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th

The Omics in the Ocean

The 9th International Symposium for
Marine Biology and Biotechnology

Ocean Science - From Reefs to the Deep

17 June 2022, Virtual symposium

Program Book



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ABOUT THE SYMPOSIUM

 **9th**
**The Omics
in the Ocean**
The 9th International Symposium for
Marine Biology and Biotechnology

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 eight 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, our annual theme is “Ocean Science — From Reefs to the Deep”. 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 (NMMBA)



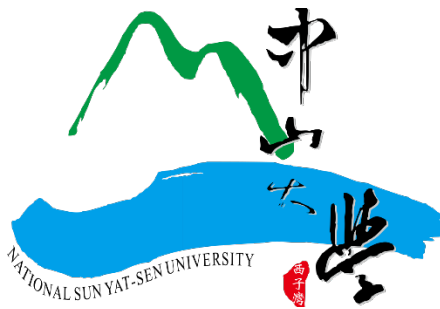
Adviser

Ministry of Education, Taiwan



Co-organizers

National Sun Yat-sen University



National Dong Hwa University



Organizing Committees

| | |
|------------------|--|
| Chii-Shiang Chen | Director General, NMMBA |
| Te-Hao Chen | Associate Research Fellow / Deputy Director General, Department of Biology, NMMBA |
| Li-Hsueh Wang | Associate Research Fellow / Director, Department of Planning and Research, NMMBA |
| Ping-Jyun Sung | Research Fellow, Department of Planning and Research, NMMBA |
| Kwee-Siong Tew | Associate Research Fellow, Department of Biology, NMMBA |
| Jimmy Kuo | Associate Research Fellow, Department of Planning and Research, NMMBA |
| Hsuan-Ching Ho | Associate Research Fellow, Department of Exhibition, NMMBA |
| Hsing-Hui Li | Assistant Research Fellow, Department of Planning and Research, NMMBA |
| Hsin Lee | Assistant Research Fellow, Department of Planning and Research, NMMBA |
| Jing-O Cheng | Research Assistant, Department of Planning and Research, NMMBA |

Grants & Sponsors

National Museum of Marine Biology and Aquarium (NMMBA)

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<https://www.nmmba.gov.tw/default.aspx>



Ministry of Science and Technology

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<https://www.most.gov.tw/?l=ch>



Key Vision of the Symposium



THE
OMICS
IN THE
OCEAN

th

**The Omics
in the Ocean**

**The 9th International Symposium for
Marine Biology and Biotechnology**

Ocean Science - From Reefs to the Deep

17 June 2022, Virtual symposium

NATIONAL MUSEUM
OF MARINE BIOLOGY & AQUARIUM

Poster of the Symposium



9th **The Omics
in the Ocean**

**The 9th International Symposium for
Marine Biology and Biotechnology**
Ocean Science - From Reefs to the Deep
17 June 2022, Virtual symposium

Registration Deadline
June 15, 2022.

Abstract Submission Deadline
June 5, 2022.

Poster Submission Deadline
June 5, 2022.



詳情請見研討會網站 (QR code)

NATIONAL MUSEUM
OF MARINE BIOLOGY & AQUARIUM

MOST Sponsored by Ministry of Science and Technology

SYMPOSIUM PROGRAM

 **th**
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The 9th International Symposium for
Marine Biology and Biotechnology

| Friday - June 17, 2022 | | |
|------------------------|--|--|
| 08:50-09:00 | <i>Opening</i> | |
| 09:00-09:50 | <p>Topic: Tradeoffs in the Holobiont: Evidence for Correlated Evolution of Coral Innate Immunity, Microbiome Structure, and Disease Susceptibility Across Coral Diversity.</p> <p>Speaker: Dr. Jesse Zaneveld</p> | <p>Moderator: Dr. Chiahsin Lin</p> |
| 09:50-10:40 | <p>Topic: Natural Product Research on Zoanthid and Marine Microorganism.</p> <p>Speaker: Dr. Yuan-Bin Cheng</p> | <p>Moderator: Dr. Ping-Jyun Sung</p> |
| 10:40-10:50 | <i>Break</i> | |
| 10:50-11:40 | <p>Topic: Hong Kong Coral Communities: Status, Threats, and Conservation.</p> <p>Speaker: Dr. Apple Pui Yi Chui</p> | <p>Moderator: Dr. Chiahsin Lin</p> |
| 11:40-12:30 | <p>Topic: Ecological Relevance of Mesophotic Marine Animal Forests in Taiwan: Insights and Prospects.</p> <p>Speaker: Dr. Vianney Denis</p> | <p>Moderator: Dr. Hsin Lee</p> |
| 12:30-13:30 | <i>Lunchtime & Poster Section</i> | |
| 13:30-14:20 | <p>Topic: How Physical Sampling, Omics and Imaging Combine to Advance in the Exploration of the Deep-sea Frontier.</p> <p>Speaker: Dr. Sarah Samadi</p> | <p>Moderator: Dr. Hsin Lee</p> |
| 14:20-15:10 | <p>Topic: Development of Ichthyology in Japan and Fish Collections.</p> <p>Speaker: Dr. Keiichi Matsuura</p> | <p>Moderator: Dr. Hsuan-Ching Ho</p> |
| 15:10-15:20 | <i>Break</i> | |
| 15:20-16:10 | <p>Topic: Collecting Deep-sea Megabenthos in Taiwan.</p> <p>Speaker: Dr. Tin-Yam Chan</p> | <p>Moderator: Dr. Chia-Wei Lin</p> |
| 16:10-17:00 | <p>Topic: Marine Biological Carbon Pump.</p> <p>Speaker: Dr. Chin-Chang Hung</p> | <p>Moderator: Dr. Ping-Jyun Sung</p> |
| 17:00-17:10 | <i>Closing & Concluding Remarks</i> | |

INVITED LECTURES

 **th**
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Jesse Robert Zaneveld

Assistant Professor

University of Washington, Bothell. School of Science, Technology, Education, and Math, Division of Biological Sciences

Education

Ph.D. University of Colorado at Boulder, Department of Molecular, Cellular, and Developmental Biology. (2011). Thesis: Habitat Adaptation and Genome Evolution in the Gut Microbiome. Advisor: Rob Knight, Department of Chemistry and Biochemistry, HHMI

B.S. Biology, B.S. Political Science. University of Oregon (Clark Honors College), Cum Laude. (2005). Thesis: The Evolution of Signal Recognition in Nuclear Receptor Proteins. Advisor: Joe Thornton, Center for Ecology and Evolutionary Biology, HHMI

Professional Experience

Research associate, Oregon State University Department of Microbiology. (Sept. 2014-August 2016). Project: The Global Coral Microbiome Projects: Co-diversification of threatened reef-building corals and their associated microbiotas. Advisor: Rebecca Vega Thurber, Department of Microbiology.

Postdoctoral Scholar, Oregon State University Department of Microbiology. (Aug 2011-2014). Project: Tracing the effects of herbivory, nutrient loading, and thermal stress on corals and their microbial symbionts using long-term field manipulations. Advisor: Rebecca Vega Thurber, Department of Microbiology.

Tradeoffs in the Holobiont: Evidence for Correlated Evolution of Coral Innate Immunity, Microbiome Structure, and Disease Susceptibility Across Coral Diversity.

Jesse Zaneveld^{1*}, Tanya Brown¹, Hannah Epstein², Ayomikun Akinrinade¹, Dylan Sonett¹, Joleah Lamb³, Rebecca Vega Thurber².

¹ Division of Biological Sciences, School of STEM, University of Washington Bothell, Bothell, WA, USA

² Division of Health Studies, School of Nursing and Health Studies, University of Washington Bothell, Bothell, WA, USA

³ Department of Microbiology, Oregon State University, Corvallis, OR, USA.

⁴ University of California, Irvine, School of Biological Sciences, Irvine, CA, USA

Abstract

Coral innate immunity plays a key role in regulating coral microbiomes. These microbiomes may contribute both to corals growth, and their susceptibility to environmental stress, predation, or disease. Changes in immunity over coral evolution may therefore have driven changes in microbiome structure, which may in turn contribute to modern cross-species differences in growth or disease susceptibility. We used phylogenetic comparative methods to test for correlations between coral innate immune gene repertoire, microbiome structure, and disease susceptibility across genera representing >240 million years of coral evolution. This analysis drew on 1440 microbiome 16S rRNA samples from coral mucus, tissue and endolithic skeleton from our Global Coral Microbiome Project (GCMP); three long-term regional disease datasets; coral trait data; and innate immune gene repertoires annotated from all publicly available coral genomes. Across sequenced coral genomes, we find that gene family expansions of TIR-domain containing innate immune genes strongly predict reduced microbiome diversity, especially within coral's endolithic skeleton. Indeed, gene copy number expansions of IL-1R genes alone explain an astounding ~83.5% of overall variance in microbiome richness across coral genera in our data. We further find that across 40 coral genera with both microbiome and disease data available, disease susceptibility doesn't significantly correlate with microbiome richness. Instead, ecological dominance of the most abundant microbial taxon increased overall disease susceptibility, especially in corals with more γ - than α - proteobacteria. This trend was driven by a correlation between the relative abundance of the bacterium *Endozoicomonas* and disease-susceptibility. This connection was especially strong in corals with a weedy (ruderal) life-history strategy. If *Endozoicomonas* is associated with disease susceptibility, why is it so common in corals? To test if this might be due to symbiotically driven growth/defense tradeoffs, we compared coral growth rates from the Coral Traits Database against *Endozoicomonas* abundance across coral diversity and found a strong correlation. We have shown in past research that *Endozoicomonas* shows stronger evidence of co-evolution with corals than many other tissue-associated microbes. If it does mediate growth/defense tradeoffs, that would be consistent with theory predicting that co-evolution is required for metabolic but not defensive mutualism. Overall, these results show how comparative biology can help reveal the evolutionary interplay between animal immunity, microbial symbiosis, and life-history strategy.

Keywords: coral microbiome, innate immunity, coral disease, *Endozoicomonas*



Yuan-Bin Cheng

Professor / Department Chair

Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Taiwan

Education

Ph.D. 2002–2007 Marine Biotechnology and Resources, Sun Yat-sen University
B.Sc. 1997–2001 Chemistry, Kaohsiung medicinal University

Professional Experience

Professor 2012–2020 Graduate Institute of Natural Products, KMU
Post doctor 2012 Agricultural Biotechnology Research Center, Academia Sinica
Post doctor 2010-2011 Scripps Institution of Oceanography, UCSD
Post doctor 2008-2010 Department of Pharmacy, NTU

Research Interests

1. Natural Product Chemistry & Structure Determination of Organic Compounds
2. Chromatography & Biosynthetic Pathway of Natural Products
3. Analysis of Bioactive Components

Natural Product Research on Zoanthid and Marine Microorganism

Abstract

Marine invertebrates are important sources of bioactive natural products with unique carbon skeletons. Natural Products derived from zoanthids demonstrate anticancer, antiviral, anti-neuroinflammation, and anti-osteoporosis activities. According to those findings, zoanthids are considered to have many medicinal properties and health benefits. Our study focuses on natural product identification and bioactivity evaluation of Taiwanese indigenous zoanthids. In the chemical investigation of the genus *Zoanthus*, two novels, 52 new and eight known zoanthamine-type alkaloids were isolated and identified. In the research of the genus *Palythoa*, eight new and 29 known secondary metabolites were obtained. The structures of all isolated components were elucidated by spectroscopic data (IR, MS, NMR, and UV), especially 2D NMR analyses (COSY, HMBC, HSQC, and NOESY). The absolute configuration of a few new compounds was further confirmed by an X-ray single crystallographic analysis using a mirror Cu-K α radiation. With respect to bioactivity, the antiviral, anti-inflammatory, and antimetastatic activities of isolated compounds were evaluated. In addition, the structure-activity relationships of the isolated marine natural products are discussed.

The marine microorganism was regarded as an alternative source of lead compounds because numerous reports stated marine microorganism produces unique metabolites with diverse bioactivities. Our latest natural product investigation focused on endophytes from marine macroalgae. A series of azaphilones were isolated from the algae-derived fungus *Penicillium sclerotiorum*. Those polyketide metabolites were evaluated for cytotoxic, anti-inflammatory, and anti-fibrosis activities. 8 α -*epi*-Hypocrellone A showed selective toxicity toward neuroblastoma cell line SH-SY5Y and inhibited the TNF- α -induced NF κ B phosphorylation but did not change the NF κ B activity. 8 α -*epi*-eupenicilazaphilone C and sclerotiorin respectively promoted and inhibited SMAD-mediated transcriptional activities stimulated by TGF- β . Our current findings showed that azaphilones could be a new target for anti-inflammatory research.



Apple Pui Yi Chui

Research Assistant Professor / Lecturer

School of Life Sciences, The Chinese University of Hong Kong

Education

| | | |
|------|---------|--|
| 2016 | Ph.D. | The Chinese University of Hong Kong |
| 2011 | M.Phil. | The Chinese University of Hong Kong |
| 2008 | B.Sc. | Hong Kong University of Science and Technology |

Professional Experience

| | |
|--------------|---|
| 2021–present | CUHK Jockey Club Museum of Climate Change Expert Committee |
| 2021–present | Education and Conservation Committee, Ocean Park Hong Kong |
| 2021–present | Environmental Campaign Committee – Government Publicity Working Group |
| 2021–present | Sustainable Fisheries Development Fund Advisory Committee, Government Agriculture, Fisheries and Conservation Department (AFCD) |
| 2020–present | Marine Fish Scholarship Fund Advisory Committee, AFCD |
| 2019–present | Country and Marine Parks Board Member, AFCD |
| 2019–present | PEW Marine Fellow |
| 2017–present | State Key Laboratory in Marine Pollution |

Research Interests

Reproductive and larval biology of corals; Population and community ecology of corals; Coral restoration

Hong Kong Coral Communities: Status, Threats, and Conservation.

Abstract

Hong Kong, located in southern China, supports extensive coral communities, with a high coral diversity of at least 84 scleractinian coral species in 28 genera recorded. Yet there are also pressures from coastal development, eutrophication, overfishing, etc. Tolo Harbour and Channel in North-eastern Hong Kong, which used to support high coverage of corals until the 1980s, were severely affected by extensive pollution impacts. Recent surveys showed that, fifteen years after the progressive improvement of water quality inside Tolo Harbour and Channel, coral recovery is very slow. While the majority of the existing restoration protocols are focused on reefs, marginal non-reefal coral communities have their own limitations which make restoration even more challenging. Coral habitat restoration is still in its infancy in Hong Kong and mainland China, most coral restoration studies have used asexual fragmentation of adult colonies in combination with various nursery techniques. Sexual propagation approach has been adopted in many localities around the world with different degrees of success but has never been tried in Hong Kong. With our first laboratory-bred and successful outplanted corals in Hong Kong being sexually mature in the wild, this shows that the application of this technique in Hong Kong is feasible. This talk will be focusing on Hong Kong coral communities: status, threats, and challenges in restoration.



Vianney Denis

Associate Professor

Institute of Oceanography, National Taiwan University, Taiwan

Education

- 2006-10 Ph.D. in Marine Ecology, University of Réunion Island, France
- 2004-05 M.Sc. in Biological Oceanology and Marine Environment, Pierre & Marie Curie University, Paris 6, France
- 2003-04 Maîtrise (1st yr Master equivalent) in Populations and Ecosystems, University of Sciences and Technologies, Lille, France
- 2002-03 B.Sc. in Organisms and Populations Biology, University of Sciences and Technologies, Lille, France

Professional Experience

- 2015-2020 Assistant Professor, Institute of Oceanography, National Taiwan University, Taiwan
- 2014-2015 Post-doctoral Researcher, National Science Council, Taiwan
- 2011-2014 Post-doctoral Researcher, National Science Council, Taiwan
- 2009-2010 Temporary Teacher and Researcher, University of Réunion Island, France

Research Interests

Coral reefs, Ecosystem resilience, Functional ecology, Acclimatization and adaption capacities, Anthropogenic disturbance, Environmental changes

Ecological Relevance of Mesophotic Marine Animal Forests in Taiwan: Insights and Prospects

Denis V¹, De Palmas S¹, Lin YV¹

¹ Institute of Oceanography, National Taiwan University, Taipei 10617, Taiwan

Contact: vianneydenis@ntu.edu.tw

Abstract

Mesophotic Marine Animal Forests (MMAFs) are ecosystems dominated by benthic suspension feeders that form three-dimensional habitats in the ocean's twilight zone. They often constitute local hotspots of diversity and host original sets of ecosystem functions and services that motivate research for their role in mitigating the effects of climate change. Despite a recent surge of interest in Taiwanese mesophotic habitats, MMAFs remain largely unexplored and misunderstood despite they could vastly surpass their shallow counterparts in terms of representativeness around the island. This presentation will go through the current knowledge of MMAFs in Taiwan and highlight recent insights from these ecosystems to the local diversity and recovery of adjacent communities. From deep thoughts may raise opportunities in marine conservation, yet most have to be discovered on Taiwanese MMAFs in terms of diversity, distribution, and functioning. Research on these ecosystems may be actively encouraged by the prospects MMAFs could represent towards achieving Sustainable Development Goals (SDG) locally and globally.



Sarah Samadi

Professor

Institut de Systématique, Évolution, Biodiversité, Muséum National d'Histoire Naturelle, Sorbonne Université, EPHE, Université des Antilles, France

Research Interests

The common background of all her scientific activities is the analysis of the conceptual grounds of systematics and evolutionary biology. Her present empirical projects are mainly in the fields of species delimitations and of speciation processes. Most of her projects are focusing on organisms from poorly known environments (mainly deep-sea environments, notably seamounts and organic remains sunken on the deep-sea floor) and are developed in the methodological framework of “Integrative Taxonomy”, in which methods in phylogenetics, population genetics and ecology are combined.

How Physical Sampling, Omics and Imaging Combine to Advance in the Exploration of the Deep-sea Frontier

Abstract

It is often put forward that the deep-sea realm is the last great frontier on earth and that technological advances will allow to pass it. I will present some examples that illustrate how physical sampling, omics, and imaging interplay in advancing in the exploration of the biodiversity of the deep-sea. Based on these examples, I will present what I feel are the main challenges in the exploration of the deep-sea realm both from the academic side and from the societal side.



Keiichi Matsuura

Researcher / Curator Emeritus

Fish Division, Department of Zoology, National Museum of Nature and Science, 4-1-1 Amakubo, Tsukuba, Ibaraki 305-0005, Japan

Education

1978: Doctor of Scientific Fisheries, Hokkaido University, Hokkaido, Japan

1973: Master of Scientific Fisheries, Hokkaido University, Hokkaido, Japan

1971: Bachelor of Scientific Fisheries, Tokyo University of Fisheries, Tokyo, Japan

Professional Experience

April 2013–present: Curator Emeritus

April 2011–March 2013: Director of Department of Zoology, National Museum of Nature and Science

July 2006–March 2011: Collection Director, National Museum of Nature and Science (the name of the museum changed in April 2007)

1995–June 2006: Chief Curator, National Science Museum

1988–1994: Senior Curator, National Science Museum

1979–1987: Curator, National Science Museum

Other Positions

2017–present: Honorary Member of Ichthyological Society of Japan

2012–present: Chair of Scientific Committee of GBIF Japan

2010 : Bleeker Awards (Systematcis)

2008–present: Honorary Foreign Member of American Society of Ichthyologists and Herpetologists

2007–2010: GBIF 1st Vice Chair

2004–2005: President-elect of the Ichthyological Society of Japan

2004–2005: President of the Union of Japanese Societies for Systematic Biology

2002–2003: Vice president of the Union of Japanese Societies for Systematic Biology

2002–2003: President of the Ichthyological Society of Japan

2000–2001: President-elect of the Ichthyological Society of Japan

1995–present: International Steering Committee Member, Indo-Pacific Fish Conference

1992–1997: Editor-in-chief, Ichthyological Research

1981–1982: Secretary, Ichthyological Society of Japan

Development of Ichthyology in Japan and Fish Collections

Abstract

Although Japan is one of the smallest countries in the world, the Japanese Archipelago extends for 3000 km from north to south and is enriched with diversified aquatic environments such as coral reefs and ice-covered seas. The diverse aquatic environments resulted in a great diversity of fishes in Japan, reaching around 4600 species (about 12% of the total number of fish species of the world). The Japanese people have been interested in fishes and started natural history studies of fishes from late 17th century, but all fishes published in old Japanese literature were given only Japanese names without scientific names, making it impossible for the Japanese authors to acquire the authorships of the fish species. In mid-19th century, more than 300 Japanese fishes were reported with scientific names by Temminck and Schlegel based on fishes collected by Siebold. This was the first review of fishes of Japan, making a base of studies on fishes of Japan for succeeding ichthyologists.

After Tokugawa Shogunate was defeated by royalists in 1867, the new government started introducing modern science to Japan from European countries and the USA. Ichthyology was also introduced from western countries and developed by many Japanese ichthyologists, but Shigeo Tanaka (Imperial University of Tokyo) stood out as the father of ichthyology in Japan. Following Tanaka, Kiyomatsu Matsubara (Kyoto University) appeared as another giant in Japanese ichthyology, making great contribution to systematic studies on fishes. After World War II ichthyological studies were developed by Matsubara and his students in many universities. This resulted not only in developments of ichthyology but also fish collections in Japan. In 1968 Japanese ichthyologists established the Ichthyological Society of Japan, which has been publishing the societies' journals and helping developments of ichthyology in Japan.

As stated above ichthyology in Japan has been developing with collection building in many institutions after World War II. In the late 1980s, ichthyologists in natural history museums and universities in Japan started computerization of data of fish collections, making great contribution to development of ichthyology. In addition to specimen databases, many underwater photographs of fishes have been collected through help of SQUA divers and digitized to make an image database of fishes (FishPix) under the joint force of the National Museum of Nature and Science and the Kanagawa Prefectural Museum of Natural History. In FishPix more than 150, 000 fish images are now available for ichthyological studies. Using collection databases and FishPix, shallow water fishes along the Kuroshio Current were studied by a team of ichthyologists from natural history museums and universities in the 2010s. Using large data of FishPix and collection databases, the joint force of ichthyologists clearly showed that the Kuroshio Current makes an invisible barrier in the sea for shallow water fishes of southern Japan, making it impossible for them to go across the Kuroshio Current.



Tin-Yam Chan

Professor

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

Education

Ph.D. (1992): Graduate School of Fisheries, National Taiwan Ocean University, Keelung, Taiwan

Professional Experience

2018-2021 Director, Centre of Excellence for the Oceans, National Taiwan Ocean University, Keelung, Taiwan

2012-2014 Program Director, Biodiversity section, Ministry of Science and Technology, Taiwan

2003-2006 Head of the Institute of Marine Biology, National Taiwan Ocean University, Keelung, Taiwan

Research Interests

Crustacea Decapoda, Taxonomy and Systematic, Deep-sea Biodiversity.

Participated in marine biodiversity expeditions in Taiwan, Philippines, Indonesia, Okinawa, New Caledonia, Vanuatu, Papua New Guinea, Madagascar, Mozambique, Antarctica.

More than 300 days at sea in research cruises, with half being the chief scientist on board.

Collecting Deep-sea Megabenthos in Taiwan

Abstract

Although Taiwan has high marine biodiversity and almost half of the coasts belong to deep-sea areas, previous surveys on the Taiwan deep-sea fauna was restricted to the catches of deep-sea commercial trawlers down to a depth of 500 m. Since the year 2000, extensive collectings of deep-sea megabenthos in Taiwanese waters have been conducted by using local research vessels and trawling gears introduced from France and Japan. The deepest megabenthos collected so far off Taiwan is from 5,314 m deep. A very high biodiversity of deep-sea fauna has been discovered from Taiwan. This talk presents the development and prospect of deep-sea megabenthos collecting in Taiwan.



Chin-Chang Hung

Professor / Dean

Department of Oceanography, College of Marine Sciences,
National Sun Yat-sen University, Taiwan

Education

Ph.D. (1999): Chemical Oceanography, Old Dominion University, Virginia, USA.

Professional Experience

2017-current, Distinguished Professor, Department of Oceanography, NSUSU, Taiwan

2011-2017, Professor, Department of Oceanography, NSUSU, Taiwan

2010-2011, Professor, National Taiwan Ocean University, Taiwan

2006-2010, Associate Professor, National Taiwan Ocean University, Keelung, Taiwan

2005-2006, Associate Res. Scientist, Dept. of Marine Science, TAMUG, TX, USA

2002-2004, Assistant Res. Scientist, Dept. of Marine Science, TAMUG, TX, USA

2001, Visiting Research Scientist, International Arctic Research Center, University of Alaska
Fairbanks, Alaska, USA

1999-2002, Postdoctoral Research Associate, Dept. of Marine Science, Texas A & M University
at Galveston (TAMUG), TX, USA

Research Interests

His research interests are focused on marine carbon cycle, especially on carbon sequestration in oceans and their mechanisms affecting marine carbon sequestration causing by internal waves, mesoscale eddies typhoons, global warming, and extreme weather events via seagoing investigations and satellite observations. Additionally, Dr. Hung works on carbon capture and utilization by microalgae and macroalgae (seaweeds) using livestock and aquaculture wastewater. Moreover, Dr. Hung also studies smart shrimp aquaculture using in situ hydrographic sensors and underwater video system. Furthermore, he is currently interested in studying impacts of ocean acidification on survival rate, growth rate, nutrition composition of crustaceans mainly on tiger shrimp, white shrimp, crabs and spiny lobsters.

Marine Biological Carbon Pump

Abstract

The ocean absorbs CO₂ from the atmosphere mainly through physical and biological pumps. Among them, the physical pump refers to the process where CO₂ dissolved in seawater through sea-air exchange is transported to deep seas through thermohaline circulation. As a preface to our proposed solution to this problem, current carbon sequestration, we will quickly consider the chemistry and biology of oceanic waters. Marine phytoplankton convert inorganic carbon to organic carbon via photosynthesis, allowing more atmospheric CO₂ to dissolve in seawater. The resultant flux of particulate organic carbon (POC) from the ocean's euphotic zone to depth, called the "biological carbon pump" (POC flux), is therefore one of the main controls on CO₂ partial pressure in the atmosphere. The export of POC transfers anthropogenic CO₂ into the ocean interior and provides energy to the ocean food web. Currently, the global POC flux ranged from 5-20 GtC y⁻¹ based on a few *in situ* measurements and biogeochemical models. In this talk, I will present: (1) what is biological carbon pump, (2) explain possible factors affecting discrepancy among different methods, (3) importance of biological carbon pump.

POSTER PRESENTATIONS

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Probing Anti-Leukemic Metabolites from Marine-Derived *Streptomyces* sp. LY1209

Lo-Yun Chen ¹, You-Ying Chen ², Bo-Rong Peng ³, Yu-Cheng Chen ⁴, Kuei-Hung Lai ^{1,5,6,*}

¹ Graduate Institute of Pharmacognosy, College of Pharmacy, Taipei Medical University, Taipei 11031, Taiwan

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

³ National Museum of Marine Biology & Aquarium, Pingtung 94450, Taiwan

⁴ Sepsis Research Center, Research Center of Tropical Medicine and Infectious Disease, Graduate Institute of Medicine, School of Medicine, Kaohsiung Medical University, Kaohsiung 80708, Taiwan

⁵ Ph.D. Program in Clinical Drug Development of Herbal Medicine, College of Pharmacy, Taipei Medical University, Taipei 11031, Taiwan

⁶ Traditional Herbal Medicine Research Center, Taipei Medical University Hospital, Taipei 11031, Taiwan

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Abstract

The unmet need for specific anti-leukemic agents for the treatment of acute lymphoblastic leukemia led us to screen a variety of marine-derived bacteria. The fermentation broth extract of *Streptomyces* sp. LY1209 exhibited the most potent anti-proliferative effect against Molt 4 leukemia cells. A chromatographic anti-proliferative profiling approach was applied to characterize the metabolites with bioactive potential. Among all the metabolites, the major anti-leukemic constituents were staurosporine and a series of diketopiperazines (DKPs), including one novel and two known DKPs identified from nature for the first time. The structures of these compounds were identified using extensive spectroscopic analysis. The anti-proliferative potential of these metabolites against the Molt 4 cancer cell line was also determined. According to the in silico analysis utilizing a chemical global positioning system for natural products (ChemGPS-NP), it was suggested that these DKPs are potential anti-microtubule and alkylating agents, while staurosporine was proposed to be a tyrosine kinase inhibitor. Our findings not only identified a series of anti-proliferative metabolites, but also suggested a strategic workflow for the future discovery of natural product drug leads.

Keywords: *Streptomyces* sp. LY1209; chromatographic bioassay profile; staurosporine; diketopiperazines

Natural spawning, embryonic and larval development of common ponyfish *Leiognathus equulus* (Forsskål, 1775) in captivity

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Abstract

The common ponyfish *Leiognathus equulus* is one of the economic aquaculture species in Taiwan. To date, few published reports have qualitatively assessed the captive spawning, embryonic and larval development of *L. equulus*. Natural spawning of *L. equulus* in captivity from 1 January 2020 to 31 December 2020 was described. During one year spawning period, the 80 broodstocks (♀ : ♂ = 1:1) produced 121 times and spawned numbers range was 992 – 277,760 eggs (average 25371.8 ± 3267.6 eggs). The average fertilization and hatching rate were $97.0 \pm 0.8\%$ and $93.3 \pm 1.2\%$, respectively. The fertilized eggs, with a mean diameter of 0.67 ± 0.02 mm, were spherical, transparent, and buoyant. Embryonic development lasted 20 h 59 min at $28.22 \pm 0.33^\circ\text{C}$. Newly hatched larvae were 1.57 ± 0.03 mm in total length (LT) and had an oil globule in the posterior area of the yolk sac. At 15 dph (days post hatch), the larvae measured 4.81 ± 0.06 mm LT, the dorsal fin rays III /15, anal fin rays II /12 and caudal fin rays 16. At 30 dph, the juveniles measured 11.96 ± 0.22 mm LT, the overall adult number of fin spines and soft rays was complete: dorsal fin rays VIII /18, anal rays III/14, pectoral fin rays 19-20 and caudal fin rays 16-18. A statistical model for the growth of the larvae and juveniles is $Y = 2.8650 - 0.1946X + 0.0231X^2 - 0.0002X^3$, where Y is the mean LT (mm) and X represents dph, which explained 96.3% of variation in growth ($R^2 = 0.963$, $n = 297$, $p < 0.001$).

Keywords: natural spawning, early development, *Leiognathus equulus*

Effect of feeding concentration and light intensity on the linear growth and color of the scleractinian coral *Pocillopora acuta*

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Abstract

Reef-building corals utilize autotrophic nutrients from photosynthetic endosymbionts (Symbiodiniaceae), as well the heterotrophic nutrients via feeding to maintain their metabolic needs. Previous studies indicated that feeding resulted in thicker tissues and those fragments would exhibited greater thermal tolerance. However, insufficient irradiance would led to discoloration (bleaching). This study aimed to investigate the influence of feeding regimes and light environments on linear growth rate and color performance in scleractinian coral. *Pocillopora acuta* were used as our target species. Every fragments were under a 12h light: 12h dark cycle and fed in a separated feeding tank once a week. Four treatment groups with two food concentrations of 37.3 and 21.6 brine shrimp inds·L⁻¹ accomplished with two light intensities of 384.6 and 142.3 μmol·m⁻²·s⁻¹ were demonstrated. All cultured corals survived the 154 day-treatment and the growth rate (linear extension) per year were 3.9-5.0cm. The physiological response variables-linear growth rate was significantly high in the high feeding concentration group, however no difference between light treatments. Color performance with various feeding concentrations and light intensities showed the similar increasing trend. This study showed the positive effect with feeding and sufficient irradiance environment and could be the reference for further coral conservation research.

Keywords: *Pocillopora acuta*, feeding regimes, light intensity, linear growth rate

Chlorophyll a-binding proteins are glycoproteins maintain symbiosis between Symbiodiniaceae and sea anemones

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Abstract

The establishment and maintenance of symbiotic relationships between cnidarians and symbiotic algae has been uncertain, and in recent years, glycan-lectin interactions have been recognized as critical, but our understanding of the effects of cell surface glycome composition on symbiosis establishment remains limited. Therefore, we used the model species *Aiptasia* (*Exaiptasia pallida*) and its homologous Symbiodiniaceae (*Breviolum minutum*) to investigate their symbiotic relationship. The Symbiodiniaceae used in this experiment were all from sea anemones. We extracted symbiotic-Symbiodiniaceae from polyp and used menthol to obtain non-symbiotic Symbiodiniaceae. First, we investigated the differences between symbiotic and non-symbiotic Symbiodiniaceae in terms of glycan and proteins. After analyzing 70 lectins by lectin array, we found 32 lectins which had significant differences (p value < 0.05) between symbiotic and non-symbiotic Symbiodiniaceae, and most belong to mannose (Man) and N-acetyllactosamine (LacNAc). Protein identification revealed 13 significant differences between symbiotic and non-symbiotic Symbiodiniaceae, and four of them were associated with chlorophyll a binding proteins. Furthermore, we wanted to clarify the correlation between the different glycan and proteins of symbiotic and non-symbiotic Symbiodiniaceae. We used wheat germ agglutinin (WGA) and Concanavalin A (Con A) to isolate glycoprotein. Five glycoproteins were isolated by wheat germ agglutinin, and two of which were associated with chlorophyll a-binding white. Nine glycoproteins were isolated from Concanavalin A, and one of which was associated with chlorophyll a-binding protein. Finally, we suggest that chlorophyll a-binding proteins may play an important role in the symbiotic relationship between the model species sea anemone and Symbiodiniaceae.

Keywords: symbiodiniacea, glycan profiles, protein, chlorophyll a-binding protein-related

The effects of cryopreservation on the cell ultrastructure in aquatic organisms

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Abstract

Cryopreservation has advanced since its inception in the 1950s. Different freezing techniques emerged and have advantages, but the researcher's technical signature is key in deriving a sound conclusion. Thus, this study provides an update on the current state of cryopreservation coupled with ultrastructural observations. Because sperm are less sensitive to freezing, have a high fluidity in the membrane, and have a low water content, they remain the most commonly examined specimen among the samples analyzed (i.e., oocytes, embryos, larvae, and algae from aquatic species). Cryopreservation research has resulted in techniques that may be used for any species. However, avoiding cryoinjury due to intracellular ice production remains a species-specific problem. More in-depth examinations of ultrastructural findings can help researchers better understand the causes behind poor cryopreservation responses. As a result, improving current cryopreservation procedures requires optimizing protocols and enhancing the survival rates of thawed samples. Nevertheless, investigations into the effects of freezing on organisms' ultrastructure remain limited, especially regarding aquatic organisms.

Keywords: cell function, freezing, ultrastructure, fish, invertebrates, TEM

Reproductive biology and histological studies of the marine angelfishes (Pomacanthidae: *Pomacanthus semicirculatus*, *Pomacanthus imperator* and *Apolemichthys trimaculatus*) in the waters of Taiwan

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Abstract

Pomacanthidae are common coral reef fishes in the world and one of the most popular marine ornamental fish. Because of its social organization is quite diverse, reproductive strategies are different, and different sexual patterns. However, knowledge of the reproductive biology of Pomacanthidae is limited. In this study, we described the reproductive biology of three species of angelfishes, such as the semicircle angelfish *Pomacanthus semicirculatus*, the emperor angelfish *Pomacanthus imperator* and the threespot angelfish *Apolemichthys trimaculatus* in Taiwan. The sampled specimens were collected from the naturally dead broodstock in captive environment. The total body length (TL), standard body length (SL), body weight (BW) and gonadal weight (GW) were recorded for each specimen. Sex and reproductive condition were determined for each individual based on histological evaluation. The gonad were classified as developing, spawning, spent and resting stage. The results showed that the gonadosomatic indices (GSI) of three species of angelfishes were low in winter, the highest GSI values in spring and descended in autumn; which suggested that spring to autumn were the probable reproductive season. *P. semicirculatus* and *P. imperator* had obvious sexual dimorphism. Size frequency distribution of three species of angelfishes also showed transitional body length between the males and females, and males were larger than females. The gonadal histological examination showed proliferating spermatocytes in the ovaries of females or remnants of oocytes in the testes of males, which indicated that the three species of angelfishes are protogynous hermaphroditism. Oocytes of all stages were present at same time, which indicated that *P. semicirculatus* and *A. trimaculatus* may be asynchronous spawner. The reproductive parameters obtained from this study provide some baseline information for management of these species.

Keywords: Pomacanthidae, reproductive biology, histology, sex change, hermaphroditism

Anti-inflammatory effects of briarane-type diterpenoids obtained from an octocoral *Briareum stechei* (Kükenthal, 1908)

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Abstract

Briareum stechei is proven to be a rich source of 3,8-cyclized cembranoids (briarane) with a bicyclo[8.4.0] carbon core. In the present study, three previously unreported briaranes, briarenols AI (1) and BI (2), along with known compound brianolide (3), were isolated and characterized through spectroscopic analysis, and the absolute configuration of 3 was corroborated by a single-crystal X-ray diffraction analysis. Currently, high-throughput screening methods for drug discovery rely on cell-based experiments or on animal models. Drug screening use mammalian system such as cell culture or mice model are relative expensive and time consuming.

In contrast, the fish, *Danio rerio* are ideal model for preclinical toxicity screening during the drug development. In this study, we investigated the protective effects of 3 on LPS-stimulated oxidative stress and lipid peroxidation in zebrafish embryos. The results showed that compound 3 significantly reduced the oxidative stress, lipid peroxidation and cell death both in (LPS)-induced RAW264.7 and zebrafish *in vivo* model. In this study, our results unveil a novel anti-inflammation effect of 3 through anti-oxidative stress.

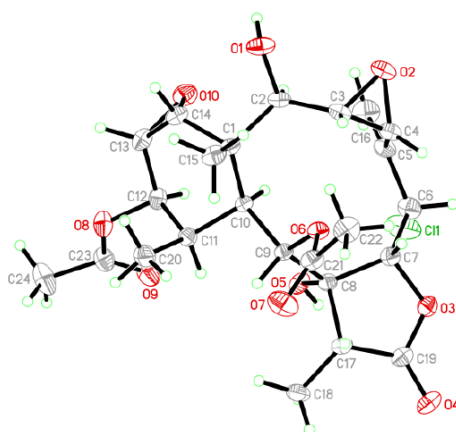


Figure 1. ORTEP reveals the structure of brianolide (3).

Keywords: briarane-type, diterpenoids, anti-inflammatory

The chemical constituents of the sponge *Lendenfeldia* species

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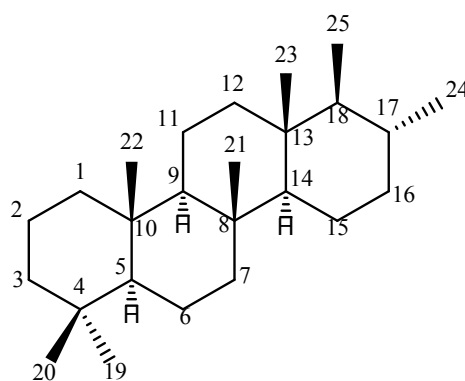
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Abstract

In this study, we isolated several scalarane sesterterpenoids from the marine sponge *Lendenfeldia* sp. which collected off the coast of Southern Taiwan in 2019. These compounds include one new scalarane, named 17,22-dihydroxy-15-en-24-methyldeoxoscalarin (**1**) along with three known compounds lendenfeldarane A (**2**), lendenfeldarane J (**3**) and 24-methyl-12,24,25-trioxoscalar-16-en-22-oic acid (**4**). All these compounds were established by spectroscopic analysis and the single-crystal X-ray diffraction analysis. In the literature, scalaranes shown many bioactivities like: antitubercular, antimicrobial, neurotrophic activity and cytotoxic. Only a few research focuses on anti-inflammatory. So that, the cytotoxic and anti-inflammatory activity assay of **1–4** will be performed in the future works.



scalarane skeleton

Keywords: *Lendenfeldia*, scalaranes, anti-inflammatory

Chemical constituents screening of the marine sponge *Neopetrosia proxima* and the octocoral *Briareum stechei*

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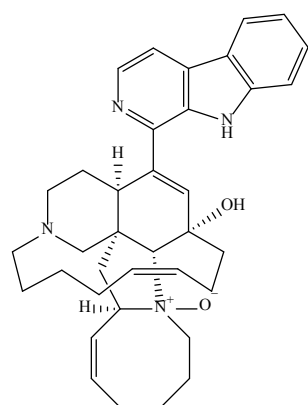
¹ Department of Marine Biotechnology and Resources, National Sun Yat-sen University, Kaohsiung 804201, Taiwan

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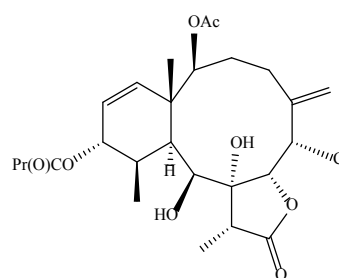
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Abstract

Chemical constituents screening of the marine sponge *Neopetrosia proxima* led to the isolation of six macrocyclic alkaloids, including a novel manzamine, manzamine A 27-*N*-oxide (**1**), as well as six known analogues, manzamines A, E, and F (**2–4**), 8-hydroxymanzamine A (**5**), and 8-hydroxymanzamine A hydrochloride (**6**). The structures of **1–6** were determined based on spectroscopic data and **1** was proved to be the first manzamine alkaloid possessing the 27-*N*-oxide moiety. The absolute configurations of **1** and **6** were established using single X-ray diffraction analysis. Compounds **1–3** showed cytotoxicity towards a panel of tumor cells. Furthermore, 12 briarane-type diterpenoids were isolated from the octocoral *Briareum stechei*, including five new briaranes, briarenols U (**7**) and V (**8**), briastecholides A–C (**9–11**), together with seven known metabolites, briaexcavatolide E (**12**), brianolide (**13**), briarenol R (**14**), briarenolide S (**15**), solenolides B, C, and E (**16–18**). The stereochemistry of solenolide B (**16**) was revised, and the absolute configurations of **13** and **17** were determined by a single-crystal X-ray diffraction analysis. Briaranes **7–18** were evaluated for their *in vitro* inflammatory activity in LPS-induced RAW264.7 macrophage cells by suppressing the expression of iNOS and COX-2 proteins.



Manzamine A 27-*N*-oxide (**1**)



Briarenol U (**7**)

Keywords: *Neopetrosia proxima*, alkaloid, manzamine, *Briareum stechei*, terpenoid, briarane

New 8,17-epoxybriaranes from octocoral *Briareum stechei* (Kükenthal, 1908)

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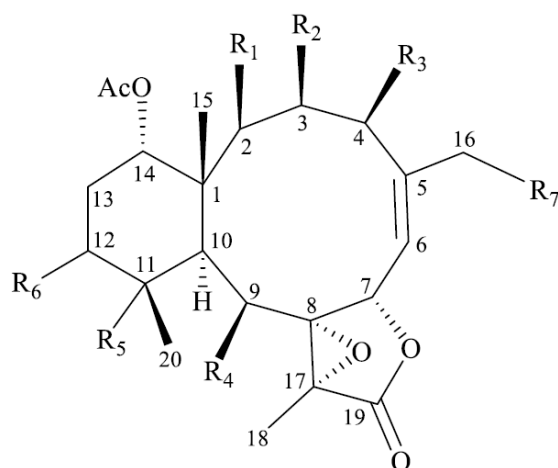
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Abstract

Three 8,17-epoxybriaranes, including a known metabolite, excavatolide M (**1**), as well as two new compounds, briastecholides K (**2**) and L (**3**), have been isolated from octocoral *Briareum stechei* collected off the waters of Taiwan. The absolute configuration of **1** was determined by single-crystal X-ray diffraction analysis for the first time in this study and the structures, including the absolute configuration of briaranes **2** and **3** were established on the basis of spectroscopic analysis and compared with that of model compound **1**.



- 1:** R₁ = R₄ = OH, R₂ = OAc, R₃ = R₅ = R₇ = H, R₆ = β-OH
- 2:** R₁ = R₄ = OAc, R₂ = H, R₃ = R₅ = R₇ = OH, R₆ = α-OC(O)(CH₂)₂CH₃
- 3:** R₁ = R₄ = OAc, R₂ = H, R₃ = R₅ = R₇ = OH, R₆ = β-OAc
- 4:** R₁ = R₄ = OAc, R₂ = R₇ = H, R₃ = R₅ = OH, R₆ = α-OC(O)(CH₂)₂CH₃
- 5:** R₁ = R₄ = R₇ = OAc, R₂ = H, R₃ = R₅ = OH, R₆ = β-OH

Keywords: *Briareum stechei*, Briarane, Briastecholide, Excavatolide, X-ray

Two new eunicellin-based diterpenoid from soft coral *Cladiella conifera* (Tixier-Durivault, 1943)

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Abstract

Cladiella were found to be rich sources of eunicellin, an octocoral identified as *Cladiella conifera* was collected of Penghu Archipelago in Taiwan. Two eunicellin type diterpenoids, coniferains A and B (Figure 1), were isolated from *C. conifera*. The structures A and B were determined by extensive spectroscopic analysis. And the cytotoxic activity was test.

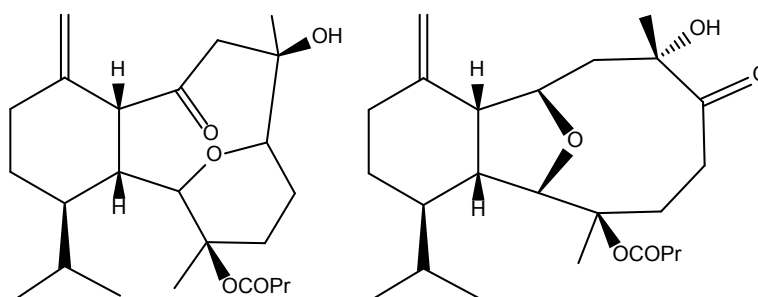


Figure 1. Coniferains A and B

Keyword: *Cladiella conifera*, eunicellin, cytotoxic

Ethyl (2*S*,4*S*)-1,4-anhydro-3-deoxypentitol-2-carboxylate, a new pentitol derivative from *Paralemnalia thyrsoides*

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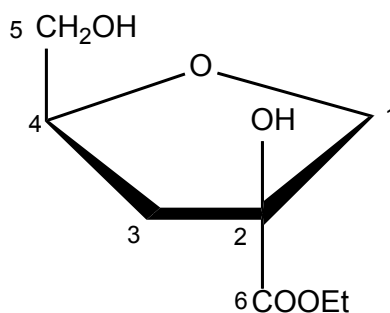
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Abstract

A chemical examination of *Paralemnalia thyrsoides* collected in the waters of Taiwan, led to the isolation of a new pentitol derivative, ethyl (2*S*,4*S*)-1,4-anhydro-3-deoxypentitol-2-carboxylate. The structure of this pentitol was established by spectroscopic analysis and its inhibitory effects on the generation of iNOS and COX-2 from RAW 264.7 stimulated by LPS were assessed.



Ethyl (2*S*,4*S*)-1,4-anhydro-3-deoxypentitol-2-carboxylate

Keywords: *Paralemnalia thyrsoides*, pentitol, furanoid, iNOS, COX-2

The isolation and structural elucidation of polyoxygenated steroids from the gorgonian *Isis hippuris*

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Abstract

Isis hippuris (sea bamboo) are widely distributed in the western Pacific area. In the literature, *I. hippuris* has investigated its secondary metabolites, such as polyoxygenated spiroketal steroids, polyoxygenated gorgosteroids, and suberosane-type sesquiterpenes. The marine natural product chemistry of *I. hippuris*, collected at Orchid Island (Lanyu), obtained various hippuristanols, including hippuristerone A (**1**), hippuristerone I (**2**), (22*S*)-3*α*-acetoxy-11*β*,18*α*-dihydroxy-24-methyl-18,20*β*;22,25-diepoxy-5*α*-furostane (**3**), and 3-acetyl-22-*epi*-hippurin-1 (**4**) in this study. The structure of isolated compounds **1–4** was identified by analyzing their spectroscopic spectra and the single-crystal X-ray diffraction analysis. The X-ray diffraction analysis of **2** and **3** is reported for the first time. The bioactivity assay of **1–4** will be performed on cytotoxic and anti-inflammatory activities.

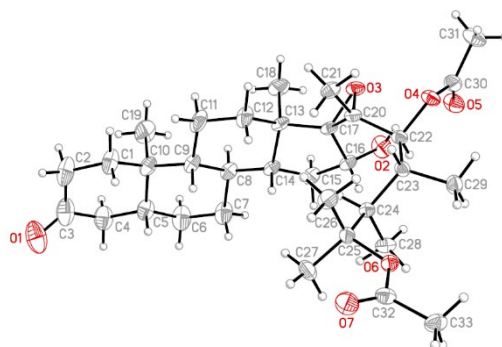


Figure 1. ORTEP reveals the structure of hippuristerone A (**1**).

Keywords: *Isis hippuris*, Sea bamboo, Steroid, X-ray

A novel bisepoxycebrene from an octocoral *Sinularia* sp.

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Abstract

The rich cebrane analogs have been demonstrated as the significant components of the octocorals *Sinularia* genus. In addition, these types of compounds have also been found to possess multiple and extensive bioactivities. Therefore, we analyzed the organic extract from an octocoral *Sinularia* sp. to identify interesting and meaningful signals in NMR analysis. A novel cebranoid, (1*R*,7*R*,8*R*,11*R*,12*R*)-7,8:11,12-bisepoxycebrene A (**1**), was isolated from an octocoral *Sinularia* sp. The structure of **1** was elucidated using spectroscopic methods. Furthermore, a single-crystal X-ray diffraction analysis determined the absolute configuration of **1**. However, compound **1** has no significant cytotoxic effect on HT-29 and HL-60 cancer cells (IC₅₀ > 20 μM) using the MTT method. We will explore more suitable pharmacological activities of **1** in the future.

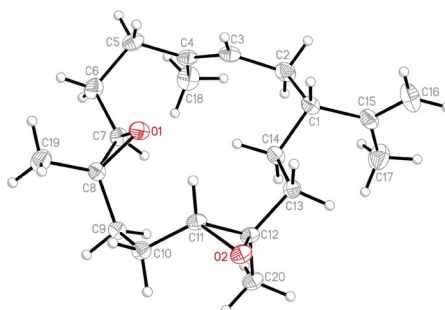


Figure 1. ORTEP revealing the structure of (1*R*,7*R*,8*R*,11*R*,12*R*)-7,8:11,12-bisepoxycebrene A (**1**).

Keywords: *Sinularia* sp., cebrane analogs, X-ray, MTT

Investigation of *Sarcodia suiae*-derived supercritical carbon dioxide extract for biofunctional skin care

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Abstract

Sarcodia suiae is a red macroalgae native to Taiwan. For this study, we used seawater that exchanges heat with LNG regasification terminals to culture *Sarcodia suiae*. We also used a supercritical carbon dioxide (scCO₂) system to extract materials from the dried powder of *Sarcodia suiae*. Later, in vitro testing revealed that the scCO₂ extract of *Sarcodia suiae* possesses anti-oxidant properties and could be effective at treating acne. Furthermore, the extract also induces growth of keratinocytes and follicle dermal papilla cells. We concluded that *Sarcodia suiae* scCO₂ extract can be used in cosmetic products. Currently we are producing *Sarcodia suiae* scCO₂ extract to supply industrial users.

Keywords: *Sarcodia suiae*, supercritical carbon dioxide, skin care

Chemical constituents and biological activity studies of formosan soft coral *Cespitularia hypotentaculata* in different growing seasons

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Abstract

In bioassays, we found that methanolic extracts of *Cespitularia hypotentaculata* before and after spawn both demonstrated significant anti-angiogenesis abilities in human endothelial progenitor cells. Angiogenesis represents an important marker for tumor metastasis. Meanwhile, the HPLC profile analytical results showed a variation of chemical constituents between soft corals in different growing seasons. At the present stage, I obtained 13 compounds, named cespitulactams A, C, and D (**1–3**), cespiphytin F (**4**), cespitaenin C (**5**), cespiphytin Q (**6**), cespitularin Q (**7**), cespiphytin L (**8**), flaccidoxide-13-acetate (**9**), taenialactam B (**10**), atractylenolactam (**11**), cespilamide D (**12**), and 3-*O*-acetyl-dilatanone (**13**).

Zoanthamine alkaloids from *Zoanthus vietnamensis*

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Abstract

A novel skeleton compound, zoanide A (**1**), together with seven new alkaloids, kuroshine L (**2**), kuroshine M (**3**), 1-keto-kuroshine A (**4**), 1-keto-11-dehydroxykuroshine A (**5**), 1-keto-zoanthenamine (**6**), 26-norzoanthenamine (**7**), 10-*epi*-1-keto-2-hydroxykuroshine K (**8**), and nine known alkaloids, kuroshine E (**9**), 18-*epi*-kuroshine A (**10**), kuroshine A (**11**), zoanthenamine (**12**), zoanthamine (**13**), 26-norzoanthamine (**14**), 28-deoxyzoanthenamine (**15**), kuroshine H (**16**), and kuroshine J (**17**) were isolated from the *Z. vietnamensis*. These secondary metabolites (**1–17**) were identified by NMR, MS spectroscopic data, and the single-crystal X-ray diffraction analyses were used to determine the absolute configuration of **1**. In addition, the biosynthetic route of zoanide A (**1**) from precursor 28-deoxyzoanthenamine (**15**) was proposed. The neuroprotective potential of four major compounds **12–15** against paclitaxel-induced neurotoxicity was evaluated.

Chemical constituents and bioactivities from the marine-derived fungus *Penicillium sclerotiorum*

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Abstract

Recently, many papers reported that endophytes isolated from marine materials are potential sources of novel natural products. Therefore, screening out the fungus and isolating their ingredients as lead drugs is an important issue. A series of azaphilones were identified from the fungus *P. sclerotiorum*. Several azaphilones showed diverse bioactivities, including anti-inflammatory, antimicrobial, and cytotoxic activities. Angiogenesis is the formation of new blood vessels for the growth and spread of tumors. Tumors can cause this blood supply to form by giving off chemical signals, including vascular endothelial growth factor (VEGF) family members that stimulate angiogenesis. Angiogenesis inhibitors are unique tumor-fighting agents because they block the growth of blood vessels that support tumor growth rather than the growth of tumor cells themselves. In this study, one new compound and ten known compounds were isolated from *P. sclerotium*, and the fractions showed an anti-angiogenesis effect.

Naturally inspired pyrone-derivatives efficiently prevents marine biofouling

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Abstract

The accumulation of microorganisms, and fouling organisms, such as barnacles, bryozoans and tubeworms on artificial surfaces causes can accelerate surface corrosion and increase ship weight and fuel consumption. Besides economic loss, biofouling causes environmental problems by spreading invasive species. Therefore, designing surfaces antifouling paint to prevent biofouling without environmental toxicology is critical to the viability of applications. In our previous study, we found that marine fungi *Trichoderma*-derived 6-pentyl-2*H*-pyran-2-one and its synthetic analogues showed significant inhibitory activity toward barnacle *A. amphitrite*, and the growth of marine biofouling bacteria. To further optimize the antifouling (AF) candidate, a series of pyrone analogues were modified on both R1 and R2 positions with functional groups such as, benzyl group, cyclopentane, bromide, and chloride, and then screened their AF potential toward marine biofouling species. All the modified analogues were screened their activity against both marine biofilm forming bacteria and, the barnacle cyprids. Obtained results showed that synthesized compounds A27, B2, C5, D2, F2, G2, G3, G4, and G6 exhibited a broad spectrum of bioactivities, such as antibarnacle settlement, antibiofilm formation and antimicrobial activities.

Keywords: natural pyrone, synthetic pyrones, antifouling agents

The analyzation and development of antibiotic components from *Vibrio* spp.

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Abstract

Vibrio, a genus of gram-negative bacteria, are commonly found in marine environment. We isolated a series of *Vibrio* bacteria from marine organisms and environment, such as sponges, soft corals, and marine sediments. Most of them showed more or less bioactivities, such as iron-chelating and antibacterial activities in the preliminary assays. We are interested in searching the new bioactive compounds from those *Vibrio* bacteria. Using the GNPS molecular spectral networking analysis as “de-replication strategy”, we found that several types of compounds in these *Vibrio* strains, including siderophores and pseudopeptides. Literature survey indicated that those pseudopeptides, andrimid and its analogues, showed clear anti-bacterial activity (Fredenhagen, A et al. 1987). In order to facilitate the species identification, we tried to build the phyloproteomic dendrogram of these *Vibrio* strains by MALDI biotyper program, which showed the similar cluster pattern as the phylogenetic tree of these *Vibrio* strains based on 16S rDNA sequencing analysis.

In advance, a series of pseudopeptides, andrimid and its analogues, were isolated from *Vibrio* strains *V. tubiashii* (DJW-05-1), *V. japonicus* (DJW-05-8), *V. fortis* (DJW-21-4). Among them, andrimid showed the inhibitory effects against pathogenic bacteria at MIC values of 2.5, 50, 39, and 10 µg/ml against *Escherichia coli*, *Acinetobacter baumannii*, *Salmonella typhimurium*, and *Staphylococcus aureus*, respectively. Due to the instability of pseudopeptides, thus, we tried to identify the amount of andrimid in the MeOH fraction by LC-MS, while the antibacterial activity of MeOH layer showed the similar trend as that of andrimid. These analytic results should be useful for the development of new antibiotic agent in the future.

Keywords: biotyper, pseudopeptides, antibacterial, *Vibrio* spp.

Study on the diversity and antimicrobial activity of bacteria in saline environments

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Abstract

A combination of culture-based and metagenomic approaches was used to characterize bacteria isolated from soil samples collected from three salt fields, Beimen, Chiku, and Jingzaijiao, at Tainan, Taiwan. A total of 449 halophilic/halotolerant bacteria were isolated, among which 54 isolates (12.0%) exhibited antimicrobial activity against at least one indicator microbe using agar block methods. Phylogenetic analysis of the 16S rDNA sequences indicated these isolates belong to the following nine bacterial genera: *Bacillus* (28), *Vibrio* (14), *Halomonas* (3), *Streptomyces* (2), *Gordonia* (1), *Virgibacillus* (1), *Pseudoalteromonas* (1), *Micrococcus* (1), and *Idiomarina* (1). Five isolates, namely G-B-SCA10-1-16, B-A-HV10-4, B-B-SCA3-1, C-A-BN3-1-1, B-A-BN3-9, and B-A-BN3-5-B, which have high antimicrobial activity were good candidates for further natural product isolation and characterization research. To understand the diversity of bacterial flora in soil collected from the salt fields, we also investigate soil samples by 16S rDNA tag pyrosequencing. A total of 793,149 sequences were obtained and clustered to 416 operational taxonomic units (OUTs; 97% sequence similarity). The bacterial communities in soil collected from the salt fields were assigned to 43 bacterial phyla and revealed abundant of phyla unclassified (47.0%), Bacteroidetes (19.6%), Patescibacteria (10.4%), and Tenericutes (6.3%). Our results demonstrate that halophilic/halotolerant bacteria could be a source of bacteria strains which have a great potential in discovery of usefully medical molecules.

Keywords: halophilic/halotolerant bacteria, salt field, secondary metabolites, next generation sequencing

Historical biogeography of Penaeidae (Crustacea: Decapoda): Evidence of Indo-West Pacific Origin

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Abstract

Penaeidae is the most economically important marine shrimp species. Its members are widespread throughout the world, with its highest species diversity centered in the Indo-West Pacific (IWP) region. We here provided an approximation to the dispersal and historical distribution of Penaeidae. The biogeographic history of 98 species and 26 penaeid genera was analysed through nuclear markers of NaK and PEPCK, and mtDNA of COI and 16S gene sequences and a time calibrated phylogenetic analyses using two outgroup species. The time-calibrated phylogenetic reconstruction enabled us to clarify the evolutionary history of Penaeidae and to infer past patterns of species distribution. Our results showed that Penaeidae is paraphyletic. The most recent common ancestor of Penaeidae is likely to occur in the IWP ca. 175 million years ago. A burst of species diversification likely took place during the late Cretaceous until middle Miocene. During this period, the area had undergone a series of paleogeographic, paleoclimatic and paleoecological events which likely played an important and essential role for the diversification and new adaptation of Penaeidae. The observed geographic distribution patterns in the family most likely point to the central IWP as the area of origin and diversification. This was followed by subsequent expansions likely occurred either westward across the Indian Ocean and eastward across the western Pacific Ocean, or both. Our results thus provide new support for S. Ekman's centre-of-origin hypothesis.

Keywords: biogeography, Penaeidae, shrimp, Indo-West Pacific, centre-of-origin hypothesis

The taxonomy and phylogeny of the superfamily Trichiuroidea (Teleostei: Scombriformes)

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Abstract

Trichiuroidea is a superfamily of acanthomorph fishes classified under the Scombriformes (Teleostei). A total of 72 species in 26 genera are currently recognized in this superfamily which comprises cutlassfishes from Trichiuridae and snake mackerels from Gempylidae. While prospective work on ecology and fisheries of this group of fishes is important for resource management and conservation, this requires a solid taxonomic basis. However, controversies still remain for phylogenetic hypothesis, taxonomic status, species-level diversity and morphological diagnosis of trichiuroids, even for species of high interest in fisheries (e.g., *Trichiurus* spp.). In this study, a comprehensive multi-nuclear gene phylogeny of the Trichiuroidea was newly reconstructed to firstly answer long-lasting questions regarding the placement of the Trichiuroidea within the monophyletic Scombriformes *sensu* Nelson et al. (2016), relationships within the superfamily and the monophyly of currently recognized genera. The phylogenetic result based on five nuclear gene sequences (*EGR1*, *EGR2B*, *EGR3*, *RH*, and *RAG1*) grouped Trichiuroidea together with five scombriform families (Caristiidae, Scombrolabracidae, Bramidae, Nomeidae and Scombridae). One of gempylid genus (*Lepidocybium*) was found to be the sister group of the Trichiuridae. Within the Trichiuroidea, most of the included genera were confirmed to be monophyletic. *Trichiurus* was found to be paraphyletic with respect to *Lepturacanthus*. These findings provided a basis for future revisions for the classification of trichiuroid taxa. To further test the species hypothesis and to explore the species-level diversity, a mitochondrial *COI* gene dataset with 687 samples was constructed for the species delimitation analyses through an integrated approach in taxonomy. A total of 56 putative species were finally determined. In several genera such as *Promethichthys*, *Rexea*, *Nesiarchus*, *Tentoriceps* and *Trichiurus*, hidden diversity was detected. For the examined *Trichiurus* species, I newly introduced the diagnostic characters that are likely to enhance the accuracy of species identification.

Keywords: Trichiuroidea, phylogeny, taxonomy, species delimitation

Antifungal activity produced by *Staphylococcus vitulinus* strain BF1 and its potential for biocontrol fungal *Fusarium solani*

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Abstract

We are interested the microbial compositions in shrimp ponds that could be an important impact factor on shrimp farming. We tried to isolate the marine microbes from the bloomed algae in the early stage of shrimp farming. In the isolation of marine microbes, we noticed an interesting interaction between a bacterium and a fungus, which were further identified as *Staphylococcus vitulinus* BF-1 and *Fusarium solani* BF-2 by 16S rRNA and ITS sequencing analysis, individually. *Fusarium* sp. has been reported as a pathogen that causes high mortality rate of shrimps in aquaculture, in which *F. solani* appears in the aquaculture due to overfeeding that could not be consumed by shrimp. It has been reported that only a few species of bacterium coccus is able to inhibit the growth of the fungus. *Staphylococcus* is one of endophytic bacteria that can use for biocontrolling phytopathogens in agriculture activities. Several *Staphylococcus* species were salinity-tolerance bacteria and inhabit in different ecological niches such as animals, plants, soil and water. To our knowledge, this is the first report of *Staphylococcus vitulinus* as biocontrol agents which might initiate a new generation of antifungal agents in aquaculture activities. In this poster, we would like to share our preliminary results about the antifungal substances of *S. vitulinus* BF1 based on molecular network and chromatographic analysis. The EA crude extract *S. vitulinus* BF1 can not inhibit when singly cultured but the antifungal activity from this bacterium appear when co-cultured together in same plate. *S. vitulinus* BF1 co-cultured bacterium part in Methanol layer showed a strong inhibitor the growth of *F.solani* BF2, but *n*-Hexane layer did not show it. Based on analysis of molecular-networking, the active fraction of MeOH layer may contain polypeptides compounds.

Keywords: antifungal, biocontrol, natural product, microbial, molecular network

The anti-inflammatory properties of culture coral extract alleviates DNCB-induced dermatitis-like lesion

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Abstract

Atopic dermatitis (AD) is a chronic inflammatory skin disease, that is associated with epidermal barrier dysfunction and cutaneous immune disorder. The clinical treatment methods of AD are complicated and limited. In the present study, we examined the effects of the anti-inflammatory properties of PT, a crude extract isolated from the culture-type soft coral, on a chemical-induced experimental AD model in mice. In an *in vitro* assay, the PT significantly attenuated the expressions of proinflammatory proteins in the lipopolysaccharide-stimulated murine macrophage cells. In animal experiments, we found that the PT alleviates 2,4-dinitrochlorobenzene (DNCB)-induced dermatitis lesions, serum IgE, and swelling of lymph and spleen in mice. From histopathological observations, it was found that the PT inhibits hyperplasia, spongiosis, hyperkeratosis, parakeratosis, and mast cells degranulation in the DNCB-stimulated skin tissues. The PT also modulates the expression of skin protective factors, including filaggrin, claudin-1, and arginase-1 proteins, in DNCB-induced AD. The present results support the fact that PT might benefit AD, and it is worthy to further investigate this aspect.

Keywords: atopic dermatitis, cultured coral, anti-inflammation, epidermal barrier, DNCB

Mitogenome architecture of *Selaroides leptolepis* and phylogenomic inferences on Carangidae populations

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Abstract

The Carangidae (Teleostei: Perciformes) is a diverse fish family that is comprised of more than 147 species distributed circumglobally. Carangids are highly valued in the marine capture fisheries industry and some species are known to constitute cryptic lineages. One taxon, the *Selaroides leptolepis*, was previously identified to exhibit a deep genetic structuring throughout its Tropical Western Pacific range. Two groups were found allopatrically distributed and further identified as Asian and Australian lineages. *S. leptolepis* is densest in the Southeast Asian waters where it is considered part of the local ichthyofauna. However, assessments from local fishing grounds reported decadal issues on overfishing and depletion of remaining wild stocks. Furthermore, comprehensive information on the molecular distinctness of these lineages remained limited, thus emerging a need for additional studies. Herein, we sequenced and annotated the mitochondrial genomes from the two lineages and performed family-level phylogenomics to understand the position of cryptic populations within Carangidae. Mitogenome assemblies yielded sizes of 16,560 and 16,562 bp for Asian and Australian lineages, respectively. Gene orders and composition were uniform comprising 13 protein-coding genes, 22 tRNAs, 2 rRNAs, and a control region. The comparison showed that the two groups were 882 bp or 5.59% different from each other – an intermediary between intraspecific and interspecific divergence values for Carangidae. Integrated phylogenomics using 60 carangid mitogenomes revealed the plausible existence of unknown geographical genetic structures within the family. This detected a trans-Pacific arrangement for *Caranx melampygus*, a Great Britain genetic structuring for *Trachurus trachurus*, and an Asian-Australian arrangements for *S. leptolepis* and *Seriola lalandi*. Oppositely, high genetic connectivity was also detected for the pan-Pacific *S. rivoliana*. This information is relevant in understanding the role of cryptic representatives in the evolution of fish families, more especially to those groups of high economic significance.

Keywords: Yellowstripe scad, mitochondria, protein-coding genes, microevolution

Integrating intra-specific trait variations to revisit scleractinian coral strategies

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Abstract

Scleractinian coral species are formed of heterogeneous rather than homogeneous individuals. This intraspecific variation provides an operating ground for natural selection, drives species' capacity to adapt to changing environments, and ultimately influences community stability and recovery. Yet, the implication of this intraspecific variation has been overlooked in community ecology, assuming that all individuals from the same species behave like one and averaging their response to stressors and disturbances. We used 16 organismal traits, i.e., traits involved in –or considered as a proxy for– energy acquisition and allocation, to characterize the coral performance niches of seven species collected from environmentally contrasted locations between reefal and non-reefal areas, and from shallow to mesophotic depths. Besides significant differences found between species, every species' niche width was characterized by large intraspecific variations. We further identified and characterized three pools of individual phenotypes, and defined as specialist a species that consistently shows conspecifics behaving within the same phenotypic pool and as generalist a species that presents conspecifics behaving in all available phenotypic pools. Whereas individuals from *Porites lutea* consistently behaved in the same phenotypic group across contrasted environmental conditions, *Acropora muricata* and *Stylophora pistillata* individuals behaved in the 3 phenotypic groups, with the other species behaved as intermediaries. Our results show that coral's resource acquisition and allocation strategies can greatly differ between and within species and that one species can harbor distinctive strategies to cope with its environment. Our analytical framework combining intra-specific variation into a trait-based approach could transcend our understanding of scleractinian corals' individual survival under stress, species responses to disturbances and stressors, and the transformations of the reef assemblages facing climate change.

Keywords: Trait-based approach, species niches, isotopes, physiology, energy flux

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Development of technology for mass production of copepod with inorganic fertilization method

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Abstract

Copepods are commonly used in larviculture of some aquaculture species. Organic fertilization method is currently used in mass producing copepods. However, the nutritional composition of organic fertilization is difficult to control, resulting in fluctuation of the quality and quantity of copepods. Inorganic fertilization can accurately control the concentration of nutrients, and it has been proved that fertilization with N: 700 $\mu\text{g L}^{-1}$ and P: 100 $\mu\text{g L}^{-1}$ can produce diverse single-cell microalgae and zooplankton. In this study, we compared organic and inorganic fertilization in mass production of copepods. In Experiment 1, we used commercially available condensed fish soluble to represent organic fertilization, and compared it with inorganic method (N: 700 $\mu\text{g L}^{-1}$, P: 100 $\mu\text{g L}^{-1}$). In, Experiment 2, we compared the original inorganic method with inorganic + Fe: 10 $\mu\text{g L}^{-1}$. The results show that inorganic fertilization method can produce the same amount of copepods as organic fertilization method, and at a lower cost. The addition of Fe can double the yield of copepods. We conclude that inorganic fertilization method can be a promising way of mass production of copepod in the future.

Key words: inorganic fertilization method, live feed, copepod

Two clades of swordtip squid *Uroteuthis edulis* in the Northwest Pacific

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Abstract

Cephalopods, including octopuses and squids, are important fishery targets all over the world. In Taiwan, swordtip squid *Uroteuthis edulis* accounts for 65% of the total cephalopod production and is one of the most important species in stick-held dip net fisheries. This species is widely distributed in the West Pacific, from Japan Sea to northern Australia; and Indian Ocean. In the NW Pacific, the major fishing ground locates in the East China Sea with annual landing of 1.5×10^4 tons. Nevertheless, the annual catch in Taiwan is continuously dropping since its peak in 1998. Species-specific information on genetic diversity provides important implications for fisheries management. However, *U. edulis* is morphologically similar to two sympatric congeneric species which further impedes the assessment of fishery resources because of the problematic species identification. The purpose of this study is to DNA-barcode *U. edulis*, investigate the genetic diversity, and provide evidence for future management of squid fishery. We used both mitochondrial genes, Cytochrome C oxidase I (COI) and 16S ribosomal RNA (16S), as the genetic markers. The Neighbor-Joining trees showed three distinctive clades (A-C) within the species. A and B are partially sympatric in the NW Pacific and C is in the Indian Ocean. A is found in colder waters in Japan, China, South Korea, and Taiwan; and B is from the warmer waters in southern China and southern Taiwan. For both clades, no further differentiation was observed in the haplotype networks. Based on our preliminary results, two clades of *U. edulis* are identified in the NW Pacific thus clade-specific database should be established for efficient management in the future.

Keywords: Swordtip squid, Mitochondrial DNA, East China Sea.

Incorporating natural habitat characteristics to inform artificial habitat designs

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Abstract

Urbanisation of coastal areas and rapid developments drive the proliferation of artificial concrete structures in marine environments. These concrete structures are generally attributed with poor quality habitat profiles for biodiversity growth compared to natural shores due to their differences in constructed materials and their lack of complexity. Although numerous studies on eco-engineering of artificial coastal marine structures (ACS) have been conducted over the recent years, studies have been lacking in the tropical region. In Malaysia, reclamation is most intense in Penang Island with the persistent rise in human population. As marine organisms are more prone to desiccation and stress during low tides, especially in tropical areas, we aim to produce habitat enhancement panels that provides both shelter and refuge. A baseline study was done to determine the type organisms residing in natural tidal pools and the data was then utilised to produce a designated habitat panel incorporating natural habitat characteristics preferred by the organisms. The dominant species found were *Amphibalanus amphitrite*, algae, *Nodilittorina trochoides* and *Anthopleura nigrescens* while the least dominant were *Grapsus albolineatus*. Design innovations were referenced from natural niche habitats (e.g. crevices, grooves, pits and pool) along with existing scientific evidences. Prototype production of the habitat panel involved (i) creating a mock up, (ii) making of mold, and (iii) making of model. Conventional seawall construction lack novel eco-engineering concepts that could enhance ecological performances on seawalls whereby introduction of supplementary surface complexity could be added with simple characteristics like pits and grooves. In this study, the panels will be replicated and attached along the seawall to promote native biodiversity on the ACS. Although creating habitat panels is a step closer towards having a greener seawall, it is not an alternate solution to address the global proliferation of ACS and certainly not be used to facilitate future coastal developments.

Keywords: coastal protection, complexity, design, ecological engineering, habitat panels

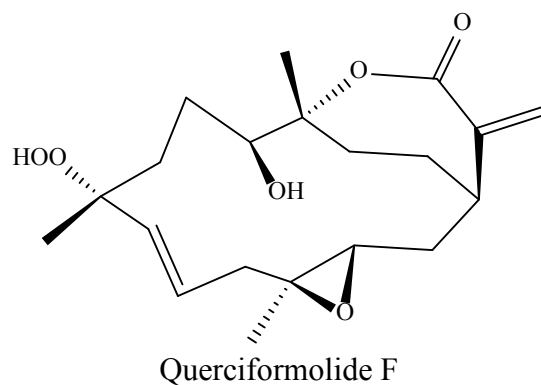
Chemical Constituents of a Formosan Soft Coral *Sinularia querciformis*

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Abstract

Chemical examination of *Sinularia querciformis* also afforded one new cembranoid, querciformolide F (**1**), along with five known cembranoids, sinulariolone (**2**), granosolide A (**3**), querciformolide A (**4**), and sinulariolide (**5**). The structure of these compounds were determined by extensive spectroscopic (IR, ESIMS, ^1H NMR, and ^{13}C NMR) data analysis and by comparison with those previously reported in the literature. The compounds **1** and **5** were found to induce significant inflammatory activity in lipopolysaccharide (LPS)-induced RAW264.7 mouse macrophage cells by enhancing the expression of the inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2) proteins.



Keywords: soft coral, *Sinularia querciformis*, anti-inflammatory

Recycled seashells as material for green artificial reef

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Abstract

Artificial reefs have long been regarded as one of the effective method in fisheries management, coral rehabilitation, and conservation. These man-made structures come in various shapes and forms to fit their specific aim of promoting marine life, but often built from Portland cement. While Portland cement is the most common material in modern construction, it is responsible for about 8% world's carbon dioxide emission. In order to achieve UN SDG 13—climate action and 14—Life below water from marine ecology perspective, we aimed to create green concrete with lesser carbon footprint for artificial reef application. The objectives of the study were to develop green concrete using seafood and steel industries by-products, and achieving comparable strength to conventional Portland cement concrete. The fabrication of green concrete was accomplished through partial replacement of cement and sand with ground granulated blast furnace slag (GGBS) and cockle shells at 50% and 100%, respectively. Our results show that by adopting partial replacement on cement alone, carbon dioxide emission could be cut down by as much as 46%, and the figure reached 73% if cockle shell was used for total replacement on sand. In terms of mechanical strength, although substitution of sand by cockle shell resulted in weaker concrete compared to conventional Portland concrete, a blend of 100% cockle shell with 50% GGBS concrete led to stronger, durable product than Portland concrete. Incorporation of cockle shell in green concrete did not only reduce carbon footprint but also enhanced micro-scale surface texture. Thus, we proposed the use of green concrete in artificial reef application in pursuit of sustainability, as well as the potential in enhancing surface complexity for species colonisation of artificial reefs.

Keywords: artificial reef, green concrete, cockle shell, carbon emission

Achievement of long term cryo-storage within the interim of vitrification and laser warming

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Abstract

Cryopreservation has become a powerful tool for preserving specimens at ultra-low temperatures and procedures like vitrification and nano-laser warming, are utilized to prevent ice crystal formation in the sample. Although cryobanks are established for long-term storage, slow to fast freezing and thawing techniques are still employed. This study introduces a novel device that allows samples to be laser warmed from long term cryo-storage. The newly development of cryo jig was able to manipulate the self-made vitrification cryotop during rapid cooling in LN₂ and ultra-rapid warming by a laser pulse without exposing the samples and compromising temperature fluctuation. This performance assures that the sample is rapidly warmed by the laser pulse with a high hitting accuracy more than 90% and successful rewarming rate of 70%. The results are dependent on the vitrification solution and mastery of the technique to increase the success rate of vitrification of the sample. As compared to its predecessor, which was previously published by our team, this device offers improved precision and stability. With further improvement and development of the long term cryo-storage technique, we expect that this study will enable further examples of the application of cryobanking using vitrification and nano-laser warming to aid a wide range of cells and tissues from diverse species.

Keywords: cryopreservation, vitrification, nano-laser warming, long term cryo-storage, cryo-bank

Survey of *Antipatharia* distribution in Hengchun Peninsula and Orchid Island, Taiwan and their lipidomic comparison

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Abstract

Antipatharians, which are commonly known as black corals, constitute approximately 230 species of colonial anthozoans found ubiquitously in global marine environments, but are particularly diverse and abundant in tropical and subtropical waters. Most of the described species are restricted to deep waters; hence, their ecology and biology is poorly understood. The purpose of this study is to investigate and compare the closely related species of black coral in biogeographical distribution and lipidomic analysis, particularly in various depth and collecting locations, serving as preliminary results for future experimental designs and comparisons. Herein, we collected species of Antipatharians during surveys of black coral communities in Hengchun Peninsula and Orchid Island of southern Taiwan from shallow (~20 m) and upper mesotrophic zone (~50 m). Phylogenetic analysis revealed that the collected 58 species can be grouped into four main branches corresponding to the families of Myriopathidae (30 species), Aphanipathidae (3 species), Antipathidae (24 species), and Stylopathidae (1 specie). We also measured the irradiation of difference spectrum using an underwater light spectrophotometer at various sampling locations. Furthermore, lipid profiles and fatty acid composition of these collected Antipatharians reflected the dynamics of these collection locations. This study is the first to characterize the abundance, distribution, morphology, phylogenetics and lipidomics of black corals in the Hengchun Peninsula and Orchid Island.

Keywords: black coral, Antipatharian, mesophotic coral ecosystems, lipid, fatty acids

Study of indigenous coral-derived bioceramic for bone regeneration

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Abstract

In human body, bone plays the most critical role of supporting movement and protecting vital organs. However, these hard tissue are fragile in the face of tremendous external forces, thereby causing bone fracture or defect. When coming to a bone fracture or defect, xenograft is an excellent choice for filling the gap and supporting bone regeneration.

The aim of this research is to screen suitable marine derived bone xenografts through a series of physical-chemical analysis, *in vitro* and *in vivo* experiments, and ultimately develop these marine bone grafts towards advanced medical devices.

Iso-aaptamine affects oxidative stress-mediated apoptosis and autophagic cell death while inhibiting angiogenesis in pancreatic cancer

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Abstract

Pancreatic cancer remains the deadliest cancer type with a 5-years survival rate of less than 10% for decades. Due to difficult diagnosis and poor prognosis, mortality rates closely parallel incidence rates. Fewer than 20% of patients have the surgically; however, ~80% of patients will relapse after surgery and ultimately die of their disease. Iso-aaptamine, a marine alkaloid, is isolated from the marine sponge (*Aaptos aaptos*). It has been found to have a variety of biological activities, especially cytotoxicity and anti-cancer activities. Therefore, the aims of this study attempt to investigate the therapeutic potential and molecular mechanism of iso-aaptamine in two PDAC (pancreatic ductal adenocarcinoma) cell lines, AsPC-1 (carried KRAS mutant) and BxPC-3 (carried KRAS wildtype). Our preliminary results show that the cytotoxic effects of iso-aaptamer are similar after 24, 48, and 72 h of AsPC-1 and BxPC-3 cells treatment with IC50 of about 30-45 mM. Iso-aaptamine was found to induce oxidative stress in AsPC-1 and BxPC-3 cells, we observed ROS production (stained by CellROX Green, MitoSOX Red, and CM-H2DCFDA), reduced expression of antioxidant enzymes including Cu-Zn-SOD (SOD1), catalase, thioredoxin, and heme oxygenase-1 (HO-1) and Mn-SOD (SOD2) were increased in BxPC-3 cells. Iso-aaptamine induces mitochondrial depolarization, cleavage of caspase-3 and PARP expression, and finally causes cellular apoptosis in BxPC-3 cells. Increased acidic vesicular organelles and p62/Beclin/LC3B protein expressions were shown that iso-aaptamine induced autophagic cell death in BxPC-3 cells. Decreased VEGF protein expression and secretin with iso-aaptamine treatment BxPC-3 cells. Iso-aaptamine also significantly inhibited angiogenesis, such as cell viability, tube formation, wound healing, and migration in human umbilical vein endothelial cells. Decreased eNOS/VEGF protein expression was also found in iso-aaptamine-treated endothelial cells. In conclusion, iso-aaptamine might be a potential antiangiogenic and anti-pancreatic cancer agent for the future development of therapeutic agents.

Keywords: isoaptamine, ROS, oxidative stress, autophagic cell death, angiogenesis

Using acute heat stress assays and large area imaging to compare upper thermal limits in corals

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Abstract

As climate change induced warming causes mass coral bleaching and mortality globally, there is a pressing need to quantify and elucidate variability in upper thermal limits among coral species and reef locations. Until recently, however, comparing results among coral heat-stress experiments has been challenging due to the lack of methodological consensus among experiments. We used a newly developed standardized heat-stress assay approach to compare the upper thermal limits of *Pocillopora acuta* colonies collected from reefs with distinct thermal characteristics in southern Taiwan. We measured the response of the coral host and its algal symbionts over the course of an 18-hour experiment in which the coral holobiont was exposed to temperatures ranging from 27°C (control), 30°C (mild), 33°C (moderate), 36°C (high), to 39°C (extreme). Dose response curves of photochemical efficiency (F_v/F_m) showed that the effective dose 50 (ED50; temperature at which 50% of the original F_v/F_m is reached) was relatively similar between reef sites (36.8°C - 37.5°C). Analyses of coral colour, host protein, chlorophyll a, and Symbiodiniaceae (density and genera) are currently underway. Complementary to this short-term heat-stress assay experiment we are also using large area imaging to monitor *P. acuta* colonies at each of our collection sites to determine if coral response to high temperature in the lab matches coral response during heat-stress events on natural reefs. These combined assessments aim to improve our understanding of upper thermal limits in corals and can be used to guide research, conservation, and restoration priorities.

Keywords: coral, F_v/F_m , dose response curves, climate change resilience, photogrammetry

Sinularin induces intrinsic apoptosis in glioblastoma multiform via oxidative stress and mitochondrial dysfunction, simultaneously inhibiting angiogenesis

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Abstract

Glioblastoma multiform (GBM) is an elusive cancer disease that leads to a 5-year survival rate of approximately 7% people suffering from GBM in the world. GBM is a highly angiogenic tumor, and inhibitors of tumor vasculature are considered promising therapeutic agents for the patients. Currently, effective agents that do not respond to chemotherapy are unavailable for GBM. Thus, a new drug is needed. This study evaluated a marine-coral product, sinularin, in GBM and endothelium cells. The results showed that sinularin dose responsively decreased cell viability for four GBM cells (GBM8401, U87MG, U138MG, and T98G), increased early/late apoptosis, and up-regulation of cleavage forms of apoptotic proteins, caspase 9, caspase 3, and PARP.

Sinularin induced oxidative stress in U87MG cells was found to increase ROS production (by CellROX Green, MitoSOX™ Red, and CM-H₂DCFDA staining) and diminished antioxidant enzymes including Cu-Zn-SOD/Mn-SOD, catalase, and thioredoxin. Sinularin treatment significantly ablated mitochondrial respiration capacities, as evidenced by sinularin-abrogated oxygen consumption in U87MG cells. Sinularin also significantly inhibited angiogenesis, such as tube formation, in human endothelial cells. Decreased VEGF protein expression was also found in sinularin-treated endothelial cells. In conclusion, sinularin might be a potential antiangiogenic and anti-brain cancer agent for the future development of therapeutic agents.

Keywords: glioblastoma multiforme, oxidative stress, intrinsic apoptosis, ROS, mitochondrial respiration, tube formation

Morphological variations of *Euthynnus affinis* and *Thunnus tongol* populations along the west and east coast of peninsular Malaysia

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Abstract

Tribe *Thunnini*, tunas are one of the fish groups that demanded by people and food industry around the world, becoming the most important fish due to their global economical importance. *Euthynnus affinis* and *Thunnus tongol* are two out of eight species are recorded along Malaysia waters. This study focused only on the traditional morphological approaches consisting of 13 morphometric characters and 6 meristic characters on both species study, were conducted to evaluate the differentiation on morphological variation among the species population. A total of 140 individuals were collected from 7 selected sites along the west and east coast of Peninsular Malaysia from January 2021 until July 2021. The results from the discriminant function analysis (DFA), standardized canonical discriminant function and hierarchical cluster analysis, revealed that the population of *E. affinis* from Kelantan and the population of *T. tongol* from Pulau Pinang, Selangor and Terengganu showed a great separation from the others. Within *E. affinis* individuals, approximately 61.4% were successfully classified based on measured morphometric characters with the highest classified individuals are from Pulau Pinang (one misclassified individual), followed by both Terengganu and Kelantan with 4 misclassified individuals each. Whereas Melaka recorded as the most misclassified individuals which is 7 individuals. Then, within *T. tongol* individuals, approximately 57.1% were successfully classified with the highest classified individuals are from Pulau Pinang (no misclassified individuals are recorded), and followed by Selangor (only one misclassified individuals) and Terengganu (2 misclassified individuals) respectively. Whereas Kelantan recorded as the most misclassified individuals with 9 individuals. Even though *E. affinis* is listed as least concern and *T. tongol* is classified as data deficient status, the stock assessment for both species is vital because they are commercially and economically important of food source to Malaysia specifically and the world too, generally. We also revealed that the meristic characters is not a good indicator to discriminate among fish populations as they are more depend on the environmental fluctuations instead of genetic expression. This finding provides additional information on morphological characters for further study especially for stock assessment and conservation for both species.

Keywords: Tuna, *Euthynnus affinis*, *Thunnus tongol*, morphometric, meristic count and peninsular Malaysia

Ac-piscidin-3 affects oxidative stress-mediated apoptosis and mitochondrial dysfunction while inhibiting angiogenesis in malignant glioblastoma multiforme

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Abstract

Malignant brain tumors are among the deadliest cancers. Even with a vigorous surgical intervention using radiation and chemotherapy, patients with malignant gliomas rarely survive more than 2 years from the date of diagnosis. The most malignant glioblastoma multiforme (GBM, grade IV) is considered highly invasive into other parts of the brain quickly which reduces the possibility of complete surgical resection and is also a highly vascular brain tumor with poor prognosis. To date, malignant GBM is difficult to treat, and its overall response to the prescribed drugs is poor. Therefore, more effective drugs are urgently needed to target GBM cancer. In this study, the antimicrobial peptide tilapia piscidin 3 (Ac-piscidin-3), isolated from *Nile tilapia* (*Oreochromis niloticus*), was applied to GBM8401 and endothelium cells. Our findings showed that low Ac-piscidin-3 concentrations induced significant inhibition of cell viability and increased apoptosis, as determined with the MTT and annexin V/PI assays. The expression levels of cleaved caspases 3, PARP, and cleaved PARP increased. Ac-piscidin-3-induced significantly increased mitochondrial and cellular reactive oxygen species (ROS) production, leading to enhanced oxidative stress. We are faced with various stressful situations and antioxidant enzymes can help mammalian animal cells cope with these stresses. The study found ac-piscidin 3 diminished antioxidant enzyme activities including SOD1, SOD2, catalase, and thioredoxin protein expression. Additionally, piscidin-3 was found to reduce mitochondrial high membrane potential, mitochondrial oxygen consumption, and mitochondrial dynamic fusion protein-OPA-1. Ac-piscidin-3 causes accumulation of acidic vesicle organelles and autophagy marker LC3-II to -I ratio. Ac-piscidin 3 also significantly inhibited angiogenesis functions such as proliferation, tube formation, and migration in primary endothelial (HUVEC) cells, however, increased ROS and mitochondrial low membrane potential in HUVEC cells. In conclusion, Ac-piscidin-3 exerts anti-brain cancer properties that include apoptosis induction but also anti-angiogenesis.

The genome of *Cassiopea*: Upside-down jellyfish as a model for coral symbiosis!

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Abstract

Tropical coral reefs are considered one of the most diverse and productive ecosystems on the planet. Corals heavily rely on the symbiosis with photosynthetic dinoflagellates of the family Symbiodiniaceae, receiving photosynthates in exchange for inorganic nutrients. The breakdown of this essential symbiotic relationship, that leads to the expulsion of Symbiodiniaceae from the coral tissue, is the underlying cause of coral bleaching and widespread mortality. Since *Cassiopea* is easily culturable and is able to survive in aposymbiotic and symbiotic states, *Cassiopea* makes a good potential model for studying cnidarian-Symbiodiniaceae symbiosis. However, a good genome is required for proper molecular studies.

Chemometric-guided exploration of marine anti-neurofibroma leads

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Abstract

In-depth analysis of metabolomics diversity of marine species through advanced mass spectrometric analysis is one of the most promising new tools for the development of marine drugs against mild and life-threatening diseases. Neurofibromas are a common type of tumor in the peripheral nervous system. Currently, there are very limited treatment options for neurofibromas. In our course of exploring potential therapeutic agents for neurofibroma treatment, the multi-informative molecular networking (MIMN) approach was proposed. The MIMNs of the *Lendenfeldia* sp. sponge extract and sub-fractions were established according to their inhibitory activity against several inflammatory chemokines in neurofibroma cell line hTERT-NF1- α 95.11b-C (CRL-3390). The visualized MIMN revealed the anti-inflammatory potential of scalarane-enriched fractions, and the follow-up annotation and isolation led to the identification of a scalarane, 24-methyl-12,24,25-trioxoscalar-16-en-22-oic acid (**2**). Our results revealed that the most abundant scalarane (**2**) dominated the anti-chemokine effect of *Lendenfeldia* sp. extract together with other scalaranes, indicating the potential application of sponge-derived scalaranes to be developed as therapeutic agents for neurofibromas.

Keywords: Neurofibromas, multi-informative molecular networking, anti-inflammation, *Lendenfeldia* sp., scalarane.

Anti-inflammatory 9,11-secosteroids from octocoral *Sinularia leptoclados*

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Abstract

Octocorals contain many natural products and have diverse pharmacological activities. In this study, seven secondary metabolites were obtained from *S. leptoclados*, including sinleptosterol A (**1**), sinleptosterol B (**2**), 8 α H-3 β ,11-dihydroxy-24-methylene-9,11-secocholest-5-en-9-one (**3**), 8 β H-3 β ,11-dihydroxy-24-methylene-9,11-secocholest-5-en-9-one (**4**), leptosterol A (**5**), (24*S*)-3 β ,11-dihydroxy-24-methyl-9,11-secocholest-5-en-9-one (**6**), and 3 β ,11-dihydroxy-9,11-secogorgost-5-en-9-one (**7**). The chemical structures were determined by organic spectroscopy (¹H NMR, ¹³C NMR, COSY, HSQC, HMBC, NOESY, IR, optical rotation, and mass spectrometry) and comparison with published data. The anti-inflammatory activity of these compounds was studied in activated human neutrophils. Our results demonstrated that compound **4** effectively inhibited superoxide anion generation and elastase release in activated human neutrophils. Based on these results, we suggest that *S. leptoclados* is significant source of 9,11-secosteroids and is potential to develop as marine anti-inflammatory agent.

Keywords: 9,11-secosteroids, *Sinularia leptoclados*, anti-inflammatory

Studies on the chemical constituents and bioactivities of soft coral *Sinularia leptoclados*

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Abstract

Marine natural products have diverse chemical structures, which are significant sources for drug discovery. Herein, the chemical ingredients of soft coral *Sinularia leptoclados* and their anti-inflammatory activity will be investigated. Three new compounds, sinleptosterols C (**1**), 8 α H-3 β -hydroxy-11-acetoxy-24-methylene-9,11-secocholest-5-en-9-one (**2**), 8 α H-(24R)-11-acetoxy-3 β -hydroxy-24-methyl-9,11-secocholest-5,22E-dien-9-one (**3**), and five known compounds, 8 β H-3 β -Hydroxy-11-acetoxy-24-methylene-9,11-secocholest-5-en-9-one (**4**), 8 β H-(24R)-11-acetoxy-3 β -hydroxy-24-methyl-9,11-secocholest-5,22E-dien-9-one (**5**), (24S)-3 β -Hydroxy-11-acetoxy-24-methyl-9,11-secocholest-5-en-9-one (**6**), 3 β ,11-dihydroxy-9,11-secogorgost-5-en-9-one (**7**), and 3 β ,11-dihydroxy-24-methylene-9,11-secocholestan-9-one (**8**), were isolated from *S. leptoclados*. Among these compounds, **3/5** and **6** showed significantly inhibitory effect on the release of elastase and superoxide anion in activated human neutrophils. In conclusion, our results indicate that *S. leptoclados* is a good source for developing 9,11-secosteroids. We also identify that compounds **3/5** and **6** are potential drug discovery for neutrophilic inflammation.

Keywords: *Sinularia leptoclados*, 9,11-secosteroid, human neutrophil, anti-inflammation

ABOUT NMMBA



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



In 1991, the preparatory office of the National Museum of Marine Biology and Aquarium (NMMBA) was formally established, and the hard and tough scheming and construction work were then begun, the opening of the Waters of Taiwan was finally finished on February 25th, 2000 after numerous efforts and frustrations, we formally stepped toward the infinite field of international marine education and research since then.

The NMMBA is located in Checheng of Pingtung County, facing the Taiwan Strait in the west and standing beside Tortoise Mt. in the east. The whole area of the district is 96.81 hectares, the construction of the museum division alone occupies 35.81 hectares, whereas the surrounding grasslands and public facility divisions (like the parking lot, and tourist information service) occupy more than 60 hectares. The building allocation can be divided into the museum (the three theme exhibit halls of Waters of Taiwan, Coral Kingdom Pavilion, and Waters of the World and administration and teaching centers), several major building divisions like the husbandry center, public facilities, research building, maintenance facilities, international conference center, and academic research center.



The full view of the NMMBA

2 Houwan Road, Checheng, Pingtung, 94450, Taiwan, R.O.C.

<http://www.nmmba.gov.tw/english/index.aspx>

Apart from the public exhibition, a group of scientists conducts scientific research in the NMMBA museum. In addition, there are two research buildings and a marine study station in the museum dedicated to studying marine biology and ecology, aquaculture, propagation, and conservation of marine fauna and flora.



The first research center in the NMMBA



The second research center in the NMMBA



The marine study station in the NMMBA

Organizer

《 National Museum of Marine Biology and Aquarium (NMMBA)

Co-organizer

 National Sun Yat-sen University

 National Dong Hwa University

Sponsor

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National Museum of Marine Biology and Aquarium, Taiwan