



16th ANNUAL POSTGRADUATE SYMPOSIUM

3rd October, 2014

PROGRAMME AND ABSTRACTS



School of Earth and Environment





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MESSAGE FROM THE RSWA PRESIDENT

Welcome to the Royal Society of Western Australia's 16th Annual Postgraduate Symposium. This Symposium allows postgraduate students in agriculture, natural sciences, earth and environmental sciences, physical sciences, biology and environmental engineering from UWA, Curtin, ECU, Murdoch and Notre Dame to present some of the results of their research in a public forum and network with other postgraduates from different disciplines and institutions.

The RSWA postgraduate symposium is hosted by a different university each year. The Society acknowledges with thanks the School of Earth and Environment, University of Western Australia, for hosting the symposium. We hope that this symposium will provide a successful forum for meeting and networking with students and scientists from your own and different disciplines.

Dr Hugo Bekle

ABOUT THE ROYAL SOCIETY OF WESTERN AUSTRALIA

Patron: Her Majesty Queen Elizabeth II

Vice Patrons: Prof Lyn Beazley AO, the Governor of Western Australia

The Royal Society of Western Australia (RSWA) is a 100 year old multidisciplinary science society with a rich history of promoting science in Western Australia through publications, meetings, symposia and special events. The history of RSWA indirectly relates back to the Royal Society (of London) that began with a group of scientists meeting in the mid-1640s to discuss the newly emerging philosophy of Science, and has seen as Presidents luminaries including Robert Boyle, Sir Isaac Newton, Sir Joseph Banks, Sir Humphrey Davy and Lord Kelvin. Early in Australia's history most States inaugurated Royal Societies modelled on the original Royal Society.

The history of the Royal Society of WA includes that of its forerunner societies, the first being **The Western Australian Natural History Society (1891-1898)** founded under the Presidency of Sir John Forrest KCMG, the first Premier of Western Australia, but it did not flourish and folded in 1898. **The Mueller Botanic Society (1897-1903)** that followed was established by a group of amateur botanists, again under the Presidency of Sir John Forrest KCMG. The society was extremely active and, with the aid of a grant of £50 from the State Government, published a journal that ran for eleven issues (Volume 1) between 1899 and 1903.

By 1903, the Mueller Botanic Society had broadened its interests to other aspects of natural history. The name of the society was changed to '**The West Australian Natural History Society (with which is incorporated the Mueller Botanic Society)**'. This society's journal continued on from that of the Mueller Botanical Society, publishing six parts of Volume II, from 1904 to 1909, but the Society struggled and in 1907 the society's council suggested that monthly meetings be held when a paper was presented, and a subcommittee was formed to explore the possibility of establishing a Royal Society.

The Royal Society of Western Australia 1914 - present

Assent for the Royal Charter was received by the Society from His Majesty King George V in November 1913. The draft rules for the new Royal Society of WA, drafted by Professors Dakin and Woolnough, and Mr Maitland, were adopted on 10th March 1914 and it was resolved *That this Society be henceforth called 'The Royal Society of Western Australia'.*

SCHEDULE OF ORAL PRESENTATIONS

8.45	REGISTRATION and refreshments	
9.15	WELCOME	Prof Lyn Beazley AO, Vice-Patron of RSWA
9.30	Tubagus Solihuddin	Geomorphology and Holocene Growth History of the Cockatoo Island Fringing Reefs, Kimberley Bioregion, Northwest Australia
9.50	Ashleigh Wolfe	The response of reptiles to urbanization
10.10	Mahbubur Rahman	Development of solar selective surfaces for photothermal applications
10.30-11.00		MORNING TEA AND POSTER SESSION
11.00	Laura Travers	Sexy sperm and female multiple mating: the role of sperm competition in the evolution of polyandry
11.20	Leslie Westerlund	“Westerlund’s Seven Phase of Technology Transfer”
11.40	Ashiwin Vadiveloo	Light spectra filtration to improve the growth and productivity of <i>Nannochloropsis</i> sp (Eustigmatophyceae)
12.00	Peter Derbyshire	Cardiac innervation of the reptile <i>Ctenophorus ornatus</i>
12.20 – 1.20		BBQ LUNCH
1.20	Giada Bufarale	Subbottom profiling and growth patterns of Kimberley coral reefs, North West Australia
1.40	Vineeta Bilgi	Oral delivery of double-stranded RNA and the effects of RNA interference on the green peach aphid, <i>Myzus persicae</i>
2.00	Jackson Bailey	Theory of ion-Atom Collisions for Proton Therapy
2.20	Gloria Rupf	Green gas for Sub-Saharan Africa: Current situation and opportunities for improving biogas dissemination
2.40 – 3.00		AFTERNOON TEA AND POSTER SESSION
3.00	Tin Hoang Cong	Seasonality and distributions of macro-algae <i>Sargassum</i> beds at Point Peron, Shoalwater Islands Marine Park, Western Australia
3.20	Mark Zammit	Molecular Collisions Matter
3.40	Dominie Wright	How do farmers like to obtain information ?
4.00 SHORT BREAK		
4.10 CLOSING REMARKS AND PRIZE GIVING		

LIST OF POSTER PRESENTATIONS

PRESENTER	POSTER TITLE
Eshan Mohammadpour	Phase transition in CrxAl(1-x)N coating at high temperatures
Chenae Tuckett	High latitude corals on the move: a comparative heat wave assessment
Mohsen Alhamami	Analytical Chemistry Study of Tropospheric Radicals using Matrix Isolation FTIR Spectroscopy

ABSTRACTS - ORAL PRESENTATIONS

TUBAGUS SOLIHUDDIN

Geomorphology and Holocene Growth History of the Cockatoo Island Fringing Reefs, Kimberley Bioregion, Northwest Australia

Tubagus Solihuddin^{1,4}, Lindsay. B. Collins^{1,4}, David Blakeway², Michael J. O' Leary^{3,4}

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The Cockatoo Island fringing reef occurs in a macrotidal and high turbidity setting, within the inshore Kimberley Bioregion. Subsidence since the Last Interglacial has provided accommodation for growth of a Holocene reef upon older reef substrate, both exposed in an excavation. High intertidal cover of *Porites* and Faviids along with branching *Millepora* and *Porites cylindrica* characterise the contemporary reef. The Holocene reef is ~13 m thick and of two distinct mud-rich facies; domal and branching coral framestone. Coral clasts are dominated by branching corals especially *Acropora* and massive corals including *Porites*. Holocene reef development started at ~8,970 cal y BP and ceased at ~1,905 cal y BP at the uppermost ~1 m of reef surface, and reef accretion rates varied from 26.8 mm/year to 0.8 mm/year, averaging ~2 mm/year. The modern live corals are uncommon in the measured Holocene sections, indicating that modern communities ecologically shifted from subtidal growth to intertidal or very shallow subtidal habitats. This pattern differs from mud-rich fringing reefs of the Great Barrier Reef, which show similarities between palaeoecological and contemporary reef communities. The study provides the first Holocene reef growth history for an inshore Kimberley reef within a biodiversity "hotspot".

BIOSKETCH

Tubagus Solihuddin is a 3rd year-PhD Candidate in the Department of Applied Geology, Curtin University in which he is studying "Holocene Reef Growth of the Inshore Kimberley Bioregion and Response to Sea-level Changes and Climate Impact". He completed his Bachelor Degree in geology and his Masters in remote sensing in Indonesia. Since 2004, Tubagus has been working in the Centre for Research and Development of Marine and Coastal Resources, The Republic of Indonesia, as a marine geologist.

ASHLEIGH WOLFE

Perth's urban reptile ecology: does living in the city affect reptile diet?

Curtin University

Human disturbance from urbanisation is an important conservation factor for species with low behavioural plasticity. In Western Australia two species, the dugite (*Pseudonaja affinis*), a highly venomous elapid snake, and bobtail (*Tiliqua rugosa*), a large-bodied omnivorous skink, are currently informally recognised as the two best urban-adapted reptile species. Their differing survival strategies appear to lend them great success in the urban environment of the City of Perth, but all knowledge currently remains anecdotal. Urban ecology is a relatively new field of study, particularly in Australia, and very little research of reptiles in urban environments has been carried out to date.

This study aims to investigate the impacts of urbanisation through ecological and behavioural observations of reptiles in an urban and a rural area using dugites and bobtails as models. One major project component of the PhD is the analysis of stomach contents of road-killed and museum specimens to compare diets of urban and rural animals. To date, dissections for stomach contents analysis have been completed for 272 dugites and seven bobtails. While the current data is still limited, it appears that dugite diet is highly dependent on ontogeny and similar between urban and rural specimens. Additionally, one bobtail was found to have a full stomach of viable *Corymbia calophylla* seeds, suggesting these reptile may be important seed dispersers. Stomach contents analysis will continue throughout the course of the PhD, with an anticipated total sample size of >500 dugites and >250 bobtails by the PhD completion in 2017.

BIOSKETCH

Ashleigh completed a Bachelor of Science (Environmental Biology) at Curtin University with First Class Honours. She is now eight months into her PhD studying the ecology of reptiles in Perth. She enjoys working with reptiles, and aims to continue research in this field following her PhD.

M. MAHBUBUR RAHMAN

Development of solar selective surfaces for photothermal applications

M. Mahbubur Rahman, Zhong-Tao Jiang, Khalil Ibrahim, Ehsan Mohammadpour, Hantarto
Widjaja and Nick Mondinos

Surface Analysis & Materials Engineering Research Group, School of Engineering & Information
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Energy conversion surfaces of photothermal devices are fabricated from solar selective materials which satisfy two major criteria: high absorptance in the visible range and low emittance in the infrared range of the solar radiation. Various types of metal oxides e.g., Mn CoO, NiCoO, CuCoO etc and nitrides e.g., TiN, TiAlN, TiAlSiN etc based thin film coatings are widely used as selective surfaces. The sol-gel dip coating method is a promising technique to synthesize metal oxides based solar selective coatings since their optical characteristics can be controlled by varying depositional parameters. In this paper, we emphasize the developments of some metal oxide and nitride based thin film coatings for the selective surface applications and summarize the optical and mechanical properties of recently studied results. Utilization of relevant analytical equipment such as UV-Vis-NIR spectrophotometer, FTIR spectrophotometer, and nanoindentator are highlighted. Sol-gel derived CuCoO thin film coatings offer the highest selectivity value of 15.1 while the magnetron sputtered metal nitride coatings were found to exhibit a maximum selectivity of 21.76.

BIOSKETCH

I am a PhD student with the Surface Analysis and Materials Engineering Research Group in the School of Engineering & Information Technology at Murdoch University. I received a BSc (Honors) and MSc degree in Physics from Jahangirnagar University in 1997 and 1998 respectively. I have completed MPhil degree in Physics from Khulna University of Engineering & Technology (KUET) in 2007. I also received another MSc degree in Physics from Memorial University, Canada in 2009.

LAURA TRAVERS

Sexy sperm and female multiple mating: the role of sperm competition in the evolution of polyandry

Laura M. Travers, Leigh W. Simmons and Francisco Garcia Gonzalez
Centre for Evolutionary Biology, University of Western Australia

Multiple mating in females (polyandry) is widespread despite its costs. One explanation embodied by the 'sexy sperm' and 'good sperm' hypotheses proposes that sperm competition may play a role in the evolution of polyandry. Polyandrous females could ensure paternity from males that pass on genes for enhanced sperm competitive ability while also producing daughters that carry genes for increased mating frequency, generating the coevolution of sperm competitiveness and polyandry through Fisherian or 'runaway' selection. Two poorly studied assumptions of these theoretical models are the presence of heritable genetic variation in sperm competitiveness and female multiple mating. In this study, we conduct quantitative genetic analysis of sperm competitiveness and female lifetime mating frequency on paternal half siblings to test these key assumptions in a wild type (*wt*) population of *Drosophila melanogaster*. We assessed the proportion of offspring sired in the offensive role (P2) in *wt* males (brothers) by conducting double mating trials using females and rival males (P1) from genetically standardized isogenic lines. Egg-to-adult viability was also measured in the *wt* males to control for heritable effects of embryo survival. We tested female multiple mating by offering mating opportunities to *wt* females (sisters) three times a week for their natural lifespan using isogenic males. In accordance with most previous quantitative genetic analyses, we found non-significant low narrow-sense heritability in sperm competitiveness ($h^2 = 0.10$, $p = 0.76$), contradictory to the sexy sperm hypothesis. However, a significant sire effect and high narrow sense heritability ($h^2 = 0.72$, $p < 0.001$) was found for female mating frequency. In addition, we found significant heritable variation in embryo viability ($h^2 = 0.89$, $p < 0.001$). The lack of sufficient heritable variation in sperm competitiveness suggests the evolution of polyandry is not driven by the 'sexy sperm' process. However, the presence of heritable genetic variation in polyandrous behaviour suggests polyandry is subject to genetic change in response to fitness costs benefits.

BIOSKETCH

I completed my undergraduate degree at Queens University, Northern Ireland where I obtained a BSc in Psychology in 2007. In 2010, I received an MSc in Applied Animal Behaviour and Animal Welfare from the University of Edinburgh. My PhD project uses a quantitative genetics approach with *Drosophila melanogaster* to investigate the genetic benefits of polyandry. I am also examining the integration between pre- and post-copulatory episodes of sexual selection by measuring pre- and post-copulatory traits across 40 isofemale lines, and assessing the relationship between these traits and how they relate to male attractiveness. After my PhD I hope to continue working as a researcher using empirical methods to test sexual selection theory.

NOTES

LESLIE WESTERLUND

Westerlund's Seven Phase of Technology Transfer

Murdoch University, Murdoch, 6150, Western Australia

The new Westerlund's Seven Phase strategy for the transfer of technology to craft villages in developing countries. This model applies a 'technical action research' methodology. This generic new technology transfer model was tested with a controlled pilot plant for highest quality cottage craft technology of papermaking in a remote island village of Wainimakutu. The A3+ deckled edged paper can be made into 2 x A4 standard paper. This was also value added for books and traditional stories of Fiji. Marketing is the new Sixth Phase and recognising Champions is the seventh.

BIOSKETCH

Leslie has pioneered the art and science of super smooth handmade eco-friendly papermaking technology for three decades. He completed a BSc over 20 years at Murdoch University (1977-97) then turned his papermaking hobby into an Honours project at Murdoch in 1998, then a Masters Project in sustainable development of the pulp and paper industry at Wollongong University in 2000.

Leslie has now completed his 10 yr PhD, passed, subject to final changes. Several books on each stage of papermaking have been published. Other special books for Fiji have been made as examples of what can be done on the paper. He would like to do another employment project for a papermaking village for a LDC.

ASHIWIN VADIVELOO

Light spectra filtration to improve the growth and productivity of *Nannochloropsis* sp. (Eustigmatophyceae).

Ashiwin Vadiveloo*¹; Navid. R. Moheimani¹; Jeffrey. J Cosgrove^{1,2}; David Parlevliet²

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Immense attention and research efforts are being channelled towards the optimization of microalgae biomass cultivation due to their potential benefit in a wide array of applications. Primary drivers are the use of algae as a sustainable source of necessary foods and fuels to help support the ever expanding global economy and increase in world population. Microalgae can also be used to produce many essential commodities, including high value bioactive products, at a commercial scale. One of the main challenges in realising the true potential of microalgae is increasing their biomass productivity. This is limited by several biotic, abiotic and operational factors. Light (quality and quantity) is by far the main limiting factor to the growth of microalgae. The influence of light irradiance on the growth and metabolism of microalgae has already been well documented. The spectral composition of light, although recognized as an important factor that affects growth and productivity of microalgae, has been much less understood. The integration of selectively wavelength-permeable photovoltaic cells into large scale outdoor commercial algal culture to improve economics has previously been proposed. With no light supplementation, this means that filtered irradiance incident on the culture is a portion of the full solar irradiance. We studied the impact of spectrally limited light and concomitant reduction in light intensity on growth, biochemical composition and light use efficiency on acclimated and non-acclimated cultures of *Nannochloropsis* sp. (MUR266). Pink light yielded the highest specific growth rate for *Nannochloropsis* sp. while the biomass productivity per photons and energy supplied were highest under blue illumination. The highest chlorophyll-*a* content of this alga was recorded under green and blue illumination, whereas

the highest cellular biochemical contents were found under blue illumination. Alga exposed to green illumination demonstrated low efficiency in conversion of light energy into biomass. The most advantageous spectra for the growth of *Nannochloropsis* sp. was found to be between 400 and 525 nm (blue light). This novel proposed illumination method does not only improve microalgae growth and productivity without resorting to artificial light resources for large scale cultivation systems, but also provides a platform for conversion of the remainder unused portions of the solar spectrum into electricity.

BIOSKETCH

Ashiwin is currently a PhD student at the Algae R&D Center of Murdoch University. He is currently working on combining selective permeable solar cells with large scale microalgae cultivation system. This proposed system would allow for the full utilization of the solar spectrum for the production of both chemical and electrical energy from on facility making efficient use of sunlight and available land. Ashiwin is a highly motivated, enthusiastic and reliable graduate with a strong academic record and is looking forward to contributing and sharing knowledge to the field of phycology in the future, both as a research scientist and as an academician.

PETER DERBYSHIRE

Cardiac innervation of the reptile *Ctenophorus ornatus*

Peter Derbyshire and James E. O'Shea

School of Animal Biology
The University of Western Australia

The control of cardiac output in vertebrates depends on a combination of hormonal and nervous inputs to the various chambers. The hormonal control of cardiac muscle has been shown consistently to rely on adrenaline to increase both force and rate of contractions across all vertebrate classes. Patterns of nervous control, however, are much more variable both within and between the vertebrate classes. Studies into the cardiac innervation in file snakes has indicated the presence of adrenergic and cholinergic nerves in the atrial chambers, however no cholinergic nerves in the ventricular chamber. These previous studies were performed at a low temperature and without the capacity to sufficiently stimulate the nerves within the ventricular walls in order to elicit a response.

The hearts of 24 anaesthetised Ornate dragons (*Ctenophorus ornatus*) were removed before being dissected into a double atrial preparation and a ventricular preparation. Each preparation was kept in McKenzie's solution, bubbled with 95% oxygen and suspended in an organ bath via a force transducer with proximate platinum electrodes. All tests were performed at three temperatures that would show a response at environmentally equivalent low, medium and high temperatures for the species. A nervous response was characterised by electrically stimulating the nerves, mimicking the response using exogenously applied adrenaline or acetylcholine before using known receptor blockers to block a response before electrically stimulating the nerves. The results of this nerve characterisation have indicated the presence of both cholinergic and adrenergic nerves in the atrial and the ventricular chambers. The response of the cholinergic nerves is attenuated under the influence of adrenaline by antagonising the adrenergic response. Blocking the cholinergic response results in an increased adrenergic response under nerve stimulation indicating the presence of cholinergic nerves. Stimulation of the nerves at supra-maximal frequency resulted in an increased cholinergic and adrenergic response in the ventricular muscle. The presence of both adrenergic and cholinergic nerves in both the atrial and ventricular chambers indicates a cardiac innervation pattern that is more complex than has been demonstrated in homeothermic mammals. Such a pattern does, however, show similarities with the pattern observed in heterothermic mammals such as bats and marsupials, if not in form than at least in function. This new information brings into question previous assumptions as to the simplicity of cardiac innervation in reptiles. It also sheds light on the evolutionary pathway that cardiac control has taken from

amphibians through reptiles to mammals and the importance of precise control over cardiac function in vertebrates that can withstand large temperature fluctuations.

BIOSKETCH

I started my studies originally at Murdoch University in Computer Science in 2004 before leaving to study Zoology and Biochemistry at The University of Western Australia in 2007. I gained a Bachelor of Science in 2010.

I began my Postgraduate research doing a Higher Degree by Research Preliminary that involved research projects into mammalian kidney development and the cardiac innervation of *Ctenophorus ornatus*. I am now currently doing my PhD in cardiac innervation patterns in reptiles while enjoying my time lab demonstrating in first and second year biology/zoology.

GIADA BUFARALE

Subbottom profiling and growth patterns of Kimberley coral reefs, North West Australia

Giada Bufarale^{1,3}, Lindsay B. Collins^{1,3}, Michael O'Leary^{2,3}, Moataz Kordi^{1,3}, Tubagus Solihuddin^{1,3}, Alexandra Stevens^{1,3}

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The Kimberley region is located on the north western continental margin of Australia and is characterised by unique and complex geology and geomorphology, significantly influenced by the macrotidal range systems (up to 11 m), which result in expansive intertidal zones.

A total of 300 km of high-resolution shallow imaging data were acquired during a sub-bottom profiling (SBP) study of various southern Kimberley reef settings. Acoustic datasets were collected with a Boomer SBP system covering reefs where remotely sensed images were previously used to produce geomorphic and substrate classification maps. A classification diagram has been developed on the basis of imaging of internal structures. Vertical and lateral differences were identified and categorised according to their shape and acoustic reflection characteristics along the hiatuses and internal reflectors.

These new datasets have provided a better understanding of Quaternary reef growth. The pre-existing substrate has influenced the successive morphology of fringing reefs, intertidal platforms and platform reefs. Global sea-level change, controlled by ice age fluctuation events, provides a signal which is recorded in successive stages of the reef growth separated by hiatuses. Two acoustic reflectors can be consistently distinguished across the inner shelf reefs (Sundays Group, Buccaneer Archipelago and Montgomery Reef), marking the boundaries between Holocene reef (Marine Isotope Stage 1, MIS1, last 12,000 years) commonly 10-15 m thick, and MIS 5 (last 125,000 years) and an ancient Neoproterozoic rock foundation over which Quaternary reef growth occurred. Three acoustic reef units characterise the Adele Group offshore.

BIOSKETCH

I gained my MSC in Geology (University of Milano-Bicocca, Italy) and subsequently started working as a marine geologist/geophysicist in a marine consultancy. In 2009 I joined the Applied Sedimentology, Coastal and Marine Geosciences group at Curtin University as a research assistant. I have carried out research on the stratigraphy and geomorphology of Shark Bay, the Swan River and Kimberley coast. In March 2014 I started a PhD on the application of shallow seismic techniques to the analysis of contrasting sedimentary systems. I am genuinely interested in broadening my competence in marine science and

related disciplines and I have high aspirations to succeed in a strong academic career, aiming for personal improvement through hard work.

VINEETA BILGI

Oral delivery of double-stranded RNA and the effects of RNA interference on the green peach aphid, *Myzus persicae*

Vineeta Bilgi*, John Fosu-Nyarko and Michael G. K. Jones

Plant Biotechnology Research Group, WA State Agricultural Biotechnology Centre, Murdoch University,
Perth, WA 6150

The green peach aphid (GPA), *Myzus persicae*, is a polyphagous insect that feeds on and causes damage to economically important crops worldwide. Genetic resistance and application of insecticides is not always effective and GPAs readily develop resistance to insecticides. An alternate approach to protect crops from aphid damage may be provided using the naturally occurring phenomenon of RNA interference (RNAi) to silence essential genes in the aphids.

However, there is limited information on the mechanism of RNAi in insects, particularly aphids. The overall aim of this research is to study the mechanisms and the effects of silencing target GPA genes through RNAi. We have identified a series of target genes in GPA, tested different concentrations of dsRNA for *in vitro* feeding, evaluated the use of vital dyes to trace uptake of dsRNA, and studied effects of RNAi of some of them on the survival, reproduction and behaviour of GPA. Comparative bioinformatics with genomic resources of *Acyrtosiphon pisum* and other species were used to identify a set of GPA ESTs essential for growth and development. The classes of gene included some involved in locomotion, moulting, osmoregulation and proton translocation. From this work we have cloned a subset of these genes and used them to establish an artificial feeding system for *in vitro* RNAi. After feeding dsRNA with suitable controls for 24 hours, the effects of RNAi were assessed by monitoring survival and fecundity on tobacco over 12 days, and also by measuring the transcript abundance by semi-quantitative PCRs.

Our results indicated that 2 ug/uL of dsRNA of a target gene was effective in inducing RNAi in GPA. Of the nine dyes used, optimal concentrations of two vital dyes were effective in tracing uptake of feed/dsRNA, allowing efficient assessment of RNAi in aphids that had fed. For this gene, there was a significant reduction in transcript levels in 78% of the aphids fed with dsRNA compared to those fed on dsGFP and no-dsRNA controls ($P<0.05$). However, the treated aphids remained alive on tobacco for only five days indicating silencing this gene disrupted the normal lifecycle. Host-delivered RNAi of target GPA genes is in progress to assess RNAi as a potential transgenic strategy to confer plant resistance to aphids.

BIOSKETCH

I am originally from Mumbai, India and I earned a Masters degree in Plant Pathology from North Dakota State University, United States. In March 2012, I joined Murdoch University to pursue Ph.D. research in Plant Biotech with a Murdoch International Postgraduate Scholarship. My advisors are Prof. Mike Jones and Dr. John Fosu-Nyarko, and together we are developing insect-proof plants using RNA interference.

NOTES

JACKSON BAILEY

Theory of Ion-Atom Collisions for Proton Therapy

J. J. Bailey, A. S. Kadyrov, I. B. Abdurakhmanov, S. K. Avazbaev, D. V. Fursa and I. Bray

Institute of Theoretical Physics, Curtin University

Hadron therapy is the most precise and advanced form of radiation cancer treatment today. It requires accurate modeling of ion beam passage through biological tissue. Current Monte Carlo simulation techniques rely on Bethe-type theories of energy loss, but the Bethe theory and its numerous improvements do not allow achievement of required accuracy goals. Over the last few years the Institute of Theoretical Physics at Curtin University has developed the most advanced fully quantum mechanical convergent close coupling approach to (anti)proton collisions with atomic and molecular targets. The approach accounts for all possible reaction channels including electron capture and is capable of providing the most detailed information about the collision process. Therefore it is ideally suited for calculations of energy losses by (anti)proton beams travelling through biological matter.

BIOSKETCH

I recently graduated from Curtin University with a BSc(Honours) in nanotechnology. This year I began a PhD with the Institute of Theoretical Physics at Curtin. My thesis will be on the theory of ion-atom collisions for application in proton therapy. After my PhD I hope to research and teach at a university.

(Jackson was awarded the 2013 Royal Society of Western Australia Student Medal for Curtin University).

GLORIA RUPF

Green gas for Sub-Saharan Africa: Current situation and opportunities for improving biogas dissemination

Gloria V. Rupf, Parisa Arabzadeh Bahri, Karne de Boer, Mark P. McHenry

School of Engineering and Information Technology, Murdoch University

Biogas technology has the potential to improve energy access and waste management practices in both urban and rural Sub-Saharan Africa (SSA), along with making a positive contribution to health and the environment. The last seven years has seen a significant increase in the uptake of domestic biogas systems in a selected number of SSA countries through the Africa Biogas Partnership Programme (ABPP). Before ABPP, biogas dissemination has been slow and sporadic in the region and even today much of the potential is still untapped. One of the restricting factors has been the focus on a selected few biogas systems that use cattle dung as their main feedstock. This presentation will provide key recommendations on how biogas dissemination can be improved in SSA. It will also highlight the range of biogas systems that are suitable in the region along with the energy production potential from a range of feedstocks. A proposed biogas system model will be introduced which could become a valuable tool for identifying optimal biogas system designs for particular applications in SSA. The optimal design will be considered for maximum benefit to the user in terms of the three pillars of sustainability: economic, social and environmental, along with technical sustainability.

BIOSKETCH

I graduated with a Bachelor of Engineering Degree (majors in Renewable Energy and Electrical Power) as well as a Bachelor of Science (major in Sustainable Energy Management) and a Postgraduate Diploma in Business Administration at Murdoch University in February last year, and then commenced my PhD studies with Murdoch's School of Engineering and IT a few months later to pursue my passion for

sustainable energy and development. My PhD is concerned with improving biogas dissemination in Sub-Saharan Africa through the development of a biogas system model that assists with design choice, identifying the optimal system based on specified optimal design criteria. Through my research I hope to empower people to identify the sustainable energy resources available to them and practical approaches to implement appropriate technologies to harness these sources.

TIN HOANG CONG

Seasonality and distributions of macro-algae *Sargassum* beds at Point Peron, Shoalwater Islands Marine Park, Western Australia

Tin Hoang Cong and Mick O'Leary

Curtin Aquatic Research Laboratory, Faculty of Science and Engineering, Curtin University

Sargassum C. Agardh is one of the most diverse species of the marine macro-algae and is distributed worldwide, commonly dominant in tropical and shallow sub-tropical waters. This study is aimed to investigate the seasonality of water qualities, canopy cover, thallus length and distributions of *Sargassum* beds around Point Peron, Shoalwater Islands Marine Park, Western Australia. The data on canopy cover, thallus length and distribution patterns were collected every three months during the summer periods from 2012 to 2014 at four different reef zones along monitored transects. Sampling was by either scuba or snorkel diving. High spatial resolution satellite images WorldView-2 (2 m resolution) of Point Peron were used to estimate the spatial distribution of *Sargassum* beds. The results showed that the *Sargassum* beds in Point Peron showed remarkable seasonal changes in canopy cover and thallus length. There was a significant difference in *Sargassum* canopy cover between seasons. However, there were no significant differences between the reef zones. Results also show that the *Sargassum* spp. community demonstrated a seasonal variation pattern of coverage and mean thallus length which is significantly influenced by the nutrient concentrations (PO_4^{3-}), sun radiation, collecting zone, and collecting season ($P < 0.05$). This study demonstrates primary and novel information on *Sargassum* beds' structure of Point Peron by using combination of *in-situ* and satellite remote sensing observations. These methods can also be applied as a bio-monitoring programme for *Sargassum* beds in Western Australia coast and other potential areas.

BIOSKETCH

Tin Hoang Cong is currently undertaking a PhD program in Environment and Agriculture at Curtin University. He acquired his Masters in marine ecology at Hue University of Sciences. After that he went to the Bermuda Institute of Ocean Sciences (United Kingdom) for an intensive international training program in Oceanography and remote sensing from 2009 to 2010. Tin was a researcher at the Centre for Coastal Management and Development Studies in Vietnam. His major specialized knowledge is ecology and several technical disciplines such as remote sensing and GIS in marine and coastal environment studies. He is a foundation member of the Tropical Research Network which has been established by eight Australian universities to increase Australia's capabilities in tropical research by training a new generation of researchers. Tin has joined six research projects comprising national and regional scales of investigations in research and management of marine and coastal areas.

NOTES

MARK ZAMMIT

Molecular collisions matter

Mark C. Zammit, Dmitry V. Fursa and Igor Bray

Department of Imaging and Applied Physics, Curtin University

Collisions between atoms and molecules are the underlying processes that govern chemistry, medicine, industry, nature and life. Because these collisions are the fundamental interactions of matter and chemistry, a countless number of applications can stem from modelling scattering processes.

During my PhD I developed the world's most accurate computer program that models electron and positron (anti particle of electron) collisions with simple molecules. In this presentation I will concentrate on the basics of scattering theory, applications this research has and the collaborative projects we work on.

BIOSKETCH

Mark is a PhD candidate at the Institute of Theoretical Physics (ITP) at Curtin University. Using quantum mechanics Mark and colleagues at the ITP are renowned developers of the world's most accurate computer programs that model collisions involving atoms and molecules. This research has applications in fusion technology, material science, astrophysics, cancer detection and radiotherapy treatment.

Currently Mark is loving his research career and highlights are working on challenging problems, attending conferences in China, Sydney and Canberra and being awarded the 2014 West Australian Student Scientist of the Year. After his PhD, Mark intends to continue researching as an academic working with the ITP and to start new research projects at the Australian Synchrotron.

DOMINIE WRIGHT

How do farmers like to obtain information ?

Dominie G Wright^A, Nancy Longnecker^B, Lynette Abbott^A and Natasha Pauli^A

^A School of Earth and Environment, University of Western Australia, Western Australia

^B Centre for Science Communication, University of Otago, Dunedin, New Zealand

How do farmers in Western Australia look for information, given the increased availability of electronic media, social media and the Internet in rural areas?

A questionnaire was developed to determine farmers' preferences for finding information to help manage their farm business. This survey was tested at a Regional Crop Update in Lake Bolac, Victoria before distributing it to farmers in February and March 2014 within Western Australia. The survey was distributed in two ways: as an online survey and as a paper based survey. The online survey was advertised through local Grower Group newsletters and handed out in Regional Crop Update meetings with a reply paid envelope. The survey was closed at the end of June 2014.

Approximately 400 surveys were handed out, at six Regional Crop Updates meetings. The response rate (16.5%) for the paper based survey was higher than those completed online. Survey data are being analysed to determine if demographic information such as gender, age and education level was related with farmers' preferences for obtaining information. Anecdotal evidence suggests that the preference for electronic data is related to age, and the use of social media is related to gender. Results will be presented.

BIOSKETCH

Dominie Wright is a PhD student in Science Communication within the School of Earth and Environment at UWA. Her PhD is titled “Are we going against the grain in training?”, developing an adult education framework for teaching in rural communities. Dominie is a Plant Pathologist with the Department of Agriculture and Food, Western Australia here in Perth. Her passions include the diagnosis of diseases in crops and seed health testing when working as a Plant Pathologist. However, she has a passion for teaching people about plant diseases, and has developed and held plant disease identification workshops for farmers and agronomists in Western Australia for the last 10 years. These workshops are still being held annually during the growing season. Dominie has also completed a Masters in Agricultural Science by research from University of Queensland, and a Graduate Diploma in Adult Education from Murdoch University.

POSTER PRESENTATIONS

EHSAN MOHAMMADPOUR

Phase transition in $\text{Cr}_x\text{Al}_{(1-x)}\text{N}$ coating at high temperatures

Ehsan Mohammadpour, , M. Mahbubur Rahman, Zhong-Tao Jiang, Khalil Ibrahim, Hantarto Widjaja and Nick Mondinos

Surface Analysis & Materials Engineering Research Group, School of Engineering & Information Technology, Murdoch University, Perth, WA 6150, Australia.

In this work, Al doped CrN superhard coatings are studied for their thermal stability. Surface and cross sectional morphology of the coating was investigated using Scanning Electron Microscopy (SEM) equipped with an Energy Dispersive Spectroscopy (EDS) detector. Synchrotron radiation X-ray diffraction (Powder Diffraction) beamline was used to investigate the microstructure and phase transition of the coating layers within the temperature range of 25 °C - 700 °C in steps of 100 °C. SEM study revealed interesting elemental distribution over the coating layers. Results indicated that CrN and Cr_2N are the main structural phases at 25 °C and 700 °C, respectively. Dominant structural changes during annealing results in the gradual transformation of cubic CrN phase to the hexagonal Cr_2N phase. In addition, the recrystallization of CrN and Cr_2N phases with preferential growth directions were observed. As the temperature increased the width of the peaks were reduced while their increased intensity indicate the grain growth in the coating layers. These CrNs have the potential to be used in cutting, milling and screw-threading tools due to their better thermal stability, corrosion and wear resistances.

BIOSKETCH

I am a PhD student at the School of Engineering and Information Technology at Murdoch University. I study the hard coating in the Surface Analysis and Materials Engineering Research Group (SAMERG). I received my BSc and MSC degrees in material engineering from Ferdowsi University of Mashad in 2004 and 2007, respectively.

CHENAE TUCKETT

High latitude corals on the move: a comparative heat wave assessment

Chenae A Tuckett¹, Thibaut de Bettignies¹, Jane Fromont², Emily Gates¹, Marie de Boisvilliers³ and Thomas Wernberg¹

¹ School of Plant Biology & Oceans Institute, the University of Western Australia

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³ School of Advanced Agricultural Science, Agronomy and Natural Resource Management, Montpellier SupAgro, 34000 Montpellier, France

Tropicalisation of temperate marine communities has been identified as one of the major consequences of increasing seawater temperatures. A 2011 marine heat wave has reshaped marine communities at the warmer range of temperate systems in Western Australia. To date, substantial decreases in habitat-forming cool-water seaweeds and increases in warm-water fish species have been documented. Here we compared pre- and post-heat wave coral communities based on transect data from 2006 and 2013. We found a two-fold increase in the abundance of corals from 2006 to 2013, which was mainly due to a greater abundance of *Plesiastrea versipora*, a species often found in temperate habitats. This change corresponded with a large increase in the number of small *P.versipora* individuals at most sites, suggesting a flux of recruitment between 2006 and 2013. There were new presence recordings of species of tropical affinity, such as *Acropora millepora*, however it is unknown when these might have recruited. This demonstrates that coral communities changed significantly between 2006 and 2013, and that this could be a consequence of the marine heat wave. However, it is still unknown if the increase in recruitment and community change was a direct positive effect of warming on coral spawning and recruitment success or the indirect effect of relaxed competition for space with seaweeds.

BIOSKETCH

Academic History

2014-to date: PhD Candidate, University of Western Australia

Thesis title: High latitude coral community dynamics

2009-2013: Bachelor of Science (honours)

Thesis title: High latitude corals on the move: a comparative heat wave assessment

Current Project

The aim of my PhD research is to investigate high latitude coral community dynamics to provide insight into their persistence in often stressful and marginal environments, at the limits of their range. I am particularly interested in looking at coral phenotypic plasticity, the environmental suitability of temperate reefs as refugia for corals under elevated ocean temperatures, and the ongoing tropicalisation of temperate ecosystems. I am currently studying biogeographical patterns of coral distributions from tropical into temperate areas, to establish a point of reference for future change. I am also investigating variability in the growth, fecundity and recruitment of corals within temperate reef environments along the latitudinal gradient of Western Australia's coastline.

Future hopes & dreams

It is my hope that in the future I will be able to continue investigating the tropicalisation of temperate marine ecosystems and that this research will have opportunities for global travel and collaboration. I hope that the insights I gain will assist conservation and management efforts to better reduce the negative impacts of change on the marine environment and the services we derive from it.

MOHSEN A. ALHAMAMI

Analytical Chemistry Study of Tropospheric Radicals using Matrix Isolation FTIR Spectroscopy

Mohsen A. Alhamami, Marcus. Kettner, Allan J. McKinley and Duncan A. Wild

School of Chemistry and Biochemistry, University of Western Australia

The Criegee Intermediates are carbonyl oxides which are hypothesized to play a major role in the reaction of O_3 with unsaturated hydrocarbons in the atmosphere; these reactions constitute an important mechanism for the removal of unsaturated hydrocarbons and for the production of OH in the troposphere. The parent Criegee Intermediate, CH_2OO , has been investigated in this study. We report preliminary results on the direct IR detection of CH_2OO , formed from the reaction of $CH_2I + O_2$, using the matrix isolation technique coupled with Fourier transform infrared spectroscopy. We have observed six of the nine vibrational bands and also measured spectra of the D, C-13 and O-18 isotopologues. Our data is consistent with a zwitterion-type rather than a biradical-type structure for the CH_2OO molecule.

BIOSKETCH

Mohsen is a first year PhD student at UWA (analytical chemistry). He has a Bachelor in chemistry (2003) from King Khaled University, Saudi Arabia, and a Masters in analytical chemistry 2011 from the University of Western Australia.

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Compiled by Lynne Milne