PARTICIPATION AND PARTNERSHIP IN MARINE BIOTECHNOLOGY: SEEDING THE BLUE BIOECONOMY

1ST AUSTRALIA NEW ZEALAND MARINE BIOTECHNOLOGY SOCIETY SYMPOSIUM

14-15 APRIL 2016
ADELAIDE, SOUTH AUSTRALIA

BOOK OF ABSTRACTS

AUSTRALIA NEW ZEALAND MARINE BIOTECHNOLOGY SOCIETY

Flinders UNIVERSITY

Acknowledgement of Traditional Lands

The land that we meet on is the traditional lands of the Kaurna* people and we respect their spiritual relationship with their country. We also acknowledge the Kaurna people as the custodians of the Adelaide region and that their cultural and heritage beliefs are still important to the living Kaurna people today.

Flinders University was established on the lands of the Kaurna nation with the main Flinders campus located near Warriparinga. Warriparinga is a significant site in the complex and multi-layered Dreaming of the ancestral being Tjilbruke. For the Kaurna nation, Tjilbruke was a keeper of the fire and a peace maker/law maker. Tjilbruke continues to be part of the living culture and traditions of the Kaurna people. His spirit lives in the land and waters, in the Kaurna people and in the glossy ibis (known as Tjilbruke for the Kaurna). Through Tjilbruke the Kaurna continue their creative relationship with their country, its spirituality and its stories.

*pronounced 'Garna'

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Foreword by the Deputy Vice-Chancellor (Research), Flinders University

Marine biotechnology is a growing field of science as research looks towards the megadiversity of the world's oceans for biological, chemical and bioproduct discovery. The importance is demonstrated by the naming of the "Blue Economy" as a key strategy of the research and industry development of many economies including Australia, New Zealand, Europe, Indonesia, the USA and China. As such, there is a need to develop the relationships, policies, platforms and tools for collaboration and translation of research outcome with businesses and industry.

This is where I think the Australia New Zealand Marine Biotechnology Society has excelled organising industry workshops and participating in overseas missions that have brought about numerous industry collaborations in algae and seafood biotechnology, including joint laboratories with the Qingdao Gather Great Ocean Group, and more recently with the Shandong Tianjiu Biotechnology Group, hosted at Flinders University.

I would like to commend the Society's efforts in co-organising the Collaboration Forum with the International Marine Biotechnology Conference in Brisbane 2013:"Strategies for Marine Biotechnology collaboration between Australia, New Zealand and China". It was from this forum that the first draft of a Strategy Paper on Marine Biotechnology was developed. This led to the championing of the inclusion and promotion of Marine Biotechnology in Australia's National Marine Science Plan 2015-2025 "Driving the development of Australia's blue economy".

The Strategy Paper and the advocacy provided by this Society has resulted in the prioritisation of "the blue economy throughout the marine science system", an emphasis given to "marine technology and innovation", the Flinders seaweed collaboration being illustrated as a case study on biodiversity research and industry, and international benchmarking against other blue economies that provides added credibility for policy development and target setting.

It is no wonder that amongst more than 500 contributors and 72 submissions to the Plan, the Society is one of three organisations specifically thanked in the acknowledgements.

I am pleased to note that the Society has also worked closely with the Australian Marine Science Association, the Australian Institute of Marine Science, Marine Innovation South Australia, the New Zealand Marine Science Society and many others. It is only through cooperation that such a challenge can be met.

I am also pleased to see the wide range of peer-reviewed poster and oral presentations at this symposium, coupled with plenary and keynote speakers who are leaders in their field. But all these would be lacking if not for the participation of industry, and I would like to especially acknowledge the industry leaders that have travelled from far to be with us here today.

The Society has done well to try to be a bridge that connects science, industry, communities and governments, and I note that International Blue Bioeconomy Forum focuses on discussions regarding the participation of wider industries, research and industry partnerships, Translational Research, diversification of products, pathways to market, connecting international markets, management of genetic resources, and climate change and genetic resources.

I wish the organising committee and delegates a very successful symposium and welcome you to visit not only the Tonsley Campus, but our main Bedford Park campus where you can tour our marine biological sciences laboratories and the Centre for Marine Bioproducts, and our view our new $70m Student Plaza with its stunning views across Adelaide. Welcome!

Professor Robert Saint

Vice-President and Deputy Vice-Chancellor (Research), Flinders University

Welcome from the Australia New Zealand Marine Biotechnology Society

Enhancing and diversifying the 'Blue Economy' in Australia and New Zealand is becoming a highly prominent element of both nation's marine science plans and is tipped to contribute significantly to a growing marine economy worth more than $100 billion in this region within the next ten years. Multidisciplinary research underpinning applications of Marine Biotechnology is increasingly being looked to as the source of innovation to realise sustainable wealth from our nation's seas, collectively accounting for the 3rd and 4th largest EEZ's globally; and combined, the largest jurisdiction in the Southern Hemisphere.

Marine biotechnology is: "The application of (marine) science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services[1]" The current market for global biomarine economies is over $US176b/yr (Biomarine 2014). Aquaculture is currently 12% of the global protein market but is projected to grow by 35% by 2020. Marine nutriceuticals and ingredients are 32% and 38% respectively of nutraceutical and natural products markets respectively and are projected to grow by 50% and 55% by 2020. Aquaculture grows more rapidly than all other animal food-producing sectors (8.8%/yr since 1970, cf 1.2% capture fisheries , 2.8% terrestrial farmed meat production) (FAO 2010). Both Australia and New Zealand have signalled a priority need to enhance sustainability of marine resource development while increasing the generation of wealth from our respective nations' seas. To this end, the Blue Economy is therefore: "A sustainable ocean economy (that) emerges when economic activity is in balance with the long-term capacity of ocean ecosystems to support this activity and remain resilient and healthy[2]".

The Australia New Zealand Marine Biotechnology Society was formed to advance Australia and New Zealand's capacity in developing a marine biotechnology economy and to stimulate and encourage strategic national and international collaborations in marine biotechnology. It is with this in mind that we have put together the 1st Australia New Zealand Marine Biotechnology Society symposium Participation and Partnership in Marine Biotechnology: seeding the blue bioeconomy.

The program includes presentations and posters across the full range of marine biotechnology 'disciplines' and sectors from biomedicinal, agricultural to industrial and environmental. An International Blue Bioeconomy Industry Forum where you can interact with industry representatives and hear about research developments from around the world will be a highlight. Together we are delighted to welcome you to Adelaide.

Professor Wei Zhang, President

Professor Chris Battershill, Vice President

Australia New Zealand Marine Biotechnology Society

[1] *The Organisation for Economic Co-operation and Development (OECD) definition of Biotechnology.*

[2] *WOS 2015. World Ocean Summit Briefing Paper "The Blue Economy: growth, opportunity and a sustainable ocean economy" Gordon & Betty Moore Foundation. The Economist Intelligence Unit Limited 2015. 20pp.*

Australia New Zealand Marine Biotechnology Society Symposium Committees

Organising Committee	Program Committee	ANZMBS Committee 2015/16
Wei Zhang	Chris Battershill	President: Prof. Wei Zhang
Chris Battershill	Joe Baker	Vice-President: Prof Chris Battershill
Shirley Sorokin	Rocky De Nys	Secretary: Ms Shirley Sorokin
Peter Nichols	Peter Nichols	Treasurer: Mr Raymond Tham
Joe Baker	Wei Zhang	Dr Michelle Prinsep
Suhelen Egan		Prof. Joe Baker
Qi Yang		Dr Peter Nichols
Peng Su		Ms Libby Evans-Illidge
Jane Keane		Dr Ken Lee
Libby Evans-Illidge		Ms Qi Yang
Te Puea Dempsey		Mr Sam McCormack
Sam Mc Cormack		Dr Yadollah Bahrami
Marina Delpin		Ex Officio: Ms Te Puea Dempsey
Raymond Tham		
Yadollah Bahrami		

Society Membership:

We welcome all delegates and their friends and colleagues to become members of the Society. Information on the Society can be found at the Centre for Marine Bioproducts Development website.

Volunteers:

We would like to thank Dr Marina Delpin for organising a team of volunteers, mainly students from the Centre for Marine Bioproducts Development, Flinders University to help with this symposium.

Getting to the Venue

Getting to the Venue

Venue:

Theatre 1, FLINDERS AT TONSLEY, Flinders University, Adelaide, South Australia. Street Address: 1284 South Rd, Clovelly Park, SA 5082, Adelaide, Australia.
http://www.flinders.edu.au/campus/tonsley/

Getting to and from the symposium will be easiest by taxi or car.

Taxi:

Taxis enter the Tonsley precinct via South Road and the pickup and drop-off area is adjacent to the Loop Bus stop on the eastern side of **Flinders at Tonsley**.

Venue Street Address:

1284 South Rd, Clovelly Park, SA 5042

Independent Taxi	13 22 11
Suburban Taxis	13 10 08
Yellow Taxis	13 22 27

Train:

The nearest train station to Tonsley is the **Clovelly Park stop** on the **Tonsley line**. It is located on Alawoona Avenue at the rear of the Tonsley Park precinct.

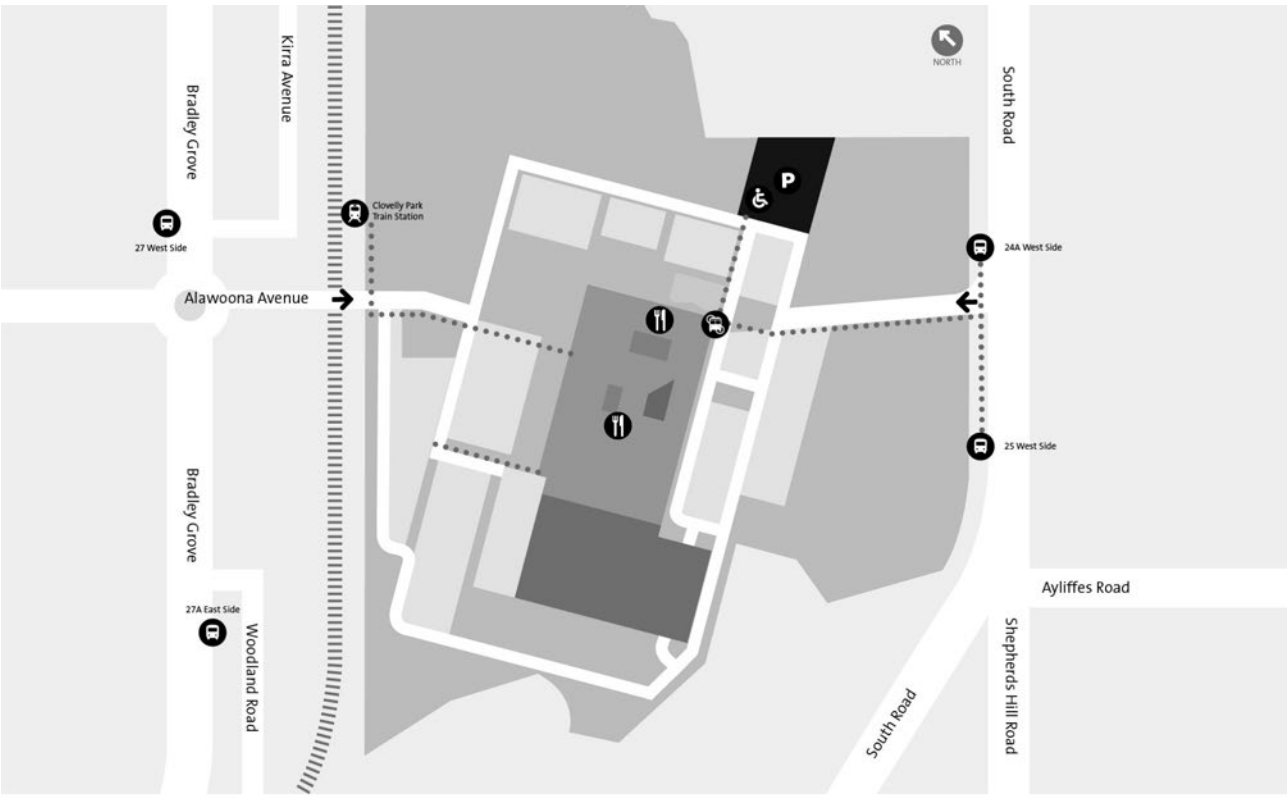
Bus:

South Road **bus stop 25** and Bradley Grove **bus stop 27 or 27A** (at the rear of the Tonsley Park precinct) are the most convenient.

Registration Desk at Tonsley:

The Registration Desk at Tonsley will be open from 7.30am on Thursday 14th April for you to pick up your name-tag and program. The program will start at 8.50am.

Note: There are 2 cafes in the courtyard at the Tonsley facility that are open from 7.00am for breakfast.



TONSLEY PRECINCT MAP

- Flinders University at Tonsley
- Flinders University Pod
- Sustainable Industries Education Centre (including TAFE SA)
- Tonsley Main Assembly Building (MAB)
- Tonsley Central Forest
- Car Park (access via South Road)
- Entry/Exit
- Bus Stop
- Train Station
- Loop Bus Stop
- Car Parking
- Disabled Parking
- Food & Beverage
- Pedestrian Walkway
- Train Line

Instructions for Oral Presentations

Apart from the 2 Opening Session speakers (30 + 5 min questions) and Session Keynote speakers (25 + 5 min) addresses, oral presentations are 15 min total in duration (ie. 12 min speaking, + 3 min for questions). Due to the full program session chairs will be very strict on timing. If your presentation is in an unusual format, i.e. you are using your own computer etc. please let us know.

If you are presenting in the first session please load your talks **before 8.30am** on Thursday morning. Note – you are welcome to send us your talk on Mon-Wed (11th-13th April, 2016).

Instructions for Poster Presentations

Please bring your posters early on the morning of the conference – assistance will be provided by our volunteers to put your posters onto poster boards. Official poster sessions are **morning and afternoon tea on the first day (Thursday)**. In addition we encourage you to be near your poster at other breaks. Delegates are encouraged to look at each poster and engage in discussions during these sessions. Posters should be removed immediately after afternoon tea on Friday.

Prizes:

Prizes will be awarded for Best Oral presentation and Best Poster presentation.

Dinner (14/4/2016) is sponsored for delegates with a 2-day registration.

Transport will be provided to take you from the symposium venue to dinner on Thursday night. Delegates are asked to make their own way back (taxi pool or take the Glenelg-City Tram) to their accommodation following the dinner.

Allergies and Special Dietary Requirements:

If you have any allergies or have a special dietary request, please email Dr Marina Delpin *marina.delpin@flinders.edu.au* at least 2 days before the symposium.

Luggage storage:

Theatre 1 is large and you are able to leave your luggage at the back of the Theatre if you come straight from the airport. Also if you are leaving on Friday afternoon, you may bring your luggage into the Theatre.

Annual General Meeting

The Society's AGM will be held at the dinner. We welcome your input to the AGM, and comments and suggestions can be emailed to *marine.bioproducts@flinders.edu.au*. Please note that if you would like to be on the Committee next year, please ask a member to nominate you or email *Shirley.sorokin@flinders.edu.au*.

Opening Speaker Profiles

Dr Helen Fitton, Chief Scientist, Marinova, Australia

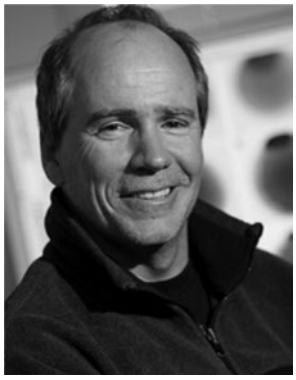
Helen has 20 years' experience in commercially-focused research and development and is recognised as a world-leading authority on fucoidan compounds. Helen has been instrumental in developing Marinova's library of Maritech® fucoidan compounds and has created effective new product applications for the nutritional, pharmaceutical, medical device and cosmetic industries. Helen has an Honours degree from Manchester University, UK, an MSc from University College London, and a PhD in Applied Chemistry from Aston University, UK.

Prof Richard Furneaux, Institute Director, The Ferrier Research Institute at Victoria University of Wellington, New Zealand

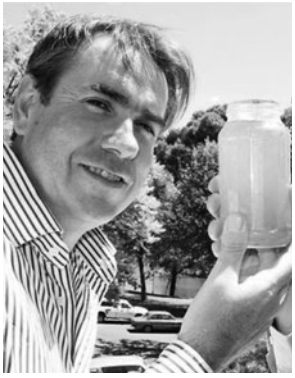
Richard is the Director of the Ferrier Research Institute of Victoria University of Wellington in New Zealand and the Director of Discovery Chemistry at GlycoSyn . Richard's world-renowned team of 28 research chemists is focused on the discovery and commercialization of 'Glycotherapeutics'—drugs and dietary supplements based upon knowledge of the role of carbohydrate molecules in biological processes. They partner nationally and internationally for biology and biochemistry. As New Zealand's leading applied organic chemistry capability, they also assist companies with the development of a range of new high value products and manufacturing processes.

Keynote Speakers

Dr Peter Nichols, CSIRO Oceans and Atmosphere



Prof. Bernie Degnan, University of Queensland



Dr David Lewis, Muradel/Adelaide University

Prof. Tony Carroll, Griffith University

International Blue Bioeconomy Industry Forum

The Forum will tackle industry matters in two panel sessions, the first on "market drivers, product demand, technology gaps and international collaboration", the second on "policy, investment and trade opportunities in blue bio-economy". Each panel will be chaired by a moderator and have a mix of both industry and research leaders, and government policy makers, who will discuss key points raised in a brief opening presentation. Questions from the floor will be welcome and the proceedings will be minuted for future engagement and strategy development.

The Forum will tackle market drivers that will drive the growth of the marine biotechnology industry in the Australasian region, and actions needed to address the trends. These actions include making marine bioproducts more standardised and recognised as nutraceuticals and functional foods, whether the future of staple diets will involve marine bioproducts, how barriers to marine biomedicine development can be overcome, marine bioproducts for aquaculture and fisheries, overcoming barriers to use of marine bioproducts by the agricultural industry. Other issues such as the Carbon Economy, E-commerce and E-retail, the Silver Economy and management of Genetic resources will be discussed. In light of these trends, the discussion will then focus on products such as Microalgae and Macroalgae with strong market demand in Australasian region, where demand is growing, and the future of these products. Questions that will be tackled include industry barriers to nutraceutical product development, industry barriers to use in functional foods, staple diet development, new medicines, mariculture products and aquafeeds, agri-industry products, biofuels and bio-sequestration, and other products such as bio-packaging.

Technology gaps will be identified, and ways to overcome them discussed. These include biodiscovery technologies for functional compounds and medicines, bioprocessing technologies for functional compounds, bioproduct standards across industry, product formulation and application to other products, production technologies and other translational technologies. The Forum will then focus on international collaboration, particularly in research and development in the Australasian region. Research and development platforms, collaboration in translational research, the role of associations like ANZMBS, national blue bioeconomy plans, and the complementarity between Australia and New Zealand will be debated by the panellists.

The Industry Forum will then discuss policies and government support for the marine biotechnology industry in Australia and New Zealand, why investment and trade opportunities are important for the growth of the marine biotechnology industry in the Australasian and Pacific regions and beyond, and what are key to attracting more investment and trade opportunities. We look forward to your participation at the Forum sessions.

Participation and partnership in marine biotechnology: seeding the blue bioeconomy.

Program for the 1st Australia New Zealand Marine Biotechnology Symposium

Thursday 14th April, 2016

Time	Speaker	Title
	Opening Session Chairs: **Wei Zhang**, Flinders University and **Chris Battershill**, University of Waikato	
8.50 am		Housekeeping
9.00 am	**Robert Saint** DVCR Flinders University	Welcome and opening
9.05 am	**Wei Zhang** Flinders University	Welcome from Society President
9.10 am	**Chris Battershill** University of Waikato	Welcome from Society Vice-President
9.20 am	**Richard Furneaux** Ferrier Research Inst.	Lessons from research seeking to support NZ Seaweed Industry development – 1980 to 2016
9.55 am	**Helen Fitton** Marinova	Sustainable and effective marine biotechnology: an industry perspective

10.30 – 11.00 am MORNING TEA/POSTER SESSION

Time	Speaker	Title
	Marine biotechnologies for food and nutrition Chairs: **Peter Nichols**, CSIRO and **Helen Fitton**, Marinova	
Keynote 11.00 am	**Peter Nichols** CSIRO	A journey from gene discovery to sustainable oilseed supplies of health-benefitting long-chain omega-3 oils
11.30 am	**Munish Puri** Deakin University	Enzymatic lignocellulose biomass processing for producing high value marine bioactives
11.45 am	**Kim Jye Lee Chang** CSIRO	Australian thraustochytrids: potential production of dietary long-chain omega-3 oils using industrial wastes
12.00 am	**Lovis Kuriakose** Deakin University	Cost-effective carbon sources enhances omega-3 fatty acid and carotenoid production in thraustochytrids

10.30 – 11.00 am MORNING TEA/POSTER SESSION (cont.)

Time	Speaker	Title
12.15 pm	**Suvimol Charoensiddhi** Flinders University	Prebiotic potential of brown seaweed *Ecklonia radiata* extracts shown by in vitro human gut bacteria fermentation
12.30 pm	**Chris Franco** Flinders University	Fish Protein Hydrolysates: Application in Deep-Fried Food and Food Safety Analysis
12.45 pm	**Trung Nguyen** Flinders University	Highly efficient recovery of omega-3-rich lipids and functional proteins from Australian lobster processing by-products for food and nutraceutical applications

1.00 – 1.45 pm LUNCH

Time	Speaker	Title
	Marine biotechnologies for the environment Chairs: **Suhelen Egan**, Uni NSW and **Libby Evans-Illidge**, AIMS	
Keynote 1.45 pm	**Bernie Degnan** University of Qld	How genomics helps us to understand, protect and use marine biodiversity
2.15 pm	**Karen Weynberg** Aust. Inst. of Marine Science	Marine viruses: unlocking the potential of the most abundant resource in the global oceans
2.30 pm	**Julien Huteau** University of Waikato	Environmental agencies and aquaculture industry
2.45 pm	**Suhelen Egan** University of NSW	Can marine biotechnology help to protect our underwater forests?
3.00 pm	**Qi Yang** Flinders University	Sponge symbiotic microbiome analysis: applicability and performance of five common 16S rRNA gene region-specific primer sets evaluated by 454 and Illumina platforms
3.15 pm	**Cherie Motti** Aust. Inst. of Marine Science	Crown-of-Thorns seastar: finding their Achilles Heel
3.30 pm	**Alexandru Bologa** ARS, Romania	Present state and evolution trends of biodiversity in the Black Sea: decline and restoration

3.45 – 4.15 pm AFTERNOON TEA/POSTER SESSION

Time	Speaker	Title
	Marine biotechnologies for fuel and agriculture (including mariculture) Chair: **Rocky de Nys**, James Cook University	
Keynote 4.15 pm	**David Lewis** Muradel/Adelaide University	Microalgae - are they an appropriate feedstock for biofuels?
4.45 pm	**Peng Su** Flinders University	Microwave-assisted rapid biomass digestion for liquid fertilizer production using South Australia beach-cast seaweed
5.00 pm	**Ashleigh Browne** University of Waikato, NZ	Novel Psa biovar 3 agrichemicals from New Zealand bioactive marine natural products.
5.15 pm	**Xuan Luo** Flinders University	Vortex fluidic device-mediated aqueous two phase extraction of C-phycocyanin from *Spirulina maxima*
5.30 pm	**Faisal Alsenani** The University of Qld	External stimuli to induce nutraceutical biosynthesis in marine microalgae
5.45 pm	**Rocky de Nys** James Cook University	The integrated culture of seaweeds in waste waters – environmental drivers and product options
6.00 pm	**Marina Delpin** Flinders University	Bioprospecting from the global Galathea 3 expedition – investigation of antimicrobial bioactivity and biotechnological potential of an environmentally isolated marine *Pseudoalteromonas*

7.00 – 10.00 pm DINNER (includes AGM)

Friday 15th April, 2016

Time	Speaker	Title
8.50 am		Housekeeping
9.00 am	**Robert Saint** DVCR Flinders University	Introduction to Chief Scientist of South Australia Dr Leanna Read.
9.05 am	**Leanna Read** Chief Scientist, SA	Chief Scientist (SA) address
	International Blue Bioeconomy Industry Forum	
9.20 am	**Wei Zhang**	Welcome to forum and forum objectives
9.25 am	**Wei Zhang**	Sustainable blue bio-economy in Australia and New Zealand: opportunities and challenges
9.45 am	**Song Qin** Yantai Coastal Research, China	Toward blue: transformation of traditional marine biotechnology industry in China

10.10 - 10.30 am MORNING TEA

Time	Speaker	Title
	International Blue Bioeconomy Industry Forum (cont)	
10.30 am	Panel discussion 1	Chair: Raymond Tham, Flinders University Marine biotechnology industry – market drivers, product demand, technology gaps and international partnership
11.15 am	Panel discussion 2	Chair: Chris Battershill, University of Waikato. Policy, investment and trade opportunities in blue bio-economy
12.00 pm	**Rob Lewis** Science Without Bounds, SA	Key recommendations
	Marine biotechnologies 'other' Chair: **Chris Battershill**, University of Waikato	
12.15 pm	**Libby Evans-Illidge** Aust. Inst. of Marine Science	Contributing to the $100B blue economy – can marine biotechnology help protect the capital?
12.30 pm	**Kathleen Hofman** Plant and Food Research, NZ	"Mind the Gap": ensuring laboratory-scale testing meets commercial-scale needs

12.45 - 1.30 pm LUNCH

Time	Speaker	Title
	Marine biotechnologies for drug discovery and development Chairs: **Rob Capon**, University of Queensland and **Tony Carroll**, Griffith University	
Keynote 1.30 pm	**Tony Carroll** Griffith University	Anti-infective natural product discovery using Australian marine invertebrates as a bio-diverse resource
2.00 pm	**Peter Duggan** CSIRO	From the ocean to the clinic - using a marine snail toxin to design potential pain killers
2.15 pm	**Larissa Buedenbender** Griffith University	Integrated high-throughput profiling of ascidian derived actinomycete extracts to aid strain selection for natural product discovery
2.30 pm	**Jadranka Nappi** University of NSW	Characterision of novel bioactive metabolites from marine epiphytic bacteria
2.45 pm	**Damien Stringer** Marinova	Gut health and fucoidan
3.00 pm	**Sam McCormack** University of Waikato, NZ	Chemical ecological and biogeographic insights to the identification of bioactive leads from New Zealand sponges (Porifera: Poecilosclerida).
3.15 pm	**Yadollah Bahrami** Flinders University	Purification and structure elucidation of novel saponins from the sea cucumber *Holothuria fuscogilva* viscera
3.30 pm	**Wei Zhang**	Thanks and final remarks

3.35 – 4.00 pm AFTERNOON TEA - Symposium Ends

ABSTRACTS

In alphabetical order by the surname of first author. Presenter is highlighted.

Poster Presentation

Neuroprotective effect of *Undaria pinnatifida* fucoidan extracts against Aβ1–42-induced cytotoxicity in PC12 cells

Mousa Alghazwi[1, 2, 3], Wei Zhang[1, 2], Scott Smid[4]

[1] *Medical Biotechnology, Flinders Medical Science and Technology, School of Medicine, Flinders University, Adelaide, SA 5042, Australia*

[2] *Centre for Marine Bioproducts Development, Flinders University, Adelaide, SA 5042, Australia*

[3] *Ministry of Higher education in Saudi Arabia, King Faisal Hospital Street, Riyadh 11153*

[4] *Discipline of Pharmacology, School of Medicine, Faculty of Health Sciences, The University of Adelaide, South Australia, Australia*

Aggregation of beta amyloid (Aβ) protein forms senile plaques that are considered one of the major hallmarks of Alzheimer's disease. Fucoidan has been shown to exhibit different biological activities, including neuroprotection. This study investigated the neuroprotective effect of fucoidan extracts from the edible Japanese brown algae *Undaria pinnatifida* against Aβ-mediated toxicity in phaeochromocytoma (PC12) neuronal cells.

Two fucoidan extracts from *Undaria pinnatifida* of varying purities (85.1% and 96%) were not cytotoxic in the MTT cell viability assay, even at the highest concentrations (100 µg/ml). Cell viability was then determined via the MTT assay using Aβ1-42 (1 µM), alone and in combination with the two fucoidan extracts each at 12.5, 25, 50 and 100 µg/ml. Aβ1-42 (1 µM) exposure resulted in approximately 30% neuronal cell toxicity. Both *U. pinnatifida* fucoidan extracts significantly inhibited the toxicity induced by Aβ1-42, with the 85.1% pure extract consistently providing greater neuroprotection (97-102%) than the 96% pure extract (83-90%) across the full extract concentration range. The fucoidan extracted from *U. pinnatifida* was also associated with anti-aggregative effects in the Thioflavin T (ThT) assay of Aβ1-42 fibrillisation; however other compounds present in the extract may also potentially exert neuroprotective activity. These results provide a promising avenue for further research into the neuroprotective role of marine-derived fucoidan extracts as novel dementia therapies.

Email: *alghoo68@uni.flinders.edu.au*

Oral Presentation

External stimuli to induce nutraceutical biosynthesis in marine microalgae

Faisal Alsenani, Faruq Ahmed, Kalpesh Sharma, Ma Ruijuan, Skye R Thomas-Hall, Md Nazmul Islam, Eladl G Eladl Eltanahy, Michael Netzel, Kent Fanning, Peer M Schenk

Algae Biotechnology Laboratory, School of Agriculture and Food Sciences, The University of Queensland, Brisbane, QLD, Australia

Queensland Alliance for Agriculture and Food Innovation, The University of Queensland

Department of Agriculture and Fisheries, QLD, Australia

Microalgae are considered a natural source of many nutraceutical and pharmaceutical compounds, including carotenoids, omega-3 fatty acids and phytosterols with human health benefits. Commercially-produced carotenoids include β-carotene, lutein and astaxanthin. In our recent study, *Chlorella* sp. BR2 and *Dunaliella salina* were treated with plant hormones, indole-3-acetic acid (IAA), salicylic acid (SA) or UV-C radiation. Significant ($p<0.05$) increases in total carotenoids were found for *Chlorella* sp. BR2 after IAA treatment, with β-carotene, lutein and violaxanthine displaying 3-fold increases compared to controls. A significant two-fold increase in total carotenoids was also found for *D. salina* after treatment with 75 mJ/m2 UV-C (up to 1% of total dry weight (DW)) compared to controls. Similarly, in *Nannochloropsis* sp. BR2 short exposure to UV-C at a dose of 100 or 250 mJ/cm2 led to a significant increase in total cellular lipid contents, including a two-fold increase in total eicosapentaenoic acid (EPA) content within 24 h that constituted 30% of total fatty acids and up to 12% of total DW at higher dosages. Plant hormones and UV-C radiation may find uses as easily applicable external inducers for large-scale production of carotenoids or omega-3 production from microalgae. Plant sterols are well-known for their ability to reduce low density lipoprotein (LDL) and cholesterol. Phytosterol contents of microalgae increased over time and of up to 5.1% DW could be produced in *Pavlova lutheri* which could be a promising feedstock for commercial phytosterol production.

Email: *faisal.alsenani@uqconnect.edu.au*

Oral Presentation

Purification and structure elucidation of novel saponins from the sea cucumber *Holothuria fuscogilva* viscera

Yadollah Bahrami[1,2,3] *, Wei Zhang[1,2], Chris Franco[1,2]

[1] *Medical Biotechnology, Flinders Medical Science and Technology, School of Medicine, Flinders University, Adelaide, SA 5042, Australia*

[2] *Centre for Marine Bioproducts Development, Flinders University, Adelaide, SA 5042, Australia*

[3] *Molecular Biology Research Centre, Kermanshah University of Medical Sciences, Kermanshah, Iran*

Holothurians, commonly known as sea cucumbers, are prolific producers of bioactive compounds with diverse functions, and are potential sources of active ingredients for agricultural, nutraceutical, pharmaceutical and cosmeceutical products. The aim of this study was to characterise novel bioactive saponins (triterpene glycosides) from the viscera of an Australian sea cucumber *Holothuria fuscogilva* Cherbonnier, 1980.

The viscera were extracted with 70% ethanol and this extract was purified by a liquid-liquid partition process and column chromatography using Amberlite XAD-4 resin, followed by iso-butanol extraction. The iso-butanol saponin-enriched mixture was further purified by high performance centrifugal partition chromatography (HPCPC). The resultant purified polar samples were analysed using matrix-assisted laser desorption/ionisation time-of-flight mass spectrometry (MALDI-ToF/ MS) and ESI-MS (Electrospray Ionisation), and MS/MS to identify saponins and elucidate their molecular structures.

At least 50 saponins were tentatively identified in the viscera of *H. fuscogilva* with a high structural diversity, including 26 new sulphated and non-sulphated triterpene glycosides, containing different aglycone and sugar moieties. Most of the identified saponins contained low molecular weights; lower than 1250 Da. The TLC profiles of the purified saponins mixture and MALDI analyses revealed that this species possesses a unique pattern of saponins, which can potentially be used for taxonomic classification of this species. Furthermore, the preliminary data of the saponin-enriched fraction from *H. fuscogilva* indicates anti-dengue virus activity. The high structural diversity and novelty of saponins from *H. fuscogilva* with potential functional activities holds great promises for their pharmaceutical, cosmeceutical, nutraceutical, and agricultural applications.

Email: *yadollah.bahrami@flinders.edu.au*

Oral Presentation

New Zealand marine biotechnology: fragmented, but poised to respond to new challenges.

Chris Battershill

University of Waikato, New Zealand

Marine biotechnology in New Zealand is alive and well, however most practitioners in this country would not claim to be 'marine biotechnologists' per se. The sector is fragmented in terms of how scientists view their profession and research foci, most identifying themselves as natural products chemists, aquaculture physiologists, or marine microbiologists as examples; with relatively little referral to the wider implications of their research in arguably more applied sectors. Where marine biotechnology is cited, it is either as a failed biomedicinal discovery experiment (which couldn't be further from the truth), or as an emerging developmental sector with public and politicians alike frequently assuming the field is centred on development of value added products from fish waste. As it happens, this is now a research priority of considerable Governmental interest but, so far, with relatively poor coordinated uptake. A consequence of unrealised collective effort is a research sector that is steeped in misunderstanding.

New Zealands EEZ supports a highly diverse marine fauna and flora with over 60% endemic for some taxa, hence a rich resource. With the Treaty of Waitangi and Wai262 legislation soon to be completed, New Zealand should also benefit from a clear understanding of the provenance of its' biodiversity in terms that satisfy the Access and Benefit Sharing components of the Nagoya Protocol (CBD).

Wider recognition of sectors that marine biotechnologies can service is now creating opportunity that includes new pathways for funding. Now is the time to harness collective expertise to forge new national and international collaborations.

Email: *cbatters@waikato.ac.nz*

Poster Presentation

Biomining extreme environments for natural product genes using Third Generation Sequencing technology

Nicole Benaud, Eden Zhang, Belinda Ferrari

School of Biotechnology and Biomolecular Sciences, University of New South Wales, Sydney, NSW, Australia, 2032

Many important bioactive compounds, including the majority of clinically useful antibiotics are derived from microbial natural products, with the most prolific bacterial producers belonging to the environmentally ubiquitous Actinobacteria, Proteobacteria, Firmicutes and Cyanobacteria Phyla. Natural products are typically produced through Non-ribosomal Peptide Synthetase (NRPS) and Polyketide Synthase (PKS) pathways. Novel chemical structures are urgently needed to combat antibiotic resistance, which has escalated to a global health crisis. Extreme environments are expected to harbour novel species, whose unique metabolic adaptations may similarly provide novel natural products; however this remains under-investigated, particularly as the majority of microorganisms defy cultivation. Next-generation sequencing has offered the means to screen environmental samples for NRPS and PKS genes. Here, we performed the first extensive survey of natural product-encoding genes in Antarctic and Arctic Polar soils, where environmental conditions are some of the most extreme on earth, and where microorganisms often represent the only life form. Third generation PacBio sequencing offers longer reads than next-generation methods, and improved performance for GC-rich sequences. We selected this platform to recover NRPS and Type I PKS gene diversity from over 200 soil samples spanning 12 Polar locations. Our preliminary results indicate that NRPS genes are widely distributed across our Polar soils in comparison to Type 1 PKS. We expect this workflow will be highly relevant and applicable to marine environments that are similarly targeted as a source of novel natural products.

Email: *n.benaud@unsw.edu.au*

Oral Presentation

Present state and evolution trends of biodiversity in the Black Sea: decline and restoration

Alexandru S. Bologa

Academy of Romanian Scientists, Section Biological Sciences, Bucharest, Romania

The biological diversity, including the marine one, and its advanced and continuous decline, respectively, range among priority issues at planetary level, *y compris* the Black Sea, nowadays. As to the Black Sea and its biodiversity, among the other concerns on present ecological disequilibrium, pollution, and living resources, the problem consists of its five times larger watershed than the sea surface itself, totalizing about 350 km3 of freshwater, originating in the hydrographic basins of the Danube, as well as the Dnester, Bug, Dneper, Don and Kuban, each year. The six Black Sea coastal states of Bulgaria, Georgia, Romania, Russian Federation, Turkey and Ukraine themselves affect marine biodiversity directly through their land-based pollution sources. This review reveals the present state and evolution trends of Black Sea *macrophyto-* and *zoobenthos*, *phytoplankton* and related blooms, *zooplankton*, *ichthyofauna* and *cetaceans*, with some examples of changes occurring in the Romanian coastal and marine ecosystem during the last seven decades. The main conclusions highlight that the Black Sea ecosystem is highly different from that documented in the former reference periods, a slight improvement and rehabilitation tendency of the ecosystem since 1995, and the considerable improvement of the pelagic ecosystem especially due to weakening of anthropic pressures. But it is still out of balance by its biodiversity and fish stocks due to eutrophication, overfishing and *alien* species invasion. The long lasting processes of ecosystem restoration, of qualitative improvement of environmental factors and of fishery resources depend on the efficiency of *conservation*, *protection* and *management* measures to be undertaken together by the 11 Danube riparian countries (members of the Danube Commission) and Black Sea coastal states (members of the Black Sea Commission). There is still a strong need for continuing regional cooperation in the fields of *monitoring*, *research*, including biotechnology, and *legislation*, by developing scientifically sound data bases and communication networks, for decision makers and end-users.

Email: *bologa1813@yahoo.ro*

Oral Presentation

Novel Psa biovar 3 agrichemicals from New Zealand bioactive marine natural products

Ashleigh Browne, Chris Battershill, Michele Prinsep, Joel Vanneste, Mike Clearwater

University of Waikato

Bioactive compounds produced by living organisms (natural products) for chemical defence have had extensive use in pharmaceutical, agrichemical, and bioremediation sectors. Increasing application harnesses the unique structure and chemical diversity of the compounds, providing relevant biological activities unsurpassed by synthetic compounds.

Marine natural products represent unexplored potential for novel bioactive compound use in pest management. Pseudomonas syringae pv. actinidiae (Psa), which causes bacterial canker of kiwifruit, threatened the viability of the New Zealand kiwifruit industry. Too few products are available for control of this disease; there is a need to find new products which kill or inhibit Psa. Previous biomedicinal work examining activity against Pseudomonas species provides insight into bioactive marine organisms which elicit defence mechanisms in the plant resulting in a decrease of disease incidence-or which kill or inhibit Psa. Such compounds are likely to be novel given their natural product origin, therefore they will be commercially marketable and exclude terrestrial pathogen resistance for agrichemical use.

Using a hypothesis driven approach that examines reported Pseudomonas bioactivities, the study seeks to identify bioactive marine organisms that possess Psa inhibition properties. Initial discovery will focus on targeted coastal marine species from genera that are known to produce desirable bioactivities in related pathogens."

Email: *ashleigh.browne@hotmail.co.nz*

Oral Presentation

Integrated high-throughput profiling of ascidian derived actinomycete extracts to aid strain selection for natural product discovery

Larissa Buedenbender

Griffith University, Queensland, Australia

Natural products particularly from microbial sources have historically played an important role in drug discovery. In the past two decades however, the interest of the pharmaceutical industry in natural product biodiscovery has declined due to the high incidence of rediscovery of known compounds. This is especially problematic in microbial natural product biodiscovery and has led researchers to access microorganisms from unique environments and develop efficient dereplication protocols to eliminate known compounds at an early stage in the discovery process. Therefore, we used an integrated high-throughput dereplication approach, combining proton NMR fingerprints of ascidian-associated actinomycete crude extracts and biological activity data.

The aim of this approach was to find an effective method using multivariate NMR-bioactivity data analysis to identify microbial strains within an isolate library that have greater potential to produce bioactive metabolites. The patterns observed through this approach were then used to dereplicate the dataset and focus further isolation efforts on extracts showing biological activity and unique chemical fingerprints.

Email: *larissa.buedenbender@griffithuni.edu.au*

Keynote Presentation

Anti-Infective natural product discovery using Australian marine invertebrates as a bio-diverse resource

Anthony Carroll, Joshua Hayton, Laurence Jennings, Allan Mun, Vicky Avery

Griffith University, Queensland, Australia

Infections are responsible for a diverse array of human diseases that can severely impact on the quality and longevity of people's lives. Drug resistant strains of *Plasmodium falciparum*, the parasite responsible for Malaria, is a major concern in a growing number of regions around the world and is responsible for over a million deaths per year. Likewise bacteria such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* are responsible for the majority of hospital acquired multidrug resistant bacterial infections and the likelihood of patients acquiring these infections while in hospital has reached alarming levels in many countries. Prions are a group of infectious proteins that are responsible for a small group of fatal neurodegenerative diseases, with bovine spongiform encephalopathy (BSE) (mad cows disease) or its human form, variant Creutzfeldt-Jakob disease (CJD), most notably publicised in the media. Prions are abhorrent versions of proteins that have undergone a change in their quaternary structure which leads them to no longer being able to perform their normal biochemical function. There is mounting evidence that prion proteins may also be linked to other diseases such as cancers, and various neurological diseases, suggesting a potential infectious basis for these diseases. Studies using yeast prions have demonstrated that small molecules can be effective at curing prion infections.

This presentation will focus on some of our recent discoveries and highlight specific antimalarial, antibacterial and antiprion studies.

Email: *A.Carroll@griffith.edu.au*

Oral Presentation

Australian thraustochytrids: potential production of dietary long-chain omega-3 oils using industrial wastes

Kim Jye Lee Chang[1*], Peter D. Nichols[1,2], Geoff J. Dumsday[3], Susan I. Blackburn[4]

[1] *CSIRO Oceans and Atmosphere, GPO Box 1538, Hobart TAS 7001.*

[2] *CSIRO Food, Nutrition and Bio-based Products, GPO Box 1538, Hobart TAS 7001. 3 CSIRO Manufacturing Private Bag 10, Clayton South Vic 3169*

[4] *Australian National Algae Culture Collection, CSIRO National Research Collections, GPO Box 1538, Hobart TAS 7001, Australia*

Alternative sources of omega-3 oil production from microalgae have been of increasing interest as replacements for fish oil, due to growing concerns with global food security, health of the ocean's fish stocks, ecological effects of industrial fishing, and high levels of pollutants in some fish oils. The use of industrial wastes for heterotrophic algal production system could not only potentially reduce the greenhouse gas emissions of industries including power plants, but also substantially reduce the cost of commercial production of algal-derived omega-3 oils.

Thraustochytrids can produce high amounts of docosahexaenoic acid (DHA,22:6Ð3). We examined aspects of cultivation of thraustochytrids using crude glycerol, and other industrial wastes such as soy pulp and protein meals, as nitrogen sources. Glycerol, a by-product of biodiesel production from vegetable oil and animal fats, is becoming increasingly available. The crude glycerol was not pre-treated prior to addition to the culture medium, with an overall aim of avoiding or minimizing unnecessary processing costs. Our initial results showed that impurities in the crude glycerol hindered growth of thraustochytrids, with a maximum yield of 9g/L dry cell weight (DCW) and 48% DHA (of TFA) at 4-days. The biomass yield was improved to 20g/L DCW using continuous fermentation in 2L bioreactors, with added pure glycerol equivalent to 4%w/v in the growth medium.

Heterotrophic cultivation of thraustochytrids using crude glycerol stream as a carbon source offers considerable potential to provide the growing global population with a secure, environmentally sustainable alternative source of health-benefitting omega-3 oils for use in feeds and foods.

Email: *kim.leechang@csiro.au*

Oral Presentation

Prebiotic potential of brown seaweed *Ecklonia radiata* extracts shown by *in vitro* human gut bacteria fermentation

Suvimol Charoensiddhi[1, 2], M.A. Conlon[3], M.S. Vuaran[3], C.M.M. Franco[1, 2], W. Zhang[1, 2]

[1] *Centre for Marine Bioproducts Development*

[2] *Department of Medical Biotechnology, School of Medicine, Flinders University, Adelaide, Australia*

[3] *CSIRO Food and Nutrition, Kintore Ave, Adelaide, SA 5000, Australia*

Seaweeds are important sources of nutrients, particularly olysaccharides and polyphenols with diverse structures and functionalities that could potentially be exploited as prebiotics. This study aimed to investigate the prebiotic potential of extract constituents of a South Australian brown seaweed *Ecklonia radiata* using different extraction processes. Seaweed extracts were prepared by enzyme, microwave-assisted, and conventional acidic and water extraction processes. Extracts were assessed for their prebiotic potential by using an in vitro anaerobic fermentation system containing human faecal inocula to measure their ability to generate short chain fatty acids (SCFA) and/or alter the growth of selected bacterial types (using quantitative real-time PCR). Following 24 h fermentation, an extract prepared using microwave-assisted Viscozyme extraction showed high potential for improving gut health as it resulted in high production of SCFA and stimulated growth of beneficial bacteria, including Bifidobacterium and Lactobacillus (both traditional markers of prebiosis), as well as *Faecalibacterium prausnitzii* (a key butyrate-producing bacteria with anti-inflammatory properties). Further separation of this crude extract resulted in a fraction enriched in polysaccharides which was not digestible by enzymes in the small intestine (suggesting it would act as a dietary fibre and reach the large bowel if ingested), and which was able to significantly increase total SCFA production during in vitro fermentation. These findings demonstrate that brown seaweed *Ecklonia radiata*-derived polysaccharides have the potential to be used as dietary supplements with gut health benefits in humans.

Email: *suvimol.charoensiddhi@flinders.edu.au*

Keynote Presentation

How genomics helps us to understand, protect and use marine biodiversity

Bernie Degnan

School of Biological Sciences, University of Queensland, Brisbane, Australia

With jurisdiction over 14.7 million square kilometres of ocean that span an array of habitats from the tropics to the cool temperate, Australia oversees a significant portion of the world's marine biodiversity. Marine genomics currently is transforming the way in which we utilise and protect the biodiversity in our oceans. Drawing upon a number of cases studies from the Marine Genomics Laboratory at the University of Queensland, I will show how basic and strategic research yields knowledge and understanding of an organism's genome, transcriptomes and proteomes, which in turn can lead to critical insights into commercial and environmental problems and eventually applied outcomes.

Email: *b.degnan@uq.edu.au*

Oral Presentation

From the ocean to the clinic - using a marine snail toxin to design potential pain killers

Peter Duggan

CSIRO Manufacturing

Ziconotide (Prialt®), a synthetic version of the peptide ω-conotoxin MVIIA found in the venom of a fish-hunting marine cone snail Conus magnus, is one of very few drugs effective in the treatment of intractable chronic pain. However, its intrathecal mode of delivery and narrow therapeutic window cause complications for patients. In this presentation, I will describe progress in the development of small molecule, non-peptidic mimics of Conotoxins. This will include a description of how some of the initially designed mimics have been modified to improve their drug-like properties.

Email: *peter.duggan@csiro.au*

Oral Presentation

Can marine biotechnology help to protect our underwater forests?

Suhelen Egan, Vipra Kumar, Melissa Gardiner and Torsten Thomas

Centre for Marine Bio-Innovation (CMB); School of Biological Earth and Environmental Science (BEES), The University of New South Wales (UNSW), Australia

Seaweeds (macroalgae) form a diverse and ubiquitous group of photosynthetic organisms that are the ecosystem engineers of marine temperate reefs. Unfortunately, seaweeds are also under threat from disease, possibly resulting from increased anthropogenic stressors such as climate change and urbanisation. However one major challenge is to identify the causative agents of disease and link specific pathogens to particular disease events. We are using a combination of "traditional" culturing and "next generation" biotechnologies to understand bleaching disease in the model macroalga *Delisea pulchra*. Our studies have revealed the presence of new pathogens (including the bacteria *Agarivorans* sp., *Aquimarina* spp. and *Alteromonas* spp.) and identified both unique and common mechanisms for host interaction and virulence in these microorganisms. It is hoped that these findings, together with a greater understanding of the microbial communities and gene functions associated with healthy and diseased seaweeds will lead to the development of future monitoring strategies for the early detection of stress and disease in these important habitat forming organisms.

Email: *s.egan@unsw.edu.au*

Oral Presentation

Contributing to the $100B blue economy – can marine biotechnology help protect the capital?

Libby Evans-Illidge, Line Bay, Sven Uthicke, Madeleine van Oppen, and Nicole Webster

Australian Institute of Marine Science, Townsville, Australia

Besides contributing directly to the development of new commercial products, markets and marine industries, marine biotechnology is well positioned to protect these opportunities by supporting the sustainable management of the marine estate and the natural capital on which they rely. This presentation will introduce a broad scope of tropical environmental marine biotechnology research undertaken at AIMS, along with proposed application of knowledge to develop innovative solutions and tools for marine resource management. Selected case studies will complement those already described in other presentations at this symposium, and will include the following: translating knowledge of physiological acclimatisation of coral and their symbionts - to develop novel bioindicators of coral health; translating knowledge of Crown of Thorns (COT) seastar genetic markers to develop methods of early detection and quantification of impending outbreaks; knowledge of genetically tolerant coral strains and the basic biology of corals to develop assisted evolution strategies to mitigate climate change impacts on coral reefs; and knowledge of the changes in holobiont diversity in response to stress, to develop microbial indicators of health. Collectively, this research seeks to apply basic knowledge about marine genomics, evolution, molecular ecology, holobiont functional diversity, and chemical ecology, to identify new innovative approaches for environmental monitoring and management interventions.

Email: *e.evansillidge@aims.gov.au*

Opening Presentation

Sustainable and effective marine biotechnology: an industry perspective

Helen Fitton

Marinova Pty Ltd, Tasmania, Australia

Marine biotechnology offers considerable promise for the design and manufacture of useful products including foods and pharmaceuticals. Research areas that initiate new products include bioprospecting and creative use of fish and macroalgae. Industries based on macroalgae in Australia include wild harvest of storm-cast macroalgae and onshore culture of algae in various forms. In the current era of climate change, every nation needs to be mindful of ecosystem protection. Australia has a large coastline with many currently intact ecosystems which are protected by regulation. Onshore culture and innovative approaches can provide zero or low impact ways to create useful biomass for business. Marinova is a Tasmanian company dedicated to the manufacture of only one compound- fucoidan -from marine algae, which is an edible bioactive used in nutraceutical products. It is under development for medical devices and pharmaceuticals. Key elements in the success of the business have included Organic certification, sustainable harvest, and continued investment in research.

Email: *Helen.Fitton@marinova.com.au*

Oral Presentation

Fish Protein Hydrolysates: Application in Deep-Fried Food and Food Safety Analysis

Shan He, Chris Franco, Wei Zhang

Centre for Marine Bioproducts Development, Flinders University/Department of Medical Biotechnology, School of Medicine, Flinders University

Four different processes (enzymatic, microwave-intensified enzymatic, chemical, and microwave-intensified chemical) were used to produce fish protein hydrolysates (FPH) from Yellowtail Kingfish for food applications. In this study, the production yield and oil-binding capacity of FPH produced from different processes were evaluated. Microwave intensification significantly increased the production yields of enzymatic process from 42% to 63%. It also increased the production yields of chemical process from 87% to 98%. The chemical process and microwave-intensified chemical process produced the FPH with low oil-binding capacity (8.66 g oil/g FPH and 6.25 g oil/g FPH), whereas the microwave-intensified enzymatic process produced FPH with the highest oil-binding capacity (16.4 g oil/g FPH). The FPH from the 4 processes were applied in the formulation of deep-fried battered fish and deep-fried fish cakes. The fat uptake of deep-fried battered fish can be reduced significantly from about 7% to about 4.5% by replacing 1% (w/w) batter powder with FPH, and the fat uptake of deep-fried fish cakes can be significantly reduced from about 11% to about 1% by replacing 1% (w/w) fish mince with FPH. Food safety tests of the FPH produced by these processes demonstrated that the maximum proportion of FPH that can be safely used in food formulation is 10%, due to its high content of histamine. This study demonstrates the value of FPH to the food industry and bridges the theoretical studies with the commercial applications of FPH.

Email: *he0091@flinders.edu.au*

Oral Presentation

"Mind the Gap": ensuring laboratory-scale testing meets commercial-scale needs

Kathleen Hofman, D S LeCorre-Bordes and P Jaksons

The New Zealand Institute for Plant & Food Research Limited, 300 Wakefield Quay, Nelson 7010, New Zealand.

The focus of our team is the understanding of molecules from marine by-products with the aim of enabling industries to use marine resources for innovative product development. We have developed a process for the preparation of a marine-derived denatured whole chain collagen for commercial electrospinning. After production, the collagen was routinely tested on laboratory-scale electrospinning equipment to confirm spinnability, which was determined from fibre morphology. However, when the product was taken up by industry we became aware that both the electrospinning conditions used post-production and the criteria for testing the collagen product did not reflect those of the industrial clients. Therefore, we modified a laboratory-scale electrospinning machine setup to achieve potential differences relevant to commercial electrospinning (≥30 kV). Using this setup, we examined the effects of different spinning parameters on fibre diameter and deposition rates and determined the optimised spinning conditions for the marine collagen material. These conditions were tested and confirmed at pilot-scale in an industrial electrospinning factory. The results of this work will be presented in the context of the "gap" between academic development and assessment criteria, and what the industry needs for success.

Email: *kathleen.hofman@plantandfood.co.nz*

Oral Presentation

Environmental agencies and aquaculture industry

Julien Huteau, Aamir Mukhtar, Chris Battershill

Environmental Research Institute/University of Waikato, New Zealand

Environmental managers require quantifiable, robust, scientific information on the ecological state of sensitive habitats within their jurisdiction to permit the development of sustainable strategies for resource use and conservation. Directly linked with human activities, pollution is compromising a wide range of sectors such as tourism, trade partners (including international) and public health associated with consumption of seafood. The sustainability of the aquaculture industry is especially dependent on the unique environmental conditions found in New Zealand assuring high quality product and customer expectation. Furthermore, scientists have alerted important environmental challenges associated with climate change and ocean acidification which could be detrimental to the future increase prediction in the production of seafood. Recent research as part of a PhD program designed to understand the ecological fate and effects of anthropogenic contaminants in estuaries has been undertaken in conjunction with the Titanium Industry Development Association (TIDA), to support innovation in the field of ecological research. This work is an exciting opportunity to develop new ways to characterise and understand disturbances from well-known pollution events. The initial phase of this research has been the development of a novel application of microhardness measurement inside cockle shells as a measure of stress. Further aspirations leading from this research will be discussed with reference to the estuarine environment as well as aquaculture/industrial partnership and the development of a biomonitoring tool.

Email: *clear.oceancoast@gmail.com*

Poster Presentation

Screening marine macro and micro-organism extracts for novel anti-prion compounds

Laurence Jennings, Alan L. Munn, Anthony R. Carroll

School of Environment, Environmental Futures Research Institute, Griffith University (Gold Coast campus), Parklands Drive, Southport, QLD 4222, AUSTRALIA.

Prion diseases are a rare group of infectious neurological disorders in animals that are caused by modified isoform prion proteins. Prion diseases include Creutzfeldt-Jakob disease, Gerstmann-Straussler-Scheinker syndrome, Fatal Familial insomnia, and kuru in humans. These amyloid formations caused by prions are also potentially associated with over 30 other human diseases including Alzheimer's, Parkinson's, and Huntington's diseases. There have been several amyloid-based prion proteins discovered in the yeast Saccharomyces cerevisiae. These prions in yeast represent a good model for research into the formation and spread of amyloids. A new high-throughput screening method to test for anti-prion activity using these yeast prions was developed. This assay was developed specifically to screen natural extracts for novel compounds with anti-prion activity.

Natural products have previously been shown to have a high chemical diversity and many natural products have been used as drugs. Particularly in the marine environment, with a large number of highly active novel metabolites isolated from marine organisms. The marine environment is a good place to look for novel activity due to the highly structurally unique natural products compared to those derived from terrestrial organisms. With a pilot study of 57 marine micro-organisms a sponge extract was found to show activity in the bioassay indicating that it contains compound(s) with anti-prion activity. The active compound(s) in the extract have been isolated and identified. This method has then been used to screen a collection of over 600 marine macro and micro-organism extracts for anti-prion activity.

Email: *laurence.jennings@griffithuni.edu.au*

Oral Presentation

Cost-effective carbon sources enhances omega-3 fatty acid and carotenoid production in thraustochytrids

Lovis Susan Kuriakose, Colin J Barrow, Munish Puri

Centre for Chemistry and Biotechnology, Deakin University, 75 Pigdons Road, Waurn Ponds, Victoria, 3216, Australia

Marine microbes have the potential in accumulating large quantities of lipids and are therefore considered as feedstock for producing nutraceuticals and biofuels 1, 2. Few isolates from Australian marine environment were obtained based on rigorous screening and fatty acid (FA) composition such as omega-3 and omega-6 polyunsaturated fatty acids3. Overall, these isolates exhibited a comprehensive fatty acid profile accommodating saturated and polyunsaturated fatty acids. Since the cost of raw materials accounts for more than 20% of the production cost, novel fermentation carbon sources from non-traditional crops and agricultural wastes have become attractive alternatives. Being economically competitive, sunflower seed extract that composed of lignocellulosic fibres (40% dry matter) and proteins (30% dry matter) offer an excellent opportunity to be used as an eco-friendly substrate for the production of value-added products. A *Thraustochytrium* sp. S7, isolated from the marine waters of New Zealand, accumulates astaxanthin as the predominant carotenoid4. Varying concentrations of sunflower seed extract was used to optimize astaxanthin and omega-3 fatty acid production. Incubation of *Thraustochytrium* sp. S7 in a production medium containing sunflower seed extract as the sole carbon source resulted in an increase in total carotenoid and fatty acid production. Interestingly there was a two fold increase in omega-3 fatty acid production with a concomitant decrease in saturated fatty acids. The results of the investigation will be shared at the time of presentation.

Email: *lov@deakin.edu.au*

Keynote Presentation

Microalgae - are they an appropriate feedstock for biofuels?

David Lewis[1,2]

[1] *Muradel Pty Ltd*

[2] *Adelaide University*

Are microalgae derived biofuels anywhere near commercial reality? Over the past few years significant scale-up of appropriate processing technologies has been undertaken to further develop production of energy positive biofuels with carbon footprints less than fossil equivalents. Several companies have adopted hydrothermal liquefaction (HTL) as the method to convert biomass to hydrocarbon feedstocks, commonly known as green crude. A sub-critical water reaction is used to drive HTL. The true boiling point (TBP) distributions of green crude show equivalent data to fossil crude oils. The TBP for green crude derived from *Tetraselmis* sp. was found to be very similar to that of West Texas Intermediate crude oil, which can be readily fractionated to typical fuel components including approximately 30% petrol, 30% bunker fuel, 20% diesel and 20% jet fuel. Specific distillates can be blended with fossil derived distillates or used directly in the fuel supply chain. The yield and quality of green crude can be manipulated in several ways by manipulating either the biomass production protocols and/or manipulating the HTL reaction conditions. To realise commercialisation of microalgae derived biofuels the products must be specified and the production process fully optimised. This presentation will provide data that shows how the yield, quality and specificity of biofuel products derived from microalgae generate commercial interest, but can economically viable processes be achieved?

Email: *david.lewis@adelaide.edu.au*

Poster Presentation

The Paradise of Modern Marine Biological Industry—MIUTON

Yuqiang Li

Qingdao Miuton Medical Co., LTD

Qingdao Miuton Medical Co., LTD. was founded in 2004, with registered capital of 24.86 million RMB. Our company, as a “High-tech enterprise, has always focused on the integration of R&D, manufacturing and sales in the area of marine biomedical materials. In 2015, Qingdao Miuton Medical Co., LTD. Has been successfully listed on the Chinese stock exchange market. And, we have also established and maintained many long-term industry - research collaboration projects and relationships with several international recognized research institutions. Especially, Dr. Yuanqiang, from our company, has developed many patents and more than 30 products, such as chitin band-aid, chitin cooling gel, and chitin eye-care stick and marine flower gel.

In 2012, Qingdao Miuton Medical Co., LTD. has been rewarded as a Chinese “High-tech Enterprise”. Furthermore, the two products of “Medical Ultrasonic Sterilizing Coupling Agent” and “Nano-silver Chitosan Wound Dressing” were rewarded as as “International Advanced Prize” in China. In 2013, “Qingdao Marine Biological Medical Technology Experts Workstation” was founded by Qingdao Miuton Medical Co., LTD together with China Ocean University. And, a contract with COVALON company, Canada was signed to license Qingdao Miuton Medical Co., LTD the exclusive right for the implementation and commercialization of the technology of ultra-smooth antibacterial catheter coating. Moreover, a project of new memory alloy of zirconium titanium niobium was funded by Qingdao Miuton Medical Co., LTD under the collaboration with RMIT University. By using one of the most advanced sintering molding technology and 3D printing to produce teeth, skull, implanted organs and other artificial joints.

Email: *1513121532@qq.com*

Oral Presentation

Vortex fluidic device-mediated aqueous two phase extraction of C-phycocyanin from Spirulina maxima

Xuan Luo[1,2] , Colin Raston[3], Paul Smith[4], Wei Zhang[1,2]

[1] *Centre for Marine Bioproducts Development*

[2] *Department of Medical Biotechnology, School of Medicine, Flinders University, Adelaide, SA 5042, Australia*

[3] *Centre for NanoScale Science and Technology, School of Chemistry and Physical Sciences, Flinders University, Adelaide, SA 5042, Australia;*

[4] *The Australian Wine Research Institute, Hartley Grove, Urrbrae, SA 5064, Australia.*

A vortex fluidic device (VFD) is effective for downstream processing of C-phycocyanin (C-PC) from blue-green microalgae *Spirulina maxima* using an aqueous two phase system (ATPS) composed of polyethylene glycol (PEG) and aqueous potassium phosphate (KPi), increasing the purity of the protein with minimal reduction in yield. The optimal operating conditions determined using conventional methods at tie line length (TLL) of 18.64% and volume ratio of 0.3 were applied to VFD continuous flow processing, resulting in instantaneous phase separation of the liquid exiting the 20 mm diameter tube inclined at 45o and rotating at 6750 rpm, for a 0.2 mL/min flow rate. This process results in a 1.18 fold increase of purity and 17% increase of yield compared to conventional purification methods using ATPS. Multi-stage counter current distribution (CCD) using VFD-ATPS led to a 6 fold increase in purity compared to crude extract, from 0.5 to 3.0. Purified C-PC showed one absolute absorption peak at 615 nm, a fluorescence emission at 643 nm, specific sharp amide I band at 1650 cm-1, negative bands at 222 nm and 208 nm and positive band at 195 nm for circular dichroism far-UV spectra and corresponding molecular weights of α and β subunits around 17 kDa, which is consistent with the purified C-PC fully retaining its characteristics and intactness. Triple TOF mass spectrometry confirmed that the purified protein is C-phycocyanin with more than 95% sequence coverage for both subunits. This work establishes the utility of using a VFD for protein purification and its potential as an effective new tool for rapid processing of biologically active and intact proteins.

Email: *xuan.luo@flinders.edu.au*

Poster Presentation

Extract of South Australian marine sponge Tedania sp. showing potent activities against breast cancer stem cells

Xuan Luo[1,2], Thi Diem Tran Nguyen[3], Shuang Peng[1,2], Robyn Meech[3], Wei Zhang*[1,2]

[1] *Centre for Marine Bioproducts Development (CMBD)*

[2] *Department of Medical Biotechnology*

[3] *Department of Clinical Pharmacology, Flinders Medical Science and Technology, School of Medicine, Flinders University, Bedford Park, South Australia 5042, Australia.*

Oceans host a huge diversity of marine organisms and natural products, a great resource for the discovery and development of new generation anti-cancer pharmaceuticals. Marine sponges were the source of over 30% of all marine natural products and nearly 50% of all marine-derived anticancer compounds discovered to date, making them inarguably the best sources for discovery of anti-cancer drug candidates. However, only a few studies have dedicated to screening these sponge-derived natural products against cancer stem cells that are highly resistant to conventional chemotherapies and considered to be the driving force for cancer relapse.

The aim of this study is therefore to develop and utilise bioassays to screen the activity of marine sponge extracts with defined anti-breast cancer activities, against breast cancer stem cells (BCSCs). High-throughput BCSC screening assays were based on breast cancer cell lines stably transfected with a pluripotency reporter gene (OCT4-GFP), which marks only the BCSC population with green fluorescence. Among six marine sponges screened, extract of *Tedania* sp. (Demospongiae: Poecilosclerida) was found to effectively reduce the OCT4-GFP-positive BCSC population and also inhibit formation of mammospheres and expression of stem cell-associated pluripotency genes at IC50 value (around 3µg/ml). *Tedania* sp. extract exhibits low toxicity towards normal mammary cells at~5 fold higher IC50 value. Further studies will focus on purification and identification of the active compounds in extract of Tedania sp. 1 and their mechanisms of actions. This study demonstrates the potential of discovering bioactive compounds for anti-CSC drugs from South Australia marine sponges."

Email: *xuan.luo@flinders.edu.au*

Oral Presentation

Chemical ecological and biogeographic insights to the identification of bioactive leads from New Zealand sponges (Porifera: Poecilosclerida).

Sam Mc Cormack, PM Ross, ID Hogg, CN Battershill.

University of Waikato, New Zealand

Sponges are reported to have the highest incidence of leads in drug discovery programmes from any plant or animal on the planet. We report on preliminary investigations on the phylogeny and chemical ecology of a group of sponges known to produce interesting biomedicinal leads. The group includes species of known cosmopolitan/alien status. Phylogenetic analysis of the diversity of a population of sponges collected from a New Zealand harbour environment utilising both molecular and classical techniques, suggests that a higher than expected proportion of cosmopolitan and potentially invasive species are associated with active compound biosynthesis. We plan a research programme that will make use of molecular biosystematics and inherent immune protein synthesis capacity combined with ecological investigation, to test the hypothesis that alien sponges produce higher rates of bioactive (immune-suppressive) secondary metabolites in order to gain an initial foothold (often as epizoic invaders) and hence be competitive in new microhabitats. The research will have two outcomes. The first will permit examination of the role of bioactive compounds from sponges, and their symbionts, that assist with defense in new or changing environments; and the second will establish whether these sponges contain other compounds that have biological applications, particularly novel bio-medicines with immunological features. The focus genus is *Mycale (Carmia)*, Porifera: Poecilosclerida. Several metabolites from these sponges are in pre-clinical trial phases (eg Peloruside A) and other compounds from this Genus have been associated with immunosuppressive activities in the past (e.g. Mycalamides).

Email: *samuel.pmccormack@gmail.com*

Oral Presentation

Crown-of-Thorns seastar: finding their Achilles Heel

Cherie Motti, M. Hall, U. Bose, S. Cummins

Australian Institute of Marine Science, Townsville, Queensland, Australia

Saponins are examined as a possible innovative control technology against the outbreak keystone species *Acanthaster planci* aka Crown-of-Thorns Seastar (COTS). COTS counter predation through both physical (thorns/aggregations) and chemical (cytotoxic steroidal asterosaponins) deterrents. The spinal glands can release saponins into the immediate water column which can transverse fish gills causing haemorrhagic activity, respiratory distress and death. COTS, however, have a built-in resistance to saponin toxicity in the form of modified sterols on their cell membranes.

An untargeted LC-MS based metabolomics approach for small molecules was used to characterise the secretome of individual COTS and those that form aggregations, those in content vs alarmed state as well as comparing male and female animals, and gametes. Ruberoside B (also isolated as saponin B) and thornasteroside A were the only identified saponins found in all states (aggregation, alarm, single male or female) and gametes (eggs and sperm). Five types of saponins were produced solely by females, whereas eight types were unique to males. Two saponins were only found in females and not in an aggregated or alarmed state.

Email: *c.motti@aims.gov.au*

Oral Presentation

Characterisation of novel bioactive metabolites from marine epiphytic bacteria

Jadranka Nappi, Francesco Ballestriero, Carolina Campi, Suhelen Egan

University of New South Wales, Australia

The aim of this study was to use a culture independent functional metagenomic approach to identify and characterise new bioactive compounds isolated from bacterial epiphytes of the seaweed *Ulva australis*.

We screened an *E. coli* fosmid (Epicentre. EpiFos) library containing 30, 000 clones of the microbial community DNA of *U. australis* for activity against the nematode Caenorhabditis elegans, used here as a eukaryotic model and proxy for parasitic nematodes. Initial screening of the library identified 150 potential toxic or repellent clones and of those, six were confirmed as being toxic to the nematode.

One of clones (JJ117) was therefore analysed further to identify the gene or gene clusters involved in the toxic activity.

To elucidate which genes are responsible for the toxic activity random transposon mutants of JJ117 were generated, expressed in *E. coli* epi300 cells and the resulting mutant clone library screened for loss of toxicity. One mutant showed considerable loss in toxic activity compared to the wildtype clone and further analysis revealed the transposon was inserted in the intergenic region of an ATP grasp superfamily protein and an Alpha E superfamily protein with 100% sequence identity to genes Dshi_3242 and Dshi_3243 respectively from *Dinoroseobaster shibae*. This study provides the first evidence of these genes being associated with antimicrobial activity, suggesting that they encode for a novel bioactive metabolite or enzyme. Given *C. elegans* is often used as a model for parasitic nematodes, the active clones identified in this study may lead to the development of novel pharmaceuticals strategies.

Email: *jadranka.nappi@gmail.com*

Oral presentation

Highly efficient recovery of omega-3-rich lipids and functional proteins from Australian lobster processing by-products for food and nutraceutical applications

Trung T. Nguyen, Andrew R. Barber, Wei Zhang

Centre for Marine Bioproducts Development, Medical Biotechnology, Flinders University, Adelaide, Australia

Global lobsters processing by-products estimated over 40,000 tons, with an estimation of 3,000 tons contributed from Australia lobster industry. Although lobster by-products have been utilized for the production of biofertiliser and aquafeed, the vast majority of these by-products are discarded as wastes with disposal costs around $150 per ton to Australian lobster processors. However, these by-products are rich in proteins, chitin, lipids, and astaxanthin that could be recovered for food, nutraceutical and pharmaceutical applications with highly added values. The aim of this study was to develop cost-effective integrated biorefinery processes for the recovery of functional and bioactive ingredients from lobster processing by-products using supercritical carbon dioxides (SC-CO2) extraction and microwave technology. Australian rock lobster livers found to be rich in lipids (24.3 %) but contaminated with heavy metals (total arsenic 240 mg/kg & cadmium 8 mg/kg). The SC-CO2 extraction was used for the recovery of lobster lipids. The results have demonstrated 94 % of lipids in lobster livers were recovered by SC-CO2 extraction. The extracted lipids were significantly rich in PUFAs (31.3 %), ω-3 (18 %), and DHA (8.1 %) but low heavy metal contamination (total arsenic: 2.2 mg/kg and cadmium: <0.01 mg/kg), far below Australian New Zealand food standard (2 mg/kg for inorganic arsenic & cadmium). To recover functional protein from lobster shells while providing the deproteinised shells suitable for further chitin recovery, microwave was used for intensifying enzymatic deproteinization of rock lobster shells. This process could remove 85 % proteins of lobster shells to produce lobster shell protein hydrolysate with excellent functional property (solubility 91.7 %, water binding 32 %, oil binding 2.3 mL/g, foaming 51.3 %, and emulsification 91.3 %) and good nutritional quality (34 % essential amino acids, 45.5 mg/g arginine, and low lysine/arginine ratio (0.7 vs 13 % of meat protein) that could be used for food and nutraceutical products. With these significant results, the integrated biorefinery process developed in this study provides an innovative and environmentally friendly solution for cost-effective recovery of multiple products from lobster processing by-products that can be used for food and nutraceutical applications.

Email: *nguy0514@flinders.edu.au*

Keynote Presentation

A journey from gene discovery to sustainable oilseed supplies of health-benefitting long-chain omega-3 oils

Peter D Nichols[1], James R. Petrie[2], Surinder P. Singh[2]

[1] *CSIRO Food, Nutrition & Bio-based Products, Oceans & Atmosphere Flagships, Hobart, Australia*

[2] *CSIRO Food, Nutrition & Bio-based Products, Agriculture Flagships, Canberra, Australia*

The omega-3 long-chain (LC, $\geq C_{20}$) polyunsaturated fatty acids - EPA and DHA - have key roles in human health and development. Numerous studies indicate that deficiencies in these fatty acids can increase the risk or severity of cardiovascular and inflammatory diseases in particular. These health-benefitting fatty acids are largely sourced from marine (fish and krill) and to a lesser extent algal oils. To meet increasing demand for the LC omega-3 oils, particularly in aquaculture and a range of human health applications, there is a real and urgent need for an alternative and sustainable source of EPA and DHA. In the case of aquaculture, the markedly changed diets presently used now see many farmed seafood products containing more omega-6 than omega-3 oil. We have therefore focused on maximising the production of DHA in oilseed. Our CSIRO team has transitioned DHA production in seed from the model species *Arabidopsis* through to *Camelina*, *Brassica juncea* and the target crop *Brassica napus* (canola), with a commercial partner – Nuseed-Global also joining the R&D effort. DHA levels that now exceed the amount typically found in bulk fish oil have been achieved in all these species. We will describe aspects of the gene selection, the transgenic plants, and seed oil fatty acid profiles, and will also discuss the characteristics of this new oil in the context of potential downstream applications.

Email: *Peter.Nichols@csiro.au*

Oral Presentation

The integrated culture of seaweeds in waste waters – environmental drivers and product options

Rocky de Nys[1], Arnold Mangott[2]

[1] *College of Marine and Environmental Sciences, James Cook University, Townsville, Australia*

[2] *MBD Energy, James Cook University, Townsville, Australia*

The integrated culture of seaweeds in waste waters from marine industries is a particularly attractive model for sustainability, reducing contaminant export while delivering biomass as a resource. However, the reality of delivering an integrated and sustainable solution can differ significantly from providing a conceptual model. The success of delivering the integrated culture of seaweeds in aquaculture waste waters is dependent on profitability, with key drivers being monetized environmental and product values. A case study is presented of the delivery of the integrated culture of seaweeds with intensive land-based aquaculture, adjacent to the World Heritage Listed Great Barrier Reef Marine Park, with a focus on delivering environmental compliance and product options. The selection of species, optimization of productivity and assessment of biomass quality to deliver a target product have been key to its success. These are described in detail highlighting the bespoke nature of integrating the culture of seaweeds into aquaculture waste streams and the partnerships required to do so. The development and assessment of future product options, ranging from human foods to bioenergy, are also described in detail as they have been explored to maximize the value of a single biomass resource through the delivery of multiple products.

Email: *rocky.denys@jcu.edu.au*

Oral Presentation

Enzymatic lignocellulose biomass processing for producing high value marine bioactives

Munish Puri, Colin J Barrow, Adarsha Gupta, Reinu E Abraham

Centre for Chemistry and Biotechnology, Deakin University, Geelong, Victoria, Australia

Lignocellulose biomass (LCB) can serve as an inexpensive carbon source for growing marine microbes including oleaginous microorganisms. Pretreatment and enzymatic hydrolysis are often attempted to loosen rigid LCB structure and facilitate sugar production. These sugars can be used as carbon sources for growing marine microbes that produce lipid biofuel, or can alternatively be utilised to produce ethanol. We have developed methods for producing sugar hydrolysate from locally available low-cost cellulosic biomass using nanomaterial immobilized enzyme. Functionalized nanomaterial's showed better immobilization yield and enzyme activity that lead to economisation the process of sugar production. Further, reducing sugars from low-cost woody biomass was explored for growing marine microbes. Profile of total lipids and unsaturated fatty acid produced from novel marine microbes was documented by gas chromatography (GC) and found to be suitable for biodiesel production. The presentation will focus on the results obtained from the present study which includes the optimised cellulosic pretreatment, reducing sugar production and its scale up, and utilisation of feed source for producing high-value bioactives such as DHA and EPA.

Email: *munish.puri@deakin.edu.au*

Industry Forum Keynote 2

Toward blue: transformation and upgradation of traditional marine biotechnology industry in China.

Song Qin, Jun Chen, Zhengyi Liu

Yantai Institute of Coastal Zone Research, Chinese Academy of Sciences, Yantai, China

17 Chunhui Road, Laishan Street, Yantai, Shandong 264003, P. R. China

Marine Biotechnology Industry is industry that explores and utilises marine bioresources for products or services. Marine special bioresources for industrialisation contain algae, sea cucumber, squid, chitin, and collagen, etc, which are mainly for healthy foods, functional products, drugs and biomaterials. According to China's Marine Economic Statistical Bulletin, from 2011 to 2015, China's Gross Ocean Production (GOP) sustainably increased. In 2015, GOP contributed 9.6% to Gross Domestic Production (GDP), and increase of 7.0% over last year. But the marine biotechnology industry had low percentage of GOP, for example, marine biological medicine industry only contributed 1.1% of the 30.2 billion RMB for GOP.

To enhance the profits of marine biotechnology industry, four bottlenecks still need to be overcome in China. These include quality, public credibility of the nutritional value of processed marine bioproducts, the variety of high-value products, and relative high costs compared to large market biomass demands. To overcome these bottlenecks, China is implementing some strategies that include a series of quality control standards at local, regional and national scale for algae, chitin, collagen etc., "Precision Nutritional Function" evaluation methodologies for the nutritional or functional value of algae, sea cucumbers etc., new bioprocessing technologies, cost reduction technologies, and biomass production technologies.

Research progress, technology development and service networks have become an important impetus for the sustainable development of the marine biotechnology industry. In the last decade, Chinese Microalgal Industry Alliance (CMIA), Alliance of Marine Bioresource High-value Utilization in Shandong Province (AMBHU) and other service networks have played important roles in promoting integration of Industry-Academy-Research communication and cooperation at regional, national or international scale. With developments in marine proteins, marine biological reagents and other products, a new marine biotechnology industry is on the rise. In future, through the "One Belt And One Road" policy of the Chinese government, CMIA and AMBHU will build more platforms for people to communicate and operate at international scale.

Email: *sqin@yic.ac.cn*

Poster Presentation

Direct transesterification of microalgae Chloroparva panonica biomass to biodiesel through Vortex Fluid Device

Eko K Sitepu[1,2], Wei Zhang[1,2], Youhong Tang[3,4], Sophie Leterme[5], Colin Raston[6]

[1] Centre for Marine Bioproducts Development

[2] Department of Medical Biotechnology, School of Medicine

[3] Centre for NanoScale Science and Technology

[4] School of Computer Science, Engineering and Mathematics

[5] School of Biological Sciences

[6] School of Chemical and Physical Sciences, Flinders University, South Australia 5042, Australia

A novel convenient method to produce biodiesel through direct transesterification of microalgae biomass was investigated by using a new developed vortex fluid device (VFD). Microalgae biomass of Chloroparva panonica was employed with sulphuric acid and sodium hydroxide as the catalysts without heating process in this study. The effects of process parameters: methanol volume (0.55 – 1.2 ml), catalyst concentration in methanol (1 – 10%, v/v), time (15 – 75 min) and rotational speed (4000 – 8000 rpm) were studied. Biodiesel formation was confirmed using FT-IR and 1H-NMR was used to determine the conversion yield. The conversion yield of 83.61% and 96.92% were obtained at 1 ml methanol volume, 30 min reaction time, 6000 rpm rotational speed and catalyst concentration of 10% and 3% (v/v) for acid and base, respectively. This research demonstrated a promising method to convert microalgae biomass directly into biodiesel at room temperature within a shorter time with higher yield using VFD compared with those of conventional reflux method.

Email: *site0003@uni.flinders.edu.au*

Poster Presentation

Engineering biosynthesis of omega-3 eicosapentaenoic acid in *Saccharomyces cerevisiae* for nutraceutical production

Shailendra P Sonkar, Munish Puri, Colin J Barrow

Centre for Chemistry and Biotechnology, Deakin University, Waurn Ponds, Geelong, Victoria 3217, Australia

Mammals cannot synthesize essential fatty acids, and are dependent on natural resources such as fish, eggs, plants and microalgae. As natural resources are limited, and demand for polyunsaturated fatty acid (PUFA) is increasing globally, it is essential to explore the alternate source for PUFA production to meet global demand. In this direction, we have adopted a synthetic biology based metabolic engineering approach to engineer PUFA biosynthesis pathway for heterologous production of omega-6/ 3 PUFAs in Saccharomyces cerevisiae. Following genes DGA1 (Diacylglycerol acyltransferase), FAA3 (Acyl-CoA synthetase), D9D (delta-9 desaturase), D12D (delta-12 desaturase), D6E (delta-6 elongase), D5D (delta-5 desaturase), D6D (delta-6 desaturase) and D17D (delta-17 desaturase) were codon optimized and expressed in an in-house S. cerevisiae strain. Further, engineered S. cerevisiae strains were cultivated into nitrogen limited synthetic dropout media, and lipid profile demonstrated biosynthesis of Linoleic acid (LA), γ-linolenic acid (GLA), Dihomo-γ-linolenic acid (DGLA), Arachidonic acid (ARA) and Eicosapentaenoic acid (EPA) using gas chromatography method. Data on fatty acid profile establishing synthesis of EPA through Delta6 Pathway will be shared at the time of presentation.

Email: *shailen78aqua@gmail.com*

Oral Presentation

Gut health and fucoidan

Damien Stringer, Sam Karpiniec, Helen Fitton,1 Nuri Guven2

[1] *Marinova Pty Ltd, Tasmania, Australia*

[2] *University of Tasmania, Australia*

Fucoidans are a class of bioactive sulfated polysaccharides derived from edible brown marine macroalgae such as *Fucus vesiculosus*. Polyphenols can be co-extracted with fucoidan from *Fucus vesiculosus*, creating a novel extract. Fucoidans and marine polyphenols have an attractive array of bioactivities and potential in human health applications including immune modulation, anti-cancer, gut health, and pathogen inhibition. Here we describe recent research in which an orally delivered fucoidan-polyphenol preparation significantly reduced the inflammatory pathology associated with dextran sulphate-induced colitis in a mouse model. There was a highly significant reduction in the levels of cytokines stimulated by dextran sulphate, in addition to reductions in damage as assessed by histology. In vitro, the fucoidan-polyphenol extract decreased adhesion of the ulcer-causing bacterium Helicobacter pylori to gastric cells. Gastric cancer cells were also growth inhibited by fucoidan at higher concentrations. Lastly, the fucoidan-polyphenol extract demonstrated an intense activity against the oxidative free radical 'superoxide'. It is proposed that this antioxidant activity may contribute to the anti-inflammatory activity observed in vivo. Ongoing research will be outlined, including investigation of the effects of fucoidan on colon cancer.

Email: *damien.stringer@marinova.com.au*

Oral Presentation

Microwave-assisted rapid biomass digestion for liquid fertilizer production using South Australia beach-cast seaweed

Peng Su[1,2], Andrew Lorbeer[1,2], Wei Zhang[1,2*], Raymond Tham[1,2] and Chris Franco[1,2]

[1] *Flinders Centre for Marine Bioproducts Development;*

[2] *Department of Medical Biotechnology, School of Medicine, Flinders University, Adelaide, South Australia, 5001*

The pristine waters of Southern Australia are a biodiversity hotspot for macroalgae, with over 1200 species, 62% of which are endemic. Large amount of seaweeds are deposited annually on the beach of south east coast of South Australia, especially, the Beachport region. More than 90% of the seaweed deposits are brown seaweed. In this study, two species *Durvilleae potatorum*, *Ecklonia radiata* and the 'mixed seaweed', were investigated for the potential to produce high quality liquid fertilizer. By a rapid microwave-assisted biomass digestion technology was developed in order to improve the productivity and quality of the product. Compared to the current industrial method of liquid fertilizer production, that requires months-long digestion, the newly developed microwave digestion technology could complete the digestion of seaweed biomass for fertilizer production in 30 minutes for both *Durvillaea potatorum* and *Ecklonia radiata* and 60 mins for the mixed seaweed. The estimated seaweed biomass digestion yields by using the rapid microwave-assisted technology for these South Australia beach-cast seaweeds were improved by more than 50 %. The quality of the seaweed fertilizer products produced were also improved, in terms of total solid content, total nitrogen content, total phosphorus content and total potassium content.

Email: *peng.su@flinders.edu.au*

Oral Presentation

Marine viruses: unlocking the potential of the most abundant resource in the global oceans

Karen Weynberg

Australian Institute of Marine Science, Townsville, Queensland, Australia

Viruses are the most abundant biological entities in the oceans, often exceeding the number of bacteria 10-fold and having high local and global diversity. Large-scale metagenomic surveys have unveiled not only the abundance but also the novelty of virus-derived sequences in the marine environment, revealing viruses are a huge untapped reservoir of novel genetic material. The role of viruses in manipulating key metabolic processes in the oceans indicates their biotechnological potential. However, the positive benefits of marine viruses remain largely overlooked. I will provide a comprehensive overview on the potential for marine viruses to be used in a variety of applications, including phage therapy; as a biocontrol mechanism for major environmental threats, such as the Crown-of-thorns starfish on the Great Barrier Reef; and as a mechanism for harvesting lipids from algae for use in biofuel production.

Email: *k.weynberg@aims.gov.au*

Poster Presentation

Virtual reality: combating coral disease with viruses seen via a 360° video tour of the Great Barrier Reef

Karen Weynberg, Patrick Buerger

Australian Institute of Marine Science, Townsville, Australia

Immerse yourself in the warm, tropical waters of the Great Barrier Reef (GBR) to gain an insight into how viruses could be used to fight disease in reef corals. Of the more than 20 diseases known to affect corals, black-band disease (BBD) is one of the best described. This disease is known to be caused by a bacterial community, in the form of a black microbial mat, which creates an anoxic environment resulting in coral tissue death. We are working on isolating and utilising a virus that infects one of the main pathogens to control and reduce the levels of BBD. This 360° virtual reality tour of the GBR explains how phage therapy could enable us to harness the power of viruses to help corals fight disease such as BBD.

Email: *k.weynberg@aims.gov.au*

Oral Presentation

Sponge symbiotic microbiome analysis: applicability and performance of five common 16S rRNA gene region-specific primer sets evaluated by 454 and Illumina platforms

Qi Yang[1,2], Wei Zhang[1,2,3*], Christopher M. M. Franco[1, 2*]

[1] *Centre for Marine Bioproducts Development, Flinders University,*

[2] *Department of Medical Biotechnology, School of Medicine, Flinders University, Adelaide, South Australia, 5042,*

[3] *Centre for Marine Drugs, Renji Hospital, Shanghai Jiaotong University, Shanghai, China, 200240*

Illumina synthesis sequencing has recently become more popular than 454 pyrosequencing for the study of sponge bacterial community. No studies, however, have validated whether the Illumina platform is able to cover all the bacterial community revealed by 454 in terms of the classification resolution and the taxa richness for the same sponge samples. The 16S rRNA gene is by far the most common genomic marker used for bacterial classification, but there is no tailored comparison on the performance of different region-specific primers in revealing the true and complete bacterial diversity of marine sponges. In this study, five widely used primer sets were selected to cover the V1-V8 regions of the 16S rRNA gene to study bacterial community of four sponge species belonging to four orders using 454 and Illumina platforms. It was found that the Illumina dataset can cover all the bacterial taxa revealed by 454 and has about four-fold higher taxa coverage than the 454 dataset. Comparison of the bacterial communities amplified by the five different primer sets on the same four sponge species revealed that they have significantly biased performance on bacterial OTUs recovery. The V5V8 region-specific primers performed the best on taxa recovery and differentiation of the bacterial communities of sponge species in different orders. In conclusion, no single primer set can cover all the bacterial community. Selecting Illumina sequencing primers or their combinations is critical to study the sponge symbiotic microbiome.

Email: *qi.yang@flinders.edu.au*

Poster Presentation

Host-specific microbial community associated with marine sponges at order level

Qi Yang[1,2], Wei Zhang[1,2], Christopher Franco[1,2]

[1] *Centre for Marine Bioproducts Development, Flinders University,*

[2] *Department of Medical Biotechnology, School of Medicine, Flinders University, Adelaide, South Australia, 5042*

Marine sponges (Porifera) host diverse microbial communities of up to 30-40% of their total biomass and 60% of the mesohyl volume. These communities are often hypothesized to be host-specific and to co-evolve with their hosts. However, a comprehensive test of this hypothesis at different taxonomic levels has not been reported. In this study, the diversity of microbes associated with 12 sponge specimens belonging to four different species of four orders (Dendroceratida, Poecilosclerida, Verongida and Halichondrida) from the same location was investigated using both culture-dependent and molecular approaches. The questions to be tested are whether (1) the sponges representing four orders share the same core microbial community, (2) each of the four sponge orders has a unique order-specific microbial community, and (3) the community structure of each sponge order was dominated by their unique host-specific microbial genera. Terminal Restriction Fragment Length Polymorphism (T-RFLP) and 16S ribosomal RNA gene amplicon Illumina sequencing were employed for describing the culture-independent microbial communities. Meanwhile, six isolation media were selected to evaluate the culturable microbial diversity between these four sponge orders. Our results demonstrated that the microbial communities of the four sponge orders revealed by the culture-based and molecular techniques are remarkably distinct. There were 89, 48, 139 and 170 pure cultures isolated from these four sponge species. Moreover, the T-RFLP analysis and operational taxonomic units (OTUs) generated by pyrosequencing illustrated that each sponge order contains a large set of unique microbial genera and shares only a few genera with other orders.

Email: *qi.yang@flinders.edu.au*

Industry Forum Keynote 1

Sustainable Blue- Bio-economy in Australia and New Zealand: Opportunities and Challenges

Wei Zhang[1,2]

[1] *Centre for Marine Bioproducts Development (CMBD)*

[2] *Department of Medical Biotechnology, School of Medicine, Flinders University, South Australia 5042, Australia.*

Australia and New Zealand are the 3rd and 4th largest EEZ's globally and collectively the largest jurisdiction in Southern hemisphere. Taking Australia alone, we enjoy a reputation as the world's fifth most 'megadiverse' country, with a huge proportion of endemic biota, especially in marine waters. Australia has over 16.1 million km^2 of oceanic jurisdiction, 70 thousand kilometres of continental coastline and 8.6 million km^2 of continental marine territory. This unique marine biological resource in both Australia and New Zealand presents an ocean of opportunities for Australian and New Zealand to develop an ocean-based bio-economy – the blue bio-economy.

The recently announced Australian and New Zealand National Marine Science Plan have identified marine biotechnology and bioproducts as the nation's priorities for the development of a new blue bio-economy that will contribute to the marine economy worth of over $100 billion within the next ten years.

This presentation will discuss the opportunities and challenges we are facing in realise this ambitious economic goals, especially looking at how we can focus on the sustainable utilisation of our unique and precious marine biological resources. This presentation will focus on a high level overview of the marine biotechnology industry development in Australia; identification of issues and opportunities for future industry developments; and discussion on the opportunities for national and international collaborations to benefit not only Australian, but the global economy and society. Case studies will be used to demonstrate the model of partnership and collaborations among government, academia, industry and investors.

Email: *Wei.zhang@flinders.edu.au*

Poster Presentation

A new manufacturing technology of pipeline type photosynthetic reactor

An shan Zhou[1], Yun ming Lu[2], Yong huang Wen[2]

[1] *Haikou City Kasihashan Photobioreactor Co., Ltd.*

[2] *Shenzhen Ludebao HealthFood Co., Ltd.*

We have developed a new Manufacturing technology of photosynthetic reactor to achieve the large scale industrial production of high photosynthetic efficiency and fully enclosed clean algae. In this technology, multilayer coil type structure is designed for the photosynthetic reactor based on aerodynamics, through the cooperation of Low negative pressure vacuum drive and automatic circuit control and Modular combination of photosynthetic production components, full automatic operation and optimal control of various parameters in the process of production and breeding and the goals of high yield, high quality and energy consumption can be achieved.

Features and advantages: Dissolved oxygen in the culture solution was below 10mg/l; Power consumption is very low, just Equivalent to 1/20 of the existing photosynthetic reactor; Solar energy can be used as power; Cells only contact with air; The shearing force is very small; Be able to achieve automatic cleaning in operation; The operation process of the whole machine is in a state of full closed, which can achieve high purity; Different size specifications for the test and production applications can be created according to the actual need; Simple structure and convenient maintenance.

This technology has been applied for China's invention patent.

Email: *gcdrill@163.com*

Oral presentation

Bioprospecting from the global Galathea 3 expedition – investigation of antimicrobial bioactivity and biotechnological potential of an environmentally isolated marine Pseudoalteromonas

Marina W Delpin[1,2], Jette Melchiorsen[1], Susan Løvstad Holdt[1], Lone Gram[1]

[1] *National Food Institute, Technical University of Denmark, Kongens Lyngby, DK-2800, Denmark*

[2] *Current Address: Flinders University, Adelaide, Australia*

Participation in the global Danish Galathea 3 voyage enabled the unique, global collection of biologically active marine microorganisms. Of the approximately 2000 bioactive marine strains isolated, 2 *Pseudoalteromonas* sp. are of great interest. The aims and foci of our work are to identify and isolate the genes producing and regulating the production of these bioactives, to determine factors influencing their production, to investigate the physiological effects on susceptible pathogens and to understand the ecology of these organisms.

Colonies and culture supernatant of *Pseudoalteromonas rubra* have the ability to inhibit the growth of nosocomial and clinically isolated human pathogenic bacterial species. In addition, *P. rubra* is bioactive against marine fish bacterial pathogens, indicating that it could potentially be developed as a probiotic species for use in aquaculture. Growth medium containing nutrients close to what would be found in the natural habitat of *P. rubra* was the best inducer of bioactivity, demonstrating the importance of carefully considering this factor when screening for antimicrobial bioactivity.

Email: *marina.delpin@flinders.edu.au*

Notes

Notes

Tonsley
Ground Floor

TONSLEY BUILDING PLAN
(GROUND FLOOR)

- Concierge
- Lifts
- Toilets
- Male Toilets/Showers
- Female Toilets/Showers
- Parenting Room
- Disabled Toilet / Shower
- Prayer Rooms Male and Female
- Secure Bike Storage
- Tonsley Theatres
- Meeting Rooms
- Wayfinding Touchscreen
- Display Screen
- Kitchenette
- Back of House Areas
- Entry/Exit

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The University of Waikato
Te Whare Wānanga o Waikato

For more information

Australia-New Zealand Marine Biotechnology Society

C/-Centre for Marine Bioproducts Development
Medical Biotechnology, School of Medicine
Room 4.17, Health Sciences Building
Flinders University, GPO Box 2100 Adelaide SA 5001

T: (08) 7221 8568 | E: marine.bioproducts@flinders.edu.au | www.flinders.edu.au |