
2. Chitosan Nanoparticles from Crab and Biological Functions
3. Chitosan Nanoparticles and mosquito Borne Diseases
4. Chemical Ecology of Insects, Climate Change, Butterflies

CURRENT RESEARCH

- Murugan and his team have investigated the use of nanoparticles, such as silver nanoparticles and other metal-based nanoparticles, as larvicidal agents against mosquito larvae. These nanoparticles are designed to target and disrupt the physiology or development of mosquito larvae, thereby reducing their population in breeding habitats.
- Murugan and his research team have studied various species of copepods that prey on mosquito larvae. These copepods feed on mosquito larvae in their aquatic habitats, thereby reducing mosquito populations naturally without the use of chemical insecticides.
- Murugan's research explores the potential of chitosan in biomedical applications, such as wound healing and drug delivery systems. Chitosan's biocompatibility and ability to promote tissue regeneration make it a valuable material in medical settings.
- He is formerly, Senior Professor and Head, Department of Zoology, and Registrar, i/c, Bharathiar University, Coimbatore, South India and formerly Vice-Chancellor at Thiruvalluvar University (State University), Vellore, TN, India during 2016-2019 (3 years).

Influence of Chitosan enriched Zinc Nanoparticles for the growth performance, feeding and metabolic process of aquatic animals-A Nanotechnology Approach

Kadarkarai Murugan [1]*, Rajapandian Rajaganesh[1], Pavithra Krishanasamy[1], Murugan Vasanthakumaran[2]*, Li-Chun Tseng[2], Shao-Hung Peng[3], Jiang-Shiou Hwang [2, 4]

[1] Department of Zoology, School of Life Sciences, Bharathiar University, Coimbatore-641 046, India.

[2] Institute of Marine Biology, National Taiwan Ocean University, Keelung, 202301, Taiwan.

[3] National Museum of Marine Biology and Aquarium, Pingtung, 94450, Taiwan.

[4] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung 202301, Taiwan.

*E-mail: kmvvk@buc.edu.in

Abstract

Multifunctional nanoparticles (NPs) production from biomaterials is a sustainable process and an eco-friendly method, and this technique has a variety of uses. This study intends to address the synthesis of Mud shrimp mud shrimp (Austinogebia edulis) chitosan-zinc oxide nanocomposite (MS-Ch-ZnONPs) and its biological functions. The zinc oxide nanoparticles (ZnONPs) were successfully synthesized using mud shrimp and coated with the chitosan (Ch) polymer through a cost-effective approach. Instruments such as UV–Vis, XRD, FTIR, DLS, Zeta potential, FE-SEM with EDX and high-resolution TEM were applied to characterize the biosynthesized MS-Ch-ZnONPs. Chitosan, a natural polymer derived from chitin found in the exoskeleton of crustaceans, has gained attention for its potential benefits in various applications, including aquaculture. Chitin is a constituent of different exoskeletons of marine arthropods such as crustaceans (crab, shrimp, lobster, krill, crayfish, barnacles), cuttlefish, and squid pen. Chitin is made up of a linear chain of acetylglucosamine groups. Chitosan extraction from mud shrimp (Austinogebia edulis) involves three consecutive stages: demineralization, deproteinization, and deacetylation. In the present study, we performed Growth Performance of Ornamental fish, Poecilia sphenops fed Indigenous feed ingredients formulated with various Levels of mud shrimp Chitosan nanoparticles for 60-Days. Feeding trials have been conducted to estimate food intake, growth studies and food utilization measures. Studies have undertaken to estimate digestive enzymes such as protease, amylase and lipase activities in the midgut regions Poecilia sphenops after fed with the mud shrimp chitosan zinc nanoparticles. We have also evaluated stress enzymes (SOD, CAT and LPO) levels in the experimental fish that were adopted with different food regimes (with and without chitosan). In general, a chitosan-enriched diet could potentially promote the growth and food intake of ornamental fish: Moreover, Chitosan is rich in nitrogen and can potentially serve as a source of dietary protein for fish. Its digestibility and nutrient profile can contribute to improved growth rates in ornamental fish species. The mud shrimp chitosan Zinc Nanoparticles enriched diet fed insects performed better growth, than the without chitosan enriched diet. The body weight gain (WG), initial weight gain, final weight gain, specific growth rate (SGR) were greater. The feed conversion ratio (FCR) among fish fed with different levels of dietary chitosan was also enhanced than the control. The activities of digestive enzyme profiles showed to have higher concentrations in the chitosan nanoparticles treatment than the control. This may be due to the fact that Chitosan has been shown to enhance the absorption of nutrients such as amino acids and minerals in the digestive tract of fish. This could lead to better utilization of the feed and ultimately promote growth. By potentially modulating oxidative stress, immune responses, and overall stress resilience, chitosan may contribute to improving the welfare

and health of ornamental fish in aquaculture settings. The changing profiles of SOD, CAT and LPO have been evaluated with mud shrimp enriched chitosan zinc nanoparticles. In the present study the levels of SOD decreased when fed on without a chitosan diet. Chitosan is known to possess antioxidant activity, which can scavenge free radicals and reduce oxidative stress in cells. This may lead to a decrease in the activity levels of oxidative stress markers such as catalase and SOD, as the antioxidant capacity of the fish is enhanced. The decrease in the activities of CAT in the body of Poecilia sphenops, may be due to the Ornamental fish requiring a balanced diet to maintain health and antioxidant defenses. We have also proved chitosan enriched diets have an influential role in boosting the predatory behavior of Poecila sphenops when fed on nanoparticle contaminated environments. The chitosan enriched diet reared Poecilia sphenops consumed a higher number of Aedes aegypti mosquito larvae at the aquarium tank. Total predation of mosquito fish against first, second, third and fourth instars Aedes aegypti without nanoparticle treatment was 150.6, 131.0, 102.6 and 80.1, respectively. At the nanoparticle exposed situation, the predatory efficiency was increased and total predation of mosquito fish was 183.2, 150.6, 126.2 and 126.2, respectively. Chitosan is a biopolymer derived from chitin, which is found in the exoskeletons of crustaceans like shrimp and crabs. It has various applications due to its biocompatibility, biodegradability, and non-toxic nature. It is also suggested that chitosan can enhance the olfactory responses of mosquito fish to cues from mosquito larvae. This increased attraction to larvae could lead to more effective hunting and feeding by the fish. The Mud shrimp mud shrimp (Austinogebia edulis) chitosan-zinc oxide nanocomposite (MS-Ch-ZnONPs) tested against the dengue mosquito as larvicidal properties and also for the water purification properties. After characterization of nanoparticles and the antibacterial efficacy of these nanoparticles against both Gram-positive and Gram-negative human pathogenic pathogens was evaluated. Finally, cytotoxicity effects of MS-Ch-ZnONPs were done and after 24 h incubation, the concentration dependent inhibition of MS-Ch-ZnONPs against A549 lung cancer cells and MCF-7 breast cancer cells were observed in cytotoxicity assay. It revealed that mud shrimp mediated MS-Ch-ZnONPs was an excellent anti-cancer agent against A549 and MCF-7 cancer cells. Mosquitoes propagate quite successfully in a variety of aquatic habitats such as drinking water systems, manmade water bodies, and sewage contaminated aquatic systems. Since water is essential for all life, without it, life won't progress and at the same time, the quality of the water is also important. With the unique structural features present in chitosan, bio-polymer helps to bind effectively with fine suspended particles, pollutants, bacteria, heavy metals etc. The biocompatible and biodegradable nature of chitosan makes it a potential candidate for mosquito breeding water purification purposes. In this regard, chitosan has been extracted from freshwater crab shells mud shrimp. It has been utilized as a potent tool in control of young instars of Aedes aegypti and its breeding water purification. After nanoparticle administration, the cell migration and wound healing, the "in vitro scratch assay" method was performed. HMEC-1 cells were seeded in a 24-well plate with 105 cells per well and incubated for 24 h. Endothelial cell migrations were assessed at 6, 12 and 24 hours after in vitro wound induction. The results of the scratch test proved that the nanoparticles could cause the cell migration and the percentage of wound closure increased with respect to time and the maximum wound closure observed was 85% after 24 hours. Antibacterial bioassay was also conducted and this evaluation typically involves conducting antibacterial assays or tests to determine the minimum inhibitory concentration (MIC) or minimum bactericidal concentration (MBC) against various bacterial strains. Gram-positive bacteria (Staphylococcus aureus) and Gram-negative bacteria (Escherichia coli) are commonly used as model pathogens in such studies due to their relevance to human health.

Keywords: Austinogebia edulis; chitosan; nanotechnology; digestive enzymes; stress physiology; predation; Poecilia sphenops; larvicidal; anti-bacterial; wound healing; anti-cancer.

Dr. Ying-Ning, Ho（何攖寧）

Email: ynho@mail.ntou.edu.tw

Tel: (02) 24622192 ext 5307 (office)、5309 (lab)

Fax: (02) 2463-3152

Affiliation:

Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan

EDUCATION & EXPERIENCES

Experiences

2024 Aug-Present Associate professor
Institute of Marine Biology, National Taiwan Ocean University

2019 Sep-2024 July Assistant professor
Institute of Marine Biology, National Taiwan Ocean University

2018 Nov-2019 Aug Postdoctoral Fellowships (JSPS)
Graduate School of Environmental Studies, Department of Environmental Studies for Advanced Society Tohoku University, Japan

2018 Aug-2018 Nov Regular Postdoctoral Scholar
Agricultural Biotechnology Research Center, Academia Sinica, Taiwan

2015 Aug-2018 Jul Postdoctoral Research Scholar
Agricultural Biotechnology Research Center, Academia Sinica, Taiwan

2014 Sep-2015 Jul Postdoctoral Fellow
National Chung Cheng University, Taiwan

2013 Oct-2014 Sep Military Service
Ocean Guard Headquarters, CGA

Education

2008-2013 Ph. D. in Life Science National Chung Hsing University, Taiwan.
2006-2008 M. S. in Life Science National Chung Hsing University, Taiwan.
2002-2006 B. S. in Life Science National Chung Hsing University, Taiwan.

GRANTS AND AWARDS

2018 Outstanding Poster Award (Poster Presentation Award), the 33rd Symposium on Natural Products (October 6-7, 2018, Kaohsiung Medical University, Taiwan)
2016 Poster Award, The second place prize, The 31st Symposium on Natural Products & Symposium on Pharmacy and Traditional Chinese Medicine. (November 14-15, 2016, Kaohsiung, Taiwan)
2015 ELSEVIER recognized reviewer for biological control
2013 Student Travel Grant (National Science Council, Taiwan)
2012 Student Travel Grant (Ministry of Education, Taiwan)
2012 Student Travel Grant (National Science Council, Taiwan)
2012 ASM Poster Award, Environmental Microbiology Symposium. （September 14, 2012, National Central University, Taiwan）
2011 Student Travel Grant (Ministry of Education, Taiwan)
2008 Honorable mention. Crazy idea (Biotechnology R & D Creative Application Competition from Agricultural biotechnology industrialization technology promotion project, Industrial Development Bureau)
2005 Outstanding Graduate Award of National Chung Hsing University. (Service Award)
2005 Ching-Ah Honor of National Chung Hsing University.

ACADEMIC SERVICE

1. ELSEVIER recognized reviewer for Biological control (awarded July, 2015)
2. Reviewer of Biological control (2015.06.26~2015.07.17)
3. Reviewer of Critical reviews in Biotechnology (2015.05.28~2015.06.21)
4. Reviewer of Biological control (2015.01.21~2015.02.12)

Exploring the 'Dark Matter' of Microbiomes: Integrating Omics Strategies to Study Marine Symbiotic Microorganisms and Plastisphere

Ying-Ning Ho[1,2,3,4*], Che-Chun Chen[4,5], Chih-Hao Hsu[1], Yu-Ling Chen[1]

[1] Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan

[2] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung, Taiwan

[3] Taiwan Ocean Genome Center, National Taiwan Ocean University, Keelung, Taiwan

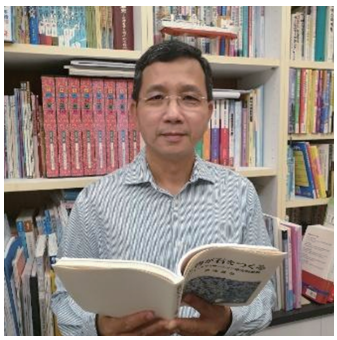
[4] Doctoral Degree Program in Marine Biotechnology, College of Life Sciences, National Taiwan Ocean University, Keelung, Taiwan

[5] Doctoral Degree Program in Marine Biotechnology, Academia Sinica, Taipei, Taiwan

*E-mail: ynho@mail.ntou.edu.tw

Abstract

Marine microorganisms, including bacteria, viruses, microalgae, and fungi, play crucial roles in biogeochemical cycles, impacting climate change and ecological sustainability. They are essential in processes such as carbon sequestration, nitrogen fixation, and sulfur cycling. Additionally, they support food webs, degrade pollutants, and are harnessed in biotechnology for sustainable solutions, all of which are vital for maintaining Earth's environmental balance. Moreover, the symbiotic microorganisms of marine organisms play an important role in enhancing their hosts' resilience to environmental adversity. We used integrated omics strategies to study the symbiotic microorganisms of marine organisms. Additionally, we used metabarcoding and metabolomics to investigate the attraction of surrounding organisms to the microbial ecosystem formed by marine plastic debris, known as the plastisphere. Consequently, the exploration of marine microbial resources is of paramount importance for environmental sustainability. We also developed the Microbial Community-Guided Culture Strategies (MCGCS) system, which uses a portable and rapid Oxford Nanopore Technologies sequencing device to predict specific microbial culture media and conditions. This system, through rapid targeted metagenomic sequencing approaches and real-time analysis, enables the testing of multiple carbon sources of interest and facilitates the discovery of target microbes in samples for cultivation. As our ability to culture and comprehend these microorganisms grows, so does our capacity to contribute to the sustainability and conservation of the marine environment.



Dr. Tung-Wei Shih(施彤煒)

Email: stw@mail.nmmst.gov.tw

Tel: +886-2-2469-6000#8010

Affiliation:

Section Chief, Research and Collection Division, National Museum of Marine Science & Technology, Keelung, Taiwan

EDUCATION & EXPERIENCES

Academic education

Ph.D. in Graduate School of Agricultural and Life Sciences, Faculty of Agriculture, The University of Tokyo, 1999

Master's Degree in Department of Aquaculture, College of Life Science, National Taiwan Ocean University, 1991

Bachelor's Degree in Department of Aquaculture, College of Life Science, National Taiwan Ocean University, 1989

RESEARCH INTERESTS

1. crustacean physiology and endocrine regulation.
2. fish breeding and aquaculture.
3. cultivation of deep-sea organisms.
4. aquatic organism breeding management and automation practices.
5. the Northern Thermal Power Plant under the industrialization strategy of Taiwan during the Japanese colonial period.
6. the relationship between museum management and marine industry development competition and collaboration.

PROFESSIONAL CERTIFICATIONS

1. Certified Aquaculture Technician
2. Basic Training Certificate for Professional Procurement Personnel

PATENT

A Method for Aquaculture Management. Patent Certificate of Republic of China, Invention No. I 284019.

Museum social responsibility - How to response to challenges in changing environment

Yu-Hung Tasi[2], Shen-Chih Wang[2], Tung-Wei Shih*[,1]

[1] Research and Collection Division, National Museum of Marine Science & Technology

[2] Industry-Academic Collaboration Division, National Museum of Marine Science & Technology

*E-mail: stw@mail.nmmst.gov.tw

Abstract

The industrial revolution is an important stage in the development of human civilization, but it also generates many problems and issues. Environment sustainability could be one of the most important issues in the process of industrial revolution. National Museum of Marine Science & Technology locates in Baodouzi of Keelung City. The museum campus includes Changtanli landfill, dung cleaning facility, abandoned power plant and reclamation. These area belongs to traditional fishing villages. However, since 2013 museum attracts more than one million visitors to landfill every year, which seems it has a considerable impact on the Changtanli fishing village. The study mainly explore how museum gradually has an impact to traditional fishing village through the operations of preparatory office and lifelong education mechanism. The study showed that planning for museum campus without walls, converting landfill to Chaojing park, conducting water quality monitoring, establishment of volunteer organization, promotion of educational activities, and local engagement might be important factors. It means museum created common good to local residents and the public.

Key word: Chaojing park; Museum social responsibility; Water monitoring; Landfill; Museum management

Dr. Hao-Ven Wang（王浩文）

Email: hvwang@mail.ncku.edu.tw

Tel: +886-6-275-7575 #58130

Affiliation:

Department of Life Sciences, National Cheng Kung University, Tainan, Taiwan.

EDUCATION & EXPERIENCES

Experiences

2021.08-present Professor National Cheng Kung University, Tainan, Taiwan

2021.08-present Adjunct Professor National Sun Yat-sen University, Kaohsiung, Taiwan

2015.08-2021.07 Associate Professor National Cheng Kung University, Tainan, Taiwan

2009.08-2015.07 Assistant Professor National Cheng Kung University, Tainan, Taiwan

2008.06-2008.10 Post-Doc. Fellow Max Planck Institute of Biochemistry, Munich, Germany

Academic education

2002.08-2008.06 *Dr.rer.nat.* Ludwig-Maximilians-University Munich, Munich, Germany

1994.09-1997.01 M.S. National Taiwan University, Taipei, Taiwan

1990.09-1994.06 B.S. National Cheng Kung University, Tainan, Taiwan

RESEARCH INTERESTS

1. Gene knockout mice
2. Molecular developmental biology
3. Cell biology
4. Cytoskeleton dynamics
5. Skeletal muscle development and regulation

AWARDS AND HONORS

2023.05 Marine Conservation Model Contribution Award. Ocean Affairs Council. Taiwan.

2021.09 Excellence in Innovative Teaching and Excellence in University Social Responsibility Teaching Award, National Cheng Kung University.

2015.09 Outstanding Teaching Excellence Award, National Cheng Kung University.

2012.09 Excellent Mentors Award, National Cheng Kung University.

Examining Taiwan's Cetacean Conservation History Through the First Blue Whale Stranding in Nearly a Century

Hao-Ven Wang

Department of Life Sciences, National Cheng Kung University
E-mail: hvwang@mail.ncku.edu.tw

Abstract

At noon on January 25, 2020, the Marine Biology and Cetacean Research Center at National Cheng Kung University (MB&CR Center at NCKU) received a phone call from an officer of the 10th Patrol Command of the Coast Guard Administration, informing that a large dead stranded whale had been found on the beach in Chang-Bin Township, Taitung County, on Taiwan's eastern coast. The personnel from the MB&CR Center at NCKU immediately set out for the scene. Measurements taken on-site, as well as external features and subsequent necropsy evidence, indicated that it was a Blue Whale with a body length of 20 meters. Reviewing the historical documents and records of the relationship between Blue Whales and Taiwan, the last connection can be traced back to 1938, when there was still a whaling station near Kenting at the southern tip of Taiwan. The data shows that the last recorded Blue Whale capture in the waters around Taiwan was from that period. Since then, there have been no sightings of cetaceans around Taiwan.

Reflecting on Taiwan's animal conservation policies and actions, the Wildlife Conservation Act of Taiwan was enacted in 1989, but the Schedule of Protected Species didn't list all Cetacea spp. until 1990. Now, there are at least 33 different cetaceans have been observed or reported in Taiwan. The first marine animal stranding network, Taiwan Cetacean Stranding Network (TCSN), which was managed by Forestry Bureau (of the Council of Agriculture, Executive Yuan) was established in 1996 and implemented till 2019. After Ocean Conservation Administration (of Ocean Affairs Council, Executive Yuan) was established in Kaohsiung, Taiwan on April 28, 2018, the newly system of Stranding Network has been shifted to and set up "Marine Animal Rescue Network, MARN" in Jan. 2019.

Since 1996, more than 2000 stranding cetaceans have been reported and 1/4 of them were live stranded individuals. Once got the stranding network report or call, the member of MARN will immediately start up and collaborate with the Coast Guard Administration and deal with the stranded individual on site. For the live stranding event, the network member will transport the stranded individual to the rescue station (for example: the cetacean rescue station in Tainan) and manage to perform the whole set of cetacean rescue, medical cares and rehabilitation. For the dead stranding event, the network member will perform the essential procedures (measurement, sampling, or necropsy, if possible, also go for CT-scan) depending on the decomposed condition of the carcass. For the Condition Code 2 (means fresh dead) event, we go further focus on the academic research, with pathology, CT-scan and necropsy for medical/scientific evidence on marine mammal health and basic research.

Dr. Wei-Cheng Yang（楊瑋誠）

Email: yangweicheng@ntu.edu.tw

Tel: +886-2-3366-3871

Affiliation:

Department of Veterinary Medicine, School of Veterinary Medicine, National Taiwan University,Taipei, Taiwan.

EDUCATION & EXPERIENCES

Experiences

Aug. 2014-July 2018 Associate Professor, Department of Veterinary Medicine, College of Veterinary Medicine, National Chiayi University

Aug. 2009-July 2014 Assistant Professor, Department of Veterinary Medicine, National Chiayi University

Sep. 2008 – June 2009 Post-doctoral fellowship in Inst. Ecology & Evolutionary Biology, NTU

July 2000 – July 2003 Veterinarian in Taiwan Cetacean Society

2017-2020 President: Taiwan Cetacean Society

2014-2016 Secretary General: Taiwan Cetacean Society

Sep 2007-present Consultant veterinarian: Farglory Ocean Park

Academic education

Sep 2003 - Jan 2008 PhD program in Ecology & Evolutionary Biology, National Taiwan University, Taiwan

Sep 1998 - June 2000 Master of Science in Veterinary Medicine, National Taiwan University, Taiwan

Sep 1993 - June 1998 Doctor of Veterinary Medicine, National Taiwan University, Taiwan

RESEARCH INTERESTS

1. Cetacean Conservation Medicine
2. Development of Diagnostic Tools for Cetaceans

Biotechnology's Role in Advancing Cetacean Conservation in Taiwan

Wei-Cheng Yang

Conservation Medicine Laboratory, School of Veterinary Medicine, National Taiwan University, Taipei, Taiwan.
*E-mail: yangweicheng@ntu.edu.tw

Abstract

Conservation Medicine Laboratory (CML) recently has made significant contributions to cetacean conservation medicine, particularly through the development of innovative diagnostic tools and genetic analyses that enhance our understanding of cetacean health and the management of vulnerable species. One of the achievements is the development of field-deployable duplex insulated isothermal PCR (iiPCR) assays for the rapid and sensitive detection of key pathogens in cetaceans. One assay targets Toxoplasma gondii, a zoonotic pathogen indicative of land-to-sea pollution [1]. This iiPCR assay, which detects the B1 gene of T. gondii alongside a cetacean-specific internal control, provides a crucial tool for on-site diagnostics. Additionally, we have developed a similar iiPCR-based portable and user-friendly diagnostic tool, for detecting Cetacean Morbillivirus (CeMV), a significant viral threat to cetacean populations [2]. These iiPCR biotechnologies underscore the importance of rapid, on-site diagnostics in cetacean conservation medicine, facilitating detection and investigation to understand the impacts of diseases on cetacean populations.

In addition to pathogen detection, CML has advanced the understanding of illegal cetacean exploitation through the development of a portable recombinase polymerase amplification (RPA) assay [3], coupled with a dual-zone lateral flow strip, allows for the rapid identification of cetacean species, even in processed or digested products. By enabling the differentiation of baleen and toothed whales within 30 minutes, this tool enhances the monitoring of illegal cetacean trade and supports the enforcement of conservation regulations, which is critical for curbing illegal activities that threaten cetacean species and for promoting the sustainable management.

Our research has also focused on the health of cetaceans, providing insights into how environmental stressors impact cetacean physiological responses for developing strategies to mitigate these impacts. In captive beluga whales, a probe-based quantitative gene expression assay that monitors key immunological genes allows for the detection of deviations from normal immune function that could indicate underlying health issues [4]. We further explored the use of skin cortisol levels and acoustic activity as indicators to evaluate stress and welfare in captive beluga whales [5]. The studies on bottlenose dolphins exposed to low-frequency underwater sound have revealed stress-induced psychophysiological impact, suggesting that anthropogenic noise could have deleterious effects on cetacean health [6,7].

Our genetic research on stranded pygmy killer whales and Kogia spp. in Taiwan has provided new

insights into the population structures of these species [8]. Contrary to the assumption that mass strandings are driven by tight kinship, our findings suggest that pygmy killer whale pods may be composed of multiple unrelated clans, with potential implications for understanding their social structure and stranding behavior. Additionally, the genetic analysis of Kogia spp. has revealed significant differences in genetic diversity between species, highlighting the need for tailored conservation strategies to protect these vulnerable populations.

CML's work contributes to the broader field of cetacean conservation medicine by developing practical tools for disease monitoring, improving the understanding of human impacts on cetacean health, and providing genetic insights that inform conservation efforts. These advancements are essential for safeguarding the health and sustainability of cetacean populations in an increasingly human-dominated environment.

Literature Cited

1. ***Hsieh MJ, Yang WC. A field-deployable insulated isothermal PCR (iiPCR) for the global surveillance of Toxoplasma gondii infection in cetaceans. Animals. 2022;12(506).***
2. ***Lattao C, Hsieh CC, Yang WC. Development of reverse transcription-insulated isothermal PCR (RT-iiPCR)-based detection method for cetacean morbillivirus (CeMV). Unpublished manuscript.***
3. ***Ho Y, Chan KW, Yang WC. A rapid DNA amplification assay for cetacean product identification: providing insights for illegal cetacean utilization and implications for conservation. Ocean Coast Manag. 2024;251:107084.***
4. ***Tsai M, Chen I, Wang J, Chou S, Li T, Leu M, Ho H, Yang WC. A probe-based qRT-PCR method to profile immunological gene expression in blood of captive beluga whales (Delphinapterus leucas). PeerJ. 2017;5:e3840.***
5. ***Wong CH, Tsai MA, Ko FC, Wang JH, Xue YJ, Yang WC. Skin cortisol and acoustic activity: potential tools to evaluate stress and welfare in captive cetaceans. Animals. 2023;13(1521).***
6. ***Chen IH, Chou LS, Chou SJ, Wang JH, Stott J, Blanchard M, Jen IF, Yang WC. Sound exposure-induced cytokine gene transcript profile changes in captive bottlenose dolphin (Tursiops truncatus) blood identified by a probe-based qRT-PCR. J Vet Med Sci. 2018 Apr 18;80(4):601-605. doi: 10.1292/jvms.17-0548.***
7. ***Yang WC, Chen CF, Chuah YC, Zhuang CR, Chen IH, Mooney TA, Stott J, Blanchard M, Jen IF, Chou LS. Anthropogenic sound exposure-induced stress in captive dolphins and implications for cetacean health. Front Mar Sci. 2021;8:606736.***
8. ***Chen YR. Genetic structure analyses of Feresa attenuata and Kogia spp. stranded in Taiwan based on mitochondrial and nuclear DNA sequences. Master's thesis. Taipei (Taiwan): National Taiwan University; 202***

Dr. Chien-Hsiang Lin(林千翔)

Email: kurosakigate.sinica.edu.tw

Tel: +886-2-2787-2238

Affiliation:

Assistant research fellow at the Biodiversity Research Center, Academia Sinica, Taipei, Taiwan.

Broadly trained marine paleontologist specializing in fish fossils, with a particular focus on using fish otoliths for taxonomic and ecological studies. My research primarily centers on deep-time marine fossils to explore their paleoecological, biogeographical, and evolutionary implications. Additionally, I investigate conservation paleobiology and understanding changes in fish communities through time using sea bottom materials as a study system. Throughout my academic career, I have collaborated extensively with various institutions, including the Royal Belgian Institute of Natural Sciences, Università degli Studi di Bari, Czech Academy of Sciences, Institut de Ciències del Mar, and Smithsonian Tropical Research Institute.

EDUCATION & EXPERIENCES

Experiences

Apr 2020 Biodiversity Research Center, Academia Sinica, Taipei, Taiwan. Assistant Research Fellow

Sep 2021 Department of Geosciences, National Taiwan University, Taiwan. Adjunct Assistant Professor

Apr 2020 Department of Life Science, National Taiwan Normal University, Taiwan. Jointly Appointed Assistant Professor & Department of Life Science, Tunghai University, Taiwan. Jointly Appointed Assistant Professor

Aug 2018–Apr 2020 Center for Ecology and Environment, Tunghai University, Taiwan. Assistant Researcher

Nov 2017–Apr 2018 Smithsonian Tropical Research Institute, Panama. Postdoctoral Fellowship

Aug 2017–Oct 2017 National Museum of Marine Biology and Aquarium, Taiwan. Ministry of Science and Technology, Research Assistant

Mar 2017–Jun 2017 Smithsonian Tropical Research Institute, Panama. Short-Term Fellowship

Aug 2011–Jul 2013 National Museum of Marine Biology and Aquarium, Taiwan. National Science Council (NSC) Research Assistant

Academic education

Sep 2013–Jan 2017 Ph.D., Institute of Earth Science, Università degli Studi di Bari, Italy

Sep 2008–Jun 2010 Master of Science, Institute of Zoology, College of Life Science, National Taiwan University, Taiwan.

Sep 2004–Jun 2008 Bachelor of Science, Department of Life Science, National Cheng Kung University, Taiwan.

RESEARCH INTERESTS

1. Global fish otoliths and their fossil records
2. Conservation Paleobiology: historical shifts in fish community and life history traits
3. Neogene marine fossils of West Pacific: diversity, paleoecology and biogeography
4. Global Sciaenidae Conservation Network: otolith morphology, diversity, and fossil record
5. 3D modeling and machine learning approaches in otoliths

GRANTS AND AWARDS

Aug 2023–Jul 2026

National Science and Technology Council, Taiwan, 112-2116-M-001-017-MY3

Spatiotemporal dynamics of diversity of paleoichthyofauna in the West Pacific (TWD5,550,000)

Jun 2023–Apr 2024

Sepkoski Grant Award, Paleontological Society, USA

Unearthing the hidden gems: exploring the rich fish fossil record of Bulacan, Philippines to reconstruct the past biodiversity of the tropical West Pacific ($1,000)

Jan 2023–Dec 2024

MOST-FNRS Bilateral Cooperation Programme, 112-2927-I-001-505

3DPhyloFish: Using 3D shape and machine learning approaches to understand the relationship between phylogeny, morphology and biodiversity in fish otoliths (TWD480,000)

Aug 2022–Jul 2023

Ministry of Science and Technology, Taiwan, 111-2116-M-001-033-

Historical shifts in fish community and life history traits(2/2) (TWD1,198,000)

Jan 2022–Dec 2023

Mobility Plus Project, Academia Sinica, Taiwan

Cenozoic fossil fishes from Taiwan and the Czech Republic – the once thrived ichthyofaunas (TWD700,000)

Jan 2022–Dec 2022

Stan Wood Award, Palaeontological Association Small Grant, UK, PA-SW202102

A diverse early Pleistocene shark teeth assemblage from southern Taiwan (£1,500)

Aug 2021–Jul 2022

Ministry of Science and Technology, Taiwan, 110-2116-M-001-009-

Historical shifts in fish community and life history traits(1/2) (TWD1,198,000)

Aug 2020–Jul 2021

Ministry of Science and Technology, Taiwan, 109-2116-M-001-022-

Significances of changes in the fish community composition in NW Pacific over the last 2 Ma, with an evaluation of population structure of croakers (Pisces, Sciaenidae) (II): life history and isotope analyses (TWD1,373,000)

Feb 2019–Dec 2020

Ministry of Science and Technology, Taiwan, 108-2116-M-029-001-MY2

Significances of changes in the fish community composition in NW Pacific over the last 2 Ma, with an evaluation of population structure of croakers (Pisces, Sciaenidae)(TWD1,715,000)

Nov 2017–Apr 2018

Smithsonian Tropical Research Institute Postdoctoral Fellowship ($18,000)

Mar 2017–Jun 2017

Smithsonian Tropical Research Institute Short-Term Fellowship ($4,000)

Sep 2013–Sep 2016

Government scholarship for overseas study, Ph.D. program. Ministry of Education, Taiwan. ($144,000)

EDITORIAL BOARD/ACADEMIC REFEREE

1. Managing editor: Zoological Studies (2024–now)
2. Members of the board of reviewers: The Anatomical Record (2024–now)
3. Research proposal reviews:
   National Science and Technology Council (NSTC), Taiwan (2022–now)
   Systematics Research Fund, The Linnean Society, United Kingdom (2024)
   Marine Geology and Geophysics Program of the National Science Foundation, USA (2022)
4. Journal reviews: (2020–2024):
   Environmental Biology of Fishes (2021), Frontiers in Marine Science (2021), Journal of the Geological Society (2022, 2023), Netherlands Journal of Geosciences (2023), Palaeontologia Electronica (2023), PLoS ONE (2022), Scientific Reports (2023), Scottish Journal of Geology (2024), Terrestrial, Atmospheric and Oceanic Sciences (2021), Zoological Journal of the Linnean Society (2023), Zoological Studies (2018–now)
5. Journal guest editor:
   Terrestrial, Atmospheric and Oceanic Sciences Journal (TAO), special issue "New advances on stratigraphy and paleontology in Taiwan"

Reconstructing paleo-reef fish community

Chien-Hsiang Lin

Biodiversity Research Center, Academia Sinica
*E-mail: chlin.otolith@gmail.com

Abstract

Understanding long-term changes in coral reef fish communities is challenging due to limited historical data. Here, I demonstrate a technique using fish otoliths in reef sediments to reconstruct these communities. I will first present a case study using otoliths from modern and mid-Holocene reefs in Caribbean Panama and the Dominican Republic. More than 5,400 otoliths were found in 169 bulk sediment samples, representing 56 taxa belonging to 35 families. Most otoliths were juveniles, which are challenging to identify, and predation appears to be a key process in otolith accumulation. Comparisons with living fish communities showed that otolith assemblages accurately reflect the living fish composition. Radiocarbon dating indicated minimal sediment mixing in actively accreting reefs. The modern fish community has significantly shifted from its past analogue, exhibiting changes in fish trophic structure. Finally, I introduce our parallel pilot effort to understand fish community dynamics over time in Green Island through coring on the reef sediments there.

Dr. Tzu-Ruei, Yang (楊子睿)

Email: tzurueiyang@nmns.edu.tw

Tel: 04-23226940 ext. 616

Affiliation:

Geology Department, Paleontology Division, National Museum of Natural Science, Taichung, Taiwan

EDUCATION & EXPERIENCES

Experiences

2018/11-2019/02 Postdoc/Wissenschaftlicher Mitarbeiter / Institut Geowissenschaften, University of Bonn, Germany

2019/03-2019/06 Postdoc / Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Science, China

2019/06- Assistant Curator / Department of Geology, National Museum of Natural Science, Taiwan

2020/02 Adjunct Assistant Professor / Dept. of Earth Sciences, NCKU

2021/08 Joint Assistant Professor / Dept. of Life Sciences, NCHU

2022/01 Associate Editor / Zoological Studies, Frontiers in Earth Sciences, Frontiers in Ecology and Evolution

2024/08- now Associate Curator / Dept. of Geology, National Museum of Natural Science

Education

2006-2010 National Cheng Kung University (Tainan, Taiwan), majoring in Earth Sciences and Life Sciences (GPA:3.6/4.0)

2010-2012 National Cheng Kung University (Tainan, Taiwan), majoring in Earth Sciences, co-advised by the curator of National Museum of Natural Sciences (Taichung, Taiwan) (GPA: 4.0/4.0)

2014-2018 Rheinische Friedrich-Wilhemls-Universität Bonn (Bonn, Germany) (was evaluated as an outstanding achievement “Sehr gut”, means very good with the grade of 1.0)

RESEARCH INTERESTS

1. Dinosaur eggs
2. Dinosaur reproductive biology
3. Taphonomy
4. Paleoecology
5. Molecular Paleontology

GRANTS AND AWARDS

2019/01 Chinese Academy of Sciences, Taiwan Young Talent Programme 500,000 (RMB)

2019/10 Ministry of Science and Technology, Taiwan (MOST-108-2116-M-178-003-MY2) 2,735,000(NTD)

2021/08 Ministry of Science and Technology, Taiwan (MOST-110-2116-M-178-002) 1,080,000(NTD)

2021/11 Deutsche Forschungsgemeischaft (DFG) 50,000(EUR)

2022/08 Ministry of Science and Technology, Taiwan (MOST-110-2116-M-178-002) 1,150,000(NTD)

2023/08 Ministry of Science and Technology, Taiwan (MOST-110-2116-M-178-002) 1,530,000(NTD)

2024/08 Ministry of Science and Technology, Taiwan (MOST-110-2116-M-178-002) 1,766,000(NTD)

2024/05 Geological Society of Taiwan Ting-Ying Ma Young Scientist’s Paper Award

2024/05 Central Geological Survey of Taiwan Excellent Paper Award

JOURNAL REVIEWS

Vertebrata PaleoAsiatica、Journal of Paleontology、Cretaceous Research、Historical Biology、Paleobiology、Scientific Reports、Journal of Vertebrate Paleontology、Communications Biology 、Palaeogeography, Palaeoclimatology, Palaeoecology, Frontiers in Ecology and Evolution、Geosciences Frontiers、Frontiers in Earth Sciences、Journal of Palaeobiogeography、Molecules、PeerJ

ACADEMIC PARTICIPATION

2015 Organizing committee of Workshop for Morphometrics University of Bonn, Germany

2015 Organizing committee of 3rd International Symposium of Paleohistology University of Bonn, Germany

2019 Chief committee of 7th Symposium of Dinosaur Eggs and Babies Qinglongshan Dinosaur Egg-Cluster National Geopark

A possible prehistoric stranding site for cetaceans in southernmost Taiwan

Tzu-Ruei Yang[1,2,3], Anneke H. van Heteren[4,5], Chiou-Ju Yao

[1] Department Geology, National Museum of Natural Science
[2] Department of Life Sciences, National Chung Hsing University
[3] Department of Earth Sciences, National Cheng Kung University
[4] Sektion Mammalogie, Zoologische Staatssammlung München, Staatliche Naturwissenschaftliche Sammlungen Bayerns, Münchhausenstraße 21, 81247 München, Germany
[5] GeoBio-Center, Ludwig-Maximilians-Universität München, Germany
[6] Department of Biology, National Museum of Natural Science
*E-mail: tzurueiyang@nmns.edu.tw

Abstract

The island of Taiwan is located at the convergent zone between the Eurasian and Philippine Sea plates. Despite its young age, an excellent marine stratigraphic record and well-preserved marine fossil record are contributed by the extraordinarily high uplifting rate and sedimentary rate. Fossilized cetacean remains represent the largest and the most common fossil record among the great amount of the Plio-Pleistocene marine fossils from western Taiwan.

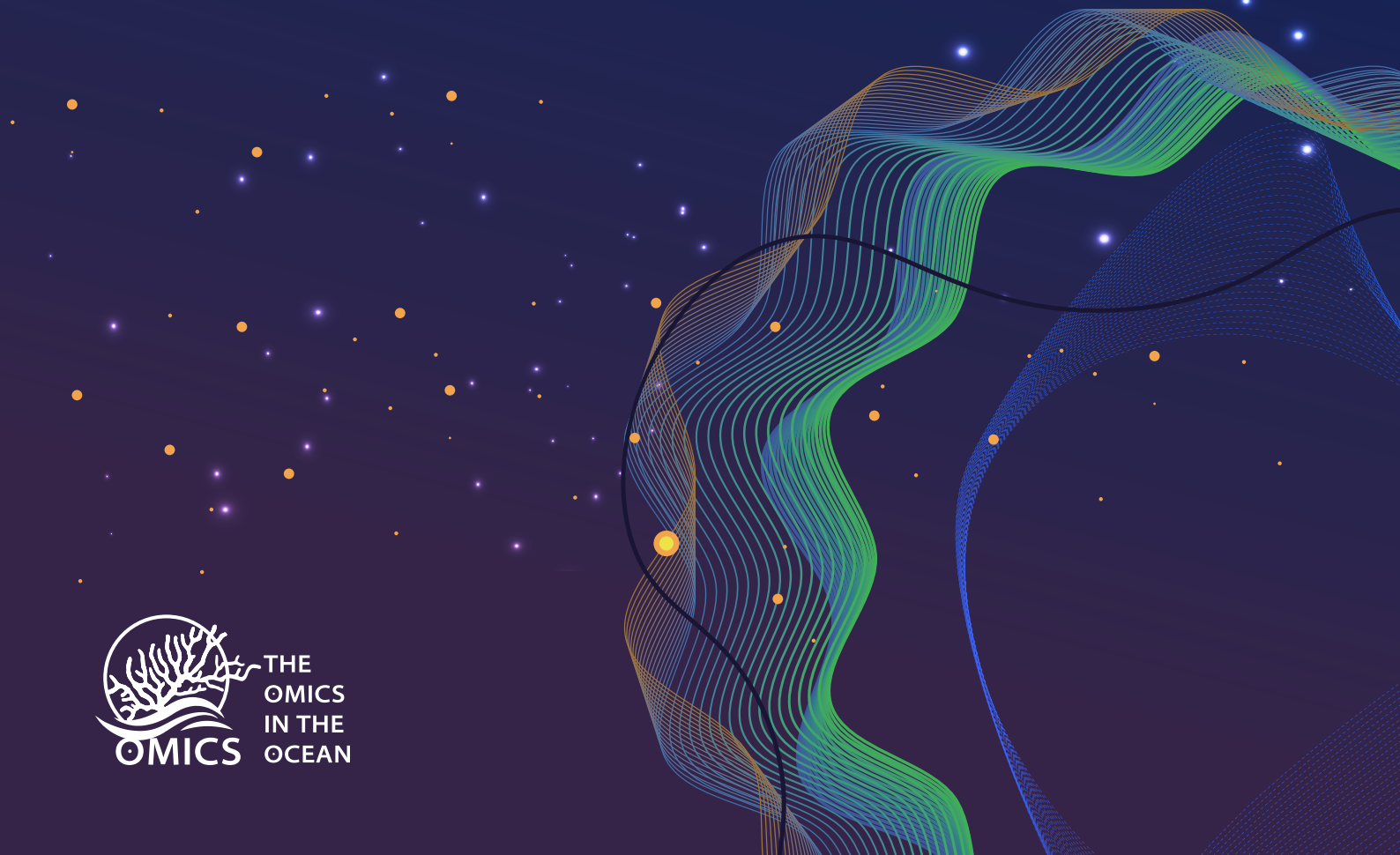
In 2022, the excursion to Tougou, Hengchun, led by the National Museum of Natural Science, Taiwan uncovered an in situ preserved gigantic baleen whale fossil yielding over 70% completeness. Based on the size of its ribs and mandibles, the baleen whale is estimated to the length of 15 meters. The morphology of its scapulae indicates the affinity to grey whales (Eschrichtius robustus). Various lines of taphonomic evidence reveal a shallow marine coastal depositionary environment for the rapid burial of the extraordinarily well-preserved baleen fossil.

Recently, an unprecedented number of additional cetacean fossils uncovered from Tougou further suggest a long-term (>260 ka) cetacean stranding site in southernmost Taiwan. Such a common occurrence echoes the frequent cetacean strands around Taiwan and the whaling activities in southernmost Taiwan in the early 19th century. In the future, we aim to investigate the biogeographical history for the cetaceans around southernmost Taiwan through continuous excursions and cross-disciplinary approaches.

The Omics in the Ocean

The 10th International Symposium for Marine Biology and Biotechnology
The 7th Taiwan Society of Marine Biotechnology Academic Symposium

POSTER PRESENTATIONS



THE OMICS IN THE OCEAN

Application of Genetic Engineering in Marine Oil Pollution Mitigation

Yu-Chien Kao [1], Pei-Luen Jiang [*,1]

[1] Department of Biotechnology, National Formosa University, Yunlin, Taiwan.

* E-mail:villy@nfu.edu.tw

Abstract

The frequent occurrence of marine oil spills has significantly impacted ecosystems. *Alcanivorax sp.*, a key microorganism in oil-contaminated marine environments, is a Gram-negative, non-motile, aerobic, halophilic, rod-shaped γ-proteobacterium. Its hydrocarbon-degrading capabilities allow it to efficiently break down hydrocarbons in crude oil. The alkane hydroxylase enzyme, encoded by the alkane metabolism gene (*AlkB1*), initiates the metabolism of alkanes in crude oil into fatty acids, thereby facilitating the biodegradation of hydrocarbons, the primary components of crude oil, and achieving bioremediation. In this study, *Alcanivorax* sp. was serially cultured in Marine Agar 2216 medium supplemented with 1% pyruvic acid. The genomic DNA (gDNA) and total RNA of the strains, were extracted and analyzed 1.5% and 1.0% agarose gels with TAE electrophoresis buffer to evaluate their integrity. Future work will involve employing genetic cloning techniques to overexpress the monooxygenases encoded by the alkane degradation gene, to enhance the ecological remediation potential in marine oil spill areas.

Keywords: *Alcanivorax sp.*; *AlkB1* gene; Oil pollution mitigation, Ecological remediation

In vitro anti-oxidant and anti-microbial activities of brown algae-derived polysaccharides

Guruvignesh Senthilkumar [1], Dillirani Nagarajan [1,*], Chiu-Wen Chen [1], Cheng-Di Dong [1]

[1] College of Hydrosphere Science, Institute of Aquatic Science and Technology, National Kaohsiung University of Science and Technology, Kaohsiung 811213, Taiwan R.O.C

* E-mail: dillirani@nkust.edu.tw

Abstract

Seaweed-derived polysaccharides are known for their potential health benefits, including antioxidant, anti-inflammatory, anti-cancer, cardioprotective, and immune-modulatory activities. The major aim of this study was to investigate the health benefits of the brown seaweed Sargassum sp. isolated from the southern coast of Taiwan when consumed directly as food. Pelagic brown seaweeds were collected from the Kenting Bay of Taiwan, washed thoroughly, oven-dried, and milled into a powder. The proximate biomass composition and the total polyphenol content were determined. The known brown algal polysaccharides, alginate, and fucoidan were extracted sequentially in one-step extraction with $CaCl_2$ to precipitate calcium alginate, and ethanol to precipitate fucoidan. The extracted polysaccharides were characterized by FT-IR analysis and further analyzed for antioxidant and anti-microbial activity. The antioxidant activity was determined by four different tests: DPPH radical scavenging assay, ABTS assay, ferrous ion chelation assay, and ferric-reducing power assay. The anti-microbial activity was tested against known bacterial pathogens using a zone of inhibition test. Fucoidan, the sulfated fucose-rich polysaccharide characteristic of certain brown macroalgae, exhibited potent anti-oxidant activity at low concentrations. Alginate also demonstrated considerable antioxidant activity, albeit at slightly higher concentrations. Anti-microbial activity was present in both polysaccharides, with slight variations in the zone of inhibition. This study proves that consumption of naturally occurring brown seaweeds and their constituent polysaccharides exhibit beneficial health-promoting effects such as antioxidant and anti-microbial activities.

Keywords: Seaweed; Polysaccharides; Antioxidant activity; Fucoidan; Alginate; Ulvan

Bioaccumulation of Polycyclic Aromatic Hydrocarbons from Oil Pollution in Corals: Physioecological Implications

Jing-O Cheng [1, *], and Fung-Chi Ko [1, 2]

[1] National Museum of Marine Biology and Aquarium, Pingtung, Taiwan
[2] Institute of Marine Biology, National Dong Hwa University, Pingtung, Taiwan
* E-mail: chengjingo@nmmba.gov.tw

Abstract

Coral reefs, hosting diverse marine communities within marine ecosystems, play a pivotal role in the geology and ecology of tropical and subtropical oceans. However, these reefs predominantly thrive in densely populated coastal areas, rendering them vulnerable to numerous anthropogenic disturbances. Among these, pollution from petroleum hydrocarbons, stemming from various sources, poses a pervasive threat to coastal coral reef ecosystems, particularly in the wake of oil spill incidents. To investigate the impacts of the impacts of oil pollution on coral health, a 72-hour exposure experiment was conducted utilizing the stony coral *Euphyllia paraancora* subjected to varying levels of oil pollution, including concentrations of 10 g of motor oil per liter (10 g/L) and 1 g of motor oil per liter (1 g/L). The study aimed to assess the bioaccumulation of polycyclic aromatic hydrocarbons (PAHs,) in coral and its ramifications on lipid content, density, and symbiotic algae chlorophyll content of symbiotic algae (zooxanthellae). Results indicated a significant accumulation of PAHs in corals exposed to higher pollution levels. Interestingly, the lipid content of the coral remained relatively unchanged after 72 hours of exposure to oil pollution. However, both the density and the chlorophyll content of symbiotic algae exhibited significant declines under high pollution conditions compared to these in the low pollution group. This suggests a potential escape of symbiotic algae from corals under threat of oil pollution, potentially jeopardizing the survival and growth of corals.

Keywords: Polycyclic aromatic hydrocarbons; Stony corals; Bioaccumulation; *Euphyllia paraancora*

Phosphorus Limitation Induces Physiological Variations in Symbiodiniaceae

Pei-Hua Yang [1], Pei-Luen Jiang [*, 1]

[1] Department of Biotechnology, National Formosa University, Yunlin, Taiwan.

* E-mail: willy@nfu.edu.tw

Abstract

Coral reefs are one of the most diverse ecosystems on Earth. Global warming destroys the symbiotic relationship between corals and *Symbiodiniaceae,* causing coral bleaching and affecting the entire coral reef ecosystem. The natural nutrients in coral reef ecosystems are constantly influenced by human factors and it will also suffer serious damage due to the combined deficiency of nitrogen and phosphorus. Studies have found that algae under phosphorus deficient nutritional stress can synthesize triglycerides (TAG), and oil will accumulate in algae cells. This study will explore the changes in lipids of *Symbiodiniaceae* in corals and their physiological structure under a phosphorus limitation environment and to understand the regulatory mechanisms of *Symbiodiniaceae* in the face of adversity. This will lead to a deeper understanding of coral ecosystems.

Keywords: *Symbiodiniaceae*; Coral reefs; Phosphorus limitation, Algae

The potential mechanisms of physiological adaptation to high sulfide extreme environment in hydrothermal vent crab, Xenograpsus testudinatus

Chi Chen [1, 2], Yao-Tse Chung [3], Pei-Hsuan Chou [4], Hsuan-Li Chu [4], Zih-Syuan Lyu [3], Hau-Wen Li [3], Guan-Chung Wu [3], Yung-Che Tseng [4], Ching-Fong Chang [3, 5]

[1] Doctoral Degree Program in Marine Biotechnology, National Taiwan Ocean University, Keelung, Taiwan

[2] Doctoral Degree Program in Marine Biotechnology, Academia Sinica, Taipei, Taiwan

[3] Department of Aquaculture, National Taiwan Ocean University, Keelung, Taiwan

[4] Institute of Cellular and Organismic Biology, Academia Sinica, Taipei, Taiwan

[5] Center of Excellence for the Ocean, National Taiwan Ocean University, Keelung, Taiwan

* E-mail: reart002@gmail.com

Abstract

In the cell, H2S derives the electron from reduced cytochrome c to induce the electron transport chain termination and then interrupt aerobic respiration. Sulfide: quinone oxidoreductase (SQR) is the key enzyme for sulfide metabolism in mitochondria, which transfers sulfur atoms from high toxic sulfide to generate low toxic thiosulfate. In this study, we cloned sulfide metabolized-related genes XtSQR1, XtSQR2, and electron carrier hemoprotein cytochrome c (XtCYC) from our transcriptomic data. To understand the relationship between sulfide metabolized-related genes and sulfide, we compared the gene expression profiles with high sulfide conditions (habitat) and low sulfide conditions (raised in normal seawater). According to qPCR analysis, SQR1 was dominantly expressed in the posterior gill (PGi). SQR2 was dominantly expressed in the digestive gland (DG). XtCYC was dominantly expressed in PGi and significantly increased in high sulfide condition compared to low sulfide condition. Furthermore, the results of SQR western blot and enzyme activity assay revealed SQR significantly increased in high sulfide condition. However, results of cytochrome c oxidase IV (COX IV) activity assay revealed no significant difference between high sulfide and low sulfide condition. Additionally, low SQR expressed XtCrab was incubated in habitat to confirmed the sulfide effect and showed 0% of mortality. In conclusion, our data suggested XtCrab could survive in high sulfide condition even with a low SQR expression level. Moreover, aerobic respiration keeps proceeding under high sulfide condition. Taken together, both sulfide metabolism and aerobic respiration maintenance might play an important role in the physiological adaptation to high sulfide extreme environment.

Keywords: Kueishan Island; Hydrothermal vent; SQR; CYC

Investigate the impact of climate change on mixed layer depth and nitrate levels in Taiwan's coastal and offshore waters

Kuo-Wei Yen [*, 1] & Shih-Hao Huang [1]

[1] Marine Fisheries Division, Fisheries Research Institute, Ministry of Agriculture, Keelung 202008, Taiwan
* E-mail: kwyen@mail.tfrin.gov.tw

Abstract

As global environmental changes continue to challenge the sustainability of Taiwan's fisheries, there is an urgent need for innovative approaches to understand and mitigate these impacts. The Taiwan Cooperative Oceanic Fisheries Investigations (TaiCOFI) program, established in 2003, has played a critical role in this effort by collecting comprehensive fishery environmental data, including water temperature, salinity, nutrients, chlorophyll, and zooplankton, from 62 monitoring stations in surrounding waters. This long-term database is essential for exploring the profound connections between oceanic processes and marine resources. Our latest findings reveal significant changes in the mixed layer depth and nitrate levels in key upwelling regions, particularly in the northeastern and southwestern shoals of Taiwan. The mixed layer depth has become noticeably shallower in recent years, suggesting a potential shift in oceanographic dynamics that could have far-reaching implications for marine ecosystems and fisheries. Moreover, a general decline in nitrate concentrations, with localized increases near the Hualien coast and northeastern waters, highlights the complex biogeochemical responses to climate change. These insights are crucial for developing sustainable management strategies and fostering international cooperation in marine sciences. By addressing the challenges posed by climate change through innovative applications and sustainable development practices, we aim to contribute to the preservation and resilience of our fisheries, ensuring that future generations can continue to benefit from its resources and beauty.

Keywords: Climate Change; Mixed Layer Depth; Nitrate Levels; Sustainable Fisheries

Enhancing *Spirulina* Growth with Automated Systems

Hao-Ren Shi [1] ,Pei-Luen Jiang [*, 1]

[1] Department of Biotechnology, National Formosa University, Yunlin, Taiwan.

* E-mail: villy@nfu.edu.tw

Abstract

Spirulina, a microscopic algae from the *Cyanobacteria phylum*, is highly valued for its rich nutritional content, including proteins, vitamins, minerals, and antioxidants. Its applications span food, health supplements, nutritional products, and water purification processes. Despite its benefits, traditional algae cultivation is labor-intensive and costly. This report explores an automated cultivation system designed to minimize energy use and enhance cost efficiency. The automated module will be equipped with sensors and automatic control devices to maintain optimal conditions for algae growth, thereby enhancing photosynthetic efficiency. Key parameters such as pH, temperature, nutrient supply, and light intensity will be meticulously controlled. Automation not only significantly boosts growth rates and biomass yield by also includes remote monitoring capabilities, allowing for real-time adjustment and reducing the margin of error.

Keywords: Spirulina; Automated cultivation system; Automated module

Body sizes and trophic levels of marine fish increase with latitudes, and decrease in the deep-sea and Antarctica

Han-Yang Lin [*, 1]

[1] Marine Fisheries Division, Fisheries Research Institute, Ministry of Agriculture, Taiwan

* E-mail: bb54jay@gmail.com

Abstract

A combination of evolutionary history and local environmental conditions shapes species' functional traits. The temperature-size rule (TSR), gill-oxygen limitation theory (GOLT), and temperature constraint hypothesis (TCH) offer frameworks to understand variations in body size and trophic levels among marine organisms. However, the global patterns of how these functional traits vary with latitude and depth remain poorly understood. This study analyzed the latitudinal gradients of trophic levels and maximum body sizes in 5619 marine fish species across three body sizes (< 30 cm, 30 – 100 cm, > 100 cm) and four trophic levels (< 2.20, 2.20 – 2.80, 2.81 – 3.70, > 3.70). These traits were examined across five-degree latitudinal bands within four depth zones: the whole water column, 0 – 200 m, 201 – 1000 m, and 1001 – 6000 m. Also, this study investigated the relationships between these functional traits and key environmental variables, including salinity, sea surface and near-seabed temperatures, and dissolved oxygen levels.

The results revealed a clear pattern: marine fish exhibited smaller body sizes and lower trophic levels in warmer latitudes, with a shift towards larger body sizes and higher trophic levels in colder, higher-latitude regions, except for the Southern Ocean. In warmer waters, species with trophic levels ≤ 2.80 dominated, whereas such species were virtually absent in colder environments. This study also observed differences in body size and trophic levels between polar regions to the greater environmental heterogeneity in the Arctic compared to Antarctica. Additionally, the findings suggest that the mean maximum body size of fish declines with increasing depth, likely due to decreasing oxygen availability. These results provide strong empirical support for the TSR, GOLT, and TCH, underscoring the critical roles of temperature and oxygen in shaping the biogeography and biological traits of marine fishes on a global scale.

Keywords: Latitudinal gradient; Depth gradient; Marine fish; Body size; Trophic level

Approach the awareness and consumption behavior of consumers on fish welfare

Su Mei Wu [*, 1], Ming Chan Tsai [1], Pei Lin Liu [2]

[1] Department of Aquatic Biosciences, National Chiayi University, Taiwan

[2] Department of Foreign Languages, National Chiayi University, Taiwan

* E-mail: sumei@mail.ncyu.edu.tw

Abstract

The aims of the present study were to explore the impact of consumer awareness on fish welfare and their consumption behavior. Consumer understanding and behavior towards fish welfare were analyzed through a questionnaire survey of 347 subjects. The results showed that consumers attached greater importance to fish welfare because the data showed that consumer respondents scored significantly higher on the overall questionnaire, as well as higher than the sales-side and production-side in each sub-item. In terms of gender, men scored significantly better than women, suggesting that men have a higher comprehensive understanding and cooperation regarding fish welfare. In terms of age group, the scores of the 36-45-year-old group were significantly lower than those of other groups in terms of knowledge of aquatic animal perception and understanding of government promotion strategies. In terms of place of residence, subjects who lived in the six capitals scored significantly higher on the overall questionnaire and each sub-item than subjects who did not live in the six capitals. In terms of education level, subjects with a college degree or graduate school degree scored significantly higher than those with a middle school or elementary school degree. Based on the results, we recommend strengthening education and advocacy for different groups, particularly focusing education on fish welfare for people in the sales-side, the 36-45-year-old age group, and those who do not live in the six capitals.

Keywords: Consumer behavior; Education; Fish welfare; Questionnaire survey

Application of eDNA metabarcoding in the assessment of fish biodiversity in four Taiwan coastal natural wetland reserves

Yu-Min Ju [*, 1, 2], Sheng-Tai Hsiao [3], Kui-Ching Hsu [4], Po-Hsun Kuo [4]

[1] National Museum of Marine Biology and Aquarium, Pingtung 944, Taiwan
[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung, 804, Taiwan
[3] Fisheries Research Institute, Council of Agriculture, Keelung, 202, Taiwan
[4] Department of Industrial Management, National Taiwan University of Science and Technology, Taipei 106, Taiwan

Abstract

Biodiversity assessments are important in conservation programs. In recent years, environmental DNA (eDNA) metabarcoding has been a highly efficient method for biodiversity monitoring as it is non-intrusive and does not subject morphological identification constraints. This study applied the eDNA metabarcoding method to assess fish biodiversity in four Taiwan wetland reserves: (1) Danshuei River Mangrove Nature Reserve, (2) Zengwen Estuary Wetland Reserve, (3) Beinan Estuary Wetland Reserve and (4) Lanyang Estuary Wetland Reserve. Using 12S genetic markers from eDNA water samples, this study detected 99 fish species from 43 families totally. Only one species (Mugil cephalus) was commonly detected in all sites. The lesser species was detected in Beinan Esturary Wetland (nine species), and most species was found in Lanyang Estuary Wetland (71 species). Although the lesser total read was detected in Beinan Esturary Wetland (22,066 reads), the total read in Lanyang Estuary Wetland was not maximum (26,451 in Lanyang, 63,564 in Danshuei and 82,597 in Zengwen). Thus, the species riches were not closely related to the sampling and laboratory analysis. The values of salinity and Chlorophyll a in these two wetlands were lower (salinity: 4 ‰ in Beinan, 8 ‰ in Lanyang, 35 ‰ in Danshuei and 36.5 ‰ in Zengwen; Chlorophyll a: 0.20 µg/L in Beinan, 0.55 µg/L in Lanyang, 1.22 µg/L in Danshuei and 1.99 µg/L in Zengwen). Thus, the species riches were also not closely related to the factors of salinity and Chlorophyll a. This study suggests that the ichthyofauna is closely related to their geographical environment. Moreover, this study found Onychostoma alticorpus and Spinibarbus hollandi, which were only distributed in southern and eastern Taiwan, in the sample from Lanyang Estuary Wetland. This result documented that freshwater fish dispersed by human intervention in Taiwan frequently.

Keywords: eDNA; Metabarcoding; 12S rRNA; Ichthyofauna; Taiwan

Aquaculture Pond Sludge Removal Expert System Design and Prototype Machine Establishment

Pei-Chi Chang [1], Chih-Hsuan Fan [1], Chao-Chun Lo [1], Yan-Jia Liou [1],Tung-Min Lin [2], Tung-Liang Liu [2], Shih-Chi Lee [1], Shu-Hsien Tsai [*, 1]

[1] Central Region Campus, Industrial Technology Research Institute, Nantou 54041, Taiwan

[2] JJIKAE Enterprise CO., LTD, Taichung 42754, Taiwan

* E-mail: SHTsai@itri.org.tw (e-mail address for the *corresponding author(s).)

Abstract

This study presents the design and development of an expert system integrated with a mechanical prototype aimed at optimizing sludge removal in aquaculture ponds. Aquaculture sludge, a byproduct containing nitrogen compounds, phosphorus, and organic carbon substances, poses significant environmental risks when accumulated in excess. The traditional methods for sludge removal, typically performed post-harvest, are time-consuming and costly. To address these challenges, this project introduces a comprehensive solution combining long-term aquaculture environmental sensing modules with an intelligent expert system and mechanical design. The system collects real-time data on sludge deposition, dissolved oxygen, pH levels, and oxidation-reduction potential (ORP), enabling timely and precise sludge removal operations. The expert system's interface allows operators to customize the activation of sludge removal equipment based on specific environmental conditions and aquaculture species. The integrated mechanical design ensures efficient operation of the sludge removal process, reducing labor costs and improving overall aquaculture productivity. The system's effectiveness is further enhanced by the application of Internet of Things (IoT) and wireless sensing technologies, which provide continuous monitoring and data visualization. This integrated approach not only improves the efficiency and sustainability of aquaculture practices but also promotes environmental protection.

Keywords: Pond sudge removal expert system; Long-term aquaculture environment sensing module; Integrated edge computing subsystem

Using DNA Barcoding to Identify Fish Eggs and Larvae for Estimating the Breeding Season of Carangidae

Hui-Ling Ko [*, 1], Yen-Wei Chang [2], Kwang-Tsao Shao [3]

[1] Marine Fisheries Division, Fisheries Research Institute, Ministry of Agriculture
[2] Seafood Technology Division, Fisheries Research Institute, Ministry of Agriculture
[3] Institute of Marine Biology, National Taiwan Ocean University
* E-mail: huilingko@gmail.com

Abstract

Understanding the early life history of fish is essential for effective fisheries management and conservation. This study focuses on the seasonal variation in the spawning of various species, specifically examining the occurrence of larval fish and fish eggs within the economically valuable Carangidae family, which includes 58 species in 22 genera recorded in Taiwan. All larval fish and fish eggs were collected between 2006 and 2023 using a plankton net in the coastal waters off Taiwan and its adjacent islands. The COI sequences obtained were identified at the species level using the BOLD database and further validated for accuracy through phylogenetic tree analysis. The final dataset comprises 450 COI sequences, representing around 27 species in 17 genera of Carangidae larval fish and fish eggs. The results indicate that spawning seasons vary among different fish species. For example, Alepes djedaba spawns from April to September, A. kleinii from May to October, Decapterus macarellus is present year-round, D. maruadsi spawns from December to August of the following year, and Scomberoides tol spawns from March to September. This study demonstrated that larval fish and fish eggs can be used to estimate the breeding season.

Keywords: DNA Barcoding; Carangidae; Breeding Season

Applying DNA barcoding to the identification of larval fish in the Cardinalfish (Apogonidae)

Yen-Wei Chang [*, 1], Hui-Ling Ko [2], Ching-Yi Chen [3], Kwang-Tsao Shao [3]

[1] Seafood Technology Division, Fisheries Research Institute, Ministry of Agriculture
[2] Marine Fisheries Division, Fisheries Research Institute, Ministry of Agriculture
[3] Institute of Marine Biology, National Taiwan Ocean University
* E-mail: ywchang@mail.tfrin.gov.tw

Abstract

Most cardinalfishes (Apogonidae) are nocturnal species and has mouthbrooding behavior, with two subfamilies 17 genera and 85 species recorded in Taiwan. During the larval fish stage, their morphological characteristics change rapidly, and they lack distinctive features for identification, which makes it challenging to identify them at the species level. This study conducted DNA barcoding identification on the cardinalfishes larval fish (Apogonidae). Sampling was conducted between 2007 and 2013 in the waters of Nanwan and Dongsha using plankton nets and light traps. After collection, the samples were photographed and measured for body length, and photographs were taken for certain species to document the ecological characteristics of their larval and juvenile stages. A total of 96 sequences from Apogonidae larval and juvenile fish were collected in this study. Phylogenetic tree analysis was conducted using adult fish sequences from the BOLD database. The results indicated that the larval and juvenile fish belonged to 33 species in 14 genera. The DNA barcoding method can assist in identifying larval fish and juveniles at the species level. The morphological characteristics confirmed by DNA barcoding can be applied to studies of their early life history, including spawning grounds, spawning seasons, and migratory distribution. This has significant implications for resource management and sustainable utilization.

Keywords: DNA Barcoding; Apogonidae; Larval fish

Ecological Significance of Symbiotic Interactions between Tridacninae and *Symbiodiniaceae* in Coral Reef Ecosystems

Jing-Ting Jiang[1], Pei-Luen Jiang [*, 1]

[1] Department of Biotechnology, National Formosa University, Yunlin, Taiwan.

* E-mail: villy@nfu.edu.tw

Abstract

The giant clam, belonging to the subfamily Tridacninae, are large marine bivalve that inhabits the warm, clear waters of coral reefs in the Indo-Pacific region. These clams primarily rely on the energy produced by its symbiotic algae, *Symbiodiniaceae,* through photosynthesis, while also supplementing their energy intake through filter feeding using its gills. *Symbiodiniaceae* are microalgae that engage in mutualistic symbiosis with host organisms, such as corals and Tridaninae, by providing them with energy through photosynthesis in exchange for nutrients and protection from the host. However, when Tridaninae are exposed to elevated water temperatures, *Symbiodiniaceae* may leave the clam's mantle tissue, leading to bleaching. Prolonged bleaching can result in the death of the clam, making it a potential indicator species for environmental monitoring. This study employs molecular biology techniques to investigate the differences in symbiotic algae from larval to adult stages of Tridaninae and across different parts of their bodies. By understanding the variations in symbiotic algae under different environmental conditions, this research aims to facilitate the use of Tridaninae as a tool for monitoring changes in marine environments.

Keywords: Tridacninae; *Symbiodiniaceae*; Coral Reef; Environmental monitoring

Diversity and antimicrobial activity of bacteria from five cultured corals

Guan-Wei Li [1], Mei-Chin Lu [1, 2], Ping-Jung Sung [2, 3], Jui-Hsin Su [2, 3], Jimmy Kuo [*, 1, 2]

[1] Graduate Institute of Marine Biology, National Dong Hwa University, Pingtung 944401, Taiwan

[2] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan

[3] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

* E-mail: jimmy@nmmba.gov.tw

Abstract

A combination of culture-based and metagenomic approaches was used to characterize bacterial communities associated with five corals, *Sinularia heterospiculata*, *Sinularia cristata*, *Sinularia wanannensis*, *Fimbriaphyllia paraancora* and *Sarcophyton glaucum*, cultured in the same tank at the Husbandry Center of the National Museum of Marine Biology and Aquarium (NMMBA). A total of 160 bacteria were isolated, among which 12 isolates (7.5%) exhibited antimicrobial activity against at least one indicator pathogen using the agar block method. Phylogenetic analysis of the 16S rDNA sequences indicated that these isolates belong to the following five bacterial genera: *Bacillus* (4), *Rossellomorea* (3), *Pseudovibrio* (2), *Vibrio* (2), and *Leisingera* (1). Three isolates, namely A-1-MA-4, C-2-SYP-4, and B-2-SYP-3, which exhibited high antimicrobial activity, were considered good candidates for further research on natural product isolation and characterization. To understand the diversity of bacterial flora associated with corals, we also investigated coral samples using 16S rDNA high-throughput sequencing. A total of 751,421 sequences were obtained and clustered into 2,771 amplicon sequence variants (ASVs). These ASVs were assigned to 38 bacterial phyla and revealed an abundance of phyla Proteobacteria (28.1%), Bacteroidota (13.7%), and Acidobacteriota (10.9%). A multidimensional scaling (MDS) plot of similarity between ASVs obtained from corals revealed that the three Sinularia species have a similar bacterial composition compared to other corals. Our results demonstrate that cultured corals have high bacterial community diversity and these bacteria could be a source of bacterial strains with great potential in the discovery of medically useful molecules.

Keywords: Coral-associated bacteria; Metagenomic analysis; Biological acitivity; Next generation sequencing

Examining the Impact of Oil-Derived Contaminants on Coral Symbionts and the Influence of Marine Suspended Particles on This Interaction

Yu-Han Cheng [*, 1], Jing-O Cheng [2], Fung-Chi Ko [, 1, 2, 3]**

[1] Graduate Institute of Marine Biology, National Dong Hwa University, Pingtung 944401, Taiwan

[2] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan

[3] National Pingtung University of Science and Technology, Taiwan

* E-mail: 105106betty@gmail.com

** E-mail: ko@gms.ndhu.edu.tw

Abstract

Marine suspended particles (MSPs) refer to organic or inorganic particles suspended in the ocean due to agitation or flow. Their relatively large surface area facilitates the adsorption of non-polar substances from the water, making them carriers of pollutants in the marine environment. Oil pollution is a severe and persistent issue in marine environments, and oil-derived substances, such as polycyclic aromatic hydrocarbons (PAHs), are hydrophobic persistent organic pollutants. Their adsorption onto MSPs can affect the bioaccumulation and biological effects on marine organisms, but related research is currently very limited.

This study focuses on the coral species *Fimbriaphyllia paraancora*, simulating exposure to oil pollution and comparing the effects of adding MSPs when exposed to oil-derived PAHs. Initial comparisons of coral symbiont density and chlorophyll a concentration showed no significant difference with the addition of MSPs. However, in the presence of oil pollution, both symbiont density and chlorophyll a concentration were lower compared to the control group.

In environments with both oil pollution and MSPs, it was found that MSPs adsorb oil pollutants, resulting in no difference in symbiont density compared to the experiment without added oil pollution. Additionally, the concentration of oil-derived PAHs in the water, after exposure, was indeed lower than the original concentration. Possible reasons for this reduction include: 1) adsorption by waterborne MSPs, 2) accumulation in the coral, or 3) volatilization into the air. The distribution and concentration of PAHs in biological accumulation are still under experimental analysis.

Keywords: Marine suspended particles; *Fimbriaphyllia paraancora*; Oil pollution; Symbiont density; Polycyclic aromatic hydrocarbons

Impacts of *Lv*CAD on WSSV replication through *de novo* pyrimidine synthesis in *Litopenaeus vannamei*

Yu-Chia Chang [1], Chih-Ling Chen [1], Shih-Shun Lin [2], Saengchan Senapin [3, 4], Pakkakul Sangsuriya [5], Han-Ching Wang [*, 1, 6]

[1] Department of Biotechnology and Bioindustry Sciences, National Cheng Kung University Tainan, Taiwan.

[2] Institute of Biotechnology, National Taiwan University, Taipei, Taiwan.

[3] Fish Health Platform, Center of Excellence for Shrimp Molecular Biology and Biotechnology (Centex Shrimp), Faculty of Science, Mahidol University, Bangkok, Thailand.

[4] National Center for Genetic Engineering and Biotechnology (BIOTEC), National Science and Technology Development Agency (NSTDA), Pathumthani, Thailand.

[5]Aquatic Molecular Genetics and Biotechnology Research Team, BIOTEC, NSTDA, Pathum Thani, Thailand.

[6] International Center for the Scientific Development of Shrimp Aquaculture (ICDSA), Tainan, Taiwan.

[*] E-mail: wanghc@mail.ncku.edu.tw

Abstract

In the replication stage of white spot syndrome virus (WSSV) infection in white shrimp, cells are prompted to induce the Warburg effect and activate pyrimidine biosynthesis to enhance nucleic acid synthesis. In pyrimidine biosynthesis, Carbamoyl-phosphate synthetase 2, aspartate transcarbamylase, and dihydroorotase (CAD) are the most upstream catalytic enzymes, composed of three distinct functional enzymes: CPS, DHO, and ATC, with a crucial role in *de novo* pyrimidine synthesis, primarily converting glutamate to dihydroorotate. To confirm the role of pyrimidine biosynthesis genes in WSSV replication and their impact on nucleic acid synthesis, dsRNA-mediated in vivo gene silencing was to validate the importance of *Lv*CAD during WSSV infection. Inhibition of *Lv*CAD significantly suppressed WSSV viral gene mRNA expression and genome copies. This study highlighted that pyrimidine biosynthesis had an important role in WSSV infection. To investigate protein-protein interactions between *Lv*CAD and WSSV open reading frames (ORFs), a Yeast Two-Hybrid system we used, with CAD broken down into its individual domains (CPS, DHO, and ATC) for separate testing. Yeast 2 Hybrid testing confirmed that WSSV ORF directly regulated expression of *Lv*CAD. During viral infection, Affinity-Purification Mass Spectrometry (AP-MS) technology was used to evaluate interactions between CAD and viral proteins. Hub genes, e.g. uncharacterized protein LOC113814457(PVHP98972.1), SID1 transmembrane family member 2-like (Sidt2), lysyl oxidase homolog 3A (LOXL3), cathepsin L(CTSL), and uncharacterized protein LOC113808206 (PVHP113307.1), had a strong correlation with CAD. The importance of hub genes in WSSV replication will be determined with dsRNA silencing and overexpression assays on these hub genes, providing insights into their influence on the mRNA expression of WSSV viral genes.

Keywords: *Litopenaeus vannamei*; White spot syndrome virus (WSSV); CAD, *de novo* Pyrimidine synthesis; Open reading frames (ORFs)

Effects of Light Spectrum and Aquaculture System on Reproduction and Cultivation of reef coral *Pocillopora acuta*.

Yu-Ting Qiu [*, 1], Mu-Hsiang Wang [1], Hao-Wei Shang [1], Tung-Yung Fan [1]

[1]National Museum of Marine Biology and Aquarium, Pingtung, Taiwan.

* E-mail: lab1518@nmmba.gov.tw

Abstract

Reef corals are rapidly declining due to the impacts of human activities and climate change. Coral abundance can be increased through aquaculture and active restoration. This study compared the effects of blue, red, and white light on the reproduction and cultivation of model reef coral Pocillopora acuta in a flow-through system (FTS) using natural seawater and a recirculating aquaculture system (RAS) using artificial seawater. Light intensity was 250 μmol/m²/s in both systems. Larval release occurred earlier in RAS, likely due to different coral source. Reproductive timing and number of larvae released were similar among light treatments in both systems. Settlement rate of larvae was significantly higher in RAS and was not influenced by light spectrum in both systems. Survivorship and growth of recruits were highest under red light, and lowest under blue light in RAS. Recruit experiment in FTS was nor finished due to the presence of coral predators and system instability. These findings can be applied to improve the effectiveness of coral aquaculture and restoration.

Keywords: Flow-through system (FTS); Recirculating aquaculture system (RAS); Light; Larvae

The change of species diversity from the uplifted Holocene coral reef at Lanyu, Taiwan

Hao-Wen Huang [*,1], Meng-Wan Yeh [1]

[1] Earth Science Department, National Taiwan Normal University, Taipei 11677, Taiwan

* E-mail: rex090790@gmail.com

Abstract

In Lanyu, uplifted Holocene coral reefs offer insights into ancient coral reef biodiversity and ecological structures. The uppermost terrace, with its flat topography, reflects a rapid sea level drop around 5.3 ka, while the lower terrace, sloping at 22 degrees, is associated with a gradual sea level decline around 2.0 ka. We analyzed and compared coral coverage, form/family composition, colony size, and Simpson's Diversity Index (D) using photogrammetry. Coral coverage was 53% on the upper terrace and 58% on the lower terrace. Six coral forms (branching, massive, encrusting, tabular, foliose, tube-like) were identified, with encrusting and massive forms dominating both terraces. The foliose form was observed only on the upper terrace. Massive *Porites* colonies on the upper terrace were larger, displaying two peaks in size distribution ($0.0036_{(min)}$ ~ $1.53_{(max)}$ m²; modes at 0.01 m² and 0.03 m²) compared to the lower terrace, which had one peak ($0.0032_{(min)}$ ~ $0.72_{(max)}$ m²; mode at 0.02 m²). The lower terrace had more *Montipora* colonies per unit area (2.42 col/m^2) than the upper terrace (1.44 col/m^2). The Simpson's Diversity Index (D) was 0.79 for the upper terrace and 0.66 for the lower, suggesting better ecological conditions on the upper terrace. The larger *Porites* colonies, known for their slow growth rate (1.2 cm/yr), indicate long-term environmental stability before the rapid sea level change. In contrast, the gradual sea level drop favored fast-growing *Montipora* (growth rate = 11 cm/yr), which dominate the lower terrace. These findings demonstrate how coral reef changed their species composition to adjust to sea level change, enhancing our understanding of coral reef responses to millennial-scale sea level changes.

Keywords: Holocene sea level change; Photogrammetry; Coral reef diversity

Acetyl-Coa metabolism turbulence during white spot syndrome virus (WSSV) infection in *Penaeus vannamei*

Shu-Wen Cheng [1], Shih-Shun Lin [2], and Han-Ching Wang [*, 1, 3]

[1] Department of Biotechnology and Bioindustry Sciences, National Cheng Kung University, Tainan, Taiwan

[2] Institute of Biotechnology, National Taiwan University, Taipei, Taiwan

[3] International Center for Scientific Development of Shrimp Aquaculture, National Cheng Kung University, Tainan, Taiwan

* E-mail: wanghc@mail.ncku.edu.tw

Abstract

White spot syndrome virus (WSSV) causes substantial economic losses due to high infectivity and mortality. WSSV induces metabolic reprogramming, including the Warburg effect, glutaminolysis, lipogenesis, lipolysis, and nucleotide biosynthesis. These metabolic changes facilitate WSSV infection and replication, particularly lipid metabolism, which has a crucial role in virion assembly. An essential metabolite in lipid metabolism, acetyl-CoA, provides the building blocks for fatty acid synthesis. To understand how acetyl-CoA is involved in WSSV infection and replication, transcriptomic and trans-omics analyses were used to identify two acetyl-CoA metabolism-related enzymes: ATP-citrate lyase (ACLY) and Acyl-CoA Synthetase Short Chain Family Member 2 (ACSS) that produce acetyl-CoA from citrate and acetate, respectively. Based on transcriptomic and trans-omics analyses, ACLY and ACSS were highly correlated with contigs or proteins exhibiting differential gene/protein expression, implying that they have vital roles in controlling acetyl-CoA metabolism during WSSV infection. Furthermore, ACLY was up-regulated and ACSS was down-regulated at 24 hours post-injection (hpi). Additionally, expression of viral genes and viral genome copies were significantly reduced after treatment with specific dsRNA or inhibitors. These results underscored the importance of ACLY and ACSS in WSSV infection. To further investigate how WSSV modulates acetyl-CoA metabolism, a yeast 2-hybrid assay was used to identify WSSV open reading frames (ORFs) that interacted directly with ACLY or ACSS. Preliminary data indicated that WSSV395 and WSSV065 potentially interacted with ACLY and ACSS, respectively. Future research will focus on elucidating regulatory mechanisms between WSSV and acetyl-CoA metabolism.

Keywords: *Penaeus vannamei*; White spot syndrome virus; Acetyl-CoA metabolism; Lipid metabolism

Triggering the malate-aspartate shuttle facilitates White Spot Syndrome Virus replication in *Litopenaeus vannamei*

Fang-Jyun Guo [1], Kuan-Lun Huang [1], Han-Ching Wang [*, 1, 2]

[1] Department of Biotechnology and Bioindustry Sciences, National Cheng Kung University, Tainan, Taiwan

[2] International Center for the Scientific Development of Shrimp Aquaculture, Tainan, Taiwan
[*] E-mail: wanghc@mail.ncku.edu.tw

Abstract

The malate-aspartate shuttle is a transport system on the inner mitochondrial membrane that can transfer cytosolic NADH into mitochondria and regenerate NAD^+ in cytosol, maintaining cellular redox homeostasis. Triggering the malate-aspartate shuttle not only supported glycolysis but also provided electron carrier NADH into the electron transport chain to produce ATP. We previously determined that glutamate oxaloacetate transaminases 1 (*Lv*GOT1) and *Lv*GOT2 in the malate-aspartate shuttle had reversed catalytic direction during viral late stage (24 hpi), implying WSSV infection may trigger reversal of the malate-aspartate shuttle. However, it remains unknown whether another part of this shuttle system is also reversed at 24 hpi, or whether regulation of malate-aspartate shuttle is phased during WSSV infection. The objective was to ascertain the importance of the malate-aspartate shuttle during WSSV replication and explore regulation of the malate-aspartate shuttle induced by WSSV. In this study, we firstly investigated up-regulation of genes involved in the malate-aspartate shuttle on mRNA expression level at viral genome replication stage (12 hpi), including malate dehydrogenase (*Lv*MDH) 1/2, transporter aspartate/glutamate carrier (*Lv*AGC), and oxoglutarate carrier (*Lv*OGC). To verify the importance of the malate-aspartate shuttle during WSSV replication, dsRNA-mediated *in vivo* gene silencing was conducted. Inhibition of *Lv*MDH1, *Lv*MDH2, *Lv*OGC or *Lv*AGC significantly suppressed both mRNA expression of WSSV gene and viral genome copy numbers, implying the importance of the malate-aspartate shuttle to WSSV replication. Furthermore, in a replenishment experiment, injection of oxaloacetate significantly increased WSSV genome copies of control group compared to *Lv*MDH1 or *Lv*MDH2 silenced group, indicating that triggering the malate-aspartate shuttle may facilitate WSSV replication when the malate-aspartate shuttle is intact.

Keywords: *Litopenaeus vannamei*; White spot syndrome virus (WSSV); Malate-aspartate shuttle

White spot syndrome virus facilitates and relies on shrimp *de novo* nucleotide synthesis to support viral pathogenesis

Cong-Yan Chen [1], Der-Yen Lee [2], Shih-Shun Lin [3], Chun-Hung Liu [4], Saengchan Senapin [5, 6], Pakkakul Sangsuriya [7], Han-Ching Wang [*, 1, 8]

[1] Department of Biotechnology and Bioindustry Sciences, National Cheng Kung University, Tainan, Taiwan

[2] Graduate Institute of Integrated Medicine, China Medical University, Taichung, Taiwan
[3] Institute of Biotechnology, National Taiwan University, Taipei, Taiwan
[4] Department of Aquaculture, National Pingtung University of Science and Technology, Pingtung, Taiwan

[5] Fish Health Platform, Center of Excellence for Shrimp Molecular Biology and Biotechnology (Centex Shrimp), Faculty of Science, Mahidol University, Bangkok, Thailand

[6] National Center for Genetic Engineering and Biotechnology (BIOTEC), National Science and Technology Development Agency (NSTDA), Pathumthani, Thailand

[7] Aquatic Molecular Genetics and Biotechnology Research Team, BIOTEC, NSTDA, Pathum Thani, Thailand

[8] International Center for Scientific Development of Shrimp Aquaculture, National Cheng Kung University, Tainan, Taiwan
* E-mail: wanghc@mail.ncku.edu.tw

Abstract

The shrimp aquaculture industry is an important economic trade and food production activity worldwide, strongly aligned with Sustainable Development Goals (SDGs), with significant development potential. Asia has > 70% of shrimp production, but has substantial economic losses due to pathogens, especially white spot syndrome virus (WSSV). Multi-omics approaches have yielded insights into how WSSV hijacks and dysregulates host metabolism, but how WSSV modulates host *de novo* nucleotide synthesis is not fully known. Although glucose and glutamine contribute to WSSV-induced metabolic reprogramming, whether they simultaneously participate in activating nucleotide metabolism is unknown. The objective was to ascertain the role and impact of host *de novo* nucleotide synthesis during WSSV infection. First, LC-ESI-MS-based stable isotope tracking analysis verified that multiple metabolites in the pentose phosphate pathway and purine/pyrimidine synthesis were significantly induced during WSSV replication. Accordingly, Real-time PCR and enzyme activity assays, were used to confirm that WSSV infection stimulated upregulation of nucleotide metabolism. In addition, dsRNA-mediated gene silencing demonstrated that *de novo* nucleotide synthesis was crucial for WSSV gene expression and replication. Furthermore, it was verified that the WSSV protein interacted with host nucleotide metabolism proteins. Regardless, underlying mechanisms of protein-protein interactions between the host and viral proteins need to be further explored. In conclusion, this research produced evidence linking host *de novo* nucleotide metabolism and WSSV pathogenesis, contributing novel insights regarding control of WSSV outbreaks.

Keywords: White spot syndrome virus (WSSV); *Litopenaeus vannamei*; Warburg effect; Nucleotide synthesis

Investigating pathogenic mechanisms of WSSV non-specific endonuclease (WSSV246) through protein-protein interactions

Yik How Teoh [1], Shih-Shun Lin [3], Saengchan Senapin [4, 5], Pakkakul Sangsuriya [6], Han-Ching Wang [*, 1, 2]

[1] Department of Biotechnology and Bioindustry Sciences, National Cheng Kung University, Tainan, Taiwan

[2] International Center for Scientific Development of Shrimp Aquaculture, National Cheng Kung University, Tainan, Taiwan

[3] Institute of Biotechnology, National Taiwan University, Taipei, Taiwan

[4] Fish Health Platform, Center of Excellence for Shrimp Molecular Biology and Biotechnology (Centex Shrimp), Faculty of Science, Mahidol University, Bangkok, Thailand.

[5] National Center for Genetic Engineering and Biotechnology (BIOTEC), National Science and Technology Development Agency (NSTDA), Pathumthani, Thailand.

[6] Aquatic Molecular Genetics and Biotechnology Research Team, BIOTEC, NSTDA, Pathum Thani, Thailand

* E-mail: wanghc@mail.ncku.edu.tw

Abstract

White spot syndrome virus (WSSV) has inflicted severe economic losses on global shrimp farming. Despite the known role of WSSV non-specific endonuclease (WSSV246) in facilitating viral infection, its underlying mechanism remains elusive. The objective was to investigate protein-protein interactions (PPI) of WSSV246 to identify candidate proteins involved in pathogenesis. A yeast two-hybrid system was used to detect PPIs between WSSV246 and viral proteins. Additionally, affinity purification coupled with mass spectrometry (AP-MS) was used to identify interactions between WSSV246 and both viral and host proteins. A correlation network analysis was performed using WSSV246-associated host proteins and data from our in-house transcriptomic database. Based on this analysis, WSSV246 may enhance transcription of viral genes by hijacking the PKA/CREB and AMPK signalling pathways, thereby influencing host lipid metabolism and energy metabolism. Moreover, hub genes (*Lv*CREB1, *Lv*PNT5C, and *Lv*ACAD9) identified from the correlation network were subjected to Real-Time PCR to evaluate their expression levels following WSSV infection. *In vivo* experiments demonstrated that silencing LvCREB1 and LvPNT5C significantly suppressed WSSV replication, suggesting their importance in WSSV replication. These findings highlighted the multifunctionality of WSSV246; it may function as a non-specific endonuclease within the nucleus while also regulating host lipid and energy metabolism by hijacking the PKA/CREB and AMPK signaling pathways. In the future, we will focus on a detailed investigation of the hub genes to elucidate the precise role of WSSV246 in these signaling pathways and its impact on host metabolism. Ultimately, this research aims to shed light on the role of WSSV246 in WSSV pathogenesis and contribute to development of new strategies for controlling WSSV outbreaks.

Keywords: White spot syndrome virus; Non-specific endonuclease; Protein-protein interaction

Health and survival of transplanted corals at Kenting outlet reef nursery, Taiwan, during the 2024 marine heatwave

Yu-Chi Chang [*,1], Ting-Hui Cheng [1, 2], Kwok-Wai Lam [2], Tung-Yung Fan[1, 2]

[1] Department of Planning and Research, National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan

[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

* E-mail: vicky123@nmmba.gov.tw

Abstract

Global marine heatwaves have intensified in severity and duration, resulting in more frequent and widespread coral bleaching events. To mitigate these effects, active restoration and the establishment of in situ coral nurseries to cultivate heat-tolerant corals become increasingly critical. In the summer of 2024, NOAA's Degree Heating Week (DHW) index in southern Taiwan has reached unprecedented high with seawater temperature peaking at 33.7°C in Kenting outlet reef. In January 2024, a coral nursery was established on the tetrapods at the same site, where 243 colonies across 9 coral species were tranpslanted. Monthly-photograph was taken to monitor survival rate and health condition, categorized into three states: healthy, bleached and dead. After 8 months, *Merulina ampliata* and *Acropora glauca* had the highest mortality, at 100% and 83%, respectively. On the other hand, the species with highest percentage of corals in "healthy state" were *Porites lutea* (73%), *Pocillopora grandis* (83%), and *Pocillopora verrucosa* (77%). These results indicate that *Porites lutea, Pocillopora grandis,* and *Pocillopora verrucosa* exhibit greater heat-tolerance. Future efforts will continue to monitor coral bleaching and recovery, as well as to expand the cultivation of heat-tolerant species.

Keywords: Coral nursery; Marine heatwave; Coral bleaching; Heat-tolerant corals

Evaluating the impact of short-term heterotrophic feeding on coral resilience under thermal stress: a comparative study of scleractinian corals

Kwok Wai Lam [*, 1], Mu-Hsiang Wan [2], Kyle Knoblock [3], Logan M. Marion [3], Marina Villoch Diaz Maurino [3], Ryan Whitehead [3], Ian Combs [3], Jason Spadaro [3], Erinn Muller [3], Michael P. Crosby [3], Tung-Yung Fan [1]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung City, Taiwan

[2] National Museum of Marine Biology and Aquarium, Pingtung, Taiwan

[3] Mote Marine Laboratory, Sarasota, FL, USA

*E-mail: lamkwlouis@hotmail.com

Abstract

Heterotrophic feeding has been shown to enhance coral resilience during thermal stress by increasing resistance to bleaching and aiding in post-stress recovery. However, the potential of short-term feeding to enhance thermal tolerance under intensifying and more frequent marine heatwaves remains unclear. This preliminary study evaluated the efficacy of two distinct dietary treatments – commercial coral diet (Golden Pearls, GP) and a combination of GP and enriched *Artemia* nauplii (ART) – on the thermal stress response of three scleractinian corals: *Porites astreoides* (*PA*), *Siderastrea sidereal* (*SS*), *and Stephanocoenia intersepta* (*SI*). Corals were subjected to two heating treatments: a long-heating treatment (9 hours in 36℃) and a short-heating treatment (4 hours in 38℃). Over six days, corals were fed daily, with one group receiving exclusively GP and another group receiving GP for 4 days and ART for 2 days. Results indicated no significant differences between the dietary treatments. Both heating treatments resulted in significant declines in photosynthetic efficiencies and increases in RGB values across all species, except for *SS* in the short-heating treatment where RGB value remained relatively stable. Moreover, *SS* exhibited the highest photosynthetic efficiency in both treatments, and *SI* showed the highest RGB value, but in the long-heating treatment, the RGB value was similar to those of *SS*. Interestingly, positive correlations between the photosynthetic efficiencies and RGB values were found for *PA* and *SI* in short-heating treatment, potentially reflecting genotype-specific differences. These findings suggest short-term heterotrophic feeding may not be sufficient enough to enhance thermal tolerance during abrupt temperature increases, although *SS* demonstrated a higher thermal-tolerance, capable of withstanding 38℃ for a brief period. We recommend assessing both photosynthetic efficiency and RGB value when evaluating coral health to account for genotype-specific differences and avoid misleading conclusions.

Keywords: Florida keys; Scleractinia; Short-term exposure; Heterotrophic feeding; Thermal tolerance

Feeding rates of five Caribbean coral species on Artemia nauplii and the impact of two diets on tissue coloration and wound healing in *Porites divaricata*

Mu-Hsiang Wang [*, 1], Kwok Wai Lam [2], Logan M. Marion [3], Ryan Whitehead [3], Ian Combs [3], Jason Spadaro [3], Michael P. Crosby [3], Tung-Yung Fan [1, 2]

[1] National Museum of Marine Biology and Aquarium, Pingtung, Taiwan
[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung City, Taiwan
[3] Mote Marine Laboratory, Sarasota, FL, USA
*E-mail: r10b45007@ntu.edu.tw

Abstract

Heterotrophic feeding has been demonstrated to enhance the health and tissue healing of scleractinian corals. In recent years, various coral feeding methods have been developed and applied in aquaculture for different coral species. This study comprised two parts: the first part compared the feeding rates of five Caribbean coral species—*Porites astreoides*, *Porites porites*, *Porites divaricata*, *Siderastrea siderea*, and *Stephanocoenia intersepta*—on enriched *Artemia* nauplii. The second part investigated the short-term effects of two feeding methods, enriched *Artemia* nauplii and commercial pellet diet (Golden Pearls), on tissue coloration and wound healing rate in *Porites divaricata*. Results from the first part showed that all five coral species consumed *Artemia* nauplii, with *Siderastrea siderea* showing the highest feeding rate, potentially due to larger polyps. In the second part, neither feeding method resulted in significant short-term changes in tissue coloration, but commercial pellet diet appeared to aid tissue healing (e.g. more zooxanthellae were observed on the recovering tissue). This study serves as a preliminary investigation, and future research will explore the effects of different feeding methods on other physiological parameters, such as reproduction, growth, and development.

Keywords: Caribbean; Scleractinia; Heterotrophic feeding; Feeding rate; Tissue healing

The effects of temperature sintering on marketing coral bone graft: *Acropora sp.* or *Porites sp.* and *Goniopora sp*

Hsiao-Lan Huang [1], Zhi-Hong Wen[*, 1, 2, 3]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung, Taiwan

[2] Institute of BioPharmaceutical Sciences, National Sun Yat-sen University, Kaohsiung, Taiwan

[3] Institute of Medical Science and Technology, National Sun Yat-sen University, Kaohsiung, Taiwan

[*] E-mail: wzh@mail.nsysu.edu.tw

Abstract

With aging, osteoporosis becomes a common condition among the elderly.This frequently necessitates the use of bone graft substitutes. Currently, several commercially available coral bone materials, such as Pro-Osteon®, BioCoral®, and CoreBone® are processed from *Acropora sp.* or *Porites sp.* and *Goniopora sp.* croal. However, we cannot determine whether these three companies have subjected the coral materials to a sintering process from the regulatory submission documents related to these products. According to the literature, sintering can remove organic matter through the process of carbonization, ensuring biological safety and reducing immune reactions. It is also widely believed that this process may affect the microstructure and mechanical properties of the material, potentially resulting in materials with higher biocompatibility and enhanced bone regeneration. Our preliminary research results indicate that sintered coral bone materials perform better in cell adhesion and proliferation experiments in some genus coral.Therefore, we proposed that making high-temperature sintering a promising method for enhancing the bioactivity of coral bone materials.

Keywords: Bone graft; Coral; Sintering

The therapeutic effects of marine-derived STING inhibitor on cystitis in rats

Hsiang-Ting Tung [*, 1], Chiao-Ching, Li [*, 1, 2, 3], Zong-Sheng Wu [*, 1], Zhi-Hong Wen [*, 1]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan.

[2] Division of Urology, Department of Surgery, Kaohsiung Armed Forces General Hospital, Kaohsiung, Taiwan.

[3] Division of Urology, Department of Surgery, Tri-Service General Hospital, National Defense Medical Center, Taipei, Taiwan.

* E-mail: ssst.ting@gmail.com (Hsiang-Ting Tung), fbsnfbsn47@gmail.com (Chiao-Ching, Li), a8905114@gmail.com (Zong-Sheng Wu), wzh@mail.nsysu.edu.tw (Zhi-Hong Wen).

Abstract

Cystitis is a common inflammation of the urinary tract that causes significant discomfort and pain. In chronic circumstances, it can lead to persistent inflammation and complications. The STING (Stimulator of Interferon Genes) pathway, a crucial factor in the immune system, plays a significant role in regulating the body's inflammatory responses, including those associated with cystitis. This study aimed to investigate the therapeutic effects of coral-derived natural STING inhibitor (DA-01) and its derivatives (DA-02 and DA-03) on cyclophosphamide (CYP)-induced cystitis in rats. The hematoxylin and eosin staining results revealed that DA-01, DA-02, and DA-03 reduced inflammation and immune cell accumulation in cystitis bladder tissue. Additionally, immunohistochemical staining and Western blot data indicated that DA-01, DA-02, and DA-03 decreased the expression of STING pathway signaling molecules. The findings indicate that DA-01, DA-02, and DA-03 could potentially reduce cystitis symptoms by inhibiting STING pathway factors, suggesting their potential as treatments for cystitis. This study emphasizes the significance of STING as a potential target for cystitis therapy and lays the groundwork for additional research into its mechanisms and clinical applications.

Keywords: STING; Cystitis; Marine natural compound; Anti-inflammation

Preliminary Screening of Endophytic Fungi from *Halodule uninervis* Seagrass in Kinmen for Antimicrobial and Antidiabetic Activity

Yi-Fei Liao [1], Wei-Chiung Chi [*, 1]

[1] Department of Food Science, National Quemoy University, Kinmen 892, Taiwan

Abstract

Marine resources are regarded as one of the worthiest treasures for producing bioactive secondary metabolites with novel skeletons. In recent decades, the resistant of pathogenic micro-organisms towards commercial drug has been dramatically increasing so that the development of new antibiotics is much needed. The purpose of this research was to explore the bioactive from n-hexane and ethyl acetate extract of Halodule uninervis seagrass collected from the coastal area of Liuyu Township, Kinmen. In the experiment, the agar diffusion method was used to confirm the antibacterial activity of the seagrass H. uninervis extracts against the common strains. For the antioxidant capacity of the extracts, we measured the DPPH free radical scavenging ability and reducing power, tyrosinase inhibition experiment, α-glucosidase activity. The content of antidiabetic activity with extract concentrations of 50 ppm, 100 ppm, 200 ppm and 400 ppm from seagrass extract with n-hexane solvent showed that it can inhibit 25%, 42%, 75% and 95% of α-glucosidase activity, respectively. In the concentration of 400ppm n-hexane extract of H. uninervis seagrass, that showed more than 25% DPPH free radical scavenging rate. In the antibacterial test, it could be seen that the extracts of n-hexane and ethyl-acetate mostly can inhibit the test strains. Total carotenoids content of H. Uninervis was 0.1497mg/g.

Keywords: Endophytic Fungi; Antimicrobial Activity; *Halodule uninervis*; DPPH

Exploring the Neuroprotective Mechanisms of Sponge-derived Compound in Experimental Parkinson's Disease Model

Hsiao-Ying Kuo [1], Ya-Jen Chiu [1], Zhi-Hong Wen [*, 1]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan
* E-mail: wzh@mail.nsysu.edu.tw

Abstract

Parkinson's disease (PD) is a common neurodegenerative disorder characterized by the degeneration of dopaminergic neurons, linked with oxidative, endoplasmic reticulum (ER) stress, and inflammatory response. This research examined the potential protective effect of the bromopyrrole alkaloid compound GYW-1, derived from sponges, against 6-hydroxydopamine (6-OHDA)-induced toxicity in an *in vitro* PD model, as well as its potential anti-inflammatory effect on LPS-induced microglial activation. Biochemical analyses, including alamarBlue assay, immunofluorescence, and western blot, were conducted to assess the neuroprotective properties of GYW-1 and its impact on ER and oxidative stress in 6-OHDA-induced SH-SY5Y cells. Additionally, the study investigates the effects of GYW-1 on the NLRP3 inflammasome and inflammatory indicators in LPS-induced human microglial HMC3 cells. The results indicated that GYW-1 demonstrated a neuroprotective effect against 6-OHDA-induced toxicity in SH-SY5Y cells. Furthermore, GYW-1 reduced ER stress and oxidative stress as indicated by decreased levels of GRP78 and p-eIF2a, alongside increased levels of p-AKT and p-ERK. In LPS-induced human microglial HMC3 cells, GYW-1 was also found to reduce the expression of microglial activation marker CD11b, as well as decrease the expression of NLRP3, IL-1β, and COX-2, indicating potential anti-inflammatory activity. These findings suggest that GYW-1 has the potential to regulate ER stress, oxidative stress, and inflammatory response by modulating the expression of relevant proteins, indicating it could be a possible therapeutic avenue for PD. This study sheds light on the potential of GYW-1 as a treatment for PD and offers a promising avenue for the development of more effective therapeutic strategies for patients.

Keywords: Sponge, Parkinson's disease; ER stress and oxidative stress; Anti-inflammation; Neuroprotection

Culturing a single polyp of *Briareum stechei* in a food storage container: A simple and miniaturized experimental platform for soft corals

Huai-Hsuan Chiu [1], Yu-Cheih Chai [1], Yi-Ling Chiu [*, 2, 3], Shinya Shikina [*, 2, 3], Hsing-Hui Li [*, 4, 5]

[1] National Changhua Girls' Senior High School, Changhua 500005,Taiwan

[2] Institute of Marine Environment and Ecology, National Taiwan Ocean University, Keelung 202301, Taiwan,

[3] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung 202301, Taiwan

[4] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan

[5] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

*E-mail: hhli@nmmba.gov.tw (Hsing-Hui Li); shikinash@mail.ntou.edu.tw (Shinya Shikina); yii2390@gmail.com (Yi-Ling Chiu)

Abstract

Coral reefs depend on the daily biological activities of healthy corals. Understanding these processes and the factors that harm coral growth is crucial for their conservation. However, the lack of a simple and cost-effective lab culture system has hindered progress. Developing such systems is essential for studying corals' cellular and molecular biology, which helps us better understand and protect these vital ecosystems. Here we present a cost-effective and accessible culture system that provides researchers, including high school students, with a simplified method for soft coral research. We modified the “coral-on-a-laboratory dish” system by replacing plastic/glass Petri dishes with food storage container, making experiments more convenient and more environmentally friendly. Under optimized conditions, coral microcolonies of *Briareum stechei* were cultured for two months in these food storage container with high survivorship and characteristic growth. The survival rate was 100%, and the overall health of the coral fragments showed marked improvement compared to pre-cultivation conditions. We used varying numbers of polyps per coral fragment and tested bleached corals to evaluate growth and metabolic responses under different conditions, which served as indicators of the coral’s health status. Data analysis confirmed the viability of this cultivation system. All fragments of *Briareum stechei*, irrespective of size or bleaching status, exhibited consistent growth. The system also enabled the successful cultivation of bleached but viable *Briareum stechei* and single-polyp coral fragments, expanding the range of experimental conditions available for researchers. Thus, this system is highly advantageous for facilitating research on soft coral health and growth dynamics.

Keywords: Soft coral; Cultivation System; Microcolony; Coral Reefs

The anti-nociceptive effects of an anti-inflammatory sponge-derived natural product on chronic constriction injury-induced neuropathic rats

Kai-Yu Liu [1], Zhi-Hong Wen [1]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

* E-mail: happycandy31@gmail.com

Abstract

Neuropathic pain is a chronic condition affecting 6.9-10% of the population, significantly impacting quality of life. Despite available treatments, many patients do not receive adequate pain relief. A marine natural sesquiterpenoid phospholipase A2 (PLA2) inhibitor derived from the Indo-Pacific sponge, is recognized for its potent analgesic and anti-inflammatory properties. In this study, we investigated the efficacy of the marine-derived PLA2 inhibitor in alleviating neuropathic pain induced by chronic constriction injury (CCI) in rats. Our preliminary results indicated that the compound exerted effects against CCI-induced thermal hyperalgesia. Acute intrathecal (i.t.) administration of compound inhibited CCI-induced nociceptive sensitization and thermal hyperalgesia in a dose-dependent manner. Moreover, chronic i.t. infusion of compound 10ng*2/day significantly attenuated thermal hyperalgesia behavior in CCI-rats. The preliminary findings strongly support our future investigation of the cellular mechanisms of this compound in neuropathic pain relief. We anticipate new opportunities for the development of analgesic drugs in the future.

Keywords: Neuropathic pain; Sponge compound; Phospholipase A2; Thermal hyperalgesia

The Anti-Cancer Effects of a Soft Coral-derived Diterpene Derivative on Malignant Melanoma

Hsin-Hsi Kuo [1] ,Hsiao-Mei Kuo [1, 2] , Ping-Jyun Sung [1, 3] ,Zhi-Hong Wen [*, 1, 4]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 80424, Taiwan

[2] Department of Neurosurgery, Kaohsiung Chang Gung Memorial Hospital, Chang Gung University College of Medicine, Kaohsiung 833301, Taiwan

[3] National Museum of Marine Biology and Aquarium, No.2, Houwan Road, Checheng, Pingtung 944401, Taiwan

[4] Institute of BioPharmaceutical Sciences, National Sun Yat-sen University, Kaohsiung, Taiwan

* E-mail: wzh@mail.nsysu.edu.tw

Abstract

Malignant melanoma is a form of skin cancer that carries a high mortality rate and ranks as the fifth most prevalent cancer in the United States. Although early-stage melanoma has a high potential for cure, it is often difficult to diagnose accurately. As a result, there is an ongoing and pressing need for continuous research and the development of improved therapeutic medications. In this study, we investigated the compound E79, which is a chemically modified form of the naturally occurring briarane-type diterpenoid EB found in soft coral, for its potential anti-melanoma properties. Past research has demonstrated that the coral-derived natural EB exhibits various biological effects, such as anti-inflammatory, analgesic, anti-arthritic, and cardioprotective properties, as well as enhancing memory and displaying anti-cancer activities. Our preliminary results indicated that E79 is superior to EB in both anti-inflammatory effects and the inhibition of malignant melanoma growth. Furthermore, it appears to elevate oxidative stress in melanoma cells, resulting in heightened endoplasmic reticulum (ER) stress and activation of the unfolded protein response (UPR). This amplifies autophagy, ultimately driving apoptosis in malignant melanoma cells. We're hoping E79 can offer better and safer treatment options for folks with malignant melanoma, which would help improve their chances and quality of life.

Keywords: Melanoma; Coral natural compound; Chemically modified

The anti-nociceptive mechanisms of STAT-3 inhibitor on chronic constriction injury-induced neuropathic pain

Yueh-Chiao Tang [1], Zhi-Hong Wen [1]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan.

* E-mail:2620tiffany@gmail.com

Abstract

Neuropathic pain affects 7-10% of the global population to date, with the potential for increased prevalence in the future due to factors like population aging and rising rates of conditions such as diabetes. Moreover, the current medications available for treating this type of pain are reported to have limited effectiveness. Previous studies indicated that STAT3 activation is vital in neuropathy-induced spinal nociceptive sensitization. This study investigates the cellular mechanisms of the anti-nociceptive effects of a STAT-3 phosphorylation inhibitor Bt on chronic constriction injury (CCI)-induced neuropathic pain in rats. The neuropathic rats received intrathecal administration of Bt compound. Subsequent behavioral tests conducted to assess nociceptive behaviors include allodynia and hyperalgesia. Our study used spinal immunohistochemistry (IHC) staining to examine the cellular and molecular signaling expression. The preliminary results indicate that the intrathecal administration of a STAT3 inhibitor significantly diminishes CCI-induced nociception and reduces neuroinflammation and the STAT3/NLRP3/IFN-r signaling pathway at the spinal level in neuropathy. The present result not only offers new insights but also sparks further research and creates opportunities for treating neuropathic pain.

Keywords: Neuropathic pain; STAT-3; Spinal cord; Chronic constriction injury

Fossils of Axiidea (Crustacea: Decapoda) from Early Pliocene Cold Seep Carbonates in Jiaxian, Kaohsiung

I-Te Chien [1], Bi-Qing Liang [1], Shao-Hung Peng [2], Shih-Wei Lee [*, 2]

[1] Department of Earth Sciences, National Cheng Kung University (NCAU), Tainan 701, Taiwan

[2] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan

* E-mail: leesw@nmmba.gov.tw

Abstract

Ghost shrimp (Thalassinidea) are widely distributed in the western Pacific and are also commonly found in Taiwan. A large number of body segment fossils, identified as Neocallichirus sp., have been discovered in Jiaxian District, Kaohsiung City. The depositional environment also contains numerous trace fossils, clearly indicating an association between the host organism and its burrows. This area, which features cold seep carbonate-bearing Yan Shui Kang Shale, provides evidence that the organism in this ancient ecosystem relied on bacteria sustained by methane seepage.

Fossil records of Pliocene and Pleistocene ghost shrimp also appear in western Taiwan, exhibiting taxonomic differences from extant species. Fossil samples are predominantly propodus, with other parts like carapace and pleopods being less common, depending on the degree of chitin calcification. The abundance of body and trace fossils of ghost shrimp and moon clams in the strata confirms an in situ burial of the original habitat. Studies suggest that this fauna thrived in methane seep environments, relying on bacteria for nutrition, with fossil evidence further supporting this ecological relationship.

Keywords: Ghost shrimp; Thalassinidea; *Neocallichirus*; *Thalassinoides*; Propodus

Research on isolation and antimicrobial potential of derived fungi from a marine brown alga Colpomenia sinuosa at Kinmen

Jing-Yi, Hung [1], Wei-Chiung Chi [*, 1]

[1] Department of Food Science, National Quemoy University, Kinmen 892, Taiwan

Abstract

The purpose of this study is to investigate the purification and isolation of fungi from brown alga *Colpomenia sinuosa* collected in the intertidal zone of Kinmen Han She Hua and the antimicrobial effects of their secondary metabolites. In the experiment, 134 fungal strains were purified and isolated using Malt Extract Agar, Potato Dextrose Agar, and Yeast Extract Malt Agar media. Secondary metabolites were produced through liquid fermentation and solid-state fermentation. The antimicrobial activity of secondary metabolites from algae was confirmed using the disk diffusion method against common bacterial strains such as *Staphylococcus aureus* and *Escherichia coli*, as well as aquatic pathogens including *Edwardsiella tarda*, *Vibrio alginolyticus*, *Vibrio parahaemolyticus*, and *Streptococcus iniae, Lactococcus garvieae, Aeromonas hydrophila, Streptococcus agalactiae* etc. The antimicrobial experiments with secondary metabolites produced through liquid fermentation showed that Km3763 can inhibit all Gram-negative bacteria, while Km3752, Km3754, and Km3767 can inhibit all Gram-positive bacteria. Km3764 exhibits strong antimicrobial activity. The secondary metabolites from solid-state fermentation of Km3778 showed broad-spectrum antibiotic kill or inhibit gram-positive, gram-negative bacteria and fungi. The research results indicate that *C. sinuosa* have great potential in the study of antimicrobial substances.

Keywords: *Colpomenia sinuosa*; Secondary metabolites; Antimicrobial activity; Disk diffusion method

Evaluation of antimicrobial activities of extracts of endophytic fungi isolated from native coastal plants *Wikstroemeia indica*

Yun-Wei Huang [1], Wei-Chiung Chi [*, 1]

[1] Department of Food Science, National Quemoy University, Kinmen 892, Taiwan

Abstract

The purpose of this research was to explore the antimicrobial activities from endophytic fungi isolated from native coastal plants collected in the coastal area of Jinhu Township, Kinmen. In the experiment, the agar diffusion method was used to confirm the antibacterial activity of the *Wikstroemeia indica* extracts against the common strains the common strains: *Staphylococcus aureus* and *Escherichia coli* and the pathogens of aquatic organisms such as *Streptococcus agalactiae*, *Aeromonas hydrophila*, *Lactococcus garvieae, Streptococcus iniae*, *Vibrio parahaemolyticus*, *Vibrio alginolyticus*, *Edwardsiella tarda* etc. For the antimicrobial activities of the extracts, it was observed in the antibacterial test that some could inhibit the test strains. The content of antimicrobial activities with extract concentrations of 1000 ppm and 5000 ppm from seagrass extract with ethyl acetate solvent showed that it can inhibit the growth of certain bacterial species, producing an inhibition zone between 0.4 and 1.0 cm. We also observed this phenomenon, where the inhibition zone of certain extracts is more distinct than that of antibiotics. In the antibacterial test, it could be seen that some of the extracts can inhibit the test strains. Our results indicate that the native coastal plants *Wikstroemeia indica* demonstrates significant potential as an antibacterial agent for further research.

Keywords: *Wikstroemeia indica*; Agar diffusion method; Antibacterial activity

Therapeutic potential of a marine anti-inflammatory compound in osteoarthritis

Kuo-Zhi Ting [1], Zhi-Hong Wen [2],Yen-Hsuan Jean [3]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-Sen University, Kaohsiung 80424, Taiwan

[2] Department of Marine Biotechnology and Resources, National Sun Yat-Sen University, Kaohsiung 80424, Taiwan

[3] Department of Orthopedic Surgery, Pingtung Christian Hospital, No. 60 Dalian Road, Pingtung 90059, Taiwan
* E-mail: wzh@mail.nsysu.edu.tw

Abstract

Osteoarthritis (OA) is a common inflammatory joint disease associated with pain, cartilage degeneration, and dysfunction. Chondrocytes in the cartilage tissue utilize glucose to produce energy via respiration in the mitochondria. Extensive research has shown that inflammation is a key factor in causing mitochondrial dysfunction, which in turn drives the progression of OA disease. A natural marine compound extracted from a sponge is a phospholipase A2 (PLA2) inhibitor with anti-inflammatory properties. Previous studies indicated that down-regulation of PLA2 reduces mitochondrial oxidative stress and dysfunction and decreases inflammation and apoptosis. The present study focused on this marine-derived anti-inflammatory compound's therapeutic and mechanistic effects in anterior cruciate ligament transection (ACLT)-induced OA in rats. At week 12 after ACLT, intra-articular injection of 0.5 or 1 μg compound in ACLT surgery knee. The preliminary results found that the sponge compound attenuated ACLT-induced nociceptive behaviors, including knee joint swelling and weight-bearing distribution.Histopathological analyses revealed that the compound caused significantly less cartilage degeneration and mitochondrial dysfunction in the articular chondrocytes of the ACLT rats.
The present findings will facilitate future research on this sponge-derived PLA2 inhibitor in prevention strategies for OA progression.

Keywords: Osteoarthritis; Anti-inflammation; Sponge; Chondrocytes; Phospholipase A2 inhibitor; Mitochondria

Effects of marine microalgae and cyanobacteria towards the morphology and survival rate of zebrafish larvae, *Danio rerio*

En Chun Toh [1], Kwee Siong Tew [1, 2, 3, 4, 5]

[1] International Graduate Program of Marine Science and Technology, National Sun Yat-sen University, Kaohsiung 80424, Taiwan

[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

[3] Institute of Marine Ecology and Conservation, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

[4] National Museum of Marine Biology & Aquarium, Pingtung 944401, Taiwan

[5] Graduate Institute of Marine Biology, National Dong Hwa University, Pingtung 944401, Taiwan

* E-mail: enchun94@hotmail.com

Abstract

The zebrafish (*Danio rerio*) is becoming internationally recognized as a test model organsims representing animals as well as human. An experiment was conducted to study selected microalgaes and cyanobacteria extracts (*Spirulina platensis*, *Monoraphidium* sp., *Halamphora* sp., *Chaetoceros* sp. and *Chattonella marina*) on the *D. rerio* larvae morphology and survival rate. Samples of microalgae and cyanobacteria at stationary phase were extracted using 95% methanol and were exposed to *D. rerio* eggs at the concentrations of 0 ppm, 10 ppm, 20 ppm, 50 ppm and 100 ppm. The embryonic development was observed daily until hatched. The results showed that no significant differences between egg morphology were detected through the exposure from 0 ppm until 100 ppm. The experiment was then repeated through an increase of concentration up to 200 ppm. It was shown that a toxic *Chattonella marina* induced negative impacts towards the zebrafish larvae morphology causing deformation with low survival rate at (46.67%) compared to control treatment (0ppm, sterile distilled water) which have 100% survival rate. This indicated that the *Chattonella marina* is lethal towards the zebrafish larvae at high concentration.

Keywords: Zebrafish; Microalgae; Cyanobacteria; Survival rate

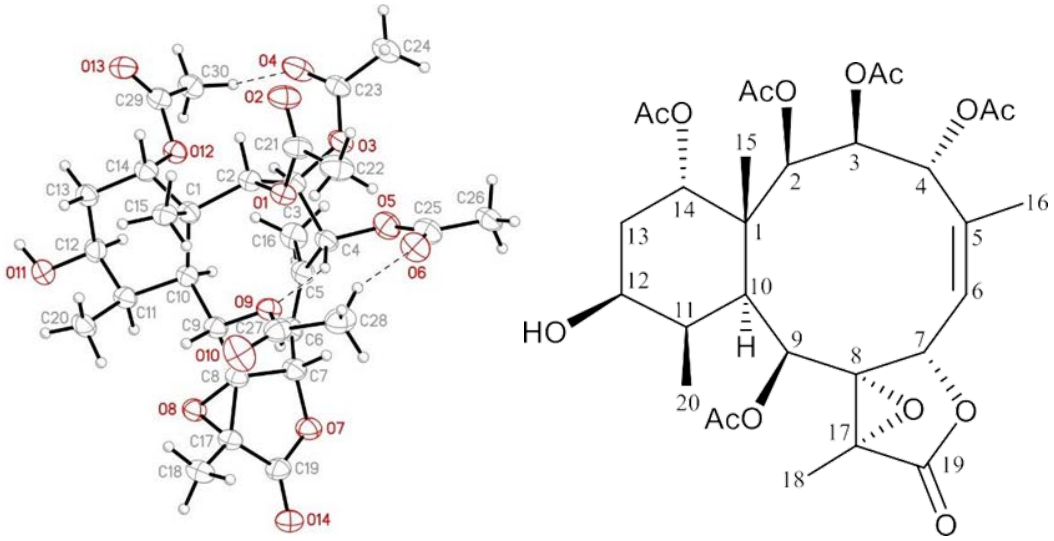
Briastecholide P , a new briarane-type diterpenoid from the Okinawa soft coral *Briareum stechei*

Yue-Wen Chuang [1, 2], You-Ying Chen [1], Ling-Yu Chien [1, 2] , Ping-Jyun Sung [*, 1, 2]

[1] National Museum of Marine Biology and Aquarium, Pingtung, Taiwan
[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung, Taiwan
* E-mail: pjsung@nmmba.gov.tw

Abstract

This research focuses on the analysis of secondary metabolites derived from the Okinawan soft coral *Briareum stechei*. Ten briarane-type diterpenoids including one new compound, briastecholide P (**1**), and nine known compounds **2-10** were isolated. Single-crystal X-ray diffraction is conducted to determine the absolute configuration of compound **1**. The structures of compounds **2-10** were identified through NMR spectral analysis and literature comparison. We evaluated the effects of compounds **1-10** on alkaline phosphatase (ALP) activity. Despite structural differences among compounds **1**, **9**, and **10** being limited to functional groups at the C-3 and C-4 positions, their respective cell proliferation rates were 89.55 ± 3.85%, 129.41 ± 5.55%, and 142.37 ± 4.72%. This prompted a focused analysis of the structure-activity relationships to elucidate their potential therapeutic mechanisms and applications.



Structure of briastecholide P and the computer-generated ORTEP of 1

Keywords: *Briareum stechei*; Briarane; MG 63; Cell proliferation; X-ray

Study on the secondary metabolites from the sponge *Lendenfeldia* sp. and its symbiotic microorganisms

Yun-Ting Zeng [1, 2], Li-Guo Zheng [1, 3], You-Ying Chen [1], Ping-Jyun Sung [*, 1, 2]

[1] National Museum of Marine Biology and Aquarium, Pingtung, Taiwan

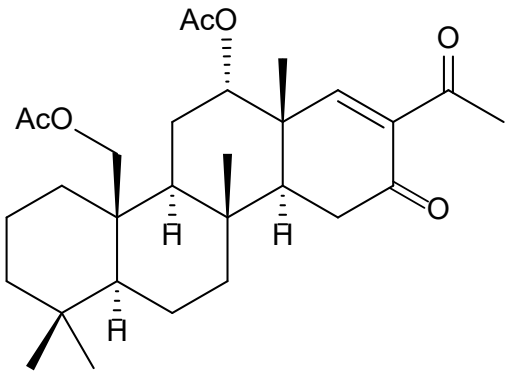
[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung, Taiwan

[3] Doctoral Degree Program in Marine Biotechnology, National Sun Yat-sen University, Kaohsiung, Taiwan

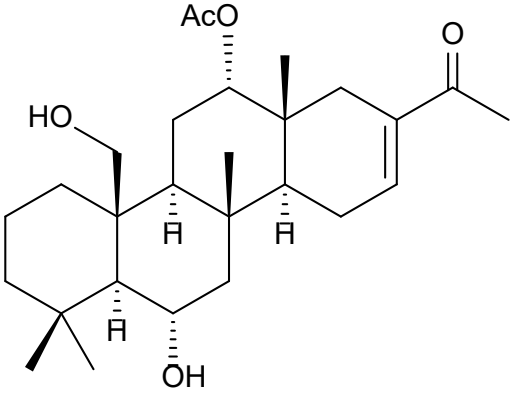
* E-mail: pjsung@nmmba.gov.tw

Abstract

Various *Lendenfeldia* sponges have been shown in previous studies to produce secondary metabolites with exceptional cytotoxic, antibacterial, and anti-inflammatory properties, indicating its substantial research value. In this study, we successfully isolated two new scalarane analugs lendenfeldarane X (**1**), lendenfeldarane Y (**2**) and identified 12 microbial strains with bioactivity from *Lendenfeldia*. Among these microorganisms, the strain *Streptomyces albogriseolus* JM128 exhibited anti-bacterial activity against *Neisseria gonorrhoeae.*



lendenfeldarane X (**1**)



lendenfeldarane Y (**2**)

Keywords: *Lendenfeldia*; Scalarane; Anti-bacterial activity; *Streptomyces albogriseolus*; *Neisseria gonorrhoeae*

Lipidomic profile variation in coral exposed to phthalate gives rise to the health concern

Ting-Ju Liu [1], Ching-Yu Lin [2], Chuan-Ho Tang [*, 1, 3]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung, Taiwan

[2] Institute of Environmental and Occupational Health Sciences, National Taiwan University, Taipei, Taiwan

[3] National Museum of Marine Biology and Aquarium, Pingtung, Taiwan

* E-mail: chtang@nmmba.gov.tw

Abstract

Increased exposure to plastic additives, such as plasticizers, for suspension feeders is expected to increase the amount of microplastics in the ocean, leading to concerns regarding the detrimental effects on coral health. Untargeted lipidomic profiling of coral exposed to di(2-ethylhexyl) phthalate (DEHP) was therefore performed to gain insights into the health risk in this study. The observed lipidomic changes, which suggest that DEHP be capable of inducing a similar activity of peroxisome proliferators-activated receptors in the coral. A decreased stability of coral-algae symbiosis was additionally indicated by an increased biosynthesis of galactolipids and 28:7-possessing betaine lipids, which metabolic shifts imply the host-controlling nitrogen limitation status being relieved in symbiotic algae. DEHP exposure likely increase coral susceptibility to environmental stimulants; therefore, the microplastics-contained DEHP is considered a risk factor for poor coral health in the ocean.

Keywords: Lipid droplet; Symbiosis; PPAR; Very-long-chain PUFA

Long-term monitoring of tropical coral reefs and underwater ecological live streams in the Hengchun Peninsula of Southern Taiwan

Hao-Wei Shang [*, 1] ,Yu-Ting Qiu [1], Yu-Chi Chang [1], Ting-Hui Cheng [1], Kwok-Wai Lam [2], Tung-Yung Fan[1, 2]

[1] Department of Planning and Research, National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan

[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

* E-mail: Samuel@nmmba.gov.tw

Abstract

The Hengchun Peninsula, located in southern Taiwan, hosts invaluable tropical shallow-water coral reefs. Long-term coral monitoring and underwater ecological live streams via YouTube have been established to observe these ecosystems. From April 2022 to May 2024, changes in hard coral coverage across five monitoring sites were recorded. Results indicated that the outlet Outlet site exhibited the highest and most stable hard coral coverage (46.3–58.2%). However, the hard coral coverage in the outer Iinlet site experienced a sharp decline from 52.9% to 30.8%, largely attributed to the impact of Typhoon Koinu. Similarly, the inner Iinlet site saw a reduction from 41% to 28.2% due to the 2022 marine heatwave, though this site later showed signs of recovery, reaching 47%. In contrast, hard coral coverage at Hejie was moderate at low range (25.9–31.7%) and Houbihu was at minimal range (8.4–18.3%), respectively, with both sites currently in a state of decline. The unprecedented marine heatwave of summer 2024, which broke historical records since 1985, was fully documented by four YouTube live-streaming cameras. These recordings captured the extensive coral bleaching and subsequent damage. The three most severe marine heatwaves and corresponding coral bleaching events in southern Taiwan occurred in 2020, 2022, and 2024, suggesting a biennial frequency of such events, with an observed trend toward increasing severity. This pattern underscores the urgent need for enhanced management and conservation efforts to mitigate the ongoing degradation of coral reef ecosystems.

Keywords: Marine heatwave; Coral coverage; YouTube live streams; DHW

Transcriptomic Analysis of Spleen in *Epinephelus fuscoguttatus* x *Epinephelus lanceolatus* with Different Co-infection Patterns of Grouper Nervous Necrosis Virus and Grouper Iridovirus

Yu-Ting Tseng [*, 1], **Hsin-Yiu Chou** [1, 2, 3]

[1] Department of Aquaculture, National Taiwan Ocean University, Taiwan

[2] Center for Marine Bioscience and Biotechnology, National Taiwan Ocean University

[3] Taiwan Marine Biotechnology Society, Taiwan

* E-mail: emma012325@gmail.com

Abstract

Nervous Necrosis Virus (NNV) and Grouper Iridovirus (GIV) are significant pathogenic viruses in cultured grouper. In recent years, co-infection of different pathogens is frequently observed at grouper aquaculture fields. We designed two co-infection patterns which is simultaneous infection with both viruses (NG) and sequential infection of NNV followed by GIV (N_G). Challenge tests were conducted on *Epinephelus fuscoguttatus x E. lanceolatus* (average weight 5.5g) and spleens were collected at 36, 48, and 72 hours post-infection. These samples were analyzed using next-generation sequencing (NGS) and differential expression gene (DEG) analysis. When compared with control group, at 48 hpi (hours post infection), both the NG and N_G groups showed significantly increased expression of genes related to carbohydrate metabolism. There were also differences in the expression of genes related to the proteasome, phagosome, and antigen presentation between the two groups. At 72 hpi, genes associated with the immune system process were significantly upregulated, with differences observed in genes related to the response to chemical stimulus and cell migration. Gene Ontology (GO) analysis linked these changes to the extracellular region, extracellular matrix, and receptor-ligand activity, while KEGG enrichment analysis indicated associations with the RAS signaling pathway and myocardial contraction.

Keywords: Nervous necrosis virus; Grouper iridovirus; Co-infection; Next-generation sequencing

Bioactive scalarane sesterterpenoids and polybrominated diphenyl ethers from the two sponges *Hippospongia* sp. and *Dysidea* sp.

You-Ying Chen [1], Ping-Jyun Sung [1], Jing-Ru Weng [2], Jui-Hsin Su [*, 1]

[1] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan
[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan
* E-mail: x2219@nmmba.gov.tw

Abstract

One new scalarane sesterterpenoid (**1**), along with four known sesterterpenoids (**2**–**5**), were isolated from the sponge *Hippospongia* sp. Five known polybrominated diphenyl ethers natural compounds (**6**–**10**) were isolated from the sponge *Dysidea* sp. The structure of marine natural products **1**–**10** were established by NMR spectral data analysis. Moreover, the structure of brominated diphenyl ethers **6**, **9** and **10** were further confirmed by X-ray single-crystal diffraction analysis (Fig. 1).

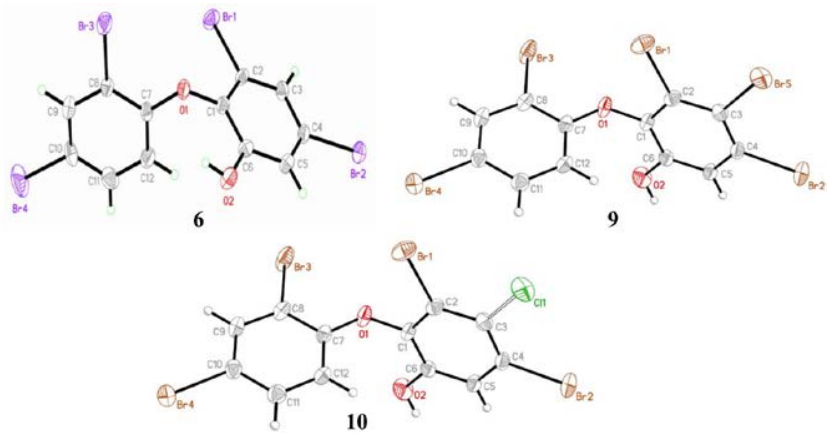


Fig. 1. Molecular structures of **6**, **9** and **10** based on X-ray analysis.

The study assessed the cytotoxicity of compounds **1**–**10** against human cholangiocellular carcinoma (HuCCT1) and human colonic adenocarcinoma (SW620). The findings indicated that sesterterpenoids **2** and **5** demonstrated substantial cytotoxic effects on these cancer cell lines. They significantly reduced cell viability and promoted apoptosis in a dose-dependent manner. Furthermore, the application of these compounds was associated with an increased expression of apoptosis-related proteins, particularly caspase-3, caspase-7, and PARP, highlighting their potential as therapeutic agents.

Keywords: Sesterterpenes; Polybrominated diphenyl ethers; Sponge; Cytotoxicity

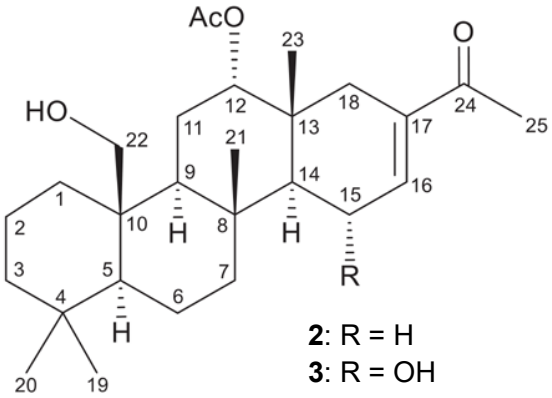
Isolation of 24-homoscalarane sesterterpenoids from marine sponge of the genus *Lendenfeldia*

Li-Guo Zheng [1, 2], You-Ying Chen [1], Jui-Hsin Su [1, 3], Ping-Jyun Sung [*, 1, 3]

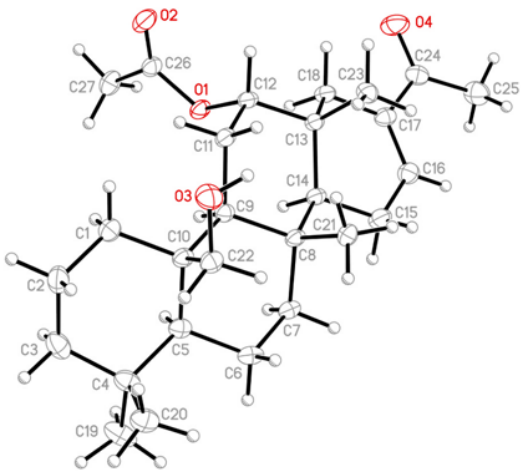
[1] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan
[2] Doctoral Degree Program in Marine Biotechnology, National Sun Yat-sen University, Kaohsiung 804201, Taiwan
[3] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan
* E-mail: pjsung@nmmba.gov.tw

Abstract

The chemical screening of an algae-containing marine sponge identified as *Lendenfeldia* species has isolated three 24-homoscalarane sesterterpenoids, including two known compounds, lendenfeldarane D (**1**), felixin A (**2**) and a new analogue, lendenfeldarane V (**3**). The structure of **2**, obtained in a previous study, was cited for the first time in this study via single-crystal X-ray diffraction analysis. The structure of **3** was ascertained via 2D NMR experiments and a literature review. The absolute configurations of **2** and **3** were delineated with DP4+ computation and specific optical rotation. Homoscalarane **2** exhibited cytotoxicity towards MG63 human osteosarcoma cells.



Structures of felixin A (**2**) and lendenfeldarane V (**3**)



ORTEP demonstrates the structure of felixin A (**2**).

Keywords: *Lendenfeldia*; Homoscalarane; Lendenfeldarane; Felixin; MG63

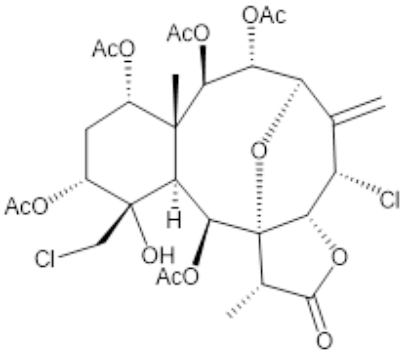
Isolation of polyacetoxybriaranes from the octocoral *Junceella* fragilis

Hai Nhat Do [1, 2],You-Ying Chen [1], Ping-Jyun Sung [*, 1 ,2]

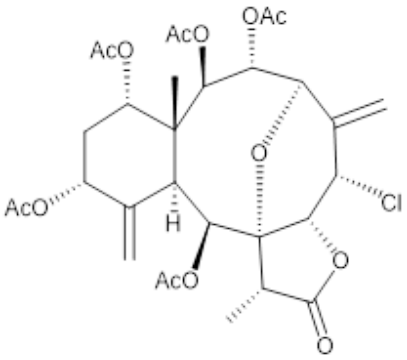
[1] National Museum of Marine Biology and Aquarium, Pingtung, Taiwan
[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung, Taiwan

Abstract

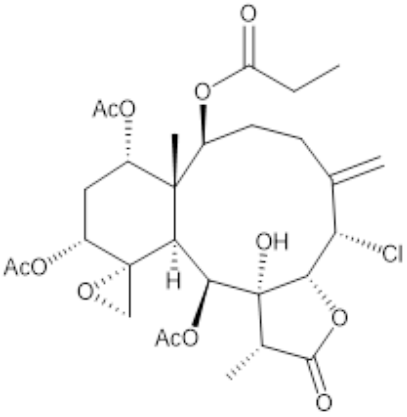
The chemical screening of an octocoral identifed as *Junceella fragilis* has led to the isolation of briarane-type diterpenoids. Twenty-four briarane-type diterpenoids, including four new compounds **1**=**4**, and twenty known compounds **5**=**24** were isolated. The structures of compounds **1**–**24** were confirmed through NMR spectral analysis and literature comparison. Single-crystal X-ray diffraction analysis was carried out to determine the absolute configurations of **6**, **7**, **9**, **12**, **16, 19**, **22**, and **23**. Previous studies have found briarane-type natural products to be a natural remedy for osteoclastogenic disease and ALP ELISA assay with MG63 human mesenchymal stem cells. The study found that briaranes **2**, **5**, and **15** were active in enhancing ALP activity at a concentration of 10 μM.



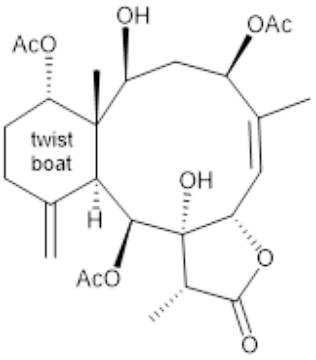
12α-Acetoxyfragilide F (**1**)



12α-Acetoxyjunceellin (**2**)



Fragilide Z (**3**)



Junceellolide Q (**4**)

Keywords: ***Junceella fragilis;*** **briarane; ALP ELISA assay; X-ray**

Studies on the Off-site Breeding, Secondary Metabolites Constituents Analysis, and Anticancer Screening of *Lobophytum* sp. in Medicinal Coral Germplasm Bank and Separation of 13-Acetoxysarcocrassolide

Shang-Yi Tu [1, 5], Yu-Hsuan Lin [1], Tsen-Ni Tsai [1, 2], Szu-Hsiang Tsai [1], Yi-Chang Liu [2], Yu-Ming Hsu [3], Ying-Chi Du [4], Fang-Rong Chang [5] and Mei-Chin Lu [*, 1]

[1] Graduate Institute of Marine Biology, National Dong Hwa University, Pingtung 944, Taiwan
[2] Division of Hematology-Oncology, Department of Internal Medicine, Kaohsiung Medical University Hospital, Kaohsiung 807378, Taiwan
[3] Research Center for Precision Environmental Medicine, Kaohsiung Medical University, Kaohsiung, 807378, Taiwan
[4] Taiwan Forestry Research Institute, Ministry of Agriculture, Taipei, Taiwan
[5] Graduate Institute of Natural Products, Kaohsiung Medical University, Kaohsiung 807378, Taiwan

* E-mail: jinx6609@nmmba.gov.tw

Abstract

Soft corals are a major source of marine natural products due to the unique structures and biological activities of their secondary metabolites. Our research team has collected 178 species of soft corals from Kenting and established a medicinal coral germplasm bank, primarily comprising six genera from the subclass Octocorallia (*Lobophytum*, *Sarcophyton*, *Sinularia*, *Briareida*, *Capnella*, and *Xenia*). In this study, crude extracts from 19 *Lobophytum* species were selected to evaluate their cytotoxicity against Molt4 leukemia cells, and identify the major active components form the extracts showed with most significant cytotoxicity. The results showed that the Lo43 extract exhibited the most significant cytotoxic activity against Molt4 leukemia cells, with 13-acetoxysarcocrassolide (13-AC) identified as the active component through bioassay-guided fractionation. HPLC analysis further confirmed that 13-AC is the major component of the Lo43 extract, and its levels may be increased by co-cultivation with nutrient solutions. In conclusion, the medicinal coral germplasm bank we established for artificial cultivation, bioactivity screening, and active compound isolation can help address the shortage of active compounds in drug development. Additionally, these cultivation techniques can be applied to wild coral propagation, contributing to the sustainable development of marine ecosystems.

Keywords: Medicinal Coral Germplasm Bank; Anti-cancer; *Lobophytum* sp.; 13-Acetoxysarcocrassolide (13-AC)

Harnessing the Power of the Ocean: Sustainable Cancer Treatment with Coral Extracts

Hung-Yu Lin [1], Szu-Hsiang Tsai [2], Tsen-Ni Tsai [2,3], Kai-Cheng Hsu [4,5], Yu-Ming Hsu [3,6], Lin-Chien Chiang [3], Mohamed El-Shazly [7], Ken-Ming Chang [8], Yu-Hsuan Lin [3], Shang-Yi Tu [3], Tony Eight Lin [4,5], Ying-Chi Du [3], Yi-Chang Liu [*,2], and Mei-Chin Lu [*,3,9]

[1] Division of Urology, Department of Surgery, School of Medicine, College of Medicine, I-SHOU University, E-Da Cancer & E-Da Hospital, Kaohsiung 824

[2] Division of Hematology-Oncology, Department of Internal Medicine, Kaohsiung Medical University Hospital, Kaohsiung 807, Taiwan

[3] Graduate Institute of Marine Biology, National Dong Hwa University, Pingtung 944, Taiwan

[4] Graduate Institute of Cancer Biology and Drug Discovery, College of Medical Science and Technology, Taipei Medical University, Taipei 110 Taiwan

[5] Ph.D. Program for Cancer Molecular Biology and Drug Discovery, College of Medical Science and Technology, Taipei Medical University, Taipei 110 Taiwan

[6] Research Center for Precision Environmental Medicine, Kaohsiung Medical University, Kaohsiung 807 Taiwan

[7] Department of Pharmacognosy, Faculty of Pharmacy, Ain-Shams University, Organization of African Unity Street, Abassia, Cairo 11566, Egypt

[8] Department of Pharmacy and Master Program, Tajen University, Pingtung 907, Taiwan

[9] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan

* E-mail: jinx6609@nmmba.gov.tw

Abstract

Marine natural products offer significant potential for drug development, but the limited availability of marine organisms presents a notable challenge. Establishing aquaculture provides a sustainable solution by enabling the mass production of bioactive compounds while mitigating the impact on wild populations and local ecosystems. To harness aquaculture as a source of biologically active substances, a cell-free system was developed to target molecular components with protein-modulating activities, such as topoisomerase II, HDAC, and tubulin polymerization, using extracts from cultured corals. Following this, in vitro analyses including MTT assays, flow cytometry, confocal microscopy, and Western blotting were conducted, complemented by in vivo xenograft models to validate the efficacy of the active extracts and elucidate their cytotoxic mechanisms. Regulatory proteins were investigated using NGS and gene editing techniques. Molecular docking and SwissADME assays assessed the pharmacokinetics, drug-likeness, and medicinal chemistry-related properties of the small molecules. The extract from *Lobophytum crassum* (LCE) demonstrated broad-spectrum activity, showing substantial inhibition of tubulin polymerization and low IC50 values against prostate cancer cells. Flow cytometry and Western blotting assays revealed that LCE induces apoptosis, as indicated by increased levels of cleaved caspase-3 and elevated proportions of early and late apoptotic cells. In xenograft studies, LCE

significantly inhibited tumor growth, reducing tumor volume (PC3: 43.9%; Du145: 49.2%) and weight (PC3: 48.8%; Du145: 7.8%). Additionally, LCE markedly reduced prostate cancer cell migration and invasion, increased the epithelial marker E-cadherin, and downregulated EMT-related proteins. Furthermore, LCE effectively countered TGF-β-induced EMT in PC3 and Du145 cells. Bioactivity-guided fractionation and SwissADME validation highlighted that the main component of LCE, 13-acetoxysacrophotoside (13-AC), shows considerable promise for development as an oral anti-cancer agent.

Keywords: Apoptosis; Epithelial-mesenchymal transition (EMT); Prostate cancer; Tubulin polymerization; 13-acetoxysacrophotoside (13-AC)

A marine-derived antimicrobial peptide exerts anti-melanoma and anti-angiogenesis

Chen-Ling Yu [1] Hsiao-Mei Kuo [1, 2] Zhi-Hong Wen [*, 1, 3]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 80424, Taiwan

[2] Department of Neurosurgery, Kaohsiung Chang Gung Memorial Hospital, Chang Gung University College of Medicine, Kaohsiung 833301, Taiwan.

[3] Institute of BioPharmaceutical Sciences, National Sun Yat-sen University, Kaohsiung, Taiwan
* E-mail: wzh@mail.nsysu.edu.tw

Abstract

Melanoma is a malignant and invasive skin tumor, ranking among the deadliest forms of skin cancer. Early-stage melanomas are prone to metastasis, leading to a poorer prognosis. Currently, it highlights the need for the development of novel therapeutic agents. Pardaxin, a teleost-derived antimicrobial peptide, has been identified to exhibit anti-tumor activity against ovarian, colorectal, and lung cancer. Whether it possesses anti-tumor activity against melanoma is yet to be clarified. In the present study conducted on the melanoma cell line A375, a decrease in cell viability was observed with increasing concentrations of Pardaxin. An upregulation in cleaved caspase-3 production evidences pardaxin-induced apoptosis. Pardaxin heightened oxidative stress, elevating reactive oxygen species (ROS) levels. It suppressed the activities of cellular and mitochondrial superoxide dismutase (SOD1), as well as catalase, while disrupting mitochondrial membrane potential. Additionally, Pardaxin reduced the oxygen consumption rate and the activities of mitochondrial complexes I–V, inhibiting ATP synthesis. Pardaxin also inhibited melanoma migration and invasion capabilities. Furthermore, Pardaxin exerted anti-angiogenetic properties by inhibiting vascular tube formation and aortic ring assay. Pardaxin lowered MMP-2 and vascular endothelial growth factor protein expression in HUVEC (human umbilical vein endothelial cells) cells. These findings suggest that Pardaxin could potentially become a promising therapeutic option for treating melanoma in the future.

Keywords: Marine antimicrobial peptides; Melanoma; Anticancer activity; Tumor angiogenesis pyrimidine synthesis; Open reading frames (ORFs)

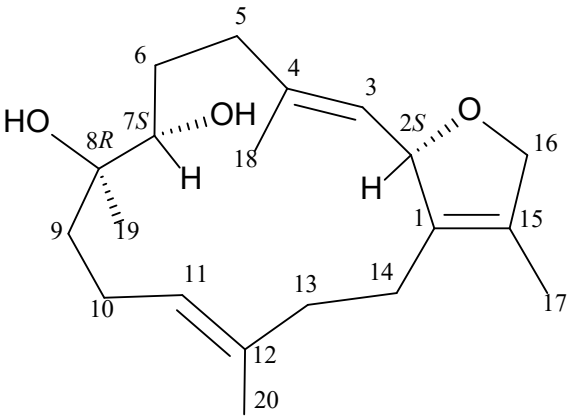
7*S*, 8*R*-Dihydroxydeepoxysarcophytoxide: A natural dihydrofuranocembranoid from the octocoral *Sarcophyton stellatum*

You-Ying Chen [1], Li-Guo Zheng [1, 2], Jyh-Horng Sheu [3], Ping-Jyun Sung [*, 1, 3]

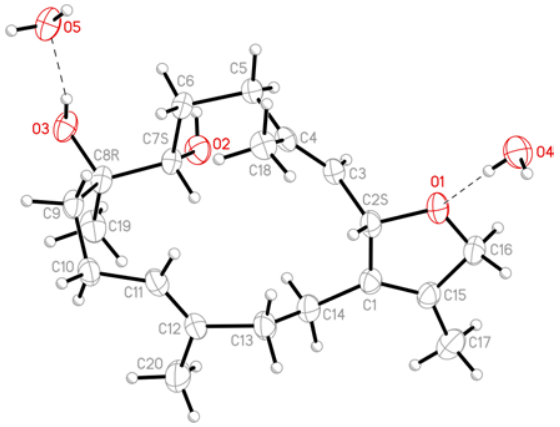
[1] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan
[2] Doctoral Degree Program in Marine Biotechnology, National Sun Yat-sen University, Kaohsiung 804201, Taiwan
[3] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan
* E-mail: pjsung@nmmba.gov.tw

Abstract

Chemical screening of the octocoral *Sarcophyton stellatum* led to the isolation of a natural dihydrofuranocembranoid, 7*S*,8*R*-dihydroxydeepoxysarcophytoxide (**1**). Single-crystal X-ray diffraction analysis was conducted to determine the absolute configuration of 1, and its structure was confirm using two-dimensional NMR experiments and a literature review. Dihydrofuranocembranoid **1** actively enhanced alkaline phosphatase activity.



Structures of 7*S*,8*R*-dihydroxydeepoxysarcophytoxide (**1**)



ORTEP plot showing the absolute configuration of **1**

Keywords: Dihydrofuranocembranoid; Sarcophytoxide; Alkaline phosphatase; Absolute configuration

Evaluation of microplastic ingestion in longfin batfish (*Platax teira*) larvae and juveniles under laboratory conditions

Chun-Yuan Lin [*, 1], Sun-Hon Lin [1], Ming-Yih Leu [1, 2, 3]

[1] Graduate Institute of Marine Biology, National Dong Hwa University, Hualien 974301, Taiwan, ROC

[2] Department of Biology, National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan, ROC

[3] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan, ROC

* E-mail: gyunwon97@gmail.com

Abstract

The increasing pollution of microplastics in marine ecosystems has become a significant environmental concern. While considerable research has been conducted on the effects of microplastics on adult fish, there remains a notable gap in understanding their impact on fish larvae and juveniles. These early life stages are critical for population recruitment, yet existing studies predominantly focus on adult specimens. Therefore, this study aims to investigate the effects of marine microplastic pollution on fish species commonly consumed in Taiwan. Conducted under controlled laboratory conditions, this research examines the patterns of microspheres ingestion and retention in the larvae and juveniles of the longfin batfish (*Platax teira*). The study explores the influence of varying microspheres concentrations on larvae and juveniles, their selective ingestion of microspheres based on color, and the retention time of microspheres within the gastrointestinal tract of these fish. Currently, the research has advanced to experiments assessing the color preferences of juvenile *P. teira*. The experiment was conducted using juveniles at 30 days post-hatch (dph). Among the five tested colors (red, green, yellow, white, and transparent), green (62.2%) exhibited the highest ingestion rate, significantly higher than white (11.0%, p=0.022) and transparent (4.4%, p=0.011) microspheres. Furthermore, the average ingestion of green-colored microsphere (2.9±1.1 spheres/fish) was significantly higher compared to red (0.7±0.6 spheres/fish, p=0.030), white (0.1±0.2 spheres/fish p=0.006), and transparent (0.3±0.5 spheres/fish, p=0.010) microspheres. These findings may be attributable to the feeding behavior and dietary preferences of juvenile *P. teira*. This study suggests that specific fish species may exhibit a preference for ingesting microplastics of certain colors. The insights gained from these experiments are expected to enhance our understanding of the ecological implications of microplastic pollution on marine fish larvae and juveniles, and to provide a valuable reference for future research in this domain.

Keywords: Microplastics; *Platax teira*; Larvae and juveniles; Ingestion; Color preference

Budding Behaviors of *Tubastraea aurea* in Response to Climate Changes

Julia Beaudoin [1], Montserrat Salazar-Martinez [1], Li-Shu Chen [2] and Jiang-Shiou Hwang [1, 3]

[1] Institute of Marine Biology, National Taiwan Ocean University, Keelung 20224, Taiwan
[2] National Museum of Marine Science & Technology, Keelung City 202010, Taiwan
[3] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung 20224, Taiwan
* E-mail: jshwang@mail.ntou.edu.tw

Abstract

As an unique species in hydrothermal vent ecosystems, *Tubastraea aurea*, an azooxanthellate, non-reef-building scleractinian coral native to the Indo-Pacific Ocean, plays a critical role in this extreme environment. This species reproduces both sexually and asexually through brooding and extra-tentacular budding, respectively. However, the impact of environmental factors, such as temperature, on its asexual budding is not well understood. With ocean temperatures rising due to climate change, assessing the effects on coral reproductive health is crucial, as these organisms are foundational to marine biodiversity and adaptation. This study provides the first detailed analysis of how varying water temperatures influence the budding behavior of *T. aurea*. Several colonies were collected, separated into individual polyps, and exposed to one of five temperature treatments: 21°C, 23°C, 25°C, 27°C, and 29°C. Initial budding was observed for several days before the temperature adjustments. Colder temperatures resulted in stable bud counts, while warmer temperatures led to fluctuations and higher bud mortality. Specifically, the 29°C treatment started with 45 buds, peaked at 65, and ended with 46, whereas the 25°C treatment, the most productive, started with 34 buds, peaked at 121, and concluded with 112. These findings underscore the importance of understanding temperature effects on coral reproduction, particularly in the context of climate change, to inform conservation strategies for this unique species.

Keywords: Budding behavior; Climate change; *Tubastraea aurea*

Impact of Polyethylene Microplastics on Zebrafish (*Danio rerio*): Toxicity, Stress Physiology, Histological Architecture, and Neurotoxicity with Gene Expression Pathway Analysis

Murugan Vasanthakumaran [*, 1], Li-Chun Tseng [1] Kadarkarai Murugan [2], Rajapandian Rajaganesh [2], Pavithra Krishanasamy [2], Shao-Hung Peng [3], Jiang-Shiou Hwang [, 1, 4]**

[1] Institute of Marine Biology, National Taiwan Ocean University, Keelung, 202301, Taiwan
[2] Department of Zoology, School of Life Sciences, Bharathiar University, Coimbatore-641 046, India.
[3] National Museum of Marine Biology and Aquarium, Pingtung, 94450, Taiwan.
[4] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung 202301, Taiwan
* E-mail: muruganvasanthakumaran@gmail.com (Presenting author)
** E-mail: jshwang@mail.ntou.edu.tw (Corresponding author)

Abstract

Microplastics have infiltrated various levels of the marine food web, accumulating in predators through prey ingestion and leading to increased concentrations of microplastics and associated toxins higher up the food chain. This biomagnification poses significant risks, not only to individual species but also to entire ecosystems. The accumulation of microplastics in marine environments is a growing concern, impacting both aquatic life and human health. Fish, a critical source of essential amino acids and vitamins, are particularly vulnerable. Zebrafish (Danio rerio), due to their genetic and physiological similarities with other vertebrates, serve as ideal model organisms for assessing environmental stressors and their broader ecological impacts.

In this study, we evaluated the effects of Polyethylene microplastics on zebrafish embryos and adults, focusing on antioxidant enzyme activity, developmental toxicity, and physiological and neurotoxic responses. Zebrafish embryos were exposed to Polyethylene microplastics at different concentrations. Microplastics exposure had reduced hatching and survival rates, inhibited heart rate, reduced body length, scoliosis, and eye damage.

Biochemical assays demonstrated that microplastics induced oxidative stress, as evidenced by increased reactive oxygen species (ROS) levels and elevated activities of superoxide dismutase (SOD) and catalase (CAT). These findings suggest that microplastics disrupt antioxidant defenses, leading to developmental toxicity in zebrafish embryos. Moreover, exposure to microplastics altered key biochemical markers, such as protein and glucose levels, and acetylcholinesterase (AChE) activity in the brain, indicating potential neurotoxicity and disruption of metabolic processes.

Histological analyses further revealed vacuolation in hepatocytes and damage to the epithelial cells lining the gills, reflecting significant cellular stress and organ dysfunction due to microplastic exposure. Our study highlights the critical need to understand the broader impacts of microplastics on marine ecosystems. We recommend further behavioral analysis, gene expression studies, and profiling of biochemical markers in both adult and embryonic zebrafish to elucidate the toxicological mechanisms of microplastic exposure.

Keywords: Microplastics; Zebrafish; Antioxidant enzymes; Histology; Neurotoxicity; Gene expression

Time-Dependent Pathogen Assemblages on Macroplastics in Shallow-Water Hydrothermal Vents: An In-Situ Study

Priyanka Muthu [1], Ying Ning Ho [1, 2, 3], Jiang Shiou Hwang [*, 1, 2]

[1] Institute of Marine Biology, National Taiwan Ocean University, Keelung 202301, Taiwan.
[2] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung 202301, Taiwan.
[3] Taiwan Ocean Genome Center, National Taiwan Ocean University, Keelung 202301, Taiwan.
* E-mail: jshwang@mail.ntou.edu.tw

Abstract

The increasing research into the plastisphere has amplified public concerns about plastic debris serving as vectors for pathogens in aquatic environments. The environmental distribution and impact of these pathogen-laden plastics are challenging to predict and analyze. To address this gap, we utilized Oxford Nanopore sequencing to deploy various plastic substrates in a shallow-water hydrothermal environment, investigating the temporal development of potential pathogens and hazardous species on these surfaces. Using advanced sequencing techniques, we identified taxonomic groups at the species level across different plastic substrates, revealing detailed microbial community structures. Non-Metric Multidimensional Scaling (NMDS) based on the Bray-Curtis dissimilarity matrix uncovered unique clustering patterns of microbial taxa on plastic substrates and in seawater over time specifically at 3 hours, Day 8, and Day 16 corresponding to primary, intermediate, and mature biofilm phases. Alpha diversity indices (Shannon, Chao1, and Pielou's evenness) were used to assess community diversity, showing distinct diversity profiles on plastic substrates compared to seawater, with significant variations observed over time.

Keywords: Plastisphere; Shallow water hydrothermal vent; Pathogens; Oxford Nanopore sequencing

Influence of Chitosan-Zinc Nanoparticles on Aquatic Animal Growth and Metabolism: A Nanotechnology Approach

Kadarkarai Murugan [*,1], Rajapandian Rajaganesh [1], Pavithra Krishanasamy [1], Murugan Vasanthakumaran [*,2], Li-Chun Tseng [2], Shao-Hung Peng [3], Jiang-Shiou Hwang [2,4]

[1] Department of Zoology, School of Life Sciences, Bharathiar University, Coimbatore-641 046, India.

[2] Institute of Marine Biology, National Taiwan Ocean University, Keelung, 202301, Taiwan.
[3] National Museum of Marine Biology and Aquarium, Pingtung, 94450, Taiwan.
[4] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung 202301, Taiwan.
* E-mail: kmmvk@buc.edu.in (Presenting author)

Abstract

The eco-friendly synthesis of multifunctional nanoparticles (NPs) from biomaterials offers sustainable solutions for various applications, including aquaculture. This study explores the synthesis and biological functions of a chitosan-zinc oxide nanocomposite derived from the mud shrimp *Austinogebia edulis* (MS-Ch-ZnONPs). The MS-Ch-ZnONPs were successfully synthesized and characterized using a range of techniques, confirming their structural integrity and coating efficiency.

Chitosan, derived from chitin in crustacean exoskeletons, is gaining attention for its potential benefits in aquaculture. This study investigates the effects of a chitosan-enriched diet on the growth performance of ornamental fish *Poecilia sphenops*, over a 60-day feeding trial. Results show that the chitosan-enriched diet significantly enhanced growth, food intake, and nutrient absorption, as indicated by increased body weight gain, specific growth rate (SGR), and feed conversion ratio (FCR). Additionally, elevated digestive enzyme activities and reduced oxidative stress markers (SOD and CAT) were observed in the fish fed with MS-Ch-ZnONPs, suggesting improved nutrient utilization and stress resilience.

The study also revealed that chitosan-enriched diets boosted predatory behavior, increasing the consumption of *Aedes aegypti* mosquito larvae in aquarium settings. Moreover, the nanoparticles demonstrated significant antibacterial activity against *Staphylococcus aureus* and *Escherichia coli*, and exhibited concentration-dependent cytotoxicity against A549 lung cancer cells and MCF-7 breast cancer cells.

The multifunctionality of chitosan, combined with its biocompatibility and biodegradability, positions it as a valuable tool for enhancing aquaculture productivity and contributing to public health through effective water purification and mosquito control.

Keywords: Mud shrimp; Chitosan; Mosquito control; Nanotechnology

Adaptive Mechanisms of *Xenograpsus testudinatus* in the Extreme Hydrothermal Vent Ecosystems of the Western Pacific Ocean: A Systematic Investigation

Subramani Thirunavukkarasu [1] and Jiang-Shiou Hwang [*, 1, 2]

[1] Institute of Marine Biology, National Taiwan Ocean University, Keelung 20224, Taiwan

[2] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung 20224, Taiwan

*E-mail: jshwang@mail.ntou.edu.tw

Abstract

Xenograpsus testudinatus (Takeda & Kurata, 1977), a grapsoid crab endemic to the volcanic rises of the western Pacific, inhabits the unique and isolated environments of shallow-water hydrothermal vents. These habitats offer rare opportunities to study genetic adaptation, metabolic regulation, population dynamics, evolutionary ecology, and meta-population structures. To maintain physiological homeostasis in such extreme conditions, *X. testudinatus* has evolved robust metabolic strategies, driven by specialized acid-base regulatory mechanisms. Symbiotic microbiomes within their holobiont significantly influence their physiological and metabolic processes. The vent crab's remarkable genetic resilience is linked to an effective detoxification mechanism for hydrogen sulfide (H_2S), facilitated by specialized cells in its gill filaments. Isotopic analyses of $\delta^{13}C$ and $\delta^{15}N$ values indicate that *X. testudinatus* extensively consumes dead zooplankton, pointing to a high degree of trophic recycling in these extreme habitats. These findings underscore the utility of these extreme marine environments in providing critical insights into eco-physiology, symbiotic interactions, and evolutionary adaptations.

Keywords: Hydrothermal vent; Metabolism; Adaptation; Micro-biomes; Eco-physiology

Detecting biodiversity of ichthyoplankton via DNA metabarcoding

Min-Yun Liu [*, 1], Ching-Sung Chang [2], Wan-Ting Chang [1]

[1] Taiwan Ocean Research Institute, NARLabs, Kaohsiung, 852005, Taiwan
[2] Institute of Bioinformatics and Systems Biology, National Yang-Ming Chiao Tung University, Hsinchu, 300093, Taiwan
* E-mail: mylalex@narlabs.org.tw

Abstract

Zooplankton is one of the important components of the marine ecosystem. It plays an important role in energy transfer in the marine food webs and is also an environmental indicator. The larvae of many marine life must go through the planktonic period, such as the larvae of many fish. Traditional zooplankton classification is based on morphological identification. Classification requires professional training and consume a lot of labor and time. We try to use DNA metabarcoding to understand the species composition and diversity of ichthyoplankton.

With or above 97% sequence Pidnet, a total of 169, 122 and 104 OTUs were detected by COI, 12S and 16S molecular markers, respectively; 53, 83 and 52 species were detected by COI, 12S and 16S molecular markers, respectively. In each sampling site, the taxa detected by the three markers were not identical. Combining these three markers, a total of 114 fish species were detected. The number of fish taxa detected combined by three markers were 1.17 to 4.19 times more than those detected by a single marker.

DNA metabarcoding can quickly identify species through sequence similarity. Due to the completeness of each database, DNA metabarcoding sequences may not be aligned to matching sequences in the database. Therefore, in order to ensure complete identification of species, multi-locus marker analysis is necessary. DNA metabarcoding could assist marine environment monitoring and conservation programs.

Keywords: **Ichthyoplankton; DNA metabarcoding; Molecular markers; Fish larval; Environment monitoring**

Discovery of azaphilones from the fungus *Penicillium sclerotiorum* with anti-lymphangiogenic effect

Tzu-Yi Ke [1], Zheng-Yu Lin [1], and Yuan-Bin Cheng [*, 1]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 80424, Taiwan
* E-mail: jmb@mail.nsysu.edu.tw

Abstract

Azaphilones are a typical fungal polyketide pigment, presenting orange, purple, red, and yellow colors. Ascomyceteous and basidiomycetous fungi, such as *Penicillium*, *Aspergillus*, *Monascus*, *Emericella*, and *Chaetomium*, widely produce them. They have been proven to have various activities, including cytotoxic, antimicrobial, antioxidation, anti-inflammatory, antimalaria, and enzyme inhibitions.

Two novel polyketide derivatives (**1** and **2**), five new sclerotiorin-type azaphilones (**3**–**7**), and two new nitrogenated azaphilones (**8** and **9**), together with 15 known compounds (**10**–**25**), were obtained and identified from the fermented liquid cultures of the marine-derived fungus *Penicillium sclerotiorum*. All the structures were determined by analyzing their mass and NMR spectroscopic data. The absolute configurations of these compounds were deduced from NMR calculations with DP4+ analyses, CD spectrum, and ECD calculations. These secondary metabolites were assessed for their anti-angiogenic effects on human endothelial progenitor cells (EPCs). Compounds **9** and **13** exhibited effective inhibitory effects of EPC growth with IC_{50} values of 5.8 ± 0.2% and 5.7 ± 0.2%, respectively.

Keywords: *Penicillium sclerotiorum*; Azaphilones; Anti-lymphangiogenic

Upside-down jellyfish(Cassiopea spp.) color change and environmental adaptation

Yi Feng Luo [1, 2], Kwee Siong Tew [*, 1, 2, 3, 4, 5]

[1] International Graduate Program of Marine Science and Technology, National Sun Yat-sen University, Kaohsiung 80424, Taiwan

[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

[3] Institute of Marine Ecology and Conservation, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

[4] National Museum of Marine Biology & Aquarium, Pingtung 944401, Taiwan

[5] Graduate Institute of Marine Biology, National Dong Hwa University, Pingtung 944401, Taiwan

* E-mail: tewks@mail.nsysu.edu.tw

Abstract

The upside-down jellyfish (Cassiopea spp.) is commonly found in environments with slow water flow, such as mangroves and seagrass beds. It occupies a unique ecological niche in these environments and also ideal for research for its accessibility. The relationship between upside-down jellyfish and Symbiodinium algae is crucial for understanding their adaptability to various environmental conditions, particularly in extreme climates. Researchers often use this jellyfish as an alternative model to study the loss of Symbiodinium algae, which occurs during coral bleaching, allowing for experimental approaches rather than mere observation. Upside-down jellyfish display a range of colors, and current studies primarily focus on the color changes associated with the loss of their symbiotic algae, typically from brown to white or transparent. However, the coloration of the jellyfish's vesicles has been rarely discussed. This experiment will investigate how different environmental factors —such as light intensity, temperature, and various types of feed that could affect the vesicle color of the jellyfish over time, hypothesizing that these color changes are reversible. Additionally, the ITS2 molecular marker will be used to identify variations in Symbiodinium species between the vesicles and other parts of the jellyfish.

Keywords: *Cassiopea spp.*; Colors; Symbiodinium; Vesicles

Assessment of microplastic ingestion in larval and juvenile silver moony (*Monodactylus argenteus*) under controlled laboratory conditions

Zi-Hao Guo [*, 1], Sun-Hon Lin [1], Ming-Yih Leu [1, 2, 3]

[1] Graduate Institute of Marine Biology, National Dong Hwa University, Hualien 974301, Taiwan, ROC

[2] Department of Biology, National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan, ROC

[3] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan, ROC

* E-mail: 611263008@gms.ndhu.edu.tw

Abstract

The impact of microplastic pollution on marine fish has garnered increasing attention; however, the effects of microplastics on the larval stage of fish remain poorly understood. This study aims to investigate the effects of microplastics on feeding behavior, exposure, and gastrointestinal retention time in the larvae of the silver moony (*Monodactylus argenteus*). By controlling environmental variables and monitoring experimental conditions, we will assess microsphere ingestion by larvae under varying exposure levels and evaluate potential color preferences of the microspheres. Additionally, we will examine microsphere retention times in the digestive tract to better understand potential health risks to the fish. Preliminary results indicate that *M. argenteus* larvae exposed to different microsphere concentrations (control; 0 microspheres/L; 1×: 10 microspheres/L; 10×:100 microspheres/L) show no significant difference in mortarlity rate among all the treatments ($p = 0.952$). The result of ingestion rate show no significant difference between the 10× concentration treatment (52.0±7.7%) and the 1× concentration treatment (87.5± 10.8%) ($p=0.331$). However, the 10× concentration treatment exhibited significantly higher ingestion rate compared to the control treatment ($p =0.004$). For the average ingestion, there was no significant difference between the 10× concentration treatment (48.7±14.2 microspheres/fish) and the 1× concentration treatment (4.7±2.3 microspheres/fish) ($p=0.329$). On the other hand, the 10× concentration treatment exhibited significantly higher average ingestion compared to the control treatment ($p =0.004$). the Further experiments will be conducted on *M. argenteus* larvae to provide a comprehensive evaluation of microsphere concentration, color preference, and gastrointestinal retention time. These findings underscore the potential impacts of microplastic ingestion on larval fish health and marine ecosystems.

Keywords: Microplastics; *Monodactylus argenteus*; Larvae; Ingestion; Intestinal retention time

Chemical Constituents and Bioactivities of *Aspergillus ochraceopetaliformis*

Yi-Lin Tsai [1], Yuan-Bin Cheng [*, 1]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 80424, Taiwan
* E-mail: jmb@mail.nsysu.edu.tw

Abstract

In this study, *Aspergillus ochraceopetaliformis* was isolated from the sea anemone *Palythoa mutuki*. Initial cytotoxic screening indicated that *A. ochraceopetaliformis* has the potential to produce anti-tumor metabolites. The chemical investigation of this fungus led to the identification of two known compounds, asteltoxin (**1**) and asteltoxin C (**2**), based on NMR and Mass spectroscopy . In the bioassay, asteltoxin (**1**) demonstrated cytotoxicity against the HuH-7 cell line, with an IC_{50} value of 84.6 μM.

Keywords: ***Aspergillus ochraceopetaliformis*****;** ***Palythoa mutuki*****; Asteltoxin**

Cultivation of *Penicillium sclerotiorum* using the OSMAC approach to explore its metabolites

Pei-Ting Chiang [1], Ming-Ya Cheng [1], Yuan-Bin Cheng [*, 1]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan
* E-mail: jmb@mail.nsysu.edu.tw

Abstract

Using the OSMAC (one strain of many compounds) approach, the algae-derived fungi *Penicillium sclerotiorum* was cultured, and two new compounds were identified. The secondary metabolites of *P. sclerotiorum* are azaphilone compounds, which exhibit various pharmacological activities, including antibacterial, anti-inflammatory, and antiviral properties. The OSMAC method allows a single strain to produce diverse metabolites under different cultivation conditions. When trace elements such as bromine were added to the medium, experimental results showed that bromine induced the production of brominated azaphilone compounds. After large-scale cultivation and extraction, two new azaphilone compounds were successfully purified: 5-bromoisochromophilone VIII (**1**) and 5-bromoisochromophilone IV (**2**). The structures of these new compounds were elucidated by CD, HRESIMS, 1D and 2D experiments NMR spectroscopic data.

Keywords: Algae-derived fungi; *P. sclerotiorum*; OSMAC; Brominated azaphilone

Mass broadcast spawning as the strategy to propagate diverse coral strains to face climate change

Hung-Kai Chen [1], Hsiang-Chun Chen [1], Li-Hsueh Wang [*, 1, 2]

[1] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan
[2] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan
* E-mail: wanglh@nmmba.gov.tw

Abstract

Coral reefs in tropical water face climate change's impact; ocean warming is causing increasingly frequent and severe thermal stress events on coral reefs, triggering bleaching that results in physiologically and metabolically impaired corals. When corals become so severely compromised that they are unable to recover, reef ecosystems degrade. Since coral reefs in shallow water are already facing the tipping point, proactive coral restoration needs to be conducted with new strategies or techniques to select stress-resisting strains for prorogation as well as preservation and restoration in the field. By using sperm-oocyte bundles collected from the field during mass broadcast spawning season at Hengchun Peninsula, we would like to fertilize coral oocytes with different colonies and infections with the different clades of Symbiodiniaceae to propagate multi-strain coral in the lab. This year, we have successfully cultured two genera coral, *Dipsastraea* and *Favites*, associated with Symbiodiniaceae clades C1, D1, or mix. Our ultimate goal is to propagate diverse coral strains in the lab to restore in the field for challenges in the future.

Keywords: Scleractinia; Sperm-oocyte bundle seperation; Symbiodiniaceae

The Taiwanese Bivalvias exhibit promising bioactive properties in bone graft

Jia-Ling Han[1], Zhi-Hong Wen [*, 1, 2, 3]

[1] Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung, Taiwan

[2] Institute of BioPharmaceutical Sciences, National Sun Yat-sen University, Kaohsiung, Taiwan

[3] Institute of Medical Science and Technology, National Sun Yat-sen University, Kaohsiung, Taiwan

* E-mail: wzh@mail.nsysu.edu.tw

Abstract

Bio-ceramics from marine organisms contain trace elements, degradable components, and a unique structure, giving them excellent bioactivity, strength, and ceramic properties. Currently, coral-derived skeletons have been used as marketed bone graft materials. To date, there has been limited research on indigenous Bivalvias, which may have the potential to develop novel bone graft materials. We are pleased to report that our research results have indicated that Taiwan's Bivalvia exhibits osteogenetic properties and demonstrates low cytotoxicity. This finding is significant as it suggests the potential for the development of innovative bone graft materials utilizing Bivalvia sourced from Taiwan. While our initial findings are promising, we recognize that further in-depth and experimental validation in animal studies is essential to fully understand the capabilities and limitations of Taiwan's Bivalvia as a source for bone graft materials.

Keywords: Bone grafts; Taiwan's Bivalvia; Marine

The Miocene to Pleistocene Sepiidae (Mollusca: Cephalopoda) of Taiwan

Shih-Wei Lee [*, 1] **, Shih-Wei Wang** [2]

[1] National Museum of Marine Biology and Aquarium (NMMBA), Pingtung 944401,Taiwan
[2] National Museum of Natural Science (NMNS), 404023 Taichung, Taiwan

* E-mail: leesw@nmmba.gov.tw

Abstract

Fossil evidence indicates that cuttlefish originated in the early Miocene, approximately 22 million years ago, with the earliest fossils found around the Mediterranean and Central Paratethys Tethys Sea. During the Mesozoic Era, this area encompassed a vast region that included presentday North Africa, Central Asia, and Eastern Europe. Fossil records of both ancient cuttlefish
(Belosaepiid) and modern cuttlefish (Sepiida) are predominantly distributed across present-day Czechia, Poland, Austria, the Netherlands, France, Slovenia, and as far east as Turkey and Egypt, with Czechia yielding the most abundant specimens. Additional isolated records have been reported from North America (for ancient cuttlefish), western India, and southern Australia, each with a single species. To date, aside from a few scientific reports on nautiloid fossils, other cephalopod groups remain unreported from the Taiwan region. This study represents the first investigation into 28 fossilized cuttlebones from the Cenozoic strata of Taiwan, collected from 11 localities. The specimens were identified as belonging to 3 genera and 11 species, including *Sepia aculeata, S. filibrachia, S. latimanus, S. lycidas, S. madokai, S. pardex, S. pharaonis, S. recurvirostra, S. vossi, Sepiella japonica, and Metasepia tullbergi.* The morphology of these cuttlebones corresponds to existing species from the surrounding regions of Taiwan, and no new species were discovered. To date, the biogeographical dispersal route of cuttlefish from their Mediterranean origin to other parts of the world remains unclear. The findings of this study suggest that cuttlefish likely migrated along the shallow seas bordering the southern edge of the Asian continent, extending toward northern Asia and Australia. Furthermore, the late Pliocene to Pleistocene cuttlefish fossils from Taiwan represent the only known records of their kind globally. Considering the richness of this specimen collection in both quantity and diversity, the cuttlefish fossils from Taiwan hold significant evolutionary and biogeographical importance.

Keywords: Cuttlebone fossils; Cephalopods; Taoyuan Daxi; Tainan Yujing; Biological migration

Challenges and Insights in the Genetic Management of Small Abalone (*Haliotis diversicolor*) in Taiwan

Yung-Cheng Chang [1, 2], Fan-Hua Nan [1], Te-Hua Hsu [*, 1, 2]

[1] Department of Aquaculture, National Taiwan Ocean University, Keelung 202301, Taiwan
[2] Center of Excellence for the Oceans, National Taiwan Ocean University, Keelung 202301, Taiwan
* E-mail: realgigi@ mail.ntou.edu.tw

Abstract

The small abalone (*Haliotis diversicolor*) is a precious species in fisheries and aquaculture. However, Taiwan's once-thriving abalone industry is now on the verge of collapse due to disease outbreaks. Although crossbreeding between Japan and Taiwan populations initially improved survival rates, the lack of ongoing breeding selection and proper genetic management has caused significant genetic issues over the past decade. Frequent commercial exchanges, stock enhancement, private introductions, and hybridization have further complicated the genetic structure of *H. diversicolor*. This study employs ISSRseq technology to address the challenges of genetic management in this species. Analysis reveals substantial genetic differences among Japan's wild population, Taiwan's wild populations, the Taiwan-Indonesia hybrid strain, and various cultured populations. Selective breeding by research institutions and private hatcheries has produced unique strains distinct from commercial abalone. The observed genetic admixture across populations is likely a result of improper stock enhancement and management. Our findings comprehensively assess Taiwan's *H. diversicolor* genetic resources, forming a crucial basis for future breeding strategies.

Keywords: Next Generation Sequencing; Molecular markers; MIG-seq; Breeding; SNP

From Coral to Cure: Expanding Bioactivity Testing and Mechanistic Studies of *Sarcophyton* sp. Compound, Sarcophytol A

Szu-Hsiang Tsai [1], Tsen-Ni Tsai [1,2], Yu-Ming Hsu [3], Ken-Ming Chang [4], Yu-Hsuan Lin [1], Shang-Yi Tu [1,5], Ying-Chi Du [1,5], Yi-Chang Liu, and Mei-Chin Lu [*, 1, 5]

[1] Graduate Institute of Marine Biology, National Dong Hwa University, Pingtung 944, Taiwan
[2] Division of Hematology-Oncology, Department of Internal Medicine, Kaohsiung Medical University Hospital, Kaohsiung 807378, Taiwan

[3] Research Center for Precision Environmental Medicine, Kaohsiung Medical University, Kaohsiung, 807378, Taiwan

[4] Department of Pharmacy and Master Program, Tajen University, Pingtung 90741, Taiwan
[5] Graduate Institute of Natural Products, Kaohsiung Medical University, Kaohsiung 807378, Taiwan

[6] National Museum of Marine Biology and Aquarium, Pingtung 944401, Taiwan
* E-mail: jinx6609@nmmba.gov.tw (M.-C. L.)

Abstract

Develop advanced aquaculture techniques to improve the cultivation of *Sarcophyton* sp. This includes optimizing growth conditions and scaling up production to meet demand while reducing reliance on wild populations. Given the rich bioactive compounds found in *Sarcophyton* sp., it is essential to explore the chemical diversity of these corals further to discover more potential drug candidates. Protecting their natural habitats is crucial to ensure the sustainability of these marine resources. The Sarcophyton species is rich in cembrane terpenoids, with Sarcophytol A being a notable marine cembrane isolated from cultured *Sarcophyton* sp. Its structure was elucidated using various spectroscopic techniques. The cytotoxicity of Sarcophytol A was assessed using MTT assays against several cancer cell lines, including CCRF, K562, and U937, yielding IC_{50} values of 8.76, 8.87, and 10.62 µg/mL, respectively, after 72 hours. Annexin-V/PI staining assays indicated that Sarcophytol A induces apoptosis of CCRF, K562, and U937 cells. Additionally, the JC-1 staining assay revealed that Sarcophytol A induces apoptosis by disrupting the mitochondrial membrane potential (MMP). This study highlights the cytotoxic effects of Sarcophytol A across multiple cancer cell lines and suggests that it affects key regulated cell death pathways, warranting further investigation.

Keywords: Aquaculture Coral; Apoptosis; Mitochondrial disruption; Sacrophyton sp.

Nutrient Dynamics and the Role of DMS in *Symbiodiniaceae* Algae Cells

Yu-Rong Zeng [1], Chun-Ting Chen [1], Pei-Luen Jiang [*, 1]

[1] Department of Biotechnology, National Formosa University, Yunlin, Taiwan.

* E-mail: villy@nfu.edu.tw

Abstract

Dimethylsulfoniopropionate (DMSP) is a globally significant organic sulfur compound present in algae, corals, plants, and heterotrophic bacteria. It serves as an osmolyte, cryoprotectant, predator deterrent, and antioxidant. DMSP is also a crucial precursor of atmospheric dimethylsulfide (DMS), a volatile compound with climate-active properties. The cleavage of DMSP by DMSP lyases in bacteria and phytoplankton results in the production of DMS, which is vital for cloud formation and potential climate regulation. Previous studies have shown that DMS concentrations tend to increase in corals under environmental stress. This study aims to investigate the changes in intracellular DMSP concentration and DMS gas emission in *Symbiodiniaceae* under nutrient-deficient stress conditions. We will also observe the major physiological responses of *Symbiodiniaceae* when subjected to such stress. Through this research, we aim to elucidate the interaction between oceanic nutrient cycles and *Symbiodiniaceae*.

Keywords: Dimethylsulfoniopropionate (DMSP); Dimethylsulfide (DMS); *Symbiodiniaceae*

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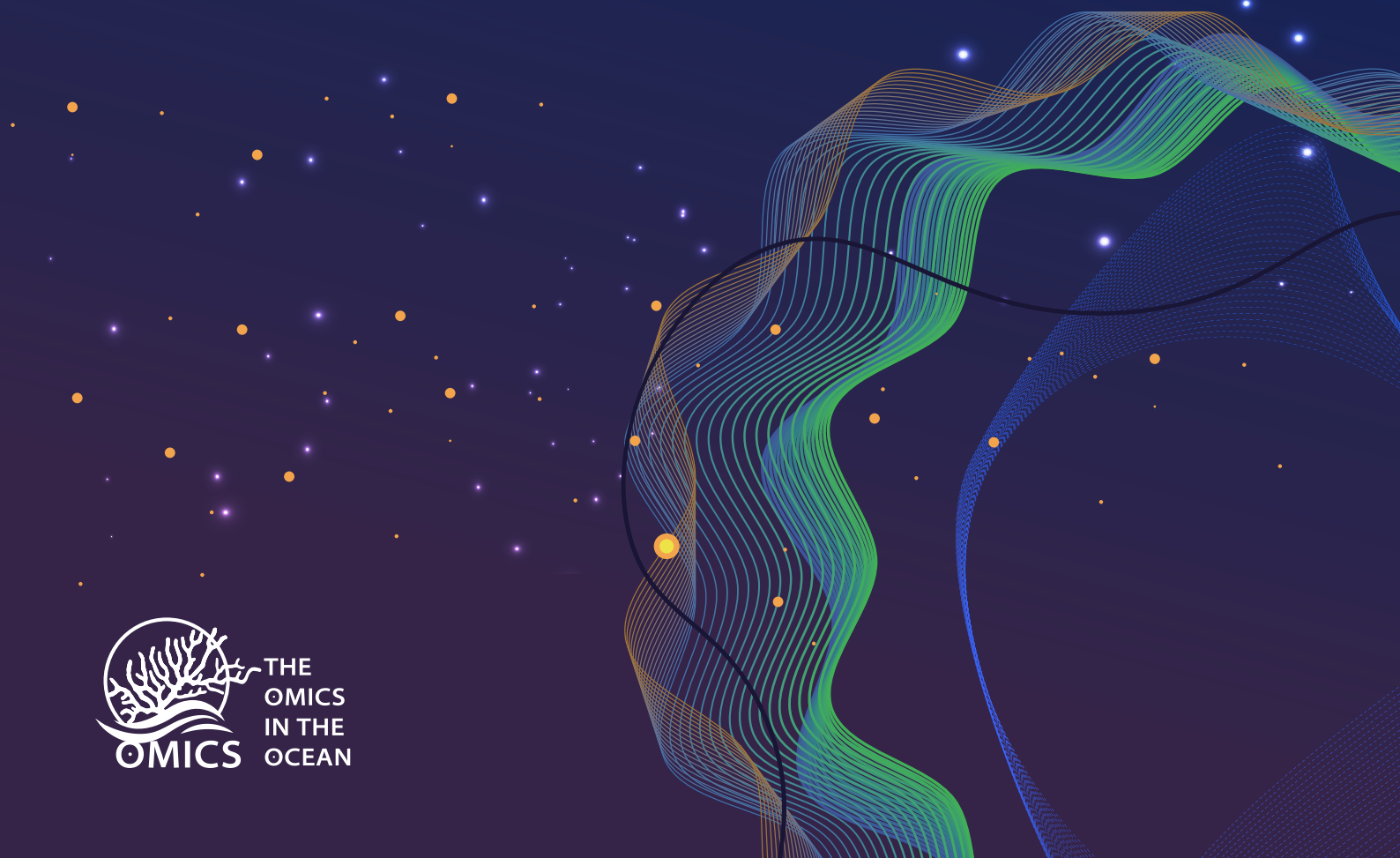

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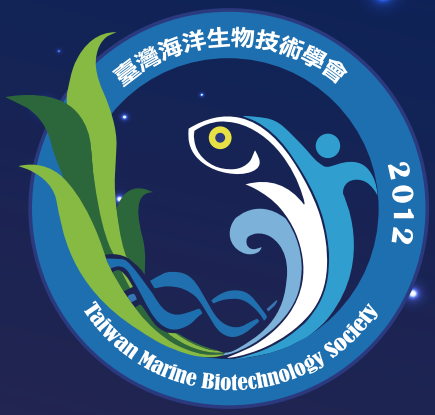
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